SIEMENS

SIMATIC
Counter Module CM35

Manual Release 06/2000

SIEMENS

CM35

Counter Module

Manual

This manual describes the counter module with order no. 6AT1 735-0AA01-0AA0

(4) J31069-D0416-U001-A5-7618

Release 06/2000

Notes on safety

This manual contains notes which you must adhere to for your own personal safety and to avoid property damage. These notes are highlighted with a warning triangle showing the degree of danger as shown below.

Danger

Means death, severe personal injury or significant property damage **will** occur when the appropriate precautionary measures are not taken.

Warning

Means death, severe personal injury or significant property damage **may** occur when the appropriate precautionary measures are not taken.

Caution

Means minor personal injury or property damage may occur when the appropriate precautionary measures are not taken.

Note

Highlights important information about the product, its handling or a particular portion of the documentation which requires special attention.

Qualified personnel

Only **qualified personnel** may commission and operate the device. For the purpose of the safety notes in this manual, qualified personnel are those persons who are authorized to commission, ground and tag devices, systems and electrical circuits in accordance with safety standards.

Use as intended

Adhere to the following.

Warning

The device may only be used for the individual applications included in the catalog and technical description. When used with devices and components of other manufacturers, these devices and components must be approved or recommended by Siemens.

Correct and safe operation of the product is dependent on proper transportation, storage, setup and installation and careful operator control and maintenance.

Brands

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The other designations in this publication may be brands whose use by third parties may violate the rights of the owners.

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Motion Control Systems
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Foreword

Purpose of this manual

This manual describes all steps required for the effective use of the CM35 counter module. It presents the functionality of the CM35 concisely and logically while you are familiarizing yourself with the module.

Contents of this manual

This manual describes the hardware and software of the CM35. It provides an introduction and can also be used as a reference work.

Target readers

This manual has been written for the following circles of readers.

- Maintenance personnel
- Programmers
- Commissioning personnel
- Service personnel

Area of validity of this manual

This manual describes the functions of the CM35 counter module as they were at the time this manual was published. We reserve the right to modify the functionality of the CM35. These changes will be described in product information sheets.

Hardware and software prerequisites for this manual

This manual describes:

- The CM35 counter module (order no. 6AT1 735-**0AA01**-0AA0)
- The configuration package (order no. 6AT1 735-**0DA01**-0YA0)

If you are using the previous version of the CM35 counter module (order no. 6AT1 735-**0AA00**-0AA0), please use the configuration package with the order number 6AT1 735-**0DA00**-0YA0.

Caution:
The CM35 counter module (order no. 6AT1 735-**0AA01**-0AA0) is not compatible with the CM35 counter module (order no. 6AT1 735-**0AA00**-0AA0).

Additional source of information

The appendix lists additional sources of information on the subject of SIMATIC S7-300.

Aids to finding information in this manual

This manual offers the following aids to help you find the special information you want.

- A comprehensive table of contents is located at the beginning of the manual.
- All chapters provide a left-hand column with an overview of the contents of the particular section.
- At the end of the manual, you will find a glossary defining important terms as they are used in the manual.

Standards

The SIMATIC S7-300 programmable controller meets the requirements of standard IEC 1131.

Contact your Siemens representative at your nearest Siemens office or the SIMATIC hotline (telephone no. 0911/895-7000 or fax no. 0911/895-7002) for questions on the products described in this manual for which you are unable to find answers.

For questions or comments on the manual itself, please fill out the response sheet at the end of the manual, and return it to the address indicated. We would also appreciate your including your personal opinion of the manual on the response sheet.

We offer courses to make it easier to get started with the SIMATIC automation system. Please contact your regional training center or the central training center in Nuremberg (tel. no. 0911/895-3154).

Table of Contents

1 Product Overview

1.1 Overview

Function scope

The CM35 is a multi-channel counter module which can be used to implement various tasks in the following operating modes.

- Pulse counter
- Period duration measurement
- Timer

} With 8 channels

- Positioning — With 4 axes

The selected operating mode applies to all channels of the CM35. The function parameters can be set separately for each channel.

Digital inputs and outputs

The counter module has eight floating digital inputs and outputs which are used for the inputs and outputs of the counting channels. The signals are led out via two sub D sockets on the front.

When not used for the operating mode, the outputs can be used as desired by the user program as process I/O.

Application areas

The module can be used for position encoding and positioning as well as in the following systems.

- Proportioning systems
- Filling systems
- Packaging systems
- Sorting systems
- Systems with defined time intervals

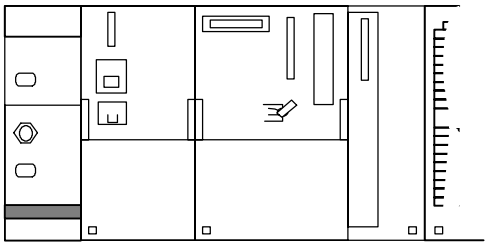
Use with programmable controllers and automation systems

The counter module can be used centrally on the SIMATIC S7-300 and as distributed I/O on the modular ET 200M I/O device on the SIMATIC S7 and SIMATIC S5. The conventional configuration procedures of STEP 7 or COM PROFIBUS (for SIMATIC S5) are used for the configuration.

1.2 Use on Programmable Controllers and Automation Systems

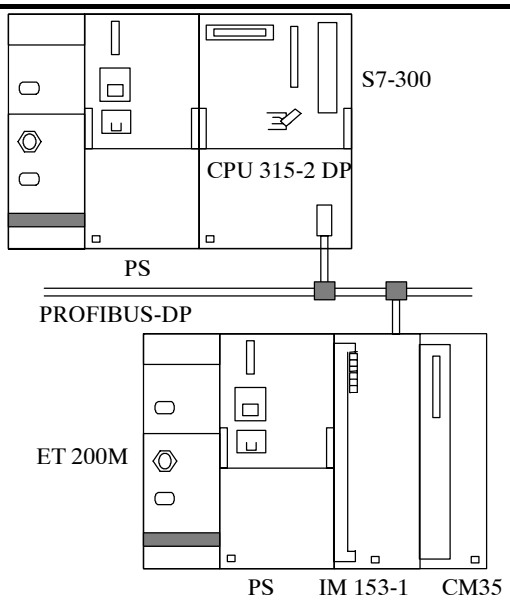
Central integration into the SIMATIC S7-300

The full function scope of the module can be utilized. System function SFC 55 is available for the parameterization. See reference manual /235/.

Possible Modules	Sample Configuration
Example: CPU 312 IFM CPU 313 CPU 314 : CPU 614	

Distributed integration into the SIMATIC S7

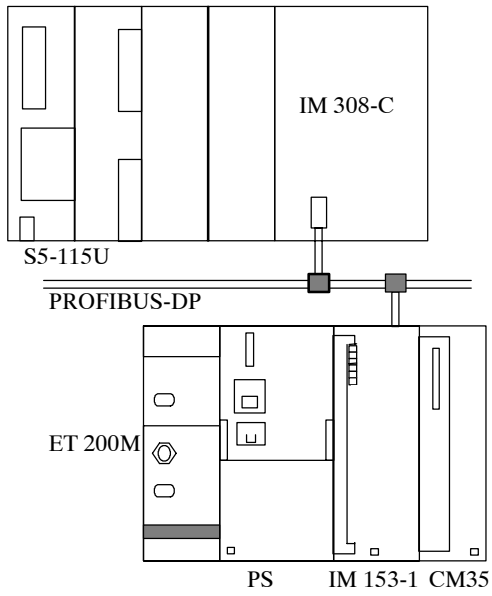
The full function scope of the module can be utilized. Parameterization is performed with system function SFC 55.

Possible Modules	Sample Configuration
Master: - S7-CPU with DP interface - CP 443-5 Ext. - IM 467 Slave: - IM 153-1 - IM 153-2	

Distributed integration into the SIMATIC S5

Since no hardware interrupts are triggered on the SIMATIC S5 by PROFIBUS-DP, the function scope is limited. Only the operating modes ″period duration measurement″ and ″timer″ can be used.

Parameterization is performed via I/O direct accesses.

Possible Modules	Sample Configuration
Master: - PLC S5-95U(-MA) - PLC S5-115U - PLC S5-135U - PLC S5-155U via IM 308-C Slave: - IM 153-1 - IM 153-2	

IM 153-1

Prerequisites for the coupling are an IM 153-1 (MLFB no. 6ES7 153-1AA02-0XB0 or later) and CM35 modules (MLFB no. 6AT1 735-0AA01-0AA0, release status 4 or later).

Up to 7 CM35 modules can be connected with each IM 153-1 interface.

Exception: Maximum of one CM35 per IM 153-1 when distributed connection to a SIMATIC S5-95U/master DP is used

Maximum of 8 CM35s per IM 153-1 when distributed connection to a SIMATIC S7 (CPU 318-2 DP, CPU 417-4 DP, CP 443-5 Ext., IM 467) is used

IM 153-2

Prerequisites for the coupling are an IM 153-2 (MLFB no. 6ES7 153-2AA01-0XB0, release status 2 or later) and CM35 modules (MLFB no. 6AT1 735-0AA01-0AA0).

CM35 modules (MLFB no. 6AT1 735-0AA01-0AA0, release status 4 or later) are required for the IM 153-2 interfaces (MLFB no. 6ES7 153-2AA02-0XB0, release status 5 or later).

Up to 7 CM35 modules can be connected to each IM 153-2 interface.

Exception: Maximum of one CM35 per IM 153-2 when distributed connection to a SIMATIC S5-95U/master DP is used

Maximum of 8 CM35s per IM 153-2 when distributed connection to a SIMATIC S7 (CPU 318-2 DP, CPU 417-4 DP, CP 443-5 Ext., IM 467) is used.

SIMATIC S7-400H and active back-plane bus, SIMATIC PCS 7

The present version of the CM35 does not support:

- The setup with active bus modules for ET 200M
- Use on high-availability programmable controllers with redundant setup (SIMATIC S7-400H)
- Use with SIMATIC PCS 7

For additional information, contact the SIMATIC hotline.

1.3 Hardware

View of the module with front door closed

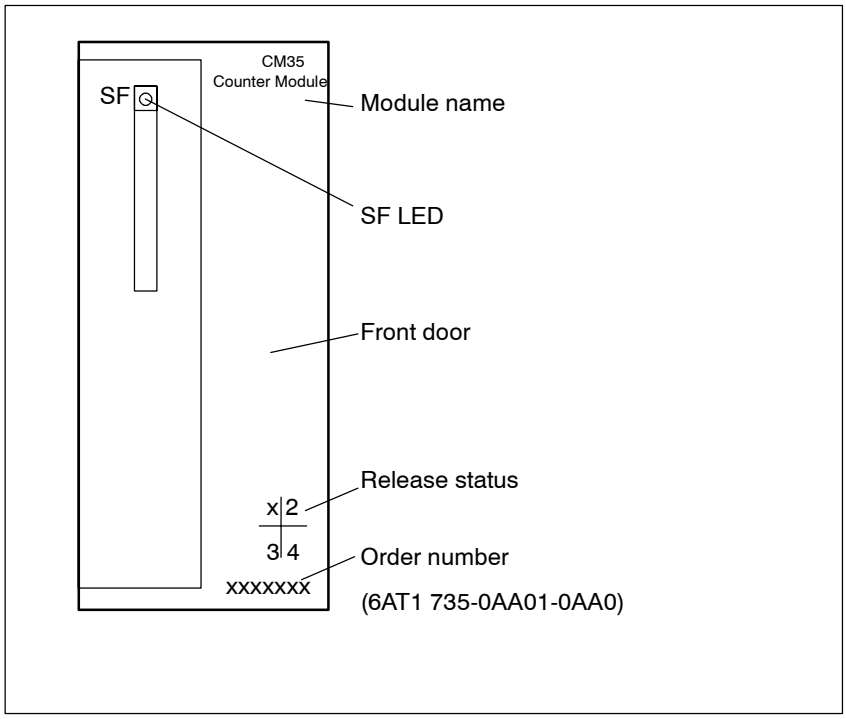


Figure 1-1 View of the front with front door closed

View of the module with front door open

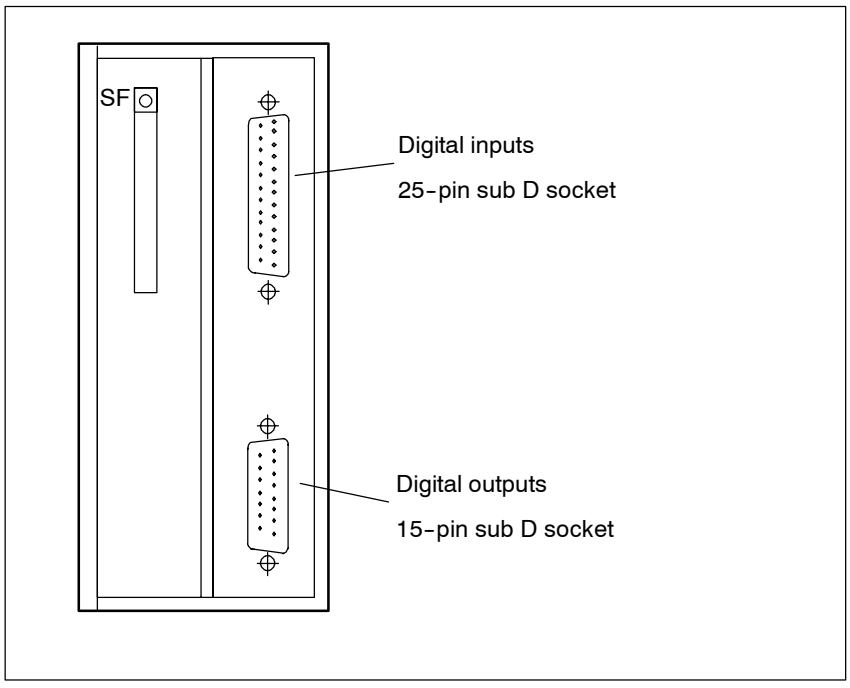


Figure 1-2 View of the front with front door open

Front plug connector

The CM35 is equipped with the following front plug connectors for connection of the process I/O.

- 25-pin sub D socket for connection of the input signals (digital inputs)

  The inputs are individually isolated from one another and can be used with a 5 V or 24 V signal level.

- 15-pin sub D socket with digital outputs and the connection for the external supply voltage for the digital outputs

  The outputs are isolated against the module logic, but are not isolated among one another. They are powered with a supply voltage of 24 V DC.

SF LED

The red SF LED on the front indicates that the module is not ready for operation. This LED goes off when a valid parameterization was transferred to the module after a warm restart or hot restart and the BASP/OD signal is no longer active.

The CM35 does not support diagnostic alarms and the STEP 7 diagnostic information.

1.4 Software

Module firmware

The firmware of the module offers four different operating modes.

- Pulse counter
  Continuous counting with maximum counting frequencies of 10 kHz
- Period duration measurement
  Measurement of period durations between 1 msec and 2.6 sec with a resolution of 1% on all 8 channels (reference frequencies: 100 kHz, 50 kHz, 25 kHz)
- Timer
  8 separate switch-on times from 10 msec to 278 min
- Positioning
  4 axes with a max. of 2^{31} increments up to a top frequency of 2 kHz

The desired operating mode is selected via the configuration user interface.

Note

The following applies when the CM35 is used to acquire frequencies.

- For lower frequencies: ″period duration measurement″ operating mode is recommended (the period duration can be converted to a frequency).
- For higher frequencies: ″pulse counting″ operating mode is recommended.

Software

Depending on use on the SIMATIC S7 or decentralized on the SIMATIC S5, configuration of the module is performed with the ″SIMATIC Manager″ or with ″COM PROFIBUS.″

1.5 Technical Data

Digital inputs

Type	Pulse counter
Number	8
System	Incremental
Limit frequency	Max. of 10 kHz
Minimum pulse duration (for high and low)	40 µsec
Signal level	• 24 Volt signals: - Signal ″H″: 15 to 30 Volt - Signal ″L″: -3 to +5 Volt • 5 Volt signals: - Signal ″H″: 2.4 to 6 Volt - Signal ″L″: -0.6 to 0.8 Volt
Input current	• For 24 V and ″H″ signal - Typical 4.7 mA • For 5 V and ″H″ signal - Typical 10 mA
Potential isolation	Yes
Maximum signal rise time	From ″L″ to ″H″: typ. 10 msec From ″H″ to ″L″: typ. 15 msec
Permissible cable length (shielded)	For 24 V 25 m For 5 V 5 m
Connection	25-pin sub D socket

Digital outputs

Number	8
Signal level	24 Volt, P-switching
Output current (short-circuit proof)	Per DO: Max. of 0.5 A Total current: Max. of 4 A
Switching frequency	Max. of 10 Hz with ohmic load 8 Hz with lamp load Max. of 0.5 Hz with inductive load
Cable length	Max. of 100 m
Connection	15-pin sub D socket

Other

Input voltage	+5 V via P bus
Current consumption	Typ. 0.150 A
UL/CSA/FM	No

MLFB no.

CM 35 counter module:	6AT1 735-0AA01-0AA0 or later
Configuration package:	6AT1 735-0DA01-0YA0 or later

Function Description

2

2.1 Function Overview

Table 2-1 Operating modes

Operating Mode	Function	Limit Frequency	Control the Digital Outputs Via ...	Hardware Interrupt for ...	Use on S5 Master or Standard Master
Pulse counter	Counting up from 0 to 65535 with comparison function	10 kHz	Operating mode/ CPU control	Comparison value is reached.	Not possible
	Counting down from 65535 to 0 with comparison function				
Period duration measurement	Measuring the time between 2 falling edges of the applied signal	1 kHz	CPU control	-	Possible
Timer	Outputting the specified switching times via the digital outputs	-	Operating mode/ CPU control	Expiration of the switch-on time	Possible
Positioning	Acquiring the actual position of axes via incremental encoder (track A/B) and comparing it with the setpoint	2 kHz	Operating mode/ CPU control	Setpoint is reached.	Not possible

2.2 Pulse Counter

In this operating mode, the CM35 continuously counts up or down between 0 and 65535 when the counter is enabled.

- When the counting value reaches the upper counting limit while counting up and another pulse arrives, the counting value jumps to the lower counting limit and counts from there without losing a pulse.
- When the counting value reaches the lower counting limit while counting down and another pulse arrives, the counting value jumps to the upper counting limit and counts from there without losing a pulse.

2.3 Period Duration Measurement

In this operating mode, the CM35 acquires low frequencies with the aid of period duration measurement.

The CM35 measures the exact time between two falling edges of the counting signal by counting the pulses of an internal, precision-quartz reference frequency.

2.4 Timer

In timer operating mode, precisely defined switch-on times of 10 milliseconds to 278 minutes can be implemented for every digital output.

2.5 Positioning

In this operating mode, the CM35 supports controlled positioning with a switch-off point.

Position acquisition is performed with an incremental encoder whose pulses are acquired by the module with the correct sign in the traversing area from –2,147,483,648 to +2,147,483,647.

Two digital outputs are available for each of the four channels. These outputs are addressed by the CM35 based on the direction.

Commissioning

3

This chapter provides all the information you will need for commissioning, including mounting, connection, configuration and parameterization.

General safety notes

Adherence to these safety notes is mandatory. Non-adherence will void the warranty!

Warning

Unqualified manipulations on the device/system or non-adherence to the warnings on the cabinet of the device/system can cause severe personal injury or property damage. Only qualified personnel may perform work on this device/system.

Note

This device has been developed, manufactured, tested and documented in accordance with pertinent safety standards. Under normal conditions, the device does not endanger property or human health.

Caution

Commissioning is prohibited until it has been determined that the machine in which these components are to be installed meets the regulations of guideline 89/392/EWG.

Note

The following rules must be adhered to ensure that EU guidelines 89/336/EWG have been met.

- The setup guidelines and safety notes in the manuals and supplementary documentation must be adhered to for both the programmable controller and the CM35.
- To achieve maximum EMC immunity, all signal lines to the CM35 must be shielded and applied to a grounded shield retainer rail.
- On the CM35, the cable shield may not be applied to the sub D plug connector.

3.1 Installation of the CM35

3.1.1 Mounting the CM35

Preparation

Before physical installation is begun, the appropriate safety precautions must be taken and the following points complied with or clarified.

- Was the module still in its original packaging?
- Check the delivery for transportation damages.
- Check the delivery for completeness.

If you discover damages or deficiencies, please contact your SIEMENS representative.

Slot

The S7 interface of the CM35 corresponds to the serial I/O bus (P bus) of the SIMATIC S7-300.

