siemens

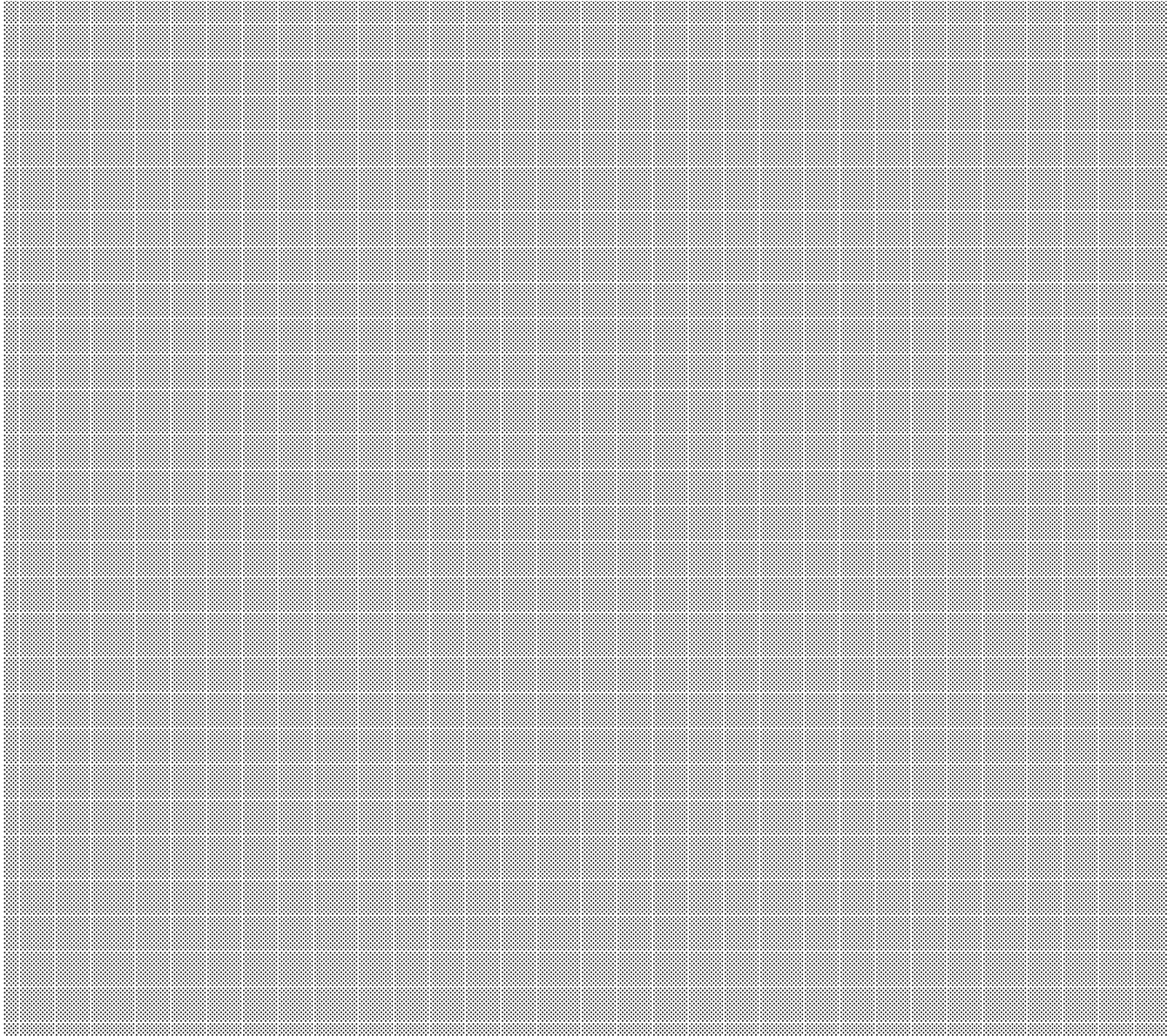# Equipment for special machines

# WF 470
# Display Module

Technical Description                    Edition 12.94

SIEMENS

WF 470
Display Module

Technical Description

Valid from: 6FM1 470-xxx25

Edition December 1994

***Please note***

*As it was our aim to provide you with a concise manual for the product in hand, we have refrained from including every single detail about the product types available. It is therefore beyond the scope of this manual to discuss every situation that could arise when commissioning, running and servicing the product.*

*Should you require additional information, please do not hesitate to contact your nearest Siemens representative.*

*The contents of this product are not part of an earlier or current agreement, undertaking or contract, nor shall they supersede any such previous arrangements. The obligations of Siemens result from the sales contract in force which also describes the warranty conditions that are valid. The contractual warranty clause is neither extended nor restricted in any way by the contents of this manual.*

# Contents

# Preface

**What does this manual contain?**

A technical description of the commissioning procedure and the use of the module within the SIMATIC S5, with particular emphasis on

the hardware, from the version represented by the order Nos. 6FM1 470-xxx25

the pertinent software,

the necessary connection conditions and guidelines.

The former hardware and software versions of the modules with Order No. 6FM1 470-3xx21 and 6FM1 470-4xx21 are dealt with in the Description, Order No. 6ZB5440-03F01-0BA5.

Detailed information relating to the WS 400 system as a whole can be found in Catalogue AR 10.

The following documentation is required for planning and configuring the hardware and software used:

Catalogue AR 10

Catalogue ST 5

WF 470 Planning Instructions

WF 470 Technical Description

**Who is this manual written for?**

This Technical Description is written for

Planning personnel involved in planning the use of the module or peripheral devices,

Commissioning and maintenance personnel involved in checking that the SIMATIC S5 installation guidelines have been complied with or in eliminating shortcomings in that matter.

Both groups should be *qualified personnel* having good knowledge of the subjects named below.

**What knowledge is required?**

Knowledge of the SIMATIC S5 installation guidelines; these can be found in the relevant manuals.

Good knowledge of the STEP 5 programming language.

On these subjects, SIEMENS offer user training courses. For further information, please refer to Catalogue IT 5.

**What do these terms/
symbols mean?**

For the purpose of this description and the product labels,

*Qualified
personnel*

means persons who are familiar with the installation, construction, commissioning and operation of the equipment, and whose qualifications are up to their job. For instance, they are:

trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety practices,

trained in the proper care and use of protective equipment in accordance with established safety practices.

This symbol displays important information on the product or a part of the manual.
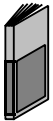
This symbol displays cross-references to other documentation.

## CAUTION

"Caution" indicates that minor personal injury or property damage **can result** if proper precautions are not taken.

# 1  Properties and Scope of Application

The WF 470 module is a diagnostic and display system for machine tools. It allows

a quick and reliable detecting, localizing and display of faults,

automatic indication of the type, location and cause of faults as well as the appropriate remedy.

The module is one of the intelligent I/O devices of the SIMATIC S5 programmable logic controllers; it can be connected, either direct or via the SIMATIC S5, to colour VDUs and keyboards. The module is equipped with its own microprocessor for image display and process data processing.

The module is suited for fault diagnostics of sequencing controls (option). The status of inputs, outputs, flags etc. can be displayed and released for controlling.

The WF 470

supports service functions, even without a programmer,

can provide for easier start-up of machines by offering interactive user guidance; the risk of operator faults is less if certain starting conditions are preset.

continuously acquires production data and can display them in a clear way, which means a considerable improvement in process monitoring.

**Important features** of the WF 470:

– Freely configurable picture and screen form generation via programmer with menu and softkey support.

– Graphic aids for a largely realistic visualization of machine and process.

– Operator hints and instructions in plain text.

– Efficient support of the SIMATIC S5 by storing and managing pictures and texts.

– Message logging via printer or message analysis in a higher-level computer to detect weak points.

– Listing of faults (e.g. of faults occuring during one shift) and printout.

– Colour hardcopy

An easily exchangeable OTPROM memory card contains the firmware for picture representation. Screen forms and process pictures can be built up from the following elements:

| Individual symbols | • 128 standard symbols<br>• 128 freely configurable symbols, 16 of them optional for representation of curves (symbols 240 to 255)<br>• ASCII character set |
|---|---|
| Composite symbols | Combination of any number of individual symbols |
| Text display windows | • Statically faded in, colour change in case of change of the indicator bit,<br>• Fading in/out in case of change of the indicator bit |
| Variable fields | • Process data input field<br>• Process data input/output field<br>• Process data output field<br>• Standardizable process data input/output fields<br>• Comment field<br>• Date<br>• Time |
| Bars, configurable in | • Position (vertical, horizontal)<br>• Direction<br>• 8 colour zones<br>• Width<br>• Length |
| Representation of curves through connection of points | • Up to 16 curves;<br>• Points optionally either static or relative to the programmed position, preset by the controller;<br>• Standardizable coordinate system;<br>• Line colour and thickness configurable. |
| Magnifications | Value range: 1 to 16, in X and Y direction individually |
| Colours | 8 different foreground and background colours |

1 – 2

```
        M A C H I N E    P I C T U R E



                                                    05



              02
                                03        03
                                                 05

                                                       04
          01
                             02



      Units:                   01  Main spindle
                               02  Feeds
                               03  Clamping device
                               04  General functions
                               05  Loading and unloading devices


      Fault:                Units:    01      03
```

Fig. 1.2  Example of a process picture

You will find a coloured representation of the masks and pictures in **/7/**, their creation is described in **/1/** (see section 6.2).

6ZB5 440-0QS02

WF 470 (Description)

# 2 Hardware

WF 470 (Description)

Fig. 2.1     Left:     WF 470A module
             Right:    WF 470B /C module (two additional slots for memory modules, additional serial
                       interface for connecting printers/computers)

## 2.1     Environment

The WF 470 is used in the SIMATIC S5 controller. The corresponding SIMATIC
installation instructions have to be followed. Peripheral devices are connected as
follows:

| Device | Connection |
|---|---|
| Colour/monochrome monitor Printer for protocol/ hardcopy functions Operator keyboard Configuring station 1) | Directly to the module |
| Keyboards | In series to the WF 470 and/or parallel to data inputs via a normal DI module of the SIMATIC S5. |
| Operator panels | As shown in fig. 2.2 |

1)    Programmers and printers; only for picture generation or correction
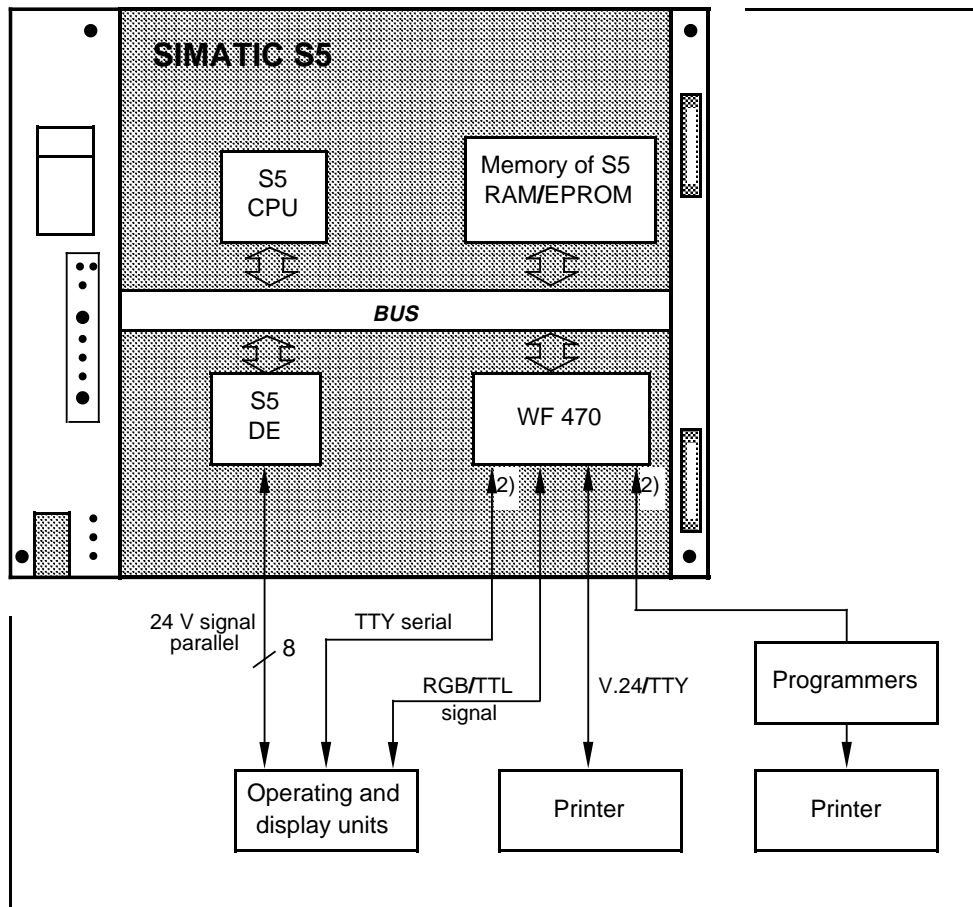


2) one alternative possible at a time

*Fig. 2.2      Environment of the WF 470, schematic diagram*

SIMATIC S5

X1

K1  K2

X
3
4
5

K3

X
6

Visual display
Operation
Diagnostics

X
7

X
9

Protocols
Fault messages
Hardcopies

**WF 470 B/C**

Configuring, back-up, loading
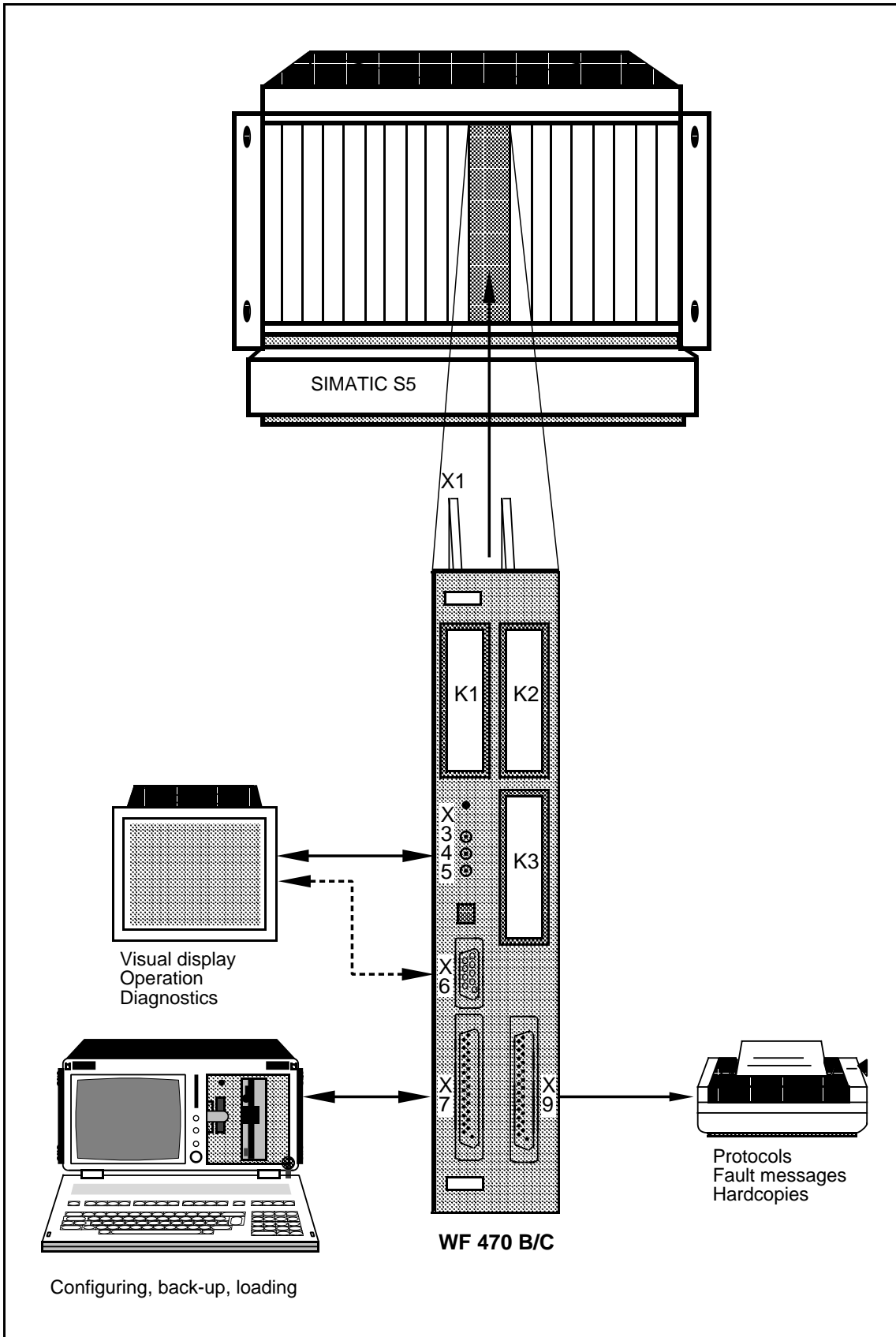
*Fig. 2.3      Hardware configuration*

## 2.2 Hardware of the WF 470
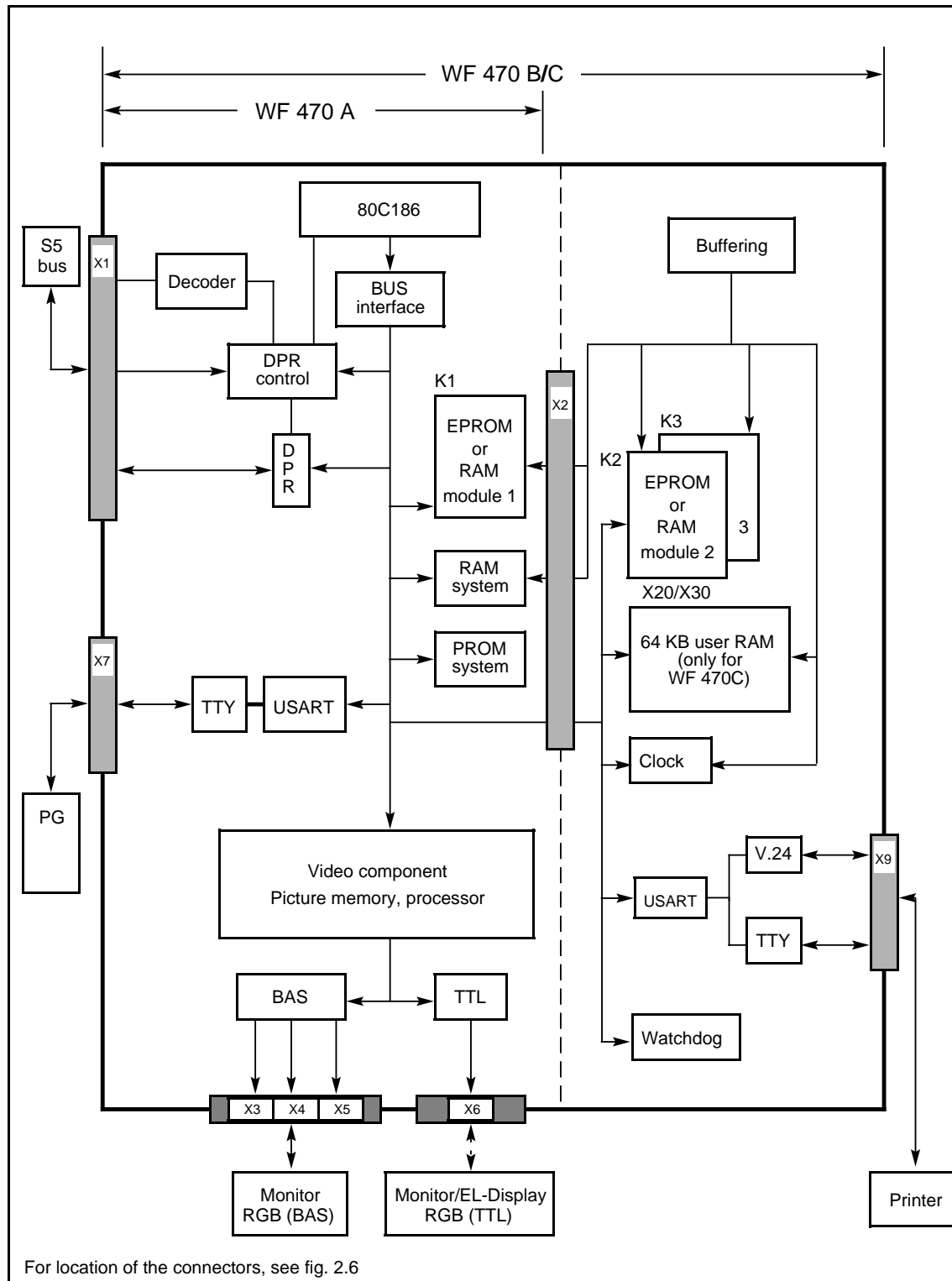


*Fig. 2.4     Hardware of the WF 470A, WF 470B, WF 470C*

Table 2.1    Technical data of the WF 470
(For order numbers 6FM1 470-xxx25, see Catalogue AR 10)

| | **WF 470A, WF 470B: monochrome and colour version**<br>**WF 470C: colour version** |
|---|---|
| Microprocessor | INTEL 80C186 (12 MHz) |
| Operating system | RMS real-time operating system |
| Memory f. oper. software | 256 Kbyte OTPROM memory card, 64 Kbyte internal RAM |
| User memory<br>RAM or EPROM modules | WF 470 A:    1 slot<br>max. capacity 128 Kbyte    } for SIMATIC memory modules<br>WF 470 B, C:    3 slots<br>max. capacity 3 x 128 Kbyte<br>The WF 470 C has an additional 64 Kbyte |
| Timing | WF 470 A:    Software clock<br>WF 470 B, C:    Hardware clock  (max. deviation 3 min./month) |
| Interfaces for<br>- Link with SIMATIC S5<br>- BAS output<br>- TTL monitor output | via Dual-Port-RAM, 256 byte<br>RGB,  picture and line synchronous pulses; Sync. on green<br>R, G, B, VSYNC, HSYNC |
| Serial interface for PG | Yes |
| SIMATIC S5 controllers | 115U, 135U, 155U |
| Power supply | via SIMATIC S5 bus;<br>voltage level 5 V DC, 24 V external for active TTY interface. |
| Current consumption<br>(fully equipped) | WF 470 A:    1.3 A    } Low-power technology;<br>WF 470 B, C:    1.8 A    can be operated without a fan |
| Dimension | Double-height Eurocard format |
| Buffering battery | Lithium battery LS 12420 CNA, 3.5 V/800 mAh<br>Ident No.: 10951586 |
| Operating temperature | 0 to 55 °C |
| Ambient temperature | – 40 to +70 °C (for storage and transport) |
| Weight with packing | WF 470 A:    0.7 kg<br>WF 470 B, C:    1.0 kg |
| Graphics | Resolution: 256 x 512 pixels, repeat frequency: 50 Hz |

## 2.3 Buffering of the WF 470

| Module | Buffering | |
|--------|-----------|---|
| WF 470A | only via SIMATIC S5 | |
| WF 470B<br>WF 470C | Three possibilities:<br>a) only via SIMATIC S5:<br><br>b) SIMATIC S5 and WF 470B/C, mixed:<br><br>c) SIMATIC S5 and WF 470B/C, together:<br>   (preferred setting) | S4.1 closed,<br>T-S open<br>S4.1 open,<br>T-S closed<br>S4.1 closed,<br>T-S closed |

The data contained in the RAM can only be buffered correctly with the battery if the SIMATIC S5 power supply emits the DSI signal (switch RAM to stand-by mode) (see section 5.5).

When the module is delivered, jumper T-S is not strapped to avoid a discharge of the battery. Strap the jumper!
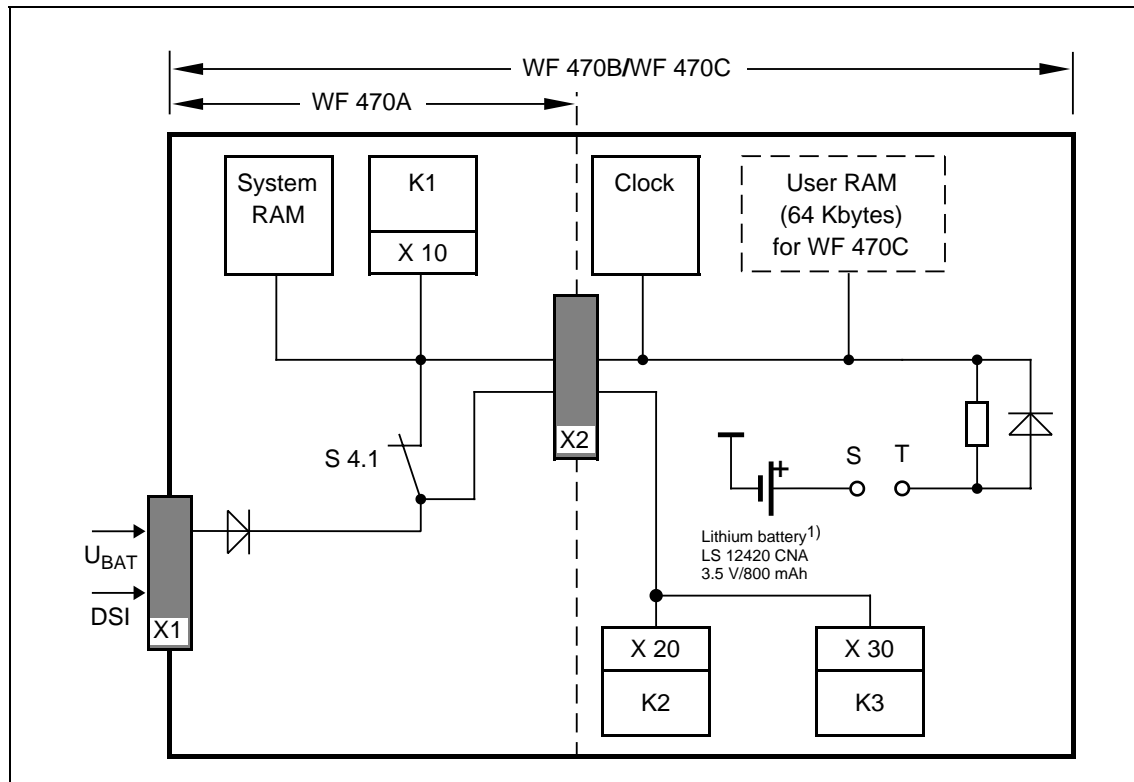


*Fig. 2.5    Data buffering of WF 470 A and WF 470 B/WF 470C*

[1]    For ordering data of the buffering battery, see preceding page; "Technical data of the WF 470"

6ZB5 440-0QS02
WF 470 (Description)

## 2.4       Link with SIMATIC S5

The WF 470 can be operated as

– Central unit module (should preferably be used)
– Peripheral module

SIMATIC S5 and WF 470 exchange data via a **dual-port-RAM** (DPR),  which is located in the WF 470. The DPR is a memory which can be read and written by both sides.

For the data transfer between the WF 470 and the SIMATIC S5, especially with options such as sequence-chain analysis protocol etc., a data block *Transfer Area* (*DBWF*) is required.

Thanks to the DPR, the WF 470 works for the SIMATIC S5 like a memory module, whose start address and address length can be set as required.

|  | DPR start address | DPR length (bytes) |
|---|---|---|
| State at delivery | $0000_{Hex}$ | 256 |
|  | WF 470 parameterized as a central unit module | |

## 2.4.1       WF 470 as a Central Unit Module

In this operating mode, the WF 470 can be plugged into the central unit or the expansion unit.

In the expansion unit, use the slots for the communication modules (CP slots; according to SIMATIC catalogue). For this, the expansion units must be linked via an appropriate interface  (e.g. AS304 - AS314).

The DPR start address is set in increments of 256 bytes, which corresponds to a $100_{Hex}$ grid if the WF 470 is used in the central unit.

The slots of the WF 470 are described in section 5.5 and the start addresses for the DPR in section 5.6.

## 2.4.2 WF 470 as a Peripheral Module

In this operating mode, the WF 470 can be plugged into a peripheral slot in the central unit (CU) or in the expansion unit (EU) (see section 2.5). Only expansion units which are linked to the central unit as follows are admitted:

| Possible links | | | Comments on the selected expansion unit |
|---|---|---|---|
| via interface modules (IM) | | | |
| CU | First EU | Second EU | |
| IM 300<br>IM 301<br>IM 301 | IM 312<br>IM 312<br>IM 310 | IM 312<br>IM 312<br>IM 310 | Digital/analog peripheral area (P area) or extended peripheral area (Q area) |
| IM 304 | IM 314 | IM 314 | P or Q area. In addition, complete address-es (16 bits) are transferred by the link. |

In an expansion unit which fulfils these conditions the WF 470 can be plugged into any peripheral place.

The WF 470 cannot be used in an expansion unit which is linked via AS 302 to AS 311. Consider the maximum current consumption.

The DPR is located in the analog area of the peripherals (peripheral bytes 128-255) or in the extended peripheral area (Q area).

| DPR start address | DPR length (byte) |
|---|---|
| *PB 128 - 255* (analog area)<br>*QB 0 - 255* (Q area)<br>adjustable in increments of the DPR length | 32, 64, 128 or 256 |

The WF 470 is not buffered in this operating mode via the SIMATIC S5 rack (WF 470B, C has its own buffering according to section 2.3).

A reduction of the DPR increases the data transfer time from the SIMATIC S5 to the WF 470. For that reason, choose the DPR length as long as possible.

The module should preferably be used in the central unit. If it is used as a peripheral module, the correct jumper setting depends on the CPU, the PLC, the expansion unit or the interface. This operating mode is therefore not recommended.

