

MANUFACTURER DOCUMENT PACKAGE

# Manufacturer's Manual

Reference package for procurement and maintenance review

SIEMENS

## 6GK1543-1AA01

PROFIBUS FMS COMMUNICATION PROCESSOR

Used with the applicable SIMATIC S5 CP 5431 FMS configuration.

REFERENCE PACKAGE

OFFICIAL DOCUMENT

Selected official manufacturer pages follow this cover.

Source: Siemens SIMATIC S5 CP 5431 FMS technical documentation

## 4 Technical Description and Installation of the CP 5430 TF/CP 5431 FMS

### 4.1 Technical Description

#### 4.1.1 Communications Processor CP 5430 TF/CP 5431 FMS

The elements of the CP 5430 TF/CP 5431 FMS important for operation can be seen in Fig. 4.1.

The description of the indicators and interfaces can be found on the following page.

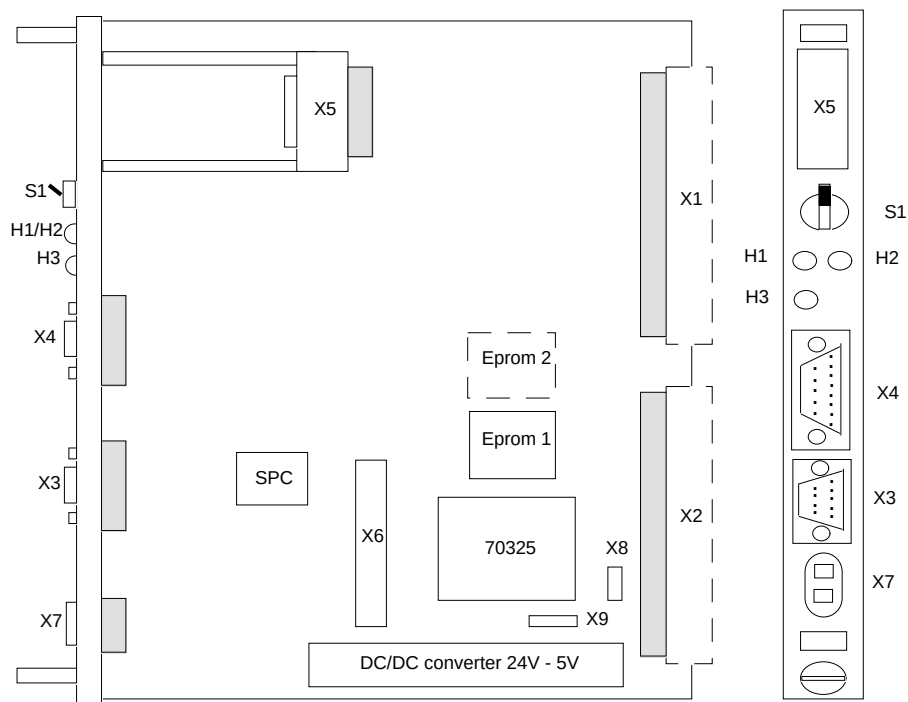


Fig. 4.1 Design of the CP 5430 TF/CP 5431 FMS

**Explanation of Fig. 4.1:****Mode indicator**

H1 : RUN (refer to Table 4.1)

H2 : STOP (refer to Table 4.1)

H3 : CP-FAULT (refer to Table 4.2)

**Mode selector switch:**

S1 : STOP/RUN (refer to Table 4.1)

**Interfaces:**

X1 : backplane connector (refer to Table 4.3)

X2 : backplane connector (refer to Table 4.3)

X3 : L2 interface (refer to Table 4.4)

X4 : PG interface (AS511) (refer to Table 4.5)

X5 : slot for memory submodule

X6 : medium connector (intended for extensions)