All slots on the SIMATIC S7 which can be assigned to signal modules (SM) are available to the CM35.

For additional information, see the manual of the SIMATIC S7-300.

The maximum number of CM35 modules which can be installed on SIMATIC programmable controllers depends on the following factors.

- Maximum number of modules in the central rack/expansion unit or the modular ET 200M I/O device
- Memory requirements of the S5/S7/C7 CPU
- Maximum permissible current consumption (5 V) from the S7 backplane bus

Physical setup

For information on possible physical setups and how to configure, see manual /70/.

Installation position

Horizontal installation is recommended. When vertical installation is used, remember that environmental temperatures are restricted (max. of 40° C).

Table 3-1 Technical data of the SIMATIC

<table>
<tr><td colspan="2"></td><td colspan="4">Number of Modules Which Can Be Installed on the Central Rack/Expansion Unit
Current (5 V) from the S7 Backplane Bus</td></tr>
<tr><td colspan="2" rowspan="2">Type of Setup</td><td colspan="3">Central Setup</td><td rowspan="2">Distributed Setup</td></tr>
<tr><td>1-row</td><td>2-row</td><td>Max. of 4-row</td></tr>
<tr><td>CPU</td><td>Work memory of the CPU in Kbytes (status 6/2000)</td><td>Central rack</td><td>IM 365</td><td>1 • IM 360
3 • IM 361</td><td>ET 200M</td></tr>
<tr><td>CPU 312 IFM</td><td>6</td><td>8 MOD
800 mA</td><td colspan="2">No multi-row setup possible</td><td rowspan="2">7 MOD per ET 200M
1000 mA</td></tr>
<tr><td>CPU 313</td><td>12</td></tr>
<tr><td>CPU 314</td><td>24</td><td rowspan="6">8 MOD

1200 mA</td><td rowspan="6">8 + 8 MOD

Total of 1100 mA</td><td>1 • 8 MOD

1 • 850 mA

plus

3 • 8 MOD

3 • 800 mA

<u>Exception:</u>
With CPU 314 IFM: Total of up to 31 modules</td><td rowspan="6">Exceptions:
Max. of 8 MOD per ET 200M with:
- CPU 318-2 DP
- CPU 417-4 DP
- CP 443-5 Ext.
- IM 467
Max. of 1 MOD per ET 200M with:
SIMATIC S5-95U/ DP master

The number of slave stations (ET 200M) per CPU depends on the CPU being used.

Example:
CPU 315-2 DP: Max. of 32 slave stations (ET 200M) per CPU</td></tr>
<tr><td>CPU 314 IFM</td><td>32</td></tr>
<tr><td>CPU 315</td><td>48</td></tr>
<tr><td>CPU 315-2 DP</td><td>64</td></tr>
<tr><td>CPU 316</td><td>128</td></tr>
<tr><td>CPU 318-2 DP</td><td>512,
of these max. of
256 for code
256 for data</td></tr>
<tr><td>CPU 31X-2 DP
CPU 41X-X DP
C7-6XX DP

S5-1X5U with IM 308-C</td><td>Depends on the CPU being used</td><td>-</td><td>-</td><td>-</td></tr>
</table>

MOD = CM35 modules

Table 3-2 Requirements on the CM35 side

With Use of	Current requirements (5 V) from S7 Backplane Bus
m • CM35	m • 150 mA

m = Number of CM35 modules

3.1.2 Mounting and Demounting the CM35

Rules

No special protective measures (ESD guidelines) are required for installation of the CM35.

Required tools

You will need a 4.5 mm screwdriver to mount and demount the CM35.

Note

Make absolutely sure that cable installation meets EMC regulations (also inside the cabinets).

Avoid installing cables next to power cables, and shield the cables in the manner described above.

Two-sided shield application is usually recommended. When interference is primarily low-frequency, one-sided shield application can be more advantageous.

Adhere to the grounding concept of the SIMATIC S7-300 to avoid problems with potential.

The setup guidelines (AR) of the SIMATIC S7 (see manual on setting up S7-300 programmable controllers and CPU data) must be adhered to during all mounting steps, and the following instructions must be performed in the order specified.

How to install

For how to mount the modules on the system, see manual /70/ or /140/.
A simplified version of installation is given here.

1. Turn off all voltages on the SIMATIC S7, secure against switch-on, and label.
2. Make protective conductor connection, or check it. See AR.
3. Mount shield connecting element (SAE).
   - The shield connecting element must be mounted directly under the slot of the CM35 on the mounting rail.
   - Each cable to be connected to the CM35 requires a shield clamp on the shield rail of the SAE.
4. Plug in bus connector. See AR.
   - A bus connector is supplied with each CM35. Insert the bus connector on the module occupying the slot to the left of the CM35.
5. Hang in CM35. See AR.
6. Secure CM35 with screw. See AR.
7. Label CM35. See AR.

How to remove/ replace modules

For how to set up/replace modules in the system, see manual /70/ or /140/.
A simplified version of removal is given here.

1. Switch the CPU to STOP.
2. Turn off the power supply.
3. Release the front plug connector, and disconnect it.
4. Release the mounting screw on the module.
5. Swivel the module out of the mounting rail, and remove it.
6. If necessary, install the new module.

For more information on removing the modules, see manuals /70/ and /140/.

3.2 Wiring the CM35

Digital inputs

The 8 counting inputs (channels) of the CM35 are available on a 25-pin sub D socket on the front of the module.
Each counting input has separate connections for reference potential (ground), and 5 V and 24 V signals. To prevent malfunctions, only one of the two signal voltages may be wired at a time.

The encoder must be powered by an external voltage source.

Digital outputs

The 8 outputs of the CM35 are available on a 15-pin sub D socket on the front of the module. A load power supply of 24 V DC must also be connected there which is able to continuously supply the sum of the required output currents.

The outputs are P switches which can handle a load current of 0.4 A. They are protected against overload and short circuits.

Shield clamps

The size of the shield clamp depends on the diameter of the cable.

To mount a cable with the shield clamp, bare the shield by cutting out approximately 1.5 cm of the cable insulation at the appropriate location on the cable.

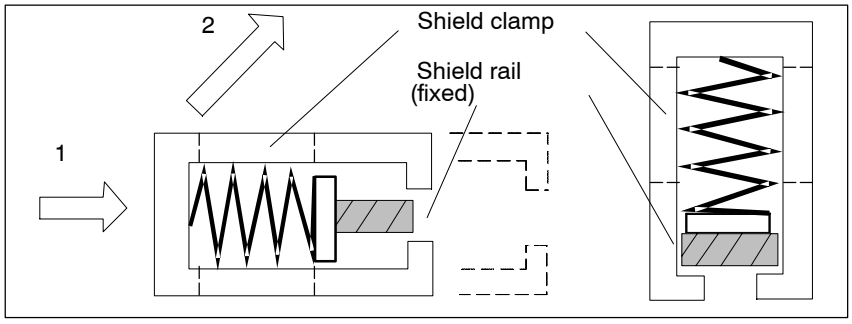


Figure 3-1 Mounting the shield clamps

Caution

Do not damage the braiding of the shield when baring the cable.

When applying the shield to all cables connected to the CM35, remember to leave enough cable between the shield connecting element and the CM35 so that the CM35 can be removed with all cables connected.

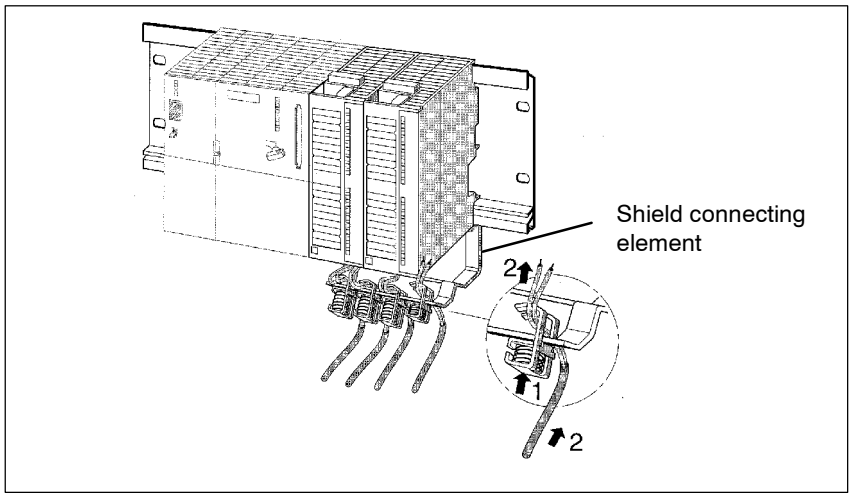


Figure 3-2 Shield connecting element

3.2.1 Connection Allocation of the 25-Pin Sub D Socket

Wiring of the operating modes pulse counter, period duration measurement and timer

The inputs must be wired in accordance with table 3-3 for modes pulse counter, period duration measurement and timer.

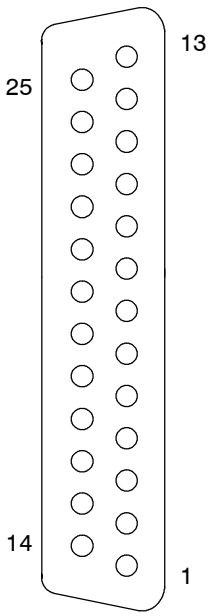


Table 3-3 Wiring

Signal Voltage	Channel	Encoder Signal	Connection to Pin ...
5 V	1	Counting pulse	20
		Ground	14
	2	Counting pulse	2
		Ground	21
	3	Counting pulse	9
		Ground	3
	4	Counting pulse	16
		Ground	10
	5	Counting pulse	23
		Ground	17
	6	Counting pulse	5
		Ground	24
	7	Counting pulse	12
		Ground	6
	8	Counting pulse	19
		Ground	13
24 V	1	Counting pulse	1
		Ground	14
	2	Counting pulse	8
		Ground	21
	3	Counting pulse	15
		Ground	3
	4	Counting pulse	22
		Ground	10
	5	Counting pulse	4
		Ground	17
	6	Counting pulse	11
		Ground	24
	7	Counting pulse	18
		Ground	6
	8	Counting pulse	25
		Ground	13

Wiring for operating mode positioning

When ″positioning″ mode is used, the inputs must be wired in accordance with table 3-4.

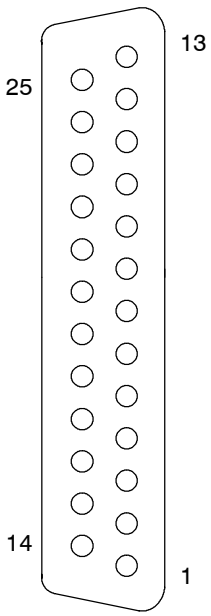


Table 3-4 Wiring for ″positioning″ operating mode

Signal Voltage	Axis	Track	Connection to Pin ...
5 V	1	A	20
		B	2
		Ground	14 / 21
	2	A	9
		B	16
		Ground	3 / 10
	3	A	23
		B	5
		Ground	17 / 24
	4	A	12
		B	19
		Ground	6 / 13
24 V	1	A	1
		B	8
		Ground	14 / 21
	2	A	15
		B	22
		Ground	3 / 10
	3	A	4
		B	11
		Ground	17 / 24
	4	A	18
		B	25
		Ground	6 / 13

Note

Connect the two ground connections for an axis.

Example of an encoder connection

- Incremental encoder with 5 V supply
- Axis 1

⇒ Track A: Pin 20
Track B: Pin 2
Ground: Pin 14 + pin 21 (connect these two)

3.2.2 Connection Allocation of the 15-Pin Sub D Socket

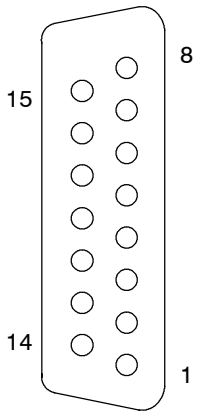


Table 3-5 Allocation of the 15-pin sub D socket

Pin	Signal	Input/ Output	Function for Mode	
			Pulse Counter, Period Duration Measurement, Timer	**Positioning**
1	VCC1	IN	Load voltage 24 V	
2	VCC1	IN	Load voltage 24 V	
3	O1	OUT	Digital output 1	Axis 1, forwards
4	O2	OUT	Digital output 2	Axis 1, backwards
5	O3	OUT	Digital output 3	Axis 2, forwards
6	O4	OUT	Digital output 4	Axis 2, backwards
7	GND 2	IN	Ground load voltage for digital outputs	
8	GND 2	IN	Ground load voltage for digital outputs	
9	VCC1	IN	Load voltage 24 V	
10	VCC1	IN	Load voltage 24 V	
11	O5	OUT	Digital output 5	Axis 3, forwards
12	O6	OUT	Digital output 6	Axis 3, backwards
13	O7	OUT	Digital output 7	Axis 4, forwards
14	O8	OUT	Digital output 8	Axis 4, backwards
15	GND 2	IN	Ground load voltage for digital outputs	

The connections for 24 V load voltage and for ground load voltage are connected internally.

3.3 Configuration and Parameterization

Configuration and parameterization of the CM35 depends on the system on which the module is to be used.

Table 3-6 Overview of configuration and parameterization

	Central Integration into the SIMATIC S7-300	**Distributed Integration into the SIMATIC S7**	**Distributed Integration into the SIMATIC S5**
Configuration tool	STEP 7, HW Config		COM PROFIBUS
Module address	Depends on slot or selectable as desired (depends on CPU)	Can be selected as desired	
Setting the operating mode	During configuration		
Parameterization	With SFC 55 “WR_PARM”		Via I/O direct accesses

Configuration with STEP 7

The object manager from the included data medium must be installed first (see chapter 3.3.1) so that STEP 7 will be able to recognize the CM35 during configuration.

Configuration with COM PROFIBUS

The current GSD files must be loaded to subdirectory GSD so that COM PROFIBUS is able to recognize the CM35 during configuration.

Parameterization

Parameterization is performed by the user program and only refers to the operating mode which was set when the module was configured.The required parameters depend on this operating mode.

The fundamentals of parameterization are described in chapter 4.2.
For details, see the descriptions of the individual operating modes.

3.3.1 Installation of the Object Manager for STEP 7

Prerequisites

To install the object manager (OM), STEP 7 (starting with V3.2) must be installed correctly on your PG/PC.

Installing the object manager

To install the object manager, proceed as shown below.

1. Make sure that no applications are open in Windows.
2. Insert the data medium.
3. Call the SETUP.EXE program.

Configuring the hardware

The CM35 counter module is located in the path shown below under STEP 7 → HW Config → Catalog.

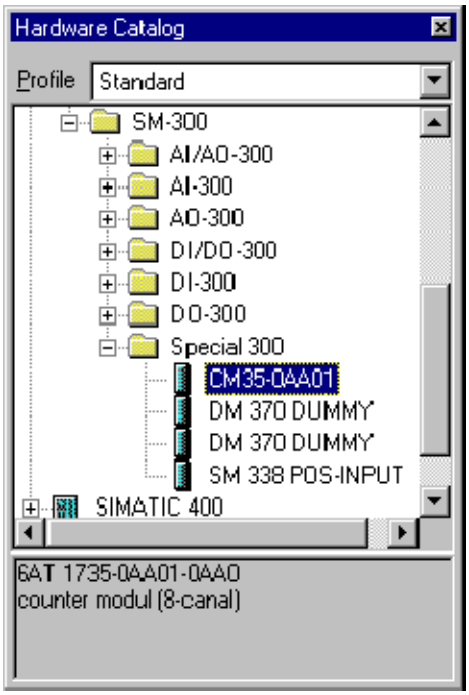


Figure 3-3 Counter module CM35 in the hardware catalog

Indicating integrated help

In addition to the dialogs of the object manager, help information is available which you can call during every phase of parameterization either with the F1 key or with the **Help** button.

3.3.2 Central Integration into the SIMATIC S7-300

Configuration

When used with an S7-300, the module is configured with STEP 7 with the application HW Config. To add a CM35 to an existing project, proceed as shown below.

1. Start the SIMATIC Manager, and open the desired project.
2. In the left-hand portion of the project screen, select the SIMATIC 300 station to which you want to add the CM35.
3. Select the menu command **Edit > Open Object**.

   This opens the HW Config application. This application contains a screen with the hardware setup of the opened station.
4. Select the CM35 from the module catalog of HW Config, and place it in the module rack.

Module address

Based on its position on the mounting rail, the required input and output address areas are automatically assigned to the CM35 and entered in the configuration table.

When certain CPUs are used, these address areas can be changed. For details, see manual /70/.

Setting the operating mode

The operating mode of the CM35 must have already been set during the configuration. Proceed as shown below.

1. In the configuration table, select the line with the CM35, and select the menu command **Edit > Object Properties**.
2. In the dialog box, open the tab **Operating Mode**, select the desired operating mode, and confirm with **OK**.

Commissioning

For additional details on preparation for operation, see manual /70/ and user manual /231/.

3.3.3 Distributed Integration into the SIMATIC S7

Configuration

The module is configured as distributed I/O with the HW Config application of STEP 7. To add a CM35 to an existing project, proceed as shown below.

1. Start the SIMATIC Manager, and open the desired project.
2. In the left-hand portion of the project screen, select the SIMATIC station from which the DP slave is to be addressed.
3. Select the menu command **Edit > Open Object**.

   This opens the HW Config application. This application contains a screen with the hardware setup of the opened station.
4. If not already done, set up a DP slave. From the ″Hardware Catalog″ screen, select an ET 200M with IM 153-2, and place it in a PROFIBUS-DP master system.
5. Select the CM35 from the hardware catalog, and place it in the ET 200M.

Module address

Based on the position on ET 200M, the required input and output address areas are automatically assigned to the CM35 and entered in the configuration table. Address gaps in the address areas of the CPU rack are utilized.

The preset address areas can be changed in accordance with certain rules. For more information on free address assignment, see manual /70/. Proceed as shown below.

1. In the configuration table, select the line with the CM35, and select the menu command **Edit > Object Properties**.
2. In the indicated dialog box, open the tab **Addresses**, and enter the desired start address.

   If there are address overlaps with other modules, you will be told this when you close the dialog box.
3. Leave the dialog box open so that you can make the following settings of the module's operating mode.

Setting the operating mode

The operating mode of the CM35 must have already been set during configuration. Proceed as shown below.

1. If not already done, select the line with the CM35 in the configuration table, and select the menu command **Edit > Object Properties**.
2. In the dialog screen, open the tab **Operating Mode**, select the desired operating mode, and confirm with **OK**.

Commissioning

For additional preparations before operation, see manual /70/ and user manual /231/.

3.3.4 Distributed Integration into the SIMATIC S5

Note

This section assumes that you have a knowledge of SIMATIC S5 and COM PROFIBUS.

Integration on the SIMATIC S5

The CM35 module can be linked as distributed I/O to the SIMATIC S5 using PROFIBUS-DP.

The modular ET 200M I/O device is required to link the CM35 modules to PROFIBUS-DP. The SIMATIC S5 is connected to PROFIBUS-DP with interface IM 308-C. Another method is to use a SIMATIC S5-95U/DP master with integrated PROFIBUS-DP interface.

3.3.4.1 Hardware Prerequisites

IM 308-C

Release 4 or later

Note

An FB 192 with release 3 can only be used with an IM 308-C starting with release 6!

When release status 2 of the FB 192 is used, all versions of the IM 308-C can be used starting with release status 3.

S5-95U/master DP

Release 2 or later

The maximum transmission speed is 9600 Kbaud to 1.5 Mbaud, depending on the length of the cable.

IM 153-1

Prerequisites for the coupling are an IM 153-1 (MLFB no. 6ES7 153-1AA02-0XB0 or later) and CM35 modules (MLFB no. 6AT1 735-0AA01-0AA0, release status 4 or later)

IM 153-2

Prerequisites for the coupling are an IM 153-2 (MLFB no. 6ES7 153-2AA01-0XB0, release status 2 or later) and CM35 modules (MLFB no. 6AT1 735-0AA01-0AA0).

CM35 modules (MLFB no. 6AT1 735-0AA01-0AA0, release status 4 or later) are required for the IM 153-2 interfaces (MLFB no. 6ES7 153-2AA02-0XB0, release status 5 or later).

3.3.4.2 Configuration

COM PROFIBUS

The IM 308-C interface module or S5-95U/DP master is parameterized with the COM PROFIBUS software. With more recent versions of COM PROFIBUS, you should be able to find the CM35 module in the ET 200M under its order number 6AT1 735-0AA01-0AA0. See figure 3-4.