## 2.5        Interfaces of the WF 470

Address switch,
setting
see section 5

X10

X1
**Bus connector**

**LED (green)**

ON:   Data transfer with
         SIMATIC S5

OFF:  No data transfer

X20

RAM

EPROM

K1    K2

**RESET**

X30

RAM

EPROM

X3 ─── R

**Monitor**

X4 ─── G

RGB (BAS)

X5 ─── B   K3

**24 V supply**

for serial interfaces

**Monitor/EL-Display**

X6

RGB (TTL)

**Serial interface**

X7

to programmer or

X9

**Printer**

computer link
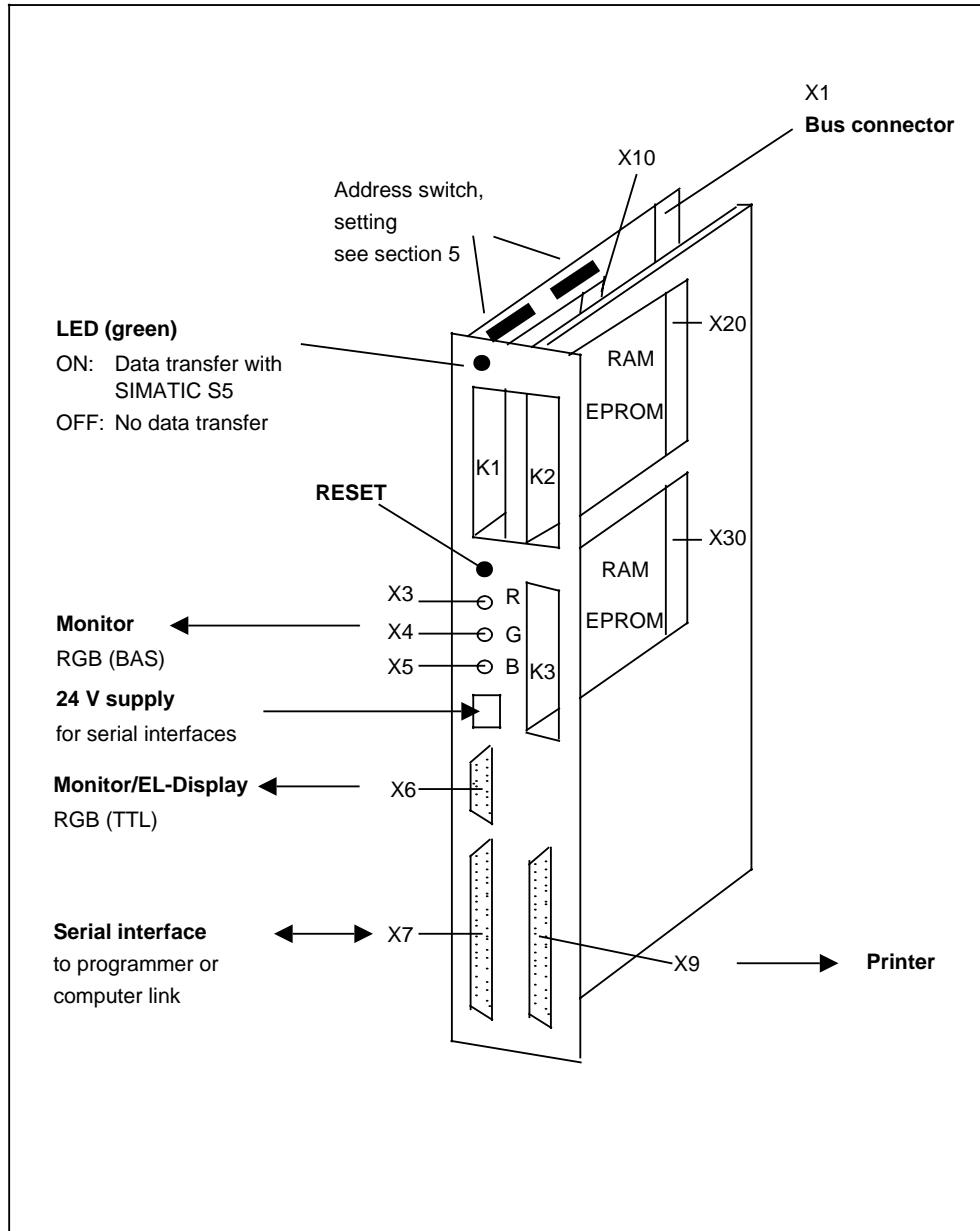
*Fig. 2.6        Interfaces of  WF 470 B and C (colour versions)*

## 2.5.1 BAS Monitor Interface X3, X4, X5

Commercial monitors with the following specification can be connected to the analog monitor interface X3, X4, X5:

| Signal | Comment |
|---|---|
| 3 x RGB/BAS | 0.7 $V_{SS}$[1] to 75  for red, green and blue channel |
| Synchronous signal VSYNC and HSYNC on green channel | 0.3 $V_{SS}$, vertical frequency 50 Hz, horizontal frequency 15.625 kHz |

[1]    $V_{SS} = V_{peak\ to\ peak}$

For reasons of resistance to interferences the cable should be as short as possible.

Interferences can be avoided by using triax cables earthed on both ends as well as monitors with galvanically isolated video inputs.

Observe the applicable SIMATIC S5 installation guidelines.

For cable lengths exceeding 60 m, signal improving measures have to be taken (cable equalizers, active amplifiers, etc.).

Make sure that the PLC lies on the same phase as the monitor.

For reasons of economy, Siemens offer the monochrome monitors with single-shielded standard cables which are adequate for normal use.

For higher requirements (if EMC guidelines have to be complied with) we recommend the use of double-shielded cables.
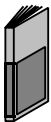
Cables for connecting the WS 495/WS 496 operating system with its keyboards and monitors to the WF 470 module can be found in Catalogue AR 10.

## 2.5.2 TTL Monitor Interface X6

The monitor interface X6 supplies the signals for data monitors with TTL interfaces.

Table 2.2    Connector assignment
(9-pin, sub-D, female)

| Pin | Signal name | Description | Wiring |
|-----|-------------|-------------|--------|
| 1 | 0 V | 0 V of the TTL logic | |
| 2 | RED | Red channel | open collector 150 pullup |
| 3 | GREEN | Green channel | open collector 150 pullup |
| 4 | BLUE | Blue channel | open collector 150 pullup |
| 5 | VSYNC | Vertical synchronous/ picture synchronous pulse | open collector 1 k pullup |
| 6 | HSYNC | Horizontal syn- chronous/line syn- chronous pulse | open collector 1 k |
| 7 | CLK | 12 MHz pixel clock for EL display | |
| 8 | +5 V | 5V for EL display connection | |
| 9 | | | |
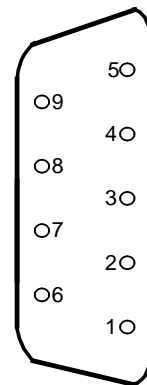
The length of the cable from the TTL monitor must not exceed 2 m; from the EL display, it must not exceed 18 m.

When using the TTL interface no mixing of colours and display of shades is possible; colour 8 does not flash!

WF 470 (Description)

## 2.5.3    Serial Interface X7 of the Basic Module

To this interface you can connect the programmer, one operator panel or, with
option COMPUTER LINK (section 4.5), a second WF 470 or other peripheral
devices.
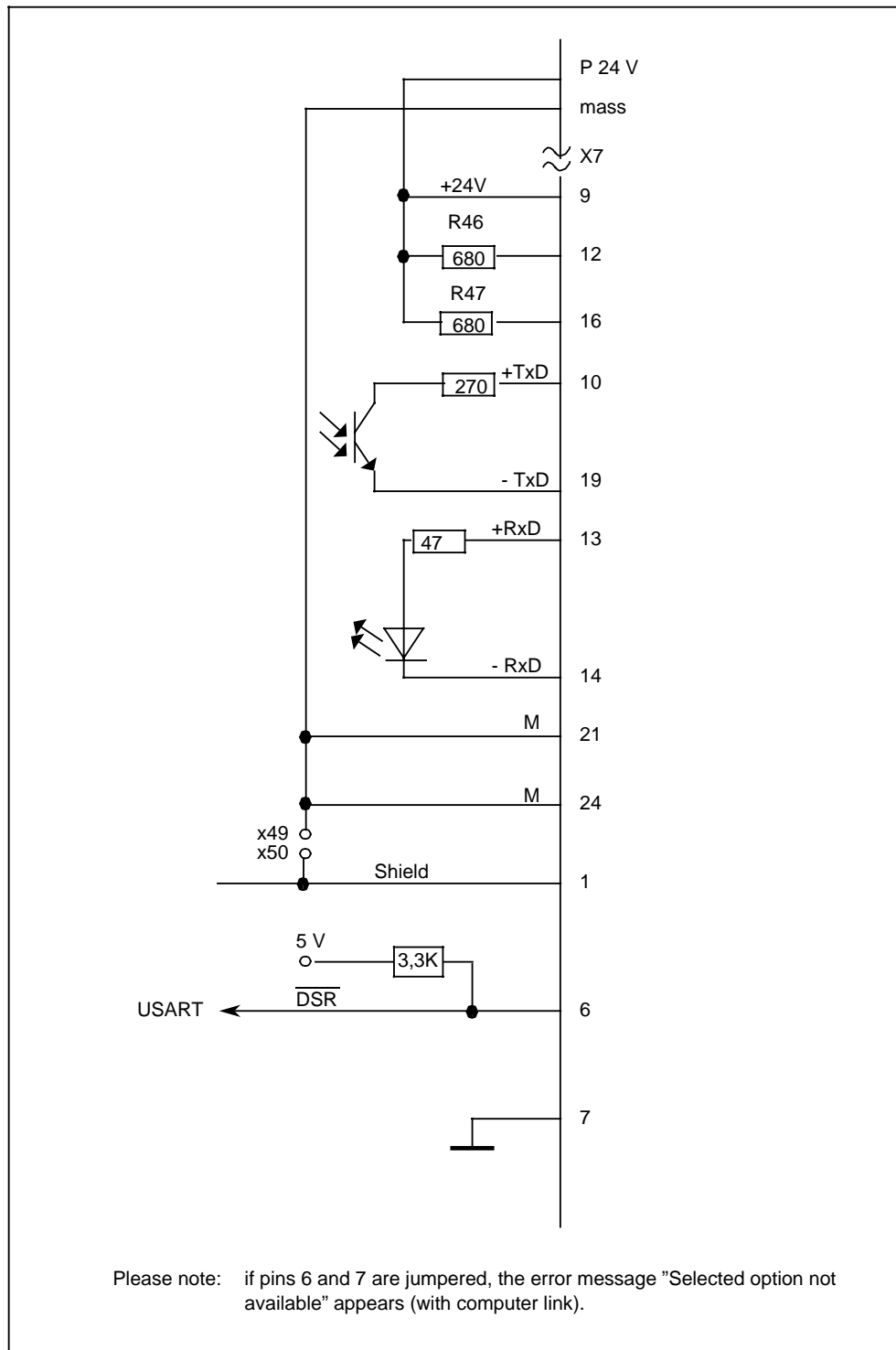


*Fig. 2.7      Interface X7  (Cannon, 25-pin, male) and 24 V supply*

## 2.5.4    Serial Interface X9 of the Expansion Module

A printer (TTY/V.24) can be connected to this interface.
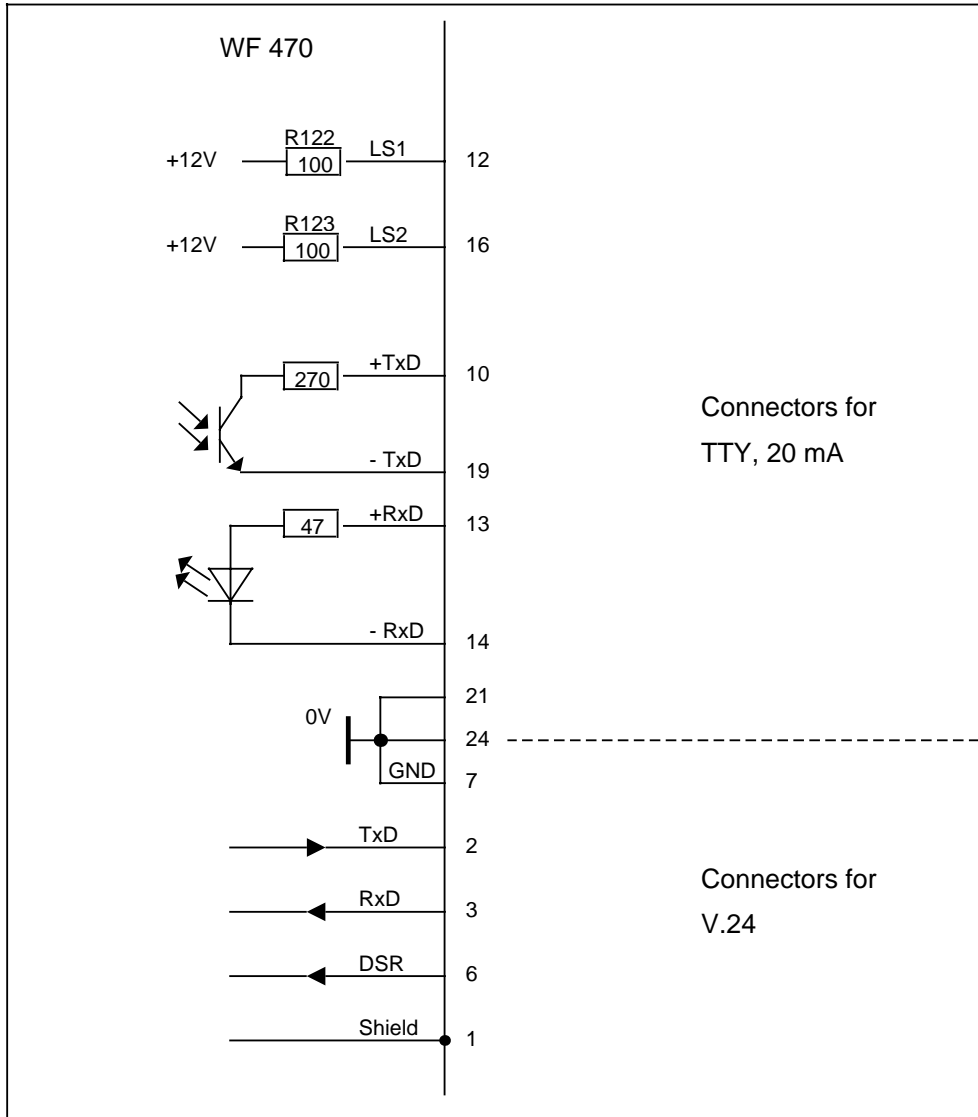


*Fig. 2.8      Interface X9 (Cannon, 25-pin, male)*

WF 470 (Description)

### 2.5.5 Interfaces X10, X20, X30 for Memory Modules

In order to store the pictures generated, texts etc., the following SIMATIC S5 memory modules can be inserted into the module slots according to Catalogue ST 5:

| Type | Capacity | Order number | Prog. No.[2] |
|------|----------|--------------|----------|
| RAM | 32 KB<br>64 KB<br>128 KB | 6ES5377-0AB21<br>6ES5377-0AB31<br>6ES5377-0AB41 | |
| EPROM (NMOS) | 32 KB<br>64 KB<br>128 KB | 6ES5373-0AA41<br>6ES5373-0AA61<br>6ES5373-0AA81 | 0014<br>0060<br>0163 |
| EPROM (CMOS)[1] | 32 KB<br>64 KB<br>128 KB | 6ES5373-1AA41<br>6ES5373-1AA61<br>6ES5373-1AA81 | 0414<br>0460<br>0463 |

[1] Programming possible from version 5.0 of the picture generation software onwards.
[2] For programming different EPROMS, enter the programming number indicated (PNUMMER) in the picture generation software.

For start-up of the WF 470 A and the WF 470 B, at least one RAM module has to be provided. For WF 470 C, the integrated CMOS-RAM is sufficient.
"Protocol" option: a RAM module in the WF 470 B is required for the message buffer.

### 2.5.6 Assignment of Bus Connector X1

Table 2.3

| Pin | d | b | z |
|-----|-----|-----|-----|
| 2 | | 0 V | 5 V |
| 4 | UBAT | PESP | |
| 6 | AB12 | AB0 | CPKL |
| 8 | AB13 | AB1 | MEMR |
| 10 | AB14 | AB2 | MEMW |
| 12 | AB15 | AB3 | RDY |
| 14 | | AB4 | DB0 |
| 16 | | AB5 | DB1 |
| 18 | | AB6 | DB2 |
| 20 | | AB7 | DB3 |
| 22 | | AB8 | DB4 |
| 24 | | AB9 | DB5 |
| 26 | | AB10 | DB6 |
| 28 | DSI | AB11 | DB7 |
| 30 | | BASP | |
| 32 | | 0 V | |

6ZB5 440-0QS02
WF 470 (Description)

## 2.6　Cables

### 2.6.1　Sockets X3, X4, X5: Monitor Connection
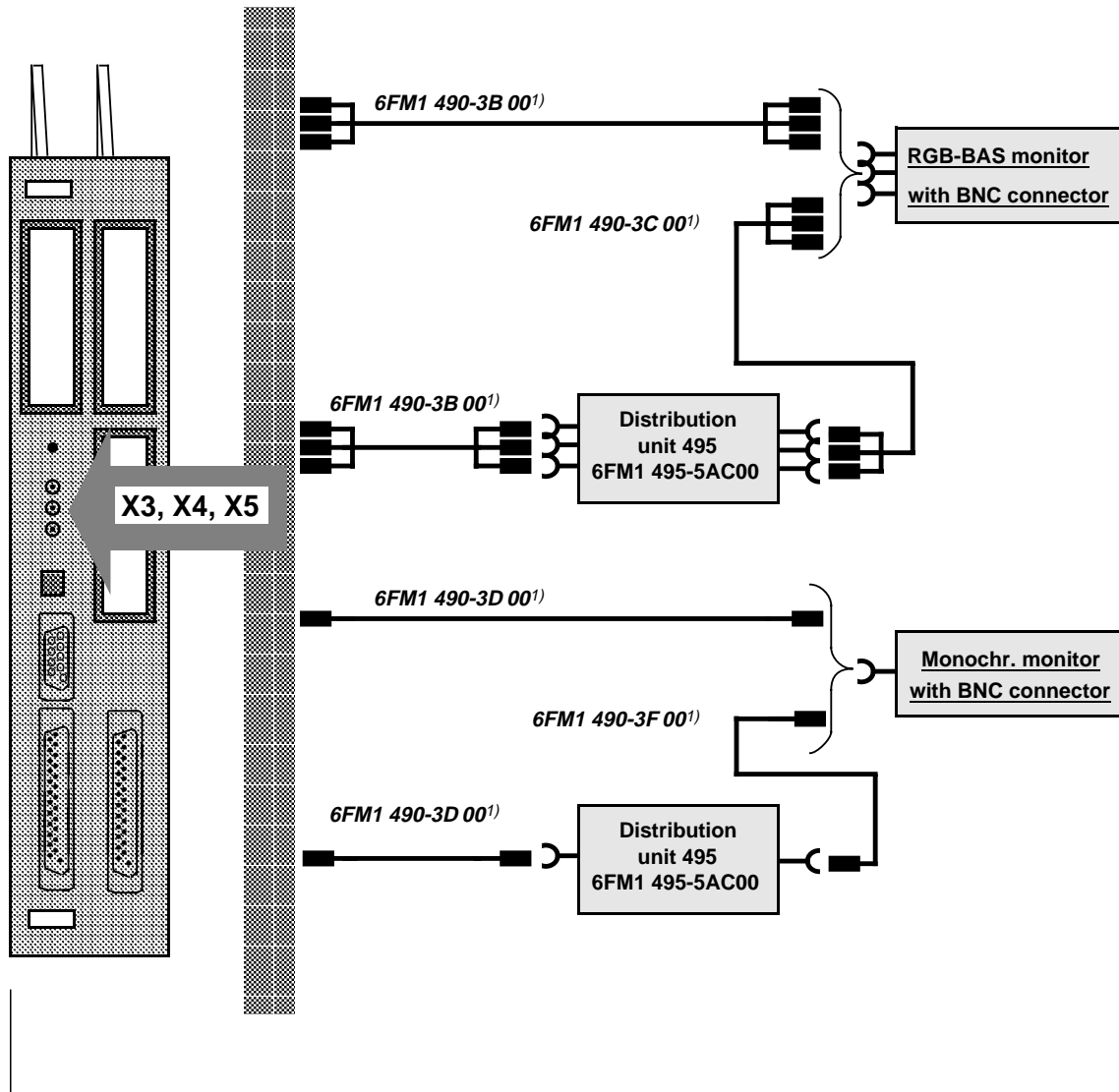


*Fig. 2.9　Cables for sockets X3, X4, X5*
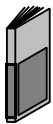
For more detailed information about the distribution unit 495 (baseplate etc.), see the description of the operating system WS 495/WS 496.

[1]　Cable length identifier, see catalogue AR 10

[2]　With distribution unit 495, for example, up to 3 WF 470 modules can be allocated to one monitor.

　　6ZB5 440-0QS02　　　　　　　　　2 – 17
WF 470 (Description)

## 2.6.2    Connector X6: Connection of TTL Monitor and EL Display

EL Display
6FM1 496-2FA00

24 V DC
Power supply                    X2

6FM1 490-3J 00[1)]

X6

6FM1 490-3K 00[1)]

EL bus terminal

6FM1 496-8AA00

Next EL display or
bus terminal

6FM1 490-3J 00[1)]

6FM1 490-3K 00[1)]
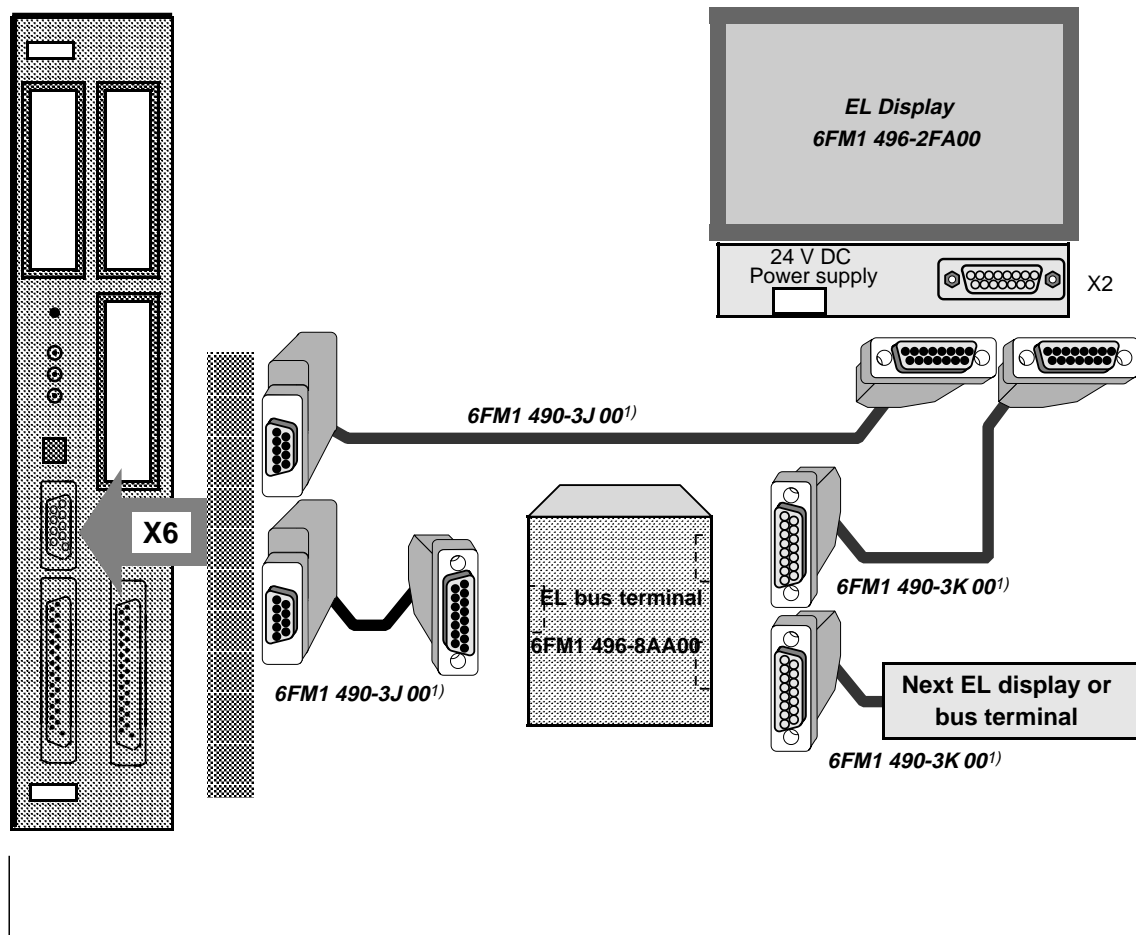
Fig. 2.10    Cables for connector X6

[1)]    Cable length identifier; for lengths of cables, see Catalogue AR 10

WF 470 (Description)

## 2.6.3 Connector X7: Connection of Programmer and Operator Panel

For PG 7xx: use adapter cable
**Order no. 6ES5731-6AG00**

WF 470 cable
*6FM1 490-1B 00[1]*

*6ES5 731-0 0[1]*

**PG 685**

**PG 7xx**

*6FM1 490-1B 00[1]*

**Distribution unit**

**6FM1 495-5AB00**

**X7**

*6FM1 490-1F 00[1]*

**PG 7xx**

*6FM1 490-1D 00[1]*

**WS 495/WS 496**
**Operator system**
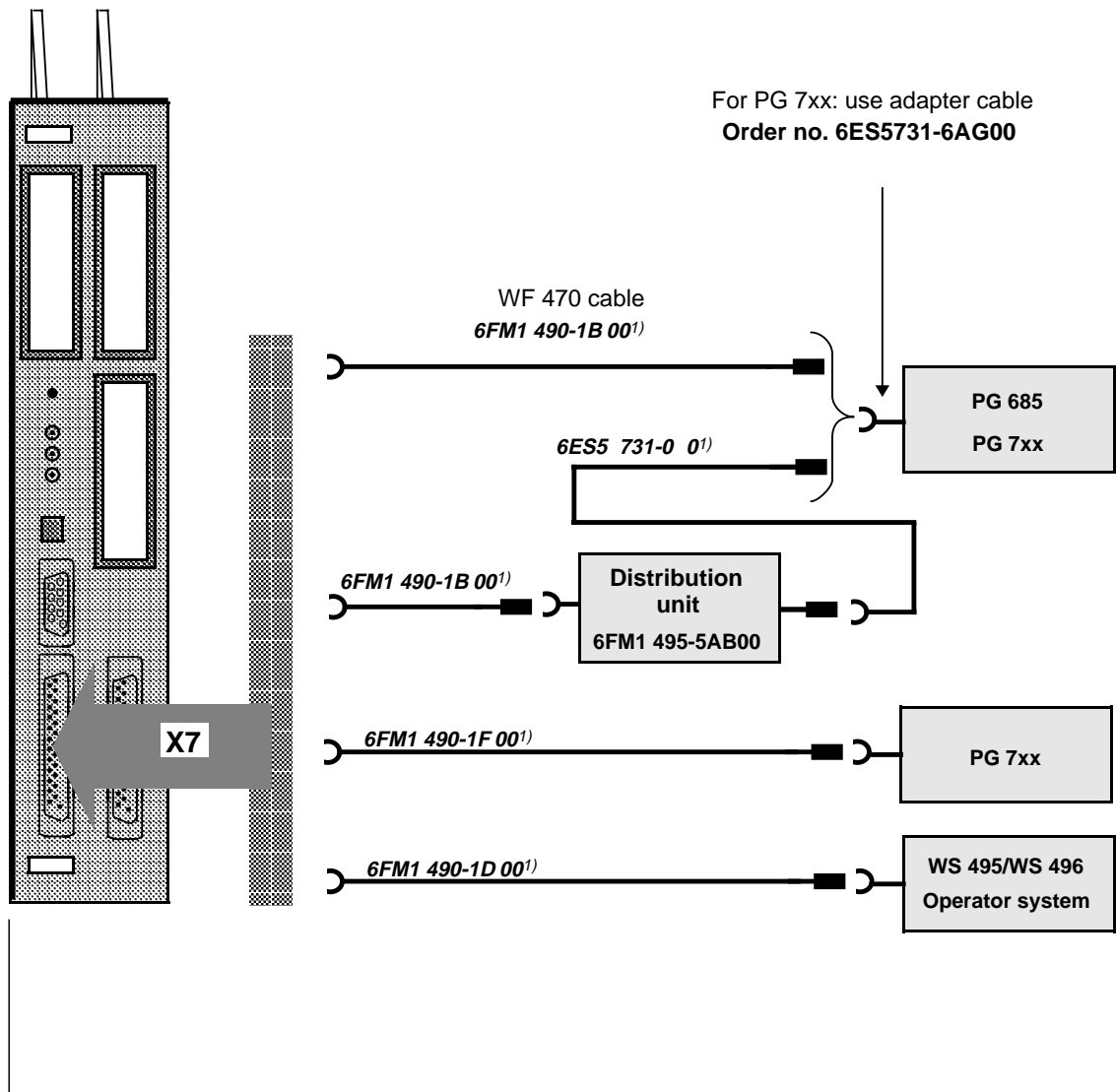
*Fig. 2.11    Cables for connector X7*
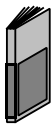
For more detailed information about distribution unit 495  (baseplate), see the description of the operating system WS 495/WS 496.

[1]    Cable length identifier, see Catalogue AR 10

[2]    With distribution unit 495, for example, up to 3 WF 470 modules can be allocated to one monitor.

