CL350 / CL400 / CL500 / ICL700

POS-SA
Module description

Edition 101

BOSCH
Automationstechnik

CL350 / CL400 / CL500 / ICL700

POS-SA
Module description

1070 072 166-101 (98.02) GB

Reg. Nr. 16149-03

Nominal charge: DM 20.00

Safety Instructions and Information

Before you start working with the POS–SA Counting / Positioning Module, we recommend that you thoroughly familarize yourself with the contents of this manual. Keep this manual in a place where it is always accessible to all users.

Standard Operation

This instruction manual presents a comprehensive set of instructions and information required for the standard operation of the described products. The referred products are used for the following purposes:

- Counting
- Positioning sensing and external pulse counting
- Switching traverse control

The products described hereunder –

- were developed, manufactured, tested and documented in accordance with the relevant safety standards. In standard operation, and provided that the specifications and safety instructions relating to the project phase, installation and correct operation of the product are followed, there should arise no risk of danger to personnel or property.
- are certified to be in full compliance with the EEC Council Directives 89/336/EEC (electromagnetic compatibility), 93/68/EEC (amending directives), 93/44/EEC (relating to machinery), as well as 73/23/EEC (operation within certain voltage limits). In addition, we certify compliance with harmonized standards EN 50081-2 and EN 50082-2.
- are designed for operation in an industrial environment. Prior to the intended installation and/or operation within a private residence or business area, on retail premises or in a small-industry setting, the user will be required to obtain a single operating license issued by the appropriate national authority or approval body. In Germany, this is the Federal Institute for Posts and Telecommunications, and/or its local branch offices.

Qualified Personnel

This instruction manual is designed for specially trained PLC personnel. The relevant requirements are based on the job specifications as outlined by the ZVEI and VDMA professional associations in Germany. Please refer to the following German-language publication:
Weiterbildung in der Automatisierungstechnik
Hrsg.: ZVEI und VDMA
MaschinenbauVerlag
Postfach 71 08 64
60498 Frankfurt

This instruction manual is specifically designed for PLC technicians.

Interventions in the hardware and software of our products which are not described in this instruction manual may only be performed by our skilled personnel.

Unqualified interventions in the hardware or software or non-compliance with the warnings listed in this instruction manual or affixed to the product may result in serious personal injury or damage to property.

Qualified personnel are persons who –

- as **planning personnel**, are familiar with the safety guidelines used in electrical engineering and automation technology.
- as **operating personnel**, are familiar with the equipment used in the field of automation technology and are thus familiar with the contents of this manual that specifically relate to operating functions.
- as **commissioning personnel**, are authorized to commission, ground/earth and classify electrical circuits and devices or systems in accordance with the relevant safety standards.

Safety Instructions on Control Components

The following warnings and notices may be affixed to the control components themselves. They are intended to alert you to specific conditions:


DANGER: High voltage!


DANGER: Battery acid!


Electrostatically sensitive components!


Disconnect at mains before opening!


Pin for connecting PE conductor only!


This connection for functional earthing or low-noise earth only!


For screened conductor only!

Safety Instructions in this Manual

These symbols are used throughout this manual subject to the following conditions.

DANGER

This symbol is used to warn of the presence of **dangerous electrical current.** Insufficient or lacking compliance with these instructions can result in **personal injury.**

DANGER

This symbol is used wherever an insufficient or lacking compliance with instructions can result in **personal injury**.

CAUTION

This symbol is used wherever an insufficient or lacking compliance with instructions can result in **damage to equipment or data files**.

This symbol is used to inform the user of special features.

Symbols used in this Manual

★

The asterisk symbol shows that the manual is describing an activity which you will be required to perform, e.g.:

★ Insert disk 1 into the floppy disk drive.

☞ **Can we improve our instruction manual? We invite our readers' contribution to the ongoing improvement of this documentation. Your opinion is important to us. To submit your suggestions, please use the questionnaire form provided on the last page of this manual.**

Safety Instructions

DANGER

Danger to personnel and equipment!

Test every new program before operating the system!

CAUTION

Danger to the module!
Do not insert or remove the module while the controller is switched ON! This may destroy the module. Prior to inserting or removing the module, switch OFF or remove the power supply module of the controller, external power supply and signal voltage!

CAUTION

Danger to the module!
All ESD protection measures must be observed when using the module! Prevent electrostatic discharges!

Observe the following protective measures for electrostatically endangered modules (EEM)!

- The personnel responsible for storage, transport and handling must be trained in ESD protection.
- EEMs must be stored and transported in the specified protective packaging.
- Out of principle, EEMs may only be handled at special ESD work stations equipped for this particular purpose.
- Personnel, work surfaces and all devices and tools that could come into contact with EEMs must be on the same potential (e.g. earthed).
- An approved earthing wrist strap must be worn. It must be connected to the work surface via a cable with integrated 1 MΩ resistor.
- EEMs may under no circumstances come into contact with objects susceptible of accumulating an electrostatic charge. Most items made of plastics belong to this category.
- When installing EEMs in or removing them from an electronic device, the power supply of the device must be switched OFF.

☞

This instruction manual applies to the following HW and SW versions:

Hardware:	**POS-SA**	**version 2 & up**
Software:	**PROFI PLC software**	**version 3.0 & up**
	WinSPS software	**version 2.0 & up**
	POS-SA function modules	**version 202 & up**

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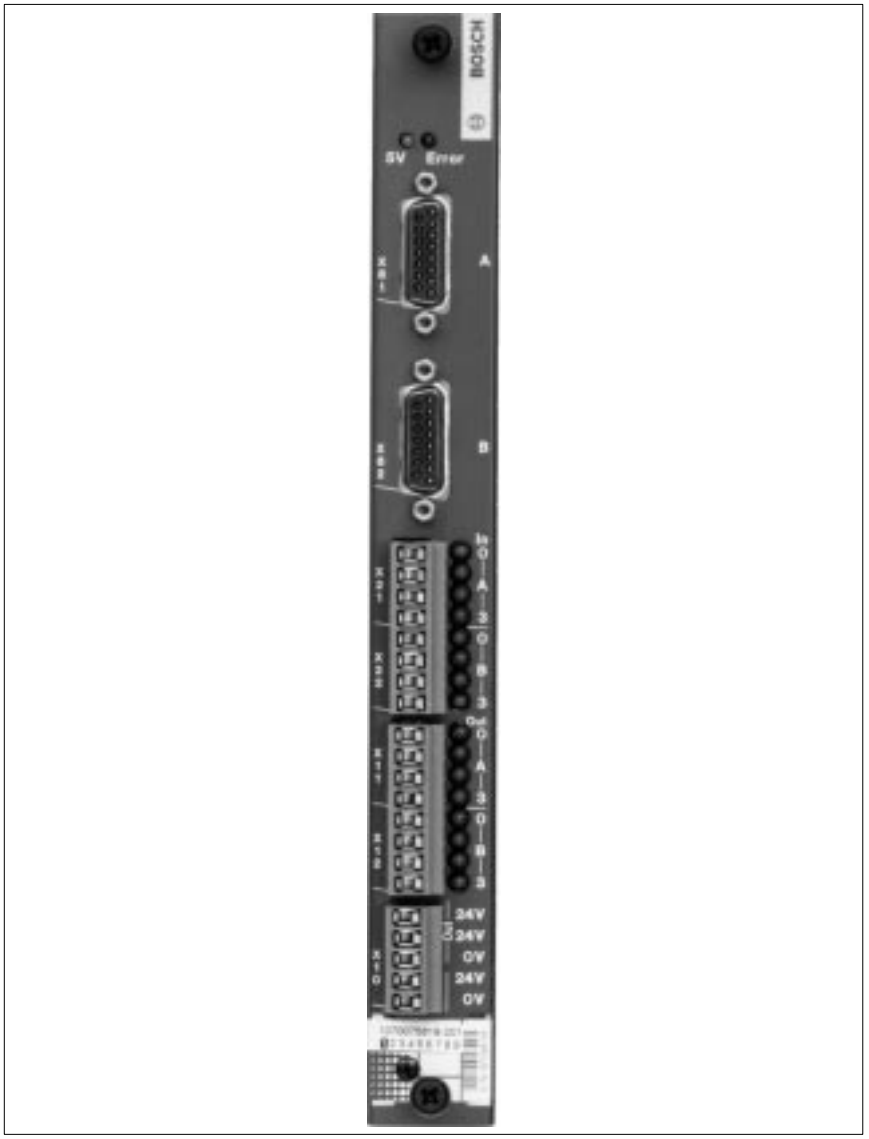

Fig. 1–1 POS-SA Counting / Positioning Module

☞ **All installation instructions applying to the CL350, CL400, CL500, and/or ICL700 must be observed.**

Application options for the POS-SA Counting / Positioning Module:

- In the CL350, CL400 and CL500 controllers (centralized and decentralized / distributed operation), or
- in the expansion unit of the ICL700 (centralized operation).

The POS-SA Counting / Positioning Module provides the following:

- Two positioning channels that are independent of each other.
- Four digital inputs for each channel.
- Four digital outputs for each channel.

Specifications	POS-SA
Sensors	
Number of encoder connections	2
Incremental	• 5 V differential signals • 24 V signals max. 2^{31} increments
Frequency	• 5 V signals, max. 800 kHz • 24 V signals, max. 200 kHz
Absolute	SSI, max. 25 bits, serial, Gray code or Dual code selectable, transmission rate 50 to 800 kHz
Line length, screened • 5 V encoder • 24 V encoder	 50 m, max. 500 kHz • 20 m, max. 150 kHz • 100 m, max. 50 kHz
Isolated potential	No
Input type • 5 V encoder signal • 24 V encoder signal	 RS-422 Type 1, as per DIN EN 61131-2

Input voltage / current
• Nominal rating
  • LOW signal
  • HIGH signal
• Switching threshold
  • LOW → HIGH
  • HIGH → LOW
	
	0 thru 8 V / ≤ 1.7 mA
	12 thru 30 V / 4 thru 10 mA
	
	typ. 10.9 V
	typ. 9.9 V

Operating power, each encoder • Short-circuit protected • Fuse	 5 V– / 400 mA 24 V– / 900 mA
3 SSI encoders on single encoder connection • Current load, SSI cycle • Line length, each encoder • Transmission frequency	 max. 60 mA max. 40 m at 0.14 mm^2 max. 200 kHz

Specifications	POS-SA
Inputs	
Type 1, as per DIN EN 61131	8 (4 per channel)
Isolated potential	No
Input voltage / current ● Nominal rating ● LOW signal ● HIGH signal	 24 V 0 thru 5 V / 0 thru 3 mA 11 thru 30 V/ 6.5 thru 20 mA
Delay interval ● LOW → HIGH ● HIGH → LOW	 typ. 1.9 ms typ. 3.5 ms
Switching threshold ● LOW → HIGH ● HIGH → LOW	 typ. 9.9 V typ. 9.0 V
Line length, unscreened	max. 100 m
Outputs	
Number of inputs	8 (4 per channel)
Isolated potential	Yes; the GND connections of both channels are not potential-isolated from each other.
Power supply (for load circuits) ● Nominal rating ● Permissible range	 24 V– 15 thru 30 V
Current load on 24 V external power supply (load circuits) ● A0 through A3 = 0 ● A0 through A3 = 1	 4 mA + external load 27 mA + external load
Reverse polarity protection / fuse	All 8 outputs combined / 3.15 A fast-acting
Output voltage ● HIGH signal ● LOW signal	 Supply voltage – 0,5 V < 40 mV
Output current ● Nominal rating ● HIGH signal ● LOW signal	 0.5 A 2 thru 600 mA max. 0.5 mA
Short-circuit protection	electronic

Specifications	POS-SA
Delay interval ● LOW → HIGH ● HIGH → LOW	 17 µs 140 µs
Contactor size	1
Lamp load	5 W at 8 Hz
Switching frequency ● Resistive load ● inductive load	 100 Hz 2 Hz
Limit, inductive cut-off voltage	electronic, to – 18 V
Parallel switching of outputs	Yes; 2 x 0.5 A each in the respective output range X11, X12
Line length, unscreened	max. 100 m
24 V Power supply	
Nominal rating	24 V–
Permissible range	15 through 30 V–
Current draw from X10	200 mA + external load
Fusing for 24 V power supply	2.5 A slow-blowing
Miscellaneous	
Current load from internal 12 V	10 mA
Storage temperature range	–25 °C thru 70 °C
Width	1 Slot

1.1 Setting Start Address

CAUTION

Danger to the module!
All ESD protection measures must be observed when using the module! Prevent electrostatic discharges!

The S1 DIP switch is located on the circuit board.

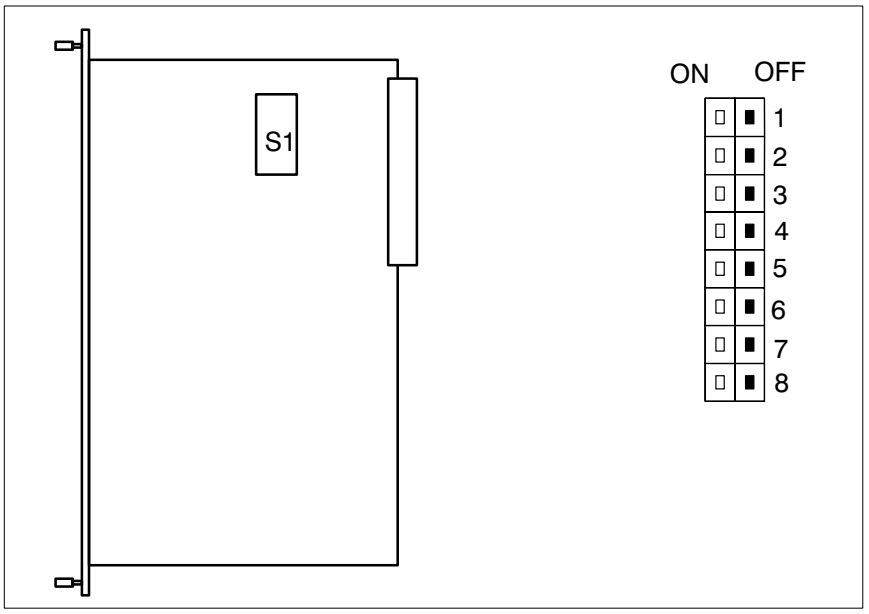

Fig. 1–2 S1 DIP Switch

Centralized Operation

☞ **An even-numbered start address in the extended input/output field must be selected, and the start address must be divisible by four.**
DIP switch segments S1/1 and S1/2 must be set to OFF.
Because address 0 on the extended input/output field is reserved for PLC interrupts, it may not be used.
For the CL500, the allocation to the processors is accomplished via DIP switch segments S1/7 and S1/8.

★ Set the start address in the extended input/output field.

The module occupies 4 bytes in the extended input and 4 bytes in the extended output field.

Switch	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
Weight	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Value	128	64	32	16	8	4	2	1
	x	x	x	x	x	x	OFF	OFF

Fig. 1–3 S1 DIP Switch, Weight

Decentralized / distributed Operation

Decentralized operation (also termed *distributed operation*) is not possible with the ICL700.

☞ **Only module numbers between 0 and 243 may be selected.**

★ Set a module number between 0 and 243 on the DIP switch.

In decentralized operation (PROFIBUS-DP), the module is addressed by the RM4-DP12 decentralized module. The address is set by means of the WinDP software.

1.2 Module Slot

CAUTION

Danger to the module!
Do not insert or remove the module while the controller is switched ON! This may destroy the module. Prior to inserting or removing the module, switch OFF or remove the power supply module of the controller, external power supply and signal voltage!

Permitted module slots are shaded grey.

Centralized Operation

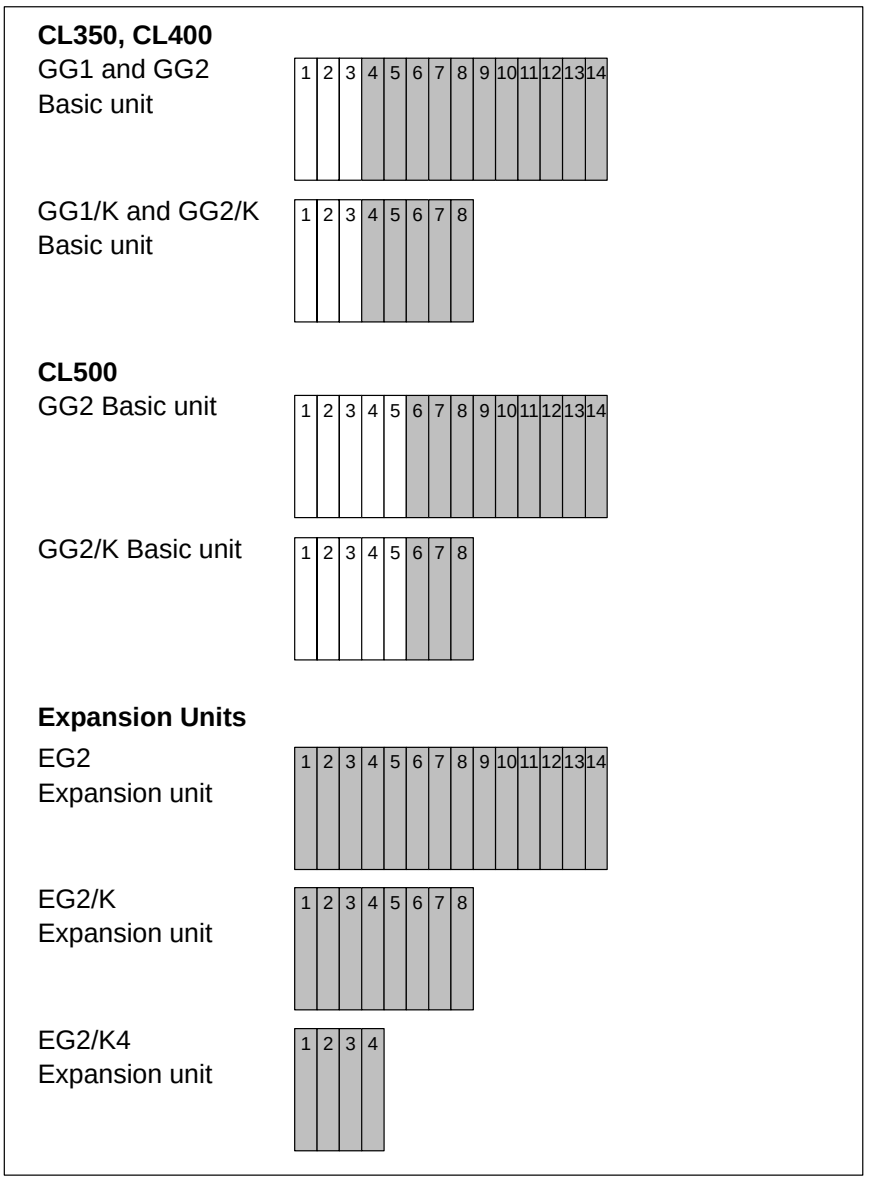

Fig. 1–4 Module Slots, Centralized Operation

Decentralized / Distributed Operation

In conjunction with the RM4-DP12 decentralized module, and using a PROFIBUS-DP connection, the POS-SA is suitable for distributed operation in an expansion module.

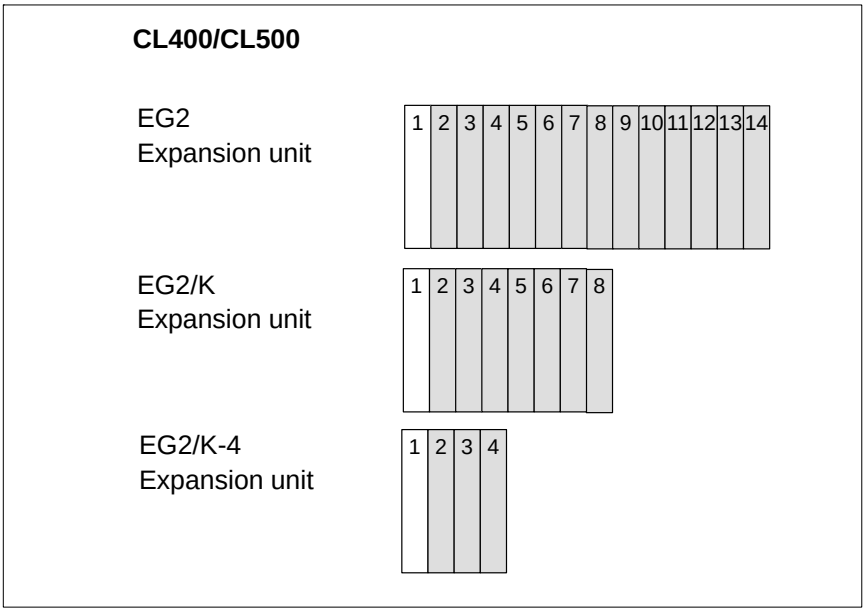

Fig. 1–5 Module Slots, Decentralized / Distributed Operation

1.3 Module Connectivity

The power supplies for the digital inputs and outputs are potential-isolated from the power supplies feeding encoder and logic circuits. For this reason, separate power supply modules must be provided for encoder / logic circuit power and for input / output power, respectively.

Applicable Installation Instructions

All installation instructions applying to the CL350, CL400, CL500 and ICL700 are also compulsory for the POS-SA Counting / Positioning Module.

The power supplied to the outputs must not be bridged with the power for the logic circuits. The power for the logic circuits must therefore be supplied by a separate power supply module.

in the POS-SA Counting / Positioning Module, the power supply for the logic circuits is directly connected to the system earth/GND. This means that, in the event that several POS-SA or RM4-DP12 modules are used, the 0 V connections (GND) of the various power supply modules must be interconnected by a common potential-equalization bus bar. If at all possible, all above-named modules should be powered by a single power supply.

The encoders must be connected to the POS-SA module by means of screened cables. The cable screen must be earthed (grounded) on both ends.

In the event that the encoders are powered via an external power supply, the 0 V terminals (GND) of the encoder power supplies must be brought to the same potential as the module power supply module (logic circuits) by connecting both via a potential-equalization bus bar.

Example of Sensor Circuit with 5 V Power Supply

If the encoder is powered by the POS-SA module, the 5 V supply voltage may drop to 4.95 V. As the voltage drop caused by long encoder cables is a factor to be considered, a sufficient wire size (conductor cross-section) must be selected.

Example:
For a encoder with a minimum of 4.75 V, 200 mA, and a cable length of 25 m, the minimum required conductor cross-section is 1 mm^2.

Example of Proper Mains Connection of POS-SA Module and Sensor

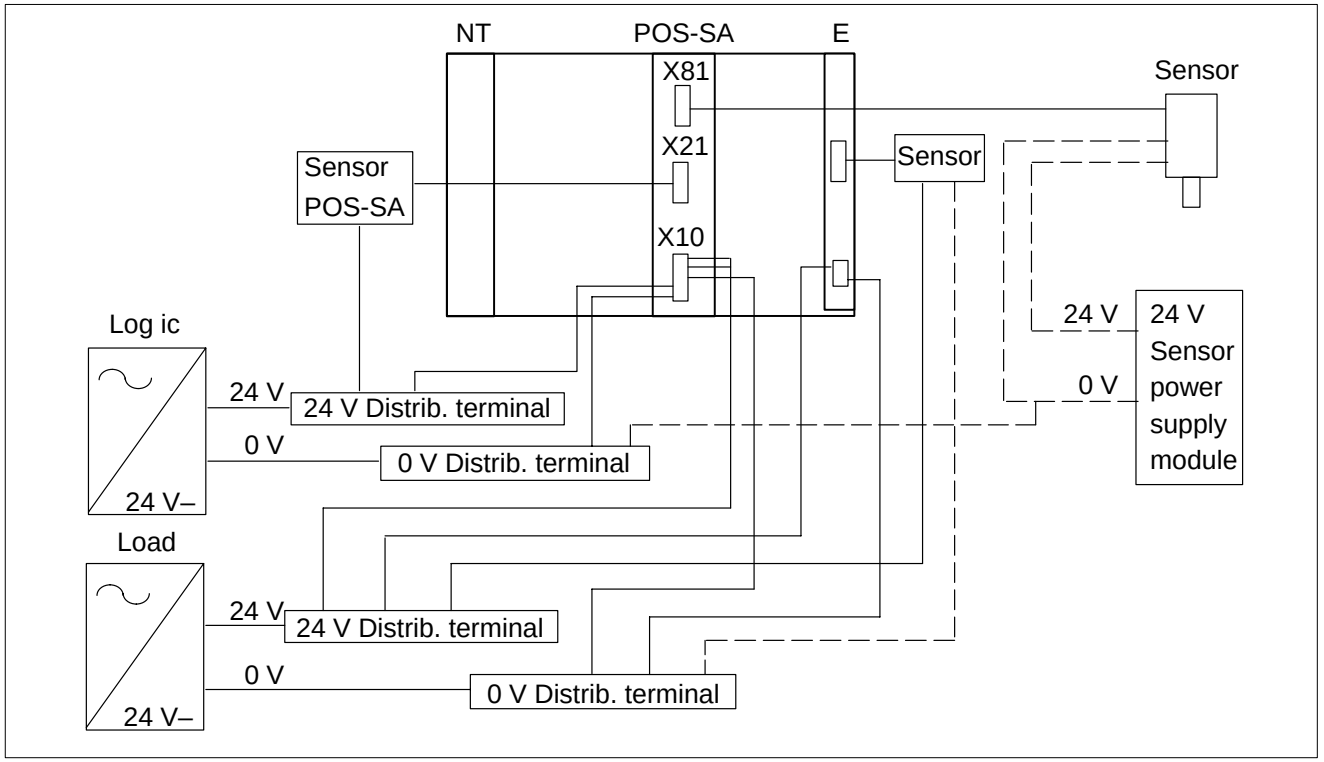

Fig. 1–6 Example of Mains Connection of POS-SA Module and Sensor

☞

The inputs of the POS-SA Counting / Positioning Module must not be GND-coupled with the other inputs of the PLC because this would negate the optical isolation. The inputs of the POS-SA must be powered by the logic circuit power of the POS-SA.