X7 : L2FO interface, provides FO link for plastic fiber optic cable

X8 : test jumper

X9 : test jumper

**Eprom 1/2:**

contains the firmware for the CP 5430 TF/CP 5431 FMS

#### 4.1.1.1 Mode Indicators (RUN and STOP LEDs)

Table 4.1 explains the significance of the RUN and STOP LEDs

##### Mode changes

The mode can change in a variety of situations. Fig. 4.2 illustrates the factors causing a particular change.

| FROM         | Actions                                                                                                                                                                                                                                                                                                                                                                                         | TO           |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| STOP         | <ul style="list-style-type: none"> <li>- Set STOP/RUN switch on front panel of CP 5430 TF/CP 5431 FMSto RUN.</li> <li>- Trigger PG function "START CP" (only when mode switch is set to RUN).</li> </ul>                                                                                                                                                                                        | RUN          |
| NOT SYNCHRON | <p>During the STOP -&gt; RUN transition, all pending jobs are deleted.</p> <p>Synchron HDB call in a start-up OB of the programmable controller; STOP/RUN switch on the front panel of the CP 5430 FMS set to RUN.</p>                                                                                                                                                                          | RUN          |
| RUN          | <ul style="list-style-type: none"> <li>- Set START/STOP switch on front panel of the CP from RUN to STOP.</li> </ul>                                                                                                                                                                                                                                                                            | STOP         |
| NOT SYNCHRON | <ul style="list-style-type: none"> <li>- trigger PG function "stop CP".</li> </ul>                                                                                                                                                                                                                                                                                                              | STOP         |
| RUN or STOP  | <ul style="list-style-type: none"> <li>- Set START/STOP switch on front panel of the CP from RUN to STOP.</li> <li>- Trigger PG function "stop CP".</li> </ul> <p>Only after power outage:</p> <ul style="list-style-type: none"> <li>- the programmable controller is in the STOP mode</li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>- No SYNCHRON HDB in start-up OB</li> </ul> | NOT SYNCHRON |

Fig. 4.2 Mode Changes

| LED                                                      | Status of the CP 5430 TF/CP 5431 FMS | Meaning                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Green RUN LED lit, red unlit                             | RUN                                  | <ul style="list-style-type: none"> <li>- All types of data transmission are possible, both from the CPU control program and via PG bus functions.</li> <li>- The memory submodule of the CP 5430 TF/CP 5431 FMS can be read, but not written to.</li> </ul>                                                                                                                                      |
| Red STOP LED lit, green unlit                            | STOP                                 | <ul style="list-style-type: none"> <li>- HDB data exchange between CP and CPU via the backplane bus blocked (evaluation of the PAFE error message possible: refer to Section 7.3.2 or 8.1.3).</li> <li>- CP can be assigned parameters via AS 511 interface (memory submodule can be written to)</li> <li>- Data exchange via PG bus function possible, management services possible.</li> </ul> |
| Green RUN LED <b>and</b> red STOP LED lit                | NOT SYNCHRON                         | <ul style="list-style-type: none"> <li>- No data transmission possible (data exchange with the CPU via the backplane bus blocked).</li> <li>- CP cannot be assigned parameters via the AS 511 interface.</li> <li>- The memory submodule of the CP 5430 TF/CP 5431 FMS can be read but not written to.</li> </ul> <p>Cause: HDB SYNCHRON run incorrectly.<br/>Remedy: call HDB SYNCHRON.</p>     |
| <b>Neither</b> green RUN LED <b>nor</b> red STOP LED lit |                                      | <p>Cause:</p> <ul style="list-style-type: none"> <li>- POWER OFF</li> <li>- CP not correctly plugged in.</li> <li>- Fault indicated by the fault LED (refer to Table 4.2).</li> </ul> <p>Result: no data transmission possible (data exchange with the CPU via the backplane bus blocked).</p>                                                                                                   |

Table 4.1      Meaning of the LEDs

**The START /STOP response**

The CP is a slave processor system in the S5 rack and must therefore follow the START/STOP response of the master (here the PLC). After switching on the power supply, the CP runs through a hardware test program. Following this, it sets up a management block in the non-backed up RAM area for every job defined in the module card for internal program management. It then waits for the start signal from the PLC. In this idle status, all the programs which process the system tasks or operate the PG interface are released, however, data exchange with the PLC or with the bus system is blocked.