## 2.6.4    Connector X9: Printer Connection



| Cable | Device |
|-------|--------|
| *6FM1 490-2CB00* | **Printer** **PT 88/PT 89** **DR 2xx-N** (V.24) |
| *6FM1 490-2H 00[1]* | **GRACIS** **Printer** (V.24) |
| *6FM1 490-1C 00[1]* | **Printer** **PT 88/PT 89** (TTY) |
| *6FM1 490-1E 00[1]* | **SICOMP Printer** **DR 2xx-N** (TTY) |
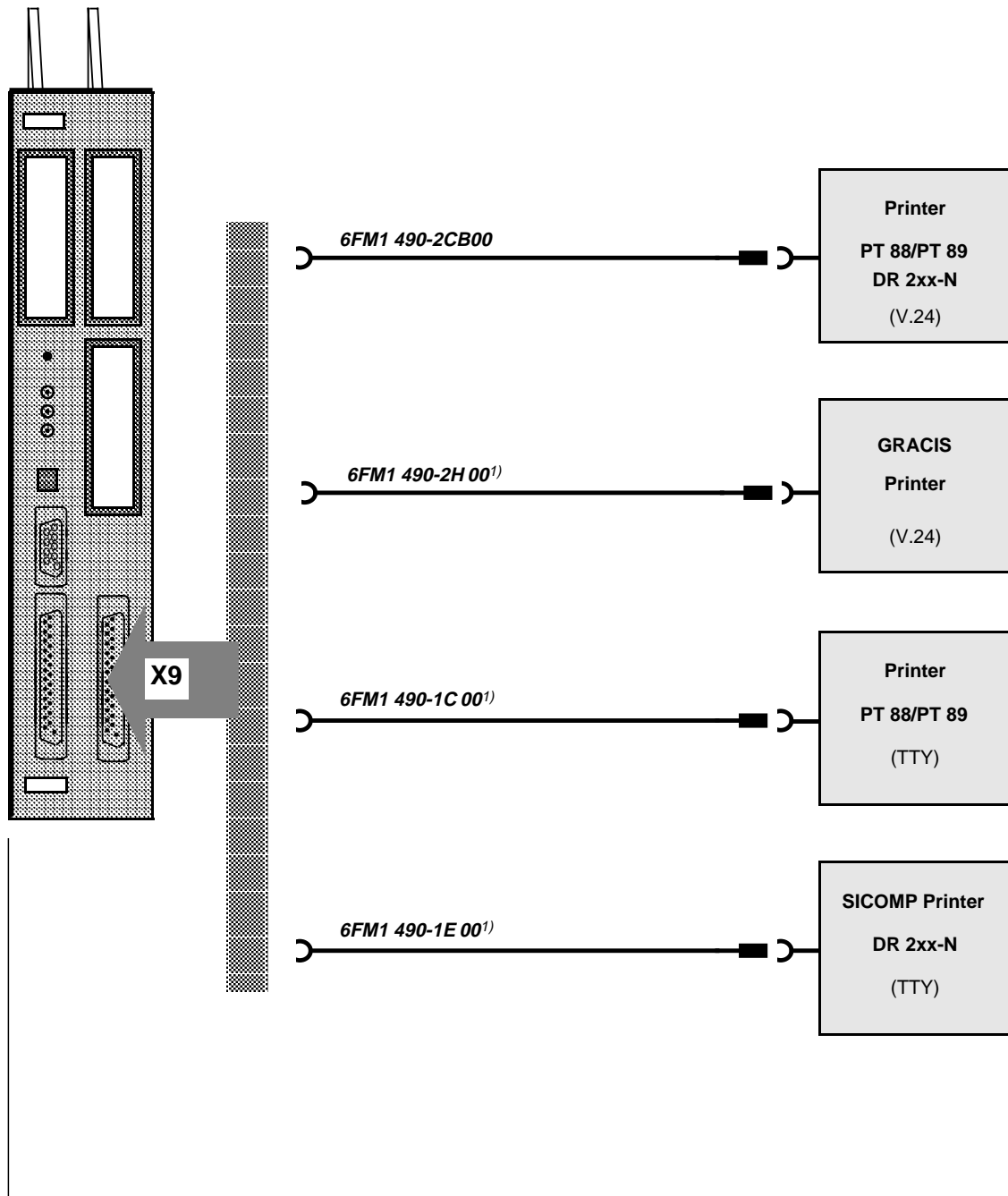
*Fig. 2.12    Cables for connector X9*

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[1]   Cable length identifier; for lengths of cables, see Catalogue AR 10

6ZB5 440-0QS02
WF 470 (Description)

## 2.6.5 Cable for Monitors 75

Table 2.4 Characteristics of the cable for colour monitors

| | |
|---|---|
| Design | 3 × single coaxial cables, PVC sheath, polyurethane sheath, additional overall shield |
| Temperature range | – 40° to 90° C |
| Resistance | against oil, coolant, acc. to VDE 472/804 |
| Smallest poss. bend. radius | 150 mm |
| Damping | 20 MHz   6.1  dB/100m<br>100 MHz  10.8  dB/100m<br>200 MHz  21.0  dB/100m<br>500 MHz  34.2  dB/100m<br>1  GHz  48.1  dB/100m |
| Characteristic impedance | 75 |
| Notes | For cable lengths exceeding <u>60 m</u>, signal-improving measures have to be taken (see section 2.5.1). |



Dimensions in mm    Cable: KWMKOYCY  3 × 0,61

Connect the outside cable shield on both ends to suitable shield bars.
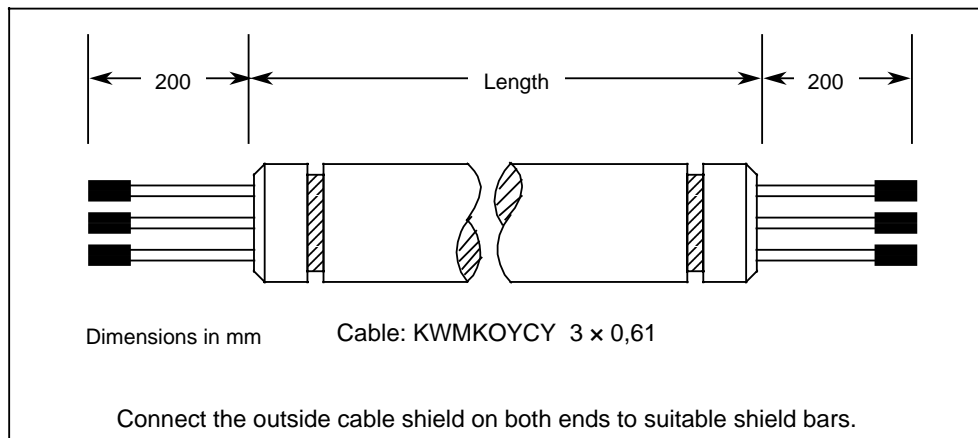
Fig. 2.13 Connecting cables for colour monitor

**Available standard connecting cables**

| WF 470 | | Colour monitor |
|---|---|---|
| 3×coaxial socket | Order no.: 6FM1 490-3B 00 [1] | 3×BNC connector |
| WF 470 | | Monochrome monitor |
| 1×coaxial socket | Order no.: 6FM1 490-3D 00 [1] | 1×BNC connector |

For reasons of economy, we offer for monochrome monitors single-shielded standard cables, which are adequate for normal use.
For higher requirements or if EMC guidelines have to be complied with, we recommend double-shielded cables.

[1] Cable length identifier; for lengths of cables, see Catalogue  AR 10

WF 470 (Description)

## 2.6.6 Connection of the WF 470 to a programmer or a Distribution Unit

Order number for cable:
6FM1 490-1B 00[1]

|  | 1 | | | | | 22 | +TxD |
| +RxD | 13 | | | | | 10 | GND |
| -RxD | 14 | | | | | 12 | |
| | | | | | | 23 | |
| | | Cable: | | | | 20 | |
| | | 5 × 0.25 shielded | | | | 6 | |
| | | Id.-Nr. 649 00 456 | | | | 8 | +RxD |
| +TxD | 10 | | | | | 21 | GND |
| -TxD | 19 | | | | | 2 | |

Fix baud rate 9600 by jumper settings on the connector

3
4
17
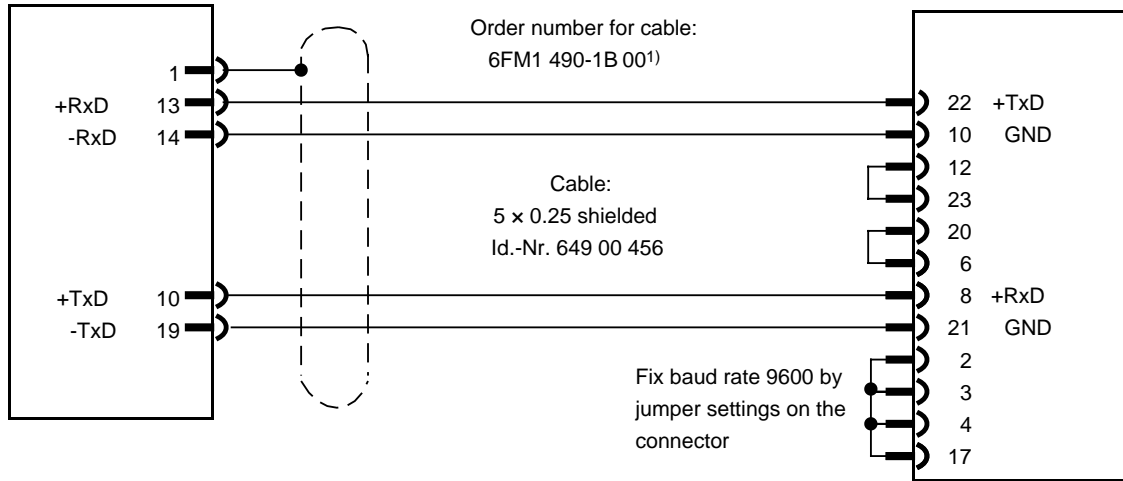
The above cable can be used to connect a PG 7xx on the programmer side by means of adapter cable 6ES5 731-6AG00.
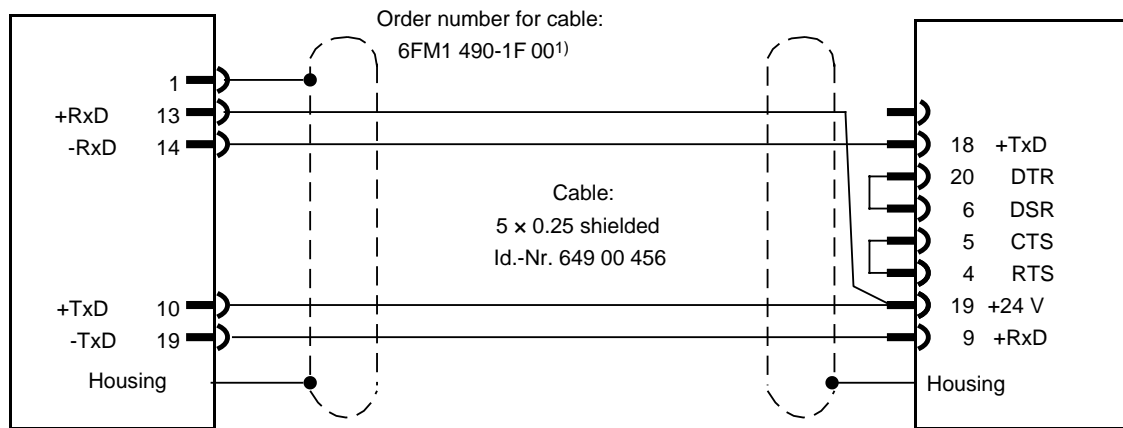
Order number for cable:
6FM1 490-1F 00[1]

|  | 1 | | | | | | |
| +RxD | 13 | | | | | 18 | +TxD |
| -RxD | 14 | | | | | 20 | DTR |
| | | | | | | 6 | DSR |
| | | Cable: | | | | 5 | CTS |
| | | 5 × 0.25 shielded | | | | 4 | RTS |
| | | Id.-Nr. 649 00 456 | | | | | |
| +TxD | 10 | | | | | 19 | +24 V |
| -TxD | 19 | | | | | 9 | +RxD |
| Housing | | | | | | Housing | |

**Connector**

25-pin, female
Connector set:
Id.-Nr. 40022251
Housing:
ID.-Nr. 40091587
**Connection side**
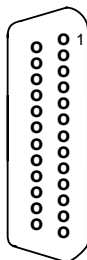
**Connector**

25-pin, male:
Connector set:
Id.-Nr. 40022273
Housing:
ID.-Nr. 40023443
Slide lock:
ID.-Nr. 40023445
**Connection side**
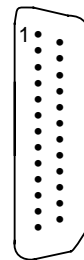
[1]  Cable lenght identifier; for lengths of cables, see Catalogue AR 10

## 2.6.7 Connection of the WF 470 B/C to a SICOMP Printer

### 2.6.7.1 V.24 Interface

Order number for cable: 6FM1 490-2CB00

**WF 470**
**Connector X9**

**Printer**
**PT 88/PT 89/ DR2xx-N**

Housing
1
TxD 2 ——————— 3 RxD
RxD 3 ——————— 2 TxD
GND 7 ——————— 7 GND
DSR 6 ——————— 25 Busy

Cable:
5 × 0.25 shielded
Id.-Nr. 649 00 456

**Connector**
25-pin, female
Connector set:
Id.-Nr. 40022251
Housing:
ID.-Nr. 40091587
**Connection side**

**Connector**
25-pin, male:
Connector set:
Id.-Nr. 40022273
Housing:
ID.-Nr. 40091587
**Connection side**

Order number for cable: 6FM1 490-2H 00[1]

**WF 470**
**Connector X9**

**GRACIS-Printer**

Housing

Housing
1

TxD 2 ——————— 3 RxD
RxD 3 ——————— 2 TxD
DSR 6 ——————— 20 DTR
GND 7 ——————— 7 GND

DSUB 25-pin

Female connector (as above)

DSUB 25-pin

Male connector (as above)

[1] Cable length identifier; for lengths of cables, see Catalogue AR 10

WF 470 (Description)

## 2.6.7.2    TTY Interface

Order number for cable:    6FM1 490-1C 00[1)]

| WF 470 | Printer |
|---|---|
| Connector X9 | PT 88/PT 89 |

| WF 470 Connector X9 | | Printer PT 88/PT 89 |
|---|---|---|
| Housing | | Housing |
| 1 | | |
| -TxD  19 | | 10  +RxD |
| GND  7 | | 9   -RxD |
| LS1  12 | | 21  +TxD |
| +RxD  13 | | 18   -TxD |
| +TxD  10 | Cable: | |
| LS2  16 | 5 × 0.25 shielded | |
| GND  21 | Id.-Nr. 649 00 456 | |
| -RxD  14 | | |
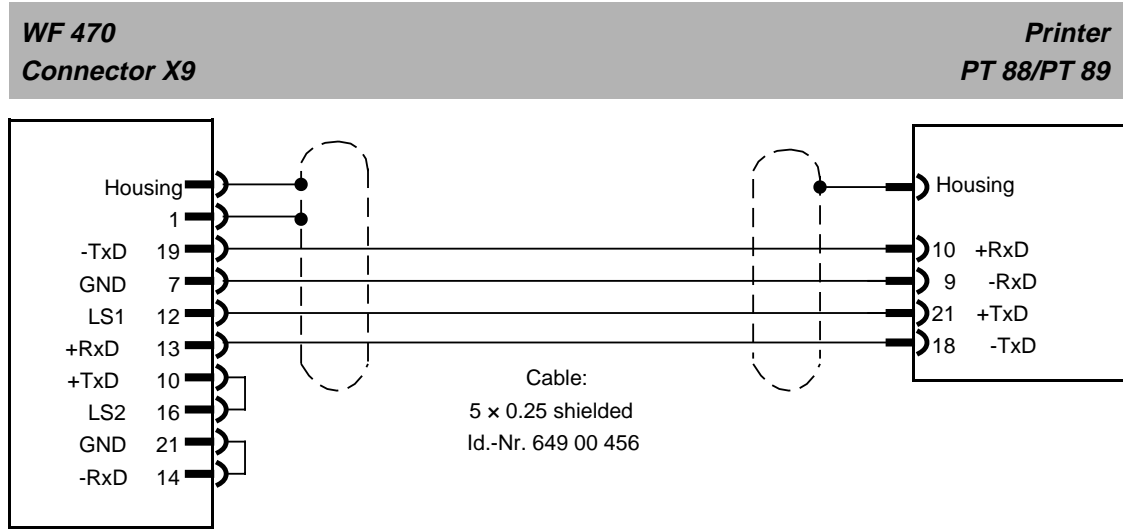
**Connector:** see previous page

Order number for cable:    6FM1 490-1E 00[1)]

| WF 470 Connector X9 passive | | Printer DR 2xx-N active |
|---|---|---|
| Housing | | Housing |
| 1 | | 1 |
| +TxD  10 | | 10  +RxD |
| -TxD  19 | | 9   -RxD |
| +RxD  13 | | 21  +TxD |
| -RxD  14 | Cable: | 18   -TxD |
| | 5 × 0.25 shielded | |
| | Id.-Nr. 649 00 456 | |
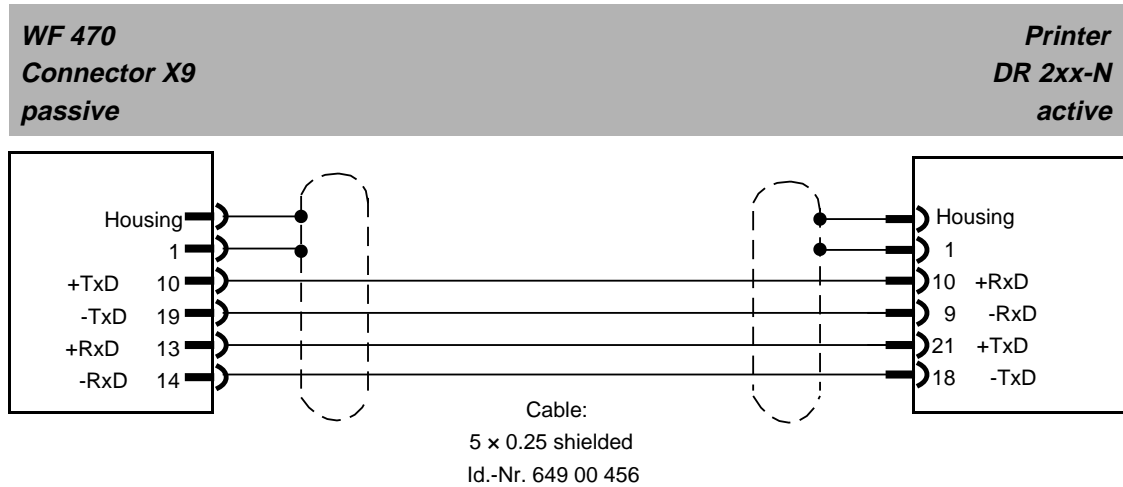
**Connector:** see previous page

[1)]   Cable length identifier; for lengths of cables, see Catalogue  AR 10

         6ZB5 440-0QS02
WF 470 (Description)

## 2.6.8 Computer Link with WF 470

**WF 470**  
**Connector X7**  
**Terminal ES 120**  
**(Bar code reader)**

| | | |
|---|---|---|
| Housing | | Housing |
| +RxD 13 | | 18 +TxD |
| -RxD 14 | | 21 -TxD |
| +TxD 10 | | 09 +RxD |
| -TxD 19 | | 10 -RxD |
| DSR 6 | | |
| OV 7 | | |

DSUB 25-pin, female

DSUB 25-pin, female
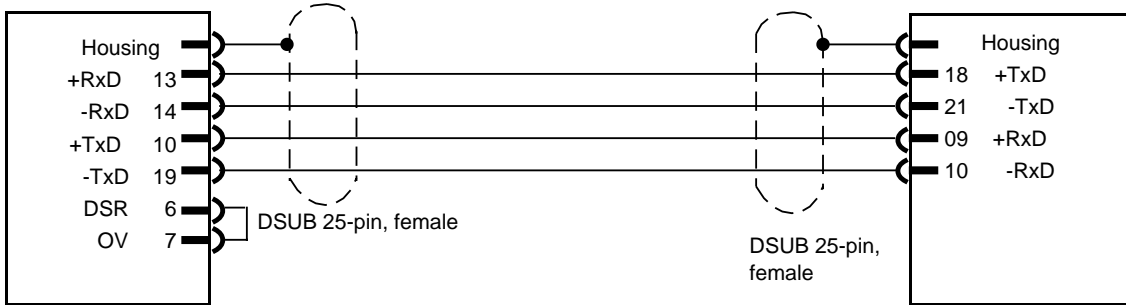
**WF 470**  
**Connector X7**  
**DS 550**  
**(Diskette drive)**

| | | |
|---|---|---|
| Housing | | Housing |
| +RxD 13 | | 25 +TxD |
| -RxD 14 | | 24 -TxD |
| +TxD 10 | | 15 +RxD |
| -TxD 19 | | 14 -RxD |
| DSR 6 | | |
| OV 7 | | |

DSUB 25-pin, female

25-pin, male
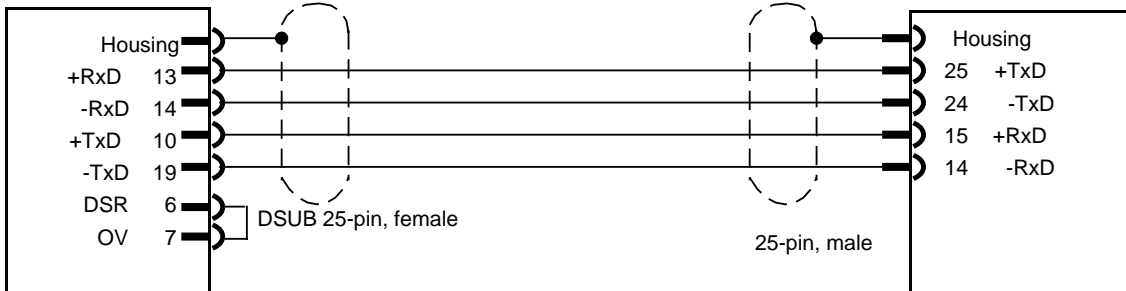
**WF 470 / 1 activ**  
**Connector X7**  
**WF 470 / 2 passive**  
**Connector X7**

| | | |
|---|---|---|
| Housing | | Housing |
| -TXD 19 | | 13 +RXD |
| GND 21 | | 14 -RXD |
| -RXD 14 | | 10 +TXD |
| GND 24 | | 19 -TXD |
| DSR 06 | Jumper from 6 to 7 | 06 BSR |
| GND 07 | | 07 GND |
| +20mA 12 | | |
| +RXD 13 | Jumper from 12 to 13 | |
| +20mA 16 | | |
| +TXD 10 | Jumper from 16 to 10 | |

DSUB25-pin, female

DSUB 25-pin, female

| | |
|---|---|
| P | +24 V via Faston |
| M | 0 V via Faston |
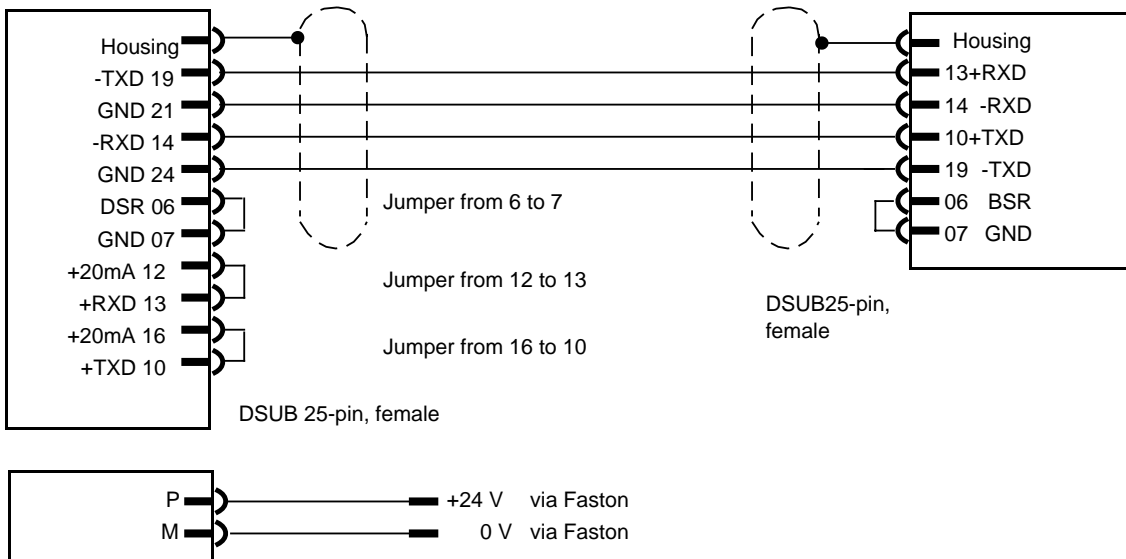
**Connector:** see section 2.6.7.1

WF 470 (Description)

## 2.7 External Devices

### 2.7.1 Keyboards and Operator Panels

The various WF 470 versions can be connected to keyboards combined with standard monitors (monochrome or colour), EL displays (reduced mounting depth) or solutions that combine sturdy, compact or modular operator panels with sealed or conventional keyboards. The key assignments are adapted to the WF functions.

Admissible keyboards and operator panels of the WS 400 to WS 495/WS 496 series can be found in the most recent Catalogue AR 10. These can be for instance:

WS 400-10, WS 400-20, WS 400-22 operator panels with 9" monochrome or colour monitor and EL display

WS 496 compact operator panel and 12" monochrome or colour monitor and 14" colour monitor

WS 400-30, WS 400-50 operator panels with 14" colour monitors

Console-mounted or free-standing keyboards for operator-process communication

Additional modules to supplement the operator panels, e.g. function module for user-defined keyboard functions and keyboard labelling

The WS 400-10, WS 400-20 and WS 400-22 operator panels are linked with the SIMATIC S5 input byte (DE) via a parallel keyboard interface. FB TAST (see section 3.2) is used for decoding the keyboard signals.

The WS 400-30, WS 400-50 and WS 496 operator panels can furthermore use the serial interface of the WF 470. FB TAST is not required in this case.

### 2.7.2 Programmers

Use the picture generation software of the SIMATIC S5 programmers to create, back up and load as well as message and protocol texts.
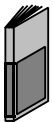
Admissible programmers and software belonging to them can be found in Catalogue AR 10.

6ZB5 440-0QS02
WF 470 (Description)

## 2.7.3 Printing

The WF 470 offers three different printing functions:

- Documentation of lists configured on the programmer (connection to the programmer's COM x).

- Output of protocols and message texts with the WF 470 option "Protocol" (connection to the WF 470 B/C's serial printer interface, V. 24 or TTY).

- Hardcopy of the WF 470 picture
(connection to the WF 470 B/C from version 6FM1 470-xxx25 onwards, serial printer interface; V. 24 connection only).

## 2.7.3.1 Documentation of Lists Configured on the Programmer

In this function, the configured elements of the list to be printed are listed in form of a table.

The layout of the documentation is fixed by the picture generation software. The printer must be able to interpret the software's print control characters. The following types of control characters are output:

1. ECMA set of characters                 (PT88, various DR 2xx printers).

2. "IBM-like" set of characters              (see following table).

Type 2 is possible from picture generation software V 5.2 onwards by loading driver "WFDRTRI.EXE" in MS-DOS.

Table 2.5

| Command | ECMA control character | IBM control character |
|---------|------------------------|-----------------------|
| Underscore ON | 1B, 30 | 1B, 2D, 01 |
| Underscore OFF | 1B, 39 | 1B, 2D, 00 |
| Standby ON | 1B, 38 | 0E |
| Standby OFF | 1B, 3C | 14 |
| Character pitch 0 | 1B, 5B, 31, 77 | 12 |
| Character pitch 1 | 1B, 5B, 32, 77 | 1B, 3A |
| Character pitch 2 | 1B, 5B, 34, 77 | 0F |
| Line feed $7/72$" | 1B, 5B, 37, 78 | 1B, 31 |
| Line feed $1/8$" | 1B, 5B, 39, 78 | 1B, 30 |
| Reset line feed | 1B, 5B, 78 | 1B, 32 |

When calling up, e.g.: C:\WFDRTRI

the following is displayed:

```
====================================================================
 || WFDrTrl <Emulation ECMA-IBM> Version 1.0                      ||
 || Copyright (C) 1993/94 Siemens AG, ZN Stuttgart, ANL TD MWE 42  ||
====================================================================
WFDrTrl . . . . . . . installed.
```

For re-installing the driver, call up "WFDRTRI.EXE" again.

### 2.7.3.2   Output of Protocols and Message Texts with the WF 470 Option "Protocol"

For this function, the printer parameters and control characters laid down in the system data list are relevant.

The parameters set on the printer (data bits, parity etc.) must correspond to those of the system data list.

The control characters of the system data list must adapted to the printer used.

Some printers can output Cyrillic characters. In order to ensure their compatibility with the WF 470's Cyrillic characters as displayed on screen, a printer is required that converts the ASCII characters according to the list in section 4.12.2.

### 2.7.3.3   Hardcopy of the WF 470 Picture

The "Hardcopy" function is only possible with printers that can be selected in the system data list [currently GRACIS printer (HP-Paint-Jet), HP-Deskjet 550C, PT 88 and compatible printers].

The printer parameters shown are absolutely necessary on the printer and in system data list.

For the "Hardcopy" function, the printer control characters available for the fonts in the system data list are irrelevant.

The print format of the hardcopy can be selected via the system data list.

Table 2.6     Printer parameters for hardcopy

| Type of link | 2 |
|---|---|
| Baud rate | 9600 bit/s |
| Data bits | 8 |
| Stop bits | 1 |
| Parity | N |
| Handshake | HW |

Set the control characters for

- Reset
- Carriage Return
- Line feed
- Paper format

as stated in the printer manual.

Hardcopy is only possible with the V. 24 printer interface.

When configuring the system data list, more detailed information on the parameters can be output by pressing the "HELP" key on the programmer.

## 2.8     Self-Diagnosis

### Overview

The WF 470's firmware has been extended for error diagnosis from version V 4.3 onwards.

The self-diagnosis comprises:

- Display of module type, hardware and firmware versions
- Memory capacity
- Display of loaded options
- Interface test (USART test)
- Check of loaded lists
- Watchdog test and self-diagnosis protocol printout.

### Calling up the self-diagnosis

Switch off all options before calling up the self-diagnosis.

The functions can be selected by

- selecting "Self-diagnosis" in the function selection screen form
- selecting picture no. "#9B".

**Functional description/Display**

On callup of the self-diagnosis, a screen display output test is started (Checking Video-RAM) and its results then displayed in a standard picture.

Notes on the standard picture

- Meaning of the background colours

| blue | Configurations |
|---|---|
| green | Tested and found o.k. |
| red | Tested and found faulty |

- Module type/version
  Display of the WF 470 module type and its hardware and firmware versions.
  The Dual-Port RAM (DPR) length displayed corresponds to the one set in the system data list.

- Memory capacity/Result of memory test
  The memory areas available are checked.
  With the options de-activated, the memory test does not affect their contents.
  Data contained in the memory is saved before the test and written back afterwards.

- Options
  Length and version of the options loaded on the module.

- USART test
  The USART test status is checked.
  If the interface checked is not available (maybe because it is busy), an error may be signalled.
  Remedy:    Interrupt interfaces
                    Reset the WF 470

- List test
  The lists available in the user memory are checked and their number displayed.

  Meaning of the information displayed:

| P:003 | 3 protocol lists available |
|---|---|
| B:XXX | Picture lists |
| T:XXX | Text lists |
| G:XXX | Sequence chain list |
| F:XXX | Free area (unused memory space) |

Memory areas that cannot be identified are displayed as "non-identifiable" lists. If several such areas are found, scrolling is possible by means of the cursor keys.

These errors can be dealt with by carrying out an overall reset or by erasing and re-loading (re-programming) the EPROM.

Lists that have been identified but found to be faulty must be re-written. Lists can be identified by their ID code and/or their name.

Any other information displayed is used for internal fault diagnosis.

# 3 SIMATIC S5 Standard Software

WF 470 (Description)

## 3.0      Overview



*Fig. 3.1      Overview of the SIMATIC S5 standard software*

All function and data blocks can be operated under a changed block number in the PLC.

## 3.1 Function Block for Linking SIMATIC S5 with WF 470

### Purpose and functioning mode

The **FB S5-WF470** function block organizes the data exchange between SIMATIC S5 and WF 470 (Fig. 3.1). The data exchange is initiated by the WF 470. It stores a data request in the form of a job in the coordination area of the DPR. The FB recognizes this job, executes and acknowledges it. If necessary, it sends an error number.

For one job the FB must be passed at least twice. The maximum data amount for one transfer depends on the DPR length.

