SIEMENS

SINEC

SINEC S1
Master Module CP 2433

C79000-G8976-C063

Release 01
Volume 1 of 1

Siemens Aktiengesellschaft

SINEC

SINEC S1 Master Modul CP 2433

Manual C79000-B8976-C086

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.

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.

WARNING !

!

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 labelling circuits and devices or systems in accordance with current standards in saftey technology;

- Training in or authorization for the maintenance and use of suitable saftey equipment in accordance with current standards in safety technology;

- First Aid qualification.

CONTENTS

1. Introduction

This chapter contains basic information and an introduction to the SINEC S1 system concept and SINEC S1 components. The main aim of the manual is to describe the SINEC S1 master components.

We recommend the following procedure when ...

...You want an overall picture of SINEC S1.	➥ Read the manual 'SINEC S1/AS-I Introduction and Basic Information'. Here, you will find general information about SINEC S1.
...You want to know how programs for the CP 2433 are created.	➥ Read Section 1.5 'The Master Mode' in Chapter 1 of the manual 'SINEC S1/AS-I Introduction and Basic Information'. Also read Chapters 2of this manual.
...You want to start up the PLC master module CP 2433.	➥ Section 2.1 'Overview of the Module and Interface Software' and 2.2 'Standard Operation' in Chapter 2 contain the required information.
... You want to create a PLC program for standard applications.	➥ Section 2.2 contains all the information required for standard operation.

1.1 General

1.1.1 Overview of the Chapters

Chapter 1 Introduction

This chapter provides basic information for the effective use of this manual.

Chapter 2 SINEC S1 Master Module CP 2433

This chapter provides an overview of the modes, installation and startup and the display and operating elements of the CP 2430.

1.1.2 Conventions used in the Text

General symbols in the text:

✔ This character indicates an action for you to perform.

☞ This character indicates special features and danger.

1.1.3 Requirements

Requirements for Understanding the Manual:

➢ for the PLC master module: knowledge of STEP 5 programming

1.1.4 Further Information

You can obtain more detailed information from your local Siemens office, particularly about the SINEC S1 components and other AS-I modules mentioned in this manual.

The order numbers for the products mentioned in this manual can be found in the current catalogs.

1.1.5 Hotline

If you have technical questions, please use our hotline on the following numbers:

xx49-9131-7-43147

xx49-9131-7-43157

2. Master Module CP 2433

This chapter explains the functions of the SINEC S1 master module CP 2433 and explains how to use it.

You will learn the following:

- ➢ Which PLC systems can be operated with the CP 2433 on SINEC S1.
- ➢ How a SINEC S1 system can be used with minimum programming in CP 2433 standard operation.
- ➢ Which additional possibilities are provided by CP 2433 extended operation with SINEC S1.
- ➢ How to deal with errors.

2.1 Overview of the Module and Interface Software

2.1.1 Introduction

The CP 2433 module can be operated in the programmable logic controllers (PLC) S5-90U, S5-95U, S5-100U and in the ET200U system (distributed peripherals). It allows connection of an AS-I cable to these programmable controllers.

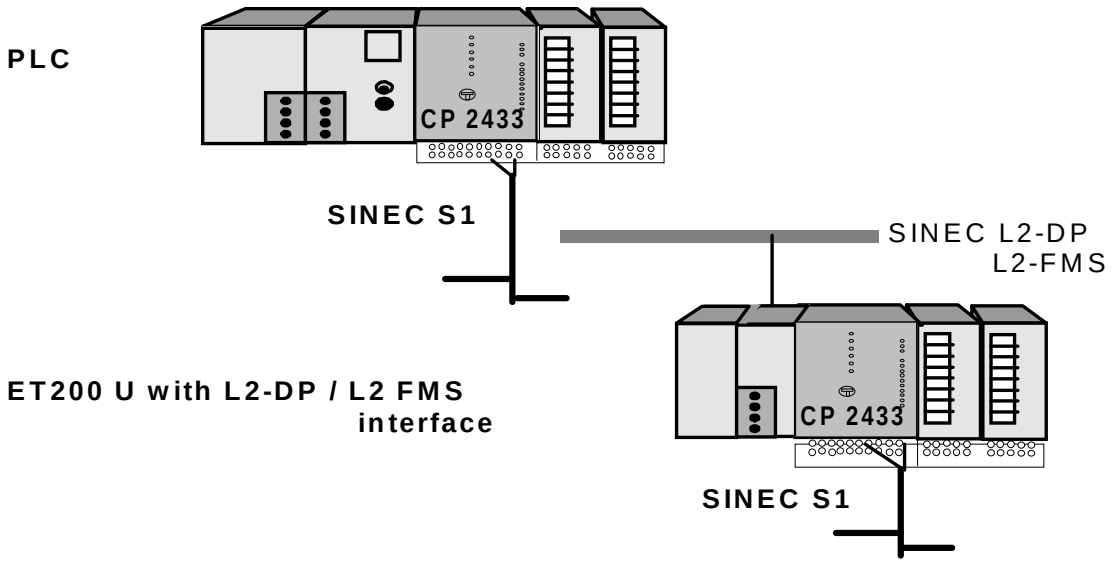


Fig. 2-1 Possible Uses of the SINEC S1 Module CP 2433

Product Structure

The CP 2433 consists of the following components:

1. CP 2433 module
2. This manual including the function block for extended operation of the CP 2433

For further products refer to /3/ or consult your local Siemens office.

2.1.2 Technical Data of the Module

The CP 2433 module has the following technical characteristics:

- ➢ The CP occupies both slots of a SIMATIC bus module.
- ➢ The CP occupies 16 bytes in the analog area of the PLC.
- ➢ The AS-I slave configuration is stored using a switch on the front panel.
- ➢ The AS-I cable is connected to the terminal on the bus module of the PLC.

Further technical data:

Bus cycle time	5 ms with 31 slaves
Configuration	By switch on the front panel or using the function block
Supported AS-I profiles	without function block: M0 with function block: M1
Interfaces	
• AS-I connection	Using S5 bus module; terminal 7-8; 9-10
Address area	16 bytes in the analog area of the PLC
Address ID for ET 200U PROFIBUS configuration	223
Power supply	DC 9V via backplane bus
Permitted ambient conditions	
• Operating temperature with horizontal installation	0 to 60°C
• Operating temperature with vertical installation	0 to 40°C
• Transport and storage temperature	-40°C to +70°C
• Relative humidity	max. 95% at +25°C
Current consumption	typically 200 mA
Design	
• Module format	S5-100U type
• Dimensions (W x H x D) in mm	90 x 134 x 85
• Weight approx.	360 g
• Space required	2 slots

Table 2-1 Technical Data

2.1.3 Slots Permitted for the CP 2433 in SIMATIC PLCs and in the ET200U

The CP 2433 can be operated in the following PLCs. The permitted slots are marked. The CP 2433 occupies two slots in the analog area of the PLC. It can nevertheless be addressed by the PLC as a digital I/O module.

➢ **S5-90U**

A maximum of one CP 2433 can be plugged into the S5-90U. Permitted slots are 0+1 or 2+3 or 4+5.

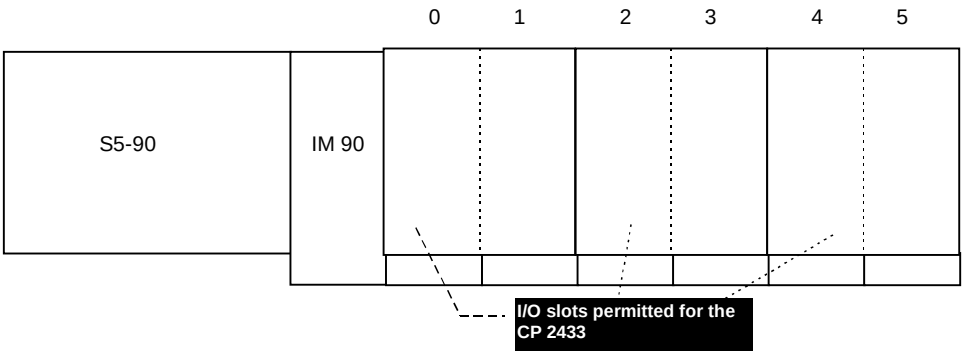


Fig. 2-2 Slots in the S5-90U

➢ **S5-95U**

A maximum of two CP 2433s can be plugged into the S5-95U. Permitted slots are 0+1 or 2+3 or 4+5 or 6+7.

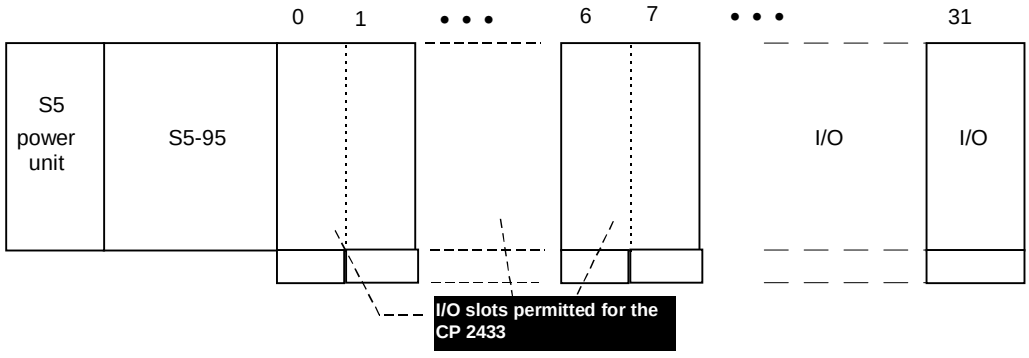


Fig. 2-3 Slots in the S5-95U

➢ S5-100U

CPU 100: A maximum of one CP 2433 can be plugged into the S5-100 U

CPU 102, CPU 103: A maximum of two CP 2433s can be plugged into the S5-100U. Using CPU 103 it is also possible to operate three CP 2433 simultaneously if no other additional modules are used.

Permitted slots are 0+1 or 2+3 or 4+5 or 6+7.

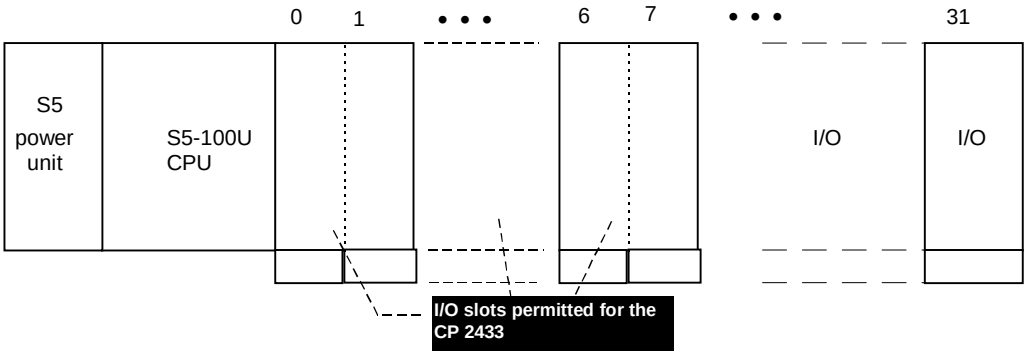


Fig. 2-4 Slots in the S5-100U

➢ ET200U

A maximum of two CP 2433s can be operated simultaneously in each ET200U station. The CP 2433 can be plugged into any bus module in the ET200U (starting at an even slot number).

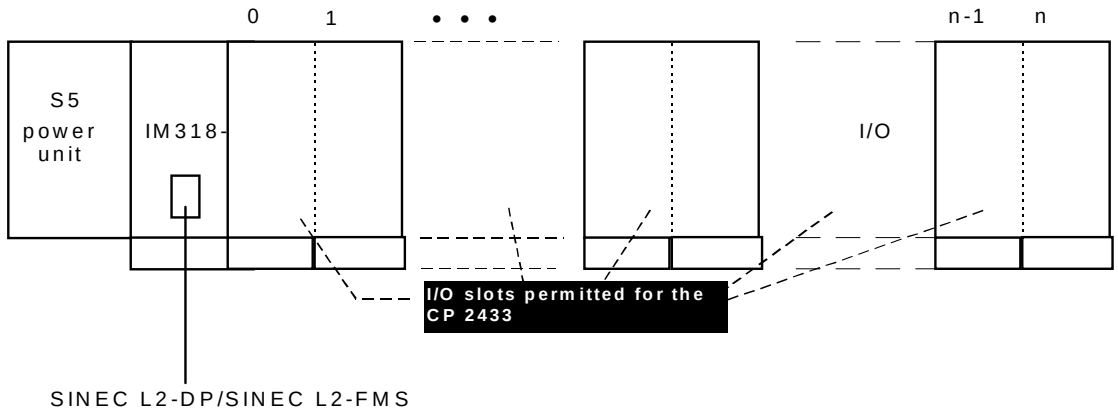


Fig. 2-5 Slots in the ET200U

2.1.4 Installation of the CP

The CP is plugged in to one of the permitted slots in the PLC. It is then secured by the screw on the front panel.

The AS-I cable is connected to the terminals of the bus module in which the CP is plugged in. It is connected to terminal pair 7,9 or 8,10 of the right slot of a SIMATIC bus module. Terminals 7 and 8 as well as 9 and 10 are electrically connected by the CP 2433 when it is plugged in.

The assignment of the pair of terminals and the polarity are indicated on the front panel of the CP. The second pair of terminals is intended for connecting the AS-I power unit or a branch of the AS-I cable. The AS-I power unit can, however, be connected at any point on the AS-I cable.