**The STOP status is defined as follows:**

- The system programs and the PG interface are enabled.
- The virtual links remain established, or continue to be established.
- Data transfer on the bus system and interfaces to the PLC are blocked.

**The RUN status is defined as follows:**

- All the programs of the CP and interfaces to the PLC are enabled.
- The PG interface is enabled and all ONLINE PG functions can be performed (exception: changing the database).
- Data transfer is enabled and can be monitored with the COM test functions.

The CP runs through a warm restart whenever the status changes from STOP to RUN and from RUN to STOP and to RUN again (resynchronization by repeatedly activating the START/STOP switch on the PLC). All previously established links are cleared and then re-established. All buffered data on the CP is lost during this status change

With the COM functions START CP and STOP CP, the PG can also set the START or STOP request. A STOP status triggered with the START/STOP switch can only be changed with the START/STOP switch.

#### 4.1.1.2 Fault LED

The fault LED is lit permanently or flashes when the firmware of the CP detects an error (refer to Table 4.2).

Note: when the CP fault LED flashes/is lit, the RUN and STOP LEDs are irrelevant!

| LED               | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fault LED flashes | <ul style="list-style-type: none"> <li>- No data transmission possible (data exchange with the CPU via the backplane bus blocked).</li> <li>- Parameters can be assigned on the AS 511 interface.</li> <li>- Data exchange using PG bus functions not possible.</li> <li>- User module detected as invalid during start-up.</li> <li>- Management services remain possible.</li> </ul> <p>Possible causes:</p> <ul style="list-style-type: none"> <li>- memory submodule fault/error</li> <li>- firmware and configuration not compatible</li> </ul> <p>The COM test functions provide further diagnostic tools (refer to Section 12.2).</p> |
| flashes 2x        | Too many links programmed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| flashes 3x        | Memory problem (not enough resources) or incomplete database (OB1 missing)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| flashes 4x        | SAP configuration incorrect (e.g. configured twice).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| flashes 5x        | Incorrect bus parameters.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| flashes 6x        | Incorrect application associations (layer 7).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| flashes 7x        | DP slave parameter assignment error                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| CP fault LED lit  | Hardware fault.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

Tabelle 4.2 Meaning of the Fault LED

#### 4.1.2 Data Exchange between the CPU and CP 5430 TF/CP 5431 FMS

The following section explains how the CP 5430 TF/CP 5431 FMS receives data for transmission from the CPU and how it passes on data it has received to the CPU.

The following programmable controllers of the SIMATIC S5 family are supported:

- S5-115U with CPU 942, 943, 944, 941B, 942B, 943B, 944B, 945
- S5-115H
- S5-135U (single and multiprocessor system) with CPU 922, 928, 928B
- S5-155U (single and multiprocessor system) with CPU 922, 928, 928B, 946/947, 948
- S5-155H.

Depending on the type of data transmission, the CPU and CPs in the same PLC exchange data in different ways:

- Using the I/Os
- Using job buffers and the dual-port RAM

##### Data exchange via I/Os

With data transmission using GP/DP/ZP (refer to Chapters 9 and 10 and 11) the data exchange takes place using the I/O address area. Depending on the address, this area in the STEP 5 control program can either be addressed via the process image of inputs and outputs (PII and PIQ) or directly.