Table 3.1          Technical data

|  | **S5-155 U** | **S5-115 U** | **S5-115 U** | **S5-135 U** | **S5-135 U** |
|---|---|---|---|---|---|
| Admissible SIMATIC-CPU | 948 [2] | 941 to 944 | 945 | 921 | 922, 928 |
| Block number Name | FB 248 S5-WF470 | FB 251 [1] S5-WF470 | FB 254 S5-WF470 | FB 252 S5-WF470 | FB 249 S5-WF470 |
| Library number | E88530 B4136-D | E88530 B4136-A | E88530 B3254-A | E88530 B4136-C | E88530 B4136-C |
| Block length (words) | 305 | 256 | 303 | 369 | 273 |
| Processing time (ms) | 0.2 to 1.5 | 5.1 to 32 1.5 to 15 0.32 to 1.5 | 0.06 to 0.2 | 1.6 to 17.5 | 1.1 to 3.9 |
| System data | BS 60 | none | none | none | none |
| Data blocks | none | none | none | DB *255* internal | none |
| Call length (words) | 8 | | | | |
| Nesting depth | 0 | | | | |
| Flags used | FY 234 to 255 | | | | |
| Called blocks | none | | | | |
| Timers | none | | | | |
| Counters | none | | | | |

1)   In the SIMATIC S5-115U FB *S5-WF470* must be loaded into the AG under another number, as an FB with the number 251 exists already on the CPU.
2)   For the preceding CPU versions 946 and 947, the same block number applies as for the CPU 948.

## Parameterization

**FB 2xx**

```
          S5-WF 470
   ADPR          BLD1
   SS            BLD2
   TAST          BLD3
```
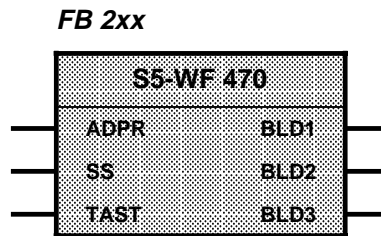
Table 3.2        Parameters of the *FB S5–WF 470*

| Parameter | Meaning | Comment | Kind | Type | Admissible values |
|---|---|---|---|---|---|
| ADPR | Start address DPR | In hexadecimal code | D | KH | see section 5 |
| SS | Key-operated switch | | I | BI | I: 0.0 to 127.7<br>F: 0.0 to 199.7<br>Q: 0.0 to 127.7 |
| TAST | Keyboard byte | From the user program or from FB TAST | I | BY | FB: 0 to 199 |
| BLD1<br>BLD2<br>BLD3 | Picture selection or picture number acknowledgement | Pic. nr. 1    Code:<br>Pic. nr. 2    ASCII<br>Pic. nr. 3    characters | Q | BY | FB: 0 to 199<br>QB: 0 to 127 |

## Application Rules

1. The FB must be called absolutely (via JU FB) in the cycle.

2. The TAST byte may only be written for one S5 cycle. To acknowledge the transmission of the code to the module, FB *S5-WF 470* deletes the TAST byte.

3. BLD 1 to BLD 3 may only be written for one S5 cycle for one picture selection and protocol selection. As an acknowledgement, the WF 470 returns the picture number via BLD 1 to BLD 3.

## 3.2        Blocks for Keyboard Decoding

### 3.2.1        Function Block TAST...

### Purpose and functioning mode

If the keyboard is connected to the SIMATIC S5 via the **parallel** inputs (24 V),
the function block *TAST...* is required for decoding the signals. Data blocks
DB *201* and DB *202* (see section 3.2.2) allocate functions to certain keycodes.

Table 3.3        Technical data

|  | **S5-155 U** | **S5-115 U** | **S5-115 U** | **S5-135 U** |
|---|---|---|---|---|
| Admissible SIMATIC CPU | 948[1] | 941 to 944 | 945 | 921, 922, 928 |
| Block number<br>Name | FB 201 (202)<br>TAST-155 | FB 201 (202)<br>TAST-115 | FB 201 (202)<br>TAST-115 | FB 201 (202)<br>TAST-135 |
| Library number | E88530-B4136-D | E88530-B4136-A | E88530-B3201-A<br>(B3202-A) | E88530-B4136-C |
| Block length (words) | 91 (105) | 100 (112) | 103 (113) | 106 (120) |
| Call length (words) | 8 | | | |
| Processing time (ms) | < 0.5 | | | |
| Data blocks | See parameter EBDB | | | |
| System data | none | | | |
| Nesting depth | 0 | | | |
| Flags used<br>(scratch flags) | FY 248  to  255<br>(FY 245 to 255) | | | |
| Called blocks,<br>timers, counters | none | | | |

[1]   For the preceding CPU versions 946 and 947 the same block applies as for the CPU 948.

### Parameterization

*FB 201*



*FB 202*
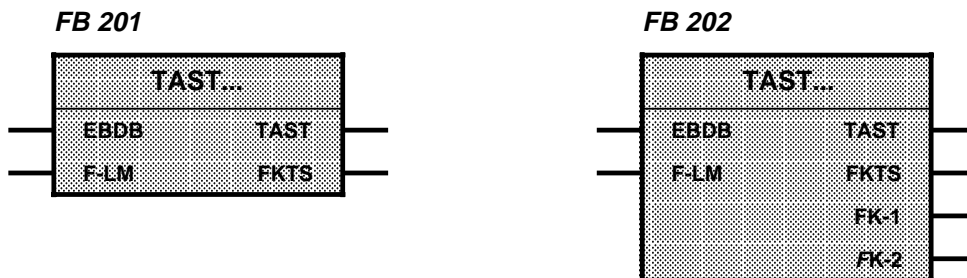
Table 3.4        Parameters of FB *TAST...*

| Parameter | Meaning | Comment | Kind | Type | Admissible values |
|---|---|---|---|---|---|
| EBDB | IB:   Number of input byte<br>DB:   DB number Allocation list | No evaluation for:<br>IB>127; DB=0 | D | KY | KY:       IB, DB<br>IB:       0 to 127<br>DB:       1 to 255 |
| F-LM | Flag: "Key pressed" | Free flag/output (="1", as long as key is pressed) | I | BI | F:   0.0 to 199.7<br>Q:   0.0 to 127.7 |
| TAST | Keyboard code | From allocation list | Q | BY | FY:       0 to 199<br>QB:       0 to 127 |
| FKTS | Function keys | One bit per function key (16) | Q | W | FW:       0 to 198<br>QW:       0 to 126 |
| FK -1 | Function key extension | Only for FB *202* | Q | W | FW:       0 to 198<br>QW:       0 to 126 |
| FK -2 | Function key extension | Only for FB *202* | Q | BY | FB:       0 to 199<br>QB:       0 to 127 |

## Application Rules

1.   The FB must be called absolutely (via JU FB) in the cycle.

**2.   Serial keybord connection**

In case of serial keyboard connection, the function keys are mapped in DW 10 of the DBWF (see section 3.5):

> <F1> to <F16> are allocated to bits 0 to 15 of the DW 10; the bit, however, is **not** reset when the key is released. Thus you cannot use function keys in the "jog mode".

When the FB *BILDLIST* is used, the DW 10 can be transferred to the parameter FKTS.

FB *TAST*... and DB 20x allocated to it can be omitted.

3.   On the WS 496 operator panel, an additional function keyboard with 24 function keys can be connected.

In this case FB *202* has to be used. The FB *202* has two additional parameters for 24 function keys; the remaining functions are identical. If the alpha block is connected to the operator panel instead of the function keyboard, FB *201* can be used.

### 3.2.2 Data Block 201, 202: Keyboard Allocation

Function block FB *TAST* receives the function allocated to a key from DB *201* or *202*, which are supplied with the standard software and are used as follows:

| For keyboard | Keyboard allocation list |
|---|---|
| Operator panel WS 400-10, -20, -22, WS 495/WS 496 | DB 201 |
| Operator panel WS 400-30, WS 400-50 | DB 202 |

The DBs contain for each key a data word with the corresponding key function.The allocation of the key to the data word is effected by the key code (cf. table 3.5).

The operator panel supplies the key code upon depression of a key. This code occupies the input byte which is indicated in the parameter EBDB of the FB *TAST*.

Examples:

a)  <F16> supplies the key code $18_{Hex}$ (=24d). The function allocated to this key is now contained in DW 24 ($97F9_{Hex}$).

In the MC5 code, [$97F9_{Hex}$] means S F249.7.

This MC5 command effects the internal setting of this flag in FB *TAST* and its transfer to the flag word defined in the parameter FKTS.

b)  Key "A" sends the code $22_{Hex}$ (=34d). DW 34 contains the ASCII code for "A": $41_{Hex}$. FB *TAST* writes the identification $41_{Hex}$ on the parameter *TAST*.

You can easily change the functions of a key by adjusting the contents of the corresponding data word to the identification desired. Corresponding to the entry in the left part of the data word the function block realizes whether an identification shall be output to the keyboard byte or whether an auxiliary flag shall be set. If the left part of the data word (DL) contains 00, the right part of the data word (DR) will be output via the keyboard byte (TAST).

If the DL does *not* contain 0, a function key or a key of the function keyboard is concerned. To each of these keys an auxiliary flag is allocated:

Flag 245.0 to 247.7 for the function keyboard,
Flag 248.0 to 249.7 for the function keys.

In this case the entire data word is executed as a command (MC5 code). Only the commands S F245.0 to 249.7 are admitted.

6ZB5 440-0QS02
WF 470 (Description)

Table 3.5    Keyboard allocation of DB *201* (state at delivery)

| Key | Key code (Hex) | Data word No. | Value DL | Value DR | Comment Flag | Comment HM |
|-----|------|-----|----|----|------|------|
| | 0 | 0 | | | | |
| F1 | 01 | 1 | 90 | F8 | FKTS.0 | 248.0 |
| F2 | 02 | 2 | 91 | F8 | FKTS.1 | 248.1 |
| F3 | 03 | 3 | 92 | F8 | FKTS.2 | 248.2 |
| F4 | 04 | 4 | 93 | F8 | FKTS.3 | 248.3 |
| F5 | 05 | 5 | 94 | F8 | FKTS.4 | 248.4 |
| F6 | 06 | 6 | 95 | F8 | FKTS.5 | 248.5 |
| F7 | 07 | 7 | 96 | F8 | FKTS.6 | 248.6 |
| F8 | 08 | 8 | 97 | F8 | FKTS.7 | 248.7 |
| [1] | 09 | 9 | 90 | F7 | FK - 2.0 | 247.0 |
| [1] | 0A | 10 | 91 | F7 | FK - 2.1 | 247.1 |
| [1] | 0B | 11 | 92 | F7 | FK - 2.2 | 247.2 |
| [1] | 0C | 12 | 93 | F7 | FK - 2.3 | 247.3 |
| [1] | 0D | 13 | 94 | F7 | FK - 2.4 | 247.4 |
| [1] | 0E | 14 | 95 | F7 | FK - 2.5 | 247.5 |
| [1] | 0F | 15 | 96 | F7 | FK - 2.6 | 247.6 |
| free | 10 | 16 | 00 | 00 | | |
| F9 | 11 | 17 | 90 | F9 | FKTS-1.0 | 249.0 |
| F10 | 12 | 18 | 91 | F9 | FKTS-1.1 | 249.1 |
| F11 | 13 | 19 | 92 | F9 | FKTS-1.2 | 249.2 |
| F12 | 14 | 20 | 93 | F9 | FKTS-1.3 | 249.3 |
| F13 | 15 | 21 | 94 | F9 | FKTS-1.4 | 249.4 |
| F14 | 16 | 22 | 95 | F9 | FKTS-1.5 | 249.5 |
| F15 | 17 | 23 | 96 | F9 | FKTS-1.6 | 249.6 |
| F16 | 18 | 24 | 97 | F9 | FKTS-1.7 | 249.7 |
| [1] | 19 | 25 | 97 | F7 | FK - 2.7 | 247.7 |
| free | 1A 1B 1C 1D 1E 1F 20 | 26 27 28 29 30 31 32 | 00 | 00 | | |

[1]    *Function keyboard*

6ZB5 440-0QS02                    3 – 9
WF 470 (Description)

Table 3.5                                                                 continued

| Key | Key code (Hex) | No. | DL | DR | Comment |
|---|---|---|---|---|---|
| % | 21 | 33 | 00 | 25 | |
| A | 22 | 34 | 00 | 41 | |
| B | 23 | 35 | 00 | 42 | |
| C | 24 | 36 | 00 | 43 | |
| D | 25 | 37 | 00 | 44 | |
| E | 26 | 38 | 00 | 45 | |
| F | 27 | 39 | 00 | 46 | |
| | 28 | 40 | 00 | 00 | |
| 7 | 29 | 41 | 00 | 37 | |
| 8 | 2A | 42 | 00 | 38 | |
| 9 | 2B | 43 | 00 | 39 | |
| ⬦ | 2C | 44 | 00 | 14 | Selection of function mask (CTRL/T) |
| // | 2D | 45 | 00 | 11 | Software reset (CTRL/K) |
| | 2E<br>2F | 46<br>47 | 00 | 00 | |
| | 30 | 48 | | | |
| G | 31 | 49 | 00 | 47 | |
| H | 32 | 50 | 00 | 48 | |
| I | 33 | 51 | 00 | 49 | |
| J | 34 | 52 | 00 | 4A | |
| K | 35 | 53 | 00 | 4B | |
| L | 36 | 54 | 00 | 4C | |
| M | 37 | 55 | 00 | 4D | |
| | 38 | 56 | 00 | 00 | |
| 4 | 39 | 57 | 00 | 34 | |
| 5 | 3A | 58 | 00 | 35 | |
| 6 | 3B | 59 | 00 | 36 | |
| | 3C | 60 | 00 | 90 | Cursor down |
| | 3D | 61 | 00 | 8F | Cursor up |
| | 3E<br>3F<br>40 | 62<br>63<br>64 | 00 | 00 | |

                             6ZB5 440-0QS02
                                                                        WF 470 (Description)

Table 3.5                                                                                continued

| Key | Key code (Hex) | Data word No. | Value DL | Value DR | Comment |
|-----|------|-----|----|----|---------|
| N | 41 | 65 | 00 | 4E | |
| O | 42 | 66 | 00 | 4F | |
| P | 43 | 67 | 00 | 50 | |
| Q | 44 | 68 | 00 | 51 | |
| R | 45 | 69 | 00 | 52 | |
| S | 46 | 70 | 00 | 53 | |
| T | 47 | 71 | 00 | 54 | |
| @ | 48 | 72 | 00 | 40 | Identification/Protocol |
| 1 | 49 | 73 | 00 | 31 | |
| 2 | 4A | 74 | 00 | 32 | |
| 3 | 4B | 75 | 00 | 33 | |
| | 4C | 76 | 00 | 92 | Cursor to the next left-hand field |
| | 4D | 77 | 00 | 91 | Cursor to the next right-hand field |
| | 4E | 78 | 00 | 86 | Switchover text - V-field |
| | 4F 50 | 79 80 | 00 | 00 | |
| U | 51 | 81 | 00 | 55 | |
| V | 52 | 82 | 00 | 56 | |
| W | 53 | 83 | 00 | 57 | |
| X | 54 | 84 | 00 | 58 | |
| Y | 55 | 85 | 00 | 59 | |
| Z | 56 | 86 | 00 | 5A | |
| + | 57 | 87 | 00 | 2B | |
| # | 58 | 88 | 00 | 23 | Standard picture identification |
| - | 59 | 89 | 00 | 2D | |
| Ø | 5A | 90 | 00 | 30 | |
| . | 5B | 91 | 00 | 2E | |
| ⊟ | 5C | 92 | 00 | 8D | Scrolling up |
| ⊟ | 5D | 93 | 00 | 8C | Scrolling down |
| | 5E 5F 60 | 94 95 96 | 00 | 00 | |

WF 470 (Description)

Table 3.5 continued

| Key | Key code (Hex) | Data word No. | Value DL | Value DR | Comment |
|---|---|---|---|---|---|
| / | 61 | 97 | 00 | 2F | |
| : | 62 | 98 | 00 | 3A | |
| = | 63 | 99 | 00 | 3D | |
| ( | 64 | 100 | 00 | 28 | |
| ) | 65 | 101 | 00 | 29 | |
| ? | 66 | 102 | 00 | 3F | |
| , | 67 | 103 | 00 | 2C | |
| | 68 | 104 | 00 | 20 | Space |
| | 69 | 105 | 00 | 86 | Switchover text - V-field |
| | 6A | 106 | 00 | 85 | Next V-field |
| | 6B | 107 | 00 | 84 | Previous V-field |
| | 6C | 108 | 00 | 04 | Acknowledgement of error message line |
| ◈ | 6D | 109 | 00 | 0A | Line feed, transfer |
| | 6E<br>6F | 110<br>111 | 00 | 00 | |

| Key | Key code (Hex) | Data word No. | Value DL | Value DR | Comment Flag | Comment Auxiliary flag |
|---|---|---|---|---|---|---|
| | 70 | 112 | 90 | F5 | FK-1.0 | 245.0 |
| | 71 | 113 | | | FK-1.1 | 245.1 |
| | 72 | 114 | | | FK-1.2 | 245.2 |
| | 73 | 115 | | | FK-1.3 | 245.3 |
| | 74 | 116 | | | FK-1.4 | 245.4 |
| | 75 | 117 | | | FK-1.5 | 245.5 |
| | 76 | 118 | | | FK-1.6 | 245.6 |
| | 77 | 119 | | | FK-1.7 | 245.7 |
| Function keyboard | 78 | 120 | | | FK - 1+1.0 | 246.0 |
| | 79 | 121 | | | FK - 1+1.1 | 246.1 |
| | 7A | 122 | | | FK - 1+1.2 | 246.2 |
| | 7B | 123 | | | FK - 1+1.3 | 246.3 |
| | 7C | 124 | | | FK - 1+1.4 | 246.4 |
| | 7D | 125 | | | FK - 1+1.5 | 246.5 |
| | 7E | 126 | | | FK - 1+1.6 | 246.6 |
| | 7F | 127 | | | FK - 1+1.7 | 246.7 |

WF 470 (Description)

## 3.2.3 **Admissible Keyboard Signals** (TAST Byte)

Table 3.6 Admissible values of the right-hand byte (DR) of a data word

| Value (Hex) | Meaning |
|---|---|
| 00 | No key code |
| 01 | CTRL/A: Index of process pictures |
| 02 | CTRL/B: Abort field input |
| 04 | CTRL/D: Acknowledgement of error message line |
| 0A | LF: Termination of input |
| 11 | CTRL/K: SW reset |
| 12<br>13 | Hardcopy<br>End of hardcopy |
| 14 | CTRL/T: Selection of function mask |
| 20 ... 7F | Full ASCII character set including rub out |
| 84<br>85 | Previous field in the list<br>Next field in the list |
| 86 | Cursor switchover text windows - V-fields |
| 8C, 8D | Scroll indices |
| 8F<br>90<br>91<br>92<br>AF<br>B0 | Cursor up / scroll text window up<br>Cursor down / scroll text window down<br>Cursor to the next right-hand field<br>Cursor to the next left-hnad field<br>Cursor inside the field to the left<br>Cursor inside the field to the right |
| DF<br>E0 | Set screen bright<br>Set screen dark |
| E1 | Special function (must not be used) |
| E2 | Read clock (store time/date from WF 470 in *DBWF*, DW 1 to 6) |
| E3 | Set clock (transfer time/date from *DBWF*, DW 1 to 6) |
| E4<br>E5 | Protocol START<br>Protocol STOP |
| E6<br>E7 | Store cursor position in DBWF, DW 7<br>Transfer cursor position from DBWF, DW 7 |
| E8 | Activate function in DBWF, DW 9 (protocol) |
| E9 | Updating of input fields (field type 0) |
| EA<br>EB | Computer link - on<br>Computer link - off |
| EC, ED | Reserve |
| EE | Activate offset in sequence chain window |
| EF | Command to computer link - start transmission |
| F0 ... FF | Error 100 to 115: For picture-independent system messages which are displayed on the screen in the system message line and are to be configured by the user. (Text in text group #SK text list 006) |

WF 470 (Description)

## 3.3 Function Block DAT-IN

### Purpose and functioning mode

Function block *DAT-IN* indicates how many data words (ANZ) were transferred from which address (DBDW) onwards from the WF 470 to the SIMATIC S5.
FB DAT-IN records every data exchange from the WF 470 to the SIMATIC S5.
This means that entries of the WF 470 into the DBWF are also displayed.

Table 3.7　　　　Technical data

|  | S5-155 U | S5-115 U | S5-115 U | S5-135 U |
|---|---|---|---|---|
| Admissible SIMATIC CPU | 948[1] | 941 to 944 | 945 | 921, 922, 928 |
| Block No. Name | FB 240 DAT-IN | FB 240 DAT-IN | FB 240 DAT-IN | FB 240 DAT-IN |
| Library number | E88530-B4136-D | E88530-B4136-A | E88530-B3240-A | E88530-B4136-C |
| Block length (words) | 47 | 42 | 49 | 47 |
| Call length (words) | 7 | | | |
| Processing time (ms) | <0.5 | | | |
| Data blocks | None | | | |
| System data | None | | | |
| Nesting depth | 0 | | | |
| Called blocks | None | | | |
| Flags used (scratch flags) | FB 240 to 255 | | | |
| Timers | None | | | |
| Counters | None | | | |

1　　For the preceding CPU versions 946 and 947, the same block number applies as for the CPU 948.

　　6ZB5 440-0QS02
WF 470 (Description)

## Parameterization

*FB 240*

```
              DAT-IN
   ADPR              DBDW
                      ANZ
                     AKTU
```
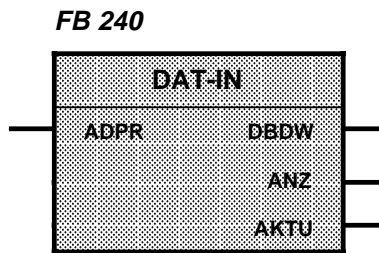
Table 3.8          Parameters of  FB *DAT-IN*

| Parameter | Meaning | Comment | Kind | Type | Admiss. values |
|---|---|---|---|---|---|
| ADPR | Start address Dual-Port-RAM | Hexadecimally encoded | D | KH | See section 5 |
| DBDW | Data block Data word | Target of data input | Q | W | FW:  0 to 198 <br> QW:  0 to 126 |
| ANZ | Number of DWs transferred | | Q | BY | FB:  0 to 199 <br> QB:  0 to 127 |
| AKTU | Identification of data transfer | Bit \| Data transfer <br> 1 \| Yes <br> 0 \| No | Q | BI | F:  0.0 to 199.7 <br> Q:  0.0 to 127.7 |

## Application Rules

1.  The FB must be called absolutely in the S5 cycle (by JU FB), if possible after FB *S5-WF470*.

2.  Output AKTU is pending at least for one SIMATIC S5 cycle.

3.  Parameters DBDW and ANZ are updated when a data transfer from the WF 470 to a data word has taken place.

WF 470 (Description)

## 3.4 Process Picture Management

## 3.4.1 Function Block BILDLIST

### Purpose, functioning mode

The function of the *FB BILDLIST* is mainly defined by data block DBBL (see section 3.4.2).
The FB *BILDLIST* has the following functions:

– Selection of process pictures via function keys, max. 170 pictures

– Call of a function block dependent on the selected process picture

– Transfer of a keyboard code to the module; thus, picture-dependent softkey assignment is possible

– Transfer of signals via flags to the picture-specific function block

Table 3.9        Technical data

|  | S5-155 U | S5-115 U | S5-115 U | S5-135 U | S5-135 U |
|---|---|---|---|---|---|
| Admissible SIMATIC CPU | 948[1] | 941 to 944 | 945 | 921 | 922, 928 |
| Block No. Name | FB 220 BILDLIST | FB 220 BILDLIST | FB 220 BILDLIST | FB 220 BILDLIST | FB 221 BILDLIST |
| Library number | E88530-B4136-D | E88530-B4136-A | E88530-B3220-A | E88530-B4136-C | E88530-B4136-C |
| Block length (words) | 393 | 446 | 404 | 390 | 391 |
| Processing time (ms) | 1.5 | 6 or 2 | 0.2 | 6 | 3 |
| Call length (words) | 10 | | | | |
| Data blocks | Acc. to parameter | | | | |
| System data | None | | | | |
| Nesting depth | 1 | | | | |
| Assigned flags | FY 240 to 255 | | | | |
| Called blocks | FB in *BILDLIST* | | | | |
| Timers | None | | | | |
| Counters | None | | | | |

[1]  For the preceding CPU versions 946 and 947, the same block number applies as for the CPU 948.

6ZB5 440-0QS02
WF 470 (Description)

## Parameterization

*FB 22x*

```
          ┌──────────────────────┐
          │      BILDLIST        │
      ────┤ DBBL          TAST   ├────
          │                      │
      ────┤ DBH           BLD1   ├────
          │                      │
      ────┤ FKTS          BLD2   ├────
          │                      │
          │               BLD3   ├────
          └──────────────────────┘
```
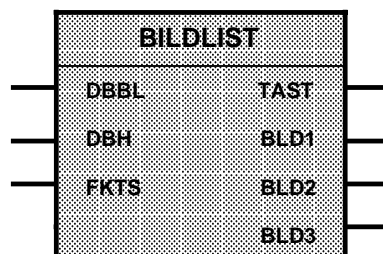
Table 3.10    Parameters of  FB *BILDLIST*

| Parameter | Meaning | Comment | Kind | Type | Admiss. values |
|-----------|---------|---------|------|------|----------------|
| DBBL | DB number for picture list | Can be pending in the EPROM. Per process picture 12 data words are assigned. | B | - | DB No.: 2 to 255 |
| DBH | DB number for auxiliary data memories | Must be pending in the RAM. Data words 0 to 14 are assigned by FB BILDLIST. | B | - | DB No.: 2 to 255 |
| FKTS | Binary signals of the function keys (from FB *TAST*) | Indication of the same FW number which is used on *FB TAST* | I | - | FW:     0 to 198 |
| TAST | Keyboard signals to the WF 470 | Indication of the same FY number which is used on FB S5-WF470 and FB *TAST* | Q | BY | FY:     0 to 199 |
| BLD1 BLD2 BLD3 | Picture number parameters to the WF 470 | Indication of the same FY number which is used on FB S5-*WF470* | Q | BY | FY:     0 to 199 |

WF 470 (Description)

## 3.4.2 Data Block DBBL

This data block determines the function of *FB BILDLIST*; it has to be created by the user. The DB number can be selected freely and has to be input at the parameter "DBBL". For each picture a set of 12 data words is required. Its contents preset which function the *FB BILDLIST* shall have, depending on the selected process picture. As via the program only data blocks up to a length of 2042 data words can be edited, 170 pictures can be managed.

The structure of a data block is described in table 3.4. The number n of the first data word of a DB must be divisible by 12 without remainder:

Block 0: DW 0 to DW 11     Block 1: DW 12 to DW 23     etc. i.e.

n   {0; 12; 24; 36; to 2016}

Table 3.11     Structure of data block *DBBL*

| DW No. | Contents Left-hand byte | Contents Right-hand byte | Data format |
|--------|--------------------------|---------------------------|-------------|
| n+0 | Space | Picture identification: 1st sign | KC |
| n+1 | Picture identification: 2nd sign | Picture identification: 3rd sign | KC |
| n+2 | | >0 :   Picture specific FB No.<br>=0 :   No FB is called | KY |
| n+3 | 1≙TAST Code | 0≙ Picture block selection | |
| n+4 | F1:  Picture block No./TAST code | F2:  Picture block No./TAST code | KY |
| n+5 | F3:  Picture block No./TAST code | F4:  Picture block No./TAST code | KY |
| n+6 | F5:  Picture block No./TAST code | F6:  Picture block No./TAST code | KY |
| n+7 | F7:  Picture block No./TAST code | F8:  Picture block No./TAST code | KY |
| n+8 | F9:  Picture block No./TAST code | F10: Picture block No./TAST code | KY |
| n+9 | F11: Picture block No./TAST code | F12: Picture block No./TAST code | KY |
| n+10 | F13: Picture block No./TAST code | F14: Picture block No./TAST code | KY |
| n+11 | F15: Picture block No./TAST code | F16: Picture block No./TAST code | KY |

*For explanations, see next page*

**Explanations to table 3.11**

DW n+0 to n+1:    Enter in these data words in ASCII code the picture
identification belonging to the block.

Example:    Picture identification $=$ABC
Blank space $\hat{=}$ 32 (ASCII) $\hat{=}$ 20$_{Hex}$
A $\hat{=}$ 65 (ASCII) $\hat{=}$ 41$_{Hex}$
B $\hat{=}$ 66 (ASCII) $\hat{=}$ 42$_{Hex}$
C $\hat{=}$ 67 (ASCII) $\hat{=}$ 43$_{Hex}$

| DW No. | Contents Left-hand byte | Contents Right-hand byte |
|--------|-------------------------|--------------------------|
| n+0 | 20$_{Hex}$ | 41$_{Hex}$ |
| n+1 | 42$_{Hex}$ | 43$_{Hex}$ |

DW n+2:    Entry of the FB which is to be called when the picture is
opened.  If "0" is entered, no FB is called. There must be no
parameters in the FB.

In the picture-specific FB the scratch flags (FY 240 to 255) of
the FB *BILDLIST* must not be used.

The FB *BILDLIST* transfers functions via the FY 247 to the
picture-specific FB. The bits 1, 3, 7 can be evaluated as
follows:

| Flag | Function |
|------|----------|
| F 247.1 | Pulse for picture change for the 1st FB run |
| F 247.3 | Pulse for picture change for the last FB run |
| F 247.7 | If the picture-specific FB sets the flag to 1, the picture change (data block change) will be blocked via the FB *BILDLIST*. |

FW 250:    A function key signal is provided as a pulse and
can be used in the picture-specific FB.
Allocation:

F 251.0 = <F1> to F 250.7= <F16>

There will be no pulse if the sequence number in
the data block has the value 255.

For alarm processing, the flag area FY 240 to
FY 255 has to be rescued in the alarm program if
this flag area is used in the alarm program.

    6ZB5 440-0QS02    
WF 470 (Description)

DW n+3:

16 bits of DW n+3 are allocated to function keys F1 to F16.
Bit 0 corresponds to F1, bit 1 to F2, and so forth.
If a bit is set to "1":
    The contents of the data byte allocated to the function key
    (see DW n+4 to n+11) is transferred to the parameter
    "TAST" of FB *220*.
    If, for instance, the data byte contains "E4$_{Hex}$" instead of a
    picture block number, the function key can be used to
    start the protocol.
If a bit is set to "0":
    On actuating the corresponding function key, the picture of
    the block number entered is opened.