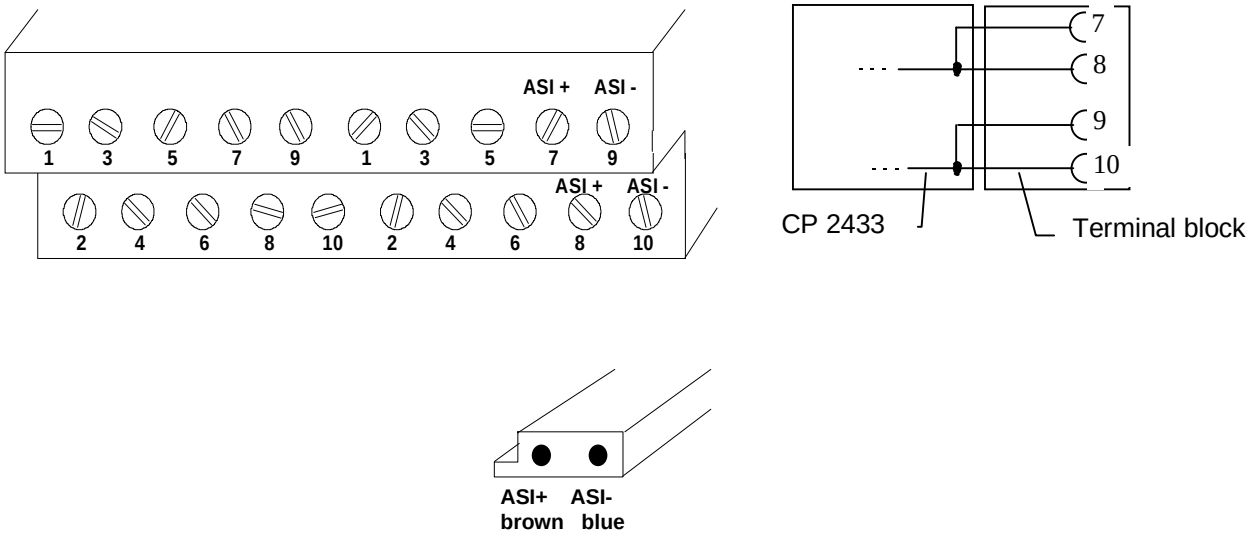


Fig. 2-6 Terminal Block with Connections and AS-I Cable

Installation

To install the CP, follow the steps outlined below:

✔ Set the coding lock of the SIMATIC bus module in which you want to plug in the CP to the value 6.

✔ Install the CP on the bus module and secure it using the screw on the front panel.

☞ **Immunity to Interference/Grounding**

To make sure that the CP 2433 is immune to interference, the PLC and AS-I power unit must be grounded correctly. For more detailed information refer to the System Manuals of the PLCs and the description of the AS-I power unit. On the PLC, it is important that the rail to which the bus modules are clipped is well grounded.

2.1.5 Addressing the CP in the PLC

The CP 2433 occupies 16 bytes in the address area (analog area) of the PLC. The location of these 16 bytes within the overall address area is determined by the slot position of the CP 2433. The following table indicates the addresses occupied depending on the selected slot. The first address of the occupied address area is called the start address.

Slots occupied by CP	Start address	Address area (I/O byte no.)
0 , 1	64	64 ... 79
2 , 3	80	80 ... 95
4 , 5	96	96 ... 111
6 , 7	112	112 ... 127

Table 2-2 Addresses Occupied Dependent on Slot

2.1.6 How the PLC Addresses the Slaves on the AS-I Cable

Each station (slave) on the AS-I cable is assigned 4 bits (a nibble) by the CP 2433. The PLC can write (slave output data) and read (slave input data) this nibble. This allows bi-directional slaves to be addressed.

This means that 31 x 4 bits of the 16 byte address area of the CP 2433 are occupied by the AS-I slave data. The remaining 4 bits are for control information and status acknowledgment of the CP 2433 (control nibble/status nibble).

The following table illustrates the assignment of the CP 2433 interface (n is the slot-dependent start address of the CP address area). The table shows the assignment of the slave I/O bits to the I/O bytes of the PLC.

Byte number	Bit 7-4	Bit 3-0
n+0	Control nibble/Status Bit 3 | Bit 2 | Bit 1 | Bit 0	Slave 1 Bit 3 | Bit 2 | Bit 1 | Bit 0
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 3 | Bit 2 | Bit 1 | Bit 0	Slave 31 Bit 3 | Bit 2 | Bit 1 | Bit 0

PLC I/O bits

Slave bits

Table 2-3 Bit Assignment of the CP 2433 Interface

Example of the assignment of connections

If AS-I modules are used as slaves on the AS-I cable, each of the connections to the AS-I module corresponds to exactly 1 bit in the PLC. The following example illustrates the assignment of two AS-I modules with addresses 2 and 3.

	Slave 2				Slave 3			
PLC bit	7	6	5	4	3	2	1	0
Connection to AS-I module	4	3	2	1	4	3	2	1

Table 2-4 Assignment of the Connections to the AS-I module

Explanation:

Slave 2 corresponds, in this case, to the AS-I module with address 2
Slave 3 corresponds to the AS-I module with address 3.

Example of the PLC Addressing a Slave

Just as with standard modules of the digital I/Os, the SIMATIC can access the inputs and outputs of the AS-I slaves. The following example illustrates this procedure:

Example: CP 2433 in slot 0+1 (start address n= 64):

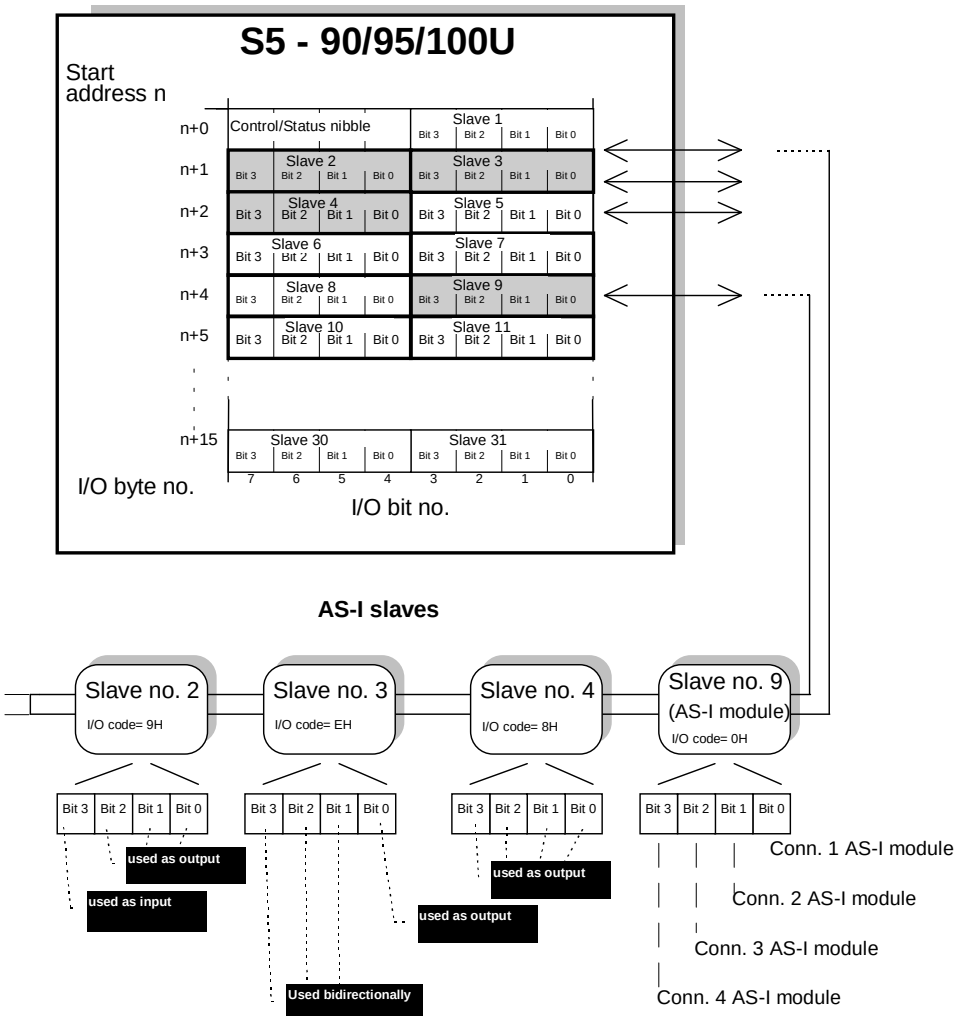


Fig. 2-7 Simulation of the Slave Addresses on the PLC Slots

With this arrangement, the following I/O accesses result when slave 2 and slave 4 are unidirectional slaves and slave 3 is a bi-directional slave:

➢ Slave 2

Bit 0	S Q 65.4
Bit 3	= Q 65.7

➢ Slave 3

Bit 2	A I 65.2
Bit 2	= Q 65.2

➢ Slave 4

Bit 2	= Q 66.6

2.1.7 Using the CP 2433 in the ET200U

Addressing

The CP 2433 occupies 2 slots and a total of 16 input and output bytes in the ET200. The 16 input bytes contain the status nibble and the input data of the slave. The 16 output bytes contain the control nibble and output data of the slaves.

Byte number	Bit 7-4	Bit 3-0
n+0	Status nibble Bit 3 | Bit 2 | Bit 1 | Bit 0	Slave 1 Bit 3 | Bit 2 | Bit 1 | Bit 0
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 3 | Bit 2 | Bit 1 | Bit 0	Slave 31 Bit 3 | Bit 2 | Bit 1 | Bit 0

Input bits ET 200 Slave input bits

Corresponds to slot m

Corresponds to slot m+1

Table 2-5 Input Area (16 Bytes) Occupied by the CP 2433 in the ET 200.

Byte number	Bit 7-4	Bit 3-0
n+0	Control nibble Bit 3 | Bit 2 | Bit 1 | Bit 0	Slave 1 Bit 3 | Bit 2 | Bit 1 | Bit 0
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 3 | Bit 2 | Bit 1 | Bit 0	Slave 31 Bit 3 | Bit 2 | Bit 1 | Bit 0

Output bits ET 200

Corresponds to slot m

Corresponds to Slot m+1

Table 2-6 Output Area (16 Bytes) Occupied by the CP 2433 in the ET 200.

The start address n is configured in the SINEC L2 master (see COM ET200 for master IM 308, or COM 5431 for master CP 5431)

The SINEC L2-DP or SINEC L2-FMS communications processor of the controller can access the input and output bytes of the CP 2433 transparently.

Special Features when Operating the CP 2433 in the ET 200

Depending on the type of SINEC L2-DP communications processor used by the controller, certain features must be taken into account when operating the CP 2433 in the ET 200.

CP 5431

✔ Set the DP updating to cycle-synchronized in COM 5431.

✔ Remember that the CP 2433 requires 16 bytes of input data and 16 bytes of output data.

IM 308

✔ **The CP 2433 occupies 2 locational spaces in the ET 200. Both locations must be entered in COM ET 200 for Windows as ident. 4AX.**
(The ident. corresponds to the module IP265 with the MLFB-no. 6ES5 265-8M..)

✔ Access to the input and output data in the IM 308 assigned to the CP 2433 **should be via the PII/PIQ when possible**

If direct peripheral access is unavoidable, remember the following points:

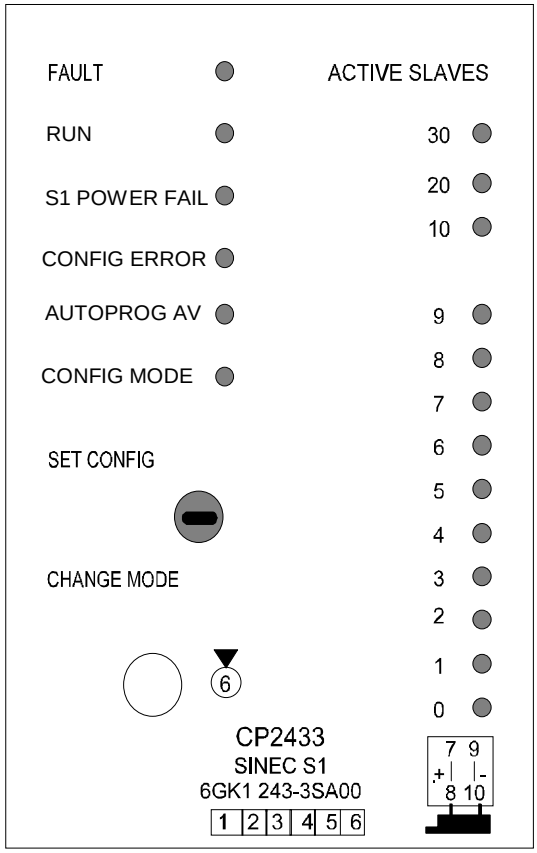
The CP 2433 occupies areas of 4 words for both slots both for write and read access.

After write and read access to the area, a so-called “last byte” (CPU-dependent) must be written or read so that the area is released again.

☞ **Refer to the ET200 manual for more information.**

2.1.8 Control and Display Elements of the CP 2433

The following diagram shows the front panel of the CP 2433 with the control and display



elements. These are described in detail below.

Fig. 2-8 Front Panel of the CP 2433

FAULT

The following display statuses are possible:

1. LED lit continuously
This indicates that the CP 2433 has detected a hardware error. In this case, the CP must be replaced.

2. LED lit while pressing the mode selector
This indicates that the CP cannot accept the mode change either because a slave with address 0 exists or because the CP is not in the configuration mode when you switch to SET CONFIG.

RUN

Indicates that the CP has started up correctly.

S1 POWER FAIL

Indicates that the voltage supplied by the AS-I power unit on the AS-I cable is too low or has failed.

CONFIG ERROR

Here, the CP 2433 indicates whether the slave configuration detected on the AS-I cable matches the configuration stored on the CP (LPS). If they do not match, the CONFIG ERROR display is lit.

The CONFIG ERROR display is lit in the following situations:

- When a configured AS-I slave does not exist on the AS-I cable (e.g. fault on the slave).
- When a slave exists on the AS-I cable but has not been configured.
- When a connected slave has different configuration data (I/O configuration, ID code) from those configured on the CP. This means that an incorrect slave type on the AS-I cable can be detected (e.g. actuator instead of sensor).
- When the CP is in the offline phase.

AUTOPROG AV

(Autoprog available) this indicates that the address of a slave can be programmed automatically. Automatic address programming makes the replacement of a defective slave on the AS-I cable much easier.

When the AUTOPROG AV display is lit, this indicates among other things that exactly **one** configured slave does not exist on the AS-I cable (e.g. failure of a station).

When the display AUTOPROG AV is lit, you can connect an identical slave with the address 0 (as supplied) instead of the failed slave. The CP then re-programs the address 0 to that of the failed slave.

CONFIG MODE

The mode is displayed here.