Both lower connections of X10 are used to supply:

- the channel 1 and channel 2 inputs
- the channel 1 and channel 2 encoders
- plus the module logic circuits

This means that the 0 V (GND) connections of the channel1 and channel2 inputs must be connected with the 0 V (GND) connection of the logic circuit power supply. The inputs of the POS-SA are at the same potential as the logic circuit power, and share the same GND. The inputs of channel1 and channel2 must be powered by the same 24 V logic circuit power supply module.

Both top connections of X10 are used to supply the channel1 and channel2 outputs.

The centre connection of X10 comprises the common 0 V (GND) connector of the channel1 and channel2 outputs.

The outputs of channel1 and channel2 are isolated via optocouplers from the power supply for inputs, encoders, and the module logic circuits.

The encoders connected to X81 and X82 can also be powered by the logic circuit power. In the event that a separate power supply module is used for the encoders, the 0 V (GND) connection of that power supply module must be connected to the 0 V (GND) connection of the logic-circuit power supply (potential-equalization bus bar).

Connecting POS-SA Counting / Positioning Module

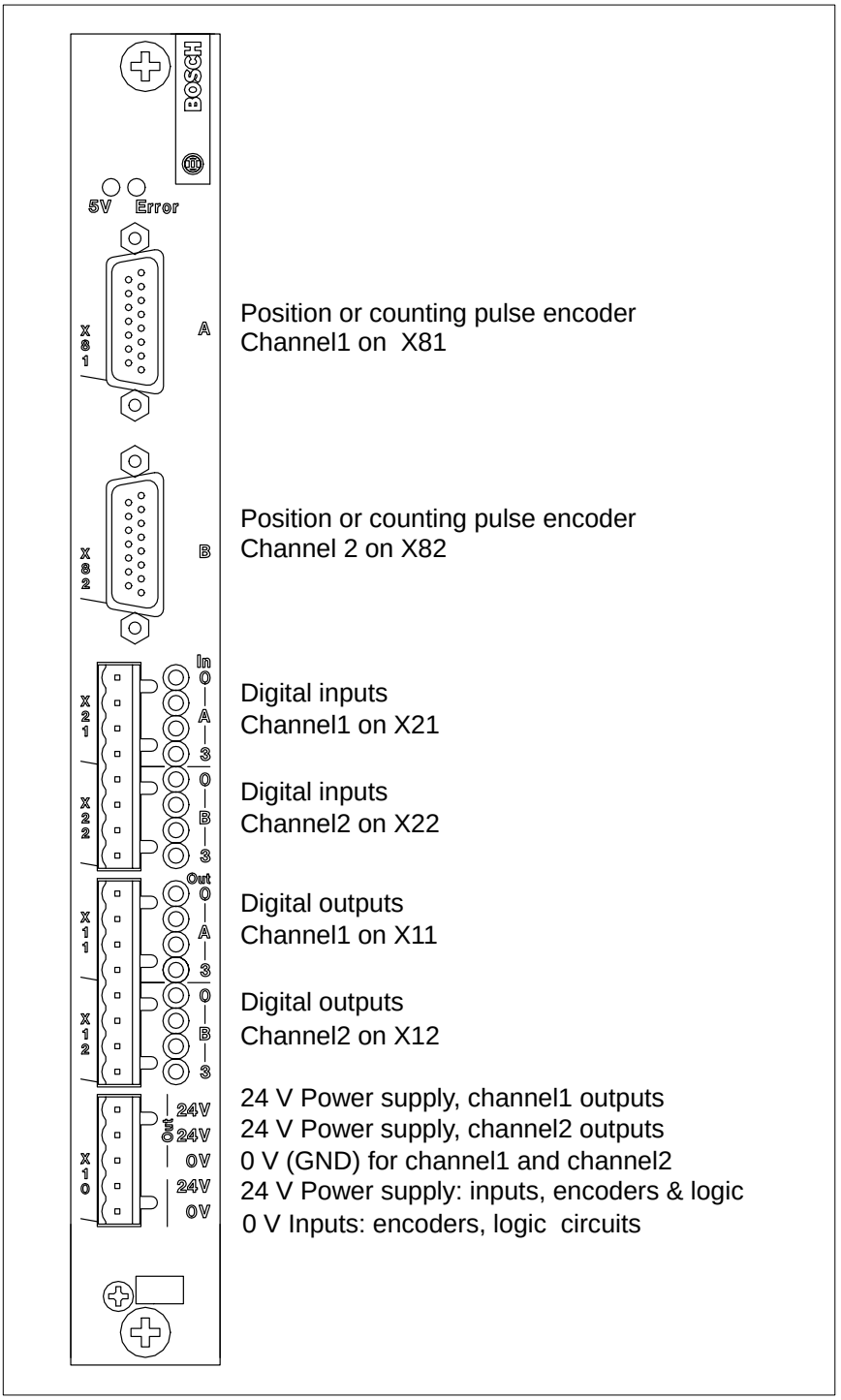

Fig. 1–7 POS-SA Front Panel

2 Module Functions

The POS-SA Counting / Positioning Module handles the following tasks on a timeline that runs in parallel with the controller functions of the central processing unit:

- Counting
- Positioning (external pulse counting / positioning switching axes), or
- Frequency measurement

2.1 Counting

The POS-SA Counting / Positioning Module contains two independent 31-bit counters.

The counting action occurs in the following directions:

- Forward,
- reverse,
- forward and reverse.

Counter Control

The counters (in forward and reverse direction) are controlled by:

- Commands, and/or
- digital inputs

Communications

Communications with the POS-SA Positioning / Counting Module is handled via the ZAEHL45 function module (CL350/CL400/CL500), or via the ZAEHLICL function module (ICL700). The ZAEHL45 and/or ZAEHLICL module must be called cyclically.

The function module contains commands for the following purposes:

- Writing data to the POS-SA, and
- reading data from the POS-SA.

The referred data is –

- read from the DBZAEHL0, DBZAEHL1, and DBZAEHL2 data modules, and
- written to the DBZAEHL0 data module.

New commands can be sent to the POS-SA module only once a positive acknowledgement has been received.

The initialization of the module occurs either while processing the OM5 or OM7 start-up module, or in the form of a one-time call via trigger pulse. In this occasion all initialization bits can be transferred at once. The module processes the commands in the proper sequence.

Even if no command is to be transferred to the POS-SA module, the Read Status And Actual Value command must still be transferred to the module because otherwise no transfer of actual values and status messages will occur.

47 Comparison Values

A maximum of 47 comparison values can be stored on the POS-SA module (function module version 203 and up).

Encoder Types

Examples of encoders that can be connected are the following:

- Light barriers,
- Pulse encoders
- Incremental-value encoders.

Examples

Among the high-speed processes captured on the basis of external timing are the following examples:

- Quantities
- Frequencies
- Rotational speeds (RPM)
- Speeds

The module is addressed via function modules and data modules, and via digital inputs and outputs.

For example, the inputs can act upon the counters in the following way:

- Disabling
- Loading and starting
- Stopping
- Enabling

For example, the outputs can control the actuators via programmed counter contents.

2.2 Position Sensing

The POS-SA Counting / Positioning Module is capable of capturing 2 paths independently of each other.

The position sensing occurs at the following points:

- Rotary axes or
- Linear axes.

The capture includes both forward and reverse motions.

Direct Disable

The digital addressing of the axes via the outputs of the POS-SA facilitates a direct disable of the axes (without PLC response interval).

The axis will then move in rapid motion / creep speed.

To ascertain disabling precision, creep speed should always be consistent.

With the axis at rest, the brake should be applied automatically.

Position Control

When addressing the axis via the analog input, the PLC can be used to set up a positioning circuit which keeps the axis in its position.

In addition, the speed may vary.

Communications

Communications with the POS-SA Positioning / Counting Module is handled via the WEG45 function module (CL350/CL400/CL500), or via the WEGICL function module (ICL700). The WEG45 and/or WEGICL module must be called cyclically.

The function module contains commands for the following purposes:

- Writing data to the POS-SA, and
- reading data from the POS-SA.

The referred data is –

- read from the DBWEG0, DBWEG1, and DBWEG2 data modules,
- and written to the DBWEG0 data module.

New commands can be sent to the POS-SA module only once a positive acknowledgement has been received.

The initialization of the module occurs either while processing the OM5 or OM7 start-up module, or in the form of a one-time call via trigger pulse. In this occasion all initialization bits can be transferred at once. The module processes the commands in the proper sequence.

Even if no command is to be transferred to the POS-SA module, the Read Status And Actual Value command must still be transferred to the module because otherwise no transfer of actual values and status messages will occur.

Prior to Automatic Start, it must be verified that the module is synchronized, and that the current Actual Value is located in a start window defined by the user. The reason for this is that the module captures only the positions. If the module is started in the wrong direction, or if the start position is located behind the comparison position, this condition will not be recognized.

In order to prevent damage due to starting the module in the wrong direction, every movement should be tracked by a monitoring time interval.

Subsequent to referencing (switch and zero-pulse), the channel returns the Axis Synchronized message. Subsequent to this message the POS-SA Counting / Positioning Module can be operated in Automatic mode with range limit switches enabled.

46 Comparison Positions

A maximum of 47 comparison values can be stored on the POS-SA module (function module version 203 and up). If the traversing direction is changed several times due to addressing the axis via the digital module outputs, the comparison positions must be enabled in groups. Otherwise they would again be activated when being travelled over.

Encoder Types

Examples of encoders that can be connected are the following:

- Incremental-value encoders or
- Absolute-value encoders (synchronous serial interface, SSI).

Up to 6 SSI absolute-value encoders (3 per channel) can be connected. For all encoders (1 through 3), only actual values and status remain to be read. Comparison and range limit values are no longer available (this applies to all encoders). The required comparisons must now be implemented in the PLC program.

Example

A switching axis is being positioned.

The module is addressed via function modules and data modules, and via digital inputs and outputs.

The inputs control, for example:

- Releases / enables
- Reference point
- Limit switches

The outputs control, for example:

- Traversing movements (Start/Stop)
- Traversing speed (rapid motion, creep speed)
- Actuators at programmed travel positions

2.3 Frequency Measurement

The frequency measuring function uses a predefined timer resolution to count the number of pulses received from the connected encoders.

The number of pulses is stored in the specified timer resolution of –

- 10 ms
- 50 ms
- 100 ms
- 1000 ms

Communications

Communications with the POS-SA Positioning / Counting Module is handled via the ZAEHL45, ZAEHLICL, WEG45 or WEGICL function module. The ZAEHL45, ZAEHLICL, WEG45 or WEGICL function module must be called cyclically.

The ZAEHL45, ZAEHLICL, WEG45 or WEGICL function modules contain commands for the following purposes:

- Writing data to the POS-SA module, and
- reading data from the POS-SA module.

The referred data is –

- read from the DBZAEHL0, DBZAEHL1, and DBZAEHL2 and/or DBWEG0, DBWEG1 and DBWEG2 data modules, and
- written to the DBZAEHL0 and/or DBWEG0 data module.

New commands can be sent to the POS-SA module only once a positive acknowledgement has been received.

The initialization of the module occurs either while processing the OM5 or OM7 start-up module, or in the form of a one-time call via trigger pulse. In this occasion all initialization bits can be transferred at once.

Even if no command is to be transferred to the POS-SA module, the Read Status And Actual Value command must still be transferred to the module because otherwise no transfer of actual values and status messages will occur.

Enabling Frequency Measurement

The frequency measurement is enabled by setting bit 12 in data word 0 of the DBZAEHL0 or DBWEG0 data module.

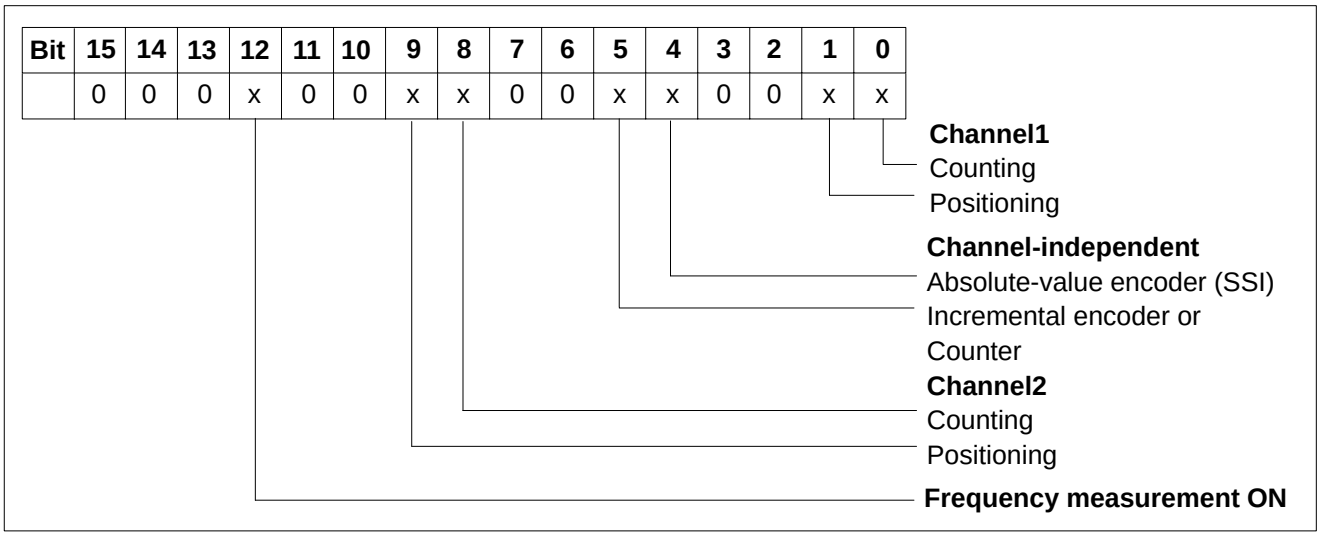

Fig. 2–1 Data Word 0, Module Mode and Encoder Connection

Setting Timer Resolution

The default timer resolution is preset in the channel configuration in data word 0 of the DBZAEHL1/2 or DBWEG1/2 data modules, bits 12 through 14.

The timer resolution values that are read by means of the Read Channel Actual Value are stored in the DBZAEHL0 or DBWEG0 D20, D22 channel1 and D32, D34 channel2.

Bit	Explanation			
0 thru 2	not used			
3 and 4	Response to System STOP			
	Bit4	Bit3		
	0	0	No response	
	0	1	Counters disabled, outputs set to 0	
	1	0	Outputs are set to 0 for the duration of System STOP, CLAB signal.	
5 thru 11	not used			
12 thru 14	Actual-value functions			
	Bit14	Bit13	Bit12	
	0	0	0	Read actual value
	0	0	1	Read timer value, 10 ms resolution
	0	1	0	Read timer value, 50 ms resolution
	0	1	1	Read timer value, 100 ms resolution
	1	0	0	Read timer value, 1000 ms resolution
15	not used			

Fig. 2–2 DBZAEHL1/2, D0 Channel Configuration

Bit	Explanation
0 thru 2	not used
3 and 4	Response to System STOP Bit4 Bit3 0 0 No response 1 0 Outputs are set to 0 for the duration of System STOP, CLAB-Signal.
5 thru 7	not used
8	Axis type 0 Linear axis 1 Rotary axis
9	0 Positive numbers only 1 Positive and negative numbers
10, 11	Number of SSI encoders Bit11 Bit10 0 0 1 SSI encoder 1 0 2 SSI encoder 1 1 3 SSI encoder
12 thru 14	Actual-value functions Bit14 Bit13 Bit12 0 0 0 Read actual value 0 0 1 Read timer value, 10 ms resolution 0 1 0 Read timer value, 50 ms resolution 0 1 1 Read timer value, 100 ms resolution 1 0 0 Read timer value, 1000 ms resolution
15	not used

Fig. 2–3 DBWEG1/2, D0 Channel Configuration

3 Counting

This chapter discusses the counting function.

The first section provides an overview of the following:

- Structure and function
- Connections
- Commands
- Execution times

Subsequent sections of this chapter provide a detailed decription of counter manipulation on the POS-SA Counting / Positioning Module, and of faults that may occur.

3.1 Overview

3.1.1 Structure and Function

The POS-SA Counting / Positioning Module contains two independent 31-bit counters.

Counting Directions

Each counter is capable of counting in the following directions:

- Forward,
- reverse, or
- forward and reverse.

Counter Control

The counters are controlled via –

- Digital input signals or
- Software commands, e.g. –
  - Stop Counter
  - Enable Counter,
  - Load And Start Counter

The counters are set by software command by means of parameter transfer in the PLC program.

Digital Inputs / Outputs

Examples of the input signals are –

- Enable,
- Disable, Stop
- Start, Load.

The outputs control the process directly.

Start, End and Comparison Values

Beside the start and end value, a maximum of 47 comparison values can be preset for each counter. When the preset counter values have been attained, outputs can be enabled, reset or toggled to facilitate the control of actuators.

Software Counter

In addition, a software counter (0 through 65535) is available that is capable of counting forward or in reverse in the event that it reaches a start value, end value or comparison value.

Signal Level

As the signal level for the counting pulses, 5 V– or 24 V– can be freely selected for each channel.

3.1.2 Connections

Encoder Connections

Pulse encoder types:

- Counting pulse generator, proximity switch (BERO), 24 V signals
- Counting pulse generator, 5 V rectangular-pulse signals
- Incremental-value encoder, 5 V differential rectang.-pulse signals
- Incremental-value encoder, 24 V rectangular-pulse signals

☞ **Counting pulse generators count each positive transition at the signal input.**

☞ **For incremental-value encoders, a 4-way interpretation of signals A and B is effected. The zero-mark signals of the incremental-value encoders are not used in counting mode.**

☞ **Absolute-value encoders cannot be used in counting mode.**

X81/X82 PIN No.	Encoders			
	Counters 24 V Signals	**Counters, 5 V Rectang. signals**	**Incr.-value counters, 5 V Diff. Rectang. Signals**	**Incr.-value counters, 24 V Rectang. Signals**
1		Counting pulse	Signal A	
2		GND	Signal A, inv	
3		Directional signal	Signal B	
4		GND	Signal B, inv	
5		Encoder voltage	Encoder voltage	
6			Zero reference mark	
7			Zero reference mark, inv	
8	Counting pulse			Signal A
9	Directional signal			Signal B
10				
11				
12	GND	GND	GND	GND
13				
14	Encoder voltage			Encoder voltage
15				Zero reference mark

Fig. 3–1 X81 / X82 Encoder Interface

Inputs

X21 / X22	Signal designation
I0	Stop counter and delete outputs (positive transition, earliest transition change after 20 µs)
I1	• Load counter with new nominal value, and start counter (positive transition) OR • Load counter with new nominal value (positive transition), and start counter (negative transition).
I2	not used
I3	Stop counter (0) / Enable counter (1)

Fig. 3–2 X21 / X22, Inputs

Outputs

The outputs O0 through O3 are available for application-specific utilization.

Input / Output Statuses

The statuses of inputs and outputs are stored in data words D12 (channel1) and D24 (channel2) of data module DBZAEHL0.

3.1.3 Commands

Communications with the POS-SA Positioning / Counting Module are handled via the ZAEHL45 function module (CL350/CL400/CL500), or via the ZAEHLICL function module (ICL700).

The function module contains commands for the following purposes:

- Writing data to the POS-SA, and
- reading data from the POS-SA.

The referred data is –

- read from the DBZAEHL0, DBZAEHL1, and DBZAEHL2 data modules, and
- written to the DBZAEHL0 data module.

Configuration Commands

- Write Module Configuration
- Write Channel Configuration
- Write Comparison Values
- Write Nominal Values

Write Module Configuration

☞ **With each new configuration command, all other previously transmitted commands lose their validity, and must again be sent to the POS-SA module.**

Preset values for –

- Counting operating mode
- Encoder, counter or incremental-value encoders

Write Channel Configuration

Preset values for –

- Start and end value for counter
- Counting direction
- Output responses to attainment of start or end value
- Utilization of digital inputs
- Defining timer resolution for frequency measurement
- Encoder type

Write Comparison Values

Comparison values must be located between start and end value.

The comparison values can be transferred to the POS-SA Counting / Positioning Module only while the counter has been stopped or disabled.

Effective with version 203 of the function modules, 47 comparison values can be stored, instead of 8 comparison values in the case of previous versions.

Preset values for –

- up to 47 comparison values per counter
- Output responses to attainment of start or end value.

Write Nominal Values

Presets the counter start values for each channel.

Read Commands

- Read Actual Value
- Read Module Status
- Read Channel Status

Read Actual Value

- Value of actual counter contents for each channel
- Value of counting frequency

Read Module Status

- Module status
- Channel status of both channels, and
- Actual values for both channels

Read Channel Status

Reads the following information for a single channel:

- Current status of inputs and outputs
- Last attained comparison value
- Software counter, and
- Fault messages

Control Commands

- Load And Start Counter
- Disable Counter
- Stop Counter
- Enable Counter

☞ **The Disable Counter command cannot be cancelled by issuing the Enable Counter command. To reenable the counter, the Load And Start Counter command is required.**

Load And Start Counter

- Loads a new nominal value into the counter, and
- starts the counter

In the event that a new nominal value is not available of the POS-SA module, the start value or end value (contingent upon the direction of travel) is loaded into the counter from the channel configuration, and the counter is started.

This command can be used to cancel a previously issued Stop Counter command.

Disable Counter

Causes immediate actions –

- Stops counters
- Disables counters
- Clears outputs

Stop Counter

Stops counter immediately. The outputs are retained.

Enable Counter

The counter is enabled. All counting pulses are subsequently counted.

3.2 Module Operation

The operation of the POS-SA Counting / Positioning Module is accomplished via –

- the digital inputs,
- the ZAEHL45 (CL350/CL400/CL500) and/or ZAEHLICL (ICL700) function module, and
- the DBZAEHL0, DBZAEHL1, and DBZAEHL2 data modules.

The ZAEHL45 and/or ZAEHLICL function module must be cyclically called up in the PLC program. The purpose is the –

- configuration of the module, and the
- configuration of the counters.

The counters are loaded and subsequently started via input E1.

At the time of the cyclical call-up of the function module by means of the appropriate commands, and dependent upon the command issued, the following action occurs (provided the control unit is in RUN):

- Data is read from the data modules, and written to the POS-SA module, and
- data is read from the POS-SA module, and stored in the DBZAEHL0 data module.

Function Modules

The ZAEHL45 and/or ZAEHLICL function module is provided on the supplied diskette in the form of a PxL file. Dependent upon the mode of module operation, the following function modules must be linked with the application project, and declared in the symbol file.

- In centralized module operation, the ZAEHL45 and/or ZAEHLICL function module must be linked in conjunction with the FIFOZM1 function module.
- In distributed module operation (PROFIBUS-DP), the ZAEHL45 function module must be linked in conjunction with the FIFODM1 function module.

FIFOZM1 or FIFODM1 comprise secondary function modules of ZAEHL45 and/or ZAEHLICL, and handle the actual data transport from and to the POS-SA module.