DW n+4 to n+11:

In these data words, the picture block numbers are entered
and allocated to the function keys, thus laying down which
pictures are to be opened with functions keys F1 to F16.
If a function key is not to select a picture, enter either its own
picture block number or 255.
If a function key is allocated picture block number 254,
pressing this key causes the process picture selected <u>before</u>
to be opened.
The values of these data bytes are transferred to the "TAST"
byte if the bit allocated to the function key in DW n+3 is set
to "1".

### 3.4.3 Auxiliary Data Block DBH

The auxiliary data block *DBH*

– has to be set up by the user,
– serves the FB *BILDLIST* as an intermediate memory for variable words and
– must be in the RAM.

When the basic picture shall be displayed automatically upon start (restart) of the
plant or upon new start, the following data words have to be overwritten in OB20
to OB22:

– DW 2 to 7 and 10 to 14 with:    KH= 0000,
– DW 1 with:    KH= 0001.

Then block 0 in DBBL will automatically be selected and the picture preset in
data block 0 will be called. If WF 725/WF 726 are used, DW8 and DW9 will be
allocated a default setting by Standard III.

### 3.4.4 Search Run

If a picture is not called via the FB *BILDLIST*, but via another data block or via
the picture index, the FB *BILDLIST* will search the respective block in the data
block *DBBL* and correspondingly activate the function key assignment.

If the searched picture is not found in any of the blocks, the data block 0 will be
processed alternatively, i.e. the function keys will be allocated the same functions
as in the basic picture.

## 3.5 **Data Block DBWF** (Transfer Area)

The *DBWF* has to be parameterized once for each module in the system data list of the configuration software of the programmer. Each *DBWF* defined in this way has a different DB number, even though *only the DBWF* is referred to in this documentation.

The first 20 data words of the *DBWF* are assigned as stated in table 3.12. The area from DW 20 onwards is provided for sequence chain diagnostics (GRAPH5 and DIMOS options); it is dealt with in sections 4.3 and 4.4.

Table 3.12          Structure of the data block DBWF

| No. | Left-hand byte | Right-hand byte | Remark |
|---|---|---|---|
| 0 | | Indic. bits | Bit 0:       Input format error<br>Bit 1-15:  Free |
| 1<br>2<br>3<br>4<br>5<br>6 | | Seconds<br>Minutes<br>Hours<br>Day<br>Month<br>Year | Date and time binary-coded;<br>Updating via keyboard byte E2 $_{Hex}$<br>(see section 3.2.3) |
| 7 | Bit 9 to 11:<br>Field type | Bit 0 to 8:<br>Field No.<br>binary-coded | Identification of the input field in which the cursor stands or shall be positioned (updating via keyboard byte E6h see section 3.2.3):<br>Bit        Meaning<br>0 to 8    Field No. (1 to 511);<br> 9         Field type 0 (I Field)<br>10         Field type 1 (I/O Field)<br>11         Window |
| 8 | Printer status | No. of output protocol | |
| 9 | Control bits for the protocol | No. of the protocol to be output | Explanation see section 4.2.*/*4.2.1 |
| 10<br>11<br>12 | | | When using the serial interface each depression of <F1> to <F16>, if  WS 495/496 is used, sets one bit in the data word 10. When using the function keyboard with its 24 function keys, each depression of a key sets one bit in data words 11 and 12. When the key is released, the respective bit is maintained! |
| 13 | DB No. | DW No. | Definition of the data block "Computer Link"<br>Explanation see section 4.5 |
| 14 | | | Reserved |
| 15 | | | Reserved |
| 16<br>17 | y1<br>y2 | x1<br>x2 | Offset for sequence-chain window:<br>DW 16 for window 1<br>DW 17 for window 2 |
| 18<br>19 | | | Occupied for protocol of<br>sequence chains |
| 20 ff. | | | Data for DIMOS, GRAPH5 or GRAPH5/II sequence-chain diagnostics (see section 4.3, 4.4 or 4.5) |

**Input format error**

In case of integer and fixed point variable fields, the format of the numeric value entered is checked for compliance with the admissible number of digits and the syntax before the value is transferred.

Whereas so far only the old value was written back into the field in case of an illicit format, bit 0 is now additionally sent in the DBWF DW 0. The bit is automatically reset if the field is changed or a new value is entered.

WF 470 (Description)

# 4 Software Packages for the WF 470

WF 470 (Description)

## 4.0 Overview

This chapter deals with the additional modules for picture generation contained in the software package, with the loadable software options and the functions of the WF 470 firmware from version 4.0 onwards.

As options, the software packages

  Service module
  Configurable protocol and fault message
  DIMOS/GRAPH5/GRAPH5/II for WF 470 / GRACIS
  Computer link

are available on diskette.


The options packages contain software modules and screen forms that must be loaded into the WF 470 modules. In addition to the sequence chain diagnostics, it contains standard blocks (FBs and SBs) for the SIMATIC S5-115U, S5-135U and S5-155U programmable controllers.

The screen forms supplied can be modified. For the integration of the screens into a (softkey) operator tree, text windows have been inserted into the pictures. These text windows access the text groups with the name "softkey texts" and the identification "T#SK", which are delivered together with the picture generation software.


**Text group "Softkey texts"** (identification "T#SK")

Text lists which correspond to a file are combined to form a text group. A separate text group (with the name "Softkey texts" and the identification "T#SK") allows the user to define individual texts for the function keys. For every option picture and for the system message line, the text group #SK contains a text list in which the softkey texts belonging to the picture are stored. The text lists are shown in the following table.

Table 4.0

| Ident. | Name | Section |
|---|---|---|
| N000 | Softkey text sequence chain screen form (for reasons of compatibility) | – |
| N001 | Softkey text service modul | 4.1 |
| N002 N003 | Softkey text GRAPH5 sequ. chain diagn. picture 1 Softkey text GRAPH5  sequ. chain diagn. picture 2 | 4.4 |
| N004 N005 | Softkey text DIMOS sequ. chain diagn. picture 1 Softkey text DIMOS sequ. chain diagn. picture 2 | 4.3 |
| N006 | S5 message texts (Error mess. system mess. line) | – |
| N007 | Softkey text computer link | 4.5 |

You can find the text group on every **picture generation software package**; you only have to copy it onto the data diskette of the user. To do this, use the copy function of the picture generation software (not of the operating system command "PIP").

The structure of the mentioned lists must not be modified. Texts, however, may be overwritten and unused lists be deleted. The DB No. indicated in the text lists is irrelevant for the direct use. This DB is not addressed and therefore need not exist in the SIMATIC S5.

**Installation**

In the PG the loadable options [*file name.SYS*] must be copied from the diskette to the hard disk with the corresponding operating system command.

e.g.:                              **"PIP"**              (in PCP/M) or

                                   **"COPY"**              (in MS DOS),

In PCP/M, copy the files into user 0 and subsequently assign the attributes [**RO SYS**]. S5 DOS must exist in user 0.

In MS DOS, copy the files the files into the directory where the file *WF470.COM* (picture generation software) is stored.

Further information can be obtained from the corresponding options diskette.

WF 470 (Description)

## 4.1 **Service Module** (Option)

No additional software is needed in the SIMATIC S5 for the service module. With the service module you can display the following:

– The status of input words, flag words, data words, timers and counters in

– Bit patterns, dual, hexadecimal, decimal
(see figure below)

The operating mode CONTROL (modification of values in the S5) is activated when the parameter SS (key switch) of the link FB S5 - WF 470 has the status "1". In this operating mode the service module cannot be deselected. The picture change is blocked.

The service module is treated on the WF 470 as a picture.

Index PROCESS PICTURES:     Display with the No. #02
Selection:                              as usual

If the peripheral modules which are not available are interrogated on a SIMATIC S5-135U with CPU 921 (S processor), the CPU goes into STOP state. Acknowledgement delay and address errors cannot be masked out. Access to peripheral bytes/words of the SIMATIC S5-115U is not permitted and causes a corresponding error message to be displayed.

```
WF 470   Service Module

Control          n/DL            n+1/DR         HEXA         DEZ

IW      000    0000 0110      1100 0000      06C0         01728
OW      000    1000 0100      1100 0000      84C0         33984
FW      100    0000 0001      0000 0000      0100         00256
C       005    0000 0000      0000 0000      0000          0000
T       102    0000 0000      0000 0000      0000          0000
PW      129    1111 1111      1111 1111      FFFF         65535
DB      030
DW      001    0000 0000      0000 0001      0001         00001
DW      002    0000 0000      0000 0101      0005         00005
DW      003    0100 1000      0010 0000      4820         18464

  1=Input word (IW)        2=Output word (OW)      3=Flag word (FW)
  4=Counter (C)            5=Timer (T)             6=Periphery (PW)
  7=DB-Number (DB)         8=DW-Number (DW)        0=delete
```

| F1 | F2 Op. | F3 | F4 | F5 | F6 | F7 | F8 |
|---|---|---|---|---|---|---|---|
| Structure | guidance | Op. elem. | Date Clock | Features | Unassigned | Sequ.funct. | Basic pict. |

*Fig. 4.1     Service module screen form (the assignments of the function keys are examples, not the standard)*

WF 470 (Description)

## 4.2 **Fault Message and Protocol** (Option)

For this module no additional software is needed in the SIMATIC S5.

Protocols are generated with the picture generation software and calculated with @xy, xy representing the protocol no.

Loaded protocols are indicated in the picture index PROTOCOLS and in the protocol screen form of the WF 470 (see section 4.2.2).

A protocol can be started or stopped by:

> entering E4$_{Hex}$, E5$_{Hex}$ in the parameter "TAST" in FB *S5-WF 470*
> entering DW 9 into the DBWF (see section 4.2.1) and by entering E8$_{Hex}$ in parameter "TAST"
> using the protocol screen form

For the sequence-chain protocol supplied with this option function blocks of the SIMATIC S5 are needed for clocking through the criteria disturbed (e.g. FB *75*, FB *170*).

## 4.2.1　　Data Block Transfer Area *DBWF*

The protocol function uses DW 8 and DW 9 of the *DBWF* (see also section 3.5) according to table 4-1.

Table 4.1

| Data word | Bit No. | Meaning |
|---|---|---|
| **DW 8** 1)<br><br>Status Message for Protocol | 0 to 5 | Number of output protocol |
| | 6 to 7 | Not used |
| | 8 | Protocol output active. One protocol is buffered. Two separate protocols can be processed at a time. |
| | 9 | Selected protocol not existent |
| | 10 | After 20 sec. waiting time: printer unclear |
| | 11 | Not used |
| | 12 | Fault message output not active |
| | 13 | Protocol not started |
| | 14 | Protocol not loaded |
| | 15 | Place for message buffer less than 50 messages |
| **DW 9** 2)<br><br>Control word for protocol | 0 to 7 | Number of output protocol (binary) |
| | 8, 9 | Output mode (dual):<br>00　　No protocol output<br>10　　Output of the freely creatable protocol and message protocol<br>11　　Output of the message protocol<br>01　　Output of the freely creatable protocol |
| | 10 to 11 | Not used |
| | 12 | Disable fault message output |
| | 13 | Stop protocol |
| | 14 | Delete selectively fault messages of individual protocols (dependent on bits 0 to 7) |
| | 15 | Delete message buffer for protocol |

1) Ref. DW 8, Bits 8 to 15: The functions are valid when the bit has the value 1.

2) The preselected functions are executed when TAST of the FB S5-WF 470 is allocated the identification $E8_{Hex}$. Several functions can be preselected simultaneously. For example, protocol can be started with the identification $E8_{Hex}$ and the signal status "0" on bit 13.

For reasons of compatibility protocol indications can also be executed via BLD1 to BLD9 (i.e. "@01" for protocol @01).

RESET does not delete the protocol buffer; information is still available. The buffer must be deleted with an explicit command (delete protocols selectively).

## 4.2.2 Protocol Screen Form

**Calling up:**

a) Via the overview mask or

b) By selecting picture #9A.

**Operation:**

Via the numeric keys of the operating keyboard 8 fields can be selected in the upper section of the screen form (fig. 4.2) and messages concerning the state of protocol be requested (table 4.2).

```
WF 470    Protocol  screen form              08.02.88  12:45:46

   ┌────────┬───────┬───────┬───────┬───────┬───────┬───────┬───────┐
   │   0    │   1   │   2   │   3   │   4   │   5   │   6   │   7   │ ◄──────
   └────────┴───────┴───────┴───────┴───────┴───────┴───────┴───────┘
   ┌────────────────────────────────────────────────────────┐
   │ Printer output free - press LF for listing output        │
   └────────────────────────────────────────────────────────┘
   ┌──────────────────────────────────────────────────────────────┐
   │ Messages 00014-00026         total:  00102                    │
   ├──────────────────────────────────────────────────────────────┤
   │ >08.02.88  14:55:58   CHIP TRANSPORT      ON                  │
   │ >08.02.88  14:55:59   PRESSURIZED AIR     ON                  │
   │ >08.02.88  14:55:59   COOLANT             ON                  │
   │ >08.02.88  14:56:00   MEASURING SYSTEM O.K.                   │
   │ >08.02.88  14:56:02   S T A R T ** LINE                       │
   │ >08.02.88  14:56:07   NO HYDRAULIC OIL                        │
   │ >08.02.88  14:56:08   STARTING POSITION                       │
   │ >08.02.88  14:56:08   NO MATERIAL                             │
   │ >08.02.88  14:56:10   MOTOR CIRCUIT-BREAKER OFF               │
   │ >08.02.88  14:56:57   NO HYDRAULIC OIL                        │
   │ <08.02.88  14:56:57   STARTING POSITION                       │
   │ <08.02.88  14:56:57   NO MATERIAL                             │
   │ <08.02.88  14:56:58   MOTOR CIRCUIT-BREAKER OFF               │
   │                                                              │
   ├──────────────────────────────────────────────────────────────┤
   │ mess. buffer 04004                                     03708 │
   └──────────────────────────────────────────────────────────────┘
                      selection of listig
   () 01 03 04 06
```

For the meaning of the selectable fields, see next page

*Fig. 4.2*

WF 470 (Description)

Table 4.2    Meaning of the fields selectable by the numeric keys

| Field | Meaning | DW 8 |
|-------|---------|------|
| 0 | Display/start protocol output | Bit 8 |
| 1 | Display: protocol not existent | Bit 9 |
| 2 | Display: printer unclear | Bit 10 |
| 3 | Alternation in screen display between text groups and sequence-chain messages | |
| 4 | Display/alternation: fault message output disabled/active | Bit 12 |
| 5 | Display/alternation: protocol start/stop | Bit 13 |
| 6 | Display: protocol not loaded | |
| 7 | Display/deletion: message buffer; if a protocol is selected simultaneously: only messages of the protocol are deletec, if () is selected: all messages are deleted. | |

Via the acceptance key, protocol functions can be started.

The loaded protocols are listed in one of the bottom lines of the picture. With the keys  < > and < >, the protocols are selected. In the display field, the messages of the selected protocol are output. The allocation of the message buffer is represented by 2 numeric fields and a bar.

Protocol output is also started in this screen form.

Select the protocol number with the cursor, enter "0" and press the acceptance key.

## 4.3 Sequence Chain Diagnostics (Option)

The diagnostics package contains the systems DIMOS, GRAPH5 (see section 4.4).and GRAPH5/II (see section 4.5). Only one of these systems may be installed at a time. For scope of delivery and names of the files on the MS-DOS diskete, see section 4.5.

### 4.3.1 Organization

Sequence chains consist of individual steps
– which are processed one by one and
– are programmed in the SIMATIC S5 in sequence blocks (SB) or program blocks (PB).

For each step one SB or PB is needed. In one program cycle, only one step of a chain is processed. Progressing from one step to the next takes place in dependence on certain continuation conditions, such as limit switches or the expiry of waiting times (see fig. 4.3).

**Calling up**

DIMOS consists of two pictures, one overview picture and one diagnostics picture. The basic picture is called with identification #05, the diagnostic picture with identification #06. In the index of pictures, however, these identifications are not displayed, but #01, as before.

```
WF 470   Step sequence analysis              02.11.87 12:45:46
```

| No. | SB | Step | Function | |
|---|---|---|---|---|
| >* 01 | 0 1 2 | 0 0 2 | MATERIAL LOADER SECTION | 01 |
| 02 | 0 1 5 | 0 0 1 | STATION | 01A |
| 03 | 0 1 9 | 0 0 2 | STATION | 01B |
| * 04 | 0 2 2 | 0 0 2 | MILLING | 02A |
| 05 | 0 2 7 | 0 0 4 | DRILLING STATION | 02B |
| 06 | 0 3 5 | 0 0 3 | DRILLING STATION | 03A |
| 07 | 0 4 3 | 0 0 3 | THREADING STATION | 03B |
| 08 | 0 5 1 | 0 0 2 | MEASUREMENT STATION | 04 |
| 09 | 0 5 8 | 0 0 4 | TURNING STATION | 05 |
| 10 | 0 7 0 | 0 0 3 | MILLING        O | 6A |
| 11 | 0 7 9 | 0 0 6 | MEASUREMENT STATION | 07 |
| 12 | 0 8 5 | 0 0 4 | STATION | 08A |
| 13 | 0 9 4 | 0 0 6 | STATION | 08B |
| 14 | 1 0 3 | 0 0 3 | STATION | 08C |
| 15 | 1 2 0 | 0 0 8 | STATION | 08D |
| 16 | 0 0 0 | 0 0 0 | RESERVE | |

*Maximum length of this text is 50 characters*

| Softkey assignment by | F1 Mimic | F2 Operate | F3 Pic elem. | F4 Print | F5 WF 470 | F6 Service fct. | F7 Analysis | F8 Index |

text group #SK and text list 004

WF 470 (Description)

| WF 470  Step sequence analysis - Diagnostic unit | | | | 02.11.87 12:45:46 |

Faulty sequences:      01 04

| No. | SB | Step | MATERIAL LOADER STATION       01 | | |
|-----|-----|------|---|---|---|
| >*01 | 012 | 002 | 06 | Transition conditions not fulfilled | 01 - 06 |

```
A  I000.0  E-STOP PRESSED
A(
ANE000.1  WORKPIECE MISSING (E 0.1)
A  I000.2  WORKPIECE NOT CLAMPED
O  I000.5  RUNOUT
)
```

***Maximum length of this text is 50 characters***

| | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 |
|---|-----|-----|-----|-----|-----|-----|-----|-----|
| Softkey assign-ment by | Mimic | Operate | Pic elem. | Print | WF 470 | Service fct. | Overview | Index |

text group #SK and text list 005

### Operation

You can pass from the overview picture to the diagnostics picture by inputting "B" via the keyboard. With input "A" you return to the overview picture. With key "C", you pass in the criteria display in the diagnostics picture from display type AWL to KOP and vice versa (from version 3.4 onwards).

Softkeys can be input into the pictures via the text group "#SK" and the text lists 004 and 005.

DIMOS can be used for:          SIMATIC S5 135 U with CPU 928,
                                SIMATIC S5 115, CPU 942/943/944
                                SIMATIC S5 155 U

DIMOS **cannot** be used for:      SIMATIC S5 135 U with CPU 921**/**922
                                        (S**/**R processor)
                                SIMATIC S5 115, CPU 941

Each step is monitored as to time (the monitoring time is programmed in FB 172.) This time begins to run anew for each step change. The function block will report an error (displayed on the WF 470), if no progressing to the next step takes place within the fixed time. The chain will only continue to run after the cause of the fault has been remedied and a new start has been effected.

The FB *172 (sequence chain organization)* carries out higher-level jobs (such as the selection of the operating mode) and guarantees the correct processing of the steps. The information for the chains (SB no., step no., etc.) is stored by the FB *172* in a data block *interface*.

Up to 16 sequence chains can be combined to form one sequence block. The total capacity is 4 sequence blocks (16 x 4 = 64 chains).
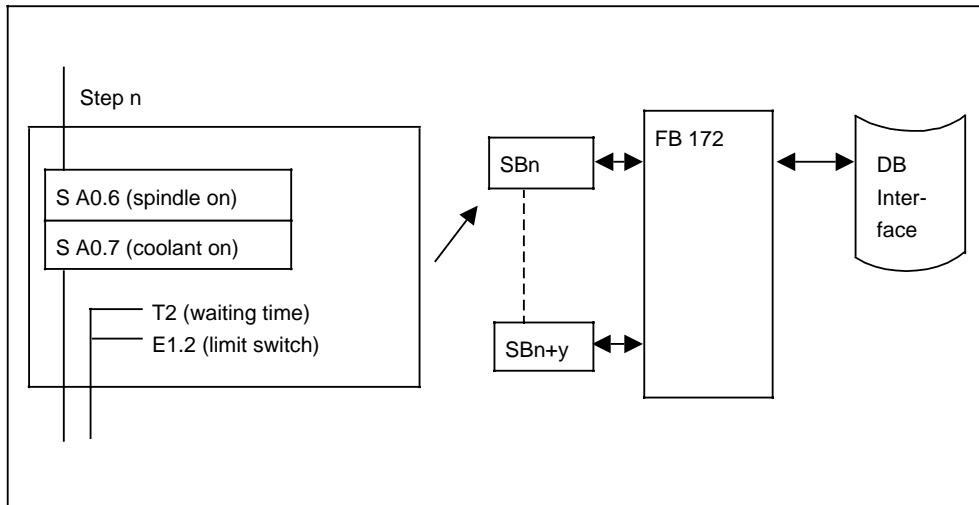


*Fig. 4.3     Example of a sequence chain*

If a continuation condition is not fulfilled within the monitoring time, the function blocks *Criteria Analysis, Criteria  Display, Sequence Chain Selection* and *S5 WF 470* provide for an error display in the sequence chain picture:

The FBs *Criteria Analysis ABL: KRAY* (FB *174*, FB *184*) and *Criteria Display ABL. KRAN* (FB *175*, FB *185*) check the current SB for unfulfilled continuation conditions. The unfulfilled conditions are stored in the form of a bit with the corresponding MC5 code in the DB *Criteria Analysis*.

This information and the data of the DB *Interface* are stored by the FB *Sequence Chain Selection* (FB *173*, FB *183*), dependent on the faulty sequence chain, in the data block *DBWF* from DW 20 onwards.

The FB *S5-WF470* transfers the data to the WF 470, which displays them in the sequence chain analysis with the corresponding messages in plain text.

WF 470 (Description)

One chain
block
consists of
up to 16
chains

Each
chain
needs an
FB 172

DB Interface

FB 173/183

DB Criteria
analysis

FB 174/184

Sequ.
chain 1

FB
172/1

DW
SCHR,
NRSB
from
FB172
chains
1-16

Sequ.
chain
selection

Criteria
analysis

**Sequ.
block 1**

Sequ.
chain 16

FB
172/16

FB 175/185

Criteria
display

DB Interface

Sequ.
chain 17

FB
172/17

DW
SCHR,
NRSB
from
FB172
chains
17-32

**Sequ.
block 2**

DBWF from
data word 20

Sequ.
chain 32

FB
172/32

FB x

S5 -
WF 470

DB Interface

Sequ.
chain 33

FB
172/33

DW
SCHR,
NRSB
from
FB172
chains
33-48

**Sequ.
block 3**

Sequ.
chain 48

FB
172/48

DB Interface

Sequ.
chain 49

FB
172/49

DW
SCHR,
NRSB
from
FB172
chains
49-64

DPR

**Sequ.
block 4**

Sequ.
chain 64

FB
172/64

Fig 4.4    Structure of sequence chain diagnostics (see section 4.3.2.1)

WF 470 (Description)

## 4.3.1.1 Function Block ABL: KORG

## Purpose and functioning mode

The FB *ABL:KORG* manages the sequence of a chain. The chain can comprise up to 255 steps. For each step a function block (SB or PB) has to be programmed according to a given structure (see also section 4.3.6).

Table 4.3        Technical Data

|  | **S5-155 U** | **S5-115 U** | **S5-135 U** |
|---|---|---|---|
| Admissible SIMATIC CPU | 946, 947 | 942 to 944 | 928 |
| Block no.<br>(name) | FB 172<br>ABL:KORG | FB 172<br>ABL:KORG | FB 172<br>ABL:KORG |
| Library no. | E88530 B4136-D | E88530 B4136-A | E88530 B4136-C |
| Processing time (ms) | Approx. 1 | | |
| Call length (words) | 19 | | |
| Nesting depth | 1 | | |
| System data | None | | |
| Assigned flags | FY 240 to 255 | | |
| Called blocks | The corresponding SB or PB | | |
| Timers | None | | |
| Counters | None | | |
| Data block interface for parameters SCHR, NRSB, KDAT | The DB must have been called before the FB is called. | | |

6ZB5 440-0QS02
WF 470 (Description)

## Parameterization

```
          ABL:KORG           FB 172

  ──  BETR          SCHR  ──
  ──  STRT          NRSB  ──
  ──  TIPP           STO  ──
  ──  EINR          ISTO  ──
  ──  SCHD          KDAT  ──
  ──  SCHS
  ──  RSET
  ──  PBSB
  ──  SBAE
  ──  TWA
  ──  TUE
  ──  KUE
```
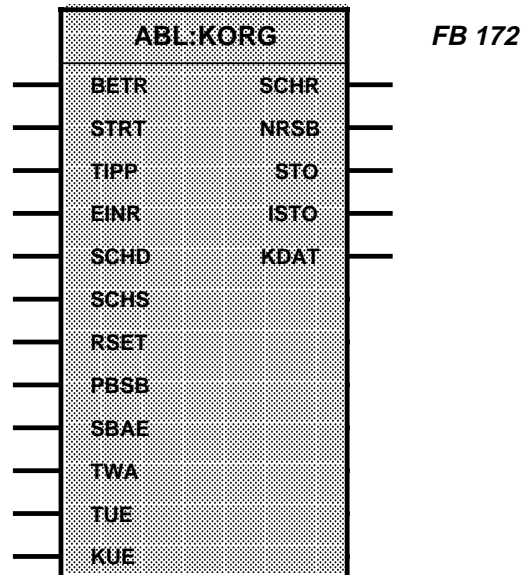
Table 4.4       Parameters of the FB *172*

| Param. | Meaning | Remark | Kind | Typ | Admiss. values |
|---|---|---|---|---|---|
| BETR | Operating mode selection | 1 = Automatic<br>0 =Manual | I | BI | I:    0.0 to 127.7<br>F:    0.0 to 199.7 |
| STRT | Chain start in both modes | Permanent signal. | I | BI | I:    0.0 to 127.7<br>F:    0.0 to 199.7 |
| TIPP | Jog mode Progressing with STRT Signal change from 0 to 1 | BETR=1, TIPP=1, STRT 0  1=step+1 during the request "STO" is displayed | I | BI | I:    0.0 to 127.7<br>F:    0.0 to 199.7 |
| EINR | Set-up mode | Direct command output! Only the specially selected step is processed. | I | BI | I:    0.0 to 127.7<br>F:    0.0 to 199.7 |
| SCHD | Step number presetting | A step can be selected in automatic or manual mode. | I | BY | IB:     0 to 127<br>FY:     0 to 199 |
| SCHS | Jump to preset step number | will be deleted in FB *172* | I | BI | I:    0.0 to 127.7<br>F:    0.0 to 199.7 |
| RSET | Sequence-chain reset | =OFF (all command outputs BEFA=0) | I | BI | I:    0.0 to 127.7<br>F:    0.0 to 199.7 |
| PBSB | Selection of SB or PB | For one sequence chain, either SB's or PB's can be used. | D | KC | KC:    PB or SB |

Table 4.4    Parameters of the FB *172*    (cont.)

| Param. | Meaning | Remark | Kind | Typ | Admiss. values |
|--------|---------|--------|------|-----|----------------|
| SBAE | No. of first and last SB or PB | | D | KY | KY:    1 to 255 |
| TWA | Indication of waiting time | Started/called if required in the SB. | T | – | T 1:    127 |
| TUE | Indication of monitoring time | Automatic start upon step change. The time value is valid for each step of the chain. | T | – | T 1:    127 |
| KUE | Time value for TUE | | D | KT | KT: 0.0 to 999.3 |
| SCHR | Output of no. of current step | SCHR  is binary coded. | Q | BY | DB *Interface*, DR |
| NRSB | Output of no. of current SB | | Q | BY | DB *Interface*, DL |
| STO | Fault | Continuous signal | Q | BI | Q:  0.0 to 127.7 F:   0.0 to 199.7 |
| ISTO | Fault | Dynamic (pulse for 1 cycle) | Q | BI | Q:  0.0 to 127.7 F:   0.0 to 199.7 |
| KDAT | Sequence-chain data | | Q | W | DB *Interface* |

## Application Rules

1.  For parameterization, the fault outputs STO of a sequence block (max. 16 chains) have to be combined on one flag word as follows:

**FW x**

| | | | FY x | | | | | | | | FY x+1 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

F (x+1).0    STO/Chain 1
F (x+1).1    STO/Chain 2
...
F x.7    STO/Chain 16

The flag word is in FB *KANW:WF* has to be parameterized at STOx.

2.  You can further evaluate the two signals bit 0 and bit 1 of KDAT, for example as the result of a logic operation (RLO with F 101.0) or as a command output (BEFA with F 101.1). The rest of the signals is used internally by the FB.

3.  For process alarm and time alarm-controlled processing the FY 240 has to be saved.
    Example:

```
OB 13:      L    FY 240
            T    FY x
            JU   FB..
            L    FY x
            T    FY 240
```

WF 470 (Description)

## 4.3.1.2 Data Block *Interface*

The output parameters SCHR, NRSB and KDAT of the FB *172* are interpreted on the WF 470 for the display. For this reason, the data have to be stored standardized in a DB according to table 4.5. 32 data words have to be reserved per sequence chain block. The DB receives its parameters from QKBx in FB *KANW:WF*.

The data block must have been called before FB *172* is called.
The data area must be contiguous.

Table 4.5      Structure of the *DB Interface*

| DW | Left-hand byte | Right-hand byte | | | Position in the sequence block | Remark |
|----|----------------|-----------------|---|---|--------------------------------|--------|
| Y | NRSB FB *172* | NRSB FB *172* | | | 1st chain | Sequence chain block: is entered in DBWF from DW 20 to 35 |
| Y+1 | | | | | 2nd chain | |
| Y+2 | | | | | 3rd chain | |
| Y+3 | | | | | 4th chain | |
| etc. | | | | | etc. | |
| Y+14 | | | | | 15th chain | |
| Y+15 | | | | | 16th chain | |
| | | Bit | 1 BEFA | 0 RLO | | |
| Y+16 | Parameter KDAT (internal data area) | | | | 1st chain | STO from FB *172* |
| Y+17 | | | | | 2nd chain | |
| Y+18 | | | | | 3rd chain | |
| Y+19 | | | | | 4th chain | |
| etc. | | | | | etc. | |
| Y+30 | | | | | 15th chain | |
| Y+31 | | | | | 16th chain | |

WF 470 (Description)

## 4.3.2 Sequence Chain Selection

### 4.3.2.1 Function Block *KANW:WF*

### Purpose and Functioning Mode

The function block *KANW:WF* manages up to 4 sequence blocks of 16 chains each for diagnostics and display with the help of the WF 470. The sequence organization of the individual chains is effected by the FB *172*.