Display on: Configuration mode

Display off: Protected mode

The configuration mode is only required when installing the CP 2433. In the configuration mode, the CP 2433 activates all connected slaves and exchanges data with them. For more information about the configuration mode/protected mode, refer to Section 2.2.1.

ACTIVE SLAVES These LEDs indicate which slaves are active on the AS-I bus. The CP 2433 can only exchange data with activated slaves.

Failed i.e. available but not projected Slaves in the protected mode are^indicated with the corresponding blinking LED.[1]

The display of the activated stations (slaves) is in the form of groups of 10. These are switched over at regular intervals. The LEDs labeled 10+, 20+, 30+ indicate which of the groups of 10 slaves are currently indicated by the LEDs 0 - 9.

☞ **If the CP 2433 is offline, the 3 group LEDs (10+, 20+, 30+) are all lit simultaneously.**

During normal operation, this status only occurs briefly in the following situations:

- the power supply is switched on, or

- the PLC goes through a cold restart, or

- the mode selector is set to run while the PLC is in the STOP mode

Example of Displays:

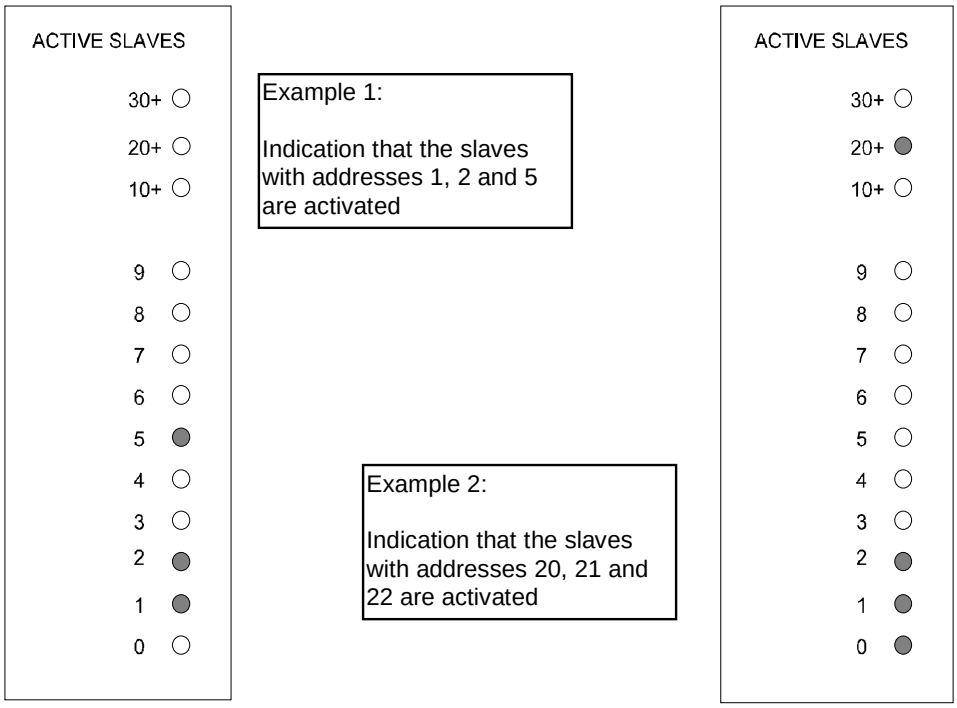


Fig. 2-9 Examples of Indicators on the CP Front Panel

[1] from version 2 of the CP 2433

switch "SET CONFIG"/ "CHANGE MODE"

The "SET CONFIG"/"CHANGE MODE" switch is required for configuring the CP 2433 for standard operation. The switch is only activated in the STOP mode of the PLC/ET200U and has the following functions:

- Switch in "CHANGE MODE" position -> mode change

  This position brings about a change between the configuration mode and the protected mode. The mode is signaled by the “CONFIG MODE” indicator.

- Switch in SETCONFIG position -> automatic configuration.

  If the CP is in the configuration mode (CONFIG_MODE indicator on) and if the switch is set to the “SET CONFIG” setting, the CP is configured automatically. Configuring then involves the following steps:

  1. The existing slave configuration indicated by the “ACTIVE SLAVES” LEDs is saved by the CP as the desired configuration (non-volatile).

  2. The CP then switches over to the protected mode.

For more information on configuring the CP 2433, refer to Section 2.2.1

2.1.9 Types of Operation with the CP 2433

With the CP 2433 module, 2 types of operation are possible:

➢ Standard operation (without function block). This type of operation is possible in all the listed PLCs and the ET200U.

➢ Extended operation (with function block). This type of operation is only possible with the S5-95U and in the S5-100U with the CPU103 (not with the CPU100 or with the CP102).

The difference between the 2 types of operation is as follows:

Standard Operation

In this type of operation, the CP 2433 operates as a conventional digital input/output module. For each slave on the AS-I cable for input and for output bits are reserved in the process image of the analog I/Os.

The data from the process image are transferred via the AS-I cable to the slaves.

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 (see PICS in the appendix).

Extended Operation

In extended operation, the PLC programmer has the complete range of functions available in the AS-I system. In particular, the assignment of parameters to slaves with an integrated AS-I connection is possible. This type of operation corresponds to the profile M1 of the AS-I master specification (see PICS in the appendix).

For extended operation, in addition to the CP 2433, function block FB 60 is also required and is supplied with this manual.

☞ **FB60 can only run on the S5-95U and S5-100U/CPU103.**

2.2 CP 2433 Standard Operation

Standard operation represents the most common and at the same time simplest use of the CP 2433. It allows direct access to the inputs and outputs of the slave (e.g. bus modules) just as with digital I/O modules of the SIMATIC PLC. This type of operation is available immediately after plugging in the module; no function block is required.

2.2.1 Configuring the CP 2433 for Standard Operation

The CP 2433 is capable of 2 operating modes, the configuration mode and the protected mode.

➢ Configuration mode:

The configuration mode is used to install and start up an AS-I network. In the configuration mode, the CP 2433 can exchange data with every slave connected to the AS-I cable.

➢ Protected mode:

If the CP 2433 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 and the configuration data stored on the CP match the values of a slave.

Configuration of the CP 2433 during installation and start-up of the AS-I network.

The following situation is assumed:

➢ The connected AS-I slaves are supplied with addresses (address programming device).

➢ The AS-I bus is complete, i.e. with the AS-I power supply unit in operation.

To configure the CP 2433 in standard operation while installing the AS-I network, follow the steps outlined below:

✔ Switch the PLC/ET200U to the STOP

✔ Change the CP 2433 to the configuration mode, (switch the mode selector to the bottom position; the CONFIG-MODE indicator lights up). If the CP is already in the configuration mode (as supplied), this step can be omitted.

✔ Switch the PLC/ET200U to RUN and test your program.

Note:
In the configuration mode, you can also add or remove slaves from the AS-I cable. Newly added slaves are activated immediately by the CP 2433.

✔ On completion of the installation of the AS-I slave, switch the PLC to the STOP mode.

✔ Now move the mode selector of the CP 2433 to the upper position. The CP adopts the configuration displayed by the “ACTIVE SLAVES” LEDs as the desired configuration and switches to the protected mode.

In the protected mode, the "CONFIG MODE" LED is switched off.

✔ Switch the PLC to RUN. The installation of the CP is then completed.

Simplified Configuration

Once you are certain that all the slaves on the AS-I cable are functioning correctly (e.g. when a CP 2433 is replaced), the CP 2433 can be started up as follows:

✔ Switch the PLC / ET200U to the STOP mode.

✔ Change the CP 2433 to the configuration mode, (switch the mode selector to the bottom position; the CONFIG-MODE indicator lights up). If the CP is already in the configuration mode (as supplied), this step can be omitted.

✔ Now move the “SET CONFIG"/"CHANGE MODE switch of the CP 2433 to the upper position. The CP then adopts the configuration displayed by the “ACTIVE SLAVES” LEDs as the desired configuration and switches to the protected mode.

In the protected mode, the "CONFIG MODE" LED is switched off.

✔ Based on the LED indicators, check whether all the slaves connected to the AS-I cable have been included correctly. If not all the slaves on the AS-I cable have been detected, repeat the 2 steps outlined above.

✔ Switch the PLC to RUN. The CP is then started up.

☞ **Note on Configuration:**

If the PLC / ET200U is in the STOP mode, the CP 2433 does not recognize whether slaves have been added to the AS-I cable or whether they have been removed. The LED indicator of the active slaves is not updated. The slaves detected after the last time the CP 2433 was booted are displayed.

If you nevertheless want to recognize changes in the slave configuration during the STOP mode of the PLC / ET200, you can achieve this by switching the button to the lower position twice initially switching to the protected mode and then once again to the configuration mode.

☞ **The CONFIG ERROR indicator is lit briefly when you change modes.**

2.2.2 Interface of the CP 2433 to the Application

As described in Section 2.1.6, the CP 2433 occupies 16 bytes in the address area of the PLC/ ET200U starting from the base address fixed by the slot being used (See Fig. 2-7 Simulation of the Slave Addresses on the PLC Slots).

Each slave address is assigned four I/O bits in the address area of the PLC.

By setting the output bit of a slave, the corresponding output data of a slave are changed, by reading the input bit, the input data of a slave are read indirectly. This is the same reaction as with a conventional I/O module.

Access to the Control/Status Nibble

In addition to the I/O data, the CP 2433 also has a control/status nibble in the I/O data area that can be written or read.

➢ By **writing** this nibble, different CP 2433 modes can be selected that influence the diagnostics.

➢ By **reading** this nibble, status and error bits of the CP 2433 can be read.

What do you have to do? A quick checklist

The list below is a brief overview of the points to bear in mind when creating the program (cyclic mode):

✔ You program the control nibble so that the required mode is set.

✔ You scan the status nibble to make sure start-up was successful.

✔ You write and read the I/O bytes as usual.

✔ You evaluate the status information (status nibble) to be able to react to an error.

The exact significance of the control and status nibble is described on the following pages.

Control Nibble (Writing)

Using the control nibble, different types of error message can be set on the CP 2433 for diagnostic purposes.

The control nibble is set by the user when the PLC / ET200U starts up.

Bit 7	Bit 6	Bit 5	Bit 4	Meaning
0	0	0	0	Normal operation with PLC
0	0	0	1	Diagnostic mode with PLC
0	0	1	0	Normal operation with ET200U
0	0	1	1	Diagnostic mode with ET200U
1	x	x	x	Reserved for operation with function block

Table 2-7 Assignment of the Control Nibble - Overview

☞ **In standard operation, the IDs reserved for the function block must not be used (value 1xxx). Illegal entries endanger the response of the CP 2433.**

Example:

The statements
```
:AN  I   64.4
:S   Q   64.4
```

Set the diagnostic mode in a CP 2433 plugged into slot 0 + 1 (start address 64).

The different types of error messages are explained in this section.

Status Nibble (Reading)

By reading the control/status nibble, you obtain status information from the CP 2433. In standard operation, only bits 5 to bit 7 are evaluated.

	Bit 7	Bit 6	Bit 5	Bit 4
Meaning	0 = slave input data are reported by CP 1 = slave diagnostic data are reported by CP	1 = error (configuration error or APF) 0 = no error	1 = CP booting completed 0 = CP booting active	reserved for function block

Table 2-8 Bits of the Status Nibble

Bit 7 "Diagnostic bit" This bit is only required for the diagnostic mode of the CP 2433. It indicates whether the CP 2433 supplies input data of the slave or diagnostic data. More information about the diagnostic mode can be found in the following section. The diagnostic bit is only valid after the CP 2433 has been booted successfully (bit 5=1).

Bit 6 "Error bit" This bit is a group error bit. Here, any “configuration error” or “AS-I power failure” is signaled. The error bit is only valid after the CP 2433 has been successfully booted (bit 5=1).

The error bit indicates configuration errors only in the protected mode and not in the configuration mode.

☞ **If errors occur, the I/O data of the slave affected are set (inputs = 0); APF errors affect all slaves.**

Bit 5 "Start-up bit" This bit indicates to the PLC whether or not a CP 2433 has been booted and has completed internal initialization. This bit must be tested when the PLC starts up before the actual PLC program is started.

Example:

If the CP 2433 is plugged into slot 2 + 3 (start address 80) and if access to the “AS-I bits” is programmed in PB3, the following statements prevent access to AS-I bits while the CP is being booted:

```
.
.
.
:A     I 80.5
:JC    PB 3
.
.
.
```

2.2.3 Error Messages of the CP 2433 in Standard Operation

As explained above, different types of error message can be set in standard CP 2433 operation by setting the control nibble. The following sections explain the different modes that can be set.

Error Message Normal Operation with PLC

This setting is intended for operating the CP 2433 in the PLC. If the CP 2433 has this setting, configuration or ASI_POWER_FAIL errors are indicated by the error bit (bit 6).

Control nibble setting:

Bit 7	Bit 6	Bit 5	Bit 4	Meaning
0	0	0	0	Error message normal operation with PLC

The error bit remains set

- ➢ As long as the voltage at the AS-I connection of the CP remains under...V (AS-I Power Fail).
- ➢ If the configuration on the AS-I cable does not match the configured configuration in the protected mode (e.g. failure of a slave).

☞ **Remember that the absence of slaves is not indicated by the error bit in the configuration mode.**

Error message diagnostic mode with PLC

This mode is also intended for operating the CP 2433 in a PLC. It allows AS-I network errors to be signaled so that the cause of errors can be detected.

Control nibble setting:

Bit 7	Bit 6	Bit 5	Bit 4	Meaning
0	0	0	1	Error message diagnostic mode with PLC

In this mode, the CP 2433 generates an error ID for the duration of a PLC cycle whenever a new configuration or APF error occurs. This error ID is indicated by bytes n+0 to n+7 (n=I/O start address) and has the following structure:

	Bit 7-4	Bit 3-0
Byte (n+0)	Status nibble	Error code
Byte (n+1)	reserved for function block	reserved for function block
Byte (n+2)	reserved for function block	reserved for function block
Byte (n+3)	reserved for function block	reserved for function block
Byte (n+4)	Configuration error with slaves 0-3 0 | 1 | 2 | 3	Configuration error with slaves 4-7 4 | 5 | 6 | 7
Byte (n+5)	Configuration error with slaves 8-11	Configuration error with slaves 12-15
Byte (n+6)	Configuration error with slaves 16-19	Configuration error with slaves 20-23
Byte (n+7)	Configuration error with slaves 24-27	Configuration error with slaves 28-31

Table 2-9 CP Error Detection

In the first byte, starting from the start address n, the status nibble and an error code are supplied by the CP 2433 that indicates which type of error has occurred.