**This data exchange is only possible using the base interface number of the CP (see Fig. 4.3). R In the multiprocessor mode, data exchange via I/Os is only possible with CPU 1 (other CPUs have no access to the base interface).**

### **Data exchange using the job buffers of the dual-port RAM**

With S5-S5 data transmission and free layer 2 access (refer to Chapters 7 and 8) data is exchanged using the dual-port RAM of the CP 5430 TF/CP 5431 FMS. All data and functions passing through the dual-port RAM of the CP 5430 TF/CP 5431 FMS must be provided by handling blocks from the point of view of the control program.

### **The principle of the PLC-CP link**

The interface between CPs and the PLC is a dual-port RAM (DPR) which is organized in the same way in all S5 CPs. The CP 5430 TF/CP 5431 FMS has four such DPR interfaces so that in multiprocessor PLCs each central processing unit (CPU) can communicate with the CP independently of the others. The STEP 5 user program controls the CP via the DPR using handling blocks (HDBs). The STEP 5 user cannot access CPs directly (without using handling blocks). The following system calls (i.e. HDBs) are available:

- SEND                transfer data to the CP
- RECEIVE           receive data from the CP
- RESET ALL        warm restart on the module
- CONTROL          request the status of a job
- SYNCHRON        start up and synchronize the PLC and CP

All these handling blocks must be assigned an interface number and a job number (SYNCHRON only requires an interface number).

**The job number (ANR)** identifies both a task on the CP and in the PLC. On the CP, the job number also involves a parameter set which defines the assignment to a virtual circuit, the data direction and the priority class.

**The interface number (SSNR)** consists of the base interface number and the page number of the CP.

For the data exchange between the CP 5430 TF/CP 5431 FMS and the PLC-CPU a 4 Kbyte dual-port RAM (DPR) is available which is divided into 4 pages each of 1 Kbyte.

In the address area of the CPU, the memory area F400H ... F7FFH (1 Kbyte) is available for addressing the dual-port RAM of CPs/IPs with page addressing. To allow more than one CP/IP to use this memory area to exchange data with a CPU, the page numbers must not overlap. To ensure a unique assignment, the pages as seen by the PLC are numbered from 0 to 255.

The CP 5430 TF/CP 5431 FMS always occupies 4 pages, beginning with the page number assigned to it with the "base interface number" parameter. For this reason, the base interface number beginning at 0 can only be set in steps of 4 (0, 4, 8, 12, ..., 248).

The grouping of pages into four for the CP is only necessary with the multiprocessor PLCs to prevent the page numbers overlapping which would result in double addressing (refer to Fig. 4.3).

In the multiprocessor PLCs, the assignment of CPU and page number is as illustrated in Fig. 4.3.

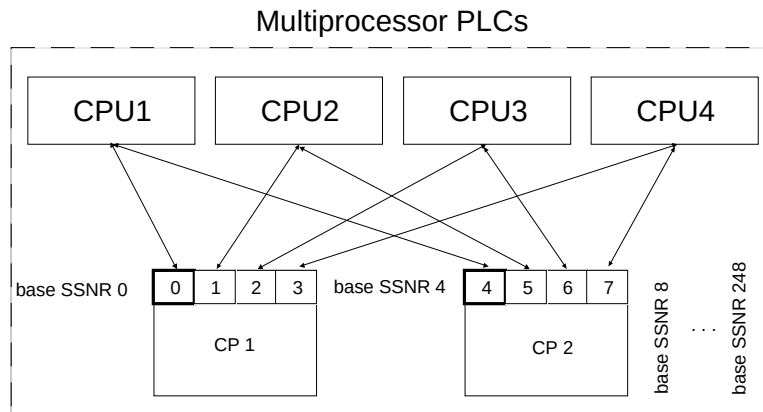


Fig. 4.3 Interface Addressing with a Multiprocessor PLC

For monoprocessor PLCs, it makes sense to use only the base interface number (refer to Fig. 4.4).