The individual chains and the FB KANW:WF are connected via up to 4 DB's *Interface*, which are parameterized on QKBx. The FB *KANW:WF* provides that the first faulty chain is displayed on the screen. If there is no fault, the first 16 chains will be displayed.

Table 4.6        Technical Data

|  | **S5-155 U** | **S5-115 U** | **S5-135 U** |
|---|---|---|---|
| Admissible SIMATIC-CPU | 946, 947 | 942 to 944 | 928 |
| Block no. (name) | FB *183* KANW:WF | FB *173* KANW:WF | FB *183* KANW:WF |
| Library no. | E88530 B4136-D | E88530 B4136-A | E88530 B4136-C |
| Processing time (ms) | 1 to 2 0.5 to 1 | 2 to 6 1 to 2 | 2 to 4 |
| Call length (words) | 20 | | |
| Nesting depth | 1 | | |
| Data blocks | Acc. to parameter | | |
| System data | None | | |
| Assigned flags | FY 240 to 255 | | |
| Called blocks | None | | |
| Timers | None | | |
| Counters | None | | |

For SIMATIC S5-155 U and 135 U, only FB *183 to 185* are delivered.

## Parameterization

**FB 173, FB 183**

```
            ┌─────────────────────┐
            │       KANW:WF       │
        ────┤ STO1          NRSB ├────
        ────┤ QKB1          ANFR ├────
        ────┤ STO2          STOS ├────
        ────┤ QKB2                │
        ────┤ STO3                │
        ────┤ QKB3                │
        ────┤ STO4                │
        ────┤ QKB4                │
        ────┤ DBWF                │
        ────┤ AKR                 │
        ────┤ DBKA                │
        ────┤ HANW                │
        ────┤ K-NR                │
        ────┤ BTQ                 │
            └─────────────────────┘
```
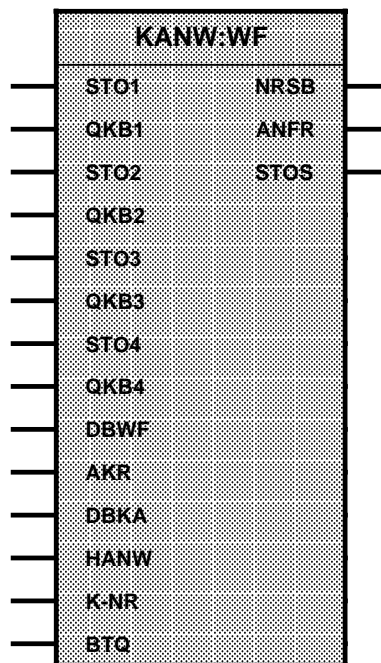
Table 4.7        Parameters of the FBs *KANW:WF*

| Param. | Meaning | Remark | Kind | Typ | Admiss. values |
|--------|---------|--------|------|-----|----------------|
| STO1 | Fault outputs KBl 1 | Bit 0:    STO chain 1<br>Bit 15:    STO chain 16 | I | W | FW:    0 to 198<br>QW:    0 to 127<br>DW:    1 to 255 |
| QKB1 | Source KBl 1 | Byte/left:  No./DB interface<br>Byte/right:    DW No.<br>KBl QKB1 must be existent | D | KY | KY=  DB No.,<br>        DW No.<br>DB No.:1 to 255<br>DW No.:1 to 239 |
| STO2 | Fault outputs KBl 2 | Assignment chain 17 to 32<br>            as for STO1 | I | W | See STO1 |
| QKB2 | Source KBl 2 | Byte/left:  No./DB interface<br>Byte/right:    DW No.<br>KY=0,0:   No DB available | D | KY | See QKB1 |
| STO3 | Fault outputs KBl 3 | Assignment chain 33 to 48<br>            as for STO1 | I | W | See STO1 |
| QKB3 | Source KBl 3 | See QKB2 | D | KY | See QKB1 |
| STO4 | Fault outputs KBl 4 | Assignment chain 49 to 64<br>            as for STO1 | I | W | See STO1 |
| QKB4 | Source KBl 4 | See QKB2 | D | KY | See QKB1 |

KBl =Sequence chain block

Table 4.7　　　Parameters of the *FB 173 und 183*　　　　　　　　(cont.)

| Param. | Meaning | Remark | Kind | Typ | Amiss. values |
|---|---|---|---|---|---|
| DBWF | DB Sequence chain data | Byte/left:　　DB No.<br>Byte/right:　DW No. data<br>　　　　　start 56 DW<br>　　　　　assigned | D | KY | KY=　DB No.,<br>　　　　DW No.<br>DB No.:1 to 255<br>DW No.:　　　20 |
| AKR | Current criteria in DB KA | from FB *ABL:KRAN* (FB *175*/*185*) | I | BI | I/O:0.0 to 127.7<br>F:　0.0 to 199.7 |
| DBKA | DB *Criteria Analysis / Display* | Parameterization of DB *Criteria Display* | D | KY | KY=　DB No.,<br>　　　　DW No.<br>DB No.:1 to 255<br>DW No.:　　　8 |
| HANW | Manual selection | 1 ≙　Diagnostics: Pre-<br>　　　selection by chain<br>　　　number<br>0 ≙　Diagnostics: Pre-<br>　　　selection by WF 470 | I | BI | I/O:0.0 to 127.7<br>F:　0.0 to 199.7 |
| K-NR | Sequence chain number | Sequence chain number for HANW binary-coded | I | BY | IB/QB: 0 to 127<br>FY:　　0 to 199 |
| BTQ | Fault acknowledge-ment key | Continue to next faulty chain in the overview screen form (no leafing backwards) | I | BI | I/O:0.0 to 127.7<br>F:　0.0 to 199.7 |
| NRSB | No. SB/PB for criteria analysis | SB No. and internal information for FB *174* | Q | W | FW:　　0 to 198<br>DW:　　1 to 255 |
| ANFR | Enable bit criteria analysis | | Q | BI | Q:　0.0 to 127.7<br>F:　0.0 to 199.7 |
| STOS | Fault bus signal | Bus message: faulty chain | Q | BI | F:　0.0 to 199.7 |

One overview page per block!
Only parameterizable blocks can be selected.

## Application Rules

1. If there are not more than 16 sequence chains, there will be only one data block for the DB *Interface*. This data block has to be indicated in parameter QKB1.

   In this case, 0.0 has to be parameterized in QKB2 to QKB4. This indication identifies the fact that the sequence chains 17 to 64 including their corresponding data blocks do not exist. Make sure that for nonexistent chains the corresponding STOx bits are set to "0". Otherwise, nonexistent chains might be reported as faulty in the diagnostics picture.

2. If one sequence block does not exist (and there is no DB *Interface* either), in QKBx KY=0,0 has to be parameterized. The corresponding STOx bits have to be set to "0". The scratch flag area from flag word 200 onwards must not be used for that purpose.

　　6ZB5 440-0QS02
WF 470 (Description)

## 4.3.2.2 Data Block *DBWF*

The data for the sequence chain display are stored in the DB *DBWF* by the
FB *KANW:WF*. These data start with DW 20 and comprise 56 or 90 words, which
are in a certain order according to table 4.8.

The DB no. can freely be selected and must be indicated in parameter DBWF of
FB *KANWWF*. The *DBWF* (Sequence chain data) is in the RAM.

Table 4.8          Structure of DB *DBWF*

| DW-No. FB *173* to *175* | DW-No. FB *183* to *185* | Bit-No. | Meaning | Remark | |
|---|---|---|---|---|---|
| 20 to 35 | 20 to 35 | 0 to 7 | Step number. | DW 20: chain 1 DW 21: chain 2, etc. | |
| | | 8 to 15 | SB/PB-No. | | |
| 36 to 39 | 36 to 39 | 0 to 3 | Faulty chain 1 to 4 | Bit=1: faulty chain  Every DW describes the state of 16 chains. | |
| | | 4 to 7 | Faulty chain 5 to 8 | | |
| | | 8. to .11 | Faulty chain 9 to 12 | | |
| | | 12 to 15 | Faulty chain 12 to 16 | | |
| 40 | 40 | 0 to 7 | Sequence chain no. | | |
| | | 8 to 15 | Identification SB/FB | | |
| 41 to 42 | 41 to 44 | | Unfulfilled continuation conditions | Max. 32 (FB *17x*) or 64 (FB *18x*) conditions | if AKR=1 (FB *175*/ FB *185*) |
| 43 to 74 | 45 to 108 | | MC5 code of the checked continuation conditions | | |
| 75 to 76 | 109 to 110 | | Internally assigned | | |

### 4.3.3 Criteria Analysis and Display

### 4.3.3.1 Function Blocks *ABL: KRAY* and *ABL: KRAN*

### Purpose and Functioning Mode

The FB *ABL:KRY (Criteria Analysis)* checks an SB or a PB for the existing continuation conditions. The parameters NRSB and ANFR of the FB *KANW:WF* determine which block shall be checked.

The following instructions are interpreted as continuation conditions (counted criteria):

| | |
|---|---|
| UE, UA, UM, UT, UZ, U(, O(, ) | 1 bracket level max. |
| UNE, UNA, UNM, UNT, UNZ | 8 brackets max. (in series) |
| OE, OA, OM, OT, OZ, O | |
| ONE, ONA, ONM, ONT, ONZ | |

The continuation conditions found are transferred to the *DB KA (Criteria Analysis)*. An unfulfilled continuation condition is reported by a bit of the output parameters KR1 and KR2 of the FB *ABL:KRAN*. A **maximum of 32 (for FB *17x*) or 64 (for FB *18x*) continuation conditions** (counted criteria) per step can be checked.

Table 4.9        Technical Data FB *ABL: KRAY*

| | **S5-155 U** | **S5-115 U** | **S5-135 U** |
|---|---|---|---|
| Adm. SIMATIC CPU | 946, 947 | 942...944 | 928 |
| Block no. (name) | FB *184* ABL:KRAY | FB *174* ABL:KRAY | FB *184* ABL:KRAY |
| Library no. | E88530 B4136-D | E88530 B4136-A | E88530 B4136-C |
| Processing time (ms) | 1 to 2 | 6 to 15 1 | 2 to 6 |
| Data blocks | DB KA, DW 0 to 106 | DB KA, DW 0 to 72 | DB KA, DW 0 to 106 |
| Call length (words) | 6 | | |
| System data | None | | |
| Nesting depth | 1 | | |
| Assigned flags | FY 238 to 255 | | |
| Called blocks, timers, counters | None | | |

WF 470 (Description)

Table 4.10        Technical  Data of the FB *ABL: KRAN (Criteria Display)*

|  | **S5-155 U** | **S5-115 U** | **S5-135 U** |
|---|---|---|---|
| Adm. SIMATIC-CPU | 946, 947 | 942 to 944 | 928 |
| Block no. (name) | FB *185* ABL:KRAN | FB *175* ABL:KRAN | FB *185* ABL:KRAN |
| Library no. | E88530 B4136-D | E88530 B4136-A | E88530 B4136-C |
| Processing time (ms) | 1 | 3 1.5 | 2.5 |
| Call length (words) | 7 | | |
| Data blocks | DB KA | | |
| System data | None | | |
| Nesting depth | 1 | | |
| Assigned flags | FY 248 to 255 | | |
| Called blocks | None | | |
| Timers | None | | |
| Counters | None | | |

## Parameterization

*FB 174, 184*
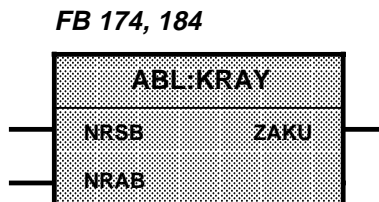


Table 4.11        Parameters of the FB *ABL:KRAY*

| Parameter | Meaning | Remark | Kind | Type | Admiss. Values |
|---|---|---|---|---|---|
| NRSB | No. of FB or PB to be checked | NRSB/Entry from FB *173*/*183* | I | W | FW:  0 to 254 |
| NRAB | No. of FB *ABL:KRAN* | Only one NRAB per DBWF permitted | D | KY | KF+175 or KF+185 |
| ZAKU | Admissible number of criteria exceeded | More than 32 (FB *174*) or 64 (FB *184*) criteria in the step | Q | BI | F:   0.0 to 199.7 Q:   0.0 to 127.7 |

WF 470 (Description)

**FB 175**



**FB 185**
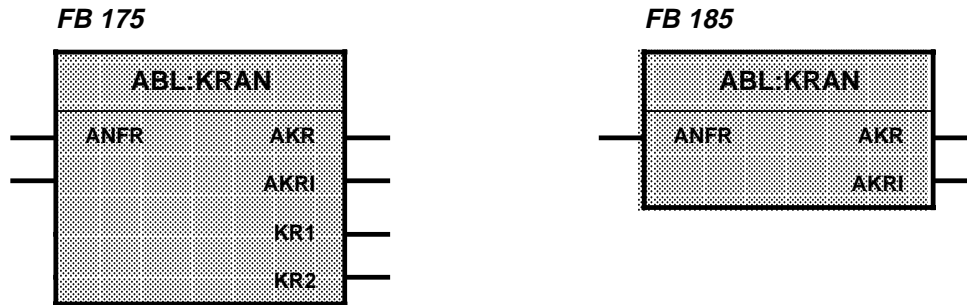


Table 4.12         Parameters of the FB *ABL:KRAN*

| Parameter | Meaning | Remark | Kind | Type | Admiss. values |
|-----------|---------|--------|------|------|----------------|
| ANFR | Enable criteria outputs for display/ evaluation | Signal comes from FB *KANW:WF* (FB *173*/*183*) | E | BI | F: 0.0 to 199.7 Q: 0.0 to 127.7 |
| AKR | Current criteria are entered in the DB and enabled | Continuous signal enable | Q | BI | F: 0.0 to 255.7 Q: 0.0 to 127.7 |
| AKRI ¹⁾ | Like AKR, as pulse | Pulse enable | Q | BI | Same as AKR |
| KR1 ²⁾ | Criteria output 1 | Unfulfilled continuation conditions 1 to 16 | Q | W | DW 8 from DB KA |
| KR2 ²⁾ | Criteria output 2 | Unfulfilled continuation conditions 17 to 32 | Q | W | DW 9 from DB KA |

¹⁾   The parameter AKRI is not used by the WF 470 and can be parameterized freely (e.g. with flag 255.7)

²⁾   This parameter exists only in FB *175.*

The continuation conditions found are directly entered into the FB *ABL:KRAN*. Therefore, the function block must be in the RAM.

6ZB5 440-0QS02
WF 470 (Description)

## 4.3.3.2 Data Block *Criteria Analysis (KA)*

The function blocks
- Criteria Analysis (FB *174* or FB *184*) and
- Criteria Display (FB *175* or FB *185*) store in the data block KA the MC 5 code
  of the checked continuation conditions and the identifications of the unfulfilled
  continuation conditions.

This information is transferred by the FB *KANW:WF* to the data block *DBWF*.

Table 4.13    Structure of *DB Criteria Analysis (KA)*

| DW-No. FB *175* | DW-No. FB *185* | Bit-No. | Meaning | Remark |
|---|---|---|---|---|
| 0 | 0 | 0 to 15 | For        Register for<br>FB *175*   FB *174*/*175*<br>FB *185*   FB *184*/*185* | |
| 1 to 7 | 1 to 7 | 0 to 15 | Reserved for internal data from FB *174*/*175* or *184*/*185* | |
| 8 to 9 | 8 to 11 | 0 to 15 | Unfulfilled criteria | A total of 32 (FB *175*) or 64 (FB *185*) |
| 10 to 41 | 12 to 65 | 0 to 15 | MC5 code of the checked continuation conditions | |
| 42 to 72 | 66 to 115 | 0 to 15 | Reserved for internal data from FB *Criteria analysis/ Criteria display* | |

### 4.3.4　　Function Block TAKT:BTQ

**Purpose and Functioning Mode**

FB *TAKT:BTQ (*FB *170)* is only used by DIMOS. It clocks the SBs until all fault messages are stored on the module. As the overview picture (#05) is also clocked, it cannot be operated during this time. The parameter BTQ1 (progressing to the next released sequence chain) is only effective after all faulty sequence chains have been clocked.

Via the parameter "Stop" the sequence chain protocol is disabled. In the "Manual" operating mode the disabling is necessary (diagnostics picture), as otherwise the displayed criteria are printed (no fault message).

As long as fault messages are pending, the protocol sets bit 0 in *DBWF* to "1". Condition: In the system data list and in the parameters of FB *KANW:WF* the first data word to be parameterized in the *DBWF* has to be DW20.

FB *170* **must** be called after the FB *KANW:WF*.

**Parameterization**　　　*FB 170*
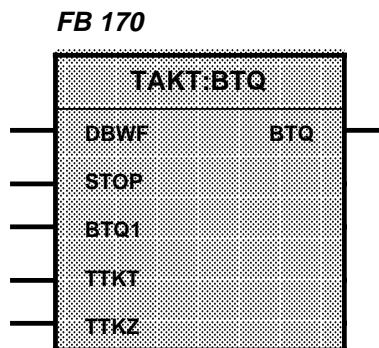


Table 4.14　　　Parameters of *FB TAKT:BTQ*

| Parameter | Meaning | Remark | Kind | Type | Admiss. values |
|---|---|---|---|---|---|
| DBWF | Transfer DB | DB No. from system data list of WF 470 | B | | DB No.: 2 to 255 |
| STOP | Stop protocol | Stop if signal=1 | I | BI | I:  0.0 to 127.7<br>F: 0.0 to 199.7 |
| BTQ1 | Next faulty chain | Selection if edge is positive | I | BI | I:  0.0 to 127.7<br>F: 0.0 to 199.7 |
| TTKT | Time step for clocking | FB *170* controls timer | T | | T 1 to 127<br>(255) |
| TTKZ | Time value | | D | KT | KT 15.1 |
| BTQ | Next faulty chain | As for FB KANW:WF | Q | BI | F: 0.0 to 199.7 |

WF 470 (Description)

## 4.3.5 Program Example

The program example on the enclosed diskette shall demonstrate how the FBs can be parameterized and where the DBs have to be called. The SBs are not programmed.

Preliminary remarks concerning:

FB *172:*
1. The calls of the FB *172* in the example apply to the fourth and the seventh sequence chains.

2. Flags 110.3 and 110.6 are given for STO, (fourth and seventh bit of FW 110).

3. With DL/DR 13 or DL/DR 16 in NRSB/SCHR the fourth and the seventh DWs of this block are addressed.

FB *172, 173:*
There is a connection between

FB *172*: Parameter SCHR, NRSB, STO, KDAT and
FB *173*: Parameter STO1, QKB1.

FB *173:*
1. FW 110 is programmed for STO1.

2. In QKB1 the beginning of the data block is fixed for NRSB, SCHR and KDAT with 101, 10 (DB101, DW 10).

WF 470 (Description)
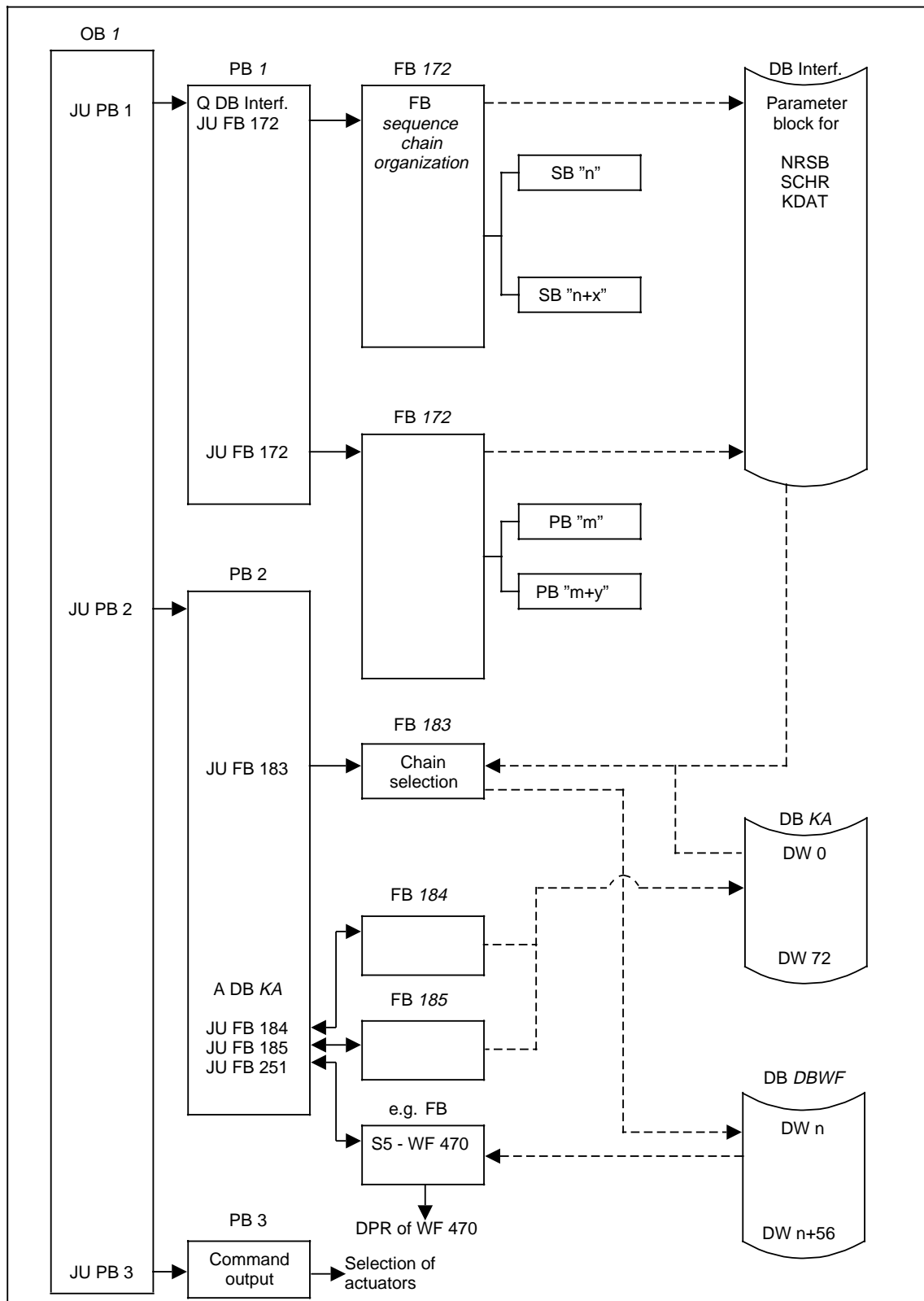
*Fig. 4.5    Structure of the program example*

Further information and a program example of the above blocks can be found on the supplied diskette.

WF 470 (Description)

## 4.3.6 Programming of the Sequence Blocks

In sequence blocks you can program both the automatic/jog mode and the subordinate manual mode. In both cases, faults are displayed on the screen.

Depending on the operating mode flags are used as shown in the table on the right. The function of these flags is always the same.

| Operat. mode | Flag |
|---|---|
| Automatic mode<br>Jog mode | F 240.6<br>F 240.7 |
| Manual mode | F 240.4<br>F 240.5 |

The flags are internally evaluated in the FB *Sequence Chain Organization (FB 172)*. This FB checks, dependent of the operating mode set, the corresponding conditions. It provides the progressing of the chain to the next step, the selection of command output and the correct diagnostics in case of a fault.

---

**Example: sequence block**

S A2.1 (Spindle on)

    E 2.1
    E 2.2
    E 2.3

**Sequence block**

F 10.0                                    F 240.6

  ──┤ ├┤ ├──────────────────────────( )──      Command output

  I 2.1        I 2.2        I 2.3        F 240.7

  ──┤ ├┤ ├──────┤ ├──────┤ ├────────( )──      Continuation
                                              conditions

**Notes**

1. Flag 240.6 must **always** be programmed as a command output flag.

2. Flag 240.7 is used in every SB and has the signal state "1" at the beginning. The result of the logic operation at the end of the SB is further evaluated in the *FB Sequence Chain Organization (FB 172)*.

3. The command output **must** be programmed in a separate program block.

---

*Fig. 4.6      Example 1 : Sequence chain for **automatic mode** only*

## Applications Rules

1.  Per branch, max. 32 or 64 conditions can be programmed. As in the display of the contact diagram only 7 contacts in a row can be displayed, the branch flag must be programmed, in case of further conditions, as the first inquiry in the supplementary branch (see example, branch 4). Brackets in OR operations are treated like conditions. Diagnostic blocks can process up to 8 expressions in brackets in one bracket level only.

2.  If a command output branch (e.g. F 240.6) has no conditions, F 240.7 will be inquired. This flag always has signal state "1" at the beginning of the sequence block. Exception: first run of SB.

3.  Waiting times will be started with F 240.7 at the beginning of the SB (start-up delay). The time inquiry is effected in the corresponding branch (e.g. branch F 240.7) and represents a continuation condition.

4.  Each step is monitored as to time (monitoring time). The time step and the time value are indicated once for a sequence chain as parameters of the FB. Upon a step change, this time automatically begins to run anew. The transfer time is fixed in the FB 172 by the parameter KUE and is valid for all steps.

    It is, however, also possible to influence the monitoring time in the SB itself. If the time step (parameter TUE=start-up delay) is loaded with another time value at the beginning of the SB, this new monitoring time is valid for this specific step. If the time step in the SB is reset with RLO = 0, the monitoring time will be invalid in this step.

5.  The branches (F 240.6, F 240.7) must be programmed, branches 1 and 2 only in manual mode.

6.  The command output must be programmed in a separate PB. The current step number is compared with constants and, in case of identity, the output allocated to the step is set (cf. example on diskette enclosed).

7.  The branches for F 204.4 and F204.5 can be omitted if the conditions for MANUAL are to be identical to those for AUTOMATIC; F 240.3, however, must be programmed with a logical "1".
    The display will be as follows:
    -  F 240.3=0   Conditions for MANUAL displayed (F 240.4, F 240.5)
    -  F 240.3=1   Conditions for AUTOMATIC displayed (F 240.6, F 240.7)

WF 470 (Description)

**Sequence block**

| Branch 1 | I 3.0 ─┤├─ I 3.1 ─┤├─ I 3.2 ─┤├──────────────────── F 240.4 ─( )─ |
| --- | --- |
| | Command output with manual conditions |

| Branch 2 | I 4.0 ─┤├──────────────────── F 240.5 ─( )─ |
| --- | --- |
| | Acknowledgement manual |

*(Manual)*

| Branch 3 | I 5.0 ─┤├──────────────────── F 240.6 ─( )─ |
| --- | --- |
| | Command output with additional execution conditions |

| Branch 4 | I 2.0 ─┤├─ I 2.1 ─┤├─ I 2.2 ─┤├─ I 2.3 ─┤├─ I 2.4 ─┤├─ I 2.5 ─┤├─ I 2.6 ─┤├─ F 240.7 ─( )─ |
| --- | --- |
| | Acknowledgement manual |
| | F 240.7 ─┤├─ I 2.7 ─┤├──────────────────── F 240.7 ─( )─ |
| | Continuation conditions automatic/jog |
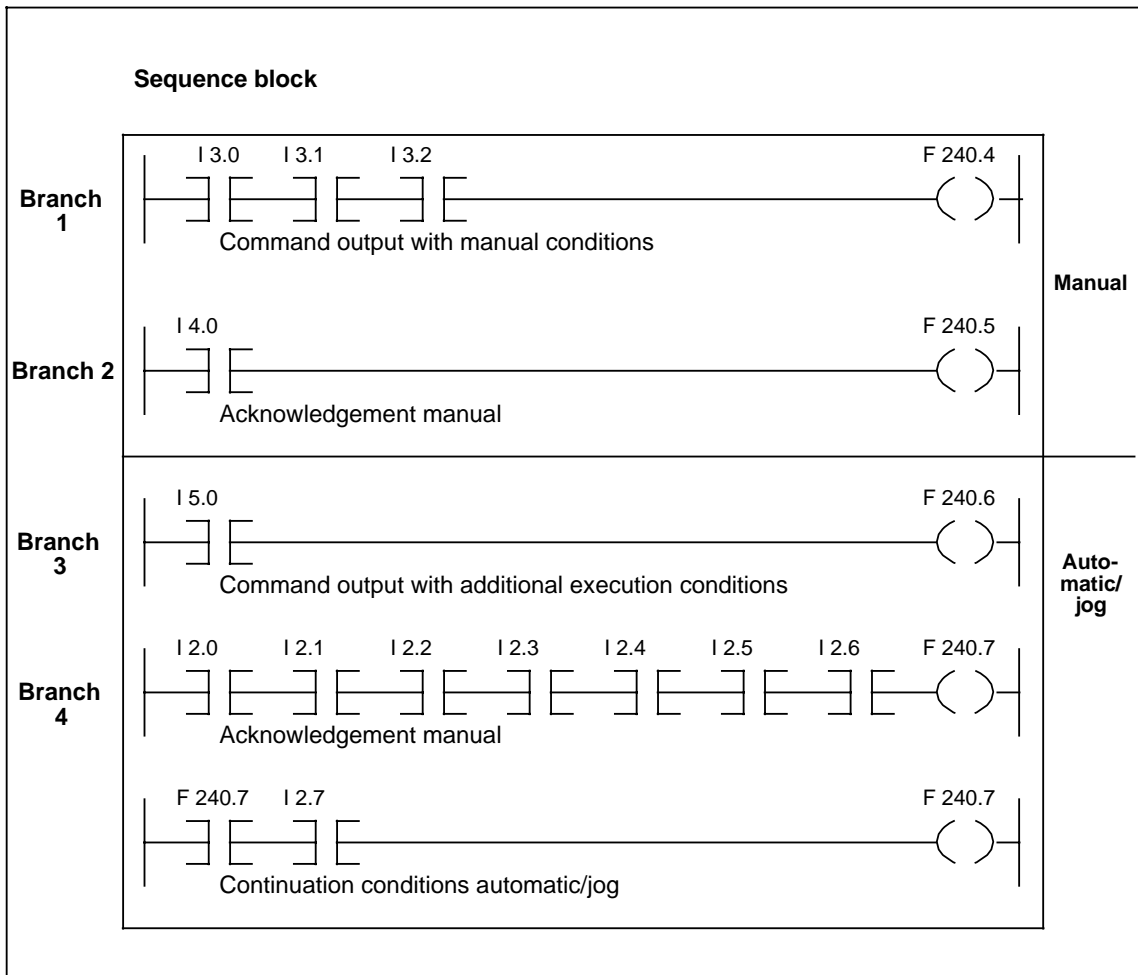
*(Automatic/jog)*

*Fig. 4.7    Example 2: Sequence chain for automatic/jog and subordinate manual mode*

