SIEMENS

SIMATIC NET

AS-Interface Master Module CP 242-2

Volume 1 of 1

C79000-G8976-C098 Release 01

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Wir haben den Inhalt der Druckschrift auf Übereinstimmung mit der beschriebenen Hard- and Software geprüft. Dennoch können Abweichungen nicht ausgeschlossen werden, so daß wir für die vollständige Übereinstimmung keine Gewähr übernehmen. Die Angaben in der Druckschrift werden jedoch regelmäßig überprüft. Notwendige Korrekturen sind in den nachfolgenden Auflagen enthalten. Für Verbesserungsvorschläge sind wir dankbar.

Technische Änderungen vorbehalten.

We have checked the contents of this manual for agreement with the hardware described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcome.

Technical data subject to change.

Nous avons vérifié la conformité du contenu du présent manuel avec le matériel et le logiciel qui y sont décrits. Or, des divergences n'étant pas exclues, nous ne pouvons pas nous porter garants pour la conformité intégrale. Si l'usage du manuel devait révéler des erreurs, nous en tiendrons compte et apporterons les corrections nécessaires dès la prochaine édition. Veuillez nous faire part de vos suggestions.

Nous nous réservons le droit de modifier les caractéristiques techniques.

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SIMATIC NET

AS-Interface Master Module CP 242-2

Description C79000-B8976-C105

Note

We would point out that the contents of this product documentation shall not become a part of or modify any prior or existing agreement, commitment or legal relationship. The Purchase Agreement contains the complete and exclusive obligations of Siemens. Any statements contained in this documentation do not create new warranties or restrict the existing warranty.

We would further point out that, for reasons of clarity, these operating instructions cannot deal with every possible problem arising from the use of this device. Should you require further information or if any special problems arise which are not sufficiently dealt with in the operating instructions, please contact your local Siemens representative.

General

This device is electrically operated. In operation, certain parts of this device carry a dangerously high voltage.

WARNING

! Failure to heed warnings may result in serious physical injury and/or material damage.

Only appropriately qualified personnel may operate this equipment or work in its vicinity. Personnel must be thoroughly familiar with all warnings and maintenance measures in accordance with these operating instructions.

Correct and safe operation of this equipment requires proper transport, storage and assembly as well as careful operator control and maintenance.

Personnel qualification requirements

Qualified personnel as referred to in the operating instructions or in the warning notes are defined as persons who are familiar with the installation, assembly, startup and operation of this product and who posses the relevant qualifications for their work, e.g.:

- ➢ Training in or authorization for connecting up, grounding or labeling circuits and devices or systems in accordance with current standards in safety technology;
- ➢ Training in or authorization for the maintenance and use of suitable safety equipment in accordance with current standards in safety technology;
- ➢ First Aid qualification.

Contents

1 Introduction

This manual describes the functions and programming of the CP 242-2. Before you read this manual, it is assumed that you know the contents of the manual 'AS-Interface Introduction and Basic Information'.

We recommend the following procedure when...

...you want an overall picture of the AS-Interface.	➥ Read the manual 'AS-Interface Introduction and Basic Information'. This manual contains general information about the **AS-Interface**, generally referred to as **AS-i** in this manual.
...you want to know how to program the CP 242-2.	➥ Read the manual 'AS-Interface Introduction and Basic Infomation' Chapter 1. You should also read Chapters 4 and 5 in this manual.
...you want to start up the PLC master module CP 242-2.	➥ You will find the information you require in Chapter 2 "Technical Description and Installation Guidelines for the CP 242-2" and in Chapter 3 "Interface to the User Program".
...you want to create a PLC program for standard applications.	➥ Chapter 4 contains all the information you require about "Standard Operation".
...you require additional information about the extended mode.	➥ You will find the required information in Chapter 5.

1.1 General

1.1.1 Overview of the Chapters

Chapter 1 Introduction

Chapter 1 contains general information about the layout and use of the manual.

Chapter 2 Technical Description and Installation Guidelines for the CP 242-2

Chapter 2 provides you with an overview of the modes, installation and startup and the display and control elements of the CP 242-2.

Chapter 3 Interface to the User Program

Chapter 3 describes the interface between an S7-200 CPU and a CP 242-2.

Chapter 4 Standard Operation

Chapter 4 describes the extremely simple standard operation of the module. This type of operation allows access to the inputs and outputs of the AS-i slaves.

Chapter 5 Extended Operation

Chapter 5 describes the extended operation of the CP 242-2. In this type of operation, the AS-i slaves can be assigned parameters or the slave addresses can be modified by the S7 program.

Chapter 6 Replacing a Defective Slave / Automatic Address Programming

Chapter 6 explains the simple procedure for replacing a failed AS-i slave.

Chapter 7 Error Indicators of the CP 242-2 / Dealing with Errors

This chapter lists the possible error indications of the CP 242-2 and describes possible remedies.

Appendix

- **A** AS-Interface Protocol Implementation Conformance Statement (PICS)
- **B** References
- **C** Abbreviations and Glossary
- **D** Notes on the CE Label

1.1.2 Symbols and Conventions Used in the Text

General symbols in the text:

✔ This symbol indicates an action for you to perform.

➢ This symbol indicates a list.

☞ This symbol highlights special features or dangers.

1.1.3 Requirements for Understanding the Manual

To fully understand the manual, you should already be familiar with the following:

➢ STEP 7 microprogramming

➢ The ‘AS-Interface Introduction and Basic Information' manual.

1.1.4 Sample Programs

The diskette accompanying this manual (S7-200 'SAMPLE/BEISPIEL') contains sample programs that provide you with instructions and help when programming the CP 242-2. These sample programs were created with STEP 7 Micro/WIN and can be run on an S7-200 CPU. The readme.txt file contains up-to-date information and explains any restrictions that apply to the use of the CP 242-2.

1.1.5 Further Support and Hotline

➢ If you have technical questions about using the software and your problem is not dealt with in the documentation or in the integrated help system, please contact your Siemens representative or dealer. The addresses are listed in Catalog IK10, in CompuServe (go autforum) and on the Internet (http://www.aut.siemens.de).

Our hotline is also available to help you with problems:

Tel. +49(911) 895–7000 (Fax -7001)

➢ Our customer support on the Internet provides useful information and answers to common questions. Under FAQ (Frequently Asked Questions), you will find a variety of information about our entire range of products.

The address of the AUT homepage in the worldwide web of Internet is:

http://www.aut.siemens.de.

2 Technical Description and Installation Guidelines for the CP 242-2

This chapter outlines the basic functions of the CP 242-2 and explains how the module is installed and started up.

You will learn the following:

➢ Which PLC systems can be operated using the CP 242-2 on the AS-Interface.

➢ How to install the CP 242-2.

➢ Which modes are supported by the CP 242-2.

☞ **When handling and installing modules, please keep to the guidelines for electrostatically sensitive devices (ESD guidelines) and follow the instructions in the manual of the S7-200 'S7-200 Programmable Controller, Hardware and Installation' /4/.**

☞ **Insert and remove components and modules only when the power is turned off.**

☞ **Immunity to interference / grounding**
To ensure that the CP 242-2 is immune to interference, the CP 242-2, the S7-200 programmable controller and the AS-i power supply unit must be correctly grounded.

☞ **The AS-i power supply unit used must provide a low voltage safely isolated from the network. Safe isolation can be implemented according to the following requirements:**

- ➢ VDE 0100 Part 410 = HD 384-4-4 = IEC 364-4-41
  (as functional extra-low voltage with safe isolation) or
- ➢ VDE 0805 = EN60950 = IEC 950
  (as safety extra-low voltage SELV) or
- ➢ VDE 0106 Part 101

2.1 Overview of the Module

2.1.1 Introduction

The CP 242-2 module can be operated in the S7-200 programmable controller. It allows the connection of an AS-i chain to this programmable controller.

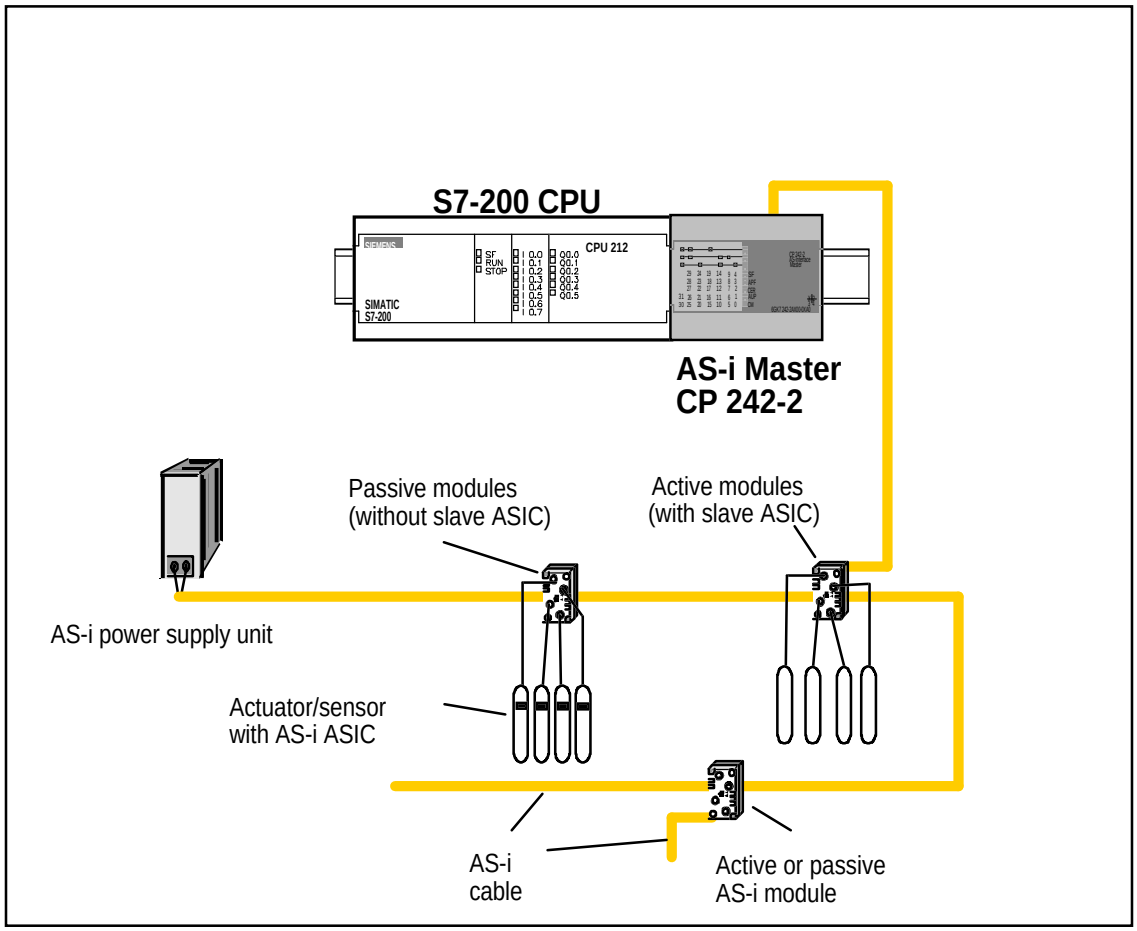


Figure 1: Example of a System Configuration; S7-200 with CP 242-2

Please refer to the accompanying product information to find out the CPUs with which the CP 242-2 can be operated.

From the point of view of the S7-200 CPU, the CP 242-2 is considered as two expansion modules (an 8DI/8DO digital module and an 8AI/8AO analog module).

The design of the CP 242-2 corresponds to that of a standard expansion module for an S7-200.

With some types of S7-200 CPU, two CP 242-2 master modules can be operated with one CPU.

Components Supplied

The CP 242-2 product includes the following components:

1. The CP 242-2 module
2. Bus connector

2.1.2 Technical Data of the Module

The CP 242-2 module has the following technical data:

Bus cycle time	5 ms with 31 slaves
Configuration	Using button on the front panel or with the "Configure Total System" command in extended operation (Section 5.2 "Description of the AS-i Commands")
AS-i master profiles supported	M1
Attachment to the AS-i cable	Via an S7-200 terminal strip for connection of field wiring (14 pin) Permissible current loading from connection 1 to 3 or from connection 2 to 4 maximum 3 A
Address range	One digital module with 8DI/8DO and one analog module with 8AI/8AO
Power supply SIMATIC backplane bus	5 V DC
Current consumption from the AS-i cable	max. 100 mA
Power supply from the AS-i cable	According to the AS-i specification
Current consumption from 5 V DC	max. 200 mA
Ambient conditions	
• Operating temperature	0 to 60°C
• Transport and storage temperature	-40°C to +70°C
• Relative humidity	max. 95% at +25°C
Construction	
• Module format	S7-200 expansion module
• Dimensions (W x H x D) in mm	90 x 80 x 62
• Weight	approx. 200 g

Table 2-1 Technical Data

2.1.3 Display and Control Elements of the CP 242-2

The following diagram shows the front panel of the CP 242-2 with its displays and control elements. The AS-i cable is connected below the front panel at the front of the CP 242-2. The SET and DISPLAY buttons are below the front cover on the front of the CP 242-2.