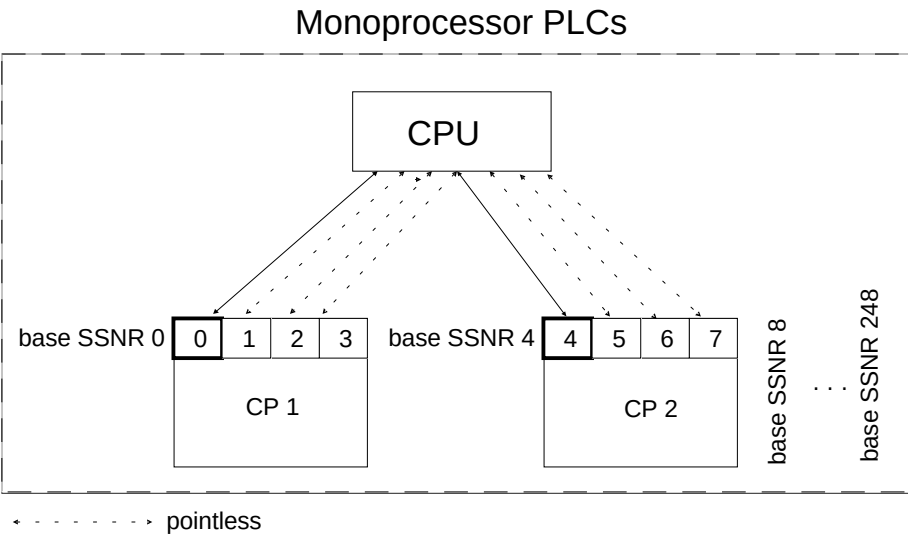


Fig. 4.4      Interface Addressing with a Monoprocessor PLC

The link between the STEP 5 user program and a particular action on the CP is the SSNR/ANR combination. To prevent the system reacting incorrectly, an ANR must only be assigned once per connected CP. Fig. 4.5 illustrates the relationship between a STEP 5 user program and the parameter set on the CP.

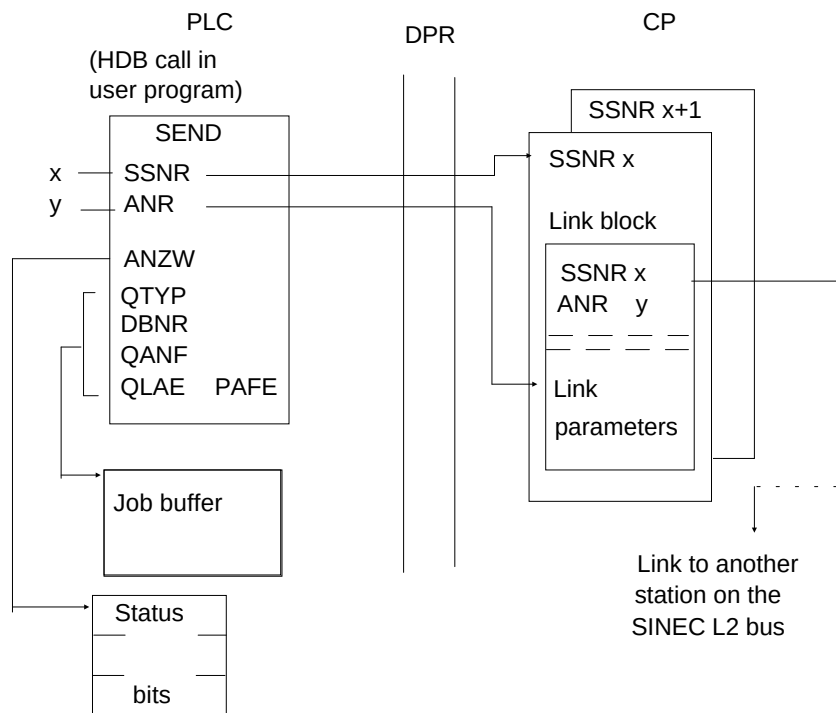


Fig. 4.5 Assignment: Calls in the User Program -> Parameter Lists on the CP



**For more details about handling blocks for the individual PLCs (particularly when the blocks are integrated in the operating system) refer to the descriptions of the relevant programmable controllers**

#### 4.1.2.1 Hardware Monitoring (Watchdog)

If an error occurs in the module which cannot be corrected by the firmware, the hardware monitoring (watchdog) responds and resets the module (cold restart).