PROFI Software Data Modules

The DBZAEHL0, DBZAEHL1, and DBZAEHL2 data modules are provided on the supplied diskette in the form of text files, and can thus be copied into freely selectable data modules in the symbol file. The data modules must be arranged in successive order, with DBZAEHL0 being the first one.

All data that is read by the POS-SA or written to the POS-SA is managed exclusively by these data modules.

WinSPS Software Data Modules

Effective with function module version 203, the following applies:

The DBZAEHL0, DBZAEHL1, and DBZAEHL2 data modules are provided on the supplied diskette in the form of PxD files, and can be directly integrated into the application project.

3.2.1 Controlling Counters via Inputs

Before the inputs can be used to control the counters, inputs I0 through I3 must be enabled by means of the Write Channel Configuration command, DBZAEHL1/2 D2.

Input I0

- Positive transition, HIGH (1) state must exceed 20 µs
  - Disables the counter
  - Clears the outputs
- Negative transition
  - Counter remains disabled
  - Outputs remain cleared

Input I1

The Write Channel Configuration command is used to define whether the counter, subsequent to being loaded, is started immediately upon the occurrence of the positive transition, or whether the counter start is delayed until the subsequent negative transition.

- Load and start immediately
  - Positive transition, loads a new nominal value into the counter, and starts the counter.
  - Negative transition, no significance
- Load and start on next negative transition
  - Positive transition, loads a new nominal value into the counter
  - Negative transition, starts the counter

In the event that a new nominal value has not been loaded into the POS-SA module, the start value or end value (contingent upon the direction of travel) is loaded into the counter.

Input I2

Input I2 has no significance in conjunction with the counting process. However, the status of I2 can be interpreted via the Read Module Status or Read Channel Status commands.

Input I3

- LOW signal
  - Stop counter
  - No influence on outputs
- HIGH signal
  - Counter enabled
  - No influence on outputs

3.2.2 Controlling Counters via ZAEHL45 and/or ZAEHLICL Function Module

The ZAEHL45 and/or ZAEHLICL function module must be called up cyclically. The function module can execute the following commands:

- Configure Module
- Configure Counter1 Or Counter2
- Write Comparison Values
- Write Nominal Values
- Read Module Status
- Read Counter1 Or Counter2 Status
- Stop Counter, Enable Counter, Disable Counter
- Load And Start Counter
- Read Actual Counter Value

Data that is to be loaded into the POS-SA must first be appropriately prepared in the DBZAEHL0, DBZAEHL1, and DBZAEHL2 data modules.

Subsequent to a cyclical call-up of the ZAEHL45 and/or ZAEHLICL function module, the acknowledgement parameters must be checked to establish whether the command was transferred without fault.

☞ **New commands can be sent to the POS-SA module only once a positive acknowledgement has been received.**

All data read by the POS-SA module is held in the DBZAEHL0 data module.

☞ **A positive acknowledgement to a Read command is required before the associated data can be interpreted and processed in the DBZAEHL0 data module.**

Example: Calling ZAEHL45 and/or ZAEHLICL Function Module

```
❑    CM      -ZAEHL45,6        ;Call function module
     ;
     P0   W   -KOMMANDO         ;Command
     P1   BY  -QUITTUNG         ;Address for user acknowledgement
     P2   W   K4                ;Start address / switching matrix address
     P3   W   K100              ;Data module number
     P4   W   -FIFOZM1          ;Program module number
     P5   W   K0                ;PLC channel number, distributed operation
```

ZAEHL45 and/or ZAEHLICL Parameter

Parameter	Input parameters	Output parameters
P0 (Word)	Command	
P1 (Byte)		Address for user acknowledgement
P2 (Word)	Centralized operation: Start address Distributed operation: BM-DP12 switching matrix address	
P3 (Word)	Data module number	
P4 (Word)	Program module number Centralized operation: FIFOZM1 Distributed operation: FIFODM1	
P5 (Word)	Centralized operation: No significance Distributed operation: PLC channel number	

Fig. 3–3 ZAEHL45 and/or ZAEHLICL Parameters

P0, Command

Bit	Explanation
0	Write Configuration
1	Write Comparison Value
2	Write Incrementer Nominal Value
3	Write Decrementer Nominal Value
4	Stop
5	Enable Counter
6	Disable Counter
7	Load And Start Counter
8	Read Status
9	IRead Actual Value
10 thru 12	not used
13	Channel 2
14	Channel 1
15	Module

Fig. 3–4 P0, Commands

Sends one or more commands to the POS-SA Counting / Posítioning Module. In the event that several commands are to be transferred with a single function module call, the function module will start the transfer with the command defined by the least significant bit (LSB). The function module processes all commands in succession. When all commands have been executed without fault, all bits in data word 82 (command buffer) will have been cleared.

The FM Active signal in the acknowledgement is set as long as the function module being processed is active. As long as the function module remains active, the command for the function module may not be changed.

The module configuration and that of the individual channels must be accomplished prior to all other commands.

Bits 8 and 9 may not be set simultaneously.

Bits 13, 14, and 15 determine whether the command refers to the module, channel1 or channel2, respectively.

For the module, the Write Configuration and Read Status commands are available.

With a single command, instructions for the module and for both channels can be transferred simultaneously.

P1, User Acknowledgement

Acknowledgements are returned to the user at the specified address. The user may not write to the acknowledgement.

As long as the module is processing a command, the FM Active signal is set. During processing the command may not be altered. As soon as all data has been written to and/or read from the POS-SA, the FM Active signal is again reset by the function module.

The summary fault signal in the acknowledgement indicates transfer faults.

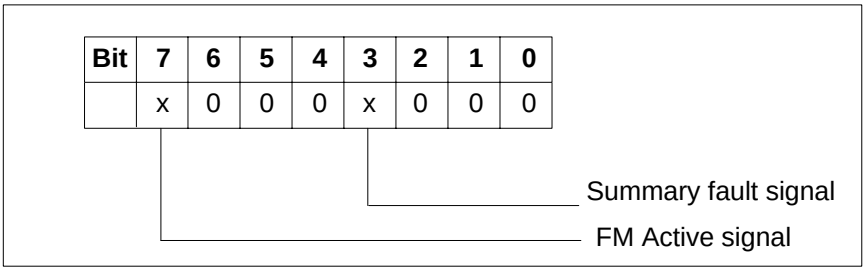

Fig. 3–5 P1 User Acknowledgement

P2, Start address

- Centralized operation
  The start address of the POS-SA module must be specified. Upward of this start address, 4 bits each are used in the EI and EO fields.
- Distributed operation
  The switching matrix address of the bus master must be specified.

P3, Data Module Number

Module number of the DBZAEHL0 data module.

P4, Program Module Number

- Centralized operation
  FIFOZM1 Program module number
- Distributed operation
  FIFODM1 Program module number

P5, PLC Channel Number

- Centralized operation
  Although the parameter is without significance, it must be specified, i.e., K0.
- Distributed operation (not possible with ICL700)
  PLC Channel number

3.2.3 Managing Data with DBZAEHL0 Data Module

PROFI Software Data Modules

The DBZAEHL0, DBZAEHL1, and DBZAEHL2 data modules are provided in the form of text files on the supplied diskette, and can thus be copied into the symbol file into freely selectable data modules. The data modules must be arranged in successive order, with DBZAEHL0 being the first one.

All data that is read by the POS-SA or written to the POS-SA is managed exclusively by these data modules.

WinSPS Software Data Modules

Effective with function module version 203, the following applies:

The DBZAEHL0, DBZAEHL1, and DBZAEHL2 data modules are provided on the supplied diskette in the form of PxD files, and can be directly integrated into the application project.

☞ **These data modules are reserved exclusively for the POS-SA module. Data words that have not been commented may not be used because they are used for internal data management functions by the ZAEHL45 and/or ZAEHLICL function module.**

Example

DM No.	Name	Comment	R/E	Length
DM 1	DBZAEHL0	Module configuration data, and data read from the module	R	256
DM 2	DBZAEHL1	Channel1 configuration data and counter1 comparison values	R	512
DM 3	DBZAEHL2	Channel2 configuration data and counter2 comparison values	R	512

Fig. 3–6 Overview List of Data Modules

☞ **Application ranges used on CL350/CL400/CL500/ICL700: M248 through M255**

DBZAEHL0

The data module contains –

- the module configuration data, and
- all data read from the POS-SA.

The data words are listed in the table in Fig. 3–7. The table is followed by a description of the data word structure. The data words are shown in their standard default settings.

Abbreviations used in the data module:

R = RAM
Sg = Sign
F = Format
B = Binary
D = Decimal
H = Hexadecimal

DM 0 Name: DBZAEHL0 Comment: Configuration and Read data RAM/EPROM: R					
No.	**Symbol**	**Type**	**Sg**	**Data field / Comment**	**F**
D 0		Word	N	Module mode with encoder connection	B
D 2 thru 6		Word	N	Internal use	
D 8		Word	N	Module status	B
D 10		Word	N	Internal use	
D 12		Word	N	Channel1, input / output statuses	B
D 14		Word	N	Channel1, number of last attained comparison value	D
D 16		Word	N	Channel1, fault messages	B
D 18		Word	N	Channel1, software counter	D
D 20		Word	N	Channel1 (counter1), actual value bit 0 through 15	H
D 22		Word	N	Channel1 (counter1), actual value bit 16 through 30	H
D 24		Word	N	Channel2, input / output statuses	B
D 26		Word	N	Channel2, number of last attained comparison value	D
D 28		Word	N	Channel2, fault messages	B
D 30		Word	N	Channel2, software counter	D
D 32		Word	N	Channel2 (counter2), actual value bit 0 through 15	H
D 34		Word	N	Channel2 (counter1), actual value bit 16 through 30	H
D 36 thru 254		Word	N	Internal use	

Fig. 3–7 DBZAEHL0

D0 Module Mode and Encoder Connection

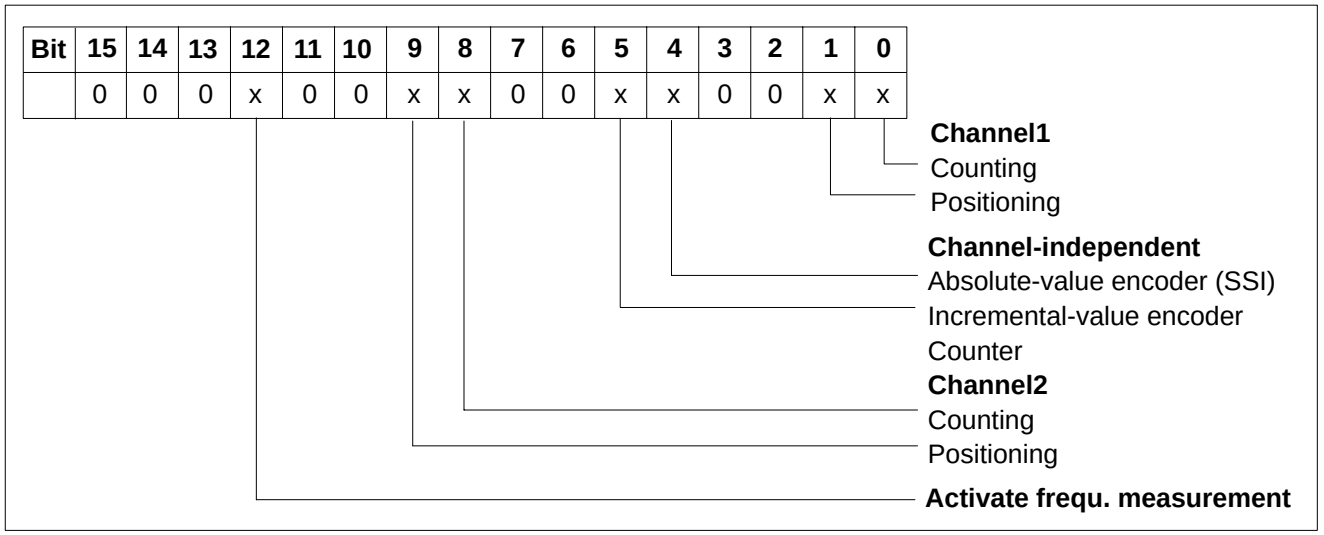

Fig. 3–8 D0, Module Mode and Encoder Connection

The Frequency Measurement function is available with version 206 and up.

The number of pulses received from the connected encoder is counted within a defined time interval. The timer resolution (10 ms, 50 ms, 100 ms or 1 sec) is defined in data word 0 of the DBZAEHL1 or DBZAEHL2 data module .

D8, Module Status

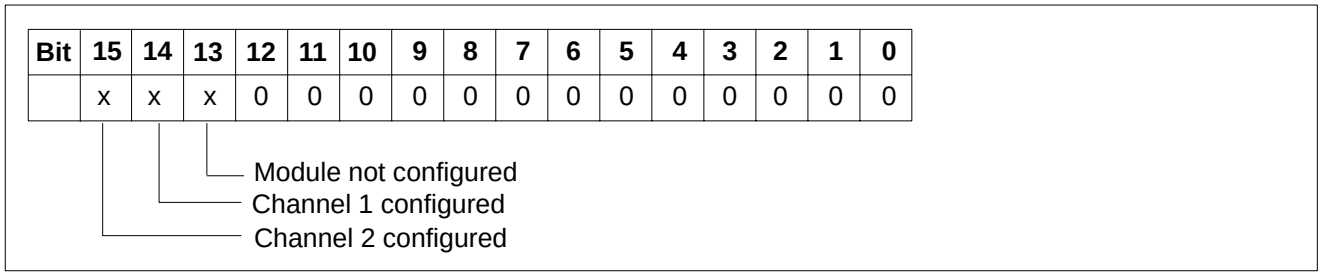

Fig. 3–9 D8, Module Status

D12, Channel1, Input / Output Statuses

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	x	x	x	x	0	0	0	0	x	x	x	x

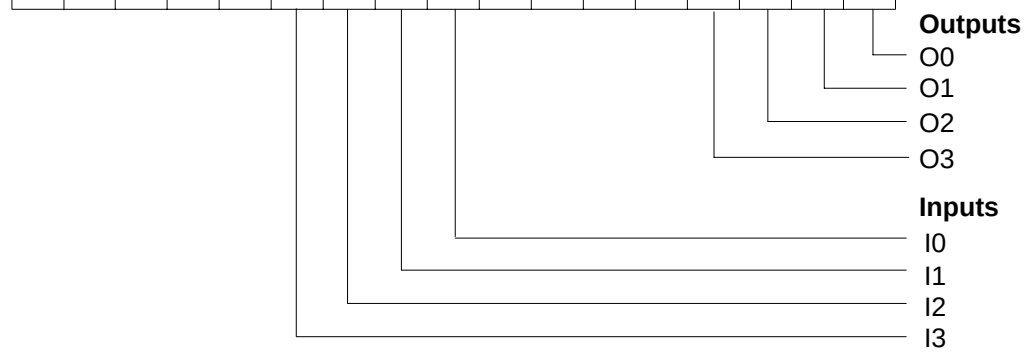

Fig. 3–10 D12, Channel1 Inputs/Outputs

D14, Channel1, Number of Last Attained Comparison Value

☞ **Upon reaching the range limit value, the number of the last attained comparison value is set to 128 (80H).**

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	0	0	x	x	x	x	x	x

Fig. 3–11 D14, Channel1, Number of Last Attained Comparison Value

D16, Channel1, Fault Messages

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	0	0	0	0	x	x	x	x

Fig. 3–12 D16, Channel1 Fault Messages

A speed failure results when the specified comparison values cannot be processed rapidly enough. Upon processing a comparison value, the POS-SA has detected that the next comparison value for the counter has already been attained.

If this is the case, the responses upon reaching the next comparison value can only be processed with a time delay. They are not discarded, however.

☞ **All fault resets require module or channel configurations.**

D18, Channel1, Software Counter

In the event that the 31 bit hardware counter is not sufficient, an additional 16 bit software counter is available. This counter is incremented or decremented upon reaching a range limit value.

Upon recognizing the comparison values, the counter contents of the software counter are not interpreted; this function must occur in the PLC.

D20/22, Channel1, Actual Value, Bit 0 through 30

Dependent upon whether bit 8 or 9 is set in parameter P0 of the ZAEHL2 function module, the contents of D20/22 is to be interpreted as follows:

- Command Bit8 (Read Module Status): Current actual values
- Command Bit9 (Read Actual Channel Value): Pulses per time matrix.

D24, Channel2, Input / Output Statuses

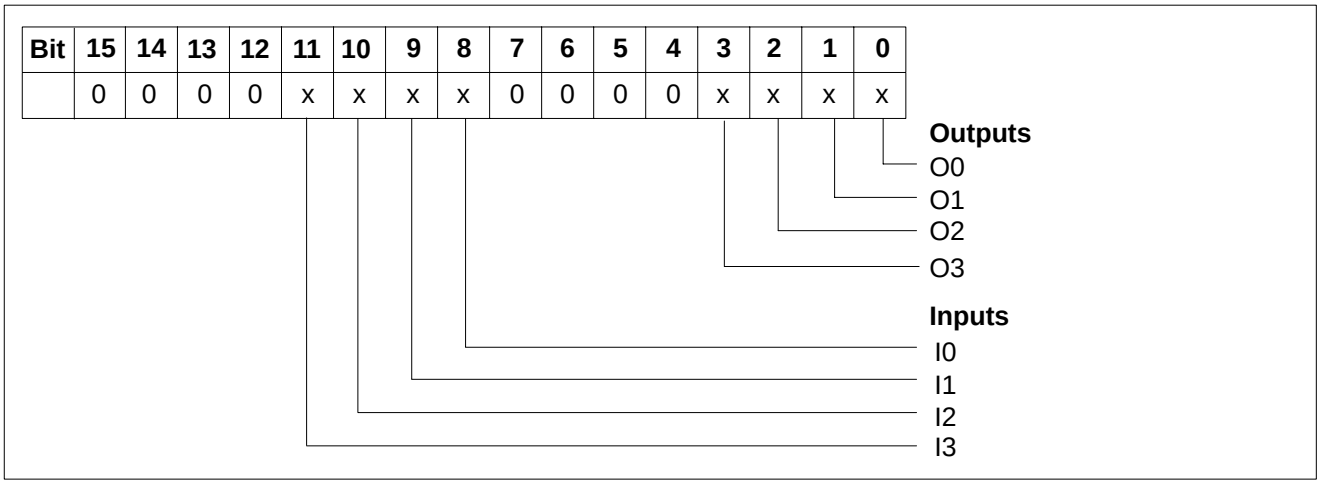

Fig. 3–13 D24, Channel2 Input / Output Statuses

D26, Channel2, Number of Last Attained Channel

☞ **Upon reaching the range limit value, the number of the last attained comparison value is set to 128 (80H).**

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	0	0	x	x	x	x	x	x

Fig. 3–14 D26, Channel1, Number of Last Attained Comparison Value

D28, Channel2, Fault Messages

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	0	0	0	0	x	x	x	x

Fig. 3–15 D28, Channel2 Fault Messages

A speed fault results when the specified comparison values cannot be processed rapidly enough. Upon processing a comparison value, the POS-SA has detected that the next comparison value for the counter has already been attained.

If this is the case, the responses upon reaching the next comparison value can only be processed with a time delay. They are not discarded, however.

☞ **All fault resets require module or channel configurations.**

D30, Channel2, Software Counter

In the event that the 31 bit hardware counter is not sufficient, an additional 16 bit software counter is available. This counter is incremented or decremented upon reaching a range limit value.

Upon recognizing the comparison values, the counter contents of the software counter are not interpreted; this function must occur in the PLC.

D32/34, Channel2, Actual Value, Bit 0 through 30I

Dependent upon whether bit 8 or 9 is set in parameter P0 of the ZAEHL2 function module, the contents of D20/22 is to be interpreted as follows:

- Command Bit8 (Read Module Status): Current actual values
- Command Bit9 (Read Actual Channel Value): Pulses per time matrix.

3.2.4 Managing Data with DBZAEHL1 Data Module

This data module contains –

- the channel1 configuration data, and
- the comparison values.

The data words are listed in the table in Fig. 3–16. The table is followed by a description of the data word structure. The data words are shown in their standard default settings.

DM 1	Name: DBZAEHL1	Comment: Channel1 configuration data		RAM/EPROM: R	
No.	**Symbol**	**Type**	**Sg**	**Data field / Comment**	**F**
D 0		Word	N	Channel parameters	B
D 2		Word	N	Utilization of inputs	B
D 4		Word	N	Encoder configuration	B
D 6		Word	N	Reserved	H
D 8		Word	N	LOW range limit value, bit 0 through bit 15	H
D 10		Word	N	LOW range limit value, bit 15 through bit 30	H
D 12		Word	N	Output response to LOW range limit value	B
D 14		Word	N	Counter response to LOW range limit value	B
D 16		Word	N	HIGH range limit value, bit 0 through bit 15	H
D 18		Word	N	HIGH range limit value, bit 16 through bit 30	H
D 20		Word	N	Output response to HIGH range limit value	B
D 22		Word	N	Counter response to HIGH range limit value	B
D 24		Word	N	Nominal incrementer value, bit 0 through bit 15	H
D 26		Word	N	Nominal incrementer value, bit 16 through bit 30	H
D 28		Word	N	Load outputs upon attaining nominal incrementer value	B
D 30		Word	N	Reserved	H
D 32		Word	N	Nominal decrementer value, bit 0 through bit 15	H
D 34		Word	N	Nominal decrementer value, bit 16 through bit 30	H
D 36		Word	N	Load outputs upon attaining nominal decrementer value	B
D 38		Word	N	Reserved	H

DM 1	Name: DBZAEHL1	Comment: Channel1 configuration data		RAM/EPROM: R	
No.	**Symbol**	**Type**	**Sg**	**Data field / Comment**	**F**
D 40		Word	N	Comparison value 1, comparison value function	B
D 42		Word	N	Comparison value 1, comparison value, bit 0 through bit 15	H
D 44		Word	N	Comparison value 1, comparison value, bit 16 through bit 30	H
D 46		Word	N	Comparison value 1, output response to comparison value	B
D 48		Word	N	Comparison value 1, counter response to comparison value	B
D 50 thru 508		Word	N	Comparison value 2 through comparison value 47	
D 510		Word	N	Internal use	

Fig. 3–16 DBZAEHL1 Data Module

☞ **All configuration combinations not listed in the following tables are invalid.**

D0, Channel Parameter

Bit	Explanation			
0 thru 2	not used			
3 thru 4	Response to System STOP			
	Bit4	Bit3		
	0	0	No response	
	0	1	Counters disabled, outputs set to 0	
	1	0	Outputs are set to 0 for the duration of System STOP, CLAB signal	
5 thru 11	not used			
12 thru 14	Actual-value functions			
	Bit14	Bit13	Bit12	
	0	0	0	Read actual value
	0	0	1	Read timer value, 10 ms resolution
	0	1	0	Read timer value, 50 ms resolution
	0	1	1	Read timer value, 100 ms resolution
	1	0	0	Read timer value, 1000 ms resolution
15	not used			

Fig. 3–17 D0, Channel Configuration

The timer resolution for the frequency measuring function is selected via bits 12, 13, and 14. The frequency measuring function is available from module version 206 upwards.

The time matrix values that are read via the Read Channel Actual Value command are stored in D20, D22 (channel1) and D32, D34 (channel2) of the DBZAEHL0 data module.

D2, Utilization of Inputs

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	x	x	x	x	x	x	x	x

I0

0 0 I0 not used

0 1 Positive transition disables counter and clears outputs

I1

0 0 I1 not used

0 1 On positive transition, load new nominal value, and start counter

1 0 On positive transition, load new nominal value, and start counter on negative transition

I2

0 0 not used

I3

0 0 not used

0 1 I3=0 Stop counter / I3=1 Enable counter

Fig. 3–18 D2, Utilization of Inputs

D4, Encoder Configuration

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	x	x	x	x	x	0	0	x

- Bit 0: Differential signals only with sym. 5 V encoder
- Bit 1: Interrupt check only with 5 V differential signal
- Bit 4: 0=5 V signals, 1=24 V signals
- Bit 5: 0=Incrementer, 1=Counter
- Bit 6: Counting direction: 0=Directional signal fr.encoder, 1=Counting direction from bit 7
- Bit 7: 0=Decrementer, 1=Incrementer

Fig. 3–19 D4, Encoder Configuration

On an incrementer, the counter starts with the LOW range limit value, and counts up to the HIGH range limit value. On a decrementer, the counter starts with the HIGH range limit value, and counts down to the LOW range limit value.