The following table shows the significance of the individual bits in this byte.

	Bit 7-4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n+0	Status nibble Value = 111x	0 = voltage on AS-I cable o.k. 1 = ASI-Power Fail (APF)	0 = configuration o.k. 1 = configuration error	reserved for function block	0

Table 2-10 CP-Status Nibble and Error Coding

Bit 7 Diagnostic bit — A “1” for this bit in the control nibble indicates that the CP 2433 is supplying diagnostic data instead of the slave input data.

☞ **If the diagnostic bit=1, the input data are invalid and must not be evaluated.**

Bit 6 Error bit — A “1” for this bit in the control nibble shows that the CP 2433 has detected an error in the AS-I network.

Bit 5 Start-up bit — After a successful start-up, this bit is permanently set to 1.

Bit 4 — This bit has no significance for the diagnostic mode. Its value is therefore marked with x.

Bit 3 ASI Power Fail — This indicates whether the d.c. voltage on the AS-I cable on the CP 2433 has reached a minimum value of xx.x V. If this voltage is below this value, this is indicated by a “1”.

Bit 2 Configuration error — Indicates when there is a discrepancy between the detected slaves on the AS-I cable and the configured slaves in the protected mode.

Bytes (n+5) to (n+7) of the input data area also indicate the slaves for which a discrepancy was detected.

☞ **If during the booting of the CP 2433 AS-Power Fail is detected or if no slaves exist when the module is booted, only bit 6 (error bit) is set in the status nibble. No error ID is signaled in this case.**

Examples of Error Messages in the Diagnostic Mode:

It is assumed that slaves 1 to 12 were configured on the CP 2433 using the switches and that the CP 2433 is in the protected mode.

If slave 4 fails following the configuring, the CP 2433 outputs the following error ID (message 1) in the input data area for the duration of a PLC cycle.

	Bit 7-4	Bit 3-0
Byte (n+0)	111x	0100
Byte (n+1)	xxxx	xxxx
Byte (n+2)	xxxx	xxxx
Byte (n+3)	xxxx	xxxx
Byte (n+4)	0000	**1**000
Byte (n+5)	0000	0000
Byte (n+6)	0000	0000
Byte (n+7)	0000	0000

x = Value not defined.

Table 2-11 Example of Error Detection - Message 1

In the next PLC cycle, the control nibble has the value 011x and the input data of the slaves are entered in the remaining nibbles.

If the non-configured slave 15 is then added to the AS-I cable, the following error ID (message 2) is signaled by the CP 2433, once again for the duration of a PLC cycle.

	Bit 7-4	Bit 3-0
Byte (n+0)	111x	0100
Byte (n+1)	xxxx	xxxx
Byte (n+2)	xxxx	xxxx
Byte (n+3)	xxxx	xxxx
Byte (n+4)	0000	**1**000
Byte (n+5)	0000	000**1**
Byte (n+6)	0000	0000
Byte (n+7)	0000	0000

x = Value not defined.

Table 2-12 Example of Error Detection - Message 2

After reconnecting slave 4, there is still one existing error (slave 15); for this reason the CP signals an error again for one PLC cycle (message 3).

	Bit 7-4	Bit 3-0
Byte (n+0)	111x	0100
Byte (n+1)	xxxx	xxxx
Byte (n+2)	xxxx	xxxx
Byte (n+3)	xxxx	xxxx
Byte (n+4)	0000	**0**000
Byte (n+5)	0000	000**1**
Byte (n+6)	0000	0000
Byte (n+7)	0000	0000

Table 2-13 Example of Error Detection - Message 3

After disconnecting slave 15, there is no further error; the error bit (bit 6) is set to 0. An error ID is not signaled.

Error Message Normal Operation with ET200U

This type of error message corresponds to the error message PLC with the difference that the error bit in the status nibble (bit 6) **remains set** after the first error occurs. This ensures that errors signaled only briefly by the CP 2433 are detected by the ET200U.

Setting the Control Nibble:

Bit 7	Bit 6	Bit 5	Bit 4	Meaning
0	0	1	0	Error message standard operation with ET200U

The error bit in the status nibble is only cleared when the control nibble is reset to “0000” or when the ET200U goes to the “STOP” mode.

Error Message Diagnostic Mode ET200U

This type of error message corresponds to the diagnostic mode with the PLC with the difference that both the diagnostic bit and the entire error ID remains set in bytes (n+0) to (n+7).

Setting the Control Nibble:

Bit 7	Bit 6	Bit 5	Bit 4	Meaning
0	0	1	1	Error message diagnostic mode with ET200U

☞ **Once the error ID is set, the input and output data of the CP are no longer updated. The slaves can then only be operated after switching off the diagnostic mode.**

The diagnostic bit and the error ID are only deleted when the control nibble is reset to “0000” or when the ET200U changes to the “STOP” mode. The I/O data exchange is then reactivated.

2.2.4 Starting up the CP 2433 in Standard Operation

The CP 2433 can only exchange data with the slaves connected to the AS-I cable after it has completed booting. During the CP booting phase, bit 5 in the status nibble is set to “0” (start-up active). The actual PLC program can only be started once this bit is set to “1” by the CP 2433.

2.2.5 Exchanging a Defective Slave/ Automatic Address Programming

If the indicator AUTO PROG AV is lit in the protected mode of the CP 2433, it indicates the following:

➢ Exactly **one** slave has failed.

➢ Automatic address programming by the CP 2433 is possible.

You can now replace the defective slave as follows:

✔ Remove the failed slave from the AS-I cable.

✔ Replace the defective slave with an identical slave with address 0 (as supplied). The CP 2433 then programs this slave with the address of the original station that had failed.

The "AUTOPROG AV" indicator then goes off. The CP 2433 indicates the slave in the LED display of the "ACTIVE SLAVES".

☞ **Note that “automatic address programming” is only possible when the CP 2433 is in the protected mode and when only one slave has failed.**

The following table lists the possible causes of errors that can occur during “automatic address programming” and how to remedy the problem.

Error	Possible cause	Remedy
After a slave fails, the “AUTOPROG AV” indicator remains off.	The CP is in the configuration mode.	“Automatic programming” is not possible in the configuration mode. The address of the new slave must be programmed with the address programming unit.
	More than one slave has failed (check "ACTIVE SLAVES" indicators).	Check AS-I cable. If “APF” is indicated at the same time, check the power supply to the AS-I cable. If more than one slave is defective, the addresses of the replacement slaves must be programmed with the address programming unit.
	The CP has detected unconfigured slaves.	Remove unconfigured slaves from the AS-I cable. Reset the CP by setting "RUN"-"STOP"-RUN" on the PLC/ET200U.
Automatic address programming not done although the "AUTOPROG AV" is lit.	The configuration data (I/O configuration, ID code) of the replacement slave do not match the values of the original slaves.	Check whether the correct replacement slave was used. Compare the vendor’s information with the configuration data. If you want to replace the original slave with a different type, the address must be assigned with the address programming unit and the CP 2433 re-configured using the switches.
	Replacement slave does not have the address “zero”.	Set the address of the replacement slave with the address programming unit.
	Replacement slave not correctly connected or defective.	Check the connections of the slave; if necessary, replace the slave.

Table 2-14 Causes of Errors and Remedy with Automatic Address Programming

2.2.6 Error Indicators of the CP 2433 in Standard Operation/ Remedy if Errors Occur

The following table lists the possible causes of problems when operating the CP 2433 and how to remedy the problem.

Error	Possible cause	Remedy
S1 POWER FAIL - 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 (total current greater than 2A).	Check the power requirements of the AS-I station. If necessary, supply the slaves with power externally.
FAULT LED lit continuously.	CP 2433 defective	Replace the CP 2433
FAULT LED lights up when the mode selector is pressed.	You want to change to the protected mode but a slave with address 0 exists.	Remove the slave with address 0 from the AS-I cable or program an address with the addressing unit and then run a PLC cold restart.
	The mode selector was set to SET CONFIG in the protected mode.	Switch the CP to CHANGE MODE with the mode selector and then to SET CONFIG.
CONFIG ERROR indicator lights up.	The CP 2433 is not yet configured.	Configure the CP with the mode selector on the front panel.
	A configured slave has failed (evaluate the "ACTIVE SLAVES" indicator).	Replace the defective slave or if the slave is not required, re-configure the CP 2433.
	An unconfigured slave was connected to the AS-I cable.	Remove the slave or re-configure the CP 2433.
	A slave has been connected whose configuration data (I/O configuration, ID code) do not match the value of the configured slave.	Check whether an incorrect slave has been connected. If necessary, re-configure the CP 2433.
CONFIG ERROR indicator flickers, meaning that a configured slave drops out sporadically.	Bad contact.	Check the connections of the AS-I slave.
	Interference on the AS-I cable.	Make sure the PLC is correctly grounded and check along the AS-I cable.

Error indicators (continued)

Error	Possible cause	Remedy
CP does not switch from the configuration mode to the protected mode.	The PLC is in the “RUN” mode.	Switch the PLC to "STOP".
	Selector not activated long enough.	Make sure the selector is activated for 0.5 s.
	A slave with the address 0 is connected to the AS-I cable. The CP 2433 cannot switch over to the protected mode as long as this slave exists.	Remove the slave with address 0.
CP does not switch from the protected mode to the configuration mode.	The PLC is in the "RUN" mode.	Switch the PL to "STOP".
	Button not activated long enough.	Make sure the selector is activated for 0.5 s.
Indicators 10+, 20+, 30+ light up simultaneously and remain lit.	The CP has booted, but has not recognized any slaves on the AS-I cable.	Connect the slaves to the AS-I cable.

Table 2-15 Error Indications in Standard Operation

2.3 Extended Operation

2.3.1 Overview of the Functions

Extended operation allows the master to be completely controlled by the user program. Access to inputs and outputs is the same as with I/O modules of the SIMATIC PLC. In contrast to standard operation, with this type of operation, a special function block for communication with the SINEC S1 master CP must be included in the user program.

To allow a simple and convenient interface for the most common applications, a distinction is made within this mode between a normal and an expert mode.

The normal mode provides an optimized interface to make installation, configuration and parameter assignment as straightforward as possible. Some of the jobs cover complete sequences of AS-I commands and therefore reduce the load on the user program.

The expert mode provides access to the individual commands implemented on the AS-I master CP complying with the AS-I specification (refer also to the PICS in the appendix).

☞ **Extended operation is only possible with the S5-95U and S5-100U / CPU 103. An S5-95U without integrated L2 interface (Order no. 6ES5095-8MA01) must be at least version 2 to allow extended operation.**

2.3.2 Programming the Interface

To supply the AS-I slaves with parameters, to supply the SINEC S1 communications processor CP 2433 with parameters and to configure it, or to read back parameters from the SINEC S1 communications processor during operation, you require a special function block (FB60) that is supplied with this manual.

Parameters and configuration data are exchanged between the CP and PLC using a working data block (working DB).

The data exchange (I/O data) between the function block and the CP is handled using the process image of the inputs and process image of the outputs as with a normal I/O module.

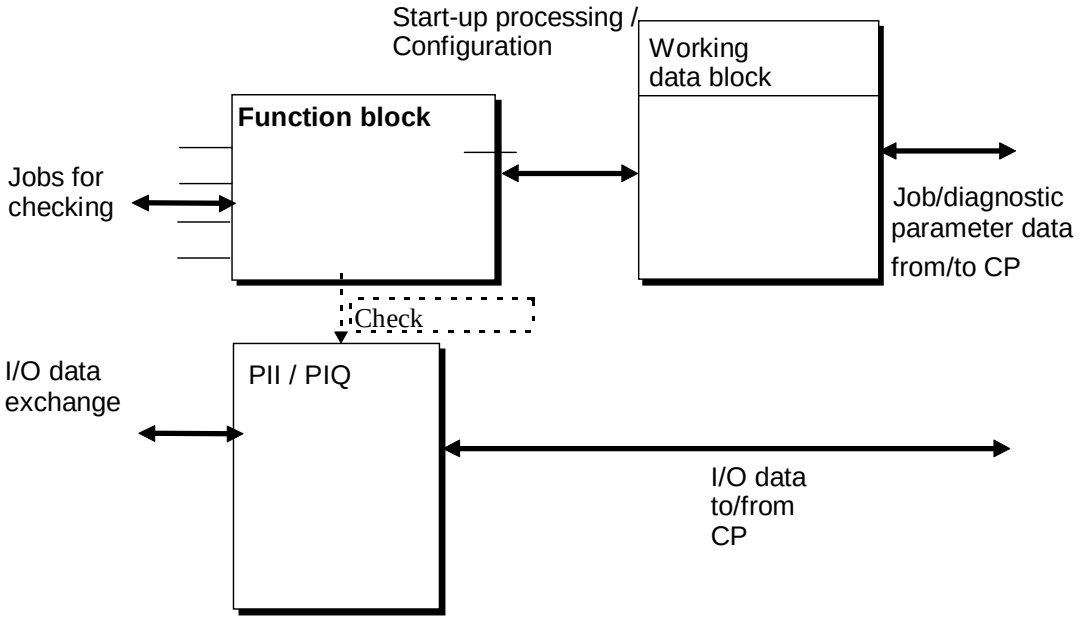


Fig. 2-10 Interface Elements for Extended Operation

For the address assignment in the PII/PIQ area, refer to the explanations in Section 2.1.6.

The FB has the following tasks during the PLC cycle:

➢ Start-up control

When requested, the FB supplies the CP or the slaves with parameters and configuration data.

➢ Checking the I/O data transfer

The FB checks and controls the I/O data transfer and the job transfer.

➢ Processing jobs

The FB handles jobs issued by the user program using special function IDs.

Calling the FB in the PLC Program

The function block must always be called once in OB1 at the start and at the end of a PLC cycle. This means that at the beginning of the cycle the PII area is updated and at the end of a cycle any calls to the CP 2433 are entered in the PIQ area.