### 4.1.3 Technical Data of the CP 5430 TF/CP 5431 FMS

#### 4.1.3.1 Interfaces

|                 |                                                                           |
|-----------------|---------------------------------------------------------------------------|
| PG interface:   | TTY<br>max. 1 km long<br>transmission protocol Siemens AS 511<br>9.6 Kbps |
| L2 interface:   | RS 485                                                                    |
| L2FO interface: | Plastic HP duplex                                                         |



**The L2FO interface and the 9-pin RS 485 connector must never be both connected at the same time. If the L2FO interface is not being used, it must be closed with the rubber plug supplied. Light falling on the receiver diode can cause disturbances.**

#### 4.1.3.2 Operating and Environmental Conditions

|                                |                                                                      |
|--------------------------------|----------------------------------------------------------------------|
| Type of protection:            | IP00                                                                 |
| Permitted ambient temperature: | 0 ... 55 °C                                                          |
| Permitted storage temperature: | - 40 ... + 70 °C                                                     |
| Humidity class:                | F complying with DIN 40040<br>(15 ... 95 % no condensation at 25 °C) |
| Operating altitude:            | up to approx. 3,000 m above sea level                                |

#### 4.1.3.3 Mechanical and Electrical Data

Current consumption:

|      |                            |
|------|----------------------------|
| 5 V  | typically 450 mA           |
| 24 V | typically 70 mA for RS 485 |

|             |                     |
|-------------|---------------------|
| Power loss: | 1.9 W for RS 485    |
|             | 5.3 W at 5V2/500 mA |

|                  |                 |
|------------------|-----------------|
| Back-up current: | typically 20 pA |
|------------------|-----------------|

|            |                                                                   |
|------------|-------------------------------------------------------------------|
| Vibration: | 10 ... 57 Hz 0.15 mm; 57 ... 150 Hz 2 g complying with IEC 68-2-6 |
|------------|-------------------------------------------------------------------|

|                       |    |
|-----------------------|----|
| Electrical isolation: | no |
|-----------------------|----|

|                      |                |
|----------------------|----------------|
| Weight of the module | approx. 0.4 kg |
|----------------------|----------------|

|                                 |                |
|---------------------------------|----------------|
| Weight of the memory submodule: | approx. 0.1 kg |
|---------------------------------|----------------|

|            |                                         |
|------------|-----------------------------------------|
| Card size: | double Eurocard format (160 x 233.4 mm) |
|------------|-----------------------------------------|

|                    |                                |
|--------------------|--------------------------------|
| Front panel width: | 20.32 mm (1 1/3 standard slot) |
|--------------------|--------------------------------|

#### 4.1.3.4 Logical Characteristics

Static RAM 384 Kbytes

DPR 4 Kbytes, 4 pages each 1024 bytes

EPROM 384 Kbytes (maximum)

#### 4.1.3.6 Performance data of the CP 5431 FMS

##### ALI

|                                |                                                                                         |
|--------------------------------|-----------------------------------------------------------------------------------------|
| Number of links:               | 32                                                                                      |
| Number of variables (indexes): | approx. 256                                                                             |
| Maximum length of a variable:  | 233 bytes                                                                               |
| Maximum PDU size:              | 241 bytes (data: 233 bytes)                                                             |
| Link attributes:               | master-master and master-slave (without slave initiative)<br>No connectionless services |