If you cannot find the CM35, copy the type or GSD files from the configuration package to the appropriate directory of COM PROFIBUS. Which files must be copied depends on the version of COM PROFIBUS.

- With COM PROFIBUS (version ≤ 3.2): Copy the type files to the directory ″TYPDAT5X.″
- With COM PROFIBUS (version ≥ 3.3): Copy the GSD files to the directory ″GSD.″

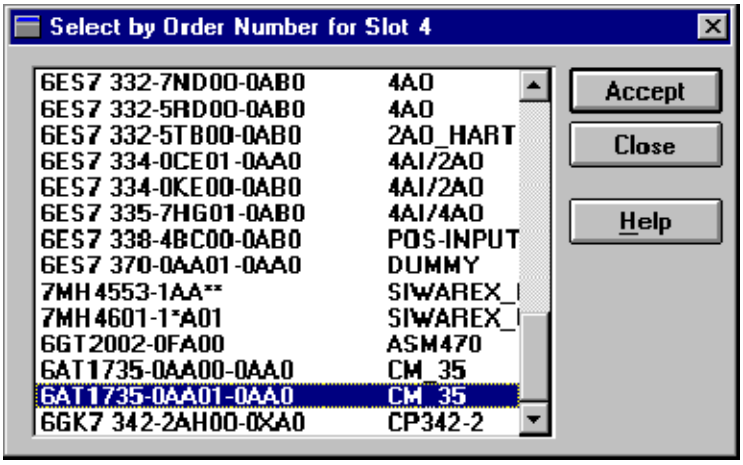


Figure 3-4 Selecting the CM35 module during configuration of the ET 200M

Table 3-7 Type and GSD files

File Name	Use
SI801DV*.200	Type file for IM 153-1
ST801EU*.200	Type file for IM 153-2
SIM801D.GS*	GSD file for IM 153-1
SIM801E.GS*	GSD file for IM 153-2
SIM8071.GS*	GSD file for IM 153-2 FO

* Identifies the particular language version

Note

The latest GSD files (only for COM PROFIBUS version ≥ 3.3) can be downloaded from the Internet (SIMATIC Customer Support).

Internet address: http://www.ad.siemens.de/support/html_00/index.shtml

Copy the new GSD files to the ″GSD″ directory, and execute the menu command ″File > Open GSD File.″

Using the GSD files included with the configuration package has a drawback - you will not be using the latest GSD file (e.g., you may not be able to find other new modules).

The type files are only required for older COM PROFIBUS versions ≤ 3.2. In the future, they will be completely replaced by the GSD files.

Configuration

The module is configured as distributed I/O on the SIMATIC S5 with COM PROFIBUS.

To add a CM35 to an existing DP master system, proceed as shown below.

1. Start COM PROFIBUS, and open the desired master system.
2. Open a DP slave (ET 200M with IM 153-1), or set up a new one.
3. Place the module in the ET 200M. In the configuration table, select the desired slot, and select the button **Order No. ...**
   In the dialog box ″Select...,″ select the order number of the CM35 (6AT1 735-0AA0**1-**0AA0), and select the **Accept** button.
4. Leave the configuration table open to set the addresses and operating mode which come next.

Module address

You can specify a start address for the input and for the output area. This address depends on the operating mode you want to use.

- Direct process inputs and outputs: Addresses in the P or Q area
  Accesses only permitted via word load and transfer operations
- Accesses via FB 192: No address specifications required
  For a detailed description of FB 192 and its manual, see the manual of COM PROFIBUS.

Address overlapping with other modules or conflicts with reserved areas are indicated by COM PROFIBUS.

Module address (for use of the IM 308-C)

The same start address is used for the input area and for the output area. The CM35 module occupies 16 bytes in the input area and 16 bytes in the output area. The module address must be a whole number multiple of 16. The start address is also required for configuration under COM PROFIBUS.

Addressing in the process image (PY0 to PY127) should never be used for consistent data.

Table 3-8 Possible addresses

CM35 number [1]		1	2	3	4	5	6	7	8
Possible CM35 addresses	P:	128	144	160	176	192	208	224	240
CM35 number		9	10	11	12	13	14	15	16
Possible CM35 addresses	Q:	0	16	32	48	64	80	96	112
CM35 number		17	18	19	20	21	22	23	24
Possible CM35 addresses	Q:	128	144	160	176	192	208	224	240

1) A fixed relationship between CM35 number and address does not exist. A maximum of 24 CM35 modules can be addressed per IM 308-C interface.

Module address (for use of the S5-95U/DP)

Input/output bytes 64 to 127 are used for both the local I/O (e.g., analog input/output modules, slots 0 to 7) and the distributed I/O (DP slaves). When the local I/O is used (e.g., analog input/output modules), the address areas must be reserved in the host parameters by the user with COM PROFIBUS.

Table 3-9 Possible addresses

CM35 number		1	2	3	4	5	6	7	8
Possible CM35 addresses	P:	64	80	96	112	128	144	160	176

Setting the operating mode

The operating mode of the CM35 must have already been set during configuration. Proceed as shown below.

1. In the configuration table, select the line with the CM35, and click the button **Param. ...**
2. In the dialog box ″Parameterize...,″ select the field under ″Value″ in the first line of the table (5), and click the **Select...** button. In the next dialog box which appears, select the desired operating mode, and confirm with **OK**.
3. Repeat this step in the second line of the table (8) with the same operating mode. See figure 3-5.
4. In the ″Parameterize...″ dialog box, click the **OK** button, and close the configuration table with **OK**.

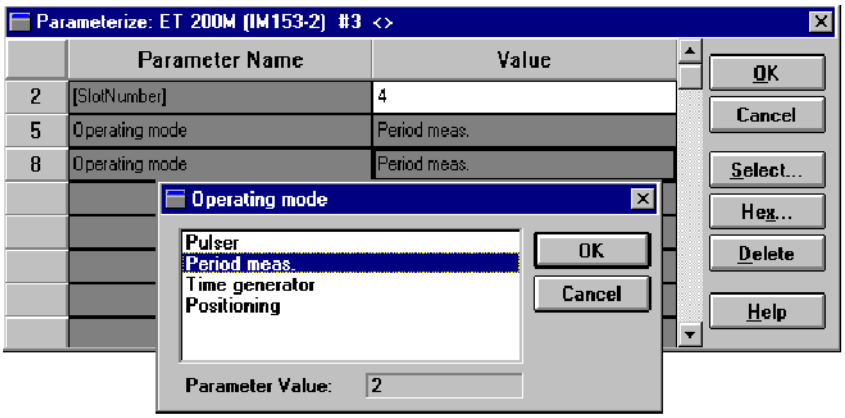


Figure 3-5 Setting the operating mode with COM PROFIBUS

Note

When distributed integration into the SIMATIC S5 is used, only the operating modes ″period duration measurement″ and ″timer″ (time generator) are permitted. See chapter 1.2.

Commissioning

For additional preparations before operation, see the manual of COM PROFIBUS.

Data consistency

When the distributed integration is used, data consistency must be considered. Data are called consistent when their contents belong together.

When you access the CM35 with load/transfer commands, only word accesses may be used and only even addresses may be accessed so that consistency is ensured.

Data consistency is specified via the COM PROFIBUS configuration. Word consistency has already been set for the CM35 in the type or GSD files included in the configuration package.

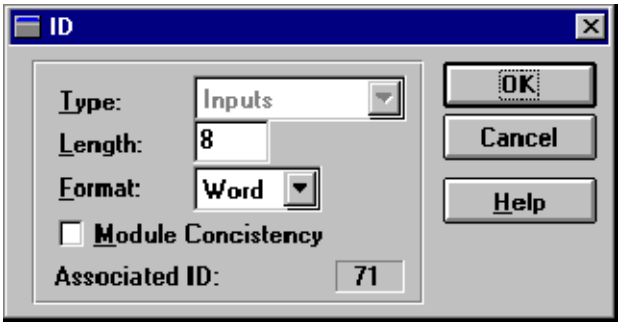


Figure 3-6 Setting of the consistency via COM PROFIBUS

For more information, see the manual on the distributed I/O system ET 200.

3.4 Reactions during Startup and in Case of Errors

Warm restart

When a warm restart (power on) takes place, the red group error LED (**SF**) on the front of the module stays on until the module is ready for operation (i.e., until it has received valid parameters).

Hot restart

When the module firmware recognizes the CPU STOP state, the parameters stored on the CM35 lose their validity. Parameter memory and the input and output area are deleted. This is indicated by the group error LED.

Reaction to failure of the S7-300

When the CPU assumes the STOP state, running operation of the CM35 is terminated. The digital outputs are switched off (i.e., reset). Although the operating mode is retained, the parameters are no longer valid.

Module power supply

Since the CM35 is completely powered by the backplane bus of the SIMATIC S7-300, it has to be switched on together with the S7-300 CPU or IM module.

4 Data Communication with the CM35

4.1 Overview

Address area

The CM35 is located in the analog address area of the programmable controller.

Central operation:

The address is assigned in one of the following ways, depending on the S7-300 CPU being used.

- Slot-oriented
- As desired

Use the module's start address from HW Config.

Distributed operation:

The address of the CM35 can be assigned as desired.

The start address of the module can be taken from one of the following.

- HW Config with an S7 master (e.g., CPU 315-2 DP)
- COM PROFIBUS with an S5 master (e.g., IM 308-C).

Parameterization

Use HW Config or COM PROFIBUS to set the operating mode for the CM35 (e.g., pulse counter).

The data required to operate the module in the selected mode (e.g., counting direction and comparison values for pulse counting mode) are transferred to the CM35 with the parameterization.

The parameters must be transferred at least once to the CM35 after CPU STOP → RUN.

With centralized use of the CM35 and with distributed use on S7 masters, the parameters are written with system function SFC 55 "WR_PARM."

With DP use with S5 masters, the parameters are written with direct I/O accesses (only in the permissible modes ″period duration measurement″ and ″timer.″

Programming

After parameterization, you can

- control operation of the individual channels via write accesses
- read the data of the CM35 with read accesses

Depending on the selected operating mode and the parameterization, the module supports the triggering of hardware interrupts with the SIMATIC S7. OB 40 must be programmed for this.

4.2 Parameterization

Parameter data

The parameter data for the individual operating modes are combined into parameter blocks. The required number of parameter blocks depends on the operating mode which you selected.

The parameters must be transferred at least once to the CM35 after CPU STOP → RUN. After the data have been transferred correctly, the red SF LED goes off and the module is ready for operation.

The parameters can be specified again during operation so that the individual channels can be adjusted to the particular state of the process.

The parameter blocks can be transferred in any sequence. The order has no effect on their use.

Note

Before a channel can be reparameterized, it must be stopped. The parameters for a channel may not be changed or written while the channel is running.

Parameter block

A parameter block consists of the following.

- A control word
- Up to 6 words of data area (parameter data)

Table 4-1 Layout of a parameter block

Word	Description
Word 1	Control word
Words 2 to 7	Parameter data

For the allocation and description of the parameter data for the individual parameter blocks, see the description of the operating mode.

Layout of the control word

The control word is the first word of each parameter block. The layout of the control word is shown below.

The bit numbering is specified for the data type ″word.″

- The low byte of word ″n″ has the byte address ″n + 1.″
- The high byte of word ″n″ has the byte address ″n.″

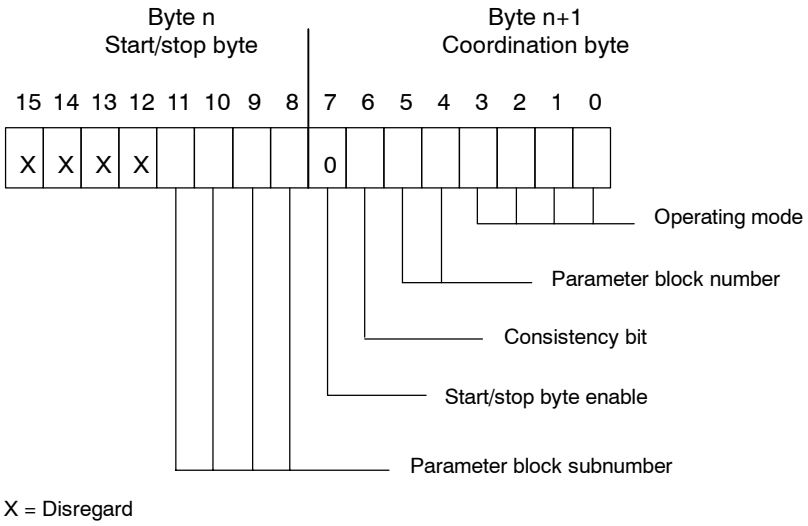


Table 4-2 shows the permissible allocations of the control word.

Table 4-2 Allocation of the control word for parameterization

Bit Address	Description	Allocation
0 to 3	Identifier for the set operating mode	0001: Pulse counter operating mode 0010: Period duration measurement operating mode 0011: Timer operating mode 0100: Positioning operating mode
4 to 5	Number of the current parameter block	01: Parameter block 1 10: Parameter block 2 11: Parameter block 3
6	Consistency bit - Only with parameterization via direct I/O accesses - Not applicable for parameterization via SFC 55	0: Write parameter block 1: Accept parameter block via CM35
7	Start/stop byte enable	0: Evaluate parameter data 1: Evaluate start/stop byte

Table 4-2 Allocation of the control word for parameterization, continued

Bit Address	Description	Allocation
8 to 11	Subnumber for parameter block - Only for ″positioning″ mode - Not applicable to the operating modes pulse counter, period duration measurement and timer	0000: Parameter subblock 0 0001: Parameter subblock 1 (axis 1) 0010: Parameter subblock 2 (axis 2) 0011: Parameter subblock 3 (axis 3) 0100: Parameter subblock 4 (axis 4)
12 to 15	Disregard	

Example (S5)

″Timer″ mode/parameterization via direct I/O accesses
Write parameter block 2:
To write data assign W#16#0023 to control word
To accept data via CM35 assign W#16#0063 to control word

Data transmission

The parameter blocks for the parameterization of the CM35 can be written in one of the following ways.

- Use of data record number 1 with SFC 55 “WR_PARM”
- Write the analog I/O address area with direct I/O accesses

The data are written with SFC 55 when the CM35 is used with SIMATIC S7.

Direct I/O write-accesses to the data must be used for DP operation with S5 masters or standard DP masters. A consistency bit which must be specified via the user program is available to ensure the data consistency of a parameter block.

4.2.1 Parameterization with SFC 55 (Only SIMATIC S7)

SFC 55 “WR_PARM” can be used to transfer to the module a complete parameter block (control word and parameterization data, length of 14 bytes) as data record 1.

Below is an example for the transmission of the 1st parameter block from DB 20 (pulse counting mode). The CM35 has the logical base address 256.

Table 4-3 Sample allocation for a data block (DB 20)

DB Address	Name	Type	Initial Value	Commentary
+0.0	Para_Block_1_Data	STRUCT		
+0.0	Control word	WORD	W#16#11	Parameter block 1/ pulse counting mode
+2.0	Cmp_Start_Value_Chan_1	WORD	W#16#00	Comparison value/start value, channel 1
+4.0	Cmp_Start_Value_Chan_2	WORD	W#16#00	Comparison value/start value, channel 2
+6.0	Cmp_Start_Value_Chan_3	WORD	W#16#00	Comparison value/start value, channel 3
+8.0	Cmp_Start_Value_Chan_4	WORD	W#16#00	Comparison value/start value, channel 4
+10.0	Cmp_Start_Value_Chan_5	WORD	W#16#00	Comparison value/start value, channel 5
+12.0	Cmp_Start_Value_Chan_6	WORD	W#16#00	Comparison value/start value, channel 6
=14.0		END_STRUCT		

```
CALL   SFC55
   REQ       :=true                    // Request to
                                          write
   IOID      :=B#16#54                 // Area identifier for
                                          composite mod.
   LADDR     :=W#16#100                // Logical address = 256
   RECNUM    :=B#16#1                  // Data record number 1
   RECORD    :=P#DB20.DBX 0.0 BYTE 14  // Pointer to beginning
                                          of the block
   RET_VAL   :=#ret_val                // Error code
   BUSY      :=#busy                   // = 1, writing not
                                          concluded
```

SFC 55 must continue to be called until BUSY is reset.

SFC 55 should not be used in OB100. We recommend setting a flag bit (startup identifier) in OB100 instead. SFC 55 should then be called based on this flag bit to parameterize the CM35 after the automation system is turned on.

If an error occurs while the function is being processed, the error code is indicated in parameter RET_VAL, and BIE is set to ″0.″

For a description of the parameterization of the system functions and the return values, see STEP 7 reference manual /235/.

4.2.2 Parameterization via Direct I/O Accesses (Only SIMATIC S5)

Parameterization via direct accesses is only permitted in the ″period duration measurement″ and ″timer″ operating modes.

Assignment of the I/O address area

The analog I/O address area contains 8 words. The data must be written with word accesses.

The I/O address area is used for parameterization as shown below.

Table 4-4 Assignment of the address area for parameterization via direct I/O accesses

Offset for the Module Start Address	Description
+0	DO byte (digital output control) may not be written during parameterization.
+2	Control word
+4 to +14	Parameterization data

Use of the consistency bit

The consistency (”C bit”) in the control word is used with direct-access parameterization to ensure consistency of the written values within one parameter block.
The CM35 does not evaluate the transferred values of one parameter block as long as the C bit is not set. These values do not become valid until the control word is written with C bit = 1.

Transmission of parameter blocks

The following sequence must be used to transfer the pafameter blocks.

1. Transfer the control word with C bit = 0.
2. Transfer all required data of the parameter block.
3. Transfer the control word with C bit = 1.

   Transfer next parameter block.

Note

The channels may not be started or stopped by accesses to the control word while parameter blocks are being transferred. The system must be in a defined state before parameter blocks are transferred.

An example is shown below.

- ″Timer″ operating mode
- Transmission of the 1st parameter block from DB 20
- The CM35 has the module start address 128.

Table 4-5 Sample allocation for a data block (DB 20)

DB Address	Name	Type	Initial Value	Commentary
0	Control_word	WORD	W#16#13	Parameter block 1/″timer″ operating mode
2	Timebase_Timer_1	BYTE	B#16#01	Time base for timer 1
3	Timebase_Timer_2	BYTE	B#16#01	Time base for timer 2
4	Timebase_Timer_3	BYTE	B#16#01	Time base for timer 3
5	Timebase_Timer_4	BYTE	B#16#01	Time base for timer 4
6	Timebase_Timer_5	BYTE	B#16#01	Time base for timer 5
7	Timebase_Timer_6	BYTE	B#16#01	Time base for timer 6
8	Timebase_Timer_7	BYTE	B#16#01	Time base for timer 7
9	Timebase_Timer_8	BYTE	B#16#01	Time base for timer 8
10	Factor_Timer_1	WORD	W#16#01	Factor for timer 1
12	Factor_Timer_2	WORD	W#16#01	Factor for timer 2
14	Control_word	WORD	W#16#53	C bit = 1/parameter block 1/ ″timer″ operating mode

```
A   DB20                // Open data block.
L   DBW0                // Load control word with C bit=0.
T   PW 130              // Module start address + 2

L   DBW2                // Load time base for timers 1 and 2.
T   PW 132              // Module start address + 4

L   DBW4                // Load time base for timers 3 and 4.
T   PW 134              // Module start address + 6

...

L   DBW12               // Load factor for timer 2.
T   PW 140              // Module start address + 14

L   DBW14               // Load control word with C bit = 1.
T   PW 130              // Module start address + 2

Transfer next parameter block.
```

Wait time, OB1/ OB100

When distributed connection to the SIMATIC S5 is used, a wait time must be adhered to after an S5 CPU STOP/RUN transition, before the module is parameterized via direct I/O accesses.

The wait time depends on the PROFIBUS transmission speed set. It can be configured in OB 100 or OB 1.

The following standard values apply.

187.5	kbit/sec	→	500 msec wait time
:			:
1.5	kbit/sec	→	100 ms wait time
:			:
12	kbit/sec	→	10 ms wait time

4.3 Programming

Parameterization must be correct before the channels and digital outputs can be controlled and the actual values can be read.
With both the SIMATIC S7 and the SIMATIC S5, direct I/O accesses are always used. Only word or double-word accesses to even addresses can be used for I/O accesses.

4.3.1 Controlling the Channels

The individual channels of the CM35 can be started and stopped by writing the control word. The control word must be written to address ″module start address + 2.″

Layout of the control word

The control word is assigned as shown below to start and stop the channels.