**Sequence block**

| Branch 1 | RLO1 ─┤├──────────────────── F 240.3 ─( )─ |
| --- | --- |
| | Manual conditions omitted |

| Branch 2 | I 5.0 ─┤├──────────────────── F 240.6 ─( )─ |
| --- | --- |

**Branch 3+4** as in Fig. 4.7
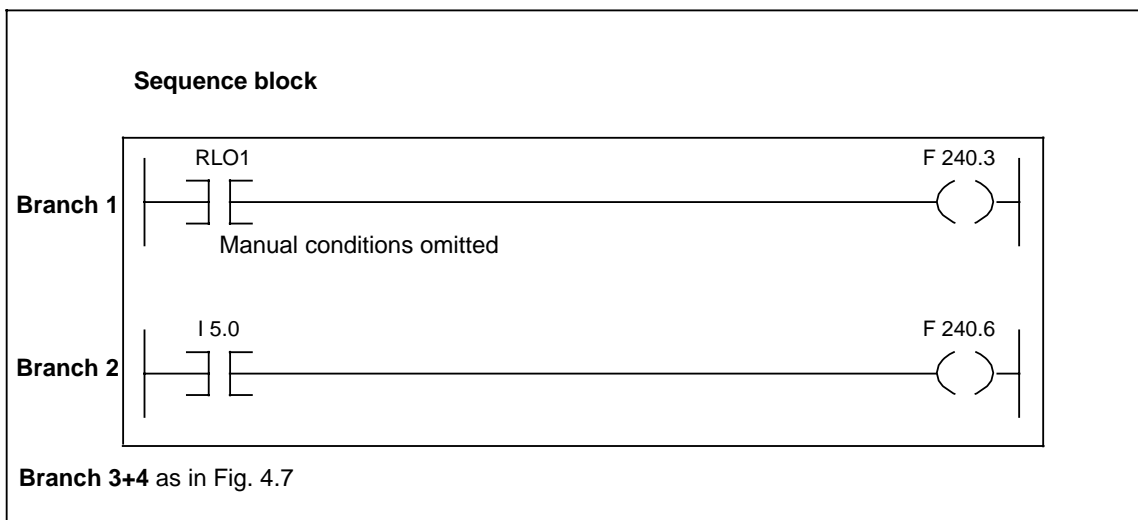
*Fig. 4.7.1    Example 2.1; MANUAL conditions identical to AUTOMATIC conditions*

WF 470 (Description)

**Sequence block**

**Branch 1**

**Branch 2**

**Branch 3**

**Branch 4**

```
              F 240.7              T 10
         ┤ ├                    T!    !Q        Start of waiting time
                           KT   TW    DU
                           010.2      DE
                                R     Q
```

```
         I 3.0     I 3.1    I 3.2                                    F 240.4
         ┤ ├      ┤ ├      ┤ ├                                        ( )
              Command output with manual conditions
```

```
         I 4.0                                                       F 240.5
         ┤ ├                                                          ( )
              Acknowledgement manual
```

```
         I 5.0                                                       F 240.6
         ┤ ├                                                          ( )
              Command output with additional execution conditions
```

```
         T 10    I 2.1    I 2.2    I 2.3    I 2.4    I 2.5    I 2.6   F 240.7
         ┤ ├    ┤ ├      ┤ ├      ┤ ├      ┤ ├      ┤ ├      ┤ ├       ( )
              Continuation conditions automatic/jog
```

**Manual**

**Automatic/jog**

*Fig. 4.8      Example 3: Sequence block with waiting time*

**Program block**

```
         DR13
         (SCHR.NR)     Z1    F
                       !=              F 5.1                    Q 2.1
         KB 3          Z2    Q        ┤ ├                        ( )
                             (BEFA=Command output)
                                                               Q 2.2
                                                                ( )
```
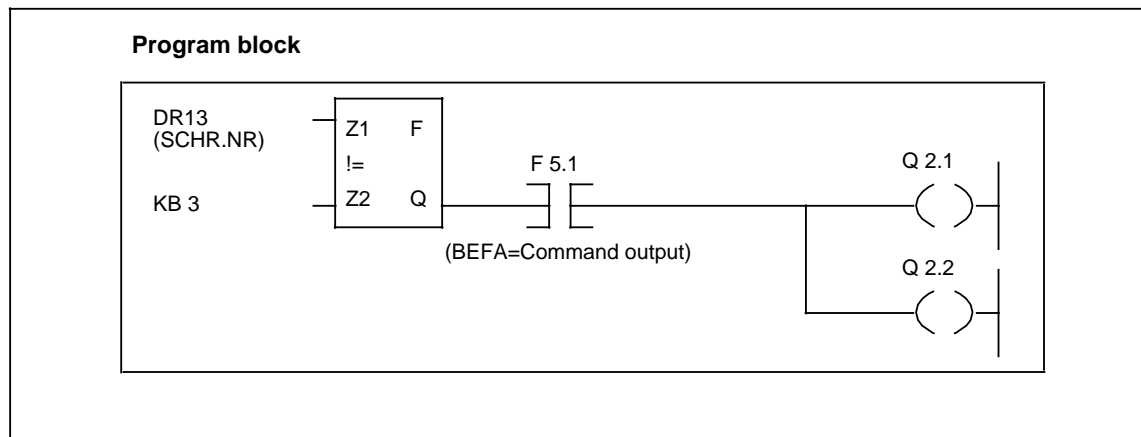
*Fig. 4.9      Example 4: Command output*

WF 470 (Description)

## 4.4 **Sequence Chain Diagnostics GRAPH5** (Option)

The diagnostics package contains the systems DIMOS (see section 4.3),
GRAPH5 and GRAPH5/II (see section 4.5). Only one of these systems may be
installed at a time. For scope of delivery and names of the files on the MS-DOS
diskette, see section 4.5

## 4.4.1 **Software for Programmers**

This module is stored in the CGR5.SYS file on the options diskette.

The software contains two pictures:

The **overview picture** shows an overview of the sequence chains and the
states of the chain:

| State | Representation |
| --- | --- |
| Chain in AUTO: chain ON | Green characters, no attribute |
| Chain not in AUTO:<br>chain OFF | Yellow characters, attribute: * |
| Mode: MAN/AUTO:<br>chain faulty | White characters, attribute:<br>* * * |
| Chain selected for diagnosis | Line on blue background |

**Diagnostics picture** with the criteria display of a chain and the following
information:

– Unfulfilled continuation conditions,
– No. of the sequence step checked and
– Branch in case of parallel branching.

Sequence Chain Diagnostics GRAPH5

```
WF 470 Graph5        Sequencer Overview     02.11.87 12:45:46

No. SB-No. State      Function

17   017    ***  POWER-ON CONDITION FOR TRANSFER LINE
18   018      *  LOADER WITH HANDLING DEVICE                    ST 1
19   019         ROUGHING FOR LEFT-HAND GEAR FLANGE             ST 2A
20   020    ***  ROUGHING FOR RIGHT-HAND GEAR FLANGE            ST 2B
21   021         DRILLING UNIT FOR HOLES IN FLANGE LEFT         ST 3A
22   022      *  DRILLING UNIT FOR HOLES IN FLANGE RIGHT        ST 3A
23   023    ***  FLANGE FINISHING LEFT-HAND SIDE                ST 4A
24   024         FLANGE FINISHING RIGHT-HAND SIDE               ST 4B
25   030         TEST STATION FOR GEAR
26   000
27   000
28   000
29   000
30   000
31   000
32   000
```

COMMENT:
no   *   Chain started and running
     *   Chain not started
   ***   Chain faulty

Softkey assignments by

| F1 Single diagnos. | F2 Chain+1 | F3 Chain -1 | F4 Scroll UP | F5 Scroll DOWN | F6 Page +1 | F7 Page-1 | F8 Basic pict. |
|---|---|---|---|---|---|---|---|

text group #SK and text list 002

```
WF 470 Graph5        Diagnostic unit        02.11.87 12:45:46

Faulted sequences: 17 20 23

Automatic:          POWER-ON CONDITIONS FOR TRANSFER LINE
Sequencer    17     U E021 7 OIL PRESSURE LUBRICATION TOO LOW OR MISSING!
SB-No.      017     U(
OR-Branch     2     UN E021 3 WORKPIECE FOR LOADER MISSING
Max. step   067     UN E021 4 BLANK CLOCKING NOT SET
                    UN E000 3 ACTIVE COOLANT
                    U E000 6 STATION NOT EMPTY
Br   Step  State    U E000 5 IDLE COUNTING
                    )
1    007            U E021 6 EMERGENCY-OFF PRESSED IN CENTRAL OPERATOR CONSOLE
2    011       *    U(
3    017    * **    ON E021 4 IDLE COUNTING NOT SELECTED
4    031            O E021 3 WORKPIECE FOR LOADER MISSING
5    034            )
6    045
7    000
8    000
```

Softkey assignments by

| F1 Graph5 Overview | F2 Chain+1 | F3 Scroll+1 | F4 Scroll -1 | F5 Change op. mode | F6 Transit.+1 | F7 Branch+1 | F8 Basic pict. |
|---|---|---|---|---|---|---|---|

text group #SK and text list 002

Fig. 4.10   Example of screen form of GRAPH5
The assignments of the function keys are suggestions, not standard.

4 – 34                     © Siemens AG 1992 All Rights Reserved    6ZB5 440-0QS02
                                                              WF 470 (Description)

## Application Rules

1. The message texts are input as in the DIMOS Sequence-Chain Diagnostics, and in the sequence-chain lists type "F" the number of the FB used has to be entered.

   The pictures can be selected under the names #03 to #04. The picture index only displays #03.

2. You can switch between the pictures #03 to #04 with the letters "A" and "B". From version V 3.4 onwards, you can switch inside the diagnostics picture (#04) between the display in AWL and KOP by inputting "C".

3. Admissible amount of the sequence chains for the diagnostics: 64.

4. Admissible amount of expressions in brackets in one bracket level only per action/transition: 8.

5. Per action/transition one logic operation with 64 criteria (for action: interlocking criteria, for transition: continuation citeria) can be diagnosed.

   The logic operation must be continuous. That means that in the command code no operation may be inserted between the first operation command and the last assignment. For the transfer of the result of the logic operation between two pseudo segments in the contact or function diagram, any auxiliary flags are admissible.

6. In the action and transition magnifier, the set of basic operations for SB's is admissible with certain restrictions:

   For S5-115U are illegal:    STS, TAK, SPR, STP


The exceeding of some of the limit values mentioned is displayed in the diagnostics picture by the following flags:

F 246.1 $\hat{=}$ Number of continuation conditions > 64
F 246.2 $\hat{=}$ Number of bracket levels > 1
F 246.3 $\hat{=}$ Number of brackets in one branch (in series) > 8

## 4.4.2 Software for SIMATIC-S5

The SIMATIC S5 software contains functions blocks for the diagnostics:

SB *0,* SB *2,* SB *3,* FB *75,* FB *76,* FB *77,* FB *79,* FB *80.*

For the programming of the SBs, please order the operating software necessary for the programmer and the function blocks for GRAPH5 separately.

The blocks SB 0, SB 2, SB 3 of the GRAPH 5 software have to be exchanged against the blocks contained on the WF 470 options diskette, as they contain additional functions for the diagnostics.

The user must additionally set up the two following data blocks DBKA and DBWF. The DB numbers are freely selectable.

### 4.4.2.1 Data Block *DBKA*

This data block must be set up, up to DW 130 inclusively (minimum length: 130+header) and must be called prior to the FB *76* and FB *77.*

### 4.4.2.2 Data Block *DBWF*

The FB *79* enters in this DB all data which the WF 470 requires for the display. The DB No. is fixed in the system data list of the WF 470. The data block has to be set up, up to DW 146 inclusively (minimum length 146+header). The DW 20 has to be parameterized as the first data word for the GRAPH5.

Table 4.15          Structure of the data block *DBWF*

| DW | Contents | | | Remark |
|---|---|---|---|---|
| 1 to 19 | Reserved for internal use | | | |
| 20 | No. 16 | Chains, started | No.  1 | Each bit corresponds to one chain. |
| 21 | No. 32 | ” ” | No.  17 | Bit=0:    Chain started |
| 22 | No. 48 | ” ” | No.  33 | Bit=1:    Chain stands still |
| 23 | No. 64 | ” ” | No.  49 | |
| 24 | No. 16 | Chains, faulty | No.  1 | Each bit corresponds to one chain. |
| 25 | No. 32 | ” ” | No.  17 | Bit=0:    Chain faulty |
| 26 | No. 48 | ” ” | No.  33 | Bit=1:    Chain not faulty |
| 27 | No. 64 | ” ” | No.  49 | |

*Continued on next page*

             6ZB5 440-0QS02
WF 470 (Description)

Table 4.15        Structure of the data block DBWF                (Cont.)

| DW | Contents | | Remark |
|---|---|---|---|
| | 15 14 13 12 11 10 9 8 | 7 6 5 4 3 2 1 0 | |
| 28 | SB No. | No./Current chain | |
| 29 | internally assigned in FB | FF =Autom. 00 =Manual | |
| 30 | Branch No. | Step No. | Displayed branch |
| 31 | No. of the faulty step | AKT/TRA | DR:00h≙ Error in one action "1"≙ Error in Transition (Bit 0 to 7=branch 1 to 8) |
| 32 | Branch No. 1 | Branch No. 2 | Current step number to branches 1 to 8 of the checked chain in case of simultaneous branching |
| 33 | Branch No. 3 | Branch No. 4 | |
| 34 | Branch No. 5 | Branch No. 6 | |
| 35 | Branch No. 7 | Branch No. 8 | |
| 36 | Branch No. 1 | Branch No. 2 | Number of the faulty steps to branches 1 to 8 of the checked chain |
| 37 | Branch No. 3 | Branch No. 4 | |
| 38 | Branch No. 5 | Branch No. 6 | |
| 39 | Branch No. 7 | Branch No. 8 | |
| 40 | 16 15 14 13 12 11 10 9 | 8 7 6 5 4 3 2 1 | Continuation conditions |
| 41 | 32 31 30 29 28 27 26 25 | 24 23 22 21 20 19 18 17 | Each bit corresponds to one continuation condition. |
| 42 | 48 47 46 45 44 43 42 41 | 40 39 38 37 36 35 34 33 | Bit=1:    condition missing |
| 43 | 64 63 62 61 60 59 58 57 | 56 55 54 53 52 51 50 49 | |
| 44 to 107 | MC5 code | | |
| 108 | Auxiliary DW for SK protocol | | FB 75 |
| 109 | Int. assigned in FB | Int. assigned in FB | |
| 110 | Sequ. block No. 1 | Sequ. block No. 33 | |
| 111 | Sequ. block No. 2 | Sequ. block No. 34 | |
| 112 etc. | Sequ. block No. 3 etc. | Sequ. block No. 35 etc. | |
| 141 | Sequ. block No. 32 | Sequ. block No. 64 | |
| 142 | Reserve | | |
| 143 | Pointer on SB list | | |
| 144 | DW n+0 | DW n+4 | Internally used area |
| 145 | | Bit pointer | |
| 146 | | Page flag | |

WF 470 (Description)

## Application Rules

1. DWs 20 to 27, 30 to 107, DL 29 and DW 109 are written by FB *79*.

2. DW 28 and DW 110 to 141 are written by the WF 470.
   DL 28:  WF 470  Picture #04        or PLC (FBx)
   DR 28:  WF 470  Picture #03, #04    or PLC (FBx)

3. Via DW 28, the WF 470 indicates which SB has to be checked. In the automatic mode, only faulty SBs can be selected for check.

4. A chain is faulty when the monitoring time has expired. If no monitoring time has been programmed, no diagnostics for the step will be effected. The transition T 1 cannot be displayed in the automatic mode because no monitoring time can be programmed in step 0.

5. The automatic mode is preset by KH=FF in DR 29. The DR 29 has to be written by the user. If KH=0 is entered in DR 29, any chain can be released for diagnostics.

   The missing continuation conditions or conditions in the action part are continuously displayed. In this operating mode you can observe the sequence.

6. In DWs 110 to 141, the WF 470 enters the first 32 SB left justified, the remaining SBs right justified. DWs 142 to 146 are used by the FB *79* for intermediate data storing.

      6ZB5 440-0QS02
WF 470 (Description)

### 4.4.3 Function Block TAKTPROT

#### Purpose and Functioning Mode

The FB *TAKTPROT* is needed for the sequence chain protocol. The FB clocks all transitions and actions until all faults for the protocol have been transferred. During this time the GRAPH5 picture cannot be operated.

The GRAPH5-block FB *75* (*GPH:REAK*) has to be the same number as the GRAPH5 diagnostics block and must therefore be loaded into the PLC under a different FB number.

#### Parameterization

**FB 75**

```
              TAKTPROT
    ──── DBWF          TIPP ────
    ──── STOP          NEXT ────
    ──── TIP
    ──── NXT
    ──── TTKT
    ──── TKTZ
```
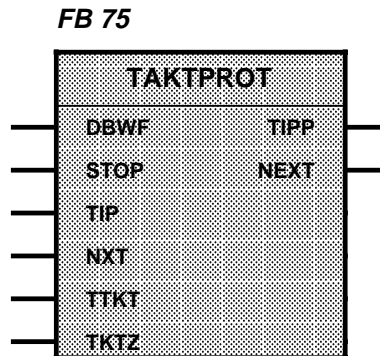
Table 4.16          Parameters of the FB *TAKTPROT*

| Parameter | Meaning | Remark | Kind | Type | Admiss.values |
|-----------|---------|--------|------|------|---------------|
| DBWF | Transfer DB | DB No. from system data list of the WF 470 | B | | DB No. 2 to 255 |
| STOP | Stop GRAPH5 protocol | Stop with signal=1 | I | BI | F: 0.0 to 199.7<br>I: 0.0 to 127.7<br>Q: 0.0 to 127.7 |
| TIP | Next alternative branch | Selection with positive edge | I | BI | F: 0.0 to 199.7<br>I: 0.0 to 127.7<br>Q: 0.0 to 127.7 |
| NXT | Next parallel branch | Selection with positive edge | I | BI | F: 0.0 to 255.7<br>I: 0.0 to 127.7<br>Q: 0.0 to 127.7 |
| TTKT | Time step for clocking | Timer is started by *FB TAKTPROT* | T | | T 1 to 127 |
| TKTZ | Time value for TTKT | Determine TKTZ empirically, starting with 1.5 sec.; observe application rules overleaf! | D | KT | KT 15.1 |
| TIPP | Next alternative branch | Same as for FB *UEBER* | Q | BI | F: 0.0 to 199.7<br>Q: 0.0 to 127.7 |
| NEXT | Next parallel branch | Same as for FB *UEBER* | Q | BI | F: 0.0 to 199.7<br>Q: 0.0 to 127.7 |

## **Application Rules**

1. The parameters TIP, NXT are ineffective as long as the protocol requires data. Afterwards, TIP is transferred to TIPP, and NXT to NEXT and the operation of the diagnostics picture activated.

2. If the fault criterion is pending for a shorter period than its transfer to the protocol buffer would have taken, only the branch and the chain in which the fault occurred will be printed out.

3. The protocol sets in DB 18 in the *DBWF bit 0 to 1*, as long as further messages are pending. FB *TAKTPROT* will set

   – DW 108 to 1, if the WF 470 shall take over data;
   – DW 108 to 2, if the next faulty chain shall be selected;
   – DW 108 to 3 (with STOP), if the GRAPH5 protocol shall be stopped.

4. Determine TKTZ empirically, starting with 1.5 sec.
   The time for TKTZ depends on:
   – type of CPU
   – sequence chain (instructions)
   – user program

Condition: In the system data list and in the FB *UEBER*, the first data word to be parameterized in the DBWF has to be DW 20.

## 4.4.4    Criteria Analysis and Display

## 4.4.4.1    Function Block *ABL:KRAY*

### Purpose and Functioning Mode

Table 4.17        Technical Data

|  | **S5-155 U** | **S5-115 U** | **S5-135 U** |
|---|---|---|---|
| Admiss. SIMATIC CPU | 946, 947 | 943, 944 | 928 |
| Block No.<br>Name | FB 76<br>ABL:KRAY | FB 76<br>ABL:KRAY | FB 76<br>ABL:KRAY |
| Library number | E88530-B4136-D | E88530-B4136-A | E88530-B4136-C |
| Processing time (ms) | 1-2 | 1-3 | 1-4 |
| Call length (words) | 5 | | |
| Data blocks | DB DBKA must be called prior to FB *ABL:KRAY* | | |
| Assigned flags | FY 200 to 254 | | |
| Called blocks | No. of the FB *ABL:KRAN* | | |
| Timers | none | | |
| Counters | none | | |

### Parameterization

**FB 76**

```
        ┌──────────────────────┐
        │      ABL:KRAY        │
   ─────┤                      ├─────
        │  NRAB        ZAKU    │
        └──────────────────────┘
```
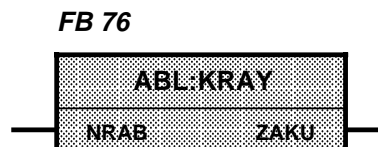
Table 4.18        Parameters of *FB ABL:KRAY*

| Parameter | Meaning | Remark | Kind | Type | Admiss.values |
|---|---|---|---|---|---|
| NRAB | No. of the<br>*FB ABL:KRAN* | | I | D | KF+77 |
| ZAKU | Signal for: Admissible amount of criteria exceeded | Signal=1 if more than 64 criteria | Q | BI | F: 0.0 to 199.7<br>Q: 0.0 to 127.7 |

## 4.4.4.2    Function Block *ABL:KRAN*

### Purpose and Functioning Mode

The block must always be in the RAM.

Table 4.19        Technical Data

|  | **S5-155 U** | **S5-115 U** | **S5-135 U** |
|---|---|---|---|
| Admiss. SIMATIC CPU | 946, 947 | 943, 944 | 928 |
| Block No.<br>Name | FB 77<br>ABL:KRAN | FB 77<br>ABL:KRAN | FB 77<br>ABL:KRAN |
| Library number | E88530-B4136-D | E88530-B4136-A | E88530-B4136-C |
| Processing time (ms) | approx. 1 | approx. 1 | approx. 3 |
| Call length (words) | 3 | | |
| Data blocks | none | | |
| Assigned flags | FY 200 to 254 | | |
| Called blocks | none | | |
| Timers | none | | |
| Counters | none | | |

### Parameterization

*FB 77*

ABL:KRAN

## 4.4.5 Function Block *UEBER*

Table 4.20 Technical Data

|  | **S5-155 U** | **S5-115 U** | **S5-135 U** |
|---|---|---|---|
| Admiss. SIMATIC CPU | 946, 947 | 943, 944 | 928 |
| Block No.<br>Name | FB 79<br>UEBER | FB 79<br>UEBER | FB 79<br>UEBER |
| Library number | E88530-B4136-D | E88530-B4136-A | E88530-B4136-C |
| Processing time (ms) | 1-4 | 1-6 | 1-10 |
| Call length (words) | 8 | | |
| Data blocks,<br>Called blocks<br>Timers, Counters | none | | |
| Assigned flags | FY 200 to 254 | | |

## Parameterization

*FB 79*
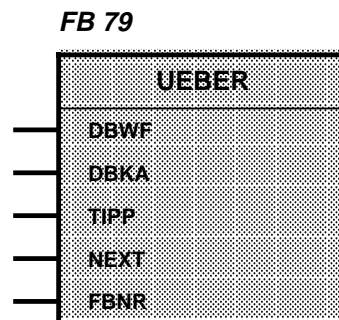


Table 4.21 Parameters of FB *UEBER*

| Parameter | Meaning | Remark | Kind | Type | Admiss. values |
|---|---|---|---|---|---|
| DBWF | DB No., DW-No. for *DBWF* | Interface WF 470 | D | KY | KY=DB/DW No.<br>DB No:1 to 255<br>DW No.:    20 |
| DBKA | DB No. for criteria analysis |  | B |  | DB 1 to DB 255 |
| TIPP | Next alternative branch step transition | Next branch for diagnostics with positive edge, switching between step and transition | I | BI | F: 0.0 to 199.7<br>Q: 0.0 to 127.7<br>I   0.0 to 127.7 |
| NEXT | Next parallel branch | Next branch for diagnostics with positive edge |  |  |  |
| FBNR |  | A1  for  FB *70* to FB *71*<br>A2  for FB *72* to FB *73*<br>NE[1] selected via DW 32 | D | KC | A1, A2, NE[1] |

[1]  NE is a new identifier which is entered for FB *70* to FB *73* independently into working DBn DW 32 of the SBn. The working DBn is given in DBGEN of GRAPH5 package.

WF 470 (Description)

## 4.4.6 Function Block MEMO

### Purpose and Functioning Mode

In case of fault(s) in sequence chains, the FB *MEMO* (FB *80)* automatically selects the automatic mode of the diagnostics and the diagnostics picture #04, diagnosing the first faulty sequence chain.

With the entry in the Interface DB *DBWF*, the criteria found are intermediately stored once in an auxiliary DB *DBHP*. The user can at any time call this stored image of the DBWF by setting the parameter CHAN.

During the display of the stored diagnostics, the current diagnostics (FB *76 to 79)* remains switched off. Only after acknowledgement of the faults (parameter QUIT) will the *DBHP* be enabled for a new entry.

During the display of intermediately stored diagnostics messages, the manual/automatic switchover must be switched off.

The way the blocks have to be called:

– FB *80* has to be called absolutely after FB 7*9,*
– FB *76,* FB *77,* FB *79* with the output of parameter SPER have to be called conditionally.

An example of the calling of the blocks can be found on the enclosed diskette.

With the FB *80* you can create your own statistics functions by repeated storing in several DBHP and evaluation of the latter.

       6ZB5 440-0QS02
WF 470 (Description)

## 4.4.7 What must be programmed?

| Step | Operation |
|---|---|
| 1 | Program GRAPH 5 sequence blocks, as usual |
| 2 | a) Call and parameterize FB *76,* FB *77,* FB *79*<br><br>b) Set up data blocks *DBKA* und *DBWF*<br><br>c) Exchange SB *0,* SB *2,* SB *3* against standard SB (with library number E88530 ...)<br><br>d) If needed, call FB *80* |
| 3 | According to operated mode:<br>Write DW 29 with KH=0000 or KH=00FF. |
| 4 | WF 470: Install the option CGR5 |
| 5 | System data list, part 1: enter DB No. and DW No. for *DBWF* |
| 6 | a) Enter the SB No. and the name of the sequence chains under sequence chain (type F).<br><br>b) Enter message texts for inputs, flags, etc. |
| 7 | Program the picture call, e.g. via FB *220* and function keys.<br>The pictures have the identifications #03 and #04.<br>Call up and parameterize the program for communicating with the WF 470 |
| 8 | The picture can be operated via the normal keyboard. |

Key Code

| Operation | Key Code |
|---|---|
| Page turning upwards | $8F_{Hex}$ |
| Page turning downwards | $90_{Hex}$ |
| Scrolling upwards | $8D_{Hex}$ |
| Scrolling downwards | $8C_{Hex}$ |
| Following chain | $91_{Hex}$ |
| Previous chain | $92_{Hex}$ |

The supplied diskette contains a programming example of this including block calls of the GRAPH5 diagnosis function block.

## 4.5 **Sequence chain diagnostics GRAPH5/II** (Option)

From November 1993 diagnostics package GRAPH5/II for ST (MS DOS) and MT (Flexos) as well as standard function blocks GRAPH5/II are available. WF 470 option "Diagnostics package DIMOS / GRAPH5" has been adapted accordingly.

In addition to the expansion to GRAPH5/II, new functions have been added to give the user improved diagnostics facilities with GRAPH5/II.

The MS DOS diskette contains the "Diagnostics package DIMOS / GRAPH5 for WF 470 / GRACIS" with:

| | |
|---|---|
| S5 files | for S5 115U (CPU 941-944 and CPU 945), S5 135U and S5 155U. |
| CGRS.SYS | Loadable option for WF 470 GRAPH5 diagnostics. |
| CGR5II.SYS | Option for WF 470 GRAPH5/II diagnostics. Can be loaded as CGR5.SYS |
| CSKA.SYS | Loadable option for WF 470 DIMOS diagnostics. |
| LIESMICH.TXT | (Information text file) |

Only one of the systems, WF 470 DIMOS diagnostics (see Section 4.3), WF 470 GRAPH5 diagnostics (see Section 4.4) or WF 470 GRAPH5/II diagnostics, can be installed.
It is not possible to run sequence chain listing with GRAPH5/II diagnostics.

### 4.5.1 **Installing GRAPH5/II diagnostics**

### 4.5.1.1 **Software**

in the programming unit:

1. Display generation software (see Catalog AR 10 and Planning Guide)
2. Option *CGR5/II.SYS* renamed to *CGR5-SYS*

in the PLC:

1. WF 470 SIMATIC standard software (see Catalog AR 10)
2. WF 470 diagnostics function blocks (FB *81* and FB *82* from the above diagnostics package)
3. Data block *DBWF* (possibly *DBHP*, see Section 4.5.3.2)
4. GRAPH5/II standard function blocks (e.g. FB *72*, SB *2* etc., see SIMATIC S5 Catalog ST 57)
5. GRAPH5/II sequence blocks (SB) and user DBs created by the user
6. Blocks for programs (e.g. OB *1*, PB *1* etc.)

in the WF 470 module:

1. Option "WF 470-GRAPH5/II diagnostics" **(file CGR5II.SYS, can only be loaded as CGR5.SYS)**
2. Parameterized system data list (*SDAT.SYS*) with data block transfer area (*DBWF*) from DW 20
3. Sequence chain lists (at least sequence chain list of type "F")

SB *0*, SB *2*, SB *3* with lib. no. E88530... must not be reloaded.
These blocks are only valid for GRAPH5 up to version V 3.x!

WF 470 (Description)

## 4.5.1.2    Rules of application

### Preparing GRAPH5 sequence blocks

−    It must be possible to run GRAPH5 sequence blocks in the PLC and

−    the STEP 5 program must be prepared for diagnostics (FB *82 - G5/II WF* called cyclically).

−    At least one sequence chain list must be transferred to the module, but only one of type "F". The F list tells the module and the SIMATIC S5 which sequence blocks (SB) are to be diagnosed.

−    Texts can be assigned the criteria in other sequence chain lists (types T, C, F, I, Q).

−    The sequence chain lists can be edited in the WF 470 display generation software or generated from SIMATIC S5 symbol files with program ZULIWF5.

−    Only one list is permissible from every sequence chain list type. If additional lists of the same type are loaded on the WF 470, the first list in the memory is used for diagnostics.

### Loading WF 470 GRAPH5/II diagnostics

−    File CGR5.SYS must be on the hard disk of the programming unit, in the same directory as the other display generation software.

−    Check the memory requirement displayed under "F6 Overview" to ascertain whether the option for the display generation software is "available". If "--00000--" is displayed under "Assigned memory" the option is not installed.