The following diagram illustrates how the user program, the function block FB60, the process images PII and PIQ and the so-called working data block interact.

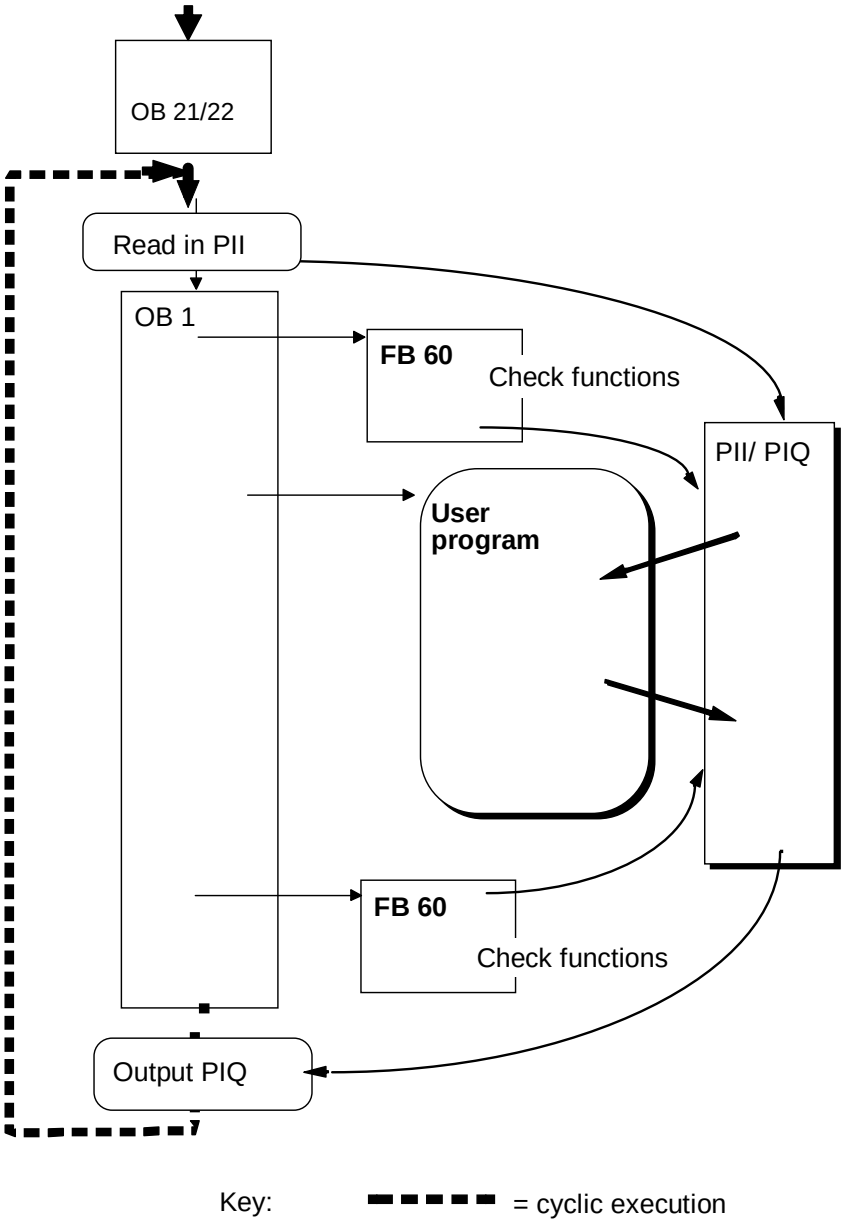


Fig. 2-11 How the Interface Functions in Extended Operation

The sequence illustrated in the diagram is explained below.

Receive end - update PII and pass on parameters

At the beginning of the cycle, the function block recognizes whether the data arriving from the CP 2433 are input data or response data to a job. The incoming data are saved in the working DB.

If the CP 2433 sends the response to a job, the input data saved from the previous program cycle are copied into the process image of the inputs (PII) so that input data are once again available to the S5 user program (the user program does not “notice” that response data arrived in this program cycle). The user then has direct access to the response data using the working DB.

Send end - output PIQ

The output data in the PIQ are transferred to the CP at the end of the cycle and from the CP to the AS-I slaves.

If a job has to be sent to the CP 2433, the function block waits until no output signal state has changed in the PIQ during a program cycle. If there is no change in a cycle, the parameter assignment data are written from the working DB to the PIQ.

If no transfer of the job assignment data is possible due to continuously changing PIQ data, the transfer of the job is forced after a specified number of cycles despite changes in the PIQ (the number of cycles can be set with the FB parameter ZYK).

PIQ data are saved by the FB and if the parameter assignment data were transferred, the PIQ data are transferred in the following cycle.

Errors

If the CP 2433 does not exist at the address specified by the user for the function block (parameter BGAD), it cannot be recognized by the function block.

Start up OB

In the start up OBs (OB21, OB22), the user sets the start up ID in the parameter FKT (see Section 2.3.4). The function block is, however, not called in the start up OBs. The function Block processes the start up routine only in the cyclic program.

Permanent storage of the FB

The function block can be stored permanently in the PLC memory in an EEPROM module of the PLC. It is also possible to re-name the block.

Transferring the working DB

☞ **Transfer of the working DB to the PLC or PG output of the working DB followed by re-transfer is not permitted when the PLC is in the RUN mode.**

Interrupt and timer OBs

☞ **In the interrupt and time OBs, both access to the PII and the PIQ of the CP 2433 and calling the function block are not permitted.**

2.3.3 Description of the FB Job Processing

The function block is used both to set the mode of the CP and to transfer jobs to be executed once. The following modes and jobs can be set by the FB parameters.

Start-up and cyclic mode: Configure configuration (with or without switching over to the protected mode).

During the start-up routine of the FB, the CP is supplied with configuration data. The CP must be in the configuration mode (see Section 2.2.1).

The configuration data stored in the working DB are written to the CP and saved permanently. The configuration data include the following:

- ➢ Configured parameters
- ➢ Configured I/O configuration
- ➢ Configured ID codes
- ➢ The list of configured slaves (LPS)

At the beginning of the transfer, the CP switches to the OFFLINE mode. At the end of the transfer, the CP switches back to the ONLINE mode.

With an additional coding, the following distinction can be made at the end of a job:

1. The CP is switched to the protected mode when configuring is completed.
   Communication is only with detected and configured AS-I slaves. The AS-I slaves can be supplied with the configured parameters.
2. The CP remains in the configuration mode when configuring is completed.
   Communication is with all detected slaves (except slave address “0”).

Processing user jobs

- ➢ Writing parameters
  The parameters from the “parameter” field in the working DB are written to the CP and stored in the data image. The parameters that have changed are passed on by the CP to the slaves.
- ➢ Configuring parameters
  The configured parameters of all the slaves are written from the working DB to the CP and entered in the configuration data of the CP.

  The configured parameters are transferred to the slaves when the CP is booted (PLC power up, PLC STOP -> RUN).

➢ Reading the configuration

The current I/O configuration, the current ID codes and the list of active slaves are read from the CP and entered in the fields configured I/Os, configured ID codes and LPS of the working DB.

These values (possibly after having been changed) can then be used to configure the CP.

Command to CP (expert mode)

With this job, the data area “command to CP” of the working DB is written to the CP. This allows all the jobs of the AS-I specification to be triggered by the user application.

If jobs which provoke a response are issued, the response is entered in the command response field of the working DB.

2.3.4 Interface of the Function Block FB60

The call interface of FB60 has the following structure:

```
     :JU FB 60                  FB 60
NAME :ASI:2433
DB   :                        ASI:2433
BGAD :                    --  DB        STAT --
FKT  :                    --  BGAD
ZYK  :                    --  FKT
STAT :                    --  ZYK
```

The function block can be called with direct or with indirect parameter assignment. With direct parameter assignment, the actual operands specified in the block are valid for the parameters DB, BGAD, FKT and ZYK. With indirect parameter assignment, these parameters must be entered in the working area of the working DB.

Description of the Block Parameters

Name	Par	Data	Meaning	Permitted values
DB	D	KF	Number of the working data block	KF = +x: x = 0: indirect parameter assignment: The parameters DB, BGAD and FKT are in the called data block from data word 1 to data word 5 DW1 = DB DW2 = BGAD DW3 = FKT DW4 = ZYK DW5 = STAT 10 <= x <= 255: Direct parameter assignment: x = Number of the working DB
BGAD	D	KF	Module address (slot-dependent start address of the I/O area used by the CP)	KF = +x: x ∈ [64, 80, 96, 112]
FKT	I	BY	Function	Flag byte(*)
ZYK	D	KF	Maximum number of cycles	KF = +x: 0 <= x <= 255 On completion of the specified number of PLC cycles, the transfer of the parameter data is forced, even if the user has changed the PIQ. If x=0, the transfer is made immediately and without any old-new comparison of the PIQ.
STAT	Q	BY	Status byte of the FB	Flag or output byte(*)

Table 2-16 Input and Output Parameters of the Function Block FB60

(*) No scratchpad flags (FY200 to FY255) must be used

Assignment of the Input Parameter FKT:

➢ IDs set during start-up. These settings must be made in the start-up OBs (OB21/22).

Bit 0: Start-up ID (must always be set in OB20/OB21)

Bit 1: Configuration - remain in configuration mode

Bit 2: Configuration - switch over to protected mode

Once the start-up has been processed, the input parameter FKT is overwritten with “0”.

➢ Job IDs

Bit 3: Job: Write parameter

Bit 4: Job: Configure parameter

Bit 5: Job: Command to CP

Bit 6: Job: Read configuration

Bit 7: Reserved

The following rules apply to issuing jobs (job IDs):

Only one job can be selected. Once the job has been processed, the function block overwrites the input parameter FKT with “0”.

The only permitted settings for parameter FKT can be found in the following table:

Meaning	FKT coding in HEX format
Start-up ID set	01 H
Start-up ID set / create configuration - remain in configuration mode	03 H
Start-up ID set / create configuration - change to protected mode	05 H
Write parameter job	08 H
Configure parameter job	10 H
Command to CP job	20 H
Read configuration job	40 H

Table 2-17 Coding of the Parameter FKT

Bits of the output parameter STAT:

Bit 0:	Job active This bit is set by the function block as soon as the job is being processed and while the CP is booting. The bit is reset when a new job can be entered.
Bit 1:	Error from FB or CP (error number in flag byte 255)
Bit 2...6:	Reserved
Bit 7:	CP is in the configuration mode

Using FB60 in the user program

The following diagram shows how the function block can be incorporated in the sequence of the control program.

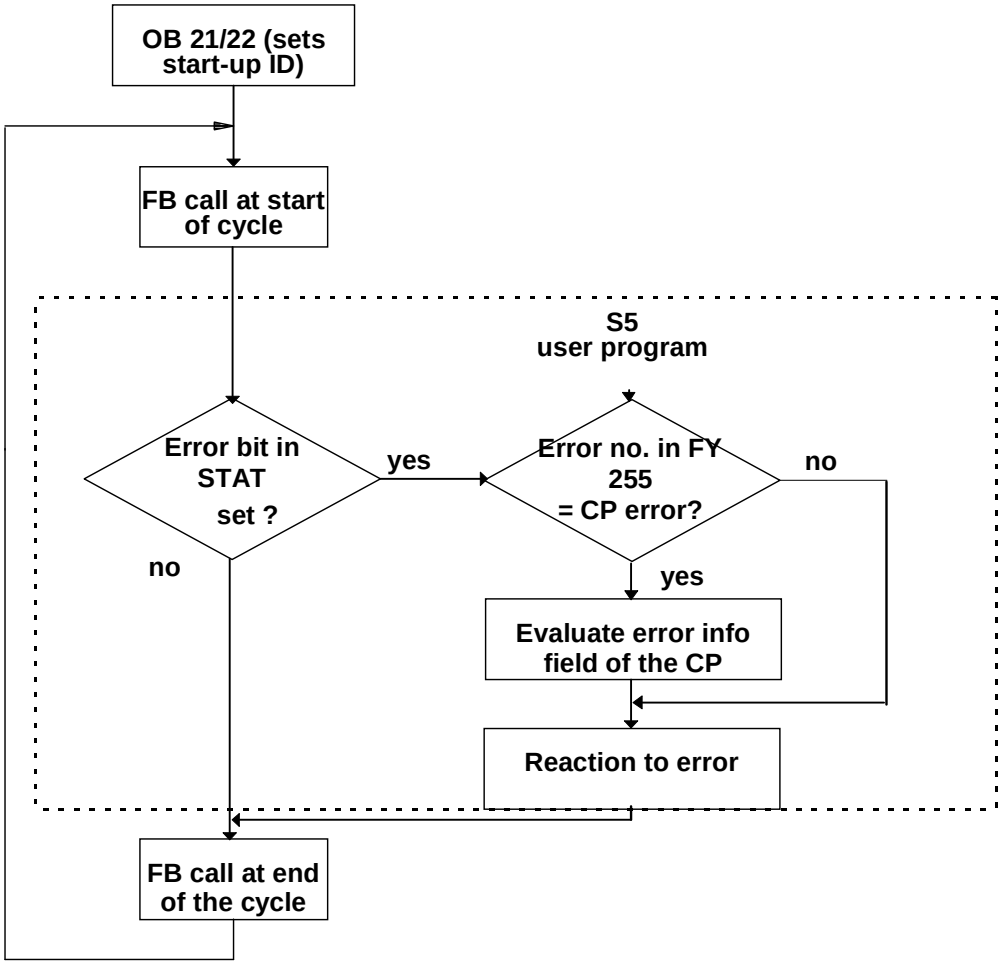


Fig. 2-12 Flowchart of the User Progam

Error ID using FY255

If an error has occurred while the function block is being processed (STAT bit one set), the flag byte 255 contains more detailed information about the cause of the error.

If the function block signals a parameter assignment error, the cause can be derived from the error number (e.g. data block does not exist or too short).

If an error is signaled by the CP during the processing of the job, this is signaled by a specific error number in flag byte 255. The cause of the error can be found in the “error information of the CP” field in the working data block. After a CP error, the function block enters the available error information here.

If the function block is processed without errors, flag byte 255 has the value zero.