D12, Output Response to LOW Range Limit Value

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	x	x	x	x	x	x	x	x

Outputs

- Bit 0: O0
- Bit 1: O1
- Bit 2: O2
- Bit 3: O3

0 0 Reset output
0 1 Set output

Fig. 3–20 D12, Output Response to LOW Range Limit Value

D14, Counter response to LOW Range Limit Value

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	0	0	0	0	x	x	x	x

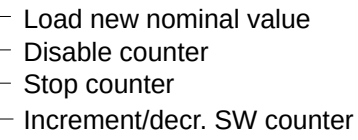

Fig. 3–21 D14, Counter Response to LOW Range Limit Value

Load new nominal value:
Immediately upon attaining the LOW range limit value, the new nominal value is loaded into the counter. Concurrent with this response the outputs are set in accordance with the output pattern represented by the new nominal value.

Disable counter:
Upon attaining the LOW range limit value, the counter is stopped, and the outputs are cleared. Once this has occurred, the counter can only be restarted via input I1 or by means of a Load And Start Counter command.

Stop counter:
Once the LOW range limit value has been reached, the counter is stopped. The counter can subsequently be restarted via inputs I1 or I3 (positive transition only), or via the Enable Counter or Load And Start Counter commands.

Increment / decrement software counter:
Upon reaching a range limit value, and dependent upon the direction of travel, the software is incremented or decremented by a count of 1.

☞ **In the case of a retriggering high-speed counter, the counter of choice should always be an incremental-value counter with a range limit value of LOW = 0. Only in this case it can be ensured that no counting pulse will be lost in an overflow condition.**

D16 / 18, HIGH Range Limit Value, Bit 0 through Bit 30

Maximum HIGH range limit value = 7FFF FFFF H

D20, Output Response to HIGH Range Limit Value

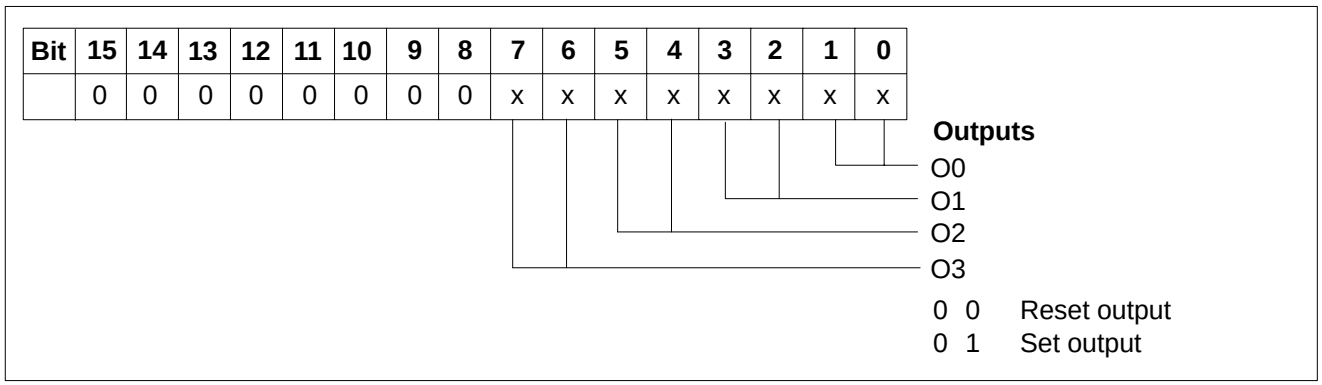

Fig. 3–22 D20, Output Response to HIGH Range Limit Value

D22, Counter Response to HIGH Range Limit Value

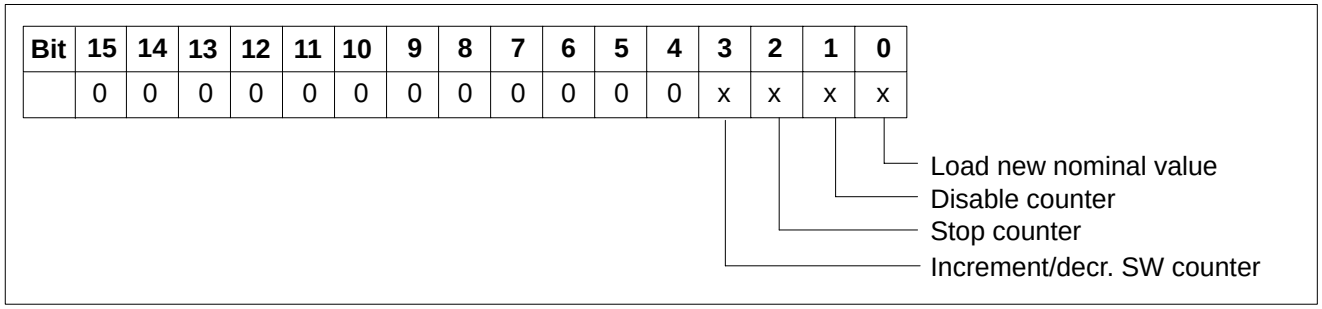

Fig. 3–23 D22, Counter Response to HIGH Range Limit Value

Load new nominal value:
Immediately upon attaining the HIGH range limit value, the new nominal value is loaded into the counter. Concurrent with this response the outputs are set in accordance with the output pattern represented by the new nominal value.

Disable counter:
Upon attaining the HIGH range limit value, the counter is stopped, and the outputs are cleared. Once this has occurred, the counter can only be restarted via input I1 or by means of a Load And Start Counter command.

Stop counter:
Once the HIGH range limit value has been reached, the counter is stopped. The counter can subsequently be restarted via inputs I1 or I3 (positive transition only), or via the Enable Counter or Load And Start Counter commands.

Increment / decrement software counter:
Upon reaching a range limit value, and dependent upon the direction of travel, the software is incremented or decremented by a count of 1.

D24 / 26, Incrementer Nominal Value, Bit 0 through Bit 30

When loading the nominal value, the digital outputs can be set or reset only.

D28, Load Outputs Upon Attaining Incrementer Nominal Value

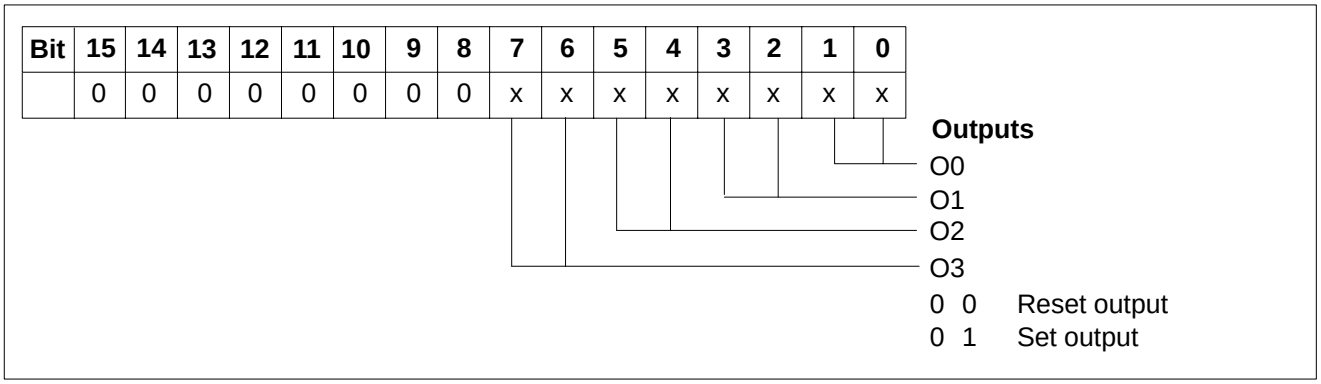

Fig. 3–24 D28, Load Outputs Upon Attaining Incrementer Nominal Value

D32 / 34, Nominal Value Decrementer, Bit 0 through Bit 30

When loading the nominal value, the digital outputs can be set or reset only.

Maximum nominal value, decrementer = 7FFF FFFF H

D36, Load Outputs Upon Attaining Decrementer Nominal Value

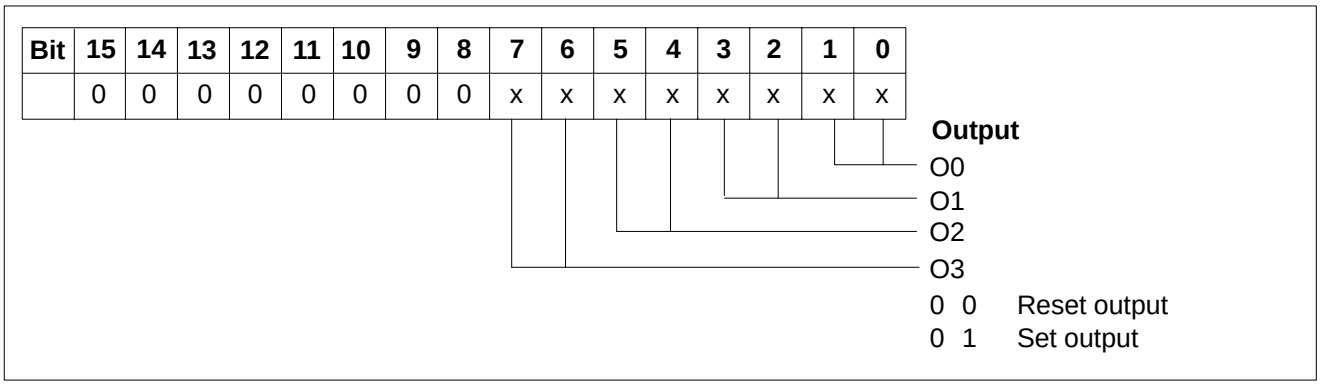

Fig. 3–25 D36, Load Outputs Upon Attaining Decrementer Nominal Value

D40 through D508, Comparison Values 1 through 47

Up to 47 comparison values can be defined between the LOW and HIGH range limit values.

These comparison values can be enabled for –

- forward counting
- reverse counting, or
- forward and reverse counting.

At each comparison point, the responses are triggered in accordance with the contents of the data words. Each preset comparison value occupies 10 bytes in the data module.

As an example, Fig. 3–26 below shows the first preset comparison value.

☞ **Function module of version 203 and higher provide 47 comparison values, whereas only 8 comparison values were available with earlier versions.**

D40, Comparison Value Function

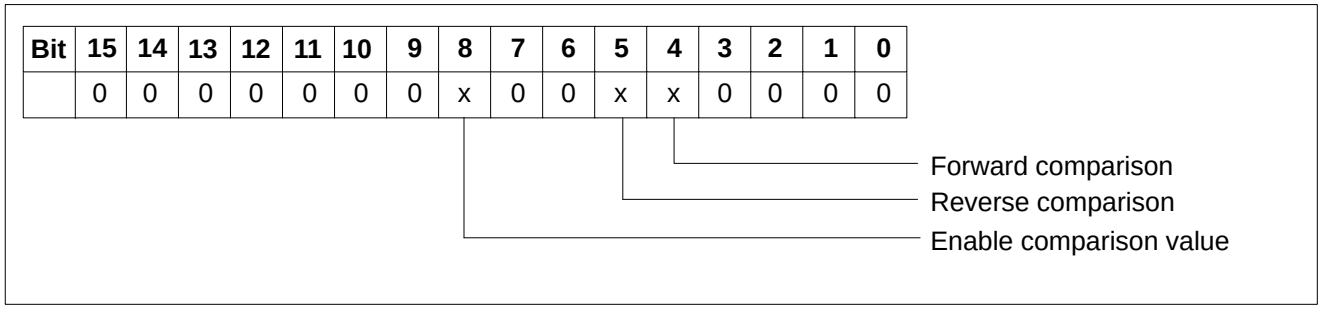

Fig. 3–26 D40, Comparison Value Function

Enable comparison value

The comparison value is enabled via bit 8.

Forward comparison and/or reverse comparison

Defines whether the comparison value is to be enabled during forward, reverse, or forward and reverse counting operations.

Delete comparison value

To delete a comparison value, bits 4 and 5 are reset, and bit 9 is set.

D42/44 Comparison Value, Bit 0 through Bit 30

D46, Output Response to Comparison Value

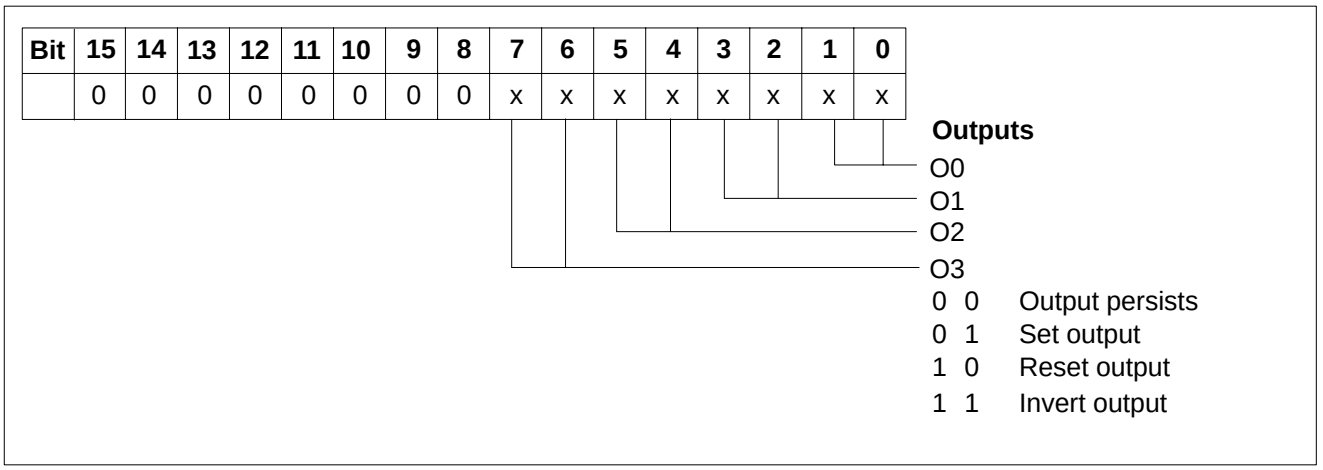

Fig. 3–27 D46, Output Response to Comparison Value

D48, Counter Response to Comparison Value

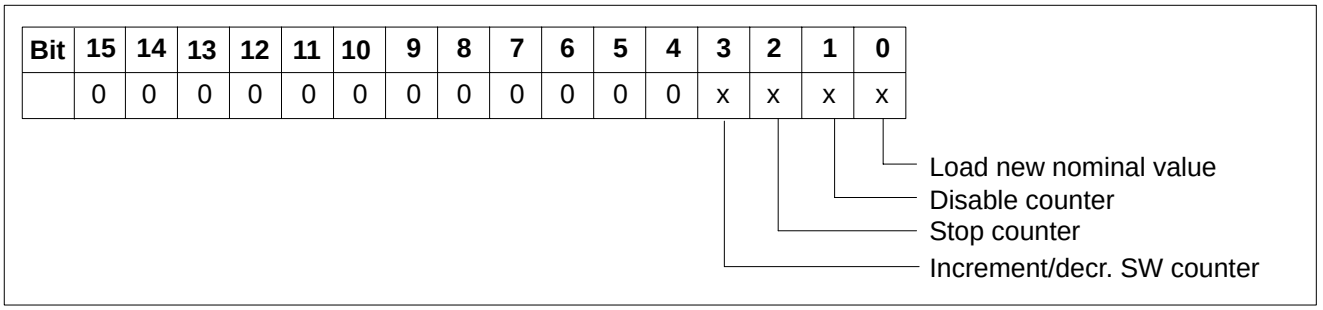

Fig. 3–28 D48, Counter Response to Comparison Value

3.2.5 DBZAEHL2 Data Module

This data module contains –

- the channel2 configuration data, and
- the comparison values.

The data words are listed in the table in Fig. 3–29. The structures of the individual data words are identical to those in the DBZAEHL1 data module (refer to Section 3.2.4, ”Managing Data with DBZAEHL1 Data Module”). It will therefore suffice to replace all occurrences of *channel1* with *channel2*.

DM 2	**Name: DBZAEHL2**	**Comment: Configuration data Channel2**		**RAM/EPROM: R**	
No.	**Symbol**	**Type**	**Sg**	**Data field / Comment**	**F**
D 0		Word	N	Channel parameters	B
D 2		Word	N	Utilization of inputs	B
D 4		Word	N	Encoder configuration	B
D 6		Word	N	Reserved	H
D 8		Word	N	LOW range limit value, bit 0 through bit 15	H
D 10		Word	N	LOW range limit value, bit 16 through bit 30	H
D 12		Word	N	Output response to LOW range limit value	B
D 14		Word	N	Counter response to LOW tange limit value	B
D 16		Word	N	HIGH range limit value, bit 0 through bit 15	H
D 18		Word	N	HIGH range limit value, bit 16 through bit 30	H
D 20		Word	N	Output response to HIGH range limit value	B
D 22		Word	N	Counter response to HIGH range limit value	B
D 24		Word	N	Nominal incrementer value, bit 0 through 15	H
D 26		Word	N	Nominal incrementer value, bit 16 through 30	H
D 28		Word	N	Load outputs upon attaining nominal incrementer value	B
D 30		Word	N	Reserved	H
D 32		Word	N	Nominal decrementer value, bit 0 through bit 15	H
D 34		Word	N	Nominal decrementer value, bit 16 through bit 30	H
D 36		Word	N	Load outputs upon attaining nominal decrementer value	B
D 38		Word	N	Reserved	H

DM 2	Name: DBZAEHL2	Comment: Configuration data Channel2		RAM/EPROM: R	
No.	**Symbol**	**Type**	**Sg**	**Data field / Comment**	**F**
D 40		Word	N	Comparison value 1, comparison value function	B
D 42		Word	N	Comparison value 1, comparison value, bit 0 through bit 15	H
D 44		Word	N	Comparison value 1, comparison value, bit 16 through bit 30	H
D 46		Word	N	Comparison value 1, output response to comparison value	B
D 48		Word	N	Comparison value 1, counter response to comparison value	B
D 50 thru 508		Word	N	Comparison value 2 through comparison value 47	
D 510		Word	N	Internal use	

Fig. 3–29 DBZAEHL2

3.2.6 Execution Times

The execution time comprises the time interval that elapses between the call-up of the function module and the resetting of the Function Module Enabled signal in the user acknowledgement. This time interval must not be confused with the module response time.

In the event that the fastest possible responses to the attainment of specific counter values are desired, the inputs and outputs of the module must be used. This dispenses with the time interval required for communications between the central processing unit and the module.

The times listed below may on occasion result from several successive PLC cycles. With a single command, the average processing time per function module call is approximately 1 to 2 ms.

If a single function module call is used to transfer several commands to the module at once, the individual execution times must be added together.

Commands	**Execution times** [**ms**]	
	CL350 / CL400 / CL500	**ICL700**
Write module configuration	108.0	92.0
Write channel configuration	4.3	17.5
Write single comparison value	3.2	17.5
Read module status	2.0	7.5
Read channel status	2.0	6.0
Read channel actual value	1.3	2.5
Write nominal values for incrementer or decrementer	3.2	8.0
Load and Start Counter	3.2	8.0
Stop counter	1.5	8.0
Enable counter	1.5	8.0
Disable counter	2.0	8.0

Fig. 3–30 Command Execution Times

3.3 Programming Example

Call-up of ZAEHL45 and/or ZAEHLICL Function Module in Cyclical Organization Module

☞ **The parameters of the ZAEHL45 and/or ZAEHLICL function module may only be changed while the FM Enable signal in the acknowledgement is reset.**

In the cyclical OM organization module –

- a check is made whether a fault has occurred in the commands that were transferred during the module start-up, and
- the module status is read in cyclical intervals.

The Read Module Status command causes the following data to be transferred to the DBZAEHL0 data module:

- The module status,
- the status of channel1 and channel2, respectively, and
- the two actual values representing counter1 and counter2. Subsequent to a positive acknowledgement, this data can be subjected to further processing.

Defining Parameters

☞ **In order to prevent a dual assignment of the operands, the parameters should be defined in the symbol file,**

☞ **M0 must be remanent.**

```
DEF     M0,     -Kommando
DEF     KE083H, -BgKaKonf ;Write configuration for module, channel1 and channel2,
                          ;write comparison values, and start and load counter
DEF     K8100H, -BgStatus ;Read module status
DEF     M2,     -Quittung ;Address for user acknowledgement
DEF     M2.3,   -FbFehler ;Fault in user acknowledgement
DEF     M2.7,    -FbAktiv ;Function module being processed
DEF     K0,      -AdrEZAZ ;Peripheral address of POS-SA module
DEF     K0,         -DbNr ;Number of first data module in POS-SA module
DEF     K0,     -SPSKanal ;PLC channel number, not used in centralized operation
```

Newly Configuring the POS-A During Start-up

```
L    W  S30,A
A    B  A.3              ;Trigger pulse, STOP/RUN toggle function
O    B  A.4              ;Trigger pulse, Power On/Off / load program
JPCI    -KeinAnl
                         ;Load program upon Power On, or STOP/RUN will cause
                         ;POS-SA to be newly configured
L    W  BgKaKonf,A
T    W  A,-Kommando
```

```
      -KeinAnl
```

Calling ZAEHL45 Function Module

```
CM       ZAEHL45,6          ;Function module call
P0    W  -Command           ;Command
P1    BY -Quittung          ;Address for user acknowledgement
P2    W  -AdrEZAZ           ;Start address in extended input/output field
P3    W  -DbNr              ;Number of data module
P4    W  -FIFOZM1           ;Program module
P5    W  -SPSKanal          ;PLC channel number, not used in centralized operation
```

Acknowledgement Query

```
U     B  FbAktiv            ;Query FM Enable signal (bit 7 of acknowledgement)
JPC      -WARTEN

U     B  -FbFehler          ;Query faults (bit3 of acknowledgement)
JPC      -Fehler

L     W  -BgStatus,A        ;Read module status
                            ;additional commands as required by application
T     W  A,-Kommando        ;New command only after positive acknowledgement
                            ;of previous command
      -WARTEN
      .
      .
      PE

      -Fehler
      .
      (HLT)                 ;During power-up, the HLT instruction indicates that
      .                     ;incorrect operation of the POS-SA has occurred.
      PE
```

3.4 Faults

This section describes the following types of faults:

- Communication faults that are indicated in the Acknowledgement parameter of the ZAEHL45 and/or ICL700 function module, and
- control / addressing faults in module or channels.

3.4.1 Communication Faults

A communication fault is indicated in the Acknowledgement parameter of the ZAEHL45 and/or ICL700 function module.

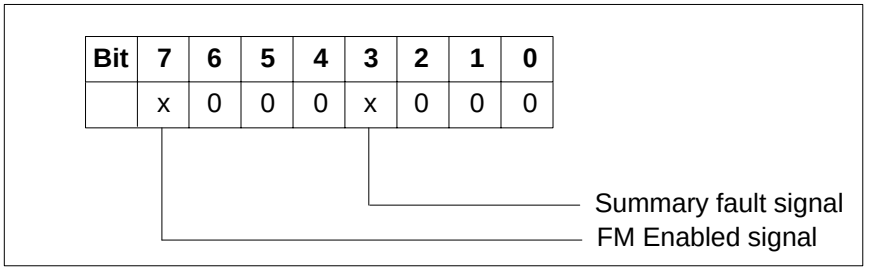

Fig. 3–31 Acknowledgement Parameter

If the summary fault signal in the acknowledgement is HIGH, this is an indication that the command has not been executed on the POS-SA module.

If the command included several tasks, i.e., module configuration, channel configuration, and comparison values, data word D82 in the DBZAEHL0 data module will provide the indication in which task of the command sequence a fault has occurred.

Data word D82 comprises a copy of the Command parameter. Upon calling the function module, the command is copied into data word D82 of the DBZAEHL0 function module. Subsequent to each successful task processing the corresponding bit in data word D82 is reset.

The bits that still remain HIGH can be used to identify the task in which a fault has occurred. Starting with the least significant bit (LSB), the first bit that remains HIGH indicates the task within the sequence of commands in which a fault has occurred.

Starting with the most significant bit (MSB), the first bit indicates whether this has been a task destined for the module, for channel1 or channel2 (bit15=module, bit14=channel1, bit13=channel2).

Starting with version 2 of the POS-SA Counting / Positioning Module, an additional fault code is returned in data word D204 of the DBZAEHL0 data module.