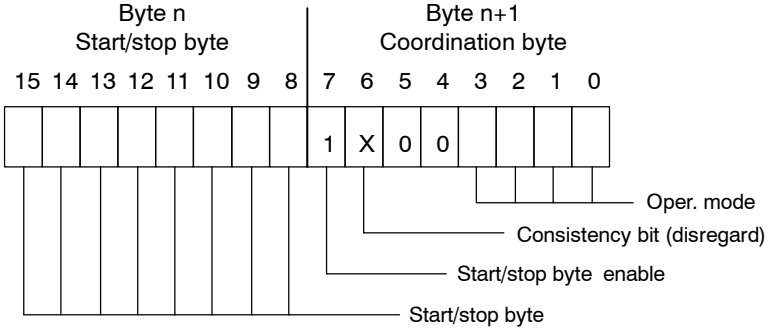


Table 4-6 shows the permissible assignments of the control word.

Table 4-6 Allocation of the control word for controlling the channels

Bit Address	Description	Allocation	
0 to 3	Identifier for the operating mode set	0001: 0010: 0011: 0100:	″Pulse counter″ operating mode ″Period duration measurement″ operating mode ″Timer″ operating mode ″Positioning″ operating mode
4 to 5	Always 0	00:	Start/stop byte is written.
6	Disregard	0/1:	Consistency bit
7	Start/stop byte enable	0: 1:	Evaluate parameter data Evaluate start/stop byte
8 to 15	Start/stop byte	Bit Address	
	Oper. mode: Pulse counter Period duration meas. Timer	8 to 15	0: Stop channel 1: Start channel
	Oper. mode: Positioning	9, 8; 11, 10; 13, 12; 15, 14	01: Start axis 10: Stop axis

Example: ″Pulse counter″ operating mode
To start all channels, write control word W#16#FF81.
To stop all channels, write control word W#16#0081.

4.3.2 Controlling the Digital Outputs

The digital outputs of the CM35 can be controlled by the user program, based on the parameterization selected.

The status of the digital outputs can be specified by writing the DO pattern (DO byte) to I/O output byte ″module start address + 0.″

Table 4-7 Allocation of the DO byte for controlling the digital outputs

Bit Address	Description	Allocation
0	Digital output 1	0: Digital output off 1: Digital output on
1	Digital output 2	
2	Digital output 3	
3	Digital output 4	
4	Digital output 5	
5	Digital output 6	
6	Digital output 7	
7	Digital output 8	

Example (S7): Set outputs 1 and 5 of the ″pulse counter″ operating mode.

- Parameterize DO mode with CPU control.
- The CM35 has the module start address 256.

```
L    2#0001_0001_0000_0000  // Load DO byte to set outputs 1 and 5
T    PQW 256                // Module start address = 256
```

Note

Remember that only word-accesses to even addresses are permitted.

4.3.3 I/O Write Accesses

When I/O write accesses (T PQW) are used, it is essential to remember that **write accesses to the same I/O addresses** may overwrite each other before being transferred to the CM35.

Example, pulse counter:

Start channel 1, then start channel 4 shortly afterwards

```
L     W#16#01 81    // Start channel 1
T     PQW 258       // Module start address +2
:     :                        :
L     W#16#08 81    // Start channel 4
T     PQW 258       // Module start address +2
```

If the time between the start of channel 1 and channel 4 is too short, the start command for channel 1 may be overwritten by the start command for channel 4.

This is particularly apt to happen if you are using distributed connection of the CM35 with low bus transmission rates. In this case, the 1st start command (channel 1) is overwritten by the 2nd start command (channel 4) before the 1st start command can be sent to the module via PROFIBUS.

The following measures should be taken to ensure that I/O write accesses do not compete at the same address.

- The same I/O address may only be write-accessed once during one OB1 cycle.
- When a distributed layout is used, the DP cycle should be at least twice as fast as the CPU cycle (DP cycle and CPU cycle can be determined with STEP 7).

4.3.4 Reading the Data

The CM35 supplies the following data, based on the operating mode set.

Table 4-8 Data of the CM35

Operating Mode	Data	Data Type
Pulse counter	Current counting value	Word
Period duration measurement	Measured period duration	Word
Timer	Status of the timer	Byte
Positioning	Current actual position	DWord

For the allocation and description of the data of the CM35, see the description of the particular operating mode.

Remember the following points which concern the assurance of data consistency based on the programmable controller used.

SIMATIC S7 (central or distributed)
Only one single load command (L PIW or L PID) can be used to read the desired value.
This means that an actual value in double-word format must be read with one double-word access (L PID). Use of two word accesses (L PIW) can cause data inconsistency in this case.

SIMATIC S5 or standard DP master (distributed)
Only **word-accesses to even addresses** may be used to read-access the desired value.

Table 4-9 shows an example of the address allocation for reading the counting values in ″pulse counter″ mode.

Table 4-9 Address allocation of the counting values for the ″pulse counter″ operating mode

Offset to Module Start Address	Meaning	Value Range
+0	Counting value, channel 1	0 to 65535
+2	Counting value, channel 2	
+4	Counting value, channel 3	
+6	Counting value, channel 4	
+8	Counting value, channel 5	
+10	Counting value, channel 6	
+12	Counting value, channel 7	
+14	Counting value, channel 8	

Example: ″Pulse counter″ mode
- Read counting value of counting channel 4
- The CM35 has module start address 256.

```
L   PIW 262     // Address = 256 + 6, read counting value,
                   channel 4
T   MW 8        // Save the counting value
```

4.3.5 Evaluating a Hardware Interrupt in OB 40

Depending on the set operating mode and the selected parameterization, you can specify that a hardware interrupt is to be triggered when certain events occur. In this case, a hardware interrupt OB (OB 40) must exist on the CPU.

When a hardware interrupt occurs, the user program is interrupted, the data of the module are transferred to the start information of OB 40, and OB 40 is called. The hardware interrupt is acknowledged when OB 40 is exited.

The following local data are located in the start information of OB 40.

- OB 40_MDL_ADDR: The base address of the module which triggered the interrupt
- OB 40_POINT_ADDR: Information on the event which triggered the interrupt

Variable OB40_POINT_ADDR consists of four bytes. The process interrupt information of the CM35 is entered in the low word (local data bytes 10 and 11 of OB 40). For the allocation and description of this interrupt information, see the description of the particular operating mode.

For a description of OB 40, see STEP 7 reference manual /235/.

Table 4-10 Hardware interrupts in the various operating modes

Local Data of OB 40	**Hardware Interrupts (The function must have been activated before the interrupts are reported.)**			
Local data word 6	**Address of the module which triggered the hardware interrupt**			
Local data byte 10	**Operating Mode**			
	Pulse Counter	**Period Duration Measurement**	**Timer for Selective Interrupt (for Group Interrupt)**	**Positioning**
Bit 0	Reserved	No hardware interrupts are reported in this operating mode.	Timer 1 faulty (malfunction of a timer)	Reserved
Bit 1			Timer 2 faulty (disregard)	
Bit 2			Timer 3 faulty (disregard)	
Bit 3			Timer 4 faulty (disregard)	
Bit 4			Timer 5 faulty (disregard)	
Bit 5			Timer 6 faulty (disregard)	
Bit 6			Timer 7 faulty (disregard)	
Bit 7			Timer 8 faulty (disregard)	
Local data byte 11	**Operating Mode**			
	Pulse Counter	**Period Duration Measurement**	**Timer for Selective Interrupt (for Group Interrupt)**	**Positioning**
Bit 0	Counter channel 1 has reached the comparison value.	No hardware interrupts are reported in this operating mode.	Timer 1 has expired. (a timer has expired)	Axis 1 has reached setpoint position.
Bit 1	Counter channel 2 has reached the comparison value.		Timer 2 expired (disregard)	Reserved
Bit 2	Counter channel 3 has reached the comparison value.		Timer 3 expired (disregard)	Axis 2 has reached setpoint position.
Bit 3	Counter channel 4 has reached the comparison value.		Timer 4 expired (disregard)	Reserved
Bit 4	Counter channel 5 has reached the comparison value.		Timer 5 expired (disregard)	Axis 3 has reached setpoint position.
Bit 5	Counter channel 6 has reached the comparison value.		Timer 6 expired (disregard)	Reserved
Bit 6	Counter channel 7 has reached the comparison value.		Timer 7 expired (disregard)	Axis 4 has reached setpoint position.
Bit 7	Counter channel 8 has reached the comparison value.		Timer 8 expired (disregard)	Reserved

4.4 Overview of the Allocation of the Address Area and Sequence of the Evaluation

Allocation of the address area

Table 4-11 shows a summary of the allocation of the address area for writing data via direct I/O accesses.

Table 4-11 Allocation of the I/O address area for writing via direct I/O accesses

Offset to Module Address (by Word)	Output Area (16 Bytes)	
+0	Do not write-access during parameterization.	
	Byte +0 (DO byte)	Byte +1 (reserved)
	Control digital outputs (0 = off, 1 = on) XXXX XXX? Digital output 1 XXXX XX?X Digital output 2 XXXX X?XX Digital output 3 XXXX ?XXX Digital output 4 XXX? XXXX Digital output 5 XX?X XXXX Digital output 6 X?XX XXXX Digital output 7 ?XXX XXXX Digital output 8	Always 0
+2 (For SFC55: +0)	Control word	
	Byte +2 (start/stop byte)	Byte +3 (coordination byte)
	Bit allocation when starting/stopping channels/axes (bit 3.7 = 1) Operating mode: Pulse counter, period duration measurement, timer XXXX XXX? Channel 1: 0 stop, 1 start (*) XXXX XX?X Channel 2: 0 stop, 1 start (*) XXXX X?XX Channel 3: 0 stop, 1 start (*) XXXX ?XXX Channel 4: 0 stop, 1 start (*) XXX? XXXX Channel 5: 0 stop, 1 start (*) XX?X XXXX Channel 6: 0 stop, 1 start (*) X?XX XXXX Channel 7: 0 stop, 1 start (*) ?XXX XXXX Channel 8: 0 stop, 1 start (*) (*) If the channel was already started, the procedure is continued when another ″1″ occurs. Operating mode: Positioning XXXX XX?? Axis 1: 01 start, 10 stop XXXX ??XX Axis 2: 01 start, 10 stop XX?? XXXX Axis 3: 01 start, 10 stop ??XX XXXX Axis 4: 01 start, 10 stop **Bit allocation for transmission of parameter blocks (bit 3.7 = 0 and ″positioning″ mode)** XXXX ???? Parameter block subnumber 0000 = Parameter subblock 0 0001 = Parameter subblock 1 : 0100 = Parameter subblock 4	XXXX ???? Operating mode 0001: Pulse counter 0010: Period duration measurement 0011: Timer 0100: Positioning XX?? XXXX 00: Start/stop channels/axes 01: Transfer parameter block 1 10: Transfer parameter block 2 11: Transfer parameter block 3 X?XX XXXX: Consistency bit With SIMATIC S7 (SFC 55): Disregard With SIMATIC S5: 0: Write parameter block 1: CM35 accepts parameter block. Note: Wait time of 1 msec between 0 → 1 ?XXX XXXX: 0: Evaluate parameterization data 1: Evaluate start/stop byte

Table 4-11 Allocation of the I/O address area for writing via direct I/O accesses

Offset to Module Address (by Word)	Output Area (16 Bytes)	
+4 to +14 (With SFC55: 2 to 12)	**Parameterization data**	
	Pulse counter:	Parameter blocks 1 to 3
	Period duration measurement:	Parameter block 1
	Timer:	Parameter blocks 1 to 3
	Positioning:	Parameter block 1 (subnumbers 0 to 4) Parameter block 2 (subnumbers 1 to 4)

Note: With parameterization via SFC55, the data to be transferred are set up the same as output words 2 to 14.

Note

Only word or double-word accesses to even addresses can be used for I/O accesses.

Table 4-12 Allocation of the I/O address area when reading via direct I/O accesses

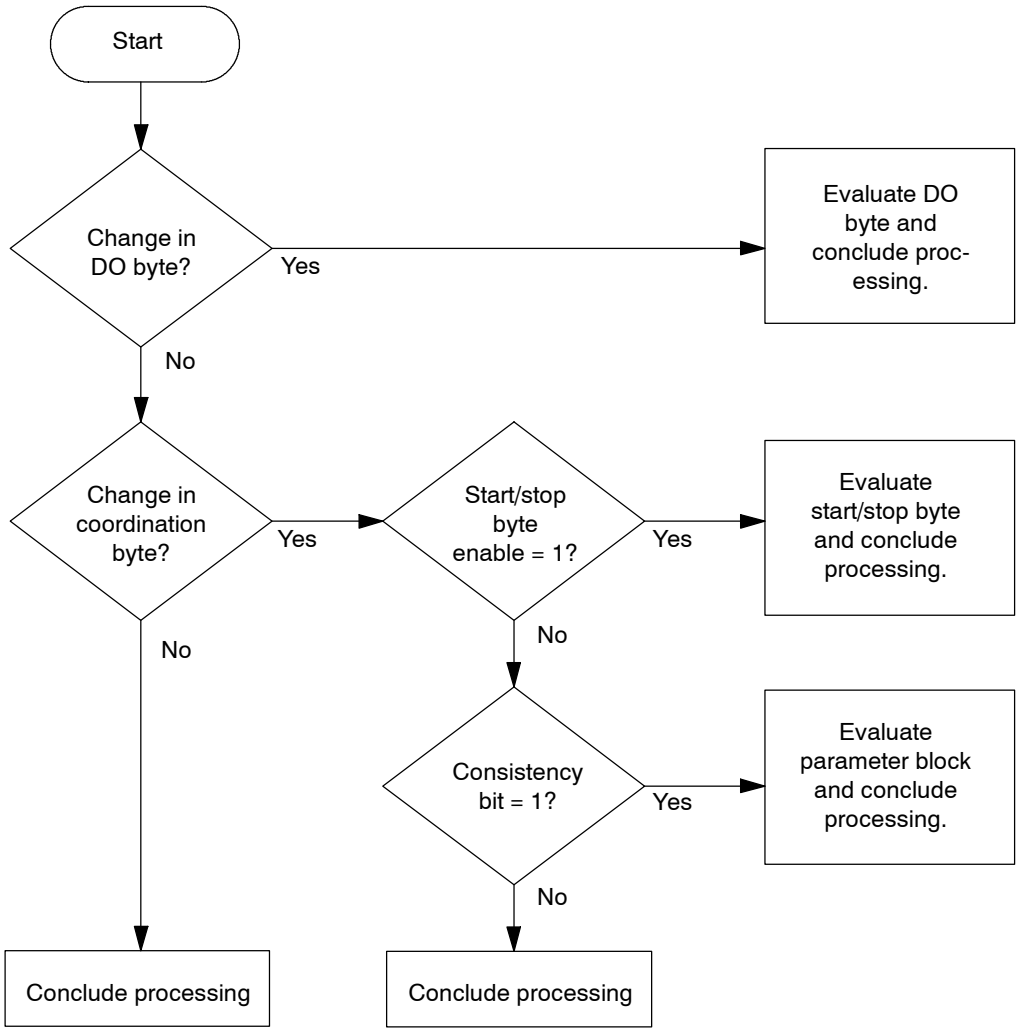
Offset to the Module Address (by Word)	Input Area (16 Bytes)			
	Operating Mode			
	Pulse Counter	**Period Duration Measurement**	**Timer**	**Positioning**
+0	Current counting value, channel 1	Measured period duration average value, channel 1	Status of timer: Bit 0: Channel 1 Bit 1: Channel 2 Bit 2: Channel 3 Bit 3: Channel 4 Bit 4: Channel 5 Bit 5: Channel 6 Bit 6: Channel 7 Bit 7: Channel 8 0: Timer is active. 1: Timer has expired and can be started again after a STOP command.	Current actual position, axis 1
+2	Current counting value, channel 2	Measured period duration average value, channel 2	Reserved	
+4	Current counting value, channel 3	Measured period duration average value, channel 3	Reserved	Current actual position, axis 2
+6	Current counting value, channel 4	Measured period duration average value, channel 4	Reserved	
+8	Current counting value, channel 5	Measured period duration average value, channel 5	Reserved	Current actual position, axis 3
+10	Current counting value, channel 6	Measured period duration average value, channel 6	Reserved	
+12	Current counting value, channel 7	Measured period duration average value, channel 7	Reserved	Current actual position, axis 4
+14	Current counting value, channel 8	Measured period duration average value, channel 8	Reserved	

Note

Only word or double-word accesses to even addresses can be used for I/O accesses.

Order of evaluation

When the CM35 recognizes that new data have been written in its address area, the DO byte and the coordination byte are evaluated in the following order.



Note

Remember that either a change in the DO byte or a change in the coordination byte is evaluated.

Pulse Counter Operating Mode

5

5.1 Function Description

In this operating mode, the CM35 counts continuously up or down within the counting range 0 to 65535, when the counter is enabled.

- When the counting value reaches the upper counting limit when counting up, and an additional counting pulse occurs, the counting value jumps to the lower counting limit and continues to count from there without losing an impulse.
- When the counting value reaches the lower counting limit when counting down, and an additional counting pulse occurs, the counting value jumps to the upper counting limit and continues to count from there without losing an impulse.

Table 5-1 Counting range

Counting Range	Lower Counting Limit	Upper Counting Limit	Counting Frequency
16 bits	0	65535	Max. of 10 kHz

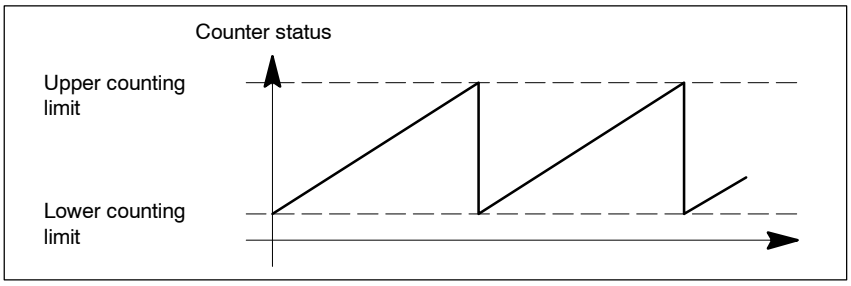


Figure 5-1 Counting up with counter started

Starting or stopping the counter

The individual counting channels are started and stopped by the user program. After a counting channel is started, the encoder pulses are counted. After a counting channel is stopped, the encoder pulses are no longer acquired.

When a counter is started, the CM35 turns on the related digital output. When the comparison value is reached, the digital output is switched off and a hardware interrupt is triggered.

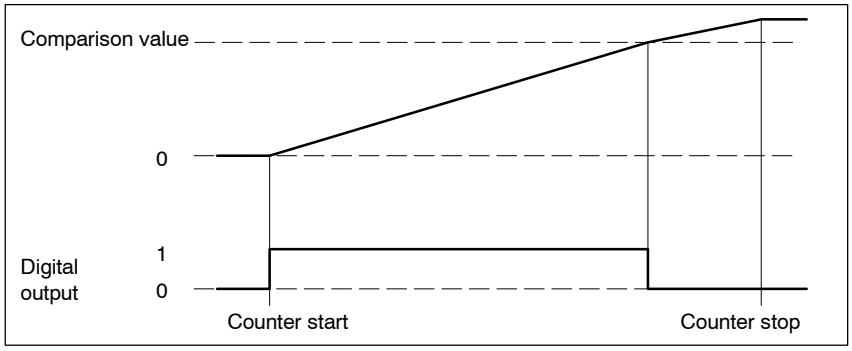


Figure 5-2 Switching the digital output, counting direction up

Counting edge

The counting value is changed with every falling edge on the related counter input.

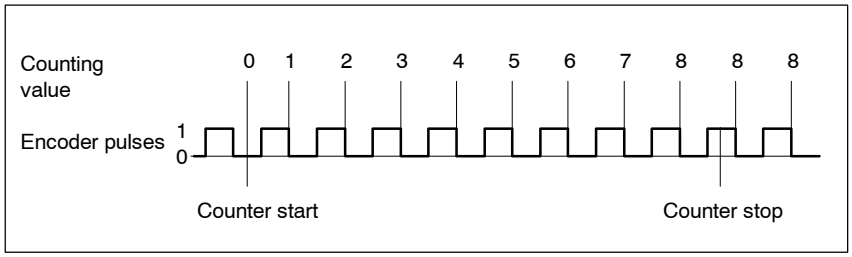


Figure 5-3 Evaluation of the encoder pulses, counting direction up

5.2 Parameterization

This chapter discusses possible parameterization in ″pulse counter″ operating mode which you can use to adjust the reaction of the counting channels to your task.