Error no.	Meaning
0	No error
1	Illegal data block number
2	Data block does not exist
3	Data block too short
4	Illegal module address
5	Start-up not run through correctly
6	CP signaling error
7	Job invalid (content of FKT incorrect)

Points to note about error processing

The error bit indicates both error statuses in the AS-I system and when jobs are completed incorrectly.

An AS-I error status may exist over several cycles so that the error bit remains set constantly. It is nevertheless possible that during this status (error = 1) a job can be executed and its correct execution can be detected. On completion of the job (the STAT bit “job active” changes from 1 to 0) the error bit indicates the result of job processing.

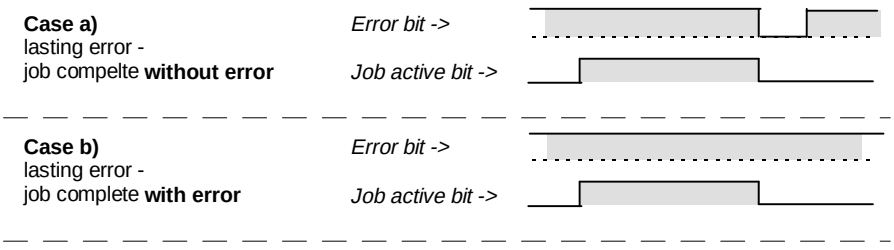


Fig. 2-13 Flowchart ‘Error Processing’

2.3.5 Structure of the Working Data Block

The working data block is used as an area for transferring parameters and configuration data between the PLC and the CP 2433.

The areas with the configuration data and the 3 lowest areas with the command field, the command response field and the error information of the CP are significant for the application.

The structure of the working data block can be seen in the following table:

	Bit 15 ...			... Bit 0
DW 0 ... DW 16 ... DW 24 ...	Working area of the data block			
DW 32	reserved	Parameter slave 1	Parameter slave 2	Parameter slave 3
DW 33 ... DW 39	Parameter slave 4 ...	...	...	Parameter slave 31
DW 40	reserved	Parameter slave 1	Parameter slave 2	Parameter slave 3
DW 41 ... DW 47	Parameter slave 4 ...	...	...	Parameter slave 31
DW 48	reserved	I/O config. slave 1	I/O config. slave 2	I/O config. slave 3
DW 49 ... DW 55	I/O config. slave 4 ...	...	...	I/O config. slave 31
DW 56	reserved	ID code slave 1	ID code slave 2	ID code slave 3
DW 57 ... DW 63	ID code slave 4 ...	...	...	ID code slave 31
DW 64	reserved	reserved	reserved	reserved
DW 65	LPS slave 0-3 0 | 1 | 2 | 3	LPS slave 4-7 4 | 5 | 6 | 7		
DW 66	LPS slave 16-19	LPS slave 20-23		
DW 67	reserved			
DW 68	reserved			
DW 69	reserved			
DW 70	reserved			
DW 71	reserved			
DW 72 ... DW 79	Command field : commands to the CP			
DW 80 ... DW 87	Command response field			
DW 88 ... DW 95	Error information of the CP			

Configured parameter

Parameters

Configured I/Os

Configured ID codes

LPS: configured slaves

Fig. 2-14 Working Data Block

2.3.6 Instructions for Configuring and Programming

2.3.6.1 How to Configure the CP 2433 with Function Block

When configuring the CP 2433 with the function block, the configuration data of the CP 2433 are entered in the working data block. The CP 2433 recognizes the following configuration data:

- ➢ Configured parameters
- ➢ Configured data (configured I/O configuration, configured ID code)
- ➢ Configured slaves (LPS)

Follow the procedure assigned below when entering the configuration data.

- ✔ Enter the configured parameters for the slaves in the appropriate field in the working DB. Configured parameters are sent to the appropriate slaves after power on (default setting for the slaves). If your slaves (e.g. AS-I modules) do not evaluate parameters, assign the value “F” to the corresponding fields.
- ✔ Enter the configuration data and the LPS in to the working DB. Here, there are two possibilities:

  1. First possibility - enter data according the vendor’s instructions

  Take the I/O configuration and the ID code of the slaves connected to the AS-I cable from the manufacturer’s technical data and enter the values in the working DB. For each slave required on the cable, enter a “1” in the LPS. Enter a “0” in the LPS for slaves that should not be detected on the cable.

  2. Second possibility - read out data from the slaves

  Set the CP 2433 to the configuration mode and start-up your AS-I network step by step. If everything runs correctly, you can then issue the job “read configuration” by setting bit 6 of the parameter “FKT” to “1”. The function block then reads in the current slave configuration connected to the AS-I cable and enters this in the fields of the working DB (configured I/O configuration, configured ID code and LPS).

  These values are now available for configuring the CP.

The configuration data in the working DB must be saved on the CP. To do this, follow the steps outlined below:

- ✔ Switch the CP to the configuration mode (selector on the module)
- ✔ Assign the value “1” to bit 2 of the parameter FKT in the start-up OBs
- ✔ Switch your PLC from “STOP” to “RUN”

When the PLC is started up, the configuration data are now saved automatically on the CP. Following this, the CP switches to the protected mode.

If you set bit 1 instead of bit 2 in the FKT parameter, the CP remains in the configuration mode after saving the configuration data, i.e. it does not switch to the protected mode.

2.3.6.2 Automatic Configuration when a CP 2433 is Replaced

If you assign “1” to bit 2 in the “FKT” parameter in the start-up OBs, a replacement CP 2433 is automatically configured. Follow the steps outlined below:

✔ Switch the CP 2433 to the configuration mode (as supplied)

✔ Switch your PLC from “STOP” to “RUN”. The CP 2433 is then configured automatically by the function block. Following this, your user program continues to run completely normally.

2.3.6.3 Check List for Programming the CP 2433 with Function Block

✔ Set bit 0 of the FKT parameter (start-up ID) to “1”, in the start-up OBs (OB21/22). If you want a replacement CP 2433 to be configured automatically when the PLC starts-up, you should also set bit 2 of the start-up ID to “1”.

✔ Make sure that the CP has been completely booted by checking bit 0 of the parameter STAT for “0”. Only start your program when the CP is completely booted.

✔ Address the inputs and outputs of the slaves as usual (see also the description of the standard mode).

Example: CP start address 80 (corresponds to slot 2+3):

Address bit 0 of slave 1 as an input	I80.0
Address bit 2 of slave 2 as an output	Q81.6

✔ Scan the error bit of the function block cyclically (bit 1 in the “STAT” parameter). If an error occurs, the function block enters an error ID in the working data block (from DW88 onwards). This provides more detailed information about the cause of the error (see Section 2.3.9).

✔ If required, send jobs from your user program via the function block to the CP. The type of job is determined by the bit set in the “FKT” parameter (e.g. bit 3 for “write parameter”). By evaluating the bit “job active” (bit 0) and the error bit (bit 1) in the “STAT” parameter you can check whether a job was executed correctly.

☞ **Supplying the parameter FKT directly using the PG test function “force variable” is not permitted.**

☞ **The example program on the diskettes supplied with this manual contains several examples for triggering and processing jobs.**

2.3.7 Job: Write Parameters

The “write parameters” job allows you to make a simple parameter change for the slaves connected to the AS-I cable.

The job follows the sequence as shown below:

➢ First, the required parameters are entered in the working DB (DW40 to 47)

➢ Following this, the “write parameter’s” job is triggered by setting bit 3 in FKT. The CP then compares the parameters currently stored on the slaves with the values in the data block to establish which parameters have changed. The slaves for which parameters have changed are then assigned the new parameters by the CP.

➢ By evaluating the bit “job active” and the error bit in the STAT parameter, you can check whether the job was correctly processed or not.

2.3.7.1 Job: Configure Parameters

With the “configure parameters” job, the configured parameters of all slaves are saved simultaneously on the CP.

The sequence of the job is as below:

➢ The configured parameters of all slaves are entered in the working DB (DW 32 to 39)

➢ The “configure parameters” job is triggered by setting bit 4 in FKT. The CP then saves the configured parameters that were entered in the data block. These parameters are transferred to the slaves automatically during a cold restart.

➢ By evaluating the “job active” bit and the error bit you can determine whether or not the job was correctly executed.

☞ **The example program on the diskettes supplied with this manual contains several examples for triggering and processing jobs.**

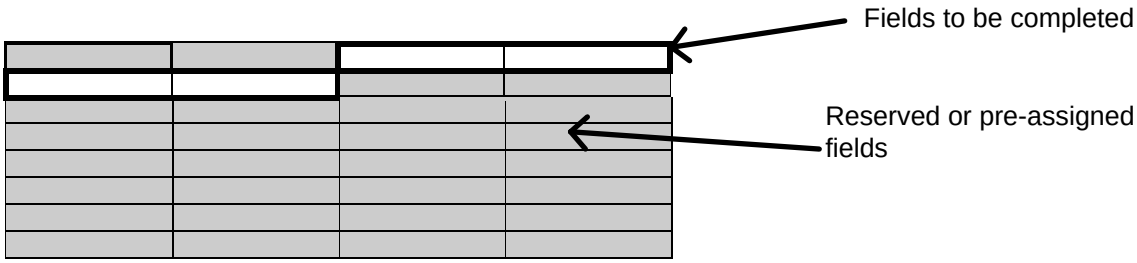
2.3.8 Description of the “Command to CP” Jobs

This section describes the command calls. These are the calls triggered in the function block by the FKT parameter “bit 5”.

To transfer parameters, the command field in the working DB is used. To return parameters and messages, the command response field in the working DB is used. The entries in the fields are explained below.

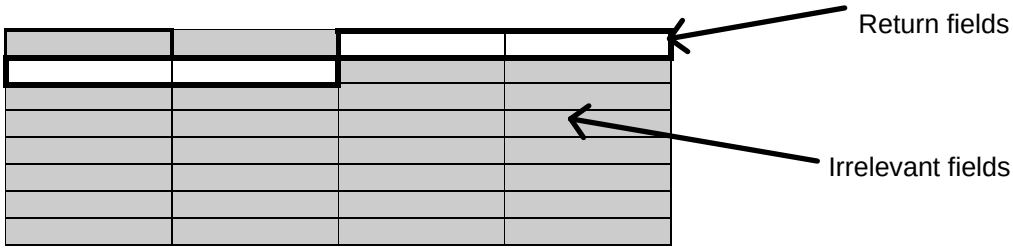
Note on the representation in the command field of the working DB:

Relevant fields are shown on a white background; irrelevant fields are gray.



Note on the representation in the command response field of the working DB:

Relevant fields are shown on a white background; irrelevant fields are gray.



How you use the jobs can be found in the individual descriptions of the jobs, the descriptions in Section 1.5 of the manual ’SINEC S1/AS-I Introduction an Basic Information’, the PICS appendix and the detailed explanations in /1/.

The commands that can be executed can be seen in the following table:

Name / Section	Parameter	Return	Coding:
Set_Permanent_Parameter / 2.3.8.1	Slave address, Parameter		0 0 H
Get_Permanent_Parameter / 2.3.8.2	Slave address	Parameter	0 1 H
Write_Parameter / 2.3.8.3	Slave address, Parameter	Return value (Echo)	0 2 H
Read_Parameter / 2.3.8.4	Slave address	Parameter value	0 3 H
Store_Actual_Parameter / 2.3.8.5	None		0 4 H
Set_Permanent_Configuration / 2.3.8.6	Slave address, Configuration		0 5 H
Get_Permanent_Configuration / 2.3.8.7	Slave address	Configured data	0 6 H
Store_Actual_Configuration / 2.3.8.8	None		0 7 H
Read Actual Configuration / 2.3.8.9	Slave address	Actual configuration data	0 8 H
Set_LPS / 2.3.8.10	LPS		0 9 H
Set_Offline_Mode / 2.3.8.11	Mode		0 A H
Set_Autoprogramming / 2.3.8.12	Mode		0 B H
Set_Operation_Mode / 2.3.8.13	Mode		0 C H
Change_Slave_Address / 2.3.8.14	Address 1, Address 2	Input data	0 D H
Read Slave Status / 2.3.8.15	Slave address	Error record of the slave	0 F H
Read Lists and Flags / 2.3.8.16	None	LDS,LAS,LPS,flags	1 0 H
Read List of ID Codes / 2.3.8.17	None	ID codes	1 1 H
Read List of I/O Configurations / 2.3.8.18	None	I/O configurations	1 2 H
Read Parameter Echo List / 2.3.8.19	None	Parameter echo list	1 3 H
Read Version Number / 2.3.8.20	None	Version string	1 4 H
Slave Diagnostics / 2.3.8.21	Slave address	Error counter of the slave	1 5 H
Read and Delete Slave Status / 2.3.8.22	Slave address	Error record of the slave	1 6 H
Read Slave ID / 2.3.8.23	Slave address	ID Code	1 7 H
Read Slave I/O / 2.3.8.24	Slave address	I/O configuration	1 8 H

Table 2-18 Overview of Command Jobs

2.3.8.1 Set_Permanent_Parameter

Meaning

With this call, a parameter value for the specified slave is transferred to the CP 2433. The value is entered as a configured value in the configuration data.

The parameter is **not** transferred to the slave by the CP 2433. Only after a cold restart or warm restart on the PLC is the parameter value transferred when the slave is activated.

☞ **The "configured parameter" field of the working DB is unchanged by this call.**

Structure in the command field

	Bit 15 Bit 12	Bit 11 Bit 8	Bit 7 Bit 4	Bit 3 Bit 0
DW 72			0 H	0 H
DW 73	Slave address		0	Parameter
DW 79				

2.3.8.2 Get_Permanent_Parameter

Meaning

With this call, a parameter value in the EEPROM of the CP 2433 is read.

Structure in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			0 H	1 H
DW 73	Slave address			
DW 79				

Structure in the command response field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 80				
DW 81	0 H	Parameter		
DW 87				

2.3.8.3 Write_Parameter

Meaning

With this call, a parameter value is transferred and is sent directly via the AS-I bus to the addressed slave. The parameter is stored in temporary storage.

In the response, the slave returns the current parameter values that can deviate from the currently written values according to the AS-I master specification (/2/). These data are entered in the parameter echo.

Structure in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			0 H	2 H
DW 73	Slave address		0 H	Parameter
DW 79				

Structure in the command response field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 80				
DW 81	0	Parameter echo		
DW 87				

2.3.8.4 Read_Parameter

Meaning

With this call, the current parameter value (actual parameter) is returned.