Example

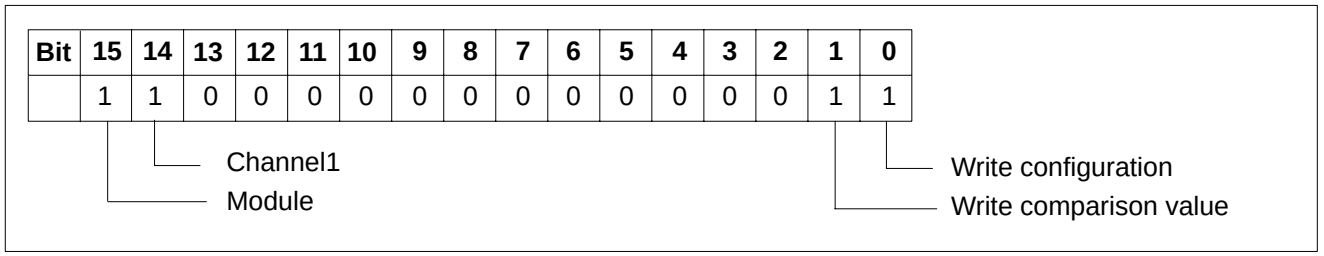

Fig. 3–32 Data Word D82 of DBZAEHL0 Data Module

Possible Causes for Communication Faults

Command	Fault message
Write Module Configuration	• The module is not powered, and can therefore not be addressed. • The selected start address does not match the start address called for the function module.
Write Channel Configuration	• The module has not been configured. • The LOW range limit value is greater than/equal to the HIGH range limit value.
Write Comparison Values	• The channel has not been configured. Only once this has been done can the comparison values be written. • The comparison values are not located between the LOW range limit value and the HIGH range limit value. • Two or more comparison values are identical.
Write Nominal Values for Incrementers or Decrementers	• Either the module or the channel has not been configured. Only once both module and channel have been configured can the nominal values be written. • The nominal values are located betwen the LOW range limit value and the HIGH range limit value.
Read Actual Value, Channel or Module Status	• The module has not been configured. • The channel has not been configured. Subsequent to the completion of module and channel configuration, all Read commands can be executed at any time.

Fig. 3–33 Communication Faults

Fault Messages in Data Word D204 of DBZAEHL0 Data Module

Fault messages are effective from POS-SA version 2 and up.

D204 in DBZAEHL0 (Hexadecimal)	Cause of Fault
0101H	Hardware fault on POS-SA.
0102H	Incorrect encoder selection in module configuration.
0103H	Absolute-value encoder configured despite counter mode.
0201H	Command not possible.
0202H	Command not permitted in current status.
0301H	It is not possible to use two identical comparison values.
0302H	One of the comparison values is located beyond both range limit values.
0303H	The incrementer nominal value is located beyond both range limit values.
0304H	The decrementer nominal value is located beyond both range limit values.
0501H	Both range limit values are equal or the HIGH range limit value is lower than the LOW range limit value.
0502H	An interruption check that is not possible with absolute signals has been selected.
0503H	The command is not permitted in counter mode.

Fig. 3–34 Fault Messages in Data Word D204

3.4.2 Operating Faults

Fault	Possible Fault Sources
Counter does not start	• The module is not configured. • The channel is not configured. • The Load And Start Counter command was not successfully executed. • When counter is controlled via inputs: The counter was not enabled by input I3. • Incorrect encoder connection. • The encoder configuration does not correspond to the connected encoder, causing the encoder signals to be incorrectly interpreted. • Subsequent to the Disable Counter command, no Load And Start Counter command was issued, or input I1 was not set.
POS-SA cannot be addressed	The start address on the POS-SA does not match the start address of the function module.
The initial response to a comparison value does not occur	• The comparison value was not written to the POS-SA. • The forward or reverse comparison of the comparison value has not been set. • The output response has not been set in the response of the comparison value.
The Fault LED on the module illuminates	An uncontrolled access, such as direct read or write access to the start address of the POS-SA, has occurred. The POS-SA module may only be accessed via the ZAEHL45 and/or ZAEHLICL function module.

Fig. 3–35 Operating Faults

4 Positioning

This chapter discusses the positioning function.
The first section provides an overview of the following:

- Structure and function
- Connections
- Commands
- Execution times

Subsequent sections of this chapter provide a detailed description of the operation of the POS-SA Counting / Positioning Module, and of faults that may occur.

4.1 Overview

4.1.1 Structure and Function

Through the utilization of two channels, the POS-SA Counting / Positioning Module is capable of capturing the positioning data for 2 traversing paths independently of each other.

Positioning

The positioning data is is captured for the following:

- Rotary axes or
- Linear axes.

The data capture includes –

- Forward travel, and
- Reverse travel.

Encoder Types

The connected encoders/transducers may be –

- Incremental encoders, or
- Absolute-value encoders (synchronous serial interface, SSI).

The POS-SA provides connections for 1 or 2 incremental-value or absolute-value encoders. The mixed operation of incremental and absolute-value encoders is not possible.

For special applications it is possible to connect a maximum of 3 absolute-value encoders to a singe encoder connection.

Positioning Control

The positioning action is controlled via –

- Input and output signals, and
- Software commands.

Inputs / Outputs

Examples of input signals are –

- Enable signal,
- Load contact,
- Zero-point reference signal (reference point), or
- Limit switch.

The outputs are capable of controlling the process, i.e., the speed:

- Rapid traversing motion, or
- Creep speed.

Start, End, and Comparison Positions

Starting with function module version number 203, a maximum of 46 comparison values can be specified in addition to a range start and range end position (software limit switches). Upon attaining the comparison positions, outputs can be set, reset or toggled.

The numerical range encompasses 32 bits (bits 0 through FFFF FFFF). This numerical range must never be exceeded because otherwise the axis will no longer be synchronized (due to the loss of encoder pulses), and must again be newly referenced.

Software Counter

In addition, a software counter (0 through 65535) is available. It is capable of counting forward or in reverse in the event that it reaches a range start, range end or comparison position.

Signal Level

As the signal level for incremental-value encoders, 5 V– or 24 V– can be selected for each channel.

Absolute-value encoders must utilize a signal level with 5 V differential.

Positioning and Controlling Paths of Linear Axes

Example:

- Configuring a channel for positioning a linear axis.
- Two end points – range start value and range end value – are specified as reference points between which the axis may travel. Range start and range end value can be utilized to function as software-implemented limit switches.
- For incremental-value encoders, reference point to be approached. The reference signal of the incremental-value encoder is connected to input I0.
- The inputs I1 and I2 can additionally be used a hardware-implemented limit switches. If a signal is present on I1 or I2, the axis must be brought to a safe stop immediately.
- Input I3 is used to enable the outputs.
- Total of 46 comparison values can be used between the range start value and range end value. The comparison values can be used in both directions of travel. The Comparison Value Attained or Comparison Value Passed information is utilized to control the application task. The outputs can be used for this purpose.

Positioning and Controlling Paths of Rotary Axes

Example:

- Configuring a channel for positioning a rotary axis.
- Two end points – range start value and range end value – are specified as reference points between which the rotary axis may travel. Range start and range end value can be utilized to function as software-implemented limit switches.
- For incremental-value encoders, reference point to be approached. The reference signal of the incremental-value encoder is connected to input I0.
- The input I1 functions as a loading contact. Contingent upon the direction of rotation, this facilitates loading the range start value or range end value.
- Input I3 is used to enable the outputs.
- Up to 46 comparison values are available between the range start and end values. The comparison values can be utilized in both directions. The Comparison Value Attained or Comparison Value Passed information is utilized to control the application task. The outputs can be used for this purpose.

4.1.2 Connections

Encoder Connections

Encoder types:

- Incremental-value encoder, 5 V differential rectangular pulse signals
- Incremental-value encoder, 24 V absolute rectangular signals
- Absolute-value sensor with 5 V SSI interface, single-turn or multi-turn with or without parity, ansd with/without voltage monitoring bit.

☞ **Up to 3 SSI encoders of the same type can be connected to an encoder connection. If 2 or 3 SSI encoders are connected to a single encoder connection, only the Actual values can be read. Comparison values, inputs and outputs will then no longer be usable.**

X81/X82 Pin No.	Encoders		
	Incremental-value encoder, 5 V Diff. rect. signals	**Incremental-value encoder, 24 V Absolute rect. signals**	**Absolute-value encoder, SSI, 5 V Differential signal**
1	Signal A		SSI1 DATA +
2	Signal A inv.		SSI1 DATA –
3	Signal B		SSI2 DATA +
4	Signal B inv.		SSI2 DATA –
5	5 V encoder operating power		5 V encoder operating power
6	Zero mark		SSI3 DATA +
7	Zero mark inv.		SSI3 DATA –
8		Signal A	
9		Signal B	
10			SSI Timing
11			SSI Timing inv.
12	GND	GND	GND
13			
14	24 V power supply for encoder	24 V power supply for encoder	24 V power supply for encoder, max. 600 mA
15		Zero mark	

Fig. 4–1 X81 / X82, Encoder Interface

Inputs

X21 or X22	Linear axis	Rotary axis
E0	Reference traversing contact	Reference traversing contact
E1	Limit switch	Loading contact
E2	Limit switch	not used
E3	Enabling contact	Enabling contact

Fig. 4–2 X21 / X22, Inputs

Outputs

The outputs O0 through O3 can be used for controlling of rapid movement / creep speed in both forward and reverse directions of travel.

4.1.3 Commands

Communications with the POS-SA Positioning / Counting Module are handled via the WEG45 function module (CL350/CL400/CL500), or via the WEGICL function module (ICL700).
The function module contains commands for the following purposes:

- Writing data to the POS-SA, and
- reading data from the POS-SA.

The referred data is –

- read from the DBWEG0, DBWEG1, and DBWEG2 data modules, and
- written to the DBWEG0 data module.

Configuration Commands

- Write Module Configuration
- Write Channel Configuration
- Write Comparison Values
- Write Incremental Reference Point
- Write Decremental Reference Point
- Start Reference Point Approach
- Set Default Outputs And Actual Value

Write Module Configuration

☞ **With each new configuration command, all other previously transmitted commands lose their validity, and must again be sent to the POS-SA module.**

Preset values for –

- Positioning operating mode
- Encoder, incrementer or SSI absolute-value encoder.

Write Channel Configuration

- Range start and range end values for positioning
- Output responses to attainment of range start and range end value
- Utilization of inputs
- Encoder type

Write Comparison Positions

Comparison values must be located between start and end position.

Effective with version 203 of the function modules, 46 comparison positions can be stored, instead of 8 comparison positions in the case of previous versions.

Preset values for –

- up to 46 comparison positions per channel
- Output responses to attainment of start or end value.

Starting with module version 206, the comparison values can also be written if, in the case of –

- Incremental-value encoders, the axis is referenced and,
- in the case of an absolute-value encoder, an enable signal has been issued.

If this occurs, all previous comparison values are deleted.

The new comparison values will only become reenabled if one of the three Enable commands has been transferred.

Write Incremental Reference Point

With incremental-value encoder and approach to reference point in positive direction: Preset of reference point offset in positive direction.

Write Decremental Reference Point

With incremental-value encoder and approach to reference point in negative direction: Preset of reference point offset in negative direction.

Start Reference Point Approach

Start reference point approach. Subsequent to starting the approach, reading and interpretation of the channel status can be used to determine whether the axis is synchronized.

Preset Outputs and Actual Values

Presetting the output to a specified value.

With incremental-value encoder, as long as the axis is not referenced: Preset the actual value to a specific value (possible only prior to referencing).

Read Commands

- Read Actual Value
- Read Module Status
- Read Channel Status

Read Actual Value

Reading current actual value from channel1 or channel 2.

For non-referenced axes, the default actual value with incremental-value encoders is located at the centre of the displayable numerical value:

- Positive numbers only: 8000 0000 H
- Positive and negative numbers: 0000 0000 H

Read Module Status

- Module status
- Channel status of both channels
- Actual values of both channels

Read Channel Status

Reads for a single channel –

- Current statuses of inputs and outputs
- Last attained comparison value
- Software counter, and
- Status and fault messages

Control Commands

- Enable positioning in incrementing direction
- Enable positioning in decrementing direction
- Enable positioning with outputs

☞ **For incremental encoders:**
When the referencing approach has been concluded, transmitting an Enable command is not required: the Enable function is automatic. In the event that the comparison values are subsequently changed, the positioning function must again be enabled by means of an Enable command.

Enable Positioning in Incrementing Direction

Setting of outputs in accordance with the activated comparison values. Starting with the first comparison value, the outputs are modified until the valid actual value – dependent upon the actual value – has been attained.

Enable Positioning in Decrementing Direction

Setting of outputs in accordance with the activated comparison values. Starting with the first comparison value, the outputs are modified until the valid actual value – dependent upon the actual value – has been attained.

Enable Positioning With Outputs

Enabling of comparison values, and of outputs. The outputs are not modified.

Special-purpose Command

Reading SSI actual value (3 SSI encoders).
Reading actual values of up to 3 SSI encoders that are connected to a single encoder connection on the POS-SA module.

4.2 Module Operation

The operation of the POS-SA Counting / Positioning Module is accomplished via –

- the inputs,
- the WEG45 (CL350/CL400/CL500), and/or WEGICL (ICL700) function module, and
- the DBWEG0, DBWEG1, and DBWEG2 data modules.

The WEG45 and/or WEGICL function module must be cyclically called up in the PLC program. The purpose is the –

- configuration of the module, and the
- configuration of the channels.

The reference point values are loaded, followed by the start of the reference point approach.

Additional Read commands for the WEG45 and/or WEGICL function module, data can be –

- read from the data modules, and written to the POS-SA module, and
- read from the POS-SA module, and stored in the DBWEG0 data module.

Function Modules

The WEG45 and/or WEGICL function module is provided on the supplied diskette in the form of a PxL file. The following links with the application project, and entry in the symbol file, are required:

- In centralized module operation, the WEG45 and/or WEGICL function module must be linked in conjunction with the FIFOZM1 function module.
- In distributed module operation (PROFIBUS-DP), the WEG45 must be linked in conjunction with the FIFODM1 function module.

FIFOZM1 or FIFODM1 comprise secondary function modules of WEG45 and/or WEGICL, and handle the actual data transport from and to the POS-SA module.

PROFI Software Data Modules

The DBWEG0, DBWEG1, and DBWEG2 data modules are provided on the supplied diskette in the form of text files, and can thus be copied into freely selectable data modules in the symbol file. The data modules must be arranged in successive order, with DBWEG0 being the first one.

All data that is read by the POS-SA or written to the POS-SA is managed exclusively by these data modules.

WinSPS Software Data Modules

Beginning with function module version 203, the following applies:

The DBWEG0, DBWEG1, and DBWEG2 data modules are provided on the supplied diskette in the form of PxD files, and can be directly integrated into the application project.

4.2.1 Approaching the Reference Point

In the case of axes with incremental measuring systems, a reference point must be approached in order to establish a fixed reference point. As a result, the axis is synchronized.

Five variants of reference points are available.

Procedural steps of approaching the reference point:

- The Write Channel Configuration command is used to set the selected variant.
- The Start Reference Point Approach command is used to activate the reference point logic.
- Upon recognizing the reference point, and contingent upon the current direction of travel, the INCR or DECR reference point offset (DBWEG1 / DBWEG2, D24, D26, and/or D32, D34) is written into the actual value.
- Reading and interpretation of the channel status provides an indication whether the reference point approach has been successfully completed: the axis bit is then set.
- If the reference point approach has been successful:
  If no reference point offsets were loaded, the actual encoder value is positioned at the half-way point between the upper and lower range limit value (software limit switch).

The method of finding the reference point differs for each of the five variants.

☞ **With reference point approaches 1 through 3, the reference offset in the encoder actual value must always be a multiple of 256. Bits 0 through 7 of the reference offset must always be set to 0.**

Reference Point Approach 1

In data module DBWEG1 / DBWEG2, D4 encoder configuration, bits 13 through 8 are set to 000001.

If input I0, preliminary contact, is enabled, the encoder actual value is set to the reference offset upon the next encoder reference pulse.

Precontact must still be active upon receipt of encoder reference pulses.

Reference Point Approach 2

In data module DBWEG1 / DBWEG2, D4 encoder configuration, bits 13 through 8 are set to 000010.

The encoder actual value is set to the reference offset by the next reference pulse from the encoder. Input I0 is not used.

Reference Point Approach 3

In data module DBWEG1 / DBWEG2, D4 encoder configuration, bits 13 through 8 are set to 000100.

As soon as input I0 (preliminary contact) is enabled, the encoder value is set to reference offset. The reference pulse from the encoder is not used.

☞ **At the time of the reference point approach, methods 4 and 5, the encoder must be at standstill because this reference point approach commences immediately upon receipt of the Start Reference Point Approach command.**

The reference offset must not be a multiple of 256; the full range of 32 bits is adopted.

Reference Point Approach 4

In data module DBWEG1 / DBWEG2, D4 encoder configuration, bits 13 through 8 are set to 010000.

Immediately upon the receipt of the Start Reference Point Approach command by the POS-SA module, the INCR reference offset is loaded into the encoder actual value.

Reference Point Approach 5

In data module DBWEG1 / DBWEG2, D4 encoder configuration, bits 13 through 8 are set to 100000.

Immediately upon the receipt of the Start Reference Point Approach command by the POS-SA module, the DECR reference offset is loaded into the encoder actual value.

4.2.2 Controlling Positioning via Inputs

Before the inputs can be used to control the positioning functions, the inputs must be enabled via the Write Channel Configuration command.

The control for each channel is effected via inputs I0 through I3.

I0

In the reference point approaches, variants 1 and 3, input I0 is used to connect the precontact:

- Reference Point Approach, method 1
  As soon as precontact is enabled, the next encoder reference pulse is used to set the encoder actual value to the reference offset. Precontact must still be active upon receipt of encoder reference pulses.
- Reference Point Approach, method 3
  As soon as precontact is enabled, the encoder value is set to reference offset. The reference pulse from the encoder is not used.

I1

Dependent upon the configuration (rotary axis or linear axis), the significance of I1 differs:

- Linear axis:
  Limit switches, for disabling the outputs.
- Rotary axis:
  I1 is used as a loading contact. As soon as I1 becomes enabled, and contingent upon the direction of rotation, the range start value or range end value is loaded.

I2

The significance of input I2 differs with the configuration of rotary or linear axis:

- Linear axis:
  Limit switches, for disabling the outputs.
- Rotary axis:
  For the rotary axis, I2 bears no significance. However, the status can be interpreted via the Read Module Status or Read Channel Status commands.

I3

I3 is used as a higher-level enable input. If the input is not set, the outputs will be disabled.

4.2.3 Controlling Positioning via WEG45 and/or WEGICL Function Module

The WEG45 and/or WEGICL function module must be called up cyclically. The configuration of the module and of the two channels may be effected once only, e.g. via trigger pulse, including via the OM1 organization module.

The function module is capable of executing the following commands:

- Configure Module
- Configure Channel1 or Configure Channel 2
- Write Comparison Values
- Write Incremental or Decremental Reference Point Offset
- Start Reference Point Approach
- Preset Outputs and Actual Value (incrementers only)
- Read Module Status
- Read Channel1 Status or Read Channel2 Status
- Enable Positioning in Incrementing / Decrementing Direction, or Enable Positioning with Current Outputs
- Read Encoder Actual Values

Data that is to be transferred to the POS-SA must first be appropriately prepared in the DBWEG0, DBWEG1, and DBWEG2 data modules.

Subsequent to a cyclical call-up of the WEG45 and/or WEGICL function module, the acknowledgement parameters must be checked to establish whether the command was transferred without fault.

☞ **New commands can be sent to the POS-SA module only once a positive acknowledgement has been received**

All data read by the POS-SA module is held in the DBZAEHL0 data module.

☞ **A positive acknowledgement to a Read command is required before the associated data may be interpreted and processed in the DBWEG0 data module.**

Example: Calling WEG45 and/or WEGICL Function Module

```
❑    CM      -WEG45,6          ;Function module call
     ;
     P0   W   -KOMMANDO         ;Command
     P1   BY  -QUITTUNG         ;Address for user acknowledgement
     P2   W   K4                ;Start address / BM-DP12 switching matrix address
     P3   W   K100              ;Data module number
     P4   W   –FIFOZM1          ;Program module number
     P5   W   K0                ;PLC channel number, distributed operation
```

WEG45 and/or WEG Parameters

Parameter	Input parameters	Output parameters
P0 (Word)	Command	
P1 (Byte)		Address for user acknowledge-ment
P2 (Word)	Centralized operation: Start address Distributed operation: BM-DP12 switching matrix address	
P3 (Word)	Data module number	
P4 (Word)	Program module number Centralized operation: FIFOZM1 Distributed operation: FIFODM1	
P5 (Word)	Centralized operation: No significance Distributed operation: (not possible w/ ICL700 PLC channel number	

Fig. 4–3 WEG45 and/or WEGICL Parameters

P0, Command

Bit	Explanation
0	Write Configuration
1	Write Comparison Value
2	Write Incrementer Reference Point Offset
3	Write Decrementer Reference Point Offset
4	Write Actual Value And Outputs
5	Start Reference Point Approach
6	Enable Positioning Incrementer
7	Enable Positioning Decrementer
8	Enable Positioning With Current Outputs
9	Read Status
10	Read Actual Value
11	Special commands, bits 1 through 10 used for misc. commands
12	not used
13	Channel 2
14	Channel 1
15	Module

Fig. 4–4 P0, Commands

In the event that several commands are to be transferred with a single function module call, the function module will start the transfer with the command defined by the least significant bit (LSB). The function module processes all commands in succession. When all commands have been executed without fault, all bits in the user acknowledgement will have been cleared.

The FM Active signal in the acknowledgement is set as long as the function module being processed is active. As long as the function module remains active, the command for the function module may not be changed.

The module configuration and that of the individual channels must be accomplished prior to all other commands.

The configuration of the module, and the configuration of the individual channels, must be accomplished prior to all other commands.

For the module, the Write Configuration and Read Status commands are available. For the two channels, all commands can be used.

With a single command, instructions for the module and for both channels can be transferred simultaneously.

Bits 8 and 9 may not be set simultaneously.

Bits 13, 14, and 15 determine whether the command refers to the module, channel1 or channel2, respectively.

Structure of Special Commands

In the case of special commands, parameter P0 for bit 11 is set to HIGH.

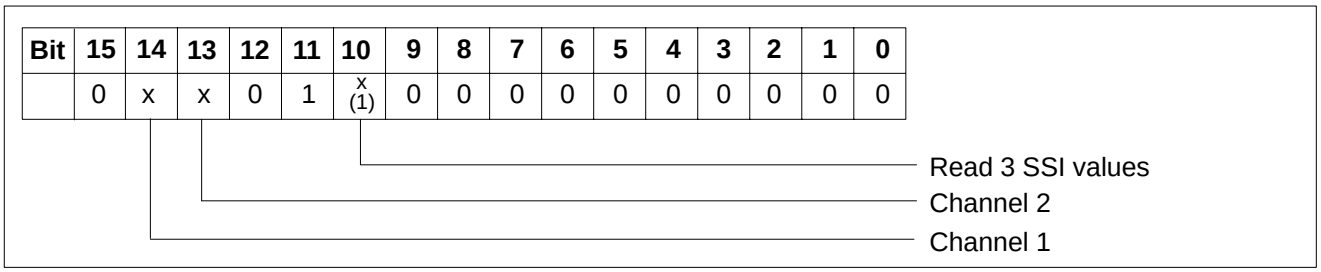

Fig. 4–5 Special Commands

P1, User Acknowledgement

Acknowledgements are returned to the user at the specified address. The user may not write to the acknowledgement.

As long as the module is processing a command, the FM Active signal is set.

The summary fault signal in the acknowledgement indicates transfer faults.

Acknowledgements are returned to the user at the specified address. The user may not write to the acknowledgement.

As soon as all data has been written to and/or read from the POS-SA, the FM Active signal is again reset by the function module.

The summary fault signal in the acknowledgement indicates transfer faults.

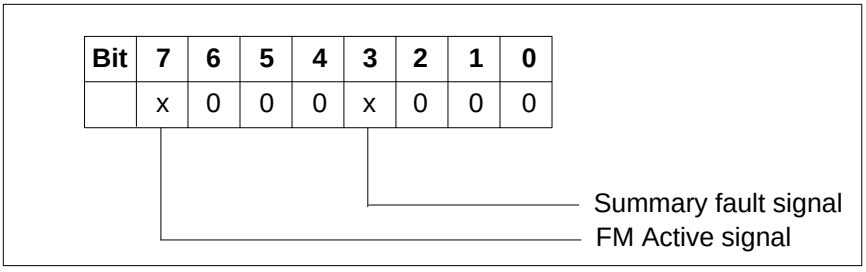

Fig. 4–6 P1, User Acknowledgement

P2, Extended Input/Output Field Address

- Centralized operation
  The start address of the POS-SA module must be specified. Upward of this start address, 4 bits each are used in the EI and EO fields.
- Distributed operation
  The switching matrix address of the BM-DP12 must be specified.