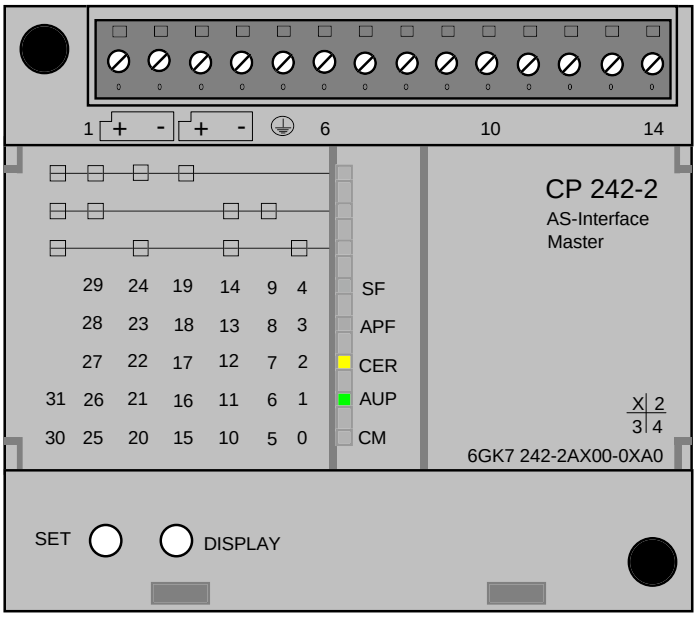


Figure 2-3 Front View of the CP 242-2 With Cover Removed

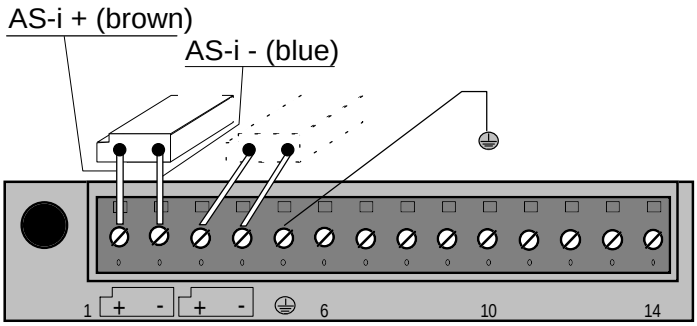


Figure 2-4 Connection of the AS-i Cable

The CP 242-2 has connections for two AS-i cables that are jumpered internally in the CP 242-2. This allows the CP 242-2 to be “looped into” the AS-i cable.

☞ **The load capacity of the contacts is a maximum of 3 A. If this value is exceed on the AS-i cable, the CP 242-2 must not be “looped into” the AS-i cable but must be connected by a separate cable (in this case only one terminal pair of the CP 242-2 is used).**

The CP 242-2 must be connected to the grounding conductor via the ⏚ terminal.

2.1.3.1 Meaning of the Display and Control Elements

The front panel of the CP 242-2 has a row of 8 LEDs.
The upper three LEDs are the group indicators.
The meaning of the lower 5 LEDs depends on the status of the group indicators.

➢ If none of the group indicator LEDs is lit, the lower 5 LEDs indicate the status of the CP 242-2. The labeling to the right of the LEDs then indicates the meaning. The default display is this status display.

➢ If one or more of the group indicator LEDs is lit, the lower 5 LEDs indicate the slaves that are active on the AS-Interface (slave display of the CP 242-2). In this case, the label to the left of the LEDs applies.

The display can be switched over using the DISPLAY button.
The SET button is used to configure the CP 242-2.

2.1.3.2 Status Display of the CP 242-2 (All Group LEDs Off)

SF (red) — System error. This LED is lit in the following situations:

- ➢ The CP 242-2 has detected an internal problem (for example a defective EEPROM).
- ➢ The CP 242-2 cannot change to the mode requested (for example a slave exists with address 0).

APF (red) — AS-i Power Fail. This indicates that the voltage supplied by the AS-i power supply unit on the AS-i cable is too low or has failed.

CER (yellow) — Configuration Error. This LED indicates whether the slave configuration detected on the AS-i cable matches the expected configuration (LPS). If they do not match, the CER LED is lit.

The CER LED is lit in the following situations:

- ➢ When a configured AS-i slave does not exist on the AS-i cable (for example failure of the slave).
- ➢ When a slave exists on the AS-i cable but it was not previously configured.
- ➢ When an attached slave has different configuration data (I/O configuration, ID code) from the slave configured on the CP 242-2.
- ➢ When the CP 242-2 is in the offline phase.

AUP (green) — Autoprog available. In the protected mode of the CP 242-2, this indicates that automatic address programming of a slave is possible. The automatic address programming makes it much easier to exchange a defective slave on the AS-i cable (for more detailed information refer to Chapter 6).

CM (yellow) Configuration Mode. This displays the operating mode of the CP 242-2.

LED lit: Configuration mode
LED unlit: Protected mode

The configuration mode is only required when installing the CP 242-2. In the configuration mode, the CP 242-2 activates all connected slaves and exchanges data with them. For more information about the configuration mode, refer to Section. 2.1.7 .

2.1.3.3 Slave Indicators of the CP 242-2 (At Least One Group LED is Lit)

The activated slaves are displayed in groups of five. The upper three group LEDs indicate which group of five is being displayed. The lower five LEDs indicate the active slaves within this group. You can switch over to the slave display mode used by pressing the DISPLAY button. You switch from group to group by pressing the DISPLAY button again:

You can return to the status display as follows:

➢ After displaying the last group (slaves 30, 31) and pressing the DISPLAY button.

➢ If you do not press the DISPLAY button for a longer period of time (approximately 8 minutes).

In the protected mode, failed or existing but unconfigured slaves are indicated by the corresponding LED flashing.

Example:
The group LEDs indicate the second group of five.
Within this group, the active slaves 6 and 8 are displayed by the lower five LEDs.

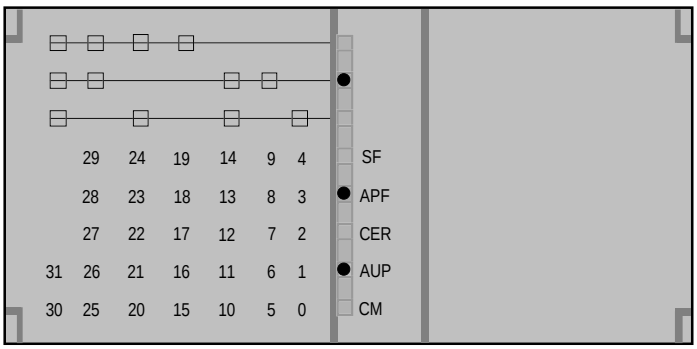


Figure 2-5 Example of a Status Display

2.1.3.4 Meaning of the Buttons

SET button

The SET button is required for configuring the CP 242-2 in standard operation.

☞ **This button is only effective when the PLC_RUN bit is set to '0' in the control byte of the CP 242-2. This is always the case when the S7-200 CPU is in the STOP mode.**

➢ If the CP 242-2 is in the configuration mode (the "CM" LED is lit), you can configure automatically by pressing the button the CP 242-2. Configuration involves the following steps:

1. The CP 242-2 saves the existing slave configuration as indicated by the LEDs of the active slaves as the expected configuration.

2. The CP 242-2 then switches to the protected mode.
   If a slave with address '0' exists, the CP 242-2 does not switch from the configuration mode to the protected mode. The SF LED signals an error while the SET button is pressed.

➢ If the CP 242-2 is in the protected mode ("CM" LED is not lit), pressing the button on the CP 242-2 switches to the configuration mode.

☞ **Pressing the button while the AS-i Power Fail LED is lit resets the CP 242-2 to its default status, as follows:**

➢ No slaves are configured

➢ All slave parameters are set

➢ Automatic address programming is activated (AUTO_ADDRESS_ENABLE = '1')

For more detailed information about configuring the CP 242-2, refer to Section 2.1.7.

DISPLAY button

The DISPLAY button is used to change the LED display of the CP 242-2. If you press this button, the display changes from the status display to the slave display. The first group of five slaves is then displayed. To move on to the next group of five slaves, press the button again.

2.1.4 Slots Permitted for the CP 242-2 in the SIMATIC S7-200 System

The CP 242-2 can be inserted in all slots for expansion modules in the S7-200 programmable controller.

There may, however, be restrictions depending on the CPU or power supply unit being used in terms of the following:

➢ Expandability with several expansion modules,

➢ The electrical configuration, in other words the total current consumption from the S7 backplane bus.

☞ **Before starting up, you should calculate the total power requirements of your S7-200 system.**
To do this, use the calculation table in the manual
"S7-200 Programmable Controller, Installation and Hardware"

2.1.5 Types of Operation With the CP 242-2

With the CP 242-2 module, two types of operation are possible:

➢ Standard operation

➢ Extended operation

The difference between the two types of operation is as follows:

Standard Operation

In this type of operation, the user program accesses the user data of the AS-i slaves and the diagnostic data of the CP 242-2. Programming is simple and this type of operation is adequate for the majority of automation tasks.

In standard operation, no commands or special parameters can be transferred to the slaves on the AS-i cable. This type of operation corresponds to the profile M0 of the AS-i master specification.

Extended Operation

In extended operation, the user program uses the command interface of the CP 242-2.

This means that the entire range of functions in the AS-i system are available to the PLC programmer. In particular, the AS-i master calls (for example to assign parameters to slaves) are available. This type of operation corresponds to profile M1 of the AS-i master specification.

2.1.6 Addressing the CP 242-2 in the PLC

From the point of view of the S7-200 CPU, the CP 242-2 behaves logically as if it were two consecutive expansion modules:

- The first module is an 8DI/8D0 digital module. It occupies 8 input and 8 output bits in the address base of the digital inputs and outputs.
  The 8 input bits form the status byte of the CP 242-2. Using this byte, the CP 242-2 transfers status information to the PLC user program.
  The 8 output bits form the control byte of the CP 242-2. Using this, the PLC user program controls the CP 242-2.
- The second module is an 8AI/8AO analog module. It occupies 16 input and 16 output bytes in the address area of the analog inputs and outputs.
- In standard operation, both the user data of the AS-i slaves and the diagnostic information of the CP 242-2 are transferred via these 16 I/O bytes.
  In extended operation, the 16 I/O bytes are also used to transfer commands.

The start addresses of the address area are decided by the S7-200 CPU being used and the slot in which the CP 242-2 is inserted.

For more detailed information about addressing, refer to the manuals of the S7-200 programmable controller.

Example of addressing the CP 242-2

1. CPU 212 and one CP 242-2

CPU 212		CP 242-2			
I0.0	Q0.0	I1.0	Q1.0	AIW0	AQW0
I0.1	Q0.1	I1.1	Q1.1	AIW2	AQW2
I0.2	Q0.2	I1.2	Q1.2	AIW4	AQW4
I0.3	Q0.3	I1.3	Q1.3	AIW6	AQW6
I0.4	Q0.4	I1.4	Q1.4	AIW8	AQW8
I0.5	Q0.5	I1.5	Q1.5	AIW10	AQW10
I0.6		I1.6	Q1.6	AIW12	AQW12
I0.7		I1.7	Q1.7	AIW14	AQW14

2. CPU 214 and one CP 242-2

CPU 214		CP 242-2			
I0.0	Q0.0	I2.0	Q2.0	AIW0	AQW0
I0.1	Q0.1	I2.1	Q2.1	AIW2	AQW2
I0.2	Q0.2	I2.2	Q2.2	AIW4	AQW4
I0.3	Q0.3	I2.3	Q2.3	AIW6	AQW6
I0.4	Q0.4	I2.4	Q2.4	AIW8	AQW8
I0.5	Q0.5	I2.5	Q2.5	AIW10	AQW10
I0.6	Q0.6	I2.6	Q2.6	AIW12	AQW12
I0.7	Q0.7	I2.7	Q2.7	AIW14	AQW14
I1.0	Q1.0				
I1.1	Q1.1				
I1.2					
I1.3					
I1.4					
I1.5					

3. CPU 214 and two CP 242-2s

CPU 214		CP 242-2				CP 242-2			
I0.0	Q0.0	I2.0	Q2.0	AIW0	AQW0	I3.0	Q3.0	AIW16	AQW16
I0.1	Q0.1	I2.1	Q2.1	AIW2	AQW2	I3.1	Q3.1	AIW18	AQW18
I0.2	Q0.2	I2.2	Q2.2	AIW4	AQW4	I3.2	Q3.2	AIW20	AQW20
I0.3	Q0.3	I2.3	Q2.3	AIW6	AQW6	I3.3	Q3.3	AIW22	AQW22
I0.4	Q0.4	I2.4	Q2.4	AIW8	AQW8	I3.4	Q3.4	AIW24	AQW24
I0.5	Q0.5	I2.5	Q2.5	AIW10	AQW10	I3.5	Q3.5	AIW26	AQW26
I0.6	Q0.6	I2.6	Q2.6	AIW12	AQW12	I3.6	Q3.6	AIW28	AQW28
I0.7	Q0.7	I2.7	Q2.7	AIW14	AQW14	I3.7	Q3.7	AIW30	AQW30
I1.0	Q1.0								
I1.1	Q1.1								
I1.2									
I1.3									
I1.4									
I1.5									

4. CPU 214, one 8DI module, one 3AI/1AO module and one CP 242-2

CPU 214		8DI	3AI / 1AO		CP 242-2			
I0.0	Q0.0	I2.0	AIW0	AQW0	I3.0	Q2.0	AIW8	AQW4
I0.1	Q0.1	I2.1	AIW2		I3.1	Q2.1	AIW10	AQW6
I0.2	Q0.2	I2.2	AIW4		I3.2	Q2.2	AIW12	AQW8
I0.3	Q0.3	I2.3			I3.3	Q2.3	AIW14	AQW10
I0.4	Q0.4	I2.4			I3.4	Q2.4	AIW16	AQW12
I0.5	Q0.5	I2.5			I3.5	Q2.5	AIW18	AQW14
I0.6	Q0.6	I2.6			I3.6	Q2.6	AIW20	AQW16
I0.7	Q0.7	I2.7			I3.7	Q2.7	AIW22	AQW18
I1.0	Q1.0							
I1.1	Q1.1							
I1.2								
I1.3								
I1.4								
I1.5								

2.1.7 Configuring the CP 242-2

The CP 242-2 is capable of two operating modes, the configuration mode and the protected mode. When supplied, the CP 242-2 is in the configuration mode as indicated by the “CM” LED being lit.