The parameter data are divided into three parameter blocks. For the structure of these parameter blocks, see chapter 5.2.2. The number of the parameter block and the offset in the related structure are specified in the description of the individual parameter data.

To be able to utilize the ″pulse counter″ operating mode, you must transfer at least parameter blocks 1 and 2 to the CM35.

Note

A channel **must** be stopped before it can be reparameterized.

- If you want to change channel-specific parameters, this channel must be stopped.
- If you want to change parameters affecting more than one channel, all channels must be stopped.

The new parameterization data take effect when the channel is started again.

For general layout and transmission of the parameter blocks, see chapter 4.2.

5.2.1 Description of the Parameterization Data

Counting direction

When you specify the direction of counting, you determine the direction in which the encoder pulses are counted.

Counting direction, up: Encoder pulses increment counting value.
Counting direction, down: Encoder pulses decrement counting value.

The parameterized direction of counting applies to all channels.

Table 5-2 Direction of counting

Variable: Counting Direction	Parameter Block	Offset	Data Type	Value Range
C_Direction	2	7.0	Bool	0: Counting direction, up 1: Counting direction, down

Comparison value/ start value

When you specify the counting direction, you determine how the comparison value/start value parameter will be used.

Counting up:

The transferred value is the comparison value.The following happens when a counter is started.

- Counting begins with the start value ″0.″
- The counting value is incremented with each encoder pulse.

When the counting value reaches the specified comparison value, the parameterized reactions are triggered (e.g., reset digital output, trigger hardware interrupt).

Counting down:

The transferred value is the start value. The following happens when a counting procedure is started.

- The counting value is set to the specified start value.
- The counting value is decremented with each encoder pulse.

When the counting value reaches the comparison value ″0,″ the parameterized reactions are triggered (e.g., reset digital output, trigger hardware interrupt).

The comparison value/start value can be specified for a specific channel.

Table 5-3 Comparison and start value

Variable: Comparison or Start Value (Depending on Direction of Counting)	Parameter Block	Offset	Data Type	Value Range
Cmp_Start_Value_Chan_1	1	2.0	Word	0 to 65535
Cmp_Start_Value_Chan_2	1	4.0	Word	
Cmp_Start_Value_Chan_3	1	6.0	Word	
Cmp_Start_Value_Chan_4	1	8.0	Word	
Cmp_Start_Value_Chan_5	1	10.0	Word	
Cmp_Start_Value_Chan_6	1	12.0	Word	
Cmp_Start_Value_Chan_7	2	2.0	Word	
Cmp_Start_Value_Chan_8	2	4.0	Word	

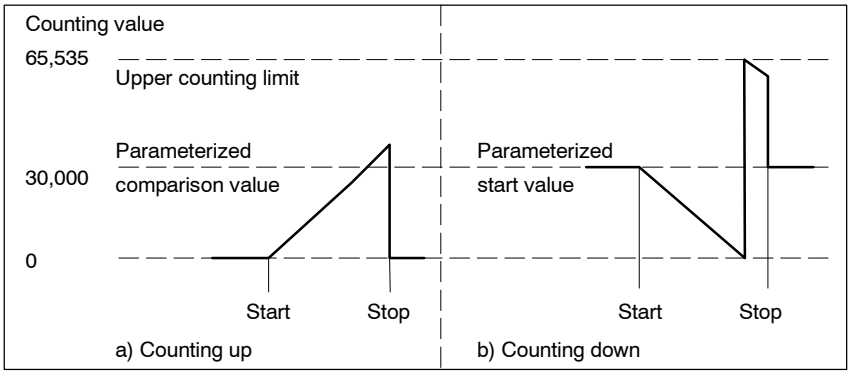


Figure 5-4 Use of the comparison value/start value parameter, delete counting value after stop

Counting value after counter stop

The ″delete counting value″ variable can be used to specify which counting value is to be indicated after stop.

Delete counting value at stop: After the counting procedure has been stopped, the counting value is set to the start value.

Delete counting value at start: After the counting procedure has been stopped, the current counting value is retained until the next start.

Parameterization applies to all channels.

Table 5-4 Delete counting value

Variable	Parameter Block	Offset	Data Type	Value Range
Delete_CountVal	2	7.5	Bool	0: Delete counting value at stop 1: Delete counting value at start

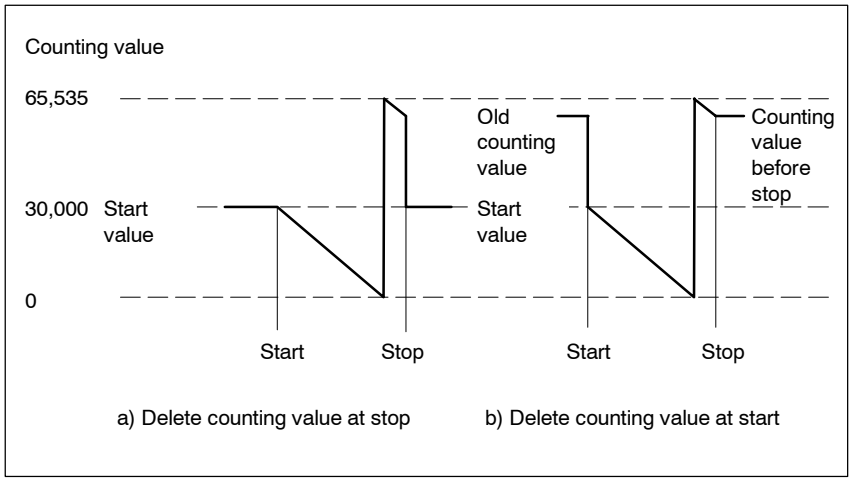


Figure 5-5 Current counting value after a counter has stopped (counting down)

Switching reaction of the digital outputs

You can choose between automatic operation and CPU control to control the digital outputs.

DO mode

Automatic: When a counter starts, the related output is switched on.
When the comparison value is reached, the related output is switched off.
While counting is running, a switched on output can be reset by the user program.

CPU control: The user program specifies the status of the outputs.
The status is not linked to the counting procedure (e.g., for adjustment mode).

DO mode can be specified for specific channels.

Table 5-5 DO mode

Variable: DO_Mode	Parameter Block	Offset	Data Type	Value Range
DO_Mode_Chan_1	2	6.0	Bool	0: Automatic 1: CPU control
DO_Mode_Chan_2	2	6.1	Bool	
DO_Mode_Chan_3	2	6.2	Bool	
DO_Mode_Chan_4	2	6.3	Bool	
DO_Mode_Chan_5	2	6.4	Bool	
DO_Mode_Chan_6	2	6.5	Bool	
DO_Mode_Chan_7	2	6.6	Bool	
DO_Mode_Chan_8	2	6.7	Bool	

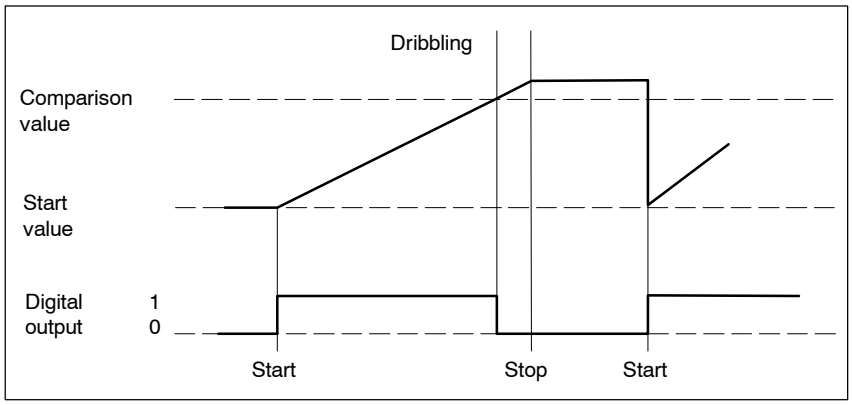


Figure 5-6 Switching of the digital outputs during automatic mode (counting up)

Hardware interrupts

You can use the ″interrupt generation″ variable to specify whether a hardware interrupt is to be triggered by the CM35 when the comparison value is reached. You can use the hardware interrupt OB to evaluate which channel has reached the comparison value.

After a counter starts, **only one** hardware interrupt is triggered even when the comparison value is reached a second time.

Parameterization applies to all channels.

Table 5-6 Interrupt generation

Variable	Parameter Block	Offset	Data Type	Value Range
Interrupt_ Generation	2	7.6	Bool	0: No hardware interrupts 1: Hardware interrupts enabled

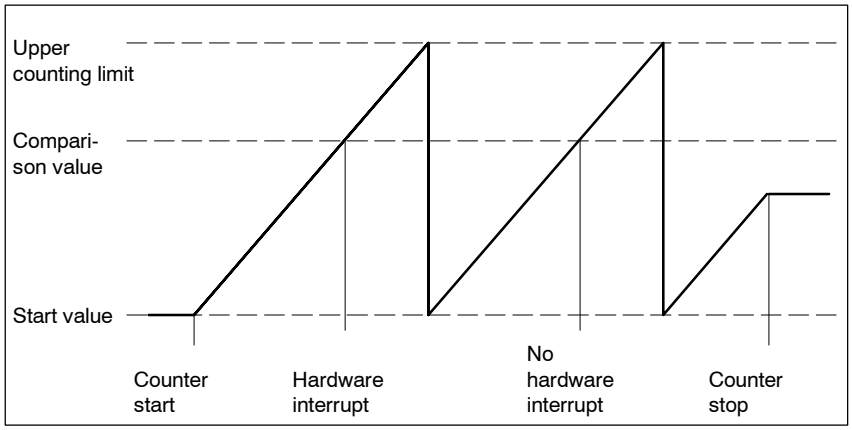


Figure 5-7 Hardware interrupt generation (counting up)

Scanning rate

You can use the scanning rate factor to specify that the counting value does not change until the stated number of encoder pulses has occurred.
This increases the counting range of the encoder pulses by a multiple of the scanning rate factor.

Evaluation of the channel-specific scanning rate factors must be enabled with the ″scanning rate″ group bit.

When a counting procedure starts, the scanning rate factor is always started again. The remaining pulses are not carried over from the previous counting procedure.

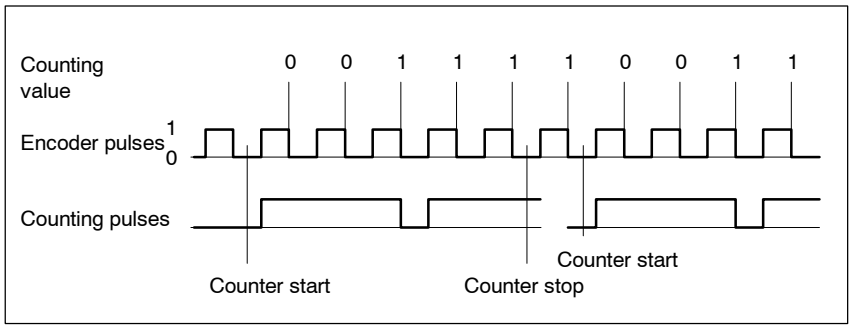


Figure 5-8 Generation of the counting value with a scanning rate factor of 3 (counting up)

Enabling of a scanning rate factor applies to all channels.

Table 5-7 Scanning rate

Variable	Parameter Block	Offset	Data Type	Value Range
Scanning Rate	2	7.7	Bool	0: Scanning rate not enabled 1: Scanning rate enabled

The scanning rate factor can be specified for each channel.
If you specify ″0″ or ″1,″ the channel does not use the scanning rate.

Table 5-8 Scanning rate factor

Variable: Scanning Rate Factor	Parameter Block	Offset	Data Type	Value Range
ScanRate_F_Chan_1	2	8.0	Byte	0 to 255
ScanRate_F_Chan_2	2	9.0	Byte	
ScanRate_F_Chan_3	2	10.0	Byte	
ScanRate_F_Chan_4	2	11.0	Byte	
ScanRate_F_Chan_5	2	12.0	Byte	
ScanRate_F_Chan_6	2	13.0	Byte	
ScanRate_F_Chan_7	3	2.0	Byte	
ScanRate_F_Chan_8	3	3.0	Byte	

5.2.2 Structure of the Parameter Blocks

Tables 5-9, 5-10 and 5-11 show the data structures of the three parameter blocks as they must be transferred with SFC55 calls to the CM35.

The first word of the parameter blocks contains the control word. The required assignment is entered as the initial value in the structures.

For transmission of the data, see chapter 4.2.

Parameter block 1 contains:

- The comparison or start values for channels 1 to 6

Table 5-9 Parameter block 1

Address	Name	Type	Initial Value	Commentary
	Para_Block_1_Data	STRUCT		
+0.0	Control_word	WORD	W#16#11	Parameter block no. 1/counter mode
+2.0	Cmp_Start_Value_Chan_1	WORD	W#16#00	Comparison value/start value, channel 1
+4.0	Cmp_Start_Value_Chan_2	WORD	W#16#00	Comparison value/start value, channel 2
+6.0	Cmp_Start_Value_Chan_3	WORD	W#16#00	Comparison value/start value, channel 3
+8.0	Cmp_Start_Value_Chan_4	WORD	W#16#00	Comparison value/start value, channel 4
+10.0	Cmp_Start_Value_Chan_5	WORD	W#16#00	Comparison value/start value, channel 5
+12.0	Cmp_Start_Value_Chan_6	WORD	W#16#00	Comparison value/start value, channel 6
=14.0		END_STRUCT		

Parameter block 2 contains:

- The comparison or start values for channels 7 and 8
- The bit-coded settings
  - For the switching reaction of the outputs
  - For the direction of counting
  - For the counting value after counter stop
  - For interrupt generation
  - For selection of scanning rate
- The scanning rate factors for channels 1 to 6

Table 5-10 Parameter block 2

Address	Name	Type	Initial Value	Commentary
	Para_Block_2_Data	STRUCT		
+0.0	Control_word	WORD	W#16#21	Parameter block no. 2/counter mode
+2.0	Cmp_Start_Value_Chan_7	WORD	W#16#00	Comparison value/start value, channel 7
+4.0	Cmp_Start_Value_Chan_8	WORD	W#16#00	Comparison value/start value, channel 8
+6.0	DO_Mode_Chan_1	BOOL	FALSE	DO mode: 0 = Automatic 1 = CPU control
+6.1	DO_Mode_Chan_2	BOOL	FALSE	
+6.2	DO_Mode_Chan_3	BOOL	FALSE	
+6.3	DO_Mode_Chan_4	BOOL	FALSE	
+6.4	DO_Mode_Chan_5	BOOL	FALSE	
+6.5	DO_Mode_Chan_6	BOOL	FALSE	
+6.6	DO_Mode_Chan_7	BOOL	FALSE	
+6.7	DO_Mode_Chan_8	BOOL	FALSE	
+7.0	C_Direction	BOOL	FALSE	Counting direction: 0 = Up 1 = Down
+7.1	Enable_Mode	BOOL	FALSE	Enable mode: (only applicable to ″automatic″ DO mode) 0 = Continuous enable 1 = Enable control by DO byte
+7.2	Reserve_1	BOOL	FALSE	Reserved
+7.3	Reserve_2	BOOL	FALSE	
+7.4	Reserve_3	BOOL	FALSE	
+7.5	Delete_CountVal	BOOL	TRUE	Delete counting value: 0 = At stop 1 = At start
+7.6	Interrupt_Generation	BOOL	FALSE	Interrupt generation: 0 = none, 1 = active
+7.7	ScanningRate	BOOL	FALSE	Scanning rate: 0 = no, 1 = yes
+8.0	ScanRate_F_Chan_1	BYTE	B#16#0	Encoder Scanning rate, channel 1
+9.0	ScanRate_F_Chan_2	BYTE	B#16#0	Encoder Scanning rate, channel 2
+10.0	ScanRate_F_Chan_3	BYTE	B#16#0	Encoder Scanning rate, channel 3
+11.0	ScanRate_F_Chan_4	BYTE	B#16#0	Encoder Scanning rate, channel 4
+12.0	ScanRate_F_Chan_5	BYTE	B#16#0	Encoder Scanning rate, channel 5
+13.0	ScanRate_F_Chan_6	BYTE	B#16#0	Encoder Scanning rate, channel 6
=14.0		END_STRUCT		

Parameter block 3 contains:

- The scanning rate factors for channels 7 and 8

Table 5-11 Parameter block 3

Address	Name	Type	Initial Value	Commentary
	Para_Block_3_Data	STRUCT		
+0.0	Control_word	WORD	W#16#31	Parameter block no. 3/ counter mode
+2.0	ScanRate_F_Chan_7	BYTE	B#16#0	Encoder scanning rate, channel 7
+3.0	ScanRate_F_Chan_8	BYTE	B#16#0	Encoder scanning rate, channel 8
+4.0	Res_4	ARRAY [0..9]	B#16#0	In reserve
*1.0		BYTE		
=14.0		END_STRUCT		

5.3 Starting and Stopping the Counting Channels

After the module has been parameterized, you can start and stop the individual counting channels of the CM35. To do this, write the start/stop block to the address ″module start address + 2.″

Table 5-12 shows the contents of the start/stop block. The required assignment of the coordination byte is entered as the initial value in the structure. For a description of the bit assignment of the coordination byte, see chapter 4.3.1.

Write-accesses to the start/stop block must be programmed as word-accesses.

Table 5-12 Start/stop block

Address	Name	Type	Initial Value	Commentary
	Start_Stop_Block	STRUCT		
+0.0	Start_Stop_Chan_1	BOOL	FALSE	0: Stop channel 1: Start channel
+0.1	Start_Stop_Chan_2	BOOL	FALSE	
+0.2	Start_Stop_Chan_3	BOOL	FALSE	
+0.3	Start_Stop_Chan_4	BOOL	FALSE	
+0.4	Start_Stop_Chan_5	BOOL	FALSE	
+0.5	Start_Stop_Chan_6	BOOL	FALSE	
+0.6	Start_Stop_Chan_7	BOOL	FALSE	
+0.7	Start_Stop_Chan_8	BOOL	FALSE	
+1.0	CoordinationByte	BYTE	B#16#81	Start/stop byte enable = 1 C bit = 0/counter mode
=2.0		END_STRUCT		

Example: The CM35 has module start address 256.

```
L    W#16#FF81      // Start all channels
T    PQW 258        // Module start address + 2
...
...
L    W#16#0081      // Stop all channels
T    PQW 258        // Module start address + 2
```

In DO mode ″automatic,″ the related output is switched on when a channel starts. The output is switched off with stop even when the comparison value has not yet been reached.

5.4 Controlling the Digital Outputs

You can control the digital outputs of the CM35 as shown below, based on the parameterization of DO mode.

DO mode:

Automatic: Note:
A parameterization bit can be used to specify whether the DO byte is to control the enable or whether the enable is continuous.

Enable mode = ″Enable control via DO byte″
The DO byte is used to enable the output for control via the counter status.

0: Output disabled
- The output is not switched on with the start of counting.
- A switched on output is forcibly switched off.

1: Output enabled
- The output is switched on at start of counting.
- The output is switched off when the comparison value is reached or counting is stopped.

Enable mode = ″continuous enable″
Control via the counter status is continuously enabled for the outputs. A switched on output can be forcibly switched off with the DO byte.
0: A switched on output is forcibly switched off.
(The forced switch-off only affects the current counting procedure.)
1: No effect

CPU control: You specify the state of the output with the DO byte.
0: Switch off output
1: Switch on output

Write the DO byte to the address ″module start address + 0.″

Note

Control of the digital outputs must be programmed with a word access.

Table 5-13 shows the assignment of the bits of the DO byte to the counting channels.

Table 5-13 Assignment of the DO byte

Address	Name	Type	Initial Value	Commentary
	DO_Block	STRUCT		
+0.0	Digital_Output_Chan_1	BOOL	FALSE	**DO mode "CPU control":** 0: Digital output off 1: Digital output on **DO mode "automatic":** 0: Digital output off 1: Digital output enabled Note: You can use a parameterization bit to specify whether enabling is to be controlled with the DO byte or whether continuous enable is to be used.
+0.1	Digital_Output_Chan_2	BOOL	FALSE	
+0.2	Digital_Output_Chan_3	BOOL	FALSE	
+0.3	Digital_Output_Chan_4	BOOL	FALSE	
+0.4	Digital_Output_Chan_5	BOOL	FALSE	
+0.5	Digital_Output_Chan_6	BOOL	FALSE	
+0.6	Digital_Output_Chan_7	BOOL	FALSE	
+0.7	Digital_Output_Chan_8	BOOL	FALSE	
+1.0	Res_1	BYTE	B#16#0	In reserve
=2.0		END_STRUCT		

Example (S7): Set outputs 1 and 5
- Parameterize DO mode with CPU control
- The CM35 has the module start address 256.

```
L   2#0001_0001_0000_0000 // Load DO byte to set outputs
                             1 and 5
T   PQW 256               // Module start address = 256
```

5.5 Hardware Interrupt Evaluation

When in ″pulse counter″ mode, the CM35 can trigger a hardware interrupt when a comparison value is reached. If this is used, the CPU **must** contain a hardware interrupt OB (OB 40).