P3, Data Module Number

Module number of the DBWEG0 data module.

P4, Program Module

- Centralized operation
  Program module number (e.g. PB0) or FIFOZM1 symbolic name
- Distributed operation
  Program module number (e.g. PB0) or FIFODM1 symbolic name

P5, PLC Channel Number

- Centralized operation
  Although the parameter is without significance, it must be specified, i.e., K0.
- Distributed operation
  PLC channel number

4.2.4 Managing Data with DBWEG0 Data Module

PROFI Software Data Modules

The DBWEG0, DBWEG1, and DBWEG2 data modules are provided in the form of text files on the supplied diskette, and can thus be copied into the symbol file into freely selectable data modules. The data modules must be arranged in successive order, with DBWEG0 being the first one.

WinSPS Software Data Modules

Effective with function module version 203, the following applies:

The DBWEG0, DBWEG1, and DBWEG2 data modules are provided on the supplied diskette in the form of PxD files, and can thus be directly copied into the application project.

☞ **These data modules are reserved exclusively for the POS-SA module. Data words that have not been commented may not be used because they are used for internal data management functions by the WEG45 and/or WEGLICL function module.**

Example

DM No.	Name	Comment	R/E	Length
DM 1	DBZAEHL0	Module configuration data, and data read from the module	R	256
DM 2	DBZAEHL1	Channel1 configuration data and channel1 comparison values	R	512
DM 3	DBZAEHL2	Channel2 configuration data and channel2 comparison values	R	512

Fig. 4–7 Overview List of Data Modules

☞ **Application ranges used on CL350/CL400/CL500/ICL700: M248 through M255**

DBWEG0

The DBWEG0 data module contains the module configuration data as well as all data that is read from the module.

The data words are listed in the table in Fig. 4–8. The table is followed by a description of the data word structure. The data words are shown in their standard default settings.

Abbreviations used in the data module:

R = RAM
Sg = Sign
F = Format
B = Binary
D = Decimal
H = Hexadecimal

DM 0	Name: DBWEG0			Comment: Configuration and Read data RAM/EPROM: R	
No.	**Symbol**	**Type**	**Sg**	**Data field / Comment**	**F**
D 0		Word	N	Module mode with encoder connection	B
D 2 thru 6		Word	N	Internal use	
D 8		Word	N	Module status	B
D 10		Word	N	Internal use	
D 12		Word	N	Channel1, input / output statuses	B
D 14		Word	N	Channel1, number of last attained comparison value	D
D 16		Word	N	Channel1, status and fault messages	B
D 18		Word	N	Channel1, software counter	D
D 20		Word	N	Chan1 encoder value, bit 0 thru 15 (incr./SSI absol.-value enc.)	H
D 22		Word	N	Chan1 encoder val., bit 16 thru 31 (incr./SSI absol.-value enc.)	H
D 24		Word	N	Channel2, input / output statuses	B
D 26		Word	N	Channel2, number of last attained comparison value	D
D 28		Word	N	Channel2, status and fault messages	B
D 30		Word	N	Channel2, software counter	D
D 32		Word	N	Chan2, encoder value, bit 0 thru 15 (incr./SSI absol.-value enc.)	H
D 34		Word	N	Chan2 encoder val., bit 16 thru 31 (incr./SSI absol.-value enc.)	H
D 36		Word	N	Chan1 SSI1 actual val., bit 0 thru 15, read via special commd.	H
D 38		Word	N	Chan1 SSI1 actual val., bit 16 thru 31, read via special commd.	H
D 40		Word	N	Chan1, SSI1 actual val., bit 0 thru 15, read via special commd.	H
D 42		Word	N	Chan1, SSI1 actual val., bit 16 thru 31, read via special commd.	H
D 44		Word	N	Chan1, SSI3 actual val., bit 0 thru 15, read via special commd.	H
D 46		Word	N	Chan1, SSI3 actual val., bit 16 thru 31, read via special commd.	H
D 48		Word	N	Chan2, SSI1 actual val., bit 0 thru 15, read via special commd.	H
D 50		Word	N	Chan2, SSI1 actual val., bit 16 thru 31, read via special commd.	H
D 52		Word	N	Chan2, SSI2 actual val., bit 0 thru 15, read via special commd.	H
D 54		Word	N	Chan2, SSI2 actual val., bit 16 thru 31, read via special commd.	H

DM 0	Name: DBWEG0	Comment: Configuration and Read data	RAM/EPROM: R		
No.	**Symbol**	**Type**	**Sg**	**Data field / Comment**	**F**
D 56		Word	N	Chan2, SSI3 actual val., bit 0 thru 15, read via special commd.	H
D 58		Word	N	Chan2, SSI3 actual val., bit 16 thru 31, read via special commd.	H
D 60 thru 254		Word	N	Internal use	

Fig. 4–8 DBWEG0

D0, Module Mode and Encoder Connection

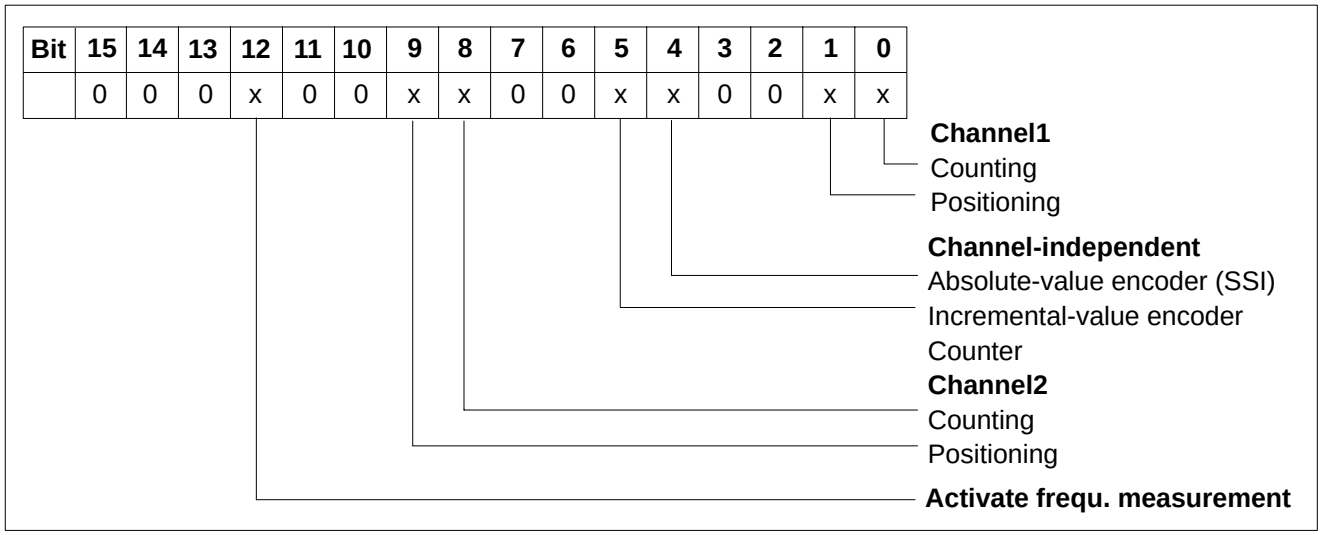

Fig. 4–9 D0, Module Mode and Encoder Connection

D8, Module Status

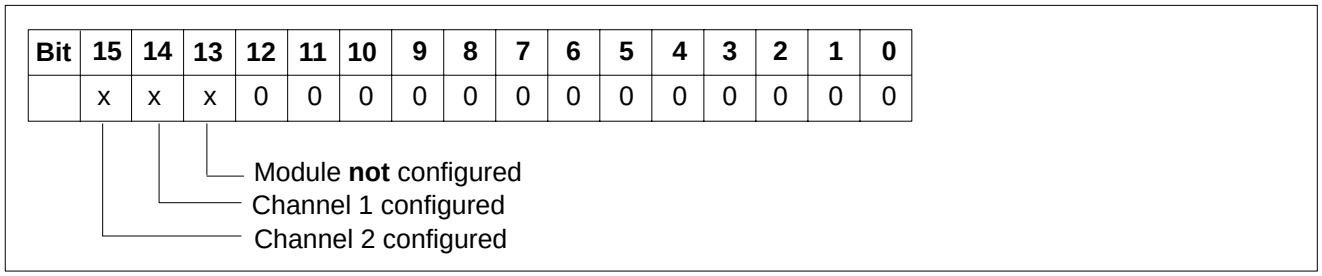

Fig. 4–10 D8, Module Status

D12, Channel1, Input / Output Statuses

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	x	x	x	x	0	0	0	0	x	x	x	x

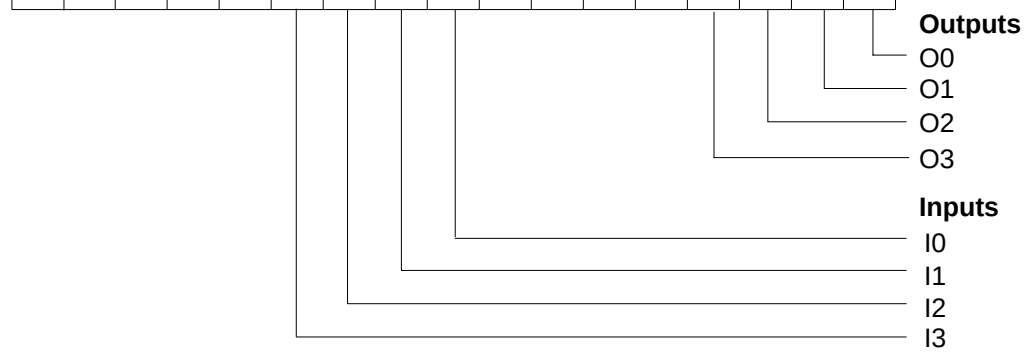

Fig. 4–11 D12, Channel1, Inputs/Outputs

D14, Channel1, Number of Last Attained Comparison Position

☞ **Upon reaching the range limit value, the number of the last attained comparison value is set to 128 (80H).**

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	x	x	x	x	x	x	x	x	0	0	0	0	0	0	0	0

Fig. 4–12 D14, Number of Last Attained Comparison Position

D16, Channel1, Status and Fault Messages

Bit	Explanation
0	Speed failure
1	Cable break on encoder signal (A) or SSI1
2	Cable break on encoder signal (B) or SSI2
3	Cable break on encoder signal (R) or SSI3
4	SSI encoder, power monitoring
5	SSI encoder, parity error
6, 7	not used
8	Channel disabled (not enabled, or referencing approach not executed)
9	Inputs disabled (not used)
10	Axis synchronized (reference point approach completed)
11	Numerical range limit attained
12 thru 15	not used

Fig. 4–13 D16, Channel1, Status and Fault Messages

A speed failure results when the specified comparison values cannot be processed rapidly enough. Upon processing a comparison value, the POS-SA has detected that the next comparison value for the counter has already been attained.

If this is the case, the responses upon reaching the next comparison value can only be processed with a time delay. They are not discarded, however.

☞ **All fault resets require module or channel configurations.**

D24, Channel2, Input / Output Statuses

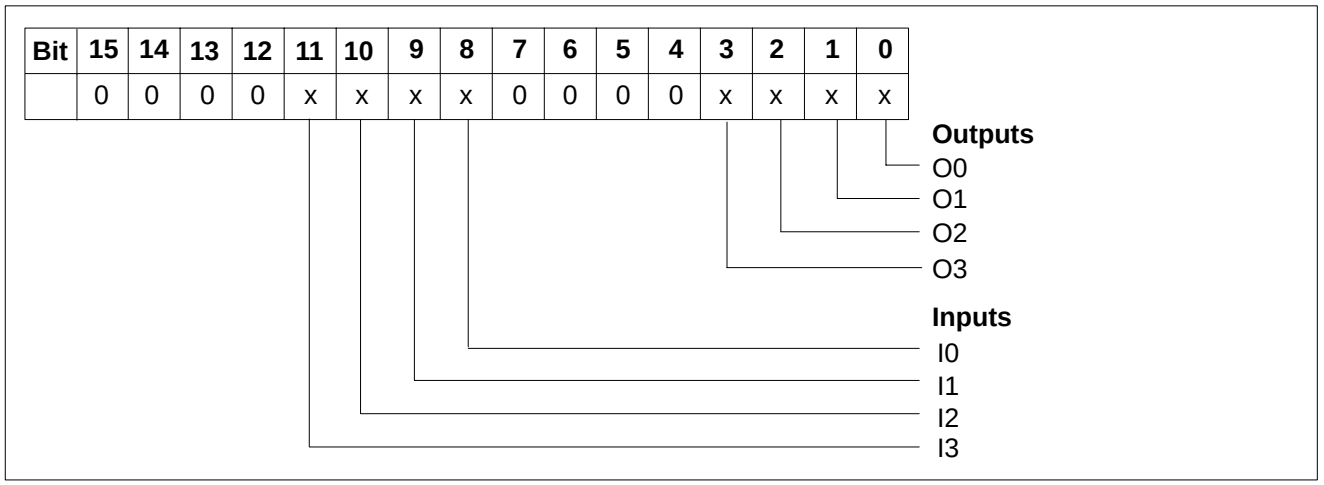

Fig. 4–14 D24, Channel2, Input / Output Statuses

D26, Channel2, Number of Last Attained Comparison Position

☞ **Upon reaching the range limit value, the number of the last attained comparison value is set to 128 (80H).**

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	0	0	x	x	x	x	x	x

Fig. 4–15 D26, Channel2, Number of Last Attained Comparison Position

D28, Channel2, Status and Fault Messages

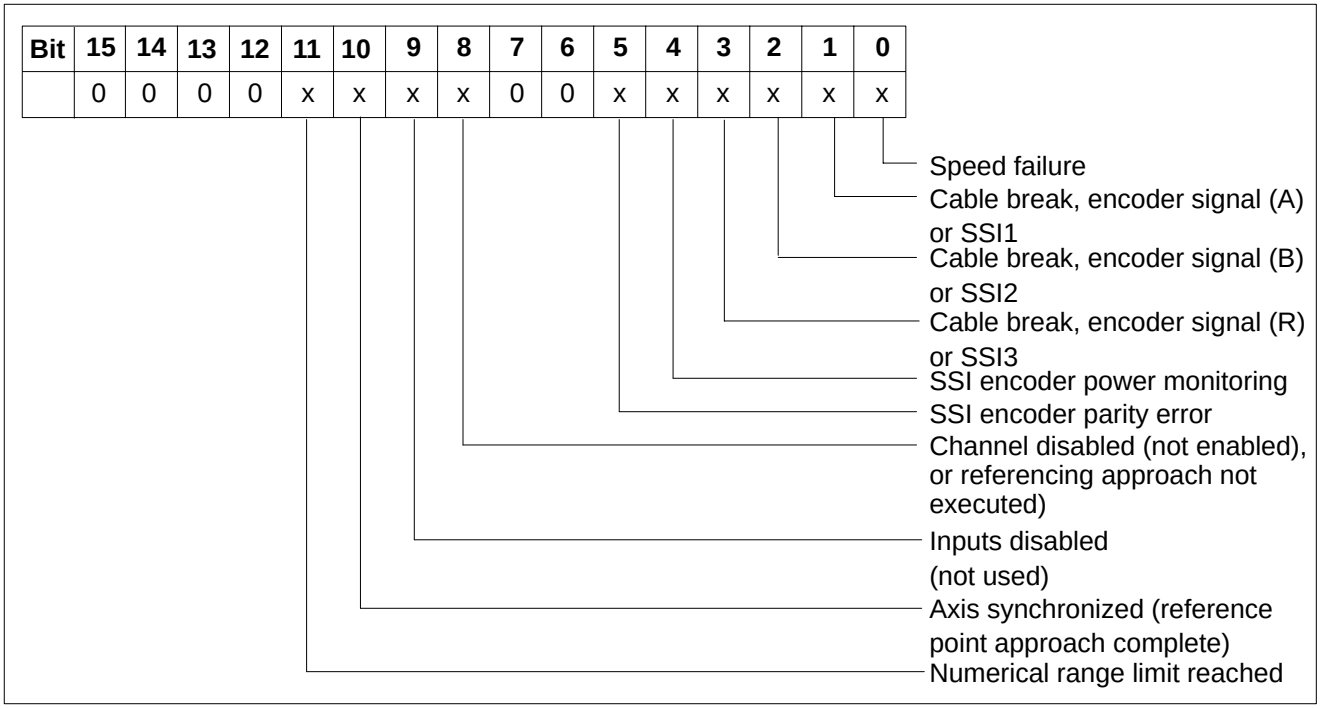

Fig. 4–16 D28, Channel2, Status and Fault Messages

A speed failure results when the specified comparison values cannot be processed rapidly enough. Upon processing a comparison value, the POS-SA has detected that the next comparison value for the counter has already been attained.

If this is the case, the responses upon reaching the next comparison value can only be processed with a time delay. They are not discarded, however.

☞ **All fault resets require module or channel configurations.**

D36 through D46, Channel1 SSI Actual Values

The actual values of the up to 3 absolute-value encoders on channel1 are stored in data words D36 through D46.

D48 through D58, Channel2 SSI Actual Values

The actual values of the up to 3 absolute-value encoders on channel2 are stored in data words D48 through D58.

4.2.5 Managing Data with DBWEG1 Data Module

This data module contains –

- the channel1 configuration data, and
- the comparison positions.

The data words are listed in the table in Fig. 4–17 with their standard default settings. The table is followed by a description of the data word structure.

DM 1 Name: DBWEG1 Comment: Channel1 configuration data RAM/EPROM: R					
No.	**Symbol**	**Type**	**Sg**	**Data field / Comment**	**F**
D 0		Word	N	Channel parameters	B
D 2		Word	N	Utilization of inputs	B
D 4		Word	N	Encoder configuration	B
D 6		Word	N	SSI parameters	B
D 8		Word	N	LOW range limit value, bit 0 thru 15	H
D 10		Word	N	LOW range limit value, bit 16 thru 31	H
D 12		Word	N	Output response to LOW range limit value	B
D 14		Word	N	Response to LOW range limit value	B
D 16		Word	N	HIGH range limit value, bit 0 thru 15	H
D 18		Word	N	HIGH range limit value, bit 16 thru 31	H
D 20		Word	N	Response to HIGH range limit value	B
D 22		Word	N	Response to HIGH range limit value	B
D 24		Word	N	INCR reference point offset, bit 0 thru 15	H
D 26		Word	N	INCR reference point offset, bit 16 thru 31	H
D 28		Word	N	Output response to INCR reference point	B
D 30		Word	N	Reserved	H
D 32		Word	N	DECR reference point offset, bit 0 thru 15	H
D 34		Word	N	DECR reference point offset, bit 16 thru 31	H
D 36		Word	N	Output response to INCR reference point	B
D 38		Word	N	Reserved	H
D 40		Word	N	Default actual value, bit 0 thru 15	H
D 42		Word	N	Default actual value, bit 16 thru 31	H
D 44		Word	N	Default for outputs	B
D 46		Word	N	Reserved	H

DM 1	Name: DBWEG1 Comment: Channel1 configuration data			RAM/EPROM: R	
No.	**Symbol**	**Type**	**Sg**	**Data field / Comment**	**F**
D 48		Word	N	Comparison posit. 1, comparison position function	B
D 50		Word	N	Comparison posit. 1, comparison position bit 0 thru 15	H
D 52		Word	N	Comparison posit. 1, comparison position bit 16 thru 31	H
D 54		Word	N	Comparison posit. 1, output response to comparison position	B
D 56		Word	N	Comparison posit. 1, positioning response to comparison posit.	B
D 58 thru 506		Word	N	Comparison position 1 through comparison position 46	
D 508 thru 510		Word	N	Internal use	

Fig. 4–17 DBWEG1

☞ **All configuration combinations not listed in the following tables are invalid.**

D0, Channel Parameter

Bit	Explanation
0 thru 2	not used
3 and 4	Response to System STOP Bit4 Bit3 0 0 No response 1 0 Outputs are set to 0 for the duration of System STOP, CLAB signal
5 thru 7	not used
8	Axis type 0 Linear axis 1 Rotary axis
9	0 positive numbers only 1 positive and negative numbers
10, 11	Number of SSI encoders Bit11 Bit10 0 0 1 SSI encoder 1 0 2 SSI encoders 1 1 3 SSI encoders

Bit	Explanation			
12 thru 14	Actual-value functions			
	Bit14	Bit13	Bit12	
	0	0	0	Read actual value
	0	0	1	Read timer value, 10 ms resolution
	0	1	0	Read timer value, 50 ms resolution
	0	1	1	Read timer value, 100 ms resolution
	1	0	0	Read timer value, 1000 ms resolution
15	not used			

Fig. 4–18 D0, Channel Parameter

The timer resolution for the frequency measuring function is controlled via bits 12, 13, and 14 (see Section 2.3, ”Frequency Measurement”). The frequency measuring function is available from module version 206 upwards.

Bit 9, positive and negative numbers, effective with module version 206:

- For positive numbers only, the range of values is located between 0000 0000 and FFFF FFFF.
- For a combination of both positive and negative numbers, the range of values is between 8000 0000 (highest negative number) and 7FFF FFFF (highest positive number). This makes it possible to shift the value 0000 0000 into the centre of the valid numerical range.
- In the case of absolute-value encoders, the maximum range of values is determined by both the revolutions-per-minute and the resolution.

D2, Utilization of Inputs

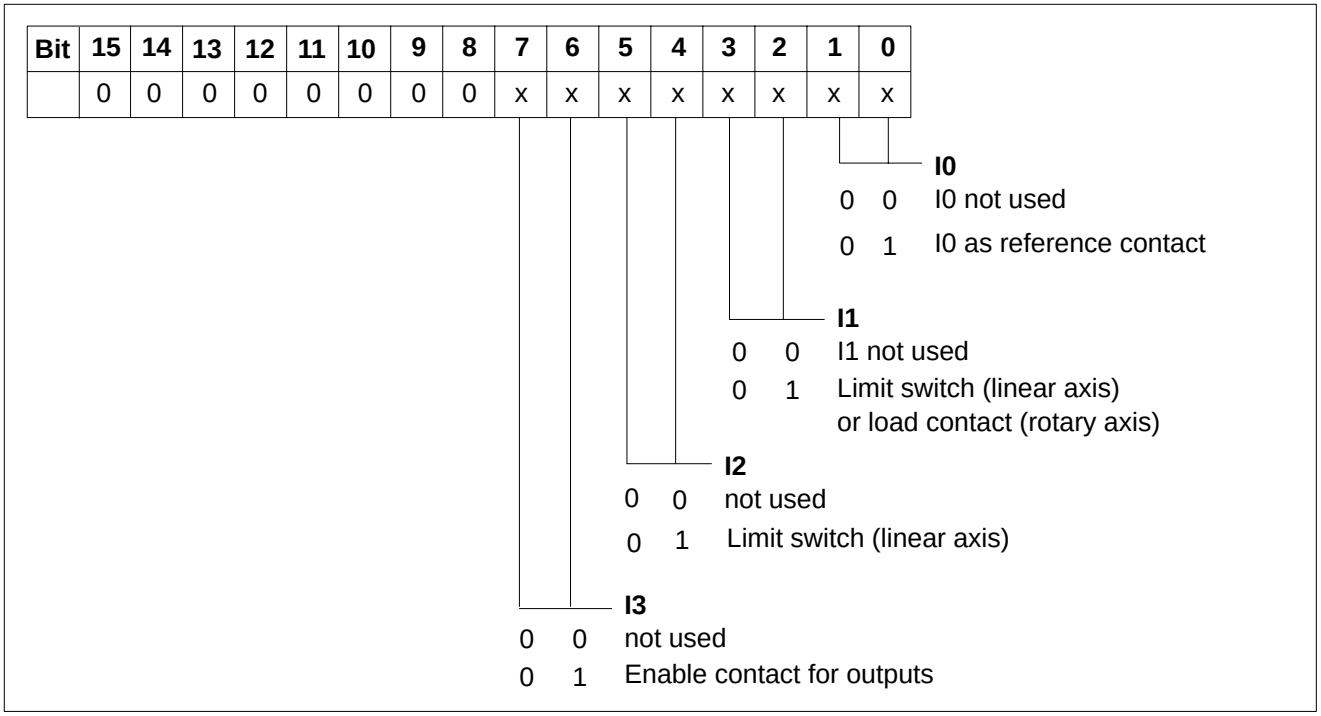

Fig. 4–19 D2, Utilization of Inputs

D4, Encoder Configuration

☞ **In accordance with the encoder type – absolute (SSI) or incremental – only the relevant data bits must be set in each case.**

☞ **If both channels are equipped with SSI encoders, the frequency should not exceed 140 kHz because this would significantly reduce the outgoing data transmission speed of the POS-SA module.**

Bit	Explanation
Incremental-value encoder	
0	Differential signals (sym. 5 V encoders only)
1, 2	not used
3	Interruption check (5 V differential signal only)
4	0 5 V encoder signals 1 24 V encoder signals
5	0 Incremental-value encoders, 4-way transition selection 1 Single-phase counter
6	Counters only 0 Counting direction determined by encoder 1 Counting direction determined by bit 7

Bit	Explanation						
7	For counters only						
	0	Incremental-value counter					
	1	Decremental-value counter					
8 thru 13	Reference point approach						
	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	
	1	0	0	0	0	0	Set DECR reference point offset as actual value
	0	1	0	0	0	0	Set INCR reference point offset as actual value
	0	0	0	1	0	0	Input I0 used as reference signal
	0	0	0	0	1	0	Encoder reference signal as reference signal
	0	0	0	0	0	1	Input I0 as precontact to encoder reference signal
14, 15	not used						

Fig. 4–20 D4, Incremental-value Encoders

Bit	Explanation			
Absolute-value encoder				
0	Differential signals, sym. 5 V encoders only			
1	0	Dual Code		
	1	Gray Code		
2	not used			
3	Interruption check, for 5 V differential signal only			
4 thru 7	not used			
8 thru 10	Data transmission frequency			
	Bit10	Bit9	Bit8	
	0	0	0	70 kHz
	0	0	1	140 kHz
	0	1	0	250 kHz
	0	1	1	400 kHz
11	not used			
12 thru 14	SSI encoder type			
	Bit14	Bit13	Bit12	
	0	0	0	13 bit single-turn encoder
	0	0	1	25 bit multi-turn encoder
	1	1	0	Special single-turn encoder
	1	1	1	Special multi-turn encoder
15	not used			

Fig. 4–21 Absolute-value Encoders

13 Bit Single-turn and 25 Bit Multi-turn Encoder

Different encoder types require different numbers of read pulses to be sent to them. For a 13 bit single-turn encoder, this is always 13, and for a 25 bit multi-turn encoder, this is always 25 pulses.