➢ Configuration Mode:

The configuration mode is used to install and start up an AS-i installation. In the configuration mode, the CP 242-2 can exchange data with every slave attached to the AS-i cable (with the exception of a slave with address “0”). Any slaves that are added later are detected immediately by the master and included in the cyclic data exchange. After testing the PLC program, the CP 242-2 can be changed to the protected mode using the SET button on the front panel while the S7-200 CPU is in the STOP mode. Any slaves active at this point are therefore configured and included in the list of configured (permanent) slaves (LPS).

➢ Protected Mode:

If the CP 242-2 is in the protected mode, it only exchanges data with slaves that are “configured”. In this sense, “configured” means that the slave address saved on the CP 242-2 and the configuration data stored on the CP 242-2 match the values of a slave.

Configuration of the CP 242-2 during installation and startup of the AS-i network

The following situation is assumed:

✔ The connected AS-i slaves have been supplied with unique addresses (for example using an address programming device).

✔ The AS-Interface is complete, in other words the AS-i power supply unit is in operation and the slaves are connected to the AS-i cable.

To configure the CP 242-2 in standard operation, follow the steps below:

✔ Switch the PLC to the STOP mode. This ensures that bit 7 (PLC_RUN) in the control byte of the CP 242-2 is set to ‘0’ (see Section 3.2).

✔ Change the CP 242-2 to the configuration mode (press the SET button of the CP 242-2; the “CM” LED is lit). If the CP 242-2 is already in the configuration mode (as supplied), this step can be omitted.

✔ Switch the PLC to RUN and set bit 7 (PLC_RUN) in the control byte of the CP 242-2 to ‘1’ (see Section 3.2).

✔ Test your program.

Note:
In the configuration mode, you can add or remove slaves on the AS-i cable. Newly added slaves are activated immediately by the CP 242-2.

✔ On completion of the installation of the AS-Interface, switch the PLC to STOP. This makes sure that bit 7 (PLC_RUN) in the control byte of the CP 242-2 is set to ‘0’.

✔ Now press the SET button of the CP 242-2 again. The CP 242-2 saves the actual configuration indicated by the active slaves display as the desired configuration and switches to the protected mode. In the protected mode, the “CM” LED is switched off.

✔ Switch the PLC to RUN and set bit 7 (PLC_RUN) in the control byte of the CP 242-2 to ‘1’.

✔ This completes installation of the CP 242-2.

3 Interface to the User Program

3.1 Overview

From the point of view of the S7-200 CPU, the CP 242-2 occupies two consecutive expansion module slots (one 8DI/8DO digital module followed by an 8AI/8AO analog module). In addition to this, the system registers required for an S7-200 expansion module for the digital and analog module are available.

The S7-200 CPU and CP 242-2 AS-i master module are coordinated via the digital module.

The slave I/O data, the transfer of the AS-i master calls (commands) and reading in of the response data and diagnostic information are handled on the analog module.

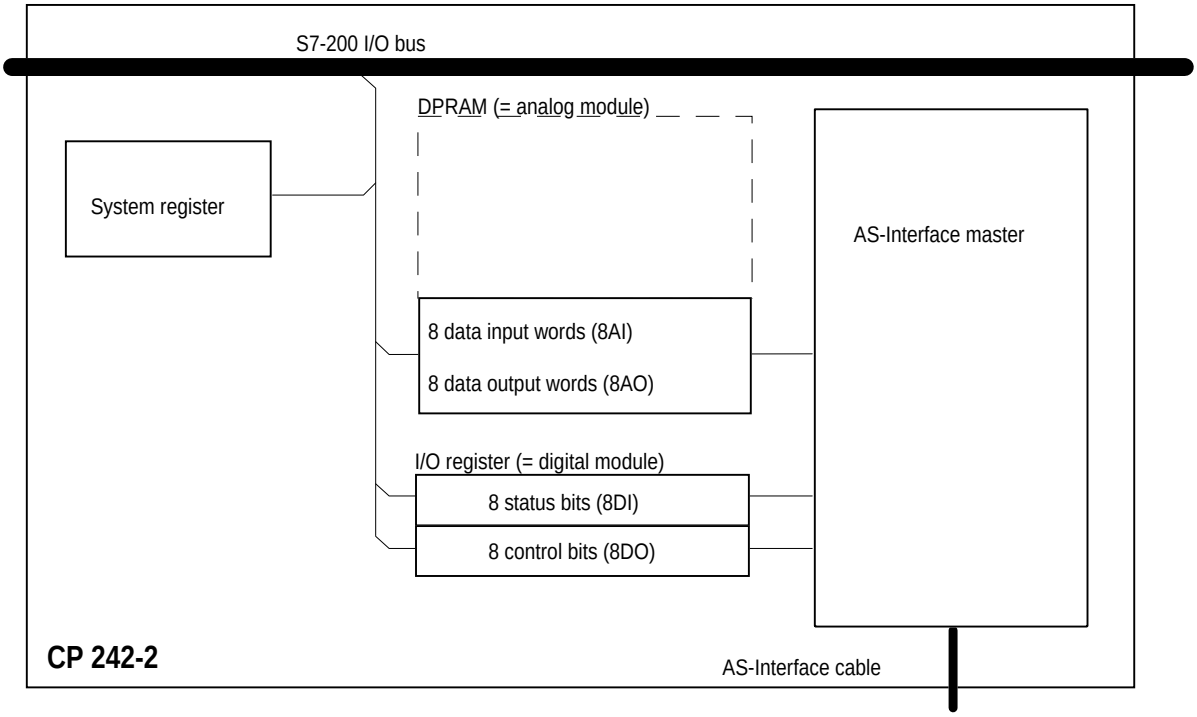


Figure 3-5 Data Model of the CP 242-2 in Terms of the CPU Interface

3.2 Meaning of the Data in the Digital Module

The digital module of the CP 242-2 consists of four registers:

- 8-bit identification register
- 8-bit error register
- 8-bit input register 8DI (status byte of the CP 242-2)
- 8-bit output register 8DO (control byte of the CP 242-2)

3.2.1 Identification Register

The identification register can be read via the special memory area of the S7-200 CPU and produces the fixed value 05 hex. This signals the existence of an 8DI/8DO digital module.

The address at which the program can access the identification register depends on the slot in which the CP 242-2 is inserted.

Example

Situation: The CP 242-2 is inserted directly beside the S7-200 CPU.
The content of the identification register can be read from SMB8.

3.2.2 Error Register

The error register has the following structure:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	APF	0	CER

The CP 242-2 signals PLC interface errors to the user program using this register.

Description of the Bits:

APF= 1 AS-i Power Fail
Indicates that the voltage supplied by the AS-i power supply unit on the AS-i cable is too low or has failed.
The APF LED is lit
(see Section 2.1.3.2 Status Display of the CP 242-2 (All Group LEDs Off))

APF=0 AS-i voltage correct
The APF LED is off.

CER=1 Configuration error (only in the protected mode)

This indicates a difference between the slave configuration detected on the AS-i cable and the desired configuration configured on the CP 242-2.
The CER LED is lit (see Section 2.1.3.2 status display of the CP 242-2)

CER=0 Configuration correct (only in the protected mode)
The CER LED is off

Example : Access to the error register in the digital module of the CP 242-2

Situation: The CP 242-2 is inserted directly beside the S7-200 CPU

✔ Evaluate bits SM9.0 and SM9.2 in the SM area (Special Memory of the S7-200 CPU). If an error has occurred, bit SM 9.0 and/or bit SM9.2 is set.

3.2.3 Status Byte

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	RESPONSE	0	0	0	0	CP_READY	MODE

This register indicates the status of the CP 242-2.

Description of the Bits:

RESPONSE	Response bit for the command interface (see Chapter 5. Extended Operation)
CP_READY=1	The CP 242-2 is ready for operation
CP_READY=0	The CP 242-2 is not ready for operation
MODE=1	The CP 242-2 is in the configuration mode
MODE=0	The CP 242-2 is in the protected mode

3.2.4 Control Byte

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
PLC_RUN	COMMAND	0	0	BS3	BS2	BS1	BS0

The user program controls the data exchange with the CP 242-2 using this register.

Description of the Bits:

PLC_RUN — In the STOP mode of the S7-200 CPU, the CP must send ‘0’ to all slaves. Since the AS-i slave data are transferred via the analog area and the S7-200 CPU does not set this area to '0' when it changes from RUN to STOP, the CPU mode must be signaled to the CP 242-2 using the PLC_RUN bit as follows:

PLC_RUN=0 — Informs the CP 242-2 that the PLC is in the STOP mode. The CP 242-2 sends '0' to all slaves. The S7-200 CPU sets the bit to '0' automatically when it changes from RUN to STOP.

PLC_RUN=1 — Informs the CP 242-2 that the PLC is in the RUN mode. The CP 242-2 sends the content of output page 0 to all slaves (see Section 3.3 “Meaning of the Data in the Analog Module”). The user program must set this bit to '1' during startup (first scan).

☞ **Do <u>not</u> set the PLC_RUN bit permanently to “1” using the S7-200 operating system functions such as “CPU Configuration/Setting Outputs” or “Forcing Outputs”.**

COMMAND	Job bit for the command interface (see Chapter 5. Extended Operation)
BS3_BS0	Page select bits for page changeover in the analog module (see Section 3.3 Meaning of the Data in the Analog Module)

3.3 Meaning of the Data in the Analog Module

The analog module of the CP 242-2 consists of the following:

➢ 8-bit identification register

➢ 8-bit error register

➢ 8 analog input words 8AI

➢ 8 analog output words 8AO

3.3.1 Identification Register

The identification register can be read via the special memory area of the S7-200 CPU and produces the fixed value 1F hex. This signals the existence of an 8AI/8AO analog module.

3.3.2 Error Register

The error register has the following structure:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	APF	0	CER

This register signals CP 242-2 errors to the user program.

☞ **The error register of the digital and the analog module provides the user with the same information about the error state of the CP 242-2.**
The meaning of the individual bits was described in Section 3.2 Meaning of the Data in the Digital Module.

3.3.3 Access to the Analog Input and Output Words

Using a page-select mechanism, the 8 analog input words and the 8 analog output words can be switched to 16 different analog input areas and 16 different analog output areas on the CP 242-2. Each of these areas is 8 words long.

The switchover to the various pages is made with bits BS3 to BS0 in the control byte of the CP 242-2 (see Section 3.2 “Meaning of the Data in the Digital Module”).

The four page select bits are coded in binary as follow:

BS3	BS2	BS1	BS0	Page No.
0	0	0	0	Page 0 selected
0	0	0	1	Page 1 selected
0	0	1	0	Page 2 selected
0	0	1	1	Page 3 selected
0	1	0	0	Page 4 selected
0	1	0	1	Page 5 selected
0	1	1	0	Page 6 selected
0	1	1	1	Page 7 selected
1	0	0	0	Page 8 selected
1	0	0	1	Page 9 selected
1	0	1	0	Page 10 selected
1	0	1	1	Page 11 selected
1	1	0	0	Page 12 selected
1	1	0	1	Page 13 selected
1	1	1	0	Page 14 selected
1	1	1	1	Page 15 selected

☞ **Make sure that the value of the page select bits is located not only in the process output image but that it is also transferred to the CP 242-2 before you access the corresponding analog values.**

3.3.4 Analog Input Area

The following diagram shows the assignment of the analog input words to the 16 pages of the CP 242-2 from the point of view of the PLC.

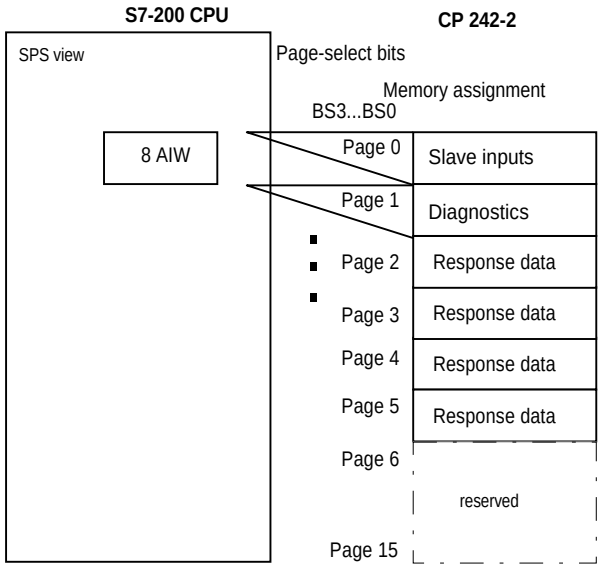


Figure 3-6 Assignment of the 8 Analog Input Words to the Page Structure of the CP 242-2

Page 0 Slave Inputs

Using these analog input words, you can access the input bits of the AS-i slaves.
The structure is described in Section 4.1 “How the PLC Addresses the Slaves on the AS-i Cable”.