The start information of OB 40 contains the following information.

- The variable OB40_MDL_ADDR contains the base address of the module which triggered the interrupt.
- The variable OB40_POINT_ADDR contains information on the event which caused the interrupt.

The variable OB40_POINT_ADDR consists of four bytes. The hardware interrupt information of the CM35 in ″pulse counter″ mode is entered in the low byte (local byte 11 of OB 40).

By evaluating local byte 11, you can determine which channel triggered the interrupt. Remember that more than one bit can be set.

Table 5-14 Assignment of the hardware interrupt information (OB 40/local byte 11)

Local Byte	Bit	Meaning	Value Range
11	0	Counter 1 has reached comparison value.	0/1
	1	Counter 2 has reached comparison value.	
	2	Counter 3 has reached comparison value.	
	3	Counter 4 has reached comparison value.	
	4	Counter 5 has reached comparison value.	
	5	Counter 6 has reached comparison value.	
	6	Counter 7 has reached comparison value.	
	7	Counter 8 has reached comparison value.	

5.6 Reading the Counting Values

In ″pulse counter″ mode, you can read the current counting values from the CM35.

To ensure data consistency, the read-access must be performed with **one** load command (L PIW).

Table 5-15 shows the addresses of the individual channels for reading the counting value.

Table 5-15 Assignment of the output area for reading the counting values

Offset to the Module Start Address	Meaning	Value Range
+0	Counting value, channel 1	0 to 65535
+2	Counting value, channel 2	
+4	Counting value, channel 3	
+6	Counting value, channel 4	
+8	Counting value, channel 5	
+10	Counting value, channel 6	
+12	Counting value, channel 7	
+14	Counting value, channel 8	

Example: ″Pulse counter″ mode
- Read counting value of counting channel 4
- The CM35 has the module start address 256.

```
L   PIW 262    // Address = 256 + 6, counting value of
                  channel 4
T   MW16       // Save the counting value
```

Period Duration Measurement Operating Mode

6

6.1 Function Description

In this operating mode, the CM35 uses period duration measurement to acquire small frequencies.

The CM35 measures the exact time between two falling edges of the counting signal by counting the pulses of an internal precision-quartz reference frequency. The period duration of the input signal is calculated from the counting value after a period, divided by the reference frequency (in kHz).

Example:

- Counting value = 100
- Reference frequency = 100 kHz (standard value)

$$\frac{100}{100\ \text{kHz}} = 1\ \text{msec}\ (\widehat{=}1\ \text{kHz})$$

⇒ Period duration = 1 msec or frequency = 1 kHz

Measuring range

At a measuring value width of 16 bits and a reference frequency of 100 kHz, period duration measurements between 655 msec (counting value 65500) and 1 msec (counting value 100) can be performed with a resolution of 1% without switching the range.

Note

The resolution depends on the lower counting value (i.e., the minimum period duration).

The reference frequency can be adjusted for measurement of longer period durations. The following table shows the reference frequencies and the resulting measuring range.

Table 6-1 Measuring ranges

Counting Range	Lower Counting Value	Upper Counting Value	Reference Frequency	Measuring Range
16 bits	100	65500	100 kHz	655 msec to 1 msec (1.53 Hz to 1 kHz)
			50 kHz	1,310 msec to 2 msec (0.76 Hz to 500 Hz)
			25 kHz	2,620 msec to 4 msec (0.38 Hz to 250 Hz)

Period number

To eliminate inaccurate measurements, you can also perform the measurement over several periods of the input signal (1 to 40).

An average value can be calculated at the end of the measuring interval.

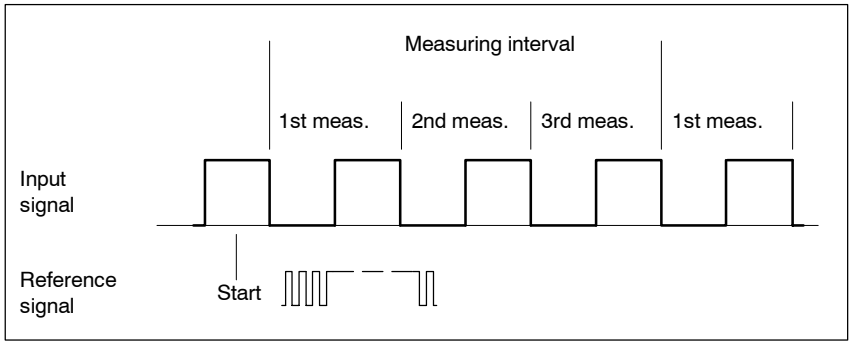


Figure 6-1 Principle of period duration measurement over 3 periods of the input signal

Starting and stopping measurement

The user program starts the individual channels. After a channel is started, the period duration is acquired based on the parameterization. The channel must be stopped before a new measurement can be made.

6.2 Parameterization

This chapter shows you available parameterizations in ″period duration measurement″ mode which you can use to adjust the reaction of the measuring channels to your task.

The parameter data are located in a parameter block. For the structure of the parameter block, see chapter 6.2.2. The description of the individual parameter data includes the number of the parameter block and the offset in the structure.

You must transfer parameter block 1 to the CM35 before you can use ″period duration measurement″ mode.

Note

The channel **must** be stopped before it can be reparameterized.

You must stop the channel before you can change the channel-specific parameters.

The new parameters take effect the next time the channel is started.

For a description of the general layout and the transmission of the parameter block, see chapter 4.2.

6.2.1 Description of the Parameter Data

Period number

When you specify the number of periods, you determine the number of periods of the input signal during which the measurement is to be performed.

You can specify the number of periods for each channel separately.

Table 6-2 Setting of the number of periods

Variable: Number of Periods	Parameter Block	Offset	Data Type	Value Range
PeriodNumber_Chan_1	1	2.0	Byte	1 to 40
PeriodNumber_Chan_2	1	3.0	Byte	
PeriodNumber_Chan_3	1	4.0	Byte	
PeriodNumber_Chan_4	1	5.0	Byte	
PeriodNumber_Chan_5	1	6.0	Byte	
PeriodNumber_Chan_6	1	7.0	Byte	
PeriodNumber_Chan_7	1	8.0	Byte	
PeriodNumber_Chan_8	1	9.0	Byte	

Measuring range

By selecting the measuring range, you can also increase the period duration which is measured.

The parameterized measuring range applies to all channels.

Table 6-3 Setting the reference frequency

Variable: Measuring Range	Parameter Block	Offset	Data Type	Value Range
F_RefFrequency	1	10.0	Byte	0h: 100 kHz (standard) (655 msec to 1 msec) 77h: 50 kHz (1310 msec to 2 msec) EFh: 25 kHz (2620 msec to 4 msec)

Note

A change in the F_RefFrequency parameter only takes effect with the first parameter transfer after a warm restart (power on).

6.2.2 Structure of the Parameter Block

Table 6-4 shows the data structure of the parameter block and how to transfer it to the CM35 using SFC 55 calls or I/O direct accesses.

The first word of the parameter block contains the control word. The structure shows the required assignment as an initial value.

When I/O direct accesses are parameterized (only possible with the SIMATIC S5), the acceptance structure must be transferred after the data structure. See table 6-5. The table shows the required assignment of the acceptance structure as an initial value.

Adhere to the specifications in chapter 4.2 which apply to transmission of the data.

Parameter block 1 contains the following information.

- The period numbers for channels 1 to 8
- The factor for reference frequency (measuring range)

Table 6-4 Parameter block 1, data structure

Address	Name	Type	Initial Value	Commentary
	Para_Block_1_Data	STRUCT		
+0.0	Control_word	WORD	W#16#12	Parameter block no. 1/ ″period duration measurement″ mode
+2.0	PeriodNumber_Chan_1	BYTE	B#16#1	Period number, channel 1
+3.0	PeriodNumber_Chan_2	BYTE	B#16#1	Period number, channel 2
+4.0	PeriodNumber_Chan_3	BYTE	B#16#1	Period number, channel 3
+5.0	PeriodNumber_Chan_4	BYTE	B#16#1	Period number, channel 4
+6.0	PeriodNumber_Chan_5	BYTE	B#16#1	Period number, channel 5
+7.0	PeriodNumber_Chan_6	BYTE	B#16#1	Period number, channel 6
+8.0	PeriodNumber_Chan_7	BYTE	B#16#1	Period number, channel 7
+9.0	PeriodNumber_Chan_8	BYTE	B#16#1	Period number, channel 8
+10.0	F_RefFrequency	BYTE	B#16#0	Factor for reference frequency
+ 12.0	Res_12	WORD	W#16#0	In reserve
= 14.0		END_STRUCT		

Table 6-5 Parameter block 1, acceptance structure (only with SIMATIC S5)

Address	Name	Type	Initial Value	Commentary
	Para_Block_1_Accept	STRUCT		
+0.0	Control_word	WORD	W#16#52	Consistency bit = 1/ parameter block no. 1/ ″period duration measurement″ mode
=2.0		END_STRUCT		

6.3 Starting and Stopping the Measuring Channels

After parameterizing the module, you can start and stop the individual measuring channels of the CM35. To do this, write the start/stop block to address ″module start address + 2.″

Table 6-6 shows the contents of the start/stop block. The required assignment of the coordination byte is entered as an initial value in the structure. For a description of the bit assignment of the coordination byte, see chapter 4.3.1.

Table 6-6 Start/stop block

Address	Name	Type	Initial Value	Commentary
	Start_Stop_Block	STRUCT		
+0.0	Start_Stop_Chan_1	BOOL	FALSE	0: Stop channel 1: Start channel
+0.1	Start_Stop_Chan_2	BOOL	FALSE	
+0.2	Start_Stop_Chan_3	BOOL	FALSE	
+0.3	Start_Stop_Chan_4	BOOL	FALSE	
+0.4	Start_Stop_Chan_5	BOOL	FALSE	
+0.5	Start_Stop_Chan_6	BOOL	FALSE	
+0.6	Start_Stop_Chan_7	BOOL	FALSE	
+0.7	Start_Stop_Chan_8	BOOL	FALSE	
+1.0	CoordinationByte	BYTE	B#16#82	Start/stop byte enable = 1 C bit = 0 ″Period duration measurement″ mode
=2.0		END_STRUCT		

Example: The CM35 has the module start address 256.

```
L    W#16#0382      // Start channels 1 and 2
T    PQW 258        // Module start address + 2
 to
...
L    W#16#0182      // Stop channel 2/
                       channel 1 still active
T    PQW 258        // Module start address + 2
```

6.4 Controlling the Digital Outputs

Since no function is assigned to the digital outputs in ″period duration measurement″ mode, they can be used as desired.

The DO byte is used to specify the state of the digital outputs.

0: Switch off output
1: Switch on output

The module firmware switches off the outputs during the transition of the CPU to the STOP state (BASF/OD signal).

Write the DO byte to address ″module start address + 0.″

Table 6-7 shows the assignment of the bits of the DO byte to the measuring channels.

Note

Control of the digital outputs must be programmed with a word access.

Table 6-7 Assignment of the DO byte

Address	Name	Type	Initial Value	Commentary
	DO_Block	STRUCT		
+0.0	Digital_Output_Chan_1	BOOL	FALSE	0: Digital output off 1: Digital output on
+0.1	Digital_Output_Chan_2	BOOL	FALSE	
+0.2	Digital_Output_Chan_3	BOOL	FALSE	
+0.3	Digital_Output_Chan_4	BOOL	FALSE	
+0.4	Digital_Output_Chan_5	BOOL	FALSE	
+0.5	Digital_Output_Chan_6	BOOL	FALSE	
+0.6	Digital_Output_Chan_7	BOOL	FALSE	
+0.7	Digital_Output_Chan_8	BOOL	FALSE	
+ 1.0	Res_1	BYTE	B#16#0	In reserve
= 2.0		END_STRUCT		

Example (S7): Set outputs 1, 3 and 5
- The CM35 has the module start address 256.

```
L   2#0001_0101_0000_0000   // Load DO byte to set outputs
                               1, 3 and 5
T   PQW 256                 // Module start address = 256
```

6.5 Hardware Interrupt Evaluation

Hardware interrupts are not generated in ″period duration measurement″ mode.

6.6 Reading the Measured Values

You can read the current measuring values of the CM35 in ″period duration measurement″ mode.

To ensure data consistency, the read access must be performed with **one** load command (L PIW).

When an overflow occurs, the hex value FFFDH (65533) is transferred (frequency below the minimum frequency, encoder interrupted, and so on).

Measuring channels which have not yet been started are transferred with the value 0000H regardless of whether or not pulses are present on the input.

Table 6-8 shows the addresses of the individual channels for reading the measured value.

Table 6-8 Assignment of the output area for reading the measured values

Offset to the Module Start Address	Meaning	Value Range
+0	Period duration average value, chan. 1	0 to 65532
+2	Period duration average value, chan. 2	
+4	Period duration average value, chan. 3	
+6	Period duration average value, chan. 4	
+8	Period duration average value, chan. 5	
+10	Period duration average value, chan. 6	
+12	Period duration average value, chan. 7	
+14	Period duration average value, chan. 8	

Example: ″Period duration measurement″ mode
- Read the measured value of channel 2
- The CM35 has the module start address 256.

```
L    PIW 258    // Address = 256 + 2, measured value
                   channel 2
T    MW16       // Save the counting value
```

7 Timer Operating Mode

7.1 Function Description

Timer mode can be used to implement precisely defined switch-on times for the 8 digital outputs of the counter module.

Switch-on times

Times from 10 milliseconds to 278 minutes can be specified seperately for the switch-on times.

Start and stop timers

The timers are started by the user program, thus setting the related digital outputs.

If no parameter values for time base and factor are available when a timer is started, these values are processed with 1 as the default value.

The related digital output is switched off after the parameterized time expires.
A started timer can be terminated by transferring the control word with a ″0″ for the applicable channel in the start/stop byte. This resets the digital output and the internal counter.

The end of the switch-on time is indicated by a hardware interrupt. This can be acquired by the user program to trigger additional processing (e.g., to position the next container in proportioning systems/filling systems).

A timer must be stopped before the user program can execute a new start. This can be done after the ″timer expired″ hardware interrupt or after a time calculated by the user program which is with certainty longer than the run time of the timer.

Controlling the outputs

The digital outputs of the timer can also be controlled by writing the DO byte (e.g., for continuous switch-on during washing procedures). The user program must ensure that the timer channels cannot be manipulated (see chapter 7.4).

Monitoring the outputs

The module can monitor the switching status of its outputs. To do this, the digital outputs must be wired to the digital inputs. The firmware cyclically compares the status of the digital outputs with the status of the digital inputs and generates a hardware interrupt when required by the parameterization (e.g., timer failure). The interrupt can be output as a group interrupt or as a selective interrupt (i.e., channel-specific).

7.2 Parameterization

This chapter describes possible parameterization in timer mode which you can use to adapt timer reactions to your task.

The parameter data are divided into three parameter blocks. For the structure of the parameter blocks, see chapter 7.2.2. The descriptions of the individual parameter data include the number of the parameter block and the offset in the related structure.

To be able to utilize ″timer″ operating mode, you must transfer parameter blocks 1, 2 and 3 to the CM35.

Note

The timer **must** be stopped before it can be reparameterized.

- When you want to change timer-specific parameters, you must stop the applicable timer.
- When you want to change timer-overlapping parameters, you must stop all timers.

The new parameter data take effect when the timer is started again.

For a description of the general layout and transfer of the parameter blocks, see chapter 4.2.

7.2.1 Description of the Parameter Data

Time base/ factor

When you specify time base and factor, you determine how long a timer is switched on. The length of time the timer is switched on is the product of time base and factor. Table 7-1 contains sample timer values.

Table 7-1 Examples of timer values

Time Base (msec)	Factor	Switch-On Duration	
1	1	1 msec	
1	65,535	65.535 sec	(1.092 min)
:			
100	1	100 msec	(1.667 min)
100	65,535	6,553.5 sec	(109.225 min)
:			
255	1	255 msec	(4.25 min)
255	65,535	16,711.425 sec	(278.542 min)

The default value for time base and factor is 1.

Note

The minimum switch-on duration is 10 msec.

The time base can be specified for a specific timer.

Table 7-2 Setting the time base

Variable: Time Base	Parameter Block	Offset	Data Type	Value Range
Timebase_Timer_1	1	2.0	Byte	1 to 255
Timebase_Timer_2	1	3.0	Byte	
Timebase_Timer_3	1	4.0	Byte	
Timebase_Timer_4	1	5.0	Byte	
Timebase_Timer_5	1	6.0	Byte	
Timebase_Timer_6	1	7.0	Byte	
Timebase_Timer_7	1	8.0	Byte	
Timebase_Timer_8	1	9.0	Byte	

The factor can be specified for a specific timer.

Table 7-3 Setting of the timer factor

Variable: Factor	Parameter Block	Offset	Data Type	Value Range
Factor_Timer_1	1	10.0	Word	1 to 65565
Factor_Timer_2	1	12.0	Word	
Factor_Timer_3	2	2.0	Word	
Factor_Timer_4	2	4.0	Word	
Factor_Timer_5	2	6.0	Word	
Factor_Timer_6	2	8.0	Word	
Factor_Timer_7	2	10.0	Word	
Factor_Timer_8	2	12.0	Word	

Interrupt generation

Here you can specify the events for which an interrupt is to be generated. You can evaluate the interrupt in the hardware interrupt OB.

Possible interrupt events are listed below.

- Timer expired
- Timer failure

The following can be selected for the interrupt.

- No interrupt
- Group interrupt
- Selective interrupt

A selective interrupt permits you to evaluate which timer triggered the interrupt.

Parameterization applies to all timers.

Table 7-4 Parameterization of the timer

Variable: Interrupt Generation	Parameter Block	Offset	Data Type	Value Range	
Timer_Expired	3	2.0	Bool	2#xxxx_xx00:	No interrupt
		2.1	Bool	2#xxxx_xx01:	Group interrupt
				2#xxxx_xx10:	Selective interrupt
Timer_Failure	3	2.4	Bool	2#xx00_xxxx:	No interrupt
		2.5	Bool	2#xx01_xxxx:	Group interrupt
				2#xx10_xxxx:	Selective interrupt

7.2.2 Structure of the Parameter Blocks

Tables 7-5, 7-7 and 7-9 show the data structures of the three parameter blocks and how they must be transferred to the CM35 with SFC 55 calls or I/O direct accesses.

The first word of the parameter blocks contains the control word. The required assignment is entered as an initial value in the structures.

When I/O direct accesses are parameterized (only with SIMATIC S5), the acceptance structures must be transferred after the data structures. See tables 7-6, 7-8 and 7-10. The required assignment of the acceptance structures is entered as an initial value.

Adhere to the information in chapter 4.2 concerning transmission of the data.