##### CI

|                            |                                                          |
|----------------------------|----------------------------------------------------------|
| Number of links:           | 32                                                       |
| Maximum PDU size:          | 32 bytes                                                 |
| Maximum number of inputs:  | 232 bytes per CI slave (max. however 256 bytes in total) |
| Maximum number of outputs: | 232 bytes per CI slave (max. however 256 bytes in total) |

##### DP (distributed I/Os)

|                                         |                                                          |
|-----------------------------------------|----------------------------------------------------------|
| Maximum number of DP slaves per Master: | 32                                                       |
| Maximum number of inputs:               | 242 bytes per DP slave (max. however 256 bytes in total) |
| Maximum number of outputs:              | 242 bytes per DP slave (max. however 256 bytes in total) |

**GP (global I/Os)**

Maximum number of GP objects: 2048 throughout the network

Maximum number of inputs: 256 bytes per station

Maximum number of outputs: 64 bytes per station

Maximum number of stations: 32

If CI and GP are used together, a maximum of 256 inputs and 256 outputs can be used.



- 1. The specifications for CI only apply when no ALI links are programmed (MMAC, MSAC).**
- 2. The sum of ALI and CI links must not exceed 48.**
- 3. The number of possible ALI links (MMAC, MSAC) can be reduced by the following:**
  - the number of CI links**
  - the number of job numbers per communication reference**
  - the number of entries in the "access to variables" field of the communication references (Get OL).**
- 4. Simultaneous operation of DP and CI is not permitted.**
- 5. Simultaneous operation of GP and CI is not possible.**

#### 4.1.3.7 Interface Assignments

This section specifies the electrical interfaces of the CP 5430 TF/CP 5431 FMS (refer to Tables 4.3 - 4.5). The interfaces are as follows:

- Backplane connector X1/X2
- L2 interface socket X3
- PG interface socket X 4

| X1      | D           | B           | Z           | X2      | D           | B           | Z           |
|---------|-------------|-------------|-------------|---------|-------------|-------------|-------------|
| Pin no. | Signal name | Signal name | Signal name | Pin no. | Signal name | Signal name | Signal name |
| 2       | -           | M5          | P5          | 2       | -           | M5          | P5          |
| 4       | UBATT       | -           | -           | 4       | -           | -           | -           |
| 6       | ADB12       | ADB0        | -           | 6       | -           | -           | -           |
| 8       | ADB13       | ADB1        | MEMR        | 8       | -           | -           | -           |
| 10      | ADB14       | ADB2        | MEMW        | 10      | -           | -           | -           |
| 12      | ADB15       | ADB3        | RDY         | 12      | -           | -           | -           |
| 14      | IRA         | ADB4        | DB0         | 14      | -           | -           | NAU         |
| 16      | IRB         | ADB5        | DB1         | 16      | -           | -           | -           |
| 18      | IRC         | ADB6        | DB2         | 18      | -           | -           | -           |
| 20      | IRD         | ADB7        | DB3         | 20      | -           | -           | -           |
| 22      | -           | ADB8        | DB4         | 22      | TxD         | -           | -           |
| 24      | -           | ADB9        | DB5         | 24      | -           | -           | -           |
| 26      | -           | ADB10       | DB6         | 26      | -           | RxDs        | -           |
| 28      | ODSI        | ADB11       | DB7         | 28      | -           | -           | -           |
| 30      | -           | BASP        | -           | 30      | -           | -           | M24         |
| 32      | -           | M5          | -           | 32      | -           | M5          | P24         |

Table 4.3 Pinout Table of the Backplane Connectors X1 and X2

## L2 interface socket X3 (RS 485)

| X3      |             |                      | occ. with |
|---------|-------------|----------------------|-----------|
| Pin no. | Signal name | PROFIBUS designation | RS 485    |
| 1       | PE          | Protective earth     | yes       |
| 2       | SIL         | -                    | -         |
| 3       | RxD/TxD-P   | Data line - B        | yes       |
| 4       | RTS (AG)    | Control - A          | yes       |
| 5       | M5V2        | Data ref. potential  | yes       |
| 6       | P5V2        | Power supply +       | yes       |
| 7       | BATT        | -                    | -         |
| 8       | RxD/TxD-N   | Data line - A        | yes       |
| 9       | RTS (PG)    | Control - B          | -         |