Page 1 Diagnostics

This page indicates the delta list of the AS-i slaves.
The delta list contains any differences between the actual configuration and the desired configuration.

By setting a bit, the following can be indicated:

➢ Missing slaves

➢ Extra slaves (not in the configuration)

➢ Slaves with incorrect I0/ID coding

The delta list is updated both in the configuration and in the protected mode.

The bytes and bits of the delta list are ordered as shown in the table below. (M: start address of the analog input area of the CP 242-2)

Byte \ Bit	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Byte m+0	slave 7	slave 6	slave 5	slave 4	slave 3	slave 2	slave 1	slave 0
Byte m+1	slave 15	slave 14	slave 13	slave 12	slave 11	slave 10	slave 9	slave 8
Byte m+2	slave 23	slave 22	slave 21	slave 20	slave 19	slave 18	slave 17	slave 16
Byte m+3	slave 31	slave 30	slave 29	slave 28	slave 27	slave 26	slave 25	slave 24

Pages 2 to 5 Response Data

These pages contain the response data of the command calls. The data structures used and the codings are described in Chapter 5. The number of pages used depends on the particular command.

Pages 6 to 15

These areas are reserved for later expansions and cannot be used.

3.3.5 Analog Output Area

The following diagram shows the assignment of the analog output words to the 16 pages of the CP 242-2 from the point of view of the PLC.

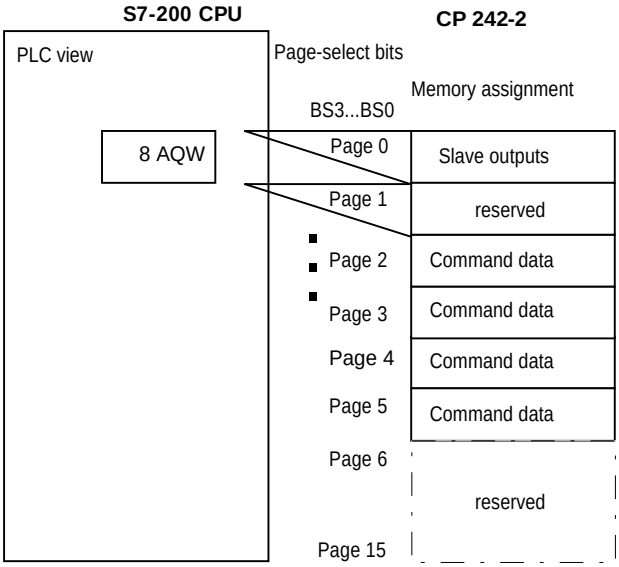


Figure 3-7 Assignment of the 8 Analog Output Words to the Page Structure of the CP 242-2

Page 0 Slave Outputs

Using this analog output area, you can access the output bits of the AS-i slaves.
The structure is described in Section 4.1.

Page 1 Reserved

This area is reserved for later expansions and cannot be used.

Pages 2 to 5 Command Data

Using this area, you store command calls on the CP 242-2. The data structures and codings used are described in Chapter 5. The number of pages used depends on the particular command.

Pages 5 to 15

These areas are reserved for later expansions and cannot be used.

4 Standard Operation

Standard operation represents the most common and at the same time simplest use of the CP 242-2. It allows access to the inputs and outputs of the slaves.

4.1 How the PLC Addresses the Slaves on the AS-i Cable

Before you can access the I/O data of the AS-i slaves, the following requirements must be met:

➢ Set the “PLC_RUN” bit (bit 7) in the digital control byte to ‘1’ at the beginning of the cyclic program.

➢ Leave the page selection bits (bits 0 to 3) in the digital control byte at ‘0’.

➢ Access to the I/O data of the slaves is then only allowed when the “CP_Ready” bit (bit 1) in the digital status byte is set to ‘1’.

The CP 242-2 assigns four bits (a nibble) to every slave on the AS-i cable. The PLC can write (slave output data) and read (slave input data) this nibble. This allows bi-directional slaves to be addressed.

Assignment of the input data of the slaves

Byte Number	Bit 7-4	Bit 3-0
m+0	reserved	slave 1 bit 4 | bit 3 | bit 2 | bit 1
m+1	slave 2	slave 3
m+2	slave 4	slave 5
m+3	slave 6	slave 7
m+4	slave 8	slave 9
m+5	slave 10	slave 11
m+6	slave 12	slave 13
m+7	slave 14	slave 15
m+8	slave 16	slave 17
m+9	slave 18	slave 19
m+10	slave 20	slave 21
m+11	slave 22	slave 23
m+12	slave 24	slave 25
m+13	slave 26	slave 27
m+14	slave 28	slave 29
m+15	slave 30 bit 4 | bit 3 | bit 2 | bit 1	slave 31 bit 4 | bit 3 | bit 2 | bit 1

m = start address of the analog input area of the CP 242-2

The table shows the assignment of the slave input bits to the analog input bytes of the PLC.

Assignment of the output data of the slaves

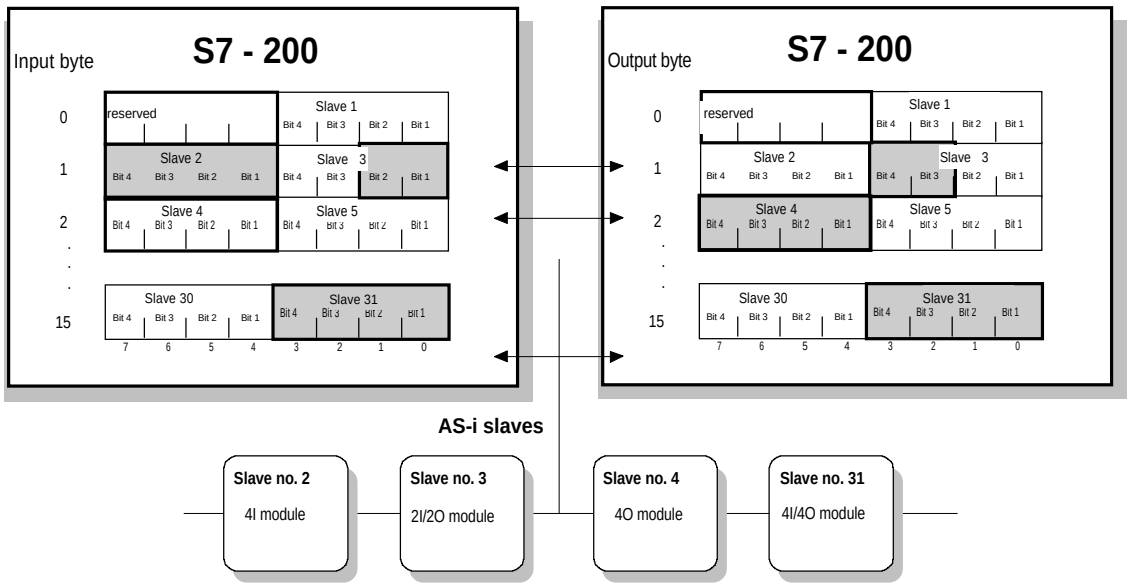
Byte Number	Bit 7-4	Bit 3-0
n+0	reserved	slave 1 bit 4 | bit 3 | bit 2 | bit 1
n+1	slave 2	slave 3
n+2	slave 4	slave 5
n+3	slave 6	slave 7
n+4	slave 8	slave 9
n+5	slave 10	slave 11
n+6	slave 12	slave 13
n+7	slave 14	slave 15
n+8	slave 16	slave 17
n+9	slave 18	slave 19
n+10	slave 20	slave 21
n+11	slave 22	slave 23
n+12	slave 24	slave 25
n+13	slave 26	slave 27
n+14	slave 28	slave 29
n+15	slave 30 bit 4 | bit 3 | bit 2 | bit 1	slave 31 bit 4 | bit 3 | bit 2 | bit 1

n = start address of the analog output area of the CP 242-2

The table shows the assignment of the slave output bits to the analog output bytes of the PLC.

Example of the PLC addressing a number of slaves

The CP 242-2 with start addresses m = 0 for analog input area and n = 0 for analog output area.



☞ **The bits relevant to the user program are shown on a gray background. The bits on a white background have no significance for the user program.**

4.2 Access to the AS-i User Data

You access the I/O data of the AS-i slaves using the analog commands of the “STEP 7 Micro” programming language.

If you want to access individual bits of the slave data, you can use the method shown in the following sample program (CPU 212 and CP 242-2).

Example 1

The example applies to a CPU 212 with a CP 242-2 plugged in directly beside it:

```
NETWORK                  //Startup processing

LD    SM0.1              //if: bit first scan bit:
SI    Q1.7, 1            //PLC_RUN = 1
RI    Q1.0, 4            //Select page 0

NETWORK                  //AS-i I/O processing

LD    I1.1               //if: CP 242-2_READY
CALL  1                  //then: AS-i I/O processing

NETWORK                  //End of main program


MEND
NETWORK                  //Begin SBR “AS-i I/O processing”

SBR   1
NETWORK                  //Fetch AS-i inputs to V memory

LD    SM0.0              //Always 1
BMW   AIW0, VW800, 8     //Transfer

NETWORK                  //Examples of access to AS-i bits

LD    V800.0             //If bit 1 of slave 1
A     V815.1             //and bit 2 of slave 31
=     V903.2             //then bit 3 of slave 7 = 1

NETWORK                  //Write from V memory to AS-i outputs

LD    SM0.0              //Always 1
BMW   VW900, AQW0, 8     //Transfer

NETWORK                  //End of SBR “AS-i I/O processing”
RET
```

4.3 Signaling Errors and Diagnostics

If the CP 242-2 recognizes errors on the ASi-Interface (AS-i slave failure, AS-i Power Failure) during operation, it signals these errors by resetting the input data of the affected slave and by setting the corresponding bit in the error register in the SM area (Special Memory). The SM byte addresses depend on the slot of the CP 242-2.

Example:
The CP 242-2 is plugged in directly beside the S7-200 CPU. If an AS-i configuration error occurs in the protected mode, the CP 242-2 sets bits SM 9.0 and SM 11.0 (both bits provide the user with the same information: AS-i configuration error).

To obtain more detailed information (which slave has failed), you can read in the delta list via page 1 of the analog input area (see Section 3.3).

☞ **Note that the operating system of the S7-200 CPU does not always update the error register in the SM area before a program cycle. For this reason, it is possible that the input data of a slave are set to '0' although no error is signaled in the error register. If you require a consistent view of input data, error bits and the delta list, you can achieve this using the “Read Data and Delta Lists” command! (see Section 5.2.1.25)**

Example 2

The example applies to a CPU 212 with a CP 242-2 plugged in directly beside it:

```
NETWORK                    //Startup processing

LD    SM0.1                //if: first scan bit:
SI    Q1.7, 1              //PLC_RUN = 1
RI    Q1.0, 4              //Select page 0

NETWORK                    //AS-i diagnostics

LD    I1.1                 //if: CP_READY
CALL  2                    //then: AS-i diagnostics

NETWORK                    //End of main program

MEND
NETWORK                    //Begin SBR “AS-i diagnostics”

SBR   2
NETWORK                    //Read delta list

LD    SM0.0                //Always 1
=I    Q1.0                 //Select page 1
BMW   AIW0, VW816, 2       //Read delta list

NOT
=I    Q1.0                 //Select page 0

NETWORK                    //Examples of access to the delta list:

LD    V816.1               //If slave 1 failed
O     V819.7               //Or if slave 31 failed
=     Q0.0                 //Then CPU output bit = 1

NETWORK                    //End of SBR “AS-i diagnostics”
RET
```

5 Extended Operation

This section explains the range of functions available for the CP 242-2 over and above those provided by standard operation.

Extended operation allows the complete control of a CP 242-2 master from within the user program. Access to the inputs and outputs is the same as when the CP 242-2 is in standard operation.

5.1 How the Command Interface Functions

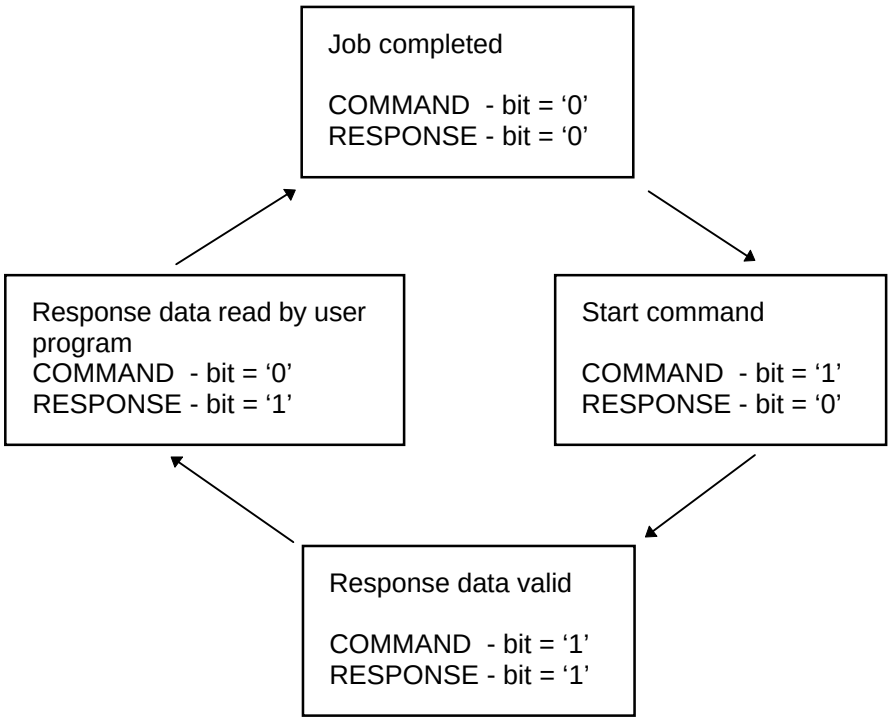
Command calls are made to the CP 242-2 from within the user program. The user specifies the command call in a command buffer and starts the job. The command buffer is in the analog output area of the CP 242-2 (for example starting at AQW0 if the CP 242-2 is plugged in directly beside the CPU 212).