Parameter block 1 contains:

- The time base for timers 1 to 8
- The factor for timers 1 and 2

Table 7-5 Parameter block 1, data structure

Address	Name	Type	Initial Value	Commentary
	Para_Block_1_Data	STRUCT		
+0.0	Control_word	WORD	W#16#13	Parameter block no. 1/ timer mode
+2.0	Timebase_Timer_1	BYTE	B#16#0A	Time base for timer 1
+3.0	Timebase_Timer_2	BYTE	B#16#0A	Time base for timer 2
+4.0	Timebase_Timer_3	BYTE	B#16#0A	Time base for timer 3
+5.0	Timebase_Timer_4	BYTE	B#16#0A	Time base for timer 4
+6.0	Timebase_Timer_5	BYTE	B#16#0A	Time base for timer 5
+7.0	Timebase_Timer_6	BYTE	B#16#0A	Time base for timer 6
+8.0	Timebase_Timer_7	BYTE	B#16#0A	Time base for timer 7
+9.0	Timebase_Timer_8	BYTE	B#16#0A	Time base for timer 8
+10.0	Factor_Timer_1	WORD	W#16#01	Factor for timer 1
+12.0	Factor_Timer_2	WORD	W#16#01	Factor for timer 2
=14.0		END_STRUCT		

Table 7-6 Parameter block 1, acceptance structure (only for SIMATIC S5)

Address	Name	Type	Initial Value	Commentary
	Para_Block_1_Accept	STRUCT		
+0.0	Control_word	WORD	W#16#53	Consistency bit = 1 / parameter block no. 1/ timer mode
=2.0		END_STRUCT		

Parameter block 2 contains:

- The factor for timers 3 to 8

Table 7-7 Parameter block 2, data structure

Address	Name	Type	Initial Value	Commentary
	Para_Block_2_Data	STRUCT		
+0.0	Control_word	WORD	W#16#23	Parameter block no. 2 / timer mode
+2.0	Factor_Timer_3	WORD	W#16#01	Factor for timer 3
+4.0	Factor_Timer_4	WORD	W#16#01	Factor for timer 4
+6.0	Factor_Timer_5	WORD	W#16#01	Factor for timer 5
+8.0	Factor_Timer_6	WORD	W#16#01	Factor for timer 6
+10.0	Factor_Timer_7	WORD	W#16#01	Factor for timer 7
+12.0	Factor_Timer_8	WORD	W#16#01	Factor for timer 8
=14.0		END_STRUCT		

Table 7-8 Parameter block 2, acceptance structure (only with SIMATIC S5)

Address	Name	Type	Initial Value	Commentary
	Para_Block_2_Accept	STRUCT		
+0.0	Control_word	WORD	W#16#63	Consistency bit = 1 / parameter block no. 2 / timer mode
=2.0		END_STRUCT		

Parameter block 3 contains:

- The settings for interrupt generation

Table 7-9 Parameter block 3, data structure

Address	Name	Type	Initial Value	Commentary
	Para_Block_3_Data	STRUCT		
+0.0	Control_word	WORD	W#16#33	Parameter block no. 3 / timer mode
+2.0	Interrupt_Generation	BYTE	B#16#0	Interrupt mode for ″timer expired″ and ″timer failure″
+3.0	Res_3	ARRAY [0..10]	B#16#0	In reserve
*1.0		BYTE		
=14.0		END_STRUCT		

Table 7-10 Parameter block 3, acceptance structure (only with SIMATIC S5)

Address	Name	Type	Initial Value	Commentary
	Para_Block_3_Accept	STRUCT		
+0.0	Control_word	WORD	W#16#73	Consistency bit = 1 / parameter block no. 3 / timer mode
=2.0		END_STRUCT		

7.3 Starting and Stopping the Timers

After parameterizing the module, you can start and stop the individual timers of the CM35. To do this, write the start/stop block to the address ″module start address + 2.″

Note

The timer must be stopped with a stop command before it can be started again.

Table 7-11 shows the contents of the start/stop block. The required assignment of the coordination byte is entered as an initial value in the structure. For a description of the bit assignment of the coordination byte, see chapter 4.3.1.

Write-access to the start/stop block **must** be programmed as a word-access.

Table 7-11 Start/stop block

Address	Name	Type	Initial Value	Commentary
	Start_Stop_Block	STRUCT		
+0.0	Start_Stop_Timer_1	BOOL	FALSE	0: Stop timer 1: Start timer
+0.1	Start_Stop_Timer_2	BOOL	FALSE	
+0.2	Start_Stop_Timer_3	BOOL	FALSE	
+0.3	Start_Stop_Timer_4	BOOL	FALSE	
+0.4	Start_Stop_Timer_5	BOOL	FALSE	
+0.5	Start_Stop_Timer_6	BOOL	FALSE	
+0.6	Start_Stop_Timer_7	BOOL	FALSE	
+0.7	Start_Stop_Timer_8	BOOL	FALSE	
+1.0	CoordinationByte	BYTE	B#16#83	Start/stop byte enable = 1 Consistency bit = 0 / timer mode
=2.0		END_STRUCT		

Example: The CM35 has the module start address 256.

```
L   W#16#F083      // Start timers 5 to 8
T   PQW 258        // Module start address + 2
...
...
L   W#16#7083      // Stop timer 8
                      Timers 5 to 7 still active
T   PQW 258        // Module start address + 2
```

7.4 Controlling the Digital Outputs

The status of the digital outputs is specified with the DO byte.

0: Switch off output
1: Switch on output

Write the DO byte to the address ″module start address + 0.″

Table 7-12 shows the allocation of the bits of the DO byte to the channels.

Note

Control of the digital outputs must be programmed with a word access.

Table 7-12 Assignment of the DO byte

Address	Name	Type	Initial Value	Commentary
	DO_Block	STRUCT		
+0.0	Digital_Output_Chan_1	BOOL	FALSE	0: Digital output off 1: Digital output on
+0.1	Digital_Output_Chan_2	BOOL	FALSE	
+0.2	Digital_Output_Chan_3	BOOL	FALSE	
+0.3	Digital_Output_Chan_4	BOOL	FALSE	
+0.4	Digital_Output_Chan_5	BOOL	FALSE	
+0.5	Digital_Output_Chan_6	BOOL	FALSE	
+0.6	Digital_Output_Chan_7	BOOL	FALSE	
+0.7	Digital_Output_Chan_8	BOOL	FALSE	
+1.0	Res_1	BYTE	B#16#0	In reserve
=2.0		END_STRUCT		

Example (S7): Set outputs 1 and 2
- The CM35 has the module start address 256.

```
L   2#0000_0011_0000_0000   // Load DO byte to set
                               outputs 1 and 2
T   PQW 256                 // Mod. start addr. = 256
```

Note

When the digital outputs are controlled , the user program must ensure that active channels (timer running) are not affected.

To prevent a just expired timer from being turned on again accidentally (or a running timer from being turned off) by control of the outputs, the outputs should not be controlled unless all timers have expired or have been stopped.

To be noticed by the CM35, the status of the DO byte must have changed by at least one bit from its last status (see also page 4-22).

7.5 Hardware Interrupt Evaluation

When in timer mode, the CM35 can trigger a hardware interrupt for the following events.

- Timer expired
- Timer failure

The user must wire digital outputs 1 to 8 with digital inputs 1 to 8 (see chap. 7.1) so that the switching status of the output can be monitored with the related input. If the output setpoint state differs from the input actual state, the following occurs based on the parameterization.

- **No** interrupt triggered
- **Group** interrupt triggered → Failure of a timer
- **Selective** interrupt triggered → Timer failure

The CPU must have a hardware interrupt OB (OB 40) for the interrupt evaluation.

The start information of OB 40 contains the following.

- Variable OB40_MDL_ADDR contains the base address of the module which triggered the interrupt.
- Variable OB40_POINT_ADDR contains information on the event which triggered the interrupt.

Variable OB40_POINT_ADDR consists of four bytes. The hardware interrupt information of the CM35 in timer mode is stored in local byte 10 (timer failure) and local byte 11 (timer expired) of OB 40.

By evaluating local bytes 10 and 11, you can tell which timer triggered an interrupt. Remember that more than one bit can be set.

Note

When a failure occurs on one of the timers (e.g., wire break), this is reported once for the applicable channel with a hardware interrupt.

The reaction to the hardware interrupt (e.g., the malfunctioning timer channel is no longer addressed by the user program) is specified by the user program (OB 40 call). All other timer channels remain functional.

After the malfunction is corrected (e.g., wire break fixed), a STOP/RUN transition of the CPU must be executed. Another method is to call SFC 57 ″PARM_MOD.″ If error correction was successful, the malfunction is no longer reported after a STOP/RUN transition or an SFC 57 call. If the malfunction is still present, another hardware interrupt is triggered.

Table 7-13 Allocation of the hardware interrupt information (OB 40/local data bytes 10 and 11)

Local Byte	Bit	Meaning		Value Range
		Group Interrupt	**Selective Interrupt**	
10	0	Failure of a timer	Timer 1 failed	0/1
	1	Disregard	Timer 2 failed	
	2		Timer 3 failed	
	3		Timer 4 failed	
	4		Timer 5 failed	
	5		Timer 6 failed	
	6		Timer 7 failed	
	7		Timer 8 failed	
11	0	Timer expired	Timer 1 expired	0/1
	1	Disregard	Timer 2 expired	
	2		Timer 3 expired	
	3		Timer 4 expired	
	4		Timer 5 expired	
	5		Timer 6 expired	
	6		Timer 7 expired	
	7		Timer 8 expired	

7.6 Reading the Status

In timer mode, you can read the status of the timers from the CM35.

For example, the user program can use this to determine which timers have expired and start them again.

Table 7-14 shows the address for reading the status.

Table 7-14 Assignment of the output area for reading the status

Offset to the Module Start Address	Meaning	Value Range
+0	Bit 0: Status of timer 1	0: Timer is active. 1: Timer has expired and can be started again after a stop command.
	Bit 1: Status of timer 2	
	Bit 2: Status of timer 3	
	Bit 3: Status of timer 4	
	Bit 4: Status of timer 5	
	Bit 5: Status of timer 6	
	Bit 6: Status of timer 7	
	Bit 7: Status of timer 8	

Example (S7): Timer mode
- Read timer status
- The CM35 has the module start address 256.

```
L   PIW 256    // Address = 256, timer status
T   MW16       // Save status
```

8 Positioning Operating mode

8.1 Function Description

In this operating mode, the CM35 supports controlled positioning with a switch-off point.

An incremental encoder is connected to acquire the position. The encoder pulses are acquired by the module with the correct sign in the traversing range from –2,147,483,648 to +2,147,483,647.

Two digital outputs which are addressed by the CM35 based on direction are available for each of the four channels.

Traversing Range	Lower Limit of Traversing Range	Upper Limit of Traversing Range
32 bits	-2,147,483,648 increments	+2,147,483,647 increments

Note

When the position is no longer in the traversing range, the actual value jumps from positive to negative or from negative to positive. You must ensure that the traversing path is located within the traversing range limits.

Synchronization

To synchronize actual value acquisition, you can execute ″set actual value″ with the user program. Move the axis to a position whose coordinate is known. Transfer this coordinate to the module with ″set actual value.″ The specified value is accepted as the current actual value.

Note

The conversion of the incremental value to a length value and vice versa must be handled by the user program.

Switching the digital outputs (hardware interrupt)

The CM35 switches on the related direction output when a positioning procedure starts. When the setpoint position is reached, the module switches off the direction output again and triggers a hardware interrupt.

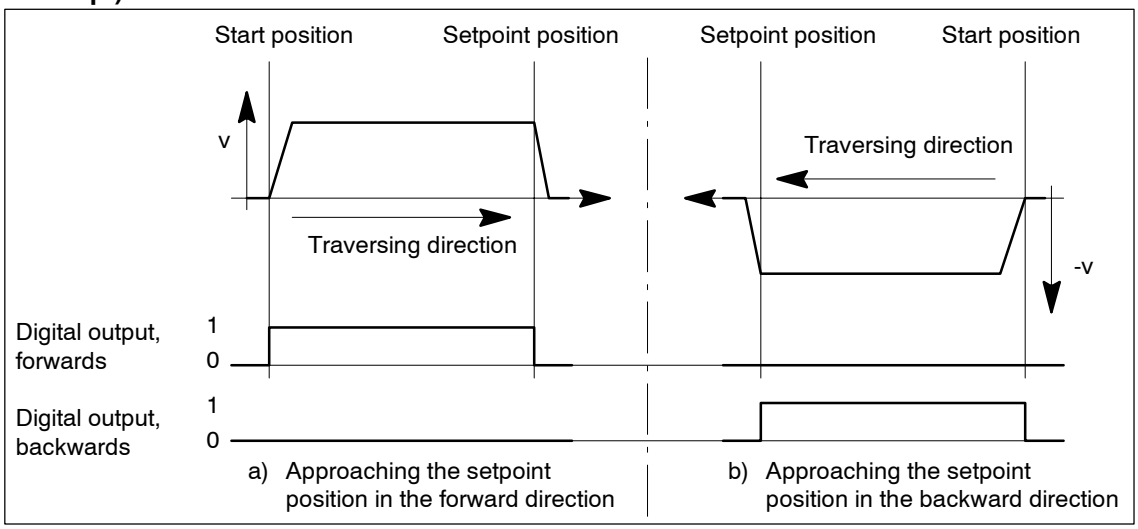


Figure 8-1 How the CM35 controls the direction of traversing

A positioning sequence

The positioning sequence is described below.

⇒ Parameterize encoder resolution.

⇒ Move axis to a position whose coordinate is known.

⇒ Set actual value.

⇒ Specify setpoint (in increments).

⇒ Start axis with START command.

⇐ Hardware interrupt indicates that setpoint position has been reached.

⇐ Axis is switched off.

⇒ STOP command concludes positioning of the axis.

⇒ Specify new setpoint.

⇒ Start axis with START command.

⇐ Hardware interrupt shows that setpoint position has been reached.

⇐ Axis is switched off.

⇒ STOP command concludes positioning of the axis.

.
.
.

Symbols: ⇒ : Transferred to CM35 module
⇐ : Executed by the CM35 module

Under normal conditions, one or more axes are stopped after the module has reported with a hardware interrupt that the destination (setpoint position) has been reached.

Note

An axis can always be stopped in an emergency by setting the control bit to stop.

Moving the axes via the CPU

To move the axes without positioning, the state of the digital outputs for forward and backward can be specified by the user program.

Evaluating the encoder pulses

Asymmetric incremental encoders with two tracks displaced by 90° can be connected to the CM35.

Direction evaluation

The CM35 determines the counting direction of the signal edges from the time sequence of the encoder signals.

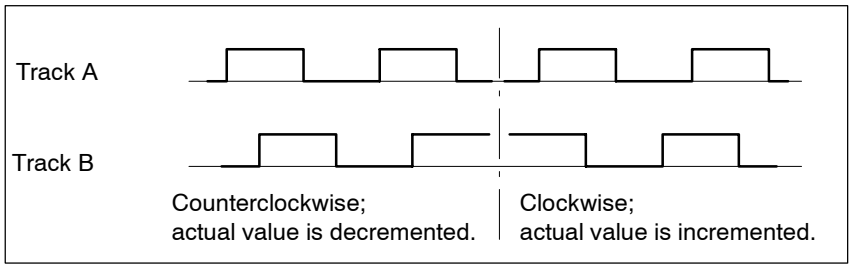


Figure 8-2 Direction evaluation

Note

The direction of rotation can be inverted with a parameter bit.

Edge evaluation

You can parameterize whether the encoder pulses are to be evaluated once, twice or four times.

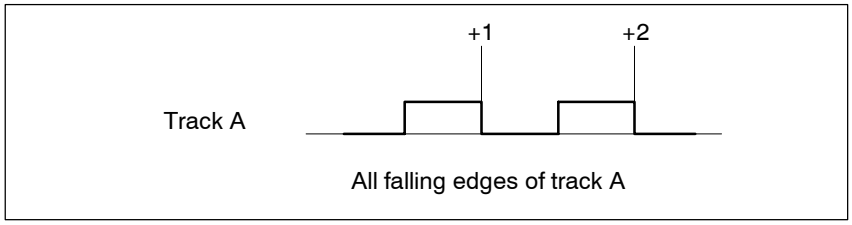


Figure 8-3 Single evaluation of the encoder pulses

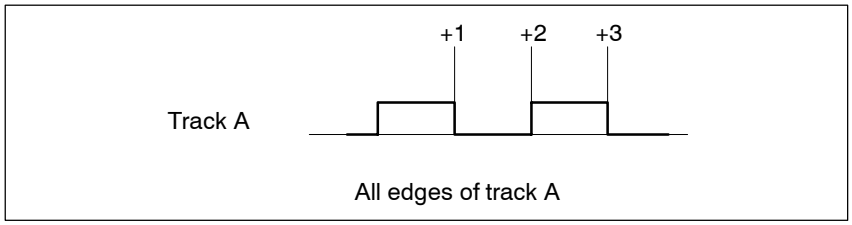


Figure 8-4 Double evaluation of the encoder pulses

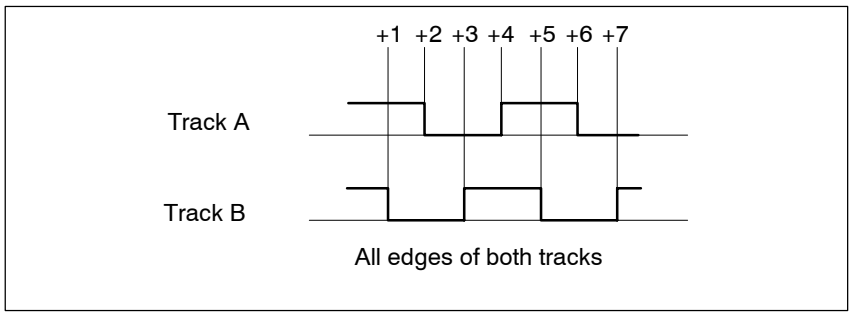


Figure 8-5 Quadruple evaluation of the encoder pulses

Note

The more edges are evaluated, the better the resolution is. For example, the resolution of the same traversing path is four times higher with quadruple evaluation than with single evaluation. Regardless of whether single, double or quadruple evaluation is set, both encoder tracks (A and B) must always be connected to the CM35.

Encoder frequencies

The permissible encoder frequency is 1000 Hertz, regardless of the edge evaluation selected.

Example of encoder selection

Maximum traversing speed	: 20 mm/sec
Spindle incline = path / encoder revolution	: 10 mm/revolution
Edge evaluation	: Double
Permissible encoder frequency	: 1000 Hz

$$\frac{\text{Steps}}{\text{Encoder revolution}} = \frac{\text{Perm. enc. frequency} \bullet \text{path / enc. revolution}}{\text{Max. traversing speed}}$$

$$= \frac{1000\ 1/\text{sec} \bullet 10\ \text{mm/revolution}}{20\ \text{mm/sec}} = 500\ /\ \text{revolution}$$

$$\text{Resolution} = \frac{\text{Path / encoder revolution}}{\text{Steps/enc. revolution} \bullet \text{evaluation}} = \frac{10\ \text{mm}}{500 \bullet 2} = 10\ \text{mm}$$

8.2 Parameterization

This chapter shows you how to use parameterization in positioning mode to adapt axis reaction to your task.

The parameter data are divided into nine parameter subblocks. Each parameter subblock must be transferred separately. For the structure of the parameter subblocks, see chapter 8.2.2. The description of the individual parameter data includes the number of the parameter block and subblock, and the offset in the related structure.

Note

An axis **must** be stopped before it can be reparameterized.

- When you want to change an axis-specific parameter, this axis must be stopped.
- When you want to change an axis-overlapping parameter, all axes must be stopped.

The new parameters take effect when the axis is started again.

For a description of the general layout and the transmission of the parameter blocks, see chapter 4.2.

8.2.1 Description of the Parameter Data

Edge evaluation and direction of rotation

When you make specifications for the edge evaluation, you determine whether only the edges of encoder track A are evaluated or the edges of both encoder tracks.

Single evaluation: All falling edges of encoder track A

Double evaluation: All edges of encoder track A

Quadruple evaluation: All edges of both encoder tracks

The parameterized edge evaluation applies to all axes.

The direction of rotation can be inverted with a parameter bit. The parameterized direction of rotation applies to all axes.

Table 8-1 Parameterizing the edge evaluation

Variable: Edge Evaluation	Parameter Block	Sub-number	Offset	Data Type	Value Range
					Edge evaluation
Encoder_Evaluation	1	0	2.0	Bool	2#xxxx_xx00: Single
			2.1	Bool	2#xxxx_xx01: Double
			2.2	Bool	2#xxxx_xx10: Quadruple
					Direction of rotation:
			2.7	Bool	2#0xxx_xxxx: Inverted
					2#1xxx_xxxx: Not inverted

Setting an actual value

You can specify an actual value for ″set actual value″ to synchronize the actual value acquisition of an axis. To do this, the axis must be moved to the position with the coordinate of the actual value.

Actual values are entered in the parameter blocks in twos complement representation.

- 2,147,483,648	-1	0	+1	+ 2,147,483,647
8000 0000...	..FFFF FFFF..	..0..	..1..	..7FFF FFFF

Specification of the actual value for ″set actual value″ is axis-specific.

Table 8-2 Setting an actual value

Variable: Set_ActualValue	Parameter Block	Sub-number	Offset	Data Type	Value Range
Set_ActualValue_Axis_1	1	1	6.0	DWord	- 2,147,483,648 to + 2,147,483,647
Set_ActualValue_Axis_2	1	2	12.0	DWord	
Set_ActualValue_Axis_3	1	3	18.0	DWord	
Set_ActualValue_Axis_4	1	4	24.0	DWord	

Setpoint

When you specify the setpoint, you transfer to the module the increment value at which the axis is to be positioned.
A hardware interrupt is generated when the axis reaches the setpoint position.