The stated numbers of pulses apply to most standard single-turn or multi-turn encoders.

If the power monitoring bit is set for a 13 bit single or 25 bit multi-turn encoder, the power monitoring bit will be read from the absolute-value encoder instead of the last data bit. This power monitoring bit is not stored in the actual value but is instead written to the channel status and fault message (DBWEG0 data module, data word16 or data word 28, bit4).

If a 13 bit single-turn or a 25 bit multi-turn encoder with parity bit is used, the parity bit can be set in the SSI parameter. In that case, the parity bit is also read from the absolute-value encoder, and stored in the channel status and fault message (DBWEG0 data module, data word 16 or 28, bit 5).

The data related to the 13 bit single-turn or 25 bit multi-turn encoders are transferred in tree structure format from the encoder to the module.

For single-turn encoders with less that 13 bits and 8192 steps, trailing zeroes will be returned.

For multi-turn encoders –

- with less than 12 bits and 4096 RPM, leading zeroes will be returned, and for those
- with less than 13 bits and 8192 steps per revolution, trailing zeroes will be returned.

However, the actual value in the data words of the DBWEG0 data module will always be indicated correctly.

Based upon the definitions in the SSI parameter, the value that is read will be shifted in the data word by the trailing numbers, for right-hand justification.

Special Single-turn and Multi-turn Encoders

With a special single-turn encoder, the number of data bits that are read from the absolute-value encoder corresponds exactly to the number of steps that are preset in the SSI parameter.

With a special multi-turn encoder, the number of data bits that are read from the absolute-value encoder corresponds exactly to the number of revolutions and steps that are preset in the SSI parameter.

If the special encoder features a power monitoring function, the power monitoring bit can be set in the SSI parameter. This power monitoring bit is written to the loaded actual value as the LSB, and is not suppressed.

If the parity bit is set for a special encoder, the parity bit will be read as an additional data bit, regardless of the selected RPM and steps. This parity bit is not stored in the actual value but is instead written to the status and fault message of the respective channel.

The actual values read from the special encoders are not shifted for right-hand justification but are shown as read.

D6, SSI Parameters

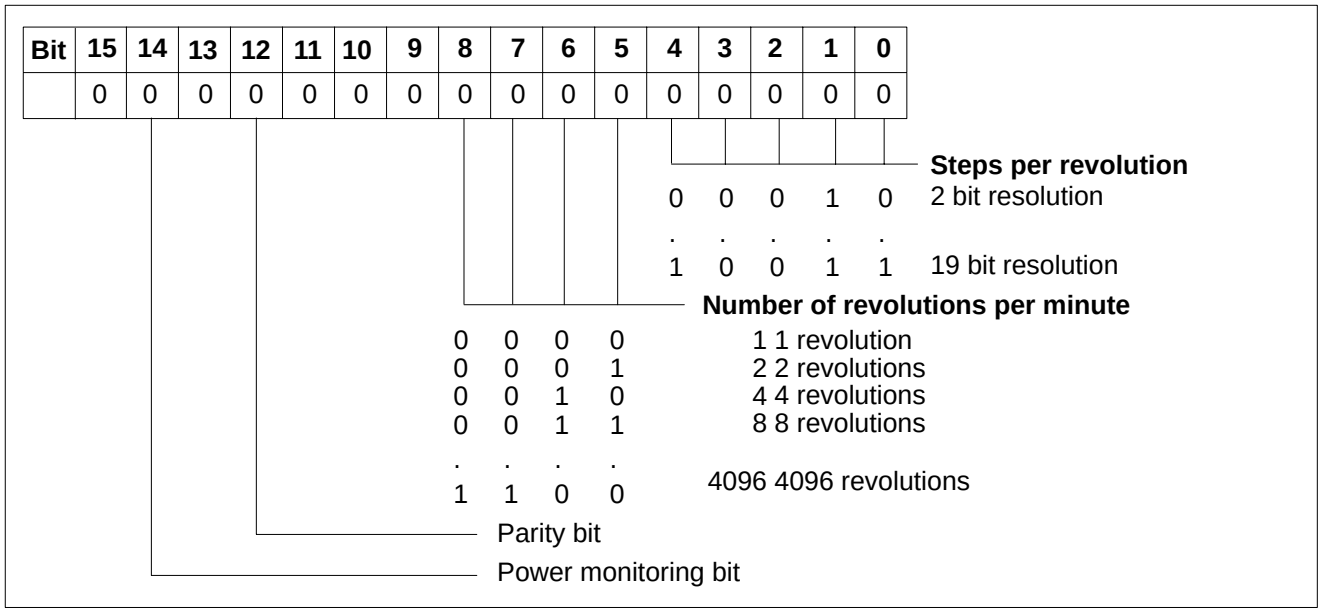

Fig. 4–22 D6, SSI Parameters

D12, Output Response to LOW Limit Value

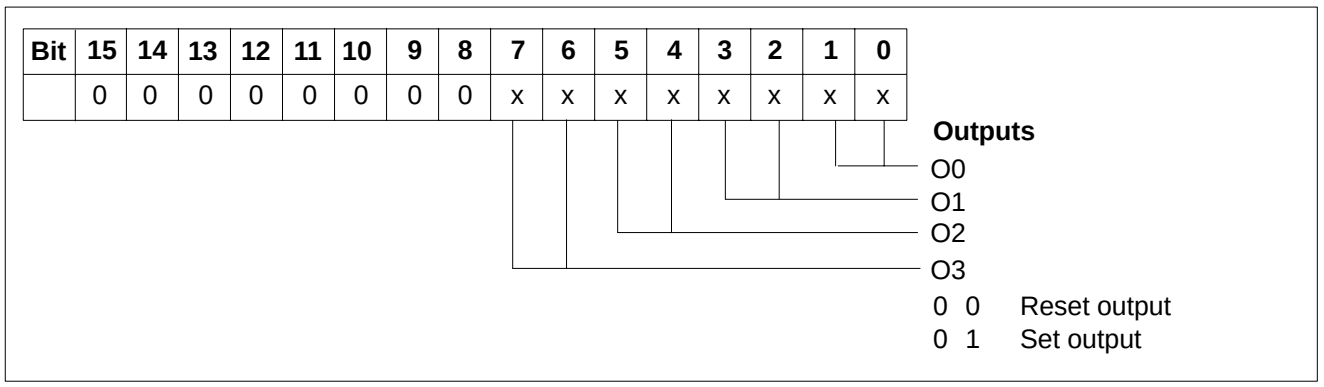

Fig. 4–23 D12: Output Response at LOW Limit Value

D14, Responses to LOW Range Limit Value

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	0	0	0	0	x	x	x	0

Clear outputs
Stop positioning function
Increment / decr. SW counter

Fig. 4–24 D14, Responses to LOW Range Limit Value

D16 / D18, HIGH Range Limit Value, Bit 0 through Bit 31

☞ **The HIGH range limit value for an absolute-value encoder must not be greater than the maximum possible SSI encoder value.**
Example: In the case of a 24 bit absolute-value encoder (4096 * 4096), the maximum permitted HIGH range limit value is 00FF FFFF.

D20, Output Response to HIGH Range Limit Value

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	x	x	x	x	x	x	x	x

Outputs
O0
O1
O2
O3
0 0 Reset output
0 1 Set output

Fig. 4–25 D20, Output Response to HIGH Range Limit Value

D22, Response to HIGH Range Limit Value

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	0	0	0	0	x	x	x	0

Clear outputs
Stop positioning function
Increment / decr. SW counter

Fig. 4–26 D22, Response to HIGH Range Limit Value

D24 through D28, Channel1, INCR Reference Point Offset

Data words D24 through D30 contain the INCR channel1 reference offsets.

☞ **The POS-SA module always sets bits 0 through bit 7 of the reference point offset to LOW, except with reference point approach, method 4.**

D28, Output Reaction at INCR Reference Point

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	x	x	x	x	x	x	x	x

Outputs
O0
O1
O2
O3
0 0 Reset output
0 1 Set output

Fig. 4–27 D28, Output Reaction at INCR Refererence Point

D32 through D38, Channel1 DECR Reference Point Offset

☞ **The POS-SA module always sets bits 0 through bit 7 of the reference point offset to LOW, except with reference point approach, method 5.**

D36, Output Reaction at DECR Reference Point

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0	x	x	x	x	x	x	x	x

Outputs
O0
O1
O2
O3
0 0 Reset output
0 1 Set output

Fig. 4–28 D36, Output Reaction at DECR Reference Point

D40 / D42, Actual-value Default, Bit 0 through Bit 31

Data words D40 through D44 can be used to set an absolute default for both the actual value and the outputs. This actual-value default is effective only prior to referencing.

D44, Output Defaults

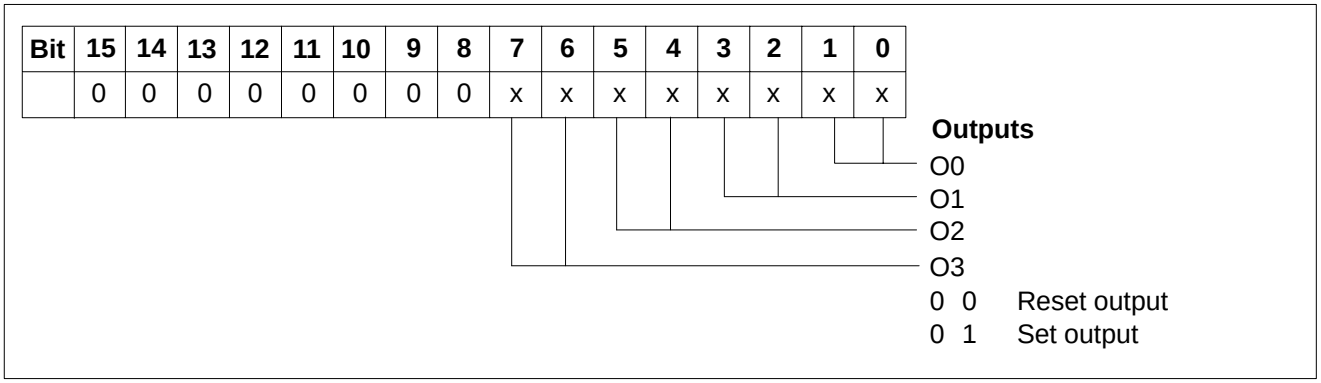

Fig. 4–29 D44, Output Defaults

D48 through D506, Comparison Positions

Up to 46 comparison positions can be defined between the LOW and HIGH range limit values.

These comparison positions can enabled for –

- forward direction
- reverse direction, or
- forward and reverse direction.

At each comparison point, the responses are triggered in accordance with the contents of the data words. The comparison values are stored in data words 48 through 506. As an example, the first default comparison position is shown below.

D48, Comparison Position 1, Comparison Position Function

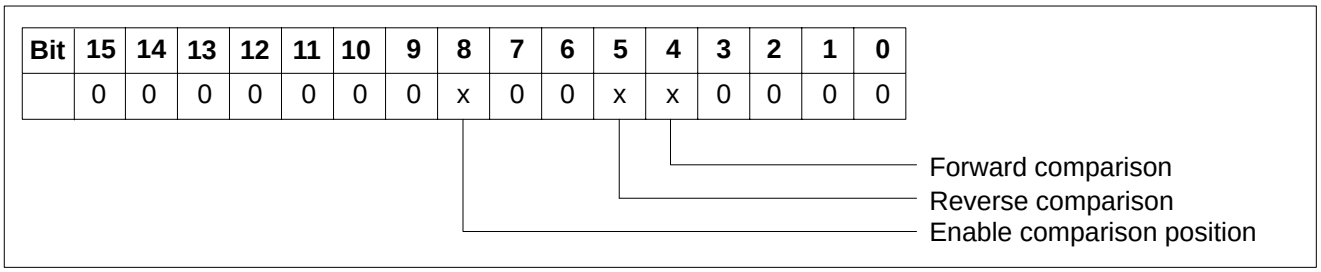

Fig. 4–30 D48, Comparison Position Function

Enable comparison position; with this bit set, the Write Comparison Position command transfers this comparison position to the POS-SA module.

Forward comparison and/or reverse comparison; defines whether the comparison function is to be enabled in forward or reverse direction, or in both forward and reverse direction.

In order to clear a comparison on the POS-SA, the bits handling forward and reverse comparison are reset, and the Enable Comparison Position bit is set.

D54, Comparison Position 1, Output Reaction at Comparison Position

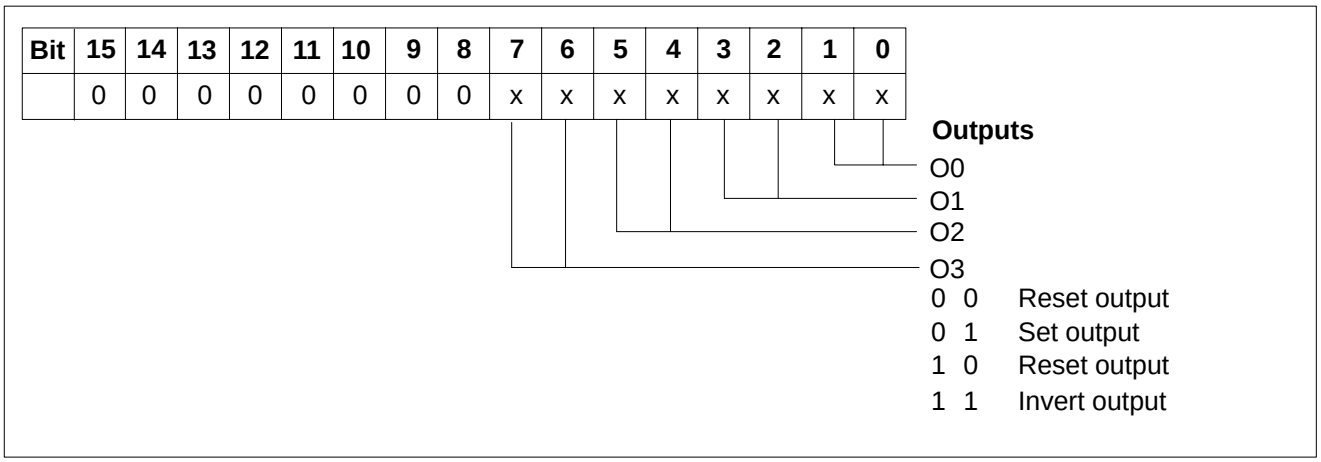

Fig. 4–31 D54, Comparison Position 1, Output Reaction at Comparison Position

D56, Comparison Position 1, Positioning Reaction at Comparison Position

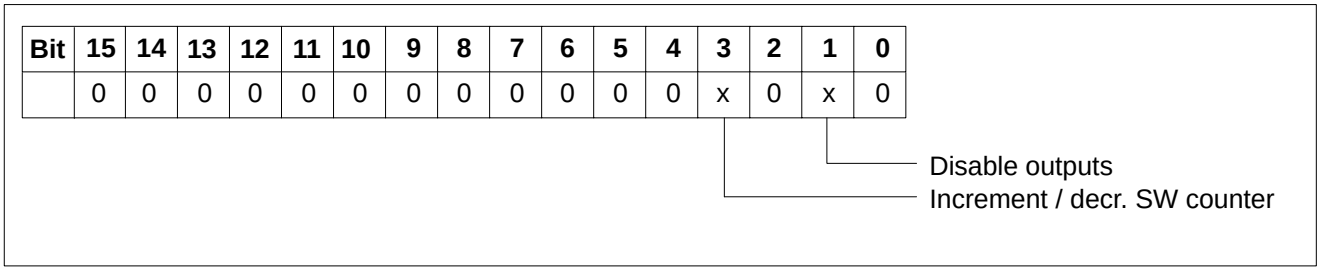

Fig. 4–32 D56, Comparison Position 1, Positioning Reaction at Comparison Position

4.2.6 Managing Data with DBWEG2 Data Module

This data module contains –

- the channel2 configuration data, and
- the channel2 comparison positions.

The data words are listed in the table in Fig. 4–33. The structures of the individual data words are identical to those in the DBWEG1 data module (refer to Section 4.2.5, "Managing Data with DBWEG1 Data Module"). It will therefore suffice to replace all occurrences of *channel1* with *channel2*.

DM 3	**Name: DBWEG2 Comment: Channel2, Configuration data**			**RAM/EPROM: R**	
No.	**Symbol**	**Type**	**Sg**	**Data field / Comment**	**F**
D 0		Word	N	Channel parameters	B
D 2		Word	N	Utilization of inputs	B
D 4		Word	N	Encoder configuration	B
D 6		Word	N	SSI parameters	B
D 8		Word	N	LOW range limit value, bit 0 thru 15	H
D 10		Word	N	LOW range limit value, bit 16 thru 31	H
D 12		Word	N	Output response to LOW range limit value	B
D 14		Word	N	Response to LOW range limit value	B
D 16		Word	N	HIGH range limit value, bit 0 thru 15	H
D 18		Word	N	HIGH range limit value, bit 16 thru 31	H
D 20		Word	N	Response to HIGH range limit value	B
D 22		Word	N	Response to HIGH range limit value	B
D 24		Word	N	INCR reference point offset, bit 0 thru 15	H
D 26		Word	N	INCR reference point offset, bit 16 thru 31	H
D 28		Word	N	Output response to INCR reference point	B
D 30		Word	N	Reserved	H
D 32		Word	N	DECR reference point offset, bit 0 thru 15	H
D 34		Word	N	DECR reference point offset, bit 16 thru 31	H
D 36		Word	N	Output response to INCR reference point	B
D 38		Word	N	Reserved	H
D 40		Word	N	Default actual value, bit 0 thru 15	H
D 42		Word	N	Default actual value, bit 16 thru 31	H
D 44		Word	N	Default for outputs	B

DM 3	Name: DBWEG2 Comment: Channel2, Configuration data			RAM/EPROM: R	
No.	**Symbol**	**Type**	**Sg**	**Data field / Comment**	**F**
D 46		Word	N	Reserved	H
D 48		Word	N	Comparison posit. 1, comparison position function	B
D 50		Word	N	Comparison posit. 1, comparison position bit 0 thru 15	H
D 52		Word	N	Comparison posit. 1, comparison position bit 16 thru 31	H
D 54		Word	N	Comparison posit. 1, output response to comparison position	B
D 56		Word	N	Comparison posit. 1, positioning response to comparison posit.	B
D 58 thru 506		Word	N	Comparison position 1 through comparison position 46	
D 508 thru 510		Word	N	Internal use	

Fig. 4–33 DBWEG2

4.2.7 Execution Times

The execution time comprises the time interval that elapses between the call-up of the function module and the resetting of the Function Module Enabled signal in the user acknowledgement. However, this time interval must not be confused with the module response time.

In the event that the fastest possible responses to the attainment of specific counter values are desired, the module inputs and outputs or the direct module responses must be used. This dispenses with the time interval required for communications between the central processing unit and the module.

The times listed below may on occasion result from several successive PLC cycles. With a single command, the average processing time per function module call is approximately 1 to 2 ms.

If a single function module call is used to transfer several commands to the module at once, the individual execution times must be added together.

Commands	**Execution times** [**ms**]	
	CL350 / CL400 / CL500	**ICL700**
Write module configuration	108.0	92.0
Write channel configuration	4.3	17.5
Write single comparison position	3.2	17.5
Read module status	2.0	7.5
Read channel status	2.0	6.0
Read channel actual value	1.3	2.5
Write reference point	3.2	8.0
Start reference point approach	3.2	8.0
Write digital outputs actual value	1.5	8.0

Fig. 4–34 Command Execution Times

4.3 Programming Example

Cyclical Organization Module

☞ **The parameters of the WEG45 and/or WEGICL function module may only be changed when the FM Enable signal in the acknowledgement is reset.**

In the cyclical OM organization module –

- a check is made whether a fault has occurred in the commands that were transferred during the module start-up, and
- the module status is read.

The Read Module Status Command causes the following data to be transferred to the DBWEG0 data module:

- The module status,
- the status of channel1 and channel 2, respectively, and
- the two actual values.

Subsequent to a positive acknowledgement this data can be subjected to further processing.

Defining Parameters

☞ **In order to prevent a dual assignment of the operands, the parameters should be defined in the symbol file.**

☞ **M0 must be remanent.**

```
DEF     M0,     -Kommando
DEF     KE02FH, -BgKaKonf ;Write configuration for module, channel1 and channel2
                          ;write comparison position,
                          ;write reference point offsets and
                          ;start reference point offset
DEF     K8100H, -BgStatus ;Read module status
DEF     M2,     -Quittung ;Address of user acknowledgement
DEF     M2.3,   -FbFehler ;Fault in user acknowledgement
DEF     M2.7,    -FbAktiv ;Function module being processed
DEF     K0,      -AdrEZAZ ;Start address of POS-SA module
DEF     K0,         -DbNr ;Nummber of first data module in POS-SA module
DEF     K0,     -SPSKanal ;PLC channel number, not used in centralized operation
```

Newly Configuring the POS-SA During Start-up

```
L     W   S30,A
A     B   A.3               ;Trigger pulse, STOP/RUN toggle function
O     B   A.4               ;Trigger pulse, Power On/Off / load program
JPCI      -KeinAnl
                            ;Trigger: Upon Power On, load program or STOP/RUN will
                            ;cause POS-SA to be newly configured
L     W   BgKaKonf,A
T     W   A,-Kommando

      -KeinAnl
```

Calling WEG45 Function Module

```
CM        WEG45,6           ;Function module call
P0    W   -Kommando         ;Command
P1    BY  -Quittung         ;Address for user acknowledgement
P2    W   -AdrEZAZ          ;Start address in extended /output field
P3    W   -DbNr             ;Data module number
P4    W   -FIFOZM1          ;Program module
P5    W   -SPSKanal         ;PLC channel number, not used in centralized operation
```

Acknowledgement Query

```
A     B   FbAktiv           ;Query FM Enable signal (bit 7 of acknowledgement)
JPC       -WARTEN

A     B   -FbFehler         ;Query faults (bit 3 of acknowledgement)
JPC       -Fehler

L     W   -BgStatus,A       ;Read module status
                            ;additional commands as required by application
T     W   A,-Kommando

      -WARTEN
      .
      .
      PE

      -Fehler
      .
      (HLT)                 ;During power-up, the HLT instruction indicates that
      .                     ;incorrect operation of the POS–SA has occurred.
      PE
```

4.4 Faults

This section describes the following types of faults:

- Communication faults that are indicated in the Acknowledgement parameter of the WEG45 and/or WEGICL function module, and
- control / addressing faults in module or channels.