Depending on the command to be executed (see Section 5.2), the job data occupy pages 2 to 5 in the analog output area of the CP 242-2. When the job is completed, the user is supplied with the job status and any possible response data in a response buffer.

The response buffer is in the analog input area of the CP 242-2 (for example starting at AIW0 if the CP 242-2 is plugged in directly beside a CPU 212). Depending on the command executed (see Section 5.2), the response data occupy pages 2 to 5 in the analog input area of the CP 242-2.

Example of a command sequence

The following status diagram shows the sequence of command execution:



Requirements

➢ The PLC_RUN bit is set to '1' in the control byte of the CP 242-2.

➢ By setting the CP_READY bit in the status byte to '1', the CP 242-2 signals that it is ready to execute commands.

☞ **If CP_READY is set to '0', no AS-i program execution is possible.**

Sequence

✔ A command is only accepted when the COMMAND and RESPONSE bit are reset.

✔ Write the job data for the required command to the analog output area. Depending on the command, the job data occupy pages 2 to 5.

✔ Set the COMMAND bit and start execution of the command.

✔ Read the RESPONSE bit.
If this bit is set, the CP 242-2 has completely executed the job and has entered valid response data in the analog input area.

✔ Read the response data.
Depending on the command that was executed, the response data occupy pages 2 to 5 in the analog input area of the CP 242-2.

✔ Reset the COMMAND bit in the control byte of the CP 242-2.

☞ ➢ **Commands started by the CP 242-2 are executed completely regardless of the state of the COMMAND bit.**

➢ **The RESPONSE bit is only reset when the COMMAND bit was set to '0'**

➢ **Byte 1 of the response data (command status) indicates whether or not a command was completed correctly or whether errors occurred.**

Example 3
The following example applies to a CPU 212 with a CP 242-2 plugged in directly beside it.

The example shows the sequence of the Read_Lists_and_Flags command. The execution of the command is triggered by the rising edge at input I0.0. To simplify the program, 64 bytes are always transferred to the CP 242-2. When the response is read in from the CP 242-2, 64 bytes are also transferred.

```
NETWORK      //Startup processing

LD    SM0.1                 //if: first scan bit:
SI    Q1.7, 1               //PLC_RUN = 1
RI    Q1.0, 4               //Select page 0

NETWORK                     //AS-i command execution

LD    I1.1                  //if: CP_READY
MOVW  16#1000, VW932        //Enter "read lists" code
CALL  3                     //then: SBR 3

NETWORK                     //End of main program
```

```
MEND
NETWORK                 //Begin SBR “AS-i command execution”

SBR  3

NETWORK                 //Transfer of the command data

LD   I0.0               //If {trigger bit
EU                      //pos. edge
UN   Q1.6               //CP command bit
UN   I1.6               //CP response bit}
                        //Then{
SI   Q1.1, 1            //Select page 2
BMW  VW932, AQW0, 8     //V memory -> page
SI   Q1.0, 1            //Select page 3
BMW  VW948, AQW0, 8     //V memory -> page
SI   Q1.2, 1            //Select page 4
RI   Q1.0, 2            //Select page 4
BMW  VW964, AQW0, 8     //V memory -> page
SI   Q1.0, 1            //Select page 5
BMW  VW980, AQW0, 8     //V memory -> page
RI   Q1.0, 4            //Select page 0
SI   Q1.6, 1            //CP command bit=1}

NETWORK                 //Transfer the response data

LD   Q1.6               //If {CP command bit
U    I1.6               //CP response bit}
                        //Then{
SI   Q1.1, 1            //Select page 2
BMW  AIW0, VW832, 8     //Page -> V memory
SI   Q1.0, 1            //Select page 3
BMW  AIW0, VW848, 8     //Page -> V memory
SI   Q1.2, 1            //Select page 4
RI   Q1.0, 2            //Select page 4
BMW  AIW0, VW864, 8     //Page -> V memory
SI   Q1.0, 1            //Select page 5
BMW  AIW0, VW880, 8     //Page -> V memory
RI   Q1.0, 4            //Select page 0
RI   Q1.6, 1            //CP command bit=0}

NETWORK                 //End of SBR “AS-i command execution”
RET
```

5.2 Description of the AS-i Commands

The following sections describe the AS-i command calls that can be sent by the S7-200 system to the CP 242-2. With these command calls, the CP 242-2 provides the complete functionality of the M1 master profile of the AS-i master specification. In addition to this, the CP 242-2 can be configured completely using command calls by the S7-200 system.

5.2.1 Commands Supported by the CP 242-2

How to use the jobs is explained in the descriptions of the individual jobs, the “AS-Interface Introduction and Basic Information” manual, the PICS appendix and the detailed explanations in /1/ and /2/.

The commands that can be executed are listed in the following table:

Section	Name	Parameter	Return	Coding:
5.2.1.1	Set_Permanent_Parameter	Slave address, parameter		0 0 H
5.2.1.2	Get_Permanent_Parameter	Slave address	Parameter	0 1 H
5.2.1.3	Write_Parameter	Slave address, parameter	Parameter echo (optional)	0 2 H
5.2.1.4	Read_Parameter	Slave address	Parameter value	0 3 H
5.2.1.5	Store_Actual_Parameters	none		0 4 H
5.2.1.6	Set_Permanent_Configuration	Slave address, configuration		0 5 H
5.2.1.7	Get_Permanent_Configuration	Slave address	Project. configuration data	0 6 H
5.2.1.8	Store_Actual_Configuration	none		0 7 H
5.2.1.9	Read Actual Configuration Data	Slave address	Actual configuration data	0 8 H
5.2.1.10	Set_LPS	LPS		0 9 H
5.2.1.11	Set_Offline_Mode	Mode		0 A H
5.2.1.12	Select Autoprogramming	Mode		0 B H
5.2.1.13	Set_Operation_Mode	Mode		0 C H
5.2.1.14	Change_Slave_Address	Address 1, ...2		0 D H
5.2.1.15	Read Slave Status	Slave address	Error record of the slave	0 F H
5.2.1.16	Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags)	none	LDS,LAS,LPS,flags	1 0 H
5.2.1.17	Read Total Configuration		Actual configuration data actual parameters LAS, flags	1 9 H
5.2.1.18	Configure Total System	Total configuration		1 A H
5.2.1.19	Write Parameter List	Parameter list		1 C H
5.2.1.20	Read Parameter Echo List	none	Parameter echo list	1 3 H
5.2.1.21	Read Version ID	none	Version string	1 4 H
5.2.1.22	Read and Delete Slave Status	Slave address	Error record of the slave	1 6 H
5.2.1.23	Read Slave ID	Slave address	ID code	1 7 H
5.2.1.24	Read Slave I/O	Slave address	I/O configuration	1 8 H
5.2.1.25	Read Data and Delta List	none	Error bits, input data delta list	1 D H

Table 5-2 Overview of the Command Jobs

General structure of the command buffer

Page	Byte	Meaning / Content
2	0	Command number
2	1	Parameter for job
2	2	Parameter for job
2	3	Parameter for job
2	4	Parameter for job
2	5	Parameter for job
2	6	Parameter for job
2	7	Parameter for job
2	8	Parameter for job
2	9	Parameter for job
2	10	Parameter for job
2	11	Parameter for job
2	12	Parameter for job
2	13	Parameter for job
2	14	Parameter for job
2	15	Parameter for job
3	0	Parameter for job
3	:	Parameter for job
3	15	Parameter for job
4	0	Parameter for job
4	:	Parameter for job
4	15	Parameter for job
5	0	Parameter for job
5	:	Parameter for job
5	15	Parameter for job

☞ **The command buffer can extend over a maximum of 4 pages (2 to 5) with a maximum of 64 bytes depending on the command.**

General structure of the response buffer:

Page	Byte	Meaning / Content
2	0	Command number (echo)
2	1	Command status
2	2	Response data
2	3	Response data
2	4	Response data
2	5	Response data
2	6	Response data
2	7	Response data
2	8	Response data
2	9	Response data
2	10	Response data
2	11	Response data
2	12	Response data
2	13	Response data
2	14	Response data
2	15	Response data
3	0	Response data
3	:	Response data
3	15	Response data
4	0	Response data
4	:	Response data
4	15	Response data
5	0	Response data
5	:	Response data
5	15	Response data

☞ **The response buffer can extend over a maximum of 4 pages (2 to 5) and a maximum of 64 bytes depending on the command.**

Meaning of the command status in the response buffer:

Value	Meaning
00H	Job completed without error
81H	Slave address incorrect
82H	Slave is not activated (not in LAS)
83H	Error on the AS-Interface
84H	Command not permitted in the current state of the CP 242-2
85H	Slave 0 exists
A1H	Slave with address to be modified not found on AS-Interface
A2H	Slave 0 exists
A3H	Slave with new address already exists on AS-Interface
A4H	Slave address cannot be deleted
A5H	Slave address cannot be set
A6H	Slave address cannot be permanently stored
F8H	Job number or job parameter unknown
F9H	EEPROM error

5.2.1.1 Set_Permanent_Parameter

Meaning

With this call, a parameter value for the specified slave is transferred to the CP 242-2. The value is saved permanently as a configured value.

The parameter is **not** transferred immediately to the slave by the CP 242-2. The parameter value is only transferred after the power supply of the PLC is turned on and the slave is activated.

Structure of the Command Buffer

Page	Byte	Meaning			
		Bit 7	Bit 4	Bit 3	Bit 0
2	0	00H			
2	1	Slave address			
2	2	irrelevant		Parameter	

Structure of the Response Buffer

Page	Byte	Meaning
2	0	00H
2	1	Command status

5.2.1.2 Get_Permanent_Parameter

Meaning

With this call, a slave-specific parameter value stored on the EEPROM of the CP 242-2 is read.

Structure of the Command Buffer

Page	Byte	Meaning
2	0	01H
2	1	Slave address

Structure of the Response Buffer

Page	Byte	Meaning			
		Bit 7	Bit 4	Bit 3	Bit 0
2	0	01H			
2	1	Command status			
2	2	irrelevant		Parameter	

5.2.1.3 Write_Parameter

Meaning

With this call, a parameter value is transferred and sent directly via the AS-i bus to the addressed slave. The parameter is saved only temporarily on the CP 242-2.

The slave transfers the current parameter value in the response. This can deviate from the values that have just been written according to the AS-i master specification (/2/). The slave response is entered in the parameter echo field.

Structure of the Command Buffer

Page	Byte	Meaning			
		Bit 7	Bit 4	Bit 3	Bit 0
2	0	02H			
2	1	Slave address			
2	2	irrelevant		Parameter	

Structure of the Response Buffer

Page	Byte	Meaning			
		Bit 7	Bit 4	Bit 3	Bit 0
2	0	02H			
2	1	Command status			
2	2	irrelevant		Parameter echo	

5.2.1.4 Read_Parameter

Meaning

This call returns the current parameter value (actual parameter) of a slave.

Structure of the Command Buffer

Page	Byte	Meaning
2	0	03H
2	1	Slave address

Structure of the Response Buffer

Page	Byte	Meaning			
		Bit 7	Bit 4	Bit 3	Bit 0
2	0	03H			
2	1	Command status			
2	2	irrelevant		Parameter	

5.2.1.5 Store_Actual_Parameters

Meaning

This call overwrites the permanently stored configured parameters with the actual parameters, in other words the parameters are reconfigured.

Structure of the Command Buffer

Page	Byte	Meaning
2	0	04H

Structure of the Response Buffer

Page	Byte	Meaning
2	0	04H
2	1	Command status

5.2.1.6 Set_Permanent_Configuration

Meaning

This call configures the I/O configuration data and the ID code for the addressed AS-i slave. The data are stored permanently on the AS-i master CP.

☞ **When this command is executed, the CP 242-2 changes to the offline phase and then returns to normal operation (cold restart on the CP 242-2 and reset on all slaves).**

Structure of the Command Buffer

Page	Byte	Meaning			
		Bit 7	**Bit 4**	**Bit 3**	**Bit 0**
2	0	05H			
2	1	Slave address			
2	2	ID code		I/O configuration	

Structure of the Response Buffer

Page	Byte	Meaning
2	0	05H
2	1	Command status

5.2.1.7 Get_Permanent_Configuration

Meaning

This call returns the desired configuration data of an addressed slave stored permanently in the EEPROM (I/O configuration data and the ID codes).

Structure of the Command Buffer

Page	Byte	Meaning
2	0	06H
2	1	Slave address

Structure of the Response Buffer

Page	Byte	Meaning	
		Bit 7 ... Bit 4	**Bit 3 ... Bit 0**
2	0	06H	
2	1	Command status	
2	2	ID code	I/O configuration

5.2.1.8 Store_Actual_Configuration

Meaning

This call stores the actual I/O configuration data and actual ID codes of all AS-i slaves permanently on the EEPROM as desired configuration data. The list of activated slaves (LAS) is also entered in the list of configured slave (LPS).