Structure in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			0 H	3 H
DW 73	Slave address			
DW 79				

Structure in the command response field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 80				
DW 81	0 H	Parameter		
DW 87				

2.3.8.5 Store_Actual_Parameters

Meaning

With this call, the configured parameters are overwritten by the actual parameters, i.e. the parameters are configured.

Structure in the command field

	Bit 15 Bit 12	Bit 11 Bit 8	Bit 7 Bit 4	Bit 3 Bit 0
DW 72			0 H	4 H
DW 73				
DW 79				

2.3.8.6 Set_Permanent_Configuration

Meaning

With this call, the I/O configuration data and the ID code for the address AS-I slave are configured. The data are stored permanently on the AS-I master module.

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

Structure in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			0 H	5 H
DW 73	Slave address		ID code	I/O configuration
DW 79				

2.3.8.7 Get_Permanent_Configuration

Meaning

With this call, the desired configuration data stored in the EEPROM (i.e. configuration data and the ID codes) of an addressed slave are returned.

Structure in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			0 H	6 H
DW 73	Slave address			
DW 79				

Structure in the command response field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 80				
	ID code	I/O configuration		
DW 87				

2.3.8.8 Store_Actual_Configuration

Meaning

With this call, the actual I/O configuration data and actual ID codes detected on the AS-I are stored permanently in the EEPROM. The list of active slaves (LAS) is stored permanently as list of configured slaves (LPS).

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

In protected mode this call will **not** be executed.

Structure in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			0	7
DW 73				
DW 79				

2.3.8.9 Read actual configuration data

With this call, the actual I/O configuration data and actual ID codes are of an addressed slave detected on the AS-I are returned.

Structure in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			0 H	8 H
DW 73	Slave address			
DW 79				

Structure in the command response field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 80				
	ID code	I/O configuration		
DW 87				

2.3.8.10 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 changes to the offline phase and then switches to the normal mode (cold restart on the CP).**

In protected mode this call will **not** be executed.

Structure in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			0 H	9 H
DW 73	LPS slave 0..3 0 | 1 | 2 | 3	LPS slave 4..7 4 | 5 | 6 | 7	LPS slave 8..11 8 | 9 | 10 | 11	LPS slave 12..15 12 | 13 | 14 | 15
	LPS slave 16..19	LPS slave 20..23	LPS slave 24..27	LPS slave 28..31
DW 79				

2.3.8.11 Set_Offline_Mode

Meaning

This call switches between the online and offline mode.

The OFFLINE bit is **not** permanently stored, i.e. during the startup/restart the bit is set to ONLINE again.

In the OFFLINE mode, the CP 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 in the command field

	Bit 15 Bit 12	Bit 11 Bit 8	Bit 7 Bit 4	Bit 3 Bit 0
DW 72			0 H	A H
DW 73	0 H	Mode(0=online 1=offline)		
DW 79				

2.3.8.12 Select Autoprogramming

Meaning

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

The **autoprogramming** bit is **not** stored permanently.

Structure in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			0 H	B H
DW 73	0 H	Mode (1=autoprog allowed 0=autoprog disabled)		
DW 79				

☞ **The change of the bit 'AUTOADDRESS_ENABLE' from 1 to 0 works immediately, the change from 0 to 1 only after changing the CP 2433 to OFFLINE!**

2.3.8.13 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, i.e. 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 start-up/warm restart.

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

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

Structure in the command field

	Bit 15 Bit 12	Bit 11 Bit 8	Bit 7 Bit 4	Bit 3 Bit 0
DW 72			0 H	C H
DW 73	0 H	Mode (0=protected mode 1=configuration mode)		
DW 79				

2.3.8.14 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 SINEC S1 system. 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.

1. A slave with the old address exists.
2. If the *old slave address* is not equal to 0, then a slave with address 0 cannot be connected at the same time.
3. The *new slave address* must have a valid value.
4. There must be no slave with the *new slave address*.

Note: When changing the slave address, the slave is not reset, i.e. data are retained until new data arrive for the new address.

Structure in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			0 H	D H
DW 73	Old slave address		New slave address	
DW 79				

2.3.8.15 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 in the command field

	Bit 15 Bit 12	Bit 11 Bit 8	Bit 7 Bit 4	Bit 3 Bit 0
DW 72			0 H	F H
DW 73	Slave address			
DW 79				

Structure in the command response field

	Bit 15 Bit 12	Bit 11 Bit 8	Bit 7 Bit 4	Bit 3 Bit 0
DW 80				
	0	Slave status S3 | S2 | S1 | S0		
DW 87				

2.3.8.16 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:

- 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 in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			1 H	0 H
DW 73				
DW 79				

Structure in the command response field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 80				
DW 81	LAS slave 0..3	LAS slave 4..7	LAS slave 8..11	LAS slave 12..15
	LAS slave 16..19	LAS slave 20..23	LAS slave 24..27	LAS slave 28..31
	LDS slave 0..3	LDS slave 4..7	LDS slave 8..11	LDS slave 12..15
	LDS slave 16..19	LDS slave 20..23	LDS slave 24..27	LDS slave 28..31
	LPS slave 0..3	LPS slave 4..7	LPS slave 8..11	LPS slave 12..15
	LPS slave 16..19	LPS slave 20..23	LPS slave 24..27	LPS slave 28..31
DW 87	Flag1		Flag2	

Flag 1:

Name	Bit number
OFFLINE_READY	0
APF	1
NORMAL_MODE	2
CONFIG_MODE	3
AUTO_ADDR_AVAIL	4
AUTO_ADDR_ASSIGN	5
LES_0	6
CONFIG_OK	7

Flag 2:

Name	Bit number
OFFLINE	0
RESERVED	1
EEPROM_OK	2
AUTO_ADDR_ENABLE	3
RESERVED	4
RESERVED	5
RESERVED	6
RESERVED	7

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 is in the normal mode.
OPERATION_MODE	The flag is set in the configuration mode and reset in the protected mode.
AUTO_ADDR_AVAIL	This flag is set when automatic address programming is enabled (i.e. exactly one slave has failed).
AUTO_ADDR_ASSIGN	This flag is set when automatic address programming is possible (i.e. AUTO_ADDR_ENABLE=1 and no 'wrong' slave is / was connected to the AS-I cable).
LES_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 is set when automatic address programming is enabled by the user (set by HTB call).

2.3.8.17 Read List of ID Codes

Meaning

With this job, the ID code of the AS-I slave is read. The ID code along with the I/O configuration is used to identify a slave uniquely.

The ID code is programmed once when the slave is manufactured and cannot be changed.

Structure in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			1 H	1 H
DW 73				
DW 79				

Structure in the command response field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 80		ID code slave 1	ID code slave 2	ID code slave 3
DW 81	ID code slave 4	ID code slave 5	ID code slave 6	ID code slave 7
	ID code slave 8	ID code slave 9	ID code slave 10	ID code slave 11
	ID code slave 12	ID code slave 13	ID code slave 14	ID code slave 15
	ID code slave 16	ID code slave 17	ID code slave 18	ID code slave 19
	ID code slave 20	ID code slave 21	ID code slave 22	ID code slave 23
	ID code slave 24	ID code slave 25	ID code slave 26	ID code slave 27
DW 87	ID code slave 28	ID code slave 29	ID code slave 30	ID code slave 31

2.3.8.18 Read List of I/O Configurations

Meaning

With this call, the I/O configuration set on the slaves can be read. The I/O configuration along with the ID code is used to identify a slave uniquely.

The coding of the I/O configuration can be found in the manufacturer's documentation for the AS-I slave.

Structure in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			1 H	2 H
DW 73				
DW 79				

Structure in the command response field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 80		I/O conf. slave 1	I/O conf. slave 2	I/O conf. slave 3
DW 81	I/O conf. slave 4	I/O conf. slave 5	I/O conf. slave 6	I/O conf. slave 7
	I/O conf. slave 8	I/O conf. slave 9	I/O conf. slave 10	I/O conf. slave 11
	I/O conf. slave 12	I/O conf. slave 13	I/O conf. slave 14	I/O conf. slave 15
	I/O conf. slave 16	I/O conf. slave 17	I/O conf. slave 18	I/O conf. slave 19
	I/O conf. slave 20	I/O conf. slave 21	I/O conf. slave 22	I/O conf. slave 23
	I/O conf. slave 24	I/O conf. slave 25	I/O conf. slave 26	I/O conf. slave 27
DW 87	I/O conf. slave 28	I/O conf. slave 29	I/O conf. slave 30	I/O conf. slave 31

2.3.8.19 Read Parameter Echo List

Meaning

This call takes into account possible future extensions of the AS-I function.

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

Structure in the command field

	Bit 15 Bit 12	Bit 11 Bit 8	Bit 7 Bit 4	Bit 3 Bit 0
DW 72			1 H	3 H
DW 73				
DW 79				

Structure in the command response field

	Bit 15 Bit 12	Bit 11 Bit 8	Bit 7 Bit 4	Bit 3 Bit 0
DW 80		Par. echo slave 1	Par. echo slave 2	Par. echo slave 3
DW 81	Par. echo slave 4	Par. echo slave 5	Par. echo slave 6	Par. echo slave 7
	Par. echo slave 8	Par. echo slave 9	Par. echo slave 10	Par. echo slave 11
	Par. echo slave 12	Par. echo slave 13	Par. echo slave 14	Par. echo slave 15
	Par. echo slave 16	Par. echo slave 17	Par. echo slave 18	Par. echo slave 19
	Par. echo slave 20	Par. echo slave 21	Par. echo slave 22	Par. echo slave 23
	Par. echo slave 24	Par. echo slave 25	Par. echo slave 26	Par. echo slave 27
DW 87	Par. echo slave 28	Par. echo slave 29	Par. echo slave 30	Par. echo slave 31

2.3.8.20 Read Version ID

Meaning

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

Structure in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			1 H	4 H
DW 73				
DW 79				

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

Structure in the command response field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 80 KS:				C
DW 81 KS:		P		2
		4		3
		3		.
		.		V
		x		.
DW 86 KS:		y		y
DW 87 KS:				

x.yy stands for the current version number.

2.3.8.21 Slave Diagnostics

Meaning

This command returns the number of AS-I errors that occurred in conjunction with a slave. With this call, the error counter is then deleted.

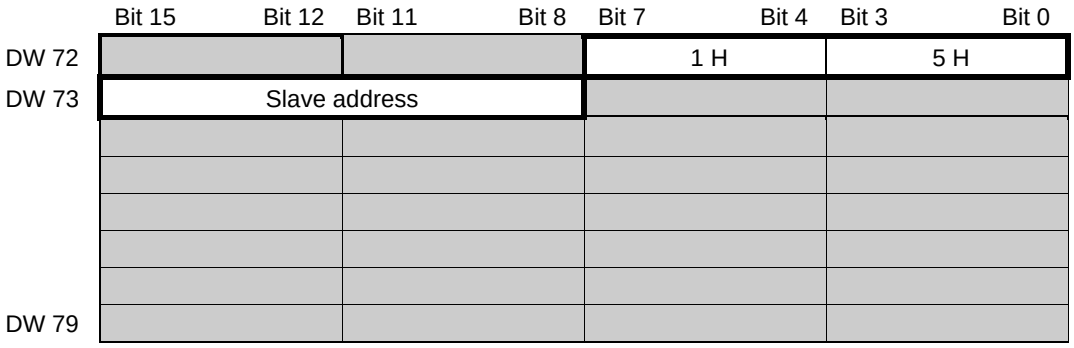
The value of the error counter is incremented in the following situations:

➢ When a slave does not reply correctly during the data exchange phase despite repeating the master frame (i.e. missing or incorrect slave frame).

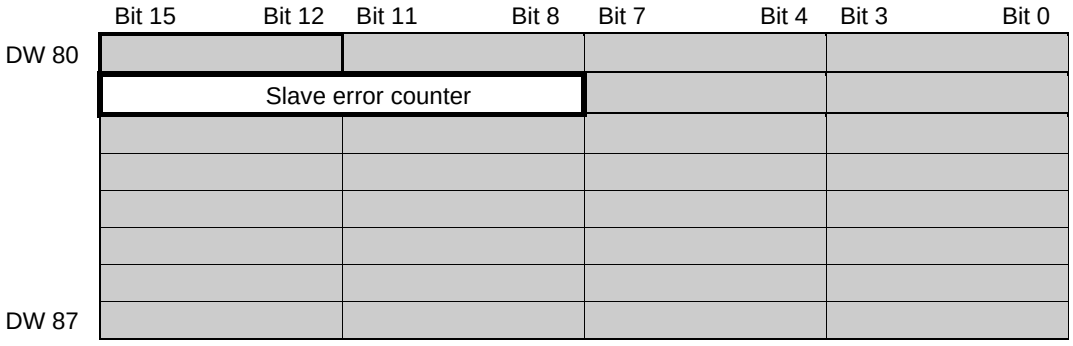
➢ With slaves that have not been activated, the error counter is incremented when a slave has already been detected (i.e. it exists in the LDS) but then no longer correctly replies.

The error counter is incremented to a maximum value of 255 and then remains at this value until deleted.

Structure in the command field



Structure in the command response field



2.3.8.22 Read Slave Status and Delete

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 in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			1 H	6 H
DW 73	Slave address			
DW 79				

Structure in the command response field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 80				
	0 H	Slave status		
DW 87				

2.3.8.23 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 in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			1 H	7 H
DW 73	Slave address			
DW 79				

Structure in the command response field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 80				
	0 H	Slave ID		
DW 87				

2.3.8.24 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 in the command field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 72			1 H	7 H
DW 73	Slave address			
DW 79				

Structure in the command response field

	Bit 15 – Bit 12	Bit 11 – Bit 8	Bit 7 – Bit 4	Bit 3 – Bit 0
DW 80				
	0 H	Slave I/O		
DW 87				

2.3.9 Error Processing / Assignment of the Error Numbers

Structure in the Error Information Field of the CP

	Bit 15 Bit 12	Bit 11 Bit 8	Bit 7 Bit 4	Bit 3 Bit 0
DW 88		Error ID	ID byte 1	
DW 89	ID byte 2		ID byte 3	
	Disc. slave 0-3	Disc. slave 4-7	Disc. slave 8-11	Disc. slave 12-15
	Disc. slave 16-19	Disc. slave 20-23	Disc. slave 24-27	Disc. slave 28-31
DW 95				

➢ The error ID has the following structure:

Bit 15..12	Bit 11	Bit 10	Bit 9	Bit 8
Status	APF	Configuration error	Command error	0

Bit 11: APF error (=ASI power fail)

Bit 10: Configuration error (only indicated in the protected mode):

If a configuration error occurs, bytes 4-7 indicate the slaves for which the configured data deviate from the actual configuration.