4.4.1 Communication Faults

A communication fault is indicated in the Acknowledgement parameter of the WEG45 and/or WEGICL function module.

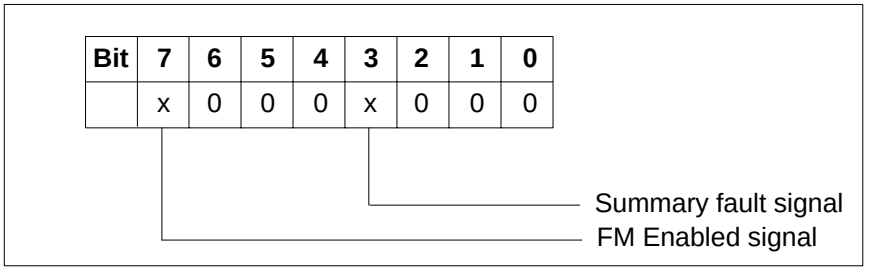

Fig. 4–35 Acknowledgement

If the summary fault signal in the acknowledgement is HIGH, this is an indication that the command has not been executed on the POS-SA module.

If the command included several tasks, i.e., module configuration, channel configuration, and comparison positions, data word D82 in the DBWEG0 data module will provide the indication in which task of the command sequence a fault has occurred.

Subsequent to each successful task processing the corresponding bit in data word D82 is reset. The bits that still remain HIGH can be used to identify the task in which a fault has occurred.

Starting with the least significant bit (LSB), the first bit that remains HIGH indicates the task within the sequence of commands in which a fault has occurred.

Starting with the most significant bit (MSB), the first bit indicates whether this has been a task destined for the module, for channel1 or channel2 (bit15=module, bit14=channel1, bit13=channel2).

Starting with version 2 of the POS-SA Counting / Positioning Module, an additional fault code is returned in data word D204 of the DBWEG0 data module.

Example

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Fig. 4–36 Data Word D82 of DBWEG0 Data Module

D82 indicates a communication fault that has occurred during the execution of the Write Module Configuration command.

Possible Causes for Communication Faults:

Command	Fault message
Write Module Configuration	• The module is not powered, and can therefore not be addressed. • The selected start address does not match the start address called for the function module.
Write Channel Configuration	• The POS-SA module has not been configured. • The LOW range limit value is greater than/equal to the HIGH range limit value.
Write Comparison Position	• The channel has not been configured. Only once this has been done can the comparison positions be written. • The comparison positions are not located between the LOW range limit value and the HIGH range limit value. • Two or more comparison positions are identical.
Write Reference Point Offset	• Either the module or the channel has not been configured. Only once both module and channel have been configured can the reference point offsets be written. • The reference point offsets are located betwen the LOW range limit value and the HIGH range limit value.
Read Actual Value, Channel or Module Status	• The module has not been configured. • The channel has not been configured. Subsequent to the completion of module and channel configuration, all Read commands can be executed at any time.

Fig. 4–37 Communication Faults

Fault Messages in Data Word D204 of DBWEG0 Data Module

Fault messages are effective from POS-SA version 2 and up.

D204 in DBWEG0 (Hexadecimal)	Cause of Fault
0101H	Hardware fault on POS-SA module.
0102H	Incorrect encoder selection selection in module configuration.
0201H	Command not possible.
0202H	Command not permitted in current status.
0301H	Two identical comparison positions are not possible.
0302H	One of the comparison values is located beyond both range limit values.
0303H	The INCR reference point offset is located beyond the range end limits.
0304H	The DECR reference point offset is located beyond the range end limits.
0401H	Both range limit values are equal or the HIGH range limit value is lower than the LOW range limit value.
0402H	An interruption check that is not possible with absolute signals has been selected.
0403H	The load contact I1 for the rotary axis has not been configured.
0404H	The defined range limit values are higher than the selected SSI encoder.
0406H	Reference point approach is not possible with absolute-value encoders.
0407H	No Enable command is possible for several absolute-value encoders or for non-referenced incremental-value encoders.
0408H	The actual value of the absolute-value encoder is located outside of the range limit values.
0409H	Command cannot be executed in positioning mode.

Fig. 4–38 Fault Messages in Data Word D204

4.4.2 Operating Faults

Fault	Possible Fault Sources
Positioning function is ineffective	● The module is not configured. ● The channel is not configured. ● Reference point has not been approached. ● On controlling the positioning via the inputs, the inputs are set incorrectly. ● The encoder connection is faulty. ● The encoder configuration does not correspond to the connected encoder, causing faulty signal interpretation by the POS-SA module.
POS-SA module cannot be addressed	The start address on the POS-SA does not match the start address of the function module.
The output reaction at a comparison position does not occur	● The comparison was not written to the module. ● The forward or reverse comparison for the comparison has not been set. ● The output reaction is not set in the reaction of a comparison value.
The Fault LED on the module illuminates	An uncontrolled access, such as direct read or write access to the start address of the POS-SA, has occurred. The POS-SA module may only be accessed via the WEG45 and/or WEGICL function module.

Fig. 4–39 Operating Faults

A Appendix

A.1 Index

Z

A.2 PLC Terminology German/English

Operanden/Operands

German		English	
AST	Anwender-Stack	AST	Application stack
AWP	Anwenderprogrammzähler	UPP	User program pointer counter
A	Ausgang	O	Output
AZ	Ausgangszusatzfeld	EO	Extended output
D	Datum	D	Data
DB	Datenbaustein	DM	Data module
DF	Datenfeld	DF	Data field
DP	Datenpuffer	DB	Data buffer
E	Eingang	I	Input
EZ	Eingangszusatzfeld	EI	Extended input
F	Fehler	E	Error
FI	FIFO-Operand (Warteschlange)	FI	FIFO operand
IA	Interface-Ausgang	IO	Interface output
IE	Interface-Eingang	II	Interface input
K	Konstante	K	Constant
KD	Doppelwort-Konstante	KD	Constant double word
KF	Gleitkomma-Konstante	KF	Constant floating point
KME	Koordinierungsmerker einfach	CFS	Coordination flag single
KMP	Koordinierungsmerker permanent	CFP	Coordination flag permanent
Kx.y	Zeitkonstante	Kx.y	Constant of time
M	Merker	M	Marker
’nr’	Parameternummer	’nr’	Number as parameter
P	Parameter	P	Parameter
PI	Peripherieinterrupt	PI	Peripheral interrupt
S	Systembereich	S	System range
SI	Systeminterrupt	SI	System interrupt
SM	Sondermerker	SM	Special marker
T	Zeit	T	Time
TI	Zeitinterrupt	TI	TIme interrupt
Z	Zähler	C	Counter
$	direkte Adreßeingabe für die Befehle L und T	$	Operand absolute
−xx	Symbolischer Operand	−xx	Symbol

Befehle/Instructions

German		English	
ADC	Addition mit Carry	ADC	Addition with carry
ADD	Addition	ADD	Addition
AF	Alarm freigeben	AE	Alarm enable
AS	Alarm sperren	AD	Alarm disable
BA	Bausteinaufruf unbedingt	CM	Call module
BAAG	Bausteinaufruf arithmetisch größer, AG=1	CMAG	Call module arithmetical greater, AG=1
BAB	Bausteinaufruf bedingt, VKE=1	CMC	Call module conditional, RES=1
BAC	Bausteinaufruf Carry, C=1	CMCY	Call module carry, C=1
BACN	Bausteinaufruf Carry nicht, C=0	CMCN	Call module carry not, C=0
BACZ	Bausteinaufruf Carry oder Null, C=1 oder Z=1	CMCZ	Call module carry or zero, C=1 or Z=1
BAI	Bausteinaufruf invers, VKE=0	CMCI	Call module conditional invers, RES=0
BALG	Bausteinaufruf logisch größer, LG=1	CMLG	Call module logical greater, LG=1
BAM	Bausteinaufruf Minus, N=1	CMM	Call module minus, N=1
BAMZ	Bausteinaufruf Minus oder Null, N=1 oder Z=1	CMMZ	Call module minus or zero, N=1 or Z=1
BAN	Bausteinaufruf nicht Null, Z=0	CMN	Call module not zero, Z=0
BAO	Bausteinaufruf Overflow, O=1	CMO	Call module overflow, O=1
BAON	Bausteinaufruf Overflow nicht, O=0	CMON	Call module overflow not, O=0
BAP	Bausteinaufruf Plus, N=0	CMP	Call module plus, N=0
BAX	Bausteinaufruf im zweiten Segment	CMX	Call module into second segment
BAZ	Bausteinaufruf Null, Z=1	CMZ	Call module zero, Z=1
BE	Bausteinende unbedingt	EM	End of module
BEAG	Bausteinende arithmetisch größer, AG=1	EMAG	End of module arithmetical greater, AG=1
BEB	Bausteinende bedingt, VKE=1	EMC	End of module conditional, RES=1
BEC	Bausteinende Carry, C=1	EMCY	End of module carry, C=1
BECN	Bausteinende Carry nicht, C=0	EMCN	End of module carry not, C=0
BECZ	Bausteinende Carry oder Null, C=1 oder Z=1	EMCZ	End of module carry zero, C=1 or Z=1
BEI	Bausteinende invers, VKE=0	EMI	End of module invers, RES=0
BELG	Bausteinende logisch größer, LG=1	EMLG	End of module logical greater, LG=1
BEM	Bausteinende Minus, N=1	EMM	End of module minus, N=1
BEMZ	Bausteinende Minus oder Null, N=1 oder Z=1	EMMZ	End of module minus Zero, N=1 or Z=1
BEN	Bausteinende nicht Null, Z=0	EMN	End of module not zero, Z=0

German		English	
BEO	Bausteinende Overflow, O=1	EMO	End of module overflow, O=1
BEON	Bausteinende Overflow nicht, O=0	EMON	End of module overflow Not, O=0
BEP	Bausteinende Plus, N=0	EMP	End of module plus, N=0
BEZ	Bausteinende Null, Z=1	EMZ	End of module zero, Z=1
BID	Wandlung Binär in Dezimal	BID	Binary to decimal conversion
BLA	Blockanfang	SBL	Start of block
BLAA	Blockanfang absolut	SBLA	Start of block absolute
BLE	Blockende	EBL	End of block
BX	2. Datenbausteinaufruf	CX	2nd call data module
BXB	2. Datenbausteinaufruf bedingt, VKE=1	CXC	2nd call data module conditional, RES=1
BXI	2. Datenbausteinaufruf bedingt invers VKE=0	CXCI	2nd call data module conditional invers, RES=0
CH	Tausche unbedingt	CH	Change
CHAG	Tausche arithmetisch größer, AG=1	CHAG	Change arithmetical greater, AG=1
CHB	Tausche bedingt, VKE=1	CHC	Change conditional, RES=1
CHC	Tausche Carry, C=1	CHCY	Change carry, C=1
CHCN	Tausche Carry nicht, C=0	CHCN	Change carry not, C=0
CHCZ	Tausche Carry oder Null, C=1 oder Z=1	CHCZ	Change carry or zero, C=1 or Z=1
CHI	Tausche bedingt invers, VKE=0	CHCI	Change conditional invers, RES=0
CHLG	Tausche logisch größer, LG=1	CHLG	Change logical greater LG=1
CHM	Tausche Minus, N=1	CHM	Change minus, N=1
CHMZ	Tausche Minus oder Null, N=1 oder Z=1	CHMZ	Change minus or zero, N=1 or Z=1
CHN	Tausche nicht Null, Z=0	CHN	Change not zero, Z=0
CHO	Tausche Overflow, O=1	CHO	Change overflow, O=1
CHON	Tausche Overflow nicht, O=0	CHON	Change overflow not, O=0
CHP	Tausche Plus, N=0	CHP	Change plus, N=0
CHZ	Tausche Null, Z=1	CHZ	Change zero, Z=1
CLSB	Lösche Systembefehle	CLSI	Clear system instruction
CMP	Zweier-Komplement	TC	Tow's complement
DBA	Bausteinaufruf registerindirekt	DCM	Dynamical call module
DEB	Wandlung Dezimal in Binär	DEB	Decimal to binary conversion
DEC	Dekrement	DEC	Decrement
DEF	Definition	DEF	Define
DEFW	Definition Wort	DEFW	Define word
DI	Sperren Interruptgruppe	DAI	Disable all interrupts
DIV	Division	DIV	Division

German		English	
DX		DX	
EI	Freigeben Interruptgruppe	EAI	Enable all interrupts
ERE	Anwenderereignis erreicht	EVA	Event achieved
ERH	Anwenderereignis anfordern im Hintergrund	EVB	Event instruction background
ERS	Anwenderereignis anfordern im Hintergrund mit Systeminterrupt	EVS	Event with system interrupt
ERU	Anwenderereignis anfordern unmittelbar	EVD	Event instruction directly
EXC	Tausche Registerinhalt	EXC	Exchange
FF	Feld freigeben	FR	Field release
FS	Feld schützen	FS	Field save
G	Größer	GT	Greater than
GG	Größer oder gleich	GTE	Greater than or equal
GL	Gleich	EQ	Equal
HLT	Halt	HLT	Halt
IF	Interrupt freigeben	EI	Enable interrupt
INC	Inkrement	INC	Increment
IR	Interrupt rücksetzen (löschen)	RI	Reset interrupt
IS	Interrupt sperren	DI	Disable interrupt
K	Kleiner	LT	Less than
KG	Kleiner oder gleich	LTE	Less than or equal
KL	Kleiner	LT	Less than
L	Laden	L	Load
LABB	Laden Inhalt des Abbildbereiches	LIMR	Load image range
LAH	Laden absolut adressiert im Hintergrund	LAB	Load absolut range in background
LAS	Laden absolut adressiert im Hintergrund mit Systeminterrupt	LAS	LAB with system interrupt
LAU	Laden absolut adressiert unmittelbar	LAD	Load absolut range directly
LFH	Laden feldadressiert im Hintergrund	LFB	Load field in background
LFI	Laden aus FIFO-Speicher	LFI	Load from FIFO
LFS	Laden feldadressiert im Hintergrund mit Systeminterrupt	LFS	LFB with system interrupt
LFU	Laden feldadressiert unmittelbar	LFD	Load field directly
LI	Laden Interruptregister der Interruptgruppe	LAI	Load all interrupts
LM	Laden der Interruptmaske	LIM	Load interrupt mask

German		English	
LMB	Laden des Inhalts des Memoryberei-ches	LMB	Load memory band
LMBX	LMB im zweiten Segment	LMBX	LMB into second segment
LO	Leer Oder, entspricht: O(	LO	Empty logical or, O=(
LPB	Laden Peripherie Bus	LPB	Load periphery bus
LPC	Laden Programmzähler	LPC	Load program counter
LSP	Laden Stack Pointer	LSP	Load stack pointer
LUZ	Laden Uhrzeit zyklisch	LCC	Load clock cyclical
LUZS	Laden Uhrzeit zyklisch mit Systeminter-rupt	LCCS	LCC with system interrupt
LZS	Laden Zeit-Sollwert	LNT	Load normalize time
MUL	Multiplikation	MUL	Multiplication
N	Einer-Komplement	N	Negation, one’s complement
NOP0	Leeranweisung 0, 0000H	NOP0	No operation, 0000H
NOP1	Leeranweisung 1, FFFFH	NOP1	No operation, FFFFH
O	Oder	O	Or
ON	Oder nicht	ON	Or not
O(	Oder Klammer auf	O(	Empty logical or, O(
P	Prüfe Bit	TST	Test
PE	Programmende	EP	End of program
Pi	Parameterfestlegung bei parametrierten Bausteinaufruf, i=’nr’	Pi	Parameter line, i=’nr’
PN	Prüfe negiert Bit	TSTZ	Test on zero
POP	Transferiere vom Stack	POP	Transfer out from stack
PSi	Parameterfestlegung bei Systembefeh-len, i=’nr’	PSi	Parameter line of system instructions, i=’nr’
PUSH	Lade auf Stack	PUSH	Load into stack
R	Rücksetzen	R	Reset
RC	Rücksetze Carry Flag	RCY	Reset carry
RCL	Rotieren links durch Carry	RCL	Rotate through carry left
RCR	Rotieren rechts durch Carry	RCR	Rotate through carry right
RFI	Rücksetzen FIFO (Lösche FIFO)	RFI	Reset FIFO
RI	Rücksetzen der Interruptregister der In-terruptgruppe	RAI	Reset all interrupts
ROL	Rotieren links	ROL	Rotate left
ROM	Rücksetzen ohne Monitoranzeige	RWM	Reset without monitoring
ROR	Rotiere rechts	ROR	Rotate right
RT	Rücksetzen Zeit	RT	Reset time

German		English	
RZ	Rücksetzen Zähler	RC	Reset counter
S	Setzen	S	Set
SA	Starte Zeit als Ausschaltverzögerung	SF	Start time as falling delay
SAR	Schiebe arithmetisch rechts	SAR	Shift arithmetical to right
SBB	Subtraktion mit borgen	SBB	Subtraction with borrow
SC	Setze Carry Flag	SCY	Set carry
SE	Starte Zeit als Einschaltverzögerung	SR	Start time as raising delay
SI	Starte Zeit als Impuls	SP	Start time as puls
SINT	Sende Interrupt	SINT	Send interrupt
SLL	Schiebe logisch links	SLL	Shift logical to left
SLR	Schiebe logisch rechts	SLR	Shift logical to right
SOM	Setzen ohne Monitoranzeige	SWM	Set without monitoring
SP	Sprung unbedingt	JP	Jump
SPAG	Sprung arithmetisch größer, AG=1	JPAG	Jump arithmetical greater, AG=1
SPB	Sprung bedingt, VKE=1	JPC	Jump conditional, RES=1
SPC	Sprung Carry, C=1	JPCY	Jump carry, C=1
SPCN	Sprung Carry nicht, C=0	JPCN	Jump carry not
SPCZ	Sprung Carry oder Null, C=1 oder Z=1	JPCZ	Jump carry or zero, C=1 or Z=1
SPI	Sprung bedingt invers, VKE=0	JPCI	Jump conditional invers, RES=0
SPLG	Sprung logisch größer, LG=1	JPLG	Jump logical greater, LG=1
SPM	Sprung Minus, N=1	JPM	Jump minus, N=1
SPMZ	Sprung Minus oder Null, N=1 oder Z=1	JPMZ	Jump minus or zero, N=1 or Z=1
SPN	Sprung nicht Null, Z=0	JPN	Jump not zero, Z=0
SPO	Sprung Overflow, O=1	JPO	Jump overflow, O=1
SPON	Sprung Overflow nicht, O=0	JPON	Jump overflow not, O=0
SPP	Sprung Plus, N=0	JPP	Jump plus, N=0
SPZ	Sprung Null, Z=1	JPZ	Jump zero, Z=1
SS	Starte Zeit als speichernde Einschalt-verzögerung	SRE	Start time as raising delay extended
SUB	Subtraktion	SUB	Subtraction
SV	Starte Zeit als verlängerter Impuls	SPE	Start puls extended
SWAP	Vertausche Hi-/Lo-Byte im Register	SWAP	Interchange operand bytes
SYN	Synchronisationspunkt erreicht	SYN	Synchronisation point achieved
SZ	Setze Zähler	SC	Set counter
T	Transfer	T	Transfer
TABB	Transferiere in den Abbildbereich	TIMR	Transfer image range

German		English	
TAH	Transfer absolut adressiert im Hinter-grund	TAB	Transfer absolut range in background
TAS	Transfer absolut adressiert im Hinter-grund mit Systeminterrupt	TAS	TAB with system interrupt
TAU	Transfer absolut adressiert unmittelbar	TAD	Transfer absolut range directly
TDEC	Zeit dekrementieren	TDEC	Time decrement
TFH	Transfer feldadressiert im Hintergrund	TFB	Transfer field in background
TFI	Transfer in FIFO-Speicher	TFI	Transfer FIFO
TFS	Transfer feldadressiert im Hintergrund mit Systeminterrupt	TFS	TFB with system interrupt
TFU	Transfer feldadressiert unmittelbar	TFD	Transfer field directly
TH	Zeit halt	TH	Timer halt
TM	Transfer der Interruptmaske	TIM	Transfer interrupt mask
TMB	Transfer in Memory-Bereich	TMB	Transfer memory band
TMBX	TMB im zweiten Segment	TMBX	TMB into second segment
TPB	Transfer Peripherie Bus	TPB	Transfer periphery bus
TSP	Transferier Stack Pointer	TSP	Transfer stack pointer
U	Und	A	And
UG	Ungleich	NEQ	Not equal
UN	Und nicht	AN	And not
VGL	Vergleichen logisch	CPL	Compare logical
VGLA	Vergleichen logisch und arithmetisch	CPLA	Compare logical and arithmetical
WE	Wecken	AB	Alarm bell request
WES	Wecken mit Systeminterrupt	ABS	AB with system interrupt
WEZ	Wecken zyklisch	ABC	Alarm bell request cyclical
WEZS	Wecken zyklisch mit Systeminterrupt	ABCS	ABC with system interrupt
XO	Exklusiv Oder	XO	Exclusive or
XON	Exklusiv Oder nicht	XON	Exclusive or not
ZR	Zähle rückwärts	CD	Count down
ZV	Zähle vorwärts	CU	Count up
=	Zuweisung	=	Equal-to sign
=OM	Zuweisung ohne Monitoranzeige	=WM	Equal without monitoring
*	Hilfsmarke setzen	*	Set help label
(	Klammer auf	(	Left bracket
)	Klammer zu	)	Right bracket
)N	Klammer zu negiert	)N	Right bracket with negation

Bausteine/Modules

German		English	
ASS	Assemblerbaustein	ASS	Assembler module
DB	Datenbaustein	DM	Data module
FB	Funktionsbaustein	FM	Function module
OB	Organisationsbaustein	OM	Organisation module
PB	Programmbaustein	PM	Program module
ZB	Zusatzbaustein	EM	Extended module

Sonstige Software-Begriffe/Miscellaneous software terms

German		English	
AWL	Anweisungsliste	IL	Instruction list
FUP	Funktionsplan	FUD	Function diagram
KPL	Kontaktplan	LD	Ladder diagram
OKN	Operandenkennzeichnen	OID	Operand identifier
OPD	Operand	OPD	Operand
OPE	Operandenergänzung	OPA	Operand attribute
OPR	Operator	OPR	Operator
OPT	Operationsteil	OPP	Operation part
PA	Programmanweisung	PI	Program instruction
PAE	Parameterergänzung	PAA	Parameter attribute
PAR	Parameter	PAR	Parameter
PZ	Programmzweig	RG	Programm rung
Q	Quelloperand	SRC	Source operand
WSB	Weiterschaltbedingung		Step-on condition
Z	Zieloperand	DEST	Destination operand

Notes:

Bosch-Automationstechnik

Robert Bosch GmbH
Geschäftsbereich
Automationstechnik
Industriehydraulik
Postfach 30 02 40
D-70442 Stuttgart
Telefax (07 11) 8 11-18 57

Robert Bosch GmbH
Geschäftsbereich
Automationstechnik
Fahrzeughydraulik
Postfach 30 02 40
D-70442 Stuttgart
Telefax (07 11) 8 11-17 98

Robert Bosch GmbH
Geschäftsbereich
Automationstechnik
Pneumatik
Postfach 30 02 40
D-70442 Stuttgart
Telefax (07 11) 8 11-89 17

Robert Bosch GmbH
Geschäftsbereich
Automationstechnik
Montagetechnik
Postfach 30 02 07
D-70442 Stuttgart
Telefax (07 11) 8 11-77 12

Robert Bosch GmbH
Geschäftsbereich
Automationstechnik
Antriebs- und Steuerungstechnik
Postfach 11 62
D-64701 Erbach
Telefax (0 60 62) 78-4 28

Robert Bosch GmbH
Geschäftsbereich
Automationstechnik
Schraub- und Einpreßsysteme
Postfach 11 61
D-71534 Murrhardt
Telefax (0 71 92) 22-1 81

Robert Bosch GmbH
Geschäftsbereich
Automationstechnik
Entgrattechnik
Postfach 30 02 07
D-70442 Stuttgart
Telefax (07 11) 8 11-34 75

Technische Änderungen vorbehalten

Ihr Ansprechpartner

BOSCH

Robert Bosch GmbH
Geschäftsbereich
Automationstechnik
Antriebs- und Steuerungstechnik
Postfach 11 62
D-64701 Erbach
Telefax (0 60 62) 78-4 28

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