☞ **When executing this command, the CP 242-2 changes to the offline phase and then switches to the normal mode (cold restart on the CP 242-2).**

The call in **not** executed in the protected mode.

Structure of the Command Buffer

Page	Byte	Meaning
2	0	07H

Structure of the Response Buffer

Page	Byte	Meaning
2	0	07H
2	1	Command status

5.2.1.9 Read Actual Configuration Data

This call returns the actual I/O configuration data and actual ID codes of an addressed slave detected on the AS-i.

Structure of the Command Buffer

Page	Byte	Meaning
2	0	08H
2	1	Slave address

Structure of the Response Buffer

Page	Byte	Meaning	
		Bit 7 ... Bit 4	**Bit 3 ... Bit 0**
2	0	08H	
2	1	Command status	
2	2	ID code	I/O configuration

5.2.1.10 Set_LPS

Meaning

With this call, the list of configured slaves is transferred for permanent storage in the EEPROM.

☞ **When executing this command, the CP 242-2 changes to the offline phase and then switches to the normal mode (cold restart on the CP 242-2 and reset on all slaves).**

This call is **not** executed in the protected mode.

Structure of the Command Buffer

Page	Byte	Meaning							
		Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
2	0	09H							
2	1	00H							
2	1	slave 0	slave 1	slave 2	slave 3	slave 4	slave 5	slave 6	slave 7
2	2	slave 8	slave 9	slave 10	slave 11	slave 12	slave 13	slave 14	slave 15
2	3	slave 16	slave 17	slave 18	slave 19	slave 20	slave 21	slave 22	slave 23
2	4	slave 24	slave 25	slave 26	slave 27	slave 28	slave 29	slave 30	slave 31

Structure of the Response Buffer

Page	Byte	Meaning
2	0	09H
2	1	Command status

5.2.1.11 Set_Offline_Mode

Meaning

This call switches between the online and offline mode.

The OFFLINE bit is **not** permanently stored, in other words, during the startup/restart the bit is set to ONLINE again.

In the offline mode, the CP 242-2 only processes jobs from the user. There is no cyclic data exchange.

The **online mode** is the normal situation with the AS-i master. Here, the following jobs are processed cyclically:

- During the data exchange phase, the fields of the output data are transferred to the slave outputs for all slaves in the LAS. The addressed slaves transfer the values of the slave inputs to the master when the transfer was free of errors.
- This is followed by the inclusion phase in which there is a search for the slaves connected to the AS-i and newly added slaves are entered in the LDS or LAS.
- In the management phase, jobs from the user such as writing parameters are executed.

Structure of the Command Buffer

Page	Byte	Meaning	
		Bit 7 **Bit 1**	**Bit 0**
2	0	0AH	
2	1	reserved	Mode (0=online 1=offline)

Structure of the Response Buffer

Page	Byte	Meaning
2	0	0AH
2	1	Command status

5.2.1.12 Select Autoprogramming

Meaning

With this call, the automatic address programming function can be enabled or disabled.

The **AUTOADDRESS_ENABLE** bit is stored permanently.

Structure of the Command Buffer

Page	Byte	Meaning	
		Bit 7 **Bit 1**	**Bit 0**
2	0	0BH	
2	1	reserved	Mode (1=Autoprog allowed 0=Autoprog disabled)

Structure of the Response Buffer

Page	Byte	Meaning
2	0	0BH
2	1	Command status

5.2.1.13 Set_Operation_Mode

With this call, you can select between the configuration mode and the protected mode.

In the **protected mode**, only slaves marked in the LPS and whose desired and actual configuration match are activated, in other words if the I/O configuration and the identification codes of the slaves in the LDS are identical to those of the configured values.

In the **configuration mode**, all detected slaves (except slave address “0”) are activated. This also applies to slaves for which there is a difference between the desired and actual configuration. The OPERATION MODE bit is saved permanently in the EEPROM, i.e. it is retained following a startup/warm restart.

When changing from the configuration mode to the protected mode, the CP 242-2 is restarted (transition to the offline phase followed by switchover to the online mode).

☞ **If the address 0 is entered in the LDS for a slave, the CP 242-2 cannot switch from the configuration mode to the protected mode.**

Structure of the Command Buffer

Page	Byte	Meaning		
		Bit 7	**Bit 1**	**Bit 0**
2	0	0CH		
2	1	reserved		Mode (0=protected mode 1=configuration mode)

Structure of the Response Buffer

Page	Byte	Meaning
2	0	0CH
2	1	Command status

5.2.1.14 Change_Slave_Address

Meaning

With this call, the slave address can be changed.

This call is mainly used to add a new AS-i slave with the default address 0 to the AS-Interface. In this case, the address is changed from the old slave address (0) to the new slave address.

This change can only be made when the following conditions are fulfilled:

- A slave with the *old slave address* exists.
- If the old slave address is not equal to 0, then a slave with address 0 cannot be connected at the same time.
- The *new slave address* must have a valid value.
- No slave with the *new slave address* must already exist.

Note: When changing the slave address, the slave is not reset, in other words the output data of the slave are retained until new data arrive for the new address.

Structure of the Command Buffer

Page	Byte	Meaning
2	0	0DH
2	1	Old slave address
2	2	New slave address

Structure of the Response Buffer

Page	Byte	Meaning
2	0	0DH
2	1	Command status

5.2.1.15 Read Slave Status

Meaning

With this call, the status register of the addressed slave can be read out. The flags of the status register have the following significance:

S0 "Address volatile"
This flag is set
- when the internal slave routine for permanent storage of the slave address is active. This can take up to 15 ms and must not be interrupted by a further addressing call.
- when the internal slave address comparison recognizes that the stored address is not the same as the entry in the address register.

S1 "Parity error detected"
This flag is set when the slave has recognized a parity error in a received frame since the last "read and delete status" job.

S2 "End bit error detected"
This flag is set when the slave has recognized an end bit error in a received frame since the last "read and delete status" job.

S3 "Read error non-volatile memory"
This flag is set when a read error has occurred when reading the non-volatile memory.

Structure of the Command Buffer

Page	Byte	Meaning
2	0	0FH
2	1	Slave address

Structure of the Response Buffer

Page	Byte	Meaning				
		Bit 7 Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2	0	0FH				
2	1	Command status				
2	2	reserved	S 3	S 2	S 1	S 0

5.2.1.16 Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags)

Meaning

With this call, the following entries are read out of the AS-i master CP 242-2:

- the list of configured slaves
- the list of active slaves LAS
- the list of detected slaves LDS
- the flags according to the AS-i specification

Structure of the Command Buffer

Page	Byte	Meaning
2	0	10H

Structure of the Response Buffer

Page	Byte	Meaning							
		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2	0	10H							
2	1	Command status							
2	2	LAS slave 0	LAS slave 1	LAS slave 2	LAS slave 3	LAS slave 4	LAS slave 5	LAS slave 6	LAS slave 7
2	3	LAS slave 8	LAS slave 9	LAS slave 10	LAS slave 11	LAS slave 12	LAS slave 13	LAS slave 14	LAS slave 15
2	4	LAS slave 16	LAS slave 17	LAS slave 18	LAS slave 19	LAS slave 20	LAS slave 21	LAS slave 22	LAS slave 23
2	5	LAS slave 24	LAS slave 25	LAS slave 26	LAS slave 27	LAS slave 28	LAS slave 29	LAS slave 30	LAS slave 31
2	6	LDS slave 0	LDS slave 1	LDS slave 2	LDS slave 3	LDS slave 4	LDS slave 5	LDS slave 6	LDS slave 7
2	7	LDS slave 8	LDS slave 9	LDS slave 10	LDS slave 11	LDS slave 12	LDS slave 13	LDS slave 14	LDS slave 15
2	8	LDS slave 16	LDS slave 17	LDS slave 18	LDS slave 19	LDS slave 20	LDS slave 21	LDS slave 22	LDS slave 23
2	9	LDS slave 24	LDS slave 25	LDS slave 26	LDS slave 27	LDS slave 28	LDS slave 29	LDS slave 30	LDS slave 31
2	10	LPS slave 0	LPS slave 1	LPS slave 2	LPS slave 3	LPS slave 4	LPS slave 5	LPS slave 6	LPS slave 7
2	11	LPS slave 8	LPS slave 9	LPS slave 10	LPS slave 11	LPS slave 12	LPS slave 13	LPS slave 14	LPS slave 15
2	12	LPS slave 16	LPS slave 17	LPS slave 18	LPS slave 19	LPS slave 20	LPS slave 21	LPS slave 22	LPS slave 23
2	13	LPS slave 24	LPS slave 25	LPS slave 26	LPS slave 27	LPS slave 28	LPS slave 29	LPS slave 30	LPS slave 31
2	14	Flag 1							
2	15	Flag 2							

Flag 1

Bit Number	Meaning
0	OFFLINE_READY
1	APF
2	NORMAL_MODE
3	CONFIG_MODE
4	AUTO_ADDR_AVAIL
5	AUTO_ADDR_ASSIGN
6	LDS_0
7	CONFIG_OK

Flag 2

Bit Number	Meaning
0	OFFLINE
1	reserved
2	EEPROM_OK
3	AUTO_ADDR_ENABLE
4	reserved
5	reserved
6	reserved
7	reserved

Meaning of the Flags

OFFLINE_READY The flag is set when the offline phase is active.

APF This flag is set when the voltage on the AS-i cable is too low.

NORMAL_MODE This flag is set when the CP 242-2 is in the normal mode.

CONFIG_MODE The flag is set in the configuration mode and reset in the protected mode.

AUTO_ADDR_AVAIL This flag is set when the automatic address programming can be executed (in other words exactly one slave is currently out of operation).

AUTO_ADDR_ASSIGN This flag is set when the automatic address programming is possible (in other words AUTO_ADDR_ENABLE = 1 and there is or was no “incorrect” slave connected to the AS-i cable).

LDS_0 This flag is set when a slave exists with address 0.

CONFIG_OK This flag is set when the desired (configured) and actual configuration match.

OFFLINE This flag is set when the CP is to change to the OFFLINE mode or is already in this mode.

EEPROM_OK This flag is set when the test of the internal EEPROM did not detect any errors.

AUTO_ADDR_ENABLE This flag indicates whether the automatic address programming is enabled (BIT = 1) or disabled (BIT = 0) by the user.

5.2.1.17 Read Total Configuration

Meaning

With this command, the following data are read from the CP 242-2:

➢ The list of active slaves (LAS). This indicates which of the connected slaves are activated.

➢ The current configuration data of the connected slaves (I/O configuration and ID code).

➢ The current parameters of the slaves (actual parameters).

➢ The current flags.

This command can, for example, be used to find out the configuration of the stations connected to the AS-i cable after installation. The configuration data that are read in can, if necessary, be modified and saved as the desired configuration on the CP 242-2 using the command “configure total system” (see Section Configure Total System / 5.2.1.18).

Structure of the Command Buffer

Page	Byte	Meaning
2	0	19H

Structure of the Response Buffer

Page	Byte	Meaning							
		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2	0	19H							
2	1	Command status							
2	2	irrelevant	LAS slave 1	LAS slave 2	LAS slave 3	LAS slave 4	LAS slave 5	LAS slave 6	LAS slave 7
2	3	LAS slave 8	LAS slave 9	LAS slave 10	LAS slave 11	LAS slave 12	LAS slave 13	LAS slave 14	LAS slave 15
2	4	LAS slave 16	LAS slave 17	LAS slave 18	LAS slave 19	LAS slave 20	LAS slave 21	LAS slave 22	LAS slave 23
2	5	LAS slave 24	LAS slave 25	LAS slave 26	LAS slave 27	LAS slave 28	LAS slave 29	LAS slave 30	LAS slave 31
2	6	ID_CODE slave 0				I/O configuration slave 0			
2	7	ID_CODE slave 1				I/O configuration slave 1			
2	8	ID_CODE slave 2				I/O configuration slave 2			
2	9	ID_CODE slave 3				I/O configuration slave 3			
2	10	ID_CODE slave 4				I/O configuration slave 4			
2	11	ID_CODE slave 5				I/O configuration slave 5			
2	12	ID_CODE slave 6				I/O configuration slave 6			
2	13	ID_CODE slave 7				I/O configuration slave 7			
2	14	ID_CODE slave 8				I/O configuration slave 8			
2	15	ID_CODE slave 9				I/O configuration slave 9			
3	0	ID_CODE slave 10				I/O configuration slave 10			
3	1	ID_CODE slave 11				I/O configuration slave 11			
3	2	ID_CODE slave 12				I/O configuration slave 12			
3	3	ID_CODE slave 13				I/O configuration slave 13			
3	4	ID_CODE slave 14				I/O configuration slave 14			
3	5	ID_CODE slave 15				I/O configuration slave 15			

3	6	ID_CODE slave 16	I/O configuration slave 16
3	7	ID_CODE slave 17	I/O configuration slave 17
3	8	ID_CODE slave 18	I/O configuration slave 18
3	9	ID_CODE slave 19	I/O configuration slave 19
3	10	ID_CODE slave 20	I/O configuration slave 20
3	11	ID_CODE slave 21	I/O configuration slave 21
3	12	ID_CODE slave 22	I/O configuration slave 22
3	13	ID_CODE slave 23	I/O configuration slave 23
3	14	ID_CODE slave 24	I/O configuration slave 24
3	15	ID_CODE slave 25	I/O configuration slave 25
4	0	ID_CODE slave 26	I/O configuration slave 26
4	1	ID_CODE slave 27	I/O configuration slave 27
4	2	ID_CODE slave 28	I/O configuration slave 28
4	3	ID_CODE slave 29	I/O configuration slave 29
4	4	ID_CODE slave 30	I/O configuration slave 30
4	5	ID_CODE slave 31	I/O configuration slave 31
4	6	irrelevant	Parameter slave 1
4	7	Parameter slave 2	Parameter slave 3
4	8	Parameter slave 4	Parameter slave 5
4	9	Parameter slave 6	Parameter slave 7
4	10	Parameter slave 8	Parameter slave 9
4	11	Parameter slave 10	Parameter slave 11
4	12	Parameter slave 12	Parameter slave 13
4	13	Parameter slave 14	Parameter slave 15
4	14	Parameter slave 16	Parameter slave 17
4	15	Parameter slave 18	Parameter slave 19
5	0	Parameter slave 20	Parameter slave 21
5	1	Parameter slave 22	Parameter slave 23
5	2	Parameter slave 24	Parameter slave 25
5	3	Parameter slave 26	Parameter slave 27
5	4	Parameter slave 28	Parameter slave 29
5	5	Parameter slave 30	Parameter slave 31
5	6	Flag1	
5	7	Flag2	

The meaning of the flags is the same as for the read lists and flags job see Section 5.2.1.16

5.2.1.18 Configure Total System

Meaning

With this call, the desired total configuration is transferred to the CP 242-2 and saved on the CP 242-2 as the desired configuration. This configures the CP 242-2.