Table 4.5 Pinout Table of the L2 Interface Socket X3

## PG interface socket X4

| X4      |                                         |
|---------|-----------------------------------------|
| Pin no. | Signal name                             |
| 1       | M-EXT (external ground))                |
| 2       | TTY <sub>IN</sub> -                     |
| 3       | -                                       |
| 4       | P24                                     |
| 5       | MASSE (internal ground))                |
| 6       | TTY <sub>OUT</sub> +                    |
| 7       | TTY <sub>OUT</sub> -                    |
| 8       | M-EXT (external ground))                |
| 9       | TTY <sub>IN</sub> +                     |
| 10      | M24                                     |
| 11      | 20 mA (control source for transmitter)) |
| 12      | MASSE (internal ground)                 |
| 13      | 20 mA (control source for receiver))    |
| 14      | Master poll                             |
| 15      | MASSE (internal ground))                |

Table 4.4 Pinout Table of the PG Interface Socket X4

## 4.2 Memory Submodules

### 4.2.1 Memory Submodule Types for the CP 5430 TF/CP 5431 FMS

To store the parameter data in the CP 5430 TF/CP 5431 FMS, the following memory submodule types can be used:

| Type of submodule | Type | Memory capacity |
|-------------------|------|-----------------|
| EPROM NMOS/CMOS   | 376  | 16Kbytes x 8    |
| EPROM NMOS/CMOS   | 376  | 32Kbytes x 8    |
| EPROM NMOS/CMOS   | 376  | 64Kbytes x 8    |
| RAM               | 377  | 16Kbytes x 8    |
| RAM-Modul         | 377  | 32Kbytes x 8    |
| RAM               | 377  | 64Kbytes x 8    |

Table 4.6 Memory Submodules Available for the CP 5430 TF/CP 5431 FMS

## 4.3 Installation Guidelines

### 4.3.1 Basic Configuration

Fig. 4.6 illustrates the minimum configuration of a SINEC L2 bus system.

- Communications processor CP 5430 TF/CP 5431 FMS
- Bus terminal with terminal cable
- Bus cable

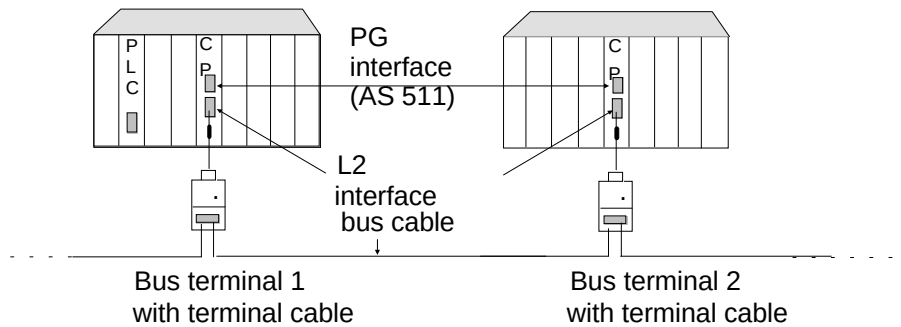


Fig. 4.6 SINEC L2 Components

#### 4.3.1.1 CP 5430 TF/CP 5431 FMS Slots in the various PLCs

The CP 5430 TF/CP 5431 FMS communications processor is designed as a board in double Eurocard format. The front panel is 1 1/3 standard slots wide.

The CP 5430 TF/CP 5431 FMS can be used in the CP slots of the PLCs listed in Section 4.1.2.

The module is supplied in a compact design and can be operated without a fan. If the module is to be inserted in the S5-115U, an adapter casing is required.