Setpoints are entered in the parameter blocks in twos complement representation as shown below.

- 2,147,483,648	-1	0	+1	+ 2,147,483,647
8000 0000...	..FFFF FFFF..	..0..	..1..	..7FFF FFFF

Specification of the setpoint is axis-specific.

Variable: Setpoint	Parameter Block	Sub-number	Offset	Data Type	Value Range
Setpoint_Axis_1	2	1	2.0	DWord	- 2,147,483,648 to + 2,147,483,647
Setpoint_Axis_2	2	2	8.0	DWord	
Setpoint_Axis_3	2	3	14.0	DWord	
Setpoint_Axis_4	2	4	20.0	DWord	

8.2.2 Structure of the Parameter Blocks

Tables 8-3 and 8-4 list the data structures of the nine parameter subblocks which were combined into two parameter blocks. Each parameter subblock must be transferred separately to the CM35 with an SFC 55 call.

The first word in the parameter subblocks contains the control word. The required assignment is entered as an initial value in the structures.

Adhere to the information in chapter 4.2 concerning transmission.

Parameter block 1 contains:

- The setting for edge evaluation
- The values for setting the actual value of axes 1 to 4

Table 8-3 Parameter block 1

Address	Name	Type	Initial Value	Commentary
0.0	Para_Block_1_0_Data	STRUCT		Selection of the edge evaluation
+0.0	Control_word	WORD	W#16#14	Parameter block no. 1; subnumber 0/ positioning mode
+2.0	Encoder_Evaluation	BYTE	B#16#80	Edge evaluation: 2#xxxx_xx00: Single 2#xxxx_xx01: Double 2#xxxx_xx10: Quadruple Direction of rotation: 2#0xxx_xxxx: Inverted 2#1xxx_xxxx: Not inverted
+3.0	In_reserve	BYTE	B#16#0	
+4.0	Res_4	ARRAY [0..9]	B#16#0	In reserve
*1.0		BYTE		
=14.0		END_STRUCT		
+14.0	Para_Block_1_1_Data	STRUCT		Set actual value for axis 1
+0.0	Control_word	WORD	W#16#114	Parameter block no. 1; subnumber 1/ positioning mode
+2.0	Set_ActualValue_Axis_1	DINT	L#0	Set actual value for axis 1
+6.0	Res_6	ARRAY [0..7]	B#16#0	In reserve
*1.0		BYTE		
=14.0		END_STRUCT		
+28.0	Para_Block_1_2_Data	STRUCT		Set actual value for axis 2
+0.0	Control_word	WORD	W#16#214	Parameter block no. 1; subnumber 2/ positioning mode
+2.0	Set_ActualValue_Axis_2	DINT	L#0	Set actual value for axis 2
+6.0	Res_6	ARRAY [0..7]	B#16#0	In reserve
*1.0		BYTE		
=14.0		END_STRUCT		

Table 8-3 Parameter block 1

Address	Name	Type	Initial Value	Commentary
+42.0	Para_Block_1_3_Data	STRUCT		Set actual value for axis 3
+0.0	Control_word	WORD	W#16#314	Parameter block no. 1; subnumber 3/ positioning mode
+2.0	Set_ActualValue_Axis_3	DINT	L#0	Set actual value for axis 3
+6.0	Res_6	ARRAY [0..7]	B#16#0	In reserve
*1.0		BYTE		
=14.0		END_STRUCT		
+56.0	Para_Block_1_4_Data	STRUCT		Set actual value for axis 4
+0.0	Control_word	WORD	W#16#414	Parameter block no. 1; subnumber 4/ positioning mode
+2.0	Set_ActualValue_Axis_4	DINT	L#0	Set actual value for axis 4
+6.0	Res_6	ARRAY [0..7]	B#16#0	In reserve
*1.0		BYTE		
=14.0		END_STRUCT		

Parameter block 2 contains:

- The setpoints of axes 1 to 4

Table 8-4 Parameter block 2

Address	Name	Type	Initial Value	Commentary
0.0	Para_Block_2_1_Data	STRUCT		Setpoint, axis 1
+0.0	Control_word	WORD	W#16#124	Parameter block no. 2; subnumber 1/ positioning mode
+2.0	Setpoint_Axis_1	DINT	L#0	Setpoint for axis 1
+6.0	Res_6	ARRAY [0..7]	B#16#0	In reserve
*1.0		BYTE		
=14.0		END_STRUCT		
+14.0	Para_Block_2_2_Data	STRUCT		Setpoint, axis 2
+0.0	Control_word	WORD	W#16#224	Parameter block no. 2; subnumber 2/ positioning mode
+2.0	Setpoint_Axis_2	DINT	L#0	Setpoint for axis 2
+6.0	Res_6	ARRAY [0..7]	B#16#0	In reserve
*1.0		BYTE		
=14.0		END_STRUCT		
+28.0	Para_Block_2_3_Data	STRUCT		Setpoint, axis 3
+0.0	Control_word	WORD	W#16#324	Parameter block no. 2; subnumber 3/ positioning mode
+2.0	Setpoint_Axis_3	DINT	L#0	Setpoint for axis 3
+6.0	Res_6	ARRAY [0..7]	B#16#0	In reserve
*1.0		BYTE		
=14.0		END_STRUCT		
+42.0	Para_Block_2_4_Data	STRUCT		Setpoint, axis 4
+0.0	Control_word	WORD	W#16#424	Parameter block no. 2; subnumber 4/ positioning mode
+2.0	Setpoint_Axis_4	DINT	L#0	Setpoint for axis 4
+6.0	Res_6	ARRAY [0..7]	B#16#0	In reserve
*1.0		BYTE		
=14.0		END_STRUCT		

8.3 Starting and Stopping the Axes

The following conditions must be met before an axis is started for the first time.

- The module is parameterized (SF LED is off).
- The actual value for the axis to be started has been set.
- A setpoint was written for the axis to be started.

To start the axis, write the start/stop block to address ”module start address + 2.”

Note

Before an axis can be started again, it must be stopped with a stop command.

Table 8-5 shows the contents of the start/stop block. The required assignment of the coordination byte is entered in the structure as an initial value. For a description of the bit assignment of the coordination byte, see chapter 4.3.1.

The write-access of the start/stop block **must** be programmed as a word-access.

Table 8-5 Start/stop block

Address	Name	Type	Initial Value	Commentary
	Start_Stop_Block	STRUCT		
+0.0	Start_Axis_1	BOOL	FALSE	01: Start axis 1
+0.1	Stop_Axis_1	BOOL	FALSE	10: Stop axis 1
+0.2	Start_Axis_2	BOOL	FALSE	01: Start axis 2
+0.3	Stop_Axis_2	BOOL	FALSE	10: Stop axis 2
+0.4	Start_Axis_3	BOOL	FALSE	01: Start axis 3
+0.5	Stop_Axis_3	BOOL	FALSE	10: Stop axis 3
+0.6	Start_Axis_4	BOOL	FALSE	01: Start axis 4
+0.7	Stop_Axis_4	BOOL	FALSE	10: Stop axis 4
+1.0	CoordinationByte	BYTE	B#16#84	Start/stop byte enable = 1 C bit = 0/ positioning mode
=2.0		END_STRUCT		

Example: The CM35 has the module start address 256.

```
L    W#16#4184      // Start axes 1 and 4
T    PQW 258        // Module start address + 2
...
...
L    W#16#8184      // Stop axis 4
                       Axis 1 is not affected.
T    PQW 258        // Module start address + 2
```

The axis stops when both bits are set to ″1″ or ″0″ for the axis.

8.4 Controlling the Digital Outputs

The user program can control the digital outputs of the CM35 (e.g., to set up or synchronize an axis).

The user program must ensure that the direct access does not cause unintentional movements or accidentally terminate running movements.
The firmware prevents forward movement and backward movement from being switched on at the same time. Forward movement is a movement in the direction of positive values.

Write the DO byte to the address ″module start address + 0.″

Table 8-6 shows the allocation of the bits in the DO byte to the axes.

Note

Control of the digital outputs must be programmed with a word access.

Table 8-6 Assignment of the DO byte

Address	Name	Type	Initial Value	Commentary
	DO_Block	STRUCT		
+0.0	Forwards_Axis_1	BOOL	FALSE	0: Axis off 1: Axis on
+0.1	Backwards_Axis_1	BOOL	FALSE	
+0.2	Forwards_Axis_2	BOOL	FALSE	
+0.3	Backwards_Axis_2	BOOL	FALSE	
+0.4	Forwards_Axis_3	BOOL	FALSE	
+0.5	Backwards_Axis_3	BOOL	FALSE	
+0.6	Forwards_Axis_4	BOOL	FALSE	
+0.7	Backwards_Axis_4	BOOL	FALSE	
+ 1.0	Res_1	BYTE	B#16#0	In reserve
= 2.0		END_STRUCT		

Example (S7): Switch on forward-movement for axis 2
- The CM35 has the module start address 256.

```
L   2#0000_0100_0000_0000   // Load DO byte for forward
                               running of axis 2
T   PQW 256                 // Module start address = 256
```

Forward motion is a movement towards the positive values.

Note

When controlling the digital outputs, the user program must ensure that active axes (positioning running) are not disturbed.

To prevent a just finished positioning procedure from being turned on again accidentally (or a running positioning procedure from being turned off) due to output control, the outputs should only be controlled when all positioning procedures have been finished or stopped.

To be noticed by the CM35, the status of the DO byte must have changed by at least one bit from its last status (see also page 4-22).

8.5 Hardware Interrupt Evaluation

In positioning mode, the CM35 can trigger a hardware interrupt when a setpoint position is reached. If this is used, the CPU **must** have a hardware interrupt OB (OB 40).

The start information of OB 40:

- Variable OB40_MDL_ADDR contains the base address of the module which triggered the interrupt.
- Variable OB40_POINT_ADDR contains information on the event which triggered the interrupt.

Variable OB40_POINT_ADDR consists of four bytes. The hardware interrupt information of the CM35 in positioning mode is entered in the low byte (local byte 11 of OB 40).

You can evaluate local byte 11 to determine which axis triggered the interrupt. Remember that more than one bit can be set.

Table 8-7 Assignment of the hardware interrupt information (OB 40/local byte 11)

Local Byte	Bit	Meaning	Value Range
11	0	Axis 1 has reached setpoint position.	0/1
	1	Reserved	
	2	Axis 2 has reached setpoint position.	
	3	Reserved	
	4	Axis 3 has reached setpoint position.	
	5	Reserved	
	6	Axis 4 has reached setpoint position.	
	7	Reserved	

8.6 Reading the Actual Positions

In positioning mode, you can read the current actual positions from the CM35.

To ensure data consistency, the read-access must be performed with **one** load command (L PID).

Table 8-8 shows the addresses of the individual axes for reading the actual position.

Table 8-8 Assignment of the output area for reading the actual positions

Offset to the Module Start Address	Meaning	Value Range
+0	Actual position of axis 1	- 2,147,483,648 to + 2,147,483,647
+4	Actual position of axis 2	
+8	Actual position of axis 3	
+12	Actual position of axis 4	

Example: Positioning mode
- Read actual position of axis 4
- The CM35 has the module start address 256.

```
L    PID 268     // Address = 256 + 12, actual position of
                    axis 4
T    MD16        // Save actual position
```

Literature

A

Supplementary literature

Below is a list of all manuals referred to in this manual.

/**70**/ Manual: *S7-300 Programmable Controller*

/**140**/ Manual: *ET 200M Distributed I/O Device*

/**231**/ User's manual: *Standard Software for S7 and M7, STEP 7*

/**235**/ Reference manual: *System Software for S7-300/400 System and Standard Functions*

EC Declaration of Conformity

B

EG-Konformitätserklärung

Nr. PE/0014/0999

Hersteller:	Siemens AG Bereich Automatisierungs- und Antriebstechnik Geschäftsgebiet Kombinationstechnik
Anschrift:	Würzburger Straße 121 D - 90766 Fürth
Produktbezeichnung:	Counter Modul CM 35 MLFB Nr.: 6AT1735-0AA01-0AA0 MLFB Nr.: 6AT1735-0AA00-0AA0

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Europäischer Richtlinien überein:

89/336/EWG Richtlinie des Rates zur Angleichung der Rechtsvorschriften der Mitgliedsstaaten über die elektromagnetische Verträglichkeit
(geändert durch 91/263/EWG, 92/31/EWG und 93/68/EWG)

Weitere Angaben über die Einhaltung dieser Richtlinie enthält Anhang EMV.

Siemens Aktiengesellschaft

Fürth, den 21.09.1999

i.V. Knobloch

Hr. Knobloch Unterschrift
Ltg. A&D MC PM2

i.V. Kronen

Hr. Kronen Unterschrift
Techn. Ltg. A&D SE B1

Der Anhang EMV ist Bestandteil dieser Erklärung.

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Zusicherung anderer Eigenschaften.

Die Sicherheitshinweise der mitgelieferten Produktdokumentation sind zu beachten.

SIEMENS

Anhang EMV
zur EG-Konformitätserklärung

Nr. PE/0014/0999

Produktbezeichnung: Counter Modul
CM 35
MLFB Nr.: 6AT1735-0AA01-0AA0
MLFB Nr.: 6AT1735-0AA00-0AA0

Die Übereinstimmung des bezeichneten Produkts mit den Vorschriften der Richtlinie **89/336/EWG** wird nachgewiesen durch die vollständige Einhaltung folgender Normen:

harmonisierte Europäische Normen:

Referenznummer	Ausgabedatum
EN 50081-2	1993
EN 50082-2	1995

Diese Konformitätserklärung gilt für folgende Komponenten:

Bestellnummer	Bezeichnung
6AT1735-0AA01-0AA0	Counter Modul CM 35 mit erweitertem FW Speicher
6AT1735-0AA00-0AA0	Counter Modul CM 35

Glossary

A

Automation system

An automation system is a programmable logic controller in a SIMATIC S7 system.

C

Configuring

Configuring is the selection and combination of individual components of a programmable controller, or the installation of required software (e.g., the operating system on the M7 automation computer) and the adjustment to special applications (e.g., by parameterizing the modules).

CPU

The CPU (Central Processing Unit) is a CPU of the programmable controller or the automation system with control and computing unit, memory, system program and interfaces to the I/O modules.

There are two kinds of configuration - the actual configuration (i.e., the modules which are actually installed) and the desired configuration. The desired configuration is specified with STEP 7 or COM ET 200 Windows or COM PROFIBUS Windows. This permits the operating system to detect incorrect configurations when it starts up.

D

DP master

When it has sending rights, the DP master can send data to other stations in the PROFIBUS-DP network and request data from other stations.
A master which conforms to part 3 of DIN standard E 19245 is called a DP master.

DP slave

A DP slave may exchange data with the DP master via the PROFIBUS-DP network only when requested by a DP master.
A slave which is used on the PROFIBUS bus with the PROFIBUS-DP protocol and conforms to part 3 of the DIN standard E 19245 is called a DP slave.

DP standard

The DP standard is the bus protocol of the ET 200 distributed I/O system based on part 3 of the draft of DIN 19245.

Data block

Data blocks are data areas in the user program which contain the user data. There are two kinds of data blocks - global data blocks and instance data blocks. Global data blocks can be accessed by all code blocks while instance data blocks are assigned to a certain FB call.

Default value

The default value is a realistic basic setting which is always used when no other value is entered.

Distributed I/O devices

Distributed I/O devices are input/output devices which are located decentrally at some distance from the CPU and are not installed in the central rack. A few examples are listed below.

- ET 200M, ET 200B, ET 200C, ET 200U
- S5-95U with PROFIBUS-DP slave interface

PROFIBUS-DP connects the distributed I/O devices with the DP master.

E

ET 200

The ET 200 is based on the PROFIBUS standard, part 1 of DIN 19245, and the draft of the PROFIBUS-DP standard (part 3 of DIN 19245).

The ET 200 utilizes the master-slave principle. For example, the master interface IM 308-C or the CPU 315-2 DP can be the DP master.

The distributed periphery ET 200B, ET 200C, ET 200M and ET 200U can be DP slaves, for example.

H

Hardware interrupt

The modules causing the interrupt trigger a hardware interrupt due to a certain event in the process. The hardware interrupt is reported to the CPU. The related → organization block is processed in the order of the particular interrupt's priority.

Hot restart

When a CPU restarts (e.g., because you turned the operating mode switch from STOP to RUN or you turned on the power), either organization block OB 100 (warm restart) or organization block OB 101 (hot restart, only with S7-400) is executed before cyclic program processing (OB 1) begins. During a hot restart, the process image of the inputs is read and processing of the STEP 7 user program is continued at the point at which it was last terminated (after STOP or power off).

I

Incremental encoder

Incremental encoders count small increments to acquire paths, positions, speeds, revolutions, and dimensions, among others.

M

Memory reset

A memory reset deletes the following memory of the CPU.

- Work memory
- Read/write area of the load memory
- System memory except for the MPI parameters and the diagnostic buffer

O

Organization block (OB)

Organization blocks are the interface between the CPU's operating system and the user program. The organization blocks specify the sequence in which the user program is processed.

P

Parameter

1. A variable of a STEP 7 code block
2. A variable which specifies the reaction of a module (one or more reactions per module). Each module comes with a realistic basic setting. You can change this basic setting with the STEP 7 tool *HW Config*.
There are two kinds of parameters - static parameters and dynamic parameters.

Parameterization

Parameterization sets the reaction of a module.

PLC

Programmable Logic Controller

PROFIBUS

PROcess FIeld BUS is the German process and fieldbus standard which is specified in the PROFIBUS standard (DIN 19245). This standard specifies the functional, electrical and physical characteristics for a bit-serial fieldbus system.

PROFIBUS address

Each bus station must have an address which identifies it unambiguously to PROFIBUS.

PCs/PGs or the ET 200-Hardheld have PROFIBUS address ″0.″

The DP master and the DP slaves have a PROFIBUS address from 1 to 125.

PROFIBUS-DP

PROFIBUS-DP is the PROFIBUS bus system with the DP protocol. DP stands for distributed periphery. The ET 200 periphery system is based on the draft of the PROFIBUS-DP standard (part 3 of DIN 19245).

PROFIBUS is a bus system which networks PROFIBUS-compatible programmable controllers and field devices at the cell and field level. PROFIBUS is available with the protocols DP (Distributed Periphery), FMS (Fieldbus Message Specification) or TF (Technological Functions).

Pulse duration

The pulse duration specifies the minimum time an output must be set.

S

Signal module

Signal modules (SM) provide the interface between the process and the programmable controller. There are digital input and output modules, analog input and output modules, and special SMs (e.g., the CM35).

Setup, centralized

Centralized setup means that the process periphery and CPU are located in the same module rack or in expansion units in the same or an adjacent cabinet.

Setup, distributed

Didtributed setup means that the process periphery is not located directly with the CPU in the same module rack or in the same or adjacent switching cabinet. Instead, the process periphery and the CPU are located at a distance from each other and are connected with a communication bus (e.g., fieldbus).

SIMATIC Manager

The SIMATIC Manager is the graphical user interface for SIMATIC users under Windows.

STARTUP

STARTUP is an operating mode of the CPU which covers the transition from STOP to RUN. STARTUP is triggered with the operating mode switch on the CPU, after power on, or by operator input on the programmer.

STEP 7

STEP 7 is the programming language for the creation of user programs for SIMATIC S7 controllers.

STOP

STOP is an international term (e.g., as an operating mode command).

System function (SFC)

A system function (SFC) is a function integrated in the CPU's operating system which can be called by the user program like a function block (FB). The related instance block is located in work memory.

System error

System errors are those errors which can occur on a programmable controller (i.e., not in the process). System errors are programming errors on the CPU and physical defects on the modules, for example.

U

User program

The user program contains all instructions and declarations, and data for signal processing via which a system or a process can be controlled. This program is assigned to a programmable module (e.g., CPU or FM) and can be structured in smaller units (blocks).

W

Warm restart

When a CPU starts up (e.g., after you turn the operating mode switch from STOP to RUN or turn the power on), organization block OB 100 (warm restart) is executed first before cyclic program processing begins (OB 1). During a warm restart, the process image of the inputs is read and the STEP 7 application program is processed starting with the first command in OB 1.

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Bestell-Nr.: J31069-D0416-U001-A5-7618
Printed in the Federal Republic of Germany