The following data are transferred:

- ➢ The list of configured slaves specifying the slaves that can be activated by the CP 242-2 in the protected mode.
- ➢ The list of configuration data specifying the ID codes and I/O configurations the slaves must have.
- ➢ The list of parameters saved in non-volatile memory on the CP. This is transferred to the slaves during the startup of the CP 242-2.
- ➢ The flags that determine the mode of the CP 242-2 after startup (in other words after the CP 242-2 has been synchronized).

Structure of the Command Buffer

Page	Byte	Meaning							
		Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
2	0	1AH							
2	1	reserved							
2	2	irrelevant	LPS slave 1	LPS slave 2	LPS slave 3	LPS slave 4	LPS slave 5	LPS slave 6	LPS slave 7
2	3	LPS slave 8	LPS slave 9	LPS slave 10	LPS slave 11	LPS slave 12	LPS slave 13	LPS slave 14	LPS slave 15
2	4	LPS slave 16	LPS slave 17	LPS slave 18	LPS slave 19	LPS slave 20	LPS slave 21	LPS slave 22	LPS slave 23
2	5	LPS slave 24	LPS slave 25	LPS slave 26	LPS slave 27	LPS slave 28	LPS slave 29	LPS slave 30	LPS slave 31
2	6	irrelevant				irrelevant			
2	7	ID_CODE slave 1				I/O configuration slave 1			
2	8	ID_CODE slave 2				I/O configuration slave 2			
2	9	ID_CODE slave 3				I/O configuration slave 3			
2	10	ID_CODE slave 4				I/O configuration slave 4			
2	11	ID_CODE slave 5				I/O configuration slave 5			
2	12	ID_CODE slave 6				I/O configuration slave 6			
2	13	ID_CODE slave 7				I/O configuration slave 7			
2	14	ID_CODE slave 8				I/O configuration slave 8			
2	15	ID_CODE slave 9				I/O configuration slave 9			
3	0	ID_CODE slave 10				I/O configuration slave 10			
3	1	ID_CODE slave 11				I/O configuration slave 11			
3	2	ID_CODE slave 12				I/O configuration slave 12			
3	3	ID_CODE slave 13				I/O configuration slave 13			
3	4	ID_CODE slave 14				I/O configuration slave 14			
3	5	ID_CODE slave 15				I/O configuration slave 15			
3	6	ID_CODE slave 16				I/O configuration slave 16			
3	7	ID_CODE slave 17				I/O configuration slave 17			
3	8	ID_CODE slave 18				I/O configuration slave 18			

3	9	ID_CODE slave 19	I/O configuration slave 19
3	10	ID_CODE slave 20	I/O configuration slave 20
3	11	ID_CODE slave 21	I/O configuration slave 21
3	12	ID_CODE slave 22	I/O configuration slave 22
3	13	ID_CODE slave 23	I/O configuration slave 23
3	14	ID_CODE slave 24	I/O configuration slave 24
3	15	ID_CODE slave 25	I/O configuration slave 25
4	0	ID_CODE slave 26	I/O configuration slave
4	1	ID_CODE slave 27	I/O configuration slave
4	2	ID_CODE slave 28	I/O configuration slave
4	3	ID_CODE slave 29	I/O configuration slave
4	4	ID_CODE slave 30	I/O configuration slave
4	5	ID_CODE slave 31	I/O configuration slave
4	6	irrelevant	Parameter slave 1
4	7	Parameter slave 2	Parameter slave 3
4	8	Parameter slave 4	Parameter slave 5
4	9	Parameter slave 6	Parameter slave 7
4	10	Parameter slave 8	Parameter slave 9
4	11	Parameter slave 10	Parameter slave 11
4	12	Parameter slave 12	Parameter slave 13
4	13	Parameter slave 14	Parameter slave 15
4	14	Parameter slave 16	Parameter slave 17
4	15	Parameter slave 18	Parameter slave 19
5	0	Parameter slave 20	Parameter slave 21
5	1	Parameter slave 22	Parameter slave 23
5	2	Parameter slave 24	Parameter slave 25
5	3	Parameter slave 26	Parameter slave 27
5	4	Parameter slave 28	Parameter slave 29
5	5	Parameter slave 30	Parameter slave 31
5	6	Flag1	
5	7	Flag2	

Structure of the Response Buffer

Page	Byte	Meaning
2	0	1AH
2	1	Command status

Flag 1

Name	Bit Number
RESERVED	0
RESERVED	1
RESERVED	2
CONFIG_MODE	3
RESERVED	4
RESERVED	5
RESERVED	6
RESERVED	7

Flag 2

Name	Bit Number
RESERVED	0
RESERVED	1
RESERVED	2
AUTO_ADDR_EN	3
RESERVED	4
RESERVED	5
RESERVED	6
RESERVED	7

Only the gray shaded flags can be modified:

CONFIG_MODE The entry ‘0’ means that the CP 242-2 starts up in the protected mode after synchronization. The entry ‘1’ means that the CP starts up in the configuration mode.

AUTO_ADDR_ENABLE ‘0’ means that the automatic address programming is disabled, ‘1’ means that the automatic address programming is enabled.

The values of the other flags are irrelevant for the “configure total system” command.

5.2.1.19 Write Parameter List

Meaning

With this command, the parameters for all slaves are transferred to the CP 242-2. The CP 242-2 transfers **only** the parameters **that have changed** to the slaves, in other words **that deviate from the current actual parameters**.

Structure of the Command Buffer

Page	Byte	Meaning							
		Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
2	0	1CH							
2	1	00H							
2	2	irrelevant				Parameter slave 1			
2	3	Parameter slave 2				Parameter slave 3			
2	4	Parameter slave 4				Parameter slave 5			
2	5	Parameter slave 6				Parameter slave 7			
2	6	Parameter slave 8				Parameter slave 9			
2	7	Parameter slave 10				Parameter slave 11			
2	8	Parameter slave 12				Parameter slave 13			
2	9	Parameter slave 14				Parameter slave 15			
2	10	Parameter slave 16				Parameter slave 17			
2	11	Parameter slave 18				Parameter slave 19			
2	12	Parameter slave 20				Parameter slave 21			
2	13	Parameter slave 22				Parameter slave 23			
2	14	Parameter slave 24				Parameter slave 25			
2	15	Parameter slave 26				Parameter slave 27			
3	0	Parameter slave 28				Parameter slave 29			
3	1	Parameter slave 30				Parameter slave 31			

Structure of the Response Buffer

Page	Byte	Meaning
2	0	1CH
2	1	Command status

5.2.1.20 Read Parameter Echo List

Meaning

When the parameters are transferred to the slave, they return “echo values” as the response. The read parameter echo list call reads out the echo values of all slaves.

Structure of the Command Buffer

Page	Byte	Meaning							
		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2	0	13H							

Structure of the Response Buffer

Page	Byte	Meaning	
2	0	13H	
2	1	Command status	
2	2	irrelevant	Parameter echo slave 1
2	3	Parameter echo slave 2	Parameter echo slave 3
2	4	Parameter echo slave 4	Parameter echo slave 5
2	5	Parameter echo slave 6	Parameter echo slave 7
2	6	Parameter echo slave 8	Parameter echo slave 9
2	7	Parameter echo slave 10	Parameter echo slave 11
2	8	Parameter echo slave 12	Parameter echo slave 13
2	9	Parameter echo slave 14	Parameter echo slave 15
2	10	Parameter echo slave 16	Parameter echo slave 17
2	11	Parameter echo slave 18	Parameter echo slave 19
2	12	Parameter echo slave 20	Parameter echo slave 21
2	13	Parameter echo slave 22	Parameter echo slave 23
2	14	Parameter echo slave 24	Parameter echo slave 25
2	15	Parameter echo slave 26	Parameter echo slave 27
3	0	Parameter echo slave 28	Parameter echo slave 29
3	1	Parameter echo slave 30	Parameter echo slave 31

5.2.1.21 Read Version ID

Meaning

With this call, the version ID of the AS-i master software is read out.

Structure of the Command Buffer

Page	Byte	Meaning
2	0	14H
2	1	Slave address

The reply of the CP 242-2 contains the name and the firmware version number of the CP 242-2 in the form shown below:

Structure of the Response Buffer

Page	Byte	Meaning
2	0	14H
2	1	Command status
2	2	C
2	3	P
2	4	
2	5	2
2	6	4
2	7	2
2	8	-
2	9	2
2	10	
2	11	V
2	12	x
2	13	.
2	14	y
2	15	y

x.yy stands for the current version number of the CP 242-2 firmware.

5.2.1.22 Read and Delete Slave Status

Meaning

With this call, the status of a slave is read out and at the same time the status register of the slave is deleted.
The flags of the status register have the following meaning:

S0 "Address volatile"
This flag is set
- when the internal slave routine for permanent storage of the slave address is active. This can take up to 15 ms and must not be interrupted by a further addressing call.
- when the internal slave address comparison recognizes that the stored address is not the same as the entry in the address register.

S1 "Parity error detected"
This flag is set when the slave has recognized a parity error in a received frame since the last "read and delete status" job.

S2 "End bit error detected"
This flag is set when the slave has recognized an end bit error in a received frame since the last "read and delete status" job.

S3 "Read error non-volatile memory"
This flag is set when a read error has occurred when reading the non-volatile memory.

Structure of the Command Buffer

Page	Byte	Meaning
2	0	16H
2	1	Slave address

Structure of the Response Buffer

Page	Byte	Meaning				
		Bit 7 Bit 4	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
2	0	16H				
2	1	Command status				
2	2	reserved	S 3	S 2	S 1	S 0

5.2.1.23 Read Slave ID

Meaning

With this call, the ID code of a slave can be read out directly over the AS-i cable. The call is intended for diagnostic purposes and is not required in the normal master mode.

Structure of the Command Buffer

Page	Byte	Meaning
2	0	17H
2	1	Slave address

Structure of the Response Buffer

Page	Byte	Meaning			
		Bit 7	**Bit 4**	**Bit 3**	**Bit 0**
2	0	17H			
2	1	Command status			
2	2	reserved		Slave ID	

5.2.1.24 Read Slave I/O

Meaning

With this call, the I/O configuration of a slave can be read out directly over the AS-i cable. The call is intended for diagnostic purposes and is not required in the normal master mode.

Structure of the Command Buffer

Page	Byte	Meaning
2	0	18H
2	1	Slave address

Structure of the Response Buffer

Page	Byte	Meaning			
		Bit 7	**Bit 4**	**Bit 3**	**Bit 0**
2	0	18H			
2	1	Command status			
2	2	reserved		Slave I/O	

5.2.1.25 Read Data and Delta List

Meaning

With this call, the error bits, the input data of the AS-i slaves and the delta list can be read out consistently.

Structure of the Command Buffer

Page	Byte	Meaning
2	0	1DH

Structure of the Response Buffer

Page	Byte	Meaning							
		Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
2	0	1DH							
2	1	Command status							
2	2	APF	CER	0	0	Data slave 1			
2	3	Data slave 2				Data slave 3			
2	4	Data slave 4				Data slave 5			
2	5	Data slave 6				Data slave 7			
2	6	Data slave 8				Data slave 9			
2	7	Data slave 10				Data slave 11			
2	8	Data slave 12				Data slave 13			
2	9	Data slave 14				Data slave 15			
2	10	Data slave 16				Data slave 17			
2	11	Data slave 18				Data slave 19			
2	12	Data slave 20				Data slave 21			
2	13	Data slave 22				Data slave 13			
2	14	Data slave 24				Data slave 25			
2	15	Data slave 26				Data slave 27			
3	0	Data slave 28				Data slave 29			
3	1	Data slave 30				Data slave 31			
3	2	Delta slave 7	Delta slave 6	Delta slave 5	Delta slave 4	Delta slave 3	Delta slave 2	Delta slave 1	Delta slave 0
3	3	Delta slave 15	Delta slave 14	Delta slave 13	Delta slave 12	Delta slave 11	Delta slave 10	Delta slave 9	Delta slave 8
3	4	Delta slave 23	Delta slave 22	Delta slave 21	Delta slave 20	Delta slave 19	Delta slave 18	Delta slave 17	Delta slave 16
3	5	Delta slave 31	Delta slave 30	Delta slave 29	Delta slave 28	Delta slave 27	Delta slave 26	Delta slave 25	Delta slave 24

The meaning of the error bits APF and CER is the same as in the error register (see 3.2).