Bit 9: Command error

➢ Byte 1-3: Contains information about incorrect commands:

Byte 1: Indicates which command was executed

Byte 2: Indicates which slave is affected (FFH=no particular slave)

Byte 3: Indicates the error type

➢ Byte 4-7: List of slaves with configuration discrepancies

Each bit corresponds to exactly one slave.

Bit = 1 Means that the slave differs from the set configuration

Error types:

Long text	Short text	Decimal value
No error	OK	0
$Address_{old}$ wrong	ADDR1_WRONG	1
Slave not in LAS	NOT_IN_LAS	2
$Address_{new}$ wrong	ADDR2_WRONG	3
Not allowed in CP status (e.g. offline)	NOT_ALLOWED	5
Transferred list empty	LIST_EMPTY	6
Slave 0 exists	SLAVE_0_EXISTS	8
Slave with $address_{old}$ not detected	SND_ERROR	10
A slave with address 0 already exists	SD0_ERROR	11
A slave with $address_{new}$ already exists	SD2_ERROR	12
Error deleting the slave address	DE_ERROR	13
Error setting the new slave address	SE_ERROR	14
Address only stored temporarily	AT_ERROR	15
Command not implemented	NOT_IMPLEM	254
Unknown command	UNKNOWN	255

Table 2-19 Error Types

☞ **If the error number 6 is entered in FY 255 (CP signals error) and the field "error information of the CP" in the working DB has "0" entered, this can have two possible causes:**

1. **When booting the CP 2433, an AS-I power fail was detected**
2. **When booting the CP 2433, there are no slaves.**

The following error types (following the short text in Table 2-19) are now explained in detail.

ADDR1_WRONG

The specified address is incorrect. The address is either not in the range 0 to 31 or you have attempted to configure parameters or data for slave 0 or to transfer parameters to slave 0. This is not permitted. Please check the selected slave address.

NOT_IN_LAS

The job was rejected because the selected slave was not in the LAS at the time when the job should have been processed. Please check whether the slave you have addressed exists and whether it is functioning correctly.

ADDR2_WRONG

The address transferred in the call is not valid. Only values from 0 to 31 (inclusive) can be transferred.

NOT_ALLOWED

The AS-I master call you have attempted is not permitted in the current CP status. Please switch to the operating mode or offline mode required for your job according to /1/.

LIST_EMPTY

The list transferred for configuring the slaves (LPS) is empty. Please select at least one slave you would like to configure.

SLAVE_0_EXISTS

It is not possible to switch to the protected mode if slave 0 exists. Please assign a valid address to this slave.

DATA_WRONG

A parameter call had an illegal value (e.g. the parameter ‘Mode‘ of the call ‘Set_Operation_Mode’ was not ‘0’ or ‘1’).

SND_ERROR

You have attempted to change the address of a non-existent slave. Please check the address information in the AS-I call.

SD0_ERROR

You have attempted to change the address of a slave although slave 0 exists. Assign a valid address to this slave (note: an address change is always made using slave 0 (/1/)).

SD2_ERROR

You have attempted to assign an existing address to a slave. Please check the address information in the AS-I call.

DE_ERROR

An error has occurred when deleting the address of the slave. Please check that the slave is functioning correctly.

SE_ERROR

An error has occurred setting the address of the slave. Please check that the slave is functioning correctly.

AT_ERROR

The slave you are addressing could not store the new address. Please check that the slave is functioning correctly.

NOT_IMPLEM / UNKNOWN

The command is not implemented or is unknown. You have specified an incorrect command ID with the call. Check the command ID in your working data block.

❑

A ASI Protocol Implementation Conformance Statement (PICS)

A.1 PICS für CP 2433

Vendor	Siemens AG
Product Name	CP 2433 - SINEC S1 master module for S5-90U, S5-95U, S5-100U and ET200U
Order Number	6GK1243-3SA00
Version	1
Master Profile	M1 with function block, M0 without function block
Date	27.9.1994

List of Master Functions Available with Function Block

No.	Function or Call to the Host Interface (symbolic representation)	M1	Comment / Function implemented by / Section
1	Image, Status = Read_IDI()	X	By process image of the controller (PII)
2	Status = Write_ODI(Image)	X	By process image of the controller (PIQ)
3	Status = Set_Permanent_Parameter(Addr, Param)	X	Set_Permanent_Parameter / 2.3.8.1
4	Param, Status = Get_Permanent_Parameter(Addr)	X	Get_Permanent_Parameter / 2.3.8.2
5	Status, Param = Write_Parameter(Addr, Param)	X	Write Parameters / 2.3.7 Write_Parameter / 2.3.8.3
6	Status, Param = Read_Parameter(Addr)	X	Read_Parameter / 2.3.8.4
7	Status = Store_Actual_Parameters()	X	Store_Actual_Parameter / 2.3.8.5
8	Status = Set_Permanent_Configuration(Addr, Config)	X	Set_Permanent_Configuration / 2.3.8.6
9	Status, Config = Get_Permanent_Configuration(Addr)	X	Get_Permanent_Configuration / 2.3.8.7
10	Status = Store_Actual_Configuration()	X	Store_Actual_Configuration / 2.3.8.8 This command also triggers a cold restart on the CP.
11	Status, Config = Read_Actual_Configuration(Addr)	X	Read_Actual_Configuration / 2.3.8.9
12	Status = Set_LPS(List31)	X	Set_LPS / 2.3.8.10
13	Status, List31 = Get_LPS()	X	Read Lists and Flags 2.3.8.16

14	Status, List31 = Get_LAS()	X	Read Lists and Flags / 2.3.8.16
15	Status, List32 = Get_LDS()	X	Read Lists and Flags / 2.3.8.16
16.0	Status = Get_Flags()	X	Read Lists and Flags / 2.3.8.16
16.1	Status, Flag = Get_Flag_Config_OK()	X	CP error bit, LED display Read Lists and Flags / 2.3.8.16
16.2	Status, Flag = Get_Flag_LDS.0()	X	Read Lists and Flags / 2.3.8.16
16.3	Status, Flag = Get_Flag_Auto_Address_Assign()	X	Read Lists and Flags / 2.3.8.16
16.4	Status, Flag = Get_Flag_Auto_Prog_Available()	X	Read Lists and Flags / 2.3.8.16
16.5	Status, Flag = Get_Flag_Configuration_Active()	X	Read Lists and Flags / 2.3.8.16
16.6	Status, Flag = Get_Flag_Normal_Operation_Active()	X	Read Lists and Flags / 2.3.8.16
16.7	Status, Flag = Get_Flag_APF()	X	CP error bit, LED display Read Lists and Flags / 2.3.8.16
16.8	Status, Flag = Get_Flag_Offline_Ready()	X	Read Lists and Flags / 2.3.8.16
17	Status = Set_Operation_Mode(Mode)	X	Set_Operation_Mode / 2.3.8.13
18	Status = Set_Offline_Mode(Mode)	X	Set_Offline_Mode / 2.3.8.11
19	Status = Activate_Data_Exchange(Mode)	-	not implemented
20	Status = Change_Slave_Address(Addr1, Addr2)	X	Change_Slave_Address / 2.3.8.14

No.	Function or Call to the Host Interface (symbolic representation)	M1	Comment / Function implemented by / Section
21.1	Status, Resp = Cmd_Reset_ASI_Slave(Addr, RESET)	-	not implemented
21.2	Status, Resp = Cmd_Read_IO_Configuration(Addr, CONF)	X	Read slave I/O / 2.3.8.24
21.3	Status, Resp = Cmd_Read_Identification_Code(Addr, IDCOD)	X	Read slave ID / 2.3.8.23
21.4	Status, Resp = Cmd_Read_Status(Addr, STAT)	X	Read slave status / 2.3.8.15
21.5	Status, Resp = Cmd_Read_Reset_Status(Addr, STATRES)	X	Read and slave status and delete / 2.3.8.22

List of Master Functions Available Without Function Block

No.	Function or Call to the Host Interface (symbolic representation)	M0	Comment / Function implemented by / Section
1	Image, Status = Read_IDI()	X	By process image of the controller (PII)
2	Status = Write_ODI(Image)	X	By process image of the controller (PIQ)
3	Status = Set_Permanent_Parameter(Addr, Param)	-	not implemented
4	Param, Status = Get_Permanent_Parameter(Addr)	-	not implemented
5	Status, GParam = Write_Parameter(Addr, Param)	-	not implemented
6	Status, Param = Read_Parameter(Addr)	-	not implemented
7	Status = Store_Actual_Parameters()	-	not implemented
8	Status = Set_Permanent_Configuration(Addr, Config)	-	not implemented
9	Status, Config = Get_Permanent_Configuration(Addr)	-	not implemented
10	Status = Store_Actual_Configuration()	X	Switch on front panel
11	Status, Config = Read_Actual_Configuration(Addr)	-	not implemented
12	Status = Set_LPS(List31)	-	not implemented
13	Status, List31 = Get_LPS()	-	not implemented
14	Status, List31 = Get_LAS()	-	not implemented
15	Status, List32 = Get_LDS()	-	not implemented
16.0	Status = Get_Flags()	-	not implemented

16.1	Status, Flag = Get_Flag_Config_OK()	X	CP error bit, LED display on front panel
16.2	Status, Flag = Get_Flag_LDS.0()	-	not implemented
16.3	Status, Flag = Get_Flag_Auto_Address_Assign()	-	not implemented
16.4	Status, Flag = Get_Flag_Auto_Prog_Available()	-	not implemented
16.5	Status, Flag = Get_Flag_Configuration_Active()	-	not implemented
16.6	Status, Flag = Get_Flag_Normal_Operation_Active()	-	not implemented
16.7	Status, Flag = Get_Flag_APF()	X	CP error bit, LED display on front panel
16.8	Status, Flag = Get_Flag_Offline_Ready()	-	not implemented
17	Status = Set_Operation_Mode(Mode)	X	Switch on front panel of the CP
18	Status = Set_Offline_Mode(Mode)	-	not implemented
19	Status = Activate_Data_Exchange(Mode)	-	not implemented
20	Status = Change_Slave_Address(Addr1, Addr2)	-	not implemented
21.1	Status, Resp = Cmd_Reset_ASI_Slave(Addr, RESET)	-	not implemented
21.2	Status, Resp = Cmd_Read_IO_Configuration(Addr, CONF)	-	not implemented
21.3	Status, Resp = Cmd_Read_Identification_Code(Addr, IDCOD)	-	not implemented
21.4	Status, Resp = Cmd_Read_Status(Addr, STAT)	-	not implemented
21.5	Status, Resp = Cmd_Read_Reset_Status(Addr, STATRES)	-	not implemented

Key to column 3

Character	Meaning
X	Function exists
-	Function does not exist

B Abbreviations / Terms

AS-I	Actuator-Sensor-Interface
AS-I library	Library with which user programs can communicate with the AS-I driver.
AS-I driver	Driver that makes the functions of the CP 2413 available to user programs
APF	ASI power fail. Flag or LED that indicates that the voltage on the AS-I-line is too low. (e.g. failure of the AS-I power supply)
CP	Communications processor: module for installation in computers and programmable logic controllers.
CP 2433	Communications processor for SIMATIC S5 and ET 200 on SINEC S1.
CP 1413	Communications processor for PCs and PGs on SINEC H1
CP 2413	Communications processor for PCs and PGs on SINEC S1
CP 5412	Communications processor for PCs and PGs on SINEC L2
FW	Firmware, here software running on the CP 2413
LAS	List of activated slaves
LDS	List of detected slaves
LPS	List of configured (permanent) slaves
PG	Programmer (programming unit)
PLC	Programmable logic controller; e.g. SIMATIC S5 PLC
SINEC	'Siemens Network Architecture for Automation and Engineering', Range of Siemens products for industrial communication.

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C Further Reading

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

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

(only available in German)

/2/ ASI Complete Specification

can be ordered from the ASI association e.V.

Address : ASI-Verein e.V.
Auf den Broich 4A
51519 Odenthal
Germany

Tel.: 02174 / 40756
Fax.:02174 / 41571

(The AS-I technology is promoted by the ASI association e.V.)

/3/ SINEC Industrial Communications Networks

Catalog IK 10 1994

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D Notes on the CE Marking of SINEC Products

Product Name CP 2433 6GK1 243-0SA00

EC EMC Directive 89/336/EEC

The SINEC products listed above meet the requirements of the EC Directice 89/336/EEC “Electromagnetic Compatibility“

CE

The EC conformity certificates are kept for the authorities responsible according to the EC directives listed above at the following address:

Siemens Aktiengesellschaft
Bereich Automatisierungstechnik
Industrielle Kommunikation (AUT 93)
Postfach 4848
D-90327 Nürnberg
Federal Republic of Germany

Area of Application EMC

The product meets the following requirements:

Area of application	Requirements	
	Emission	Immunity
Industry	EN 50081-2 : 1993	EN 50082-2 : 1995

The product can also be used in the residential environment (residential, commercial and light industry).

Area of application	Requirements	
	Emission	Immunity
Residential	Individual approval	EN 50082-1 : 1992

You must acquire the individual approval from the respective national authority or testing body.

Installation Guidelines

This product meet the requirements providing you adhere to the installation guidelines

1. Manual of CP 2433 Master Module;
2. System Manual AG S5-90U, S5-95U, S5-100U, Manual for ET200U

Working with the Product

To protect the product from electrostatic discharge, personnel must first neutralize any charges on their person before touching the modules.

Notes for the Manufacturers of Machines

The product is not a machine in the sense of the EU directive. There is therefore no conformity certificate for the EU directive 89/392 for machines. If the product is part of the electrical equipment of a machine, the manufacturer of the machine must include the product in the conformity certificate procedure for the machine.

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