6 Replacing a Defective Slave / Automatic Address Programming

If the indicator AUP is lit in the protected mode, it indicates the following:

➢ Exactly **one** slave has failed.

➢ Automatic address programming by the CP 242-2 is possible.

You can now replace the defective slave as follows:

✔ Remove the failed slave from the AS-i cable. You can identify the failed slave simply by the flashing LED assigned to the slave in the front panel display. First, press the DISPLAY button to change the display of the CP 242-2 from the status display to the slave display. The first group of 5 slaves is displayed. By repeatedly pressing the DISPLAY button, you can display the remaining slave groups one after the other.

✔ Replace the defective slave with an identical slave with address 0 (as supplied). The CP 242-2 then programs this slave with the address of the original station that had failed.

The “AUP” indicator then goes off. The CP 242-2 indicates the new slave in the LED display.

☞ **Note that “automatic address programming” is only possible when:**

➢ **The “AUTO_ADDRESS_ENABLE” flag is set to 1.**

➢ **The CP 242-2 is in the protected mode.**

➢ **Only one slave has failed.**

7 Error Indicators of the CP 242-2 / Dealing with Errors

The following table lists the possible causes of errors that can occur when operating the CP 242-2 and how to remedy the problem.

Error	Possible Cause	Remedy
APF indicator lit.	The AS-i power supply unit is not connected or is defective.	Check the connection of the AS-i power supply unit; if necessary replace the power supply unit.
	Power requirements of the AS-i slave too high.	Check the power requirements of the AS-i slaves. If necessary, supply the slaves with power externally.
SF lights up without pressing the SET button	The CP 242-2 is in the protected mode and an AS-i configuration error has occurred (for example slave failure)	Eliminate the configuration error.
	The CP 242-2 is defective. Internal EEPROM error.	Replace the CP 242-2.
SF is lit when the SET button is pressed.	A slave with address 0 exists when there is a change to the protected mode.	Remove the slave with address 0 from the AS-i cable.
CER is lit permanently.	The CP 242-2 has not yet been configured.	Configure the CP 242-2 using the mode button on the front panel.
	A configured slave has failed (evaluate “ACTIVE SLAVES” display).	Replace the defective slave or configure the CP 242-2 again if the slave is not required.
	An unconfigured slave was connected to the AS-i cable.	Remove the slave or reconfigure the CP 242-2.
	A slave has been connected whose configuration data (I/O configuration, ID code) do not match the values of the configured slaves.	Check whether the wrong slave has been connected. If necessary, reconfigure the CP 242-2.
CER display flickers, in other words a configured slave is lost sporadically.	Bad electrical connection.	Check the electrical connections of the AS-i slaves.
	Interference on the AS-i cable.	Check the correct grounding of the PLC and check the AS-i cable. **Check that the shield of the AS-i power supply unit is connected correctly**.
The CP 242-2 does not switch from the configuration mode to the protected mode.	The PLC is in the “RUN” mode.	Switch the PLC to “STOP”. This sets the PLC_RUN bit to ‘0’.
	SET button nor pressed long enough.	Press the button for at least half a second.
	A slave with address 0 is connected to the AS-i cable. The CP 242-2 cannot change to the protected mode as long as this slave exists.	Remove the slave with address 0.
The CP 242-2 does not switch from a protected mode to the configuration mode.	The PLC is in the “RUN” mode	Switch the PLC to “STOP”. This sets the PLC_RUN bit to ‘0’.
	Button not pressed long enough	Press the button for at least half a second.

Error	Possible Cause	Remedy
The “AUP” display remains unlit after the failure of a slave.	The CP 242-2 is in the configuration mode.	“Automatic programming” is not possible in the configuration mode. Program the address of the new slave with the address programming device.
	More than one slave has failed.	Check the AS-i cable. If “APF” is displayed at the same time, check the power supply on the AS-i cable. If more than one slave is defective, program the address of the replaced slaves with the address programming device.
	The CP 242-2 has detected non-configured slaves.	Remove the non-configured slaves from the AS-i cable.
	The AUTO_ADDRESS_ENABLE flag is not set.	Set the bit with the appropriate commands or by pressing the SET button during AS-i Power Fail.
Automatic address programming is unsuccessful although the “AUP” display is lit.	The configuration data (I/O configuration, ID code) of the replaced slaves do not match the values of the original slaves.	Check whether the correct “replacement slave” was used. Compare the information from the manufacturer about configuration data. If you want to replace the original slave with a different type, assign the address with the address programming device and reconfigure the CP 242-2 (for example by pressing the SET button).
	Replaced slave does not have the address “zero”	Set the address of the replaced slave using the address programming device.
	Replaced slave is not correctly connected or is defective.	Check the connections of the slaves; if necessary, replace the slave.
“CER” LCD and the LEDs of active slaves flicker irregularly.	An extender is installed in the AS-Interface with “Line1” and “Line2” connections reversed.	Correct the connections to the extender.

Table 7-1 Error Indications on the CP 242-2

A AS-Interface Protocol Implementation Conformance Statement (PICS)

A.1 PICS for CP 242-2

Vendor	Siemens AG
Product Name	CP 242-2 - AS-i master module CP 242-2 for SIMATIC S7-200
Order Number	6GK7242-2AX00-0XA0
Version	1
Master Profile	M1
Date	29.2.1997

List of Master Functions Available

No.	Function or Call on the Host Interface (symbolic representation)	M1	Comment / Function implemented by / Section
1	Image, Status = Read_IDI()	X	By the controller accessing the I/O interface of the CP 242-2
2	Status = Write_ODI(Image)	X	By the controller accessing the I/O interface of the CP 242-2
3	Status = Set_Permanent_Parameter(Addr, Param)	X	Set_Permanent_Parameter / 5.2.1.1
4	Param, Status = Get_Permanent_Parameter(Addr)	X	Get_Permanent_Parameter / 5.2.1.2
5	Status, GParam = Write_Parameter(Addr, Param)	X	Write_Parameter / 5.2.1.3
6	Status, Param = Read_Parameter(Addr)	X	Read_Parameter / 5.2.1.4
7	Status = Store_Actual_Parameters()	X	Store_Actual_Parameters / 5.2.1.5
8	Status = Set_Permanent_Configuration(Addr, Config)	X	Set_Permanent_Configuration / 5.2.1.6
9	Status, Config = Get_Permanent_Configuration(Addr)	X	Get_Permanent_Configuration / 5.2.1.7
10	Status = Store_Actual_Configuration()	X	(By pressing SET button or with a command) Store_Actual_Configuration / 5.2.1.8. Command also triggers cold restart on CP 242-2.
11	Status, Config = Read_Actual_Configuration(Addr)	X	Read Actual Configuration Data / 5.2.1.9
12	Status = Set_LPS(List31)	X	Set_LPS / 5.2.1.10
13	Status, List31 = Get_LPS()	X	Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) / 5.2.1.16
14	Status, List31 = Get_LAS()	X	Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) / 5.2.1.16

No.	Function or Call on the Host Interface (symbolic representation)	M1	Comment / Function implemented by / Section
15	Status, List32 = Get_LDS()	X	Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) / 5.2.1.16
16.0	Status = Get_Flags()	X	Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) / 5.2.1.16
16.1	Status, Flag = Get_Flag_Config_OK()	X	Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) / 5.2.1.16
16.2	Status, Flag = Get_Flag_LDS.0()	X	Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) / 5.2.1.16
16.3	Status, Flag = Get_Flag_Auto_Address_Assign()	X	Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) / 5.2.1.16
16.4	Status, Flag = Get_Flag_Auto_Prog_Available()	X	Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) / 5.2.1.16
16.5	Status, Flag = Get_Flag_Configuration_Active()	X	Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) / 5.2.1.16
16.6	Status, Flag = Get_Flag_Normal_Operation_Active()	X	Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) / 5.2.1.16
16.7	Status, Flag = Get_Flag_APF()	X	Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) / 5.2.1.16
16.8	Status, Flag = Get_Flag_Offline_Ready()	X	Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) / 5.2.1.16
17	Status = Set_Operation_Mode(Mode)	X	(By pressing the SET button or with a command) Set_Operation_Mode / 5.2.1.13
18	Status = Set_Offline_Mode(Mode)	X	Set_Offline_Mode / 5.2.1.11
19	Status = Activate_Data_Exchange(Mode)	-	not implemented
20	Status = Change_Slave_Address(Addr1, Addr2)	X	Read Slave I/O / 5.2.1.24
21	Status = Set_Auto_Address_Enable	X	Select Autoprogramming / 5.2.1.12
22	Status = Get_Auto_Address_Enable	X	Read Lists and Flags (Get_LPS, Get_LAS, Get_LDS, Get_Flags) / 5.2.1.16
23.1	Status, Resp = Cmd_Reset_ASI_Slave(Addr, RESET)	-	not implemented
23.2	Status, Resp = Cmd_Read_IO_Configuration(Addr, CONF)	X	Read Slave I/O / 5.2.1.24
23.3	Status, Resp = Cmd_Read_Identification_Code(Addr, IDCOD)	X	Read Slave ID / 5.2.1.23
23.4	Status, Resp = Cmd_Read_Status(Addr, STAT)	X	Read Slave Status / 5.2.1.15
23.5	Status, Resp = Cmd_Read_Reset_Status(Addr, STATRES)	X	Read and Delete Slave Status / 5.2.1.22

Symbols in column 3

Symbol	Meaning
X	Function exists
	Function does not exist

How the AS-i Cycle Depends on the Number of Connected Slaves

The following table shows how the AS-i cycle time depends on the number of connected slaves.

Number of slaves	1	2	3	4	5	6	7	8
Cycle time in µs	307	459	609	762	914	1066	1218	1369

Number of slaves	9	10	11	12	13	14	15	16
Cycle time in µs	1521	1673	1825	1977	2129	2280	2432	2584

Number of slaves	17	18	19	20	21	22	23	24
Cycle time in µs	2736	2888	3041	3193	3345	3497	3649	3802

Number of slaves	25	26	27	28	29	30	31
Cycle time in µs	3954	4105	4258	4410	4562	4714	4866

The specified times apply assuming that no frames are repeated, there are no management calls and all slaves are synchronized.

B References

/1/ AS-Interface Das Aktuator-Sensor-Interface für die Automation

Werner Kriesel, O.W. Madelung, Carl Hanser Verlag München Wien 1994

/2/ AS-Interface Complete Specification

can be ordered from the ASI Association e.V.

Address

AS-International Association e.V.
Manager: Dr. Otto W. Madelung
Auf den Broich 4A
D - 51519 Odenthal
Germany

Tel.: +49 - 2174 - 40756
Fax.: +49 - 2174 - 41571

(The AS-i technology is promoted by the ASI Association e. V.)

/3/ SIMATIC NET Industrial Communications Networks

Catalog IK 10

The catalog can be ordered from your local SIEMENS branch office or distributor.

/4/ S7-200 Programmable Controller
Hardware and Installation

The manual can be ordered from your local SIEMENS branch office or distributor.

/5/ Profibus & AS-Interface
Components on the Field Bus
Catalog ST PI

The catalog can be ordered from your local SIEMENS branch office or distributor.

C Abbreviations and Glossary

AS-i	Actuator-Sensor-Interface
APF	ASI Power Fail. Flag or LED display indicating that the power supply on the AS-i cable is too low or has failed (e.g. AS-i power unit defective)
CP	Communications Processor: communications module for installation in computers and programmable controllers.
CPU	Central Processing Unit
LAS	List of activated slaves
LDS	List of detected slaves
LPS	List of configured (permanent) slaves
PG	Programming device
PLC	Programmable logic controller, for example SIMATIC S7-200
SIMATIC NET	Previously SINEC, product range for industria communication from Siemens
SM	Special Memory on the S7-200 CPU

D Notes on the CE Label

Product name: CP 242-2 6GK7242-2AX00-0XA0

EU directive EEC 89/336/EEC

The product listed above meets the requirements of the EU directive 89/336/EEC “Electromagnetic Compatibility”.

CE

The EU conformity certificates are available for the relevant authorities according to the EU directive and are kept at the following address:

Siemens Aktiengesellschaft
Bereich Automatisierungstechnik
Industrielle Kommunikation (AUT93)
Postfach 4848
D-90327 Nuremberg
Germany

Area of Application

The product meets the following requirements:

Area of application	Requirements	
	Noise emission	Noise immunity
Industrial	EN 50081-2 : 1993	EN 50082-2 : 1995

Installation instructions

The product meets the requirements providing you adhere to the instructions for installation and operation as described in the following documentation:

Description of the AS-Interface Master Module CP 242-2
S7-200 Programmable Controller
Hardware and Installation

Information for manufacturers of machines

The product is not a machine in the sense of the EU directive on machines. There is therefore no conformity certificate for this product complying with the EU directive for machines 89/392/EEC.

If the product is integrated as part of a machine, it must be included in the conformity application of the manufacturer.

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