−    Option "WF 470 GRAPH5/II diagnostics" can be distinguished from option "WF 470 GRAPH5 diagnostics" by the version number   V 4.0.

−    The option "WF 470 GRAPH5/II diagnostics" (file *CGR5II.SYS* on the hard disk as *CGR5.SYS*) is loaded onto the module with the WF 470 display generation software (blown onto RAM or EPROM card and then slotted into the WF 470 hardware).

−    The WF 470 module should be loaded with firmware V4.2 or higher. Older firmware versions limit the functions available (e.g. no date/time display).

Once the option has been transferred to the WF 470 display, identifier "#03" - GRAPH Vx.y appears in the process display list of contents of the module for the overview display. The display identifier of the second process display of the GRAPH5 diagnostics (#04 diagnostics display) does **not** appear in the process display list of contents, however, it can be selected via the SIMATIC S5 (display flag BLD of FB *S5 WF 470*).

### DBWF

The DBWF used is parameterized in the system data list (*SDAT.SYS*). DW 20 must be defined as the permanent initial address. *SDAT.SYS* is loaded on the WF 470 module.

### Function check

Whether the WF 470 diagnostics is functioning or not can be seen in the status messages (e.g. sequence chain running "no asterisk") in the overview display (#03).

## 4.5.2    **GRAPH5/II submodule** (CRG5II.SYS)

The option WF 470 GRAPH5/II diagnostics contains two WF 470 displays:

–    Overview display (#03)

–    Diagnostics display (#04).

However, these displays cannot be edited with the WF 470 display generation software. Only the standard texts in these displays can be accessed by the user by changing/loading the texts in text group #SP, list N012.
A user-definable softkey menu (two lines of text per softkey) can be also inserted in each of the two displays via text group #SK.

Two message windows each of which are 40 characters long and located above the softkey menu in each display are available for displaying status messages.

### 4.5.2.1    **Overview display (**#03**)**

| | |
|---|---|
| 1st line | `WF 470 GRAPH5 V 4.0     Sequencer Overview     21.01.94 08:10:50` |
| 2nd line | `No  SB-No  State          Function` |

```
17   015    ***   TRANSFER LINE START-UP CONDITIONS
18   018      *   LOADER ARM AND MANIPULATOR                 ST 1
19   019            FIRST CUT COMPONENT SIDE LEFT            ST 2A
20   020    ***   FIRST CUT COMPONENT SIDE RIGHT           ST 2B
21   021            DRILL HOLES COMPONENT SIDE LEFT          ST 3A
22   022      *   DRILL HOLES COMPONENT SIDE RIGHT         ST 3A
23   023    ***   FINE MACHINING COMPONENT SIDE LEFT       ST 4A
24   024            FINE MACHINING COMPONENT SIDE RIGHT      ST 4B
25   030            MEASURING STATION - EXTERNAL DIMENSIONS  ST 7

   a.s.o.
```

*Comment:*
*No    *    sequence started and running*
*       *    sequence not started*
*    ***    sequence fault*

| | |
|---|---|
| 3rd line (State) | `storing`                    `more than 64 criteria!` |

| 4th line (Softkey) | F1 Diagnostics | F2 Seq. +1 | F3 Seq. -1 | F4 Scroll down | F5 Scroll UP | F6 Page+1 | F7 Page-1 | F8 Index |
|---|---|---|---|---|---|---|---|---|

*Fig. 4.11    Example of a GRAPH5/II screen form: Overview display (#03)*
*The function key texts are suggestions, not standard.*

The overview display contains a list of the configured sequence blocks with the names of the sequence chains from the type "F" sequence chain list and the current status.
The display is being updated cyclically if "storing" does not appear in the status line.

## Elements of the overview display

- 1st line: Title with version, date, time
  (WF 470 firmware version V 4.2 and higher).

- 2nd line: Display block with an overview and the status of maximum 64
  sequence chains. A maximum of 18 sequence chains can be
  displayed on a screen page at any one time. Explanation of texts in
  overview display:

  No.      Serial number (sequence chain number) of a configured SB
           in the type "F" sequence chain list

  SB-No.   Number of the SB to be diagnosed in the controller. An SB
           is configured when a sequence chain with corresponding
           SB number is listed in a type "F" sequence chain list. An
           appropriate text can also be defined in the type "F"
           sequence chain list.

  State    Current state of the sequence chain

  The state of the sequence chain is displayed as follows with a
  symbol in the status column:

| State | Representation | |
|---|---|---|
| Sequence chain currently selected ($\hat{=}$ cursor position) | Background colour 2:<br>Symbol: | Blue |
| Sequence chain(s) defective | Foreground colour 8:<br>possibly blinking:<br>Symbol: | White<br>$* * *$ |
| Sequence chain(s) not in automatic mode | Foreground colour 4:<br>Symbol: | Yellow<br>$*$ |
| Sequence chain running in automatic mode | Foreground colour 3:<br>Symbol: | Green<br>None |

  "Function"   Comment for the SB currently set, configured in type
               "F" sequence chain list

- 3rd line: Single-line message window for displaying diagnostics error/status
  messages (see Section Diagnostics display).

- 4th line: Softkey menu with two-line texts; these texts are configured in text
  group #SK and text list 002.

4 – 49

### Input possibilities in the overview display

- Page:   up by max. 18 SB                                (key code $8F_{Hex}$)
              down by max. 18 SB                         (key code $90_{Hex}$)
- Scroll:   up by one SB                                      (key code $8C_{Hex}$)
              down by one SB                            (key code $8D_{Hex}$)

The cursor does not move when paging/scrolling.

- Selection  of the next SB in mode:
            "Diagnostics of all SBs" or
            of the next defective SB in
            mode: "Only defective SBs"           (key code $91_{Hex}$)
- Selection  of the previous SB in mode:
            "Diagnostics of all SBs" or
            of the previous defective SB in
            mode "Only defective SBs"            (key code $92_{Hex}$)
- Switchover to diagnostics display              (key code $42_{Hex}$
                                                        =̂ "B")

    6ZB5 440-0QS02
WF 470 (Description)

## 4.5.2.2     Diagnostics display (#04)

| | |
|---|---|
| 1st line | ```WF 470 Graph5  V 4.0   Diagnostic Unit        21.01.94 08:10:50``` |
| 2nd line | ```Faulted Sequences:   17 20 23``` |
| 3rd line | ```15 17            TRANSFER LINE START-UP CONDITIONS``` |
| 4th line | ```Man. Contr.        MC5-CODE          SYMBOL/COMMENT          VKE/STA``` |
| 5th line | ```No.           15    A IO21.7 OIL PRESSURE LOW OR MISSING!        0  0```<br>```SB-No.        017    A(                                       1  0```<br>```Action         2    AN IO21.3 LOADING STATION WORKPIECE MISSING   0  1```<br>```                     AN IO21.4 INDEXING PULSE NOT SELECTED        0  1```<br>```Max.step      067    AN IO00.3 COOLANT ON                         0  1```<br>```                     A IO00.6 STATION NOT EMPTY                   0  1```<br>```                     A IO00.5 INDEX                               0  0```<br>```Branch Step State    )                                        0  0```<br>```                     A IO21.6 E-STOP PRESSED                      0  0```<br>```1  007             A(                                       1  0```<br>```2  011        *   ON IO21.4 INDEXING PULSE NOT SELECTED        0  0```<br>```3  017       **   O IO21.3 LOADING STATION WORKPIECE MISSING   0  0```<br>```4  031             )                                        0  0```<br>```5  034```<br>```6  045```<br>```7  000```<br>```8  000``` |
| 6th line | ```all criteria``` |
| 7th line (State) | ```more than 64 criteria!      \|    more than 64 criteria!``` |
| 8th line (Softkey) | F1 Graph5 Overview \| F2 Seg. +1 \| F3 Scroll+1 \| F4 Scroll-1 \| F5 Change Mode \| F6 Transit.+1 \| F7 Branch +1 \| F8 Index |

*Fig. 4.12    Example of a GRAPH5/II screen form: Diagnostics display (#04)*
*The function key texts are suggestions, not standard.*

### Elements of the diagnostics display

- 1st line: Title with version, date, time
  (WF 470 firmware version V 4.2 and higher).
- 2nd line: Overview "Faulted sequencers"
  One line, max. 19 defective sequence block numbers
  When the diagnostics function is triggered the sequence block numbers are displayed in ascending order.
  While diagnostics is running the sequence block numbers are displayed chronologically. If several sequence chains are defective this is **no** longer displayed in the second line. However, the sequence chain can be selected by moving the cursor left/right. The cursor in the 2nd line is then no longer visible.
- 3rd line: Starting from left
  - 1st statement:    No.    =̂ current sequence chain number
  - 2nd statement:    SB-No. =̂ current sequence block number.
  - 3rd statement:    Comment for SB currently set, configured in type "F" sequence chain list

- 4th line: Left-hand window: Mode display

    "Diagnostics of all SBs"  (*DBWF*, DR 29: KH 00)
    "Man. Contr."     (*DBWF*, DR 29: KH FF)

  Right-hand window: Method of representation of criteria

    "STL":  Standard text: MC5 code
               Symbol/Comment
               VKE/STA"
    "LAD":  Display of operand symbol and
          corresponding comment

- 5th line: Left-hand window: "No."  $\hat{=}$ Selected sequence chain number

          "SB-No." $\hat{=}$ Selected sequence block number

    "ACTION"    (*DBWF*, DR 31: KH 00)  Indi-
                       cates

    "OR-      (*DBWF*, DR 31:    type
    BRANCH"       KH 01...08) $\hat{=}$ of
                       detail

    "SUL"     *DBW*F, DR 31: KH 41  dis-
    (cross-step    ...5A$\hat{=}$"A"..."Z" in  play
    detail display)  ASCII)

    "MAX. STEP"    $\hat{=}$   Display of max.
                       number of steps in
                       sequence block
    "Branch step state"  $\hat{=}$   Branch overview
                       with step and status
                       displays
          "∗∗∗"  $\hat{=}$   defective branch
                $\hat{=}$   current set branch
                       (cursor position)

  Right-hand window: Criteria display

    Switch between display in "LAD" and "STL" by
    pressing key "C".
    "STL"  $\hat{=}$ Display of S5 program code,
         corresponding symbol/comment and
         calculated RLO or status STA (16 lines).
    "LAD"  $\hat{=}$ Display of criteria in "LAD". The operand
         symbol and the accompanying comment
         are additionally displayed in line 4 for the
         selected element (inversely).

- 6th line: Operating mode display:

    Press key "D" to switch over modes.
    "all criteria" or
    "unsatisfied criteria"

- 7th line: Message window for status display:

    "more than 64 criteria!": Permissible number of 64
                  criteria in sequence block
                  exceeded
    "storing/not storing":  FB 81 used
                  (first alarm acquisition)

- 8th line: Softkey menu with two-line user-defined texts

## Operation of diagnostics display

| Operation | | Key code |
|---|---|---|
| Switchover into overview display | | A |
| STL <--> LAD switchover | | C |
| Switchover between modes: | "all criteria" or "unsatisfied criteria" | D |
| Next (defective) SB | | $091_{Hex}$ |
| Previous (defective) SB | | $092_{Hex}$ |
| SB No. input | | 0...9 LF [2] |
| Chain No. input | | 0...9 LF [2] |
| Scroll up/down STL list | -line by line- | $08C_{Hex}$, $08D_{Hex}$ |
| Page up/down STL list | -page by page- | $08F_{Hex}$, $090_{Hex}$ |
| Scroll LAD[1] right/left | -one operand at a time- | $0AF_{Hex}$, $0B0_{Hex}$ |
| Scroll LAD[1] up/down | -line by line- | $08F_{Hex}$, $090_{Hex}$ |

[1] The next output field assigned a LAD element in the search direction is selected in the displayed section of the screen of the LAD matrix. Empty fields and fields that only have horizontal or perpendicular connecting lines are skipped. Scrolling can be continued until the last assigned column/line of the LAD has been reached. Possible scroll directions are indicated by arrows.

[2] Linefeed

## Display of criteria in diagnostics display

**Basis** for the criteria display in the diagnostics display are the MC5 code and status information stored in the *DBWF*. The result of the logic operation (RLO) is calculated on the WF 470. Depending on the STATUS of the criteria these will be displayed as either "satisfied" or "unsatisfied".

A **maximum of 64 criteria** can be diagnosed and displayed. If more criteria are shown in the detail display, error message "more than 64 criteria!" is output. No guarantees can then be made for the accuracy of the criteria, RLO and status conditions displayed in the diagnostics display.

A **maximum of 8 bracket levels** must not be exceeded in one step.

The SBs must be programmed in such a way that the networks can also be displayed on the programmer in LAD representation.

**Switchover** between modes "all criteria" and "unsatisfied criteria" is possible with key "D".

**Mode "all criteria":** From the first statement up to 64 criteria are displayed in the detail display. The following assignments apply:
- in STL: Display of status in column "RLO/STA"
- in LAD: Criteria unsatisfied $\hat{=}$ thin line
Criteria satisfied $\hat{=}$ thick line

The criteria are not analyzed by masking fulfilled branches. The current detail display with the corresponding status of the individual criteria is displayed in full.
F 233.0 is displayed as "AUTOFREE" and
F 205.6 is displayed as "MANUALFREE" with firmly assigned symbols.

**Mode "criteria unsatisfied":** The detail display in question is analyzed and only the relevant, unsatisfied criteria between the start and end criteria of a branch are displayed (see Section 4.5.4 Programming notes). Satisfied OR branches cancel all other unsatisfied branches, i.e. they are not displayed either.

## Mode "Diagnostics of all SBs" or "Only defective SBs"

**Mode "Diagnostics of all SBs":** Selection: *DBWF*, DR 29 = KH00
All the sequence chains configured in the type "F" sequence chain list can be displayed.

**Mode "Only defective SBs":** Selection: *DBWF*, DR = KHFF
Only those SBs that are defective can be displayed.

**Chain/SB switchover:**
- using cursor keys (cursor left/right)
- via input in diagnostics display or SIMATIC S5 (DL 28)

Depending on the diagnostics state, selection of a non-existent SB will be ignored or will cause a return jump to the first sequence chain.

## 4.5.3    Standard blocks in the PLC

The following standard function blocks in the diagnostics package (see S5 files,
Section 4.5) are used for GRAPH5/II diagnostics:

– FB *81* (*G5/II-ME*): Function block "Acquisition and storing of a first fault" (only
call up cyclically when required)

– FB *82* (*G5/II-WF*): GRAPH5/II diagnostics function block for WF 470 (must be
called cyclically)

FB *81* and FB *82* can be used with the following PLCs:

S5 115 U with CPU 941 - 944
S5 115 U with CPU 945
S5 135 U with CPU 928
S5 155 U with CPU 946, 947 and 948

The standard blocks of the diagnostics package of the WF 470 GRAPH5/II
diagnostics are based on the SIMATIC S5 standard function blocks of GRAPH5/II
(FB *70*/SB *0* etc). Before installing WF 470 GRAPH5/II diagnostics it is therefore
important to ensure that the sequence chain programming operates correctly
without diagnostics.

**Differences between/similarities with** older WF 470 diagnostics packages on
the SIMATIC S5 side:

– On no account must SB *0*, SB *2*, SB *3* with lib. no. E88530.... be reloaded
Only GRAPH5/II standard blocks with lib. no. P71200-x xxx-D-x are allowed.
– Data block *DBKA* is no longer necessary.
– FB *82* performs the functions of blocks FB *76*, FB *77* and FB *79*
– FB *81* performs the functions of block FB *80*, but in the 1st PLC cycle
– Sequence chain listing is not possible with GRAPH5/II.

## 4.5.3.1    Function block "GRAPH5/II diagnostics" (FB 82, G5/II-WF2)

### Tasks/method of operation

FB *82*, *G5/II-WF2* must be parameterized and called.

FB *82* monitors all the sequence chains that are entered in *DBWF*, DW *110 - 141*
(from type "F" sequence chain list) and diagnoses the selected sequence chain.

FB *82* starts reading out the MC5 code at the beginning of a detail display (first
statement). Only statements that can be diagnosed are read out and their status
is stored in *DBWF*.

The number of diagnosable commands it limited to max. 64 per detail display.

The detail display is aborted at the latest after the 64th criterion.

If more than 64 criteria exist in the detail display message flag D109.1 is also set
and message "more than 64 criteria!" is output.

The RLO carried across network boundaries is masked by FB *82* (see Section
4.5.4 Programming notes).

### The following statements are acquired by the FB 82:

Operations "A, AN, O, ON, =, R, S, A(, O(, ), ***", referring to I, Q, F, T, C are entered by the diagnostics FB in **DBWF**, no other commands are entered.

### Parameterization

*FB 82*

```
        ┌─────────────────────┐
        │       G5/II-WF       │
        ├─────────────────────┤
    ────┤ DBWF                 │
        │                      │
    ────┤ TIPP                 │
        │                      │
    ────┤ NEXT                 │
        └─────────────────────┘
```
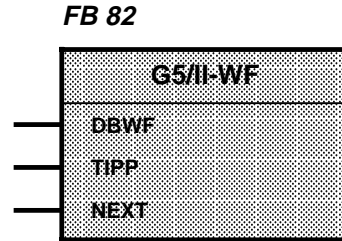
Table 4.22        FB *G5/II-WF* parameters

| Parameters | Meaning | Kind | Type | Admiss. values |
|---|---|---|---|---|
| DBWF | Transfer area WF 470 - GRAPH5/II submodule | DO | | DB-No. 2...255 |
| TIPP (pos. edge) | Diagnostics: One further on in ring: I---> Sx --> SA...SZ --> Ty... I I ... --> Ty + n ---------> I I <------------------------------- I | I | BI | F:     < 200 <br> I:        y.x |
| NEXT (pos. edge) | Diagnostics: One further on in ring: I--> Sx (branch 1) .. ----------> I I ... --> Sm (branch 8) --> I I <------------------------------ I | I | BI | F:     < 200 <br> I:        y.x |

WF 470 (Description)

## Application rules

1. The permissible values for parameterizing FB *82* must be observed.

2. DBWF:
   The parameter value entered must correspond to the value in the system data
   list of the WF 470 (DB transfer area, DW transfer area = permanently set to
   DW 20).
   The *DBWF* serves as the diagnostics interface to the GRAPH5/II submodule
   on the WF 470 and must be at least 172 DW long. The data entered therein
   are made available to the user in the overview and diagnostics displays of the
   WF 470 (see assignment of *DBWF*).

3. TIPP:
   Progression of the diagnostics to the next action, SUL or OR branch is
   possible with the positive edge, irrespective of whether the sequence chain is
   running, has stopped or is defective.
   If the message "storing" is output, jog mode is not possible.

4. NEXT:
   If simultaneous branching has been activated, several actions are displayed in
   the diagnostics display (line 5, left-hand window: "Branch, step, status").
   With every positive edge the cursor is simultaneously placed on the next
   branch which is displayed in the diagnostics display.

### 4.5.3.2 Function block "Acquisition of first fault(s)" FB 81, G5/II-ME
(complements FB 82)

### Structure, method of operation

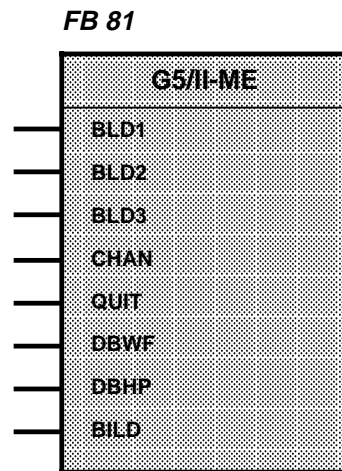This block complements FB *82* "Acquisition and storing of a first fault" (ESTO).

It is the task of FB *81* to hold and display the state of the first defective sequence chain in the cycle in which the fault occurs. FB *82* is required as a basis.

If a fault occurs it is diagnosed by FB *82* and entered in *DBWF*. FB *81* then saves the contents of *DBWF* into *DBHP*.
If display selection #04 (diagnostics display) has been activated via parameter "DISPLAY", this display is called simultaneously (once if a fault occurs) and the ESTO is displayed.

Switchover between the "current" and held display is implemented with parameter "CHAN".

FB *82* cannot continue diagnostics as long as the ESTO (message "storing") is displayed. FB *81* cannot start storing data again until it has been acknowledged via parameter QUIT.

*FB 81*

```
         G5/II-ME
    ────  BLD1
    ────  BLD2
    ────  BLD3
    ────  CHAN
    ────  QUIT
    ────  DBWF
    ────  DBHP
    ────  BILD
```

## Parameterization

Table 4.23　　　　Parameters of FB *G5/I-ME*

| Parameters | Meaning | Kind | Type | Admiss. values | |
|---|---|---|---|---|---|
| BLD1<br>BLD2<br>BLD3 | Display parameters of FB *S5-WF 470* | I/O | BY | FY: | < 200 |
| CHAN<br>(pos.edge) | Switchover between the current display and the stored ESTO | I | BI | F:<br>I: | < 200<br>y.x |
| QUIT<br>(pos.edge) | Acknowledgement of a stored ESTO:<br>= = > enable DBHP for next entry | I | BI | F:<br>I: | < 200<br>y.x |
| DBWF | Transfer area<br>WF 470 – GRAPH5/II- submodul | DO | | DB-No. 2...255 | |
| DBHP | Auxiliary DB for first fault | DO | | DB-No. 2...255 | |
| BILD | Additional call of diagnostics display from any WF 470 display | I | BI | F:<br>I: | < 200<br>y.x |

## Application rules

1. To ensure correct first fault acquisition, call sequence FB *81*, FB *82* after the last GRAPH5/II sequence chain must be observed.

2. BLD 1 / 2 / 3:
   The parameters are identical to those in FB *S5 WF 470*. The same operands and values must be used.

3. CHAN:
   When an ESTO has been acquired it is possible to switch between the registered ESTO and the current sequence chain state with the positive edge of parameter "CHAN".
   The display for ESTO is marked by the message "storing" in the status window.

4. QUIT:
   FB *81* is acknowledged with this parameter, i.e. acquisition of a new ESTO is enabled. The fault still stored can no longer be displayed.

5. DBWF:
   See parameter for FB *82*.

6. DBHP:
   *DBHP* serves as the buffer for storing the first fault states from *DBWF*. Data block *DBHP* has to be set up once by the user with KH 0000, DW 0 - 172.
   A current (unacknowledged) ESTO can be identified in *DBHP* by D 2.0 = "1!.

7. BILD:
   The diagnostics display (#04) is switched over to automatically on a first fault if the parameter value was previously set to "1".
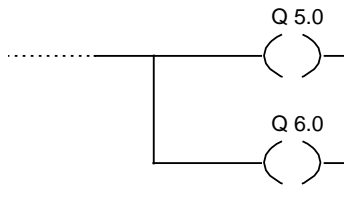
### 4.5.4 Programming notes

These programming notes explain some special features, GRAPH5/II and WF 470 GRAPH5/II diagnostics.

Please consult the GRAPH5/II description for general programming rules for GRAPH5/II.

The programming software for GRAPH5/II together with a description can be ordered from SIMATIC S5 Catalog ST 59.

### 4.5.4.1 Representation of parallel outputs

Example for SIMATIC S5                                      Example for WF 470-Diagnostics

```
                          Q 5.0                        Q 5.0            Q 6.0
............──────────────( )──|            ..........──( )────────────( )──|

                          Q 6.0
            ──────────────( )──|
```
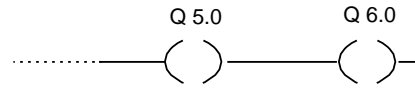
### 4.5.4.2 Manual/automatic flag in OR branch

Manual and automatic mode in GRAPH5/II FB (parameters A/H) must not **be mutually exclusive**, i.e. manual and automatic flags must be in OR branches.

```
     F 233.0
──┤ ├──────────..........

     F 205.6                         Correct!
──┤ ├──────────..........

     F 205.6      F 233.0
──┤ ├──────┤ ├──────..........       Incorrect! (RLO always 0)
```

     6ZB5 440-0QS02
WF 470 (Description)
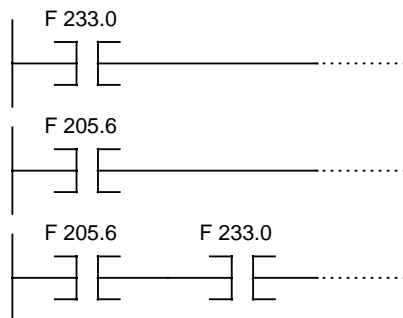
## 4.5.4.3 RLO carried across network boundaries

A RLO carried across network boundaries is <u>never displayed</u>.
The networks are contiguous.

F x.y

F x.y

The order of the program in STL must be:

**:= F x.y**
**\*\*\***

**:A F x.y**

etc.

If a different command sequence is programmed, the above rule no longer
applies.

## 4.5.4.4 Criteria analysis
(Representation in mode "unsatisfied criteria")
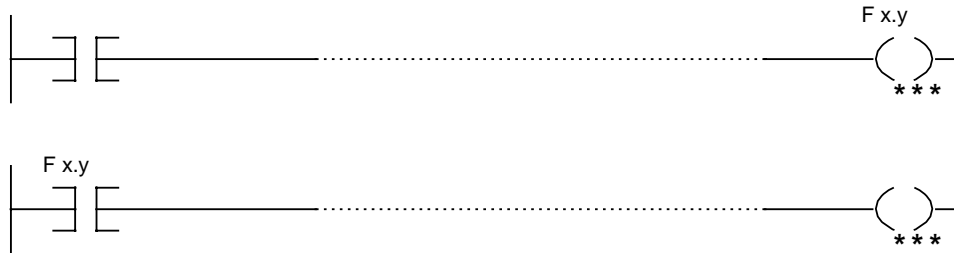
Criteria analysis is only performed between

− start criterion
(first command output flag: automatic = F 233.0,
manual = F 205.6) and

− end criterion [assignment operation (=),
set operation (S) or
reset operation (R), except for RLO carried across].

Only unsatisfied criteria are displayed in the diagnostics display.

If a step consists of several rungs which contain start and end criteria, the criteria
analysis is executed from the beginning for each rung and is displayed on the
WF 470 in a separate rung.

### Example with manual and automatic flags

The programming line depends on the "1" status of the MANUAL flag (F 205.6)
and the AUTO flag (F 233.0).



**Start criterion**

**End criterion**

WF 470 (Description)
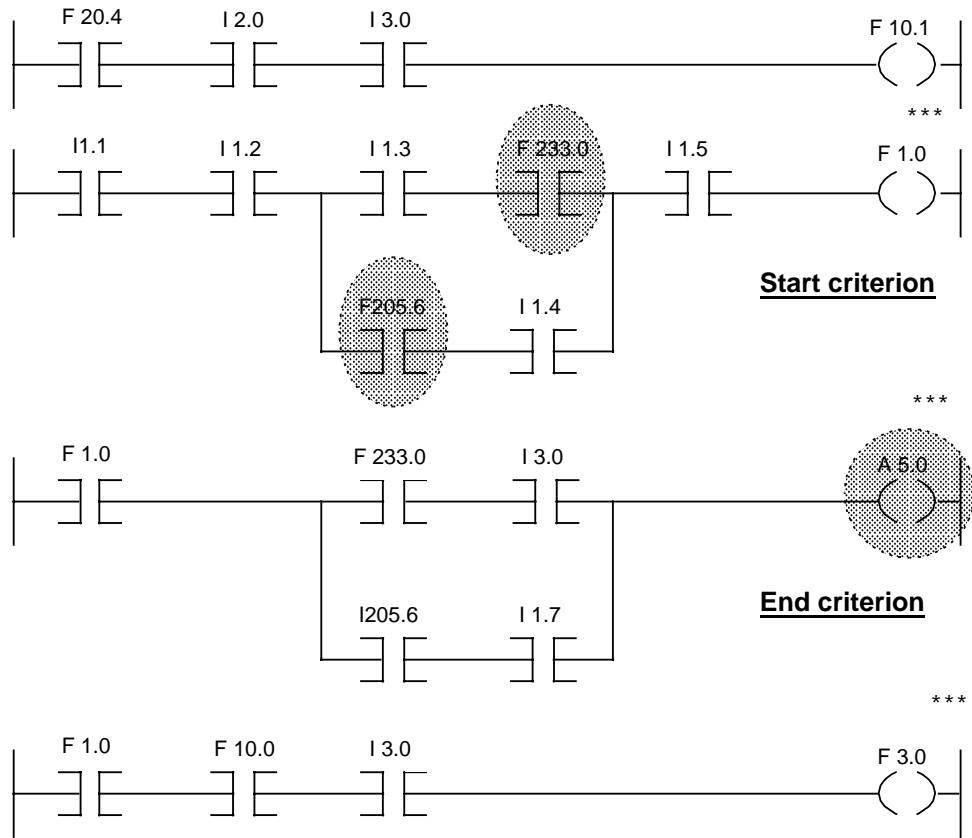
## Values assumed for previous example:

I 1.1 = x          I 1.4 = 0          I 3.0 = 0

I 1.2 = x          I 1.5 = 0

I 1.3 = x          I 1.7 = 0

**Display in automatic** (status automatic flag *DBWF*, DR152 = 1)
Start criterion: F 223.0

```
      I 1.5        I 3.0                                    Q 5.0
  ┌────┤/├──────────┤/├──────────────────────────────────────( )──┐
                                                              ***
```
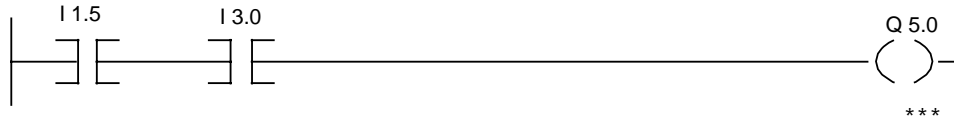
**Display in manual** (status manual flag *DBWF*, DL152 = 1)
Initial criterion: F 205.6

```
      I 1.4        I 1.5        I 1.7                        Q 5.0
  ┌────┤/├──────────┤/├──────────┤/├──────────────────────────( )──┐
```
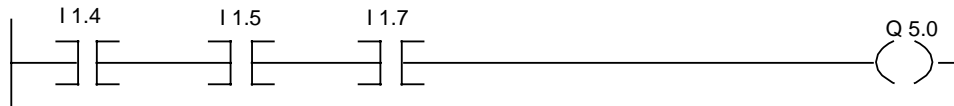
The example shows that only the active branches for AUTO or MANUAL are
taken into account.

Flags F 233.0/F 205.6 (start criteria) are <u>not</u> represented.

## Example without manual and automatic flags

If neither F 233.0 nor F 205.6 are programmed in a rung (see marked rung) and if their is no direct relationship between an RLO carry flag and the previous rung, the rung is completely excluded from the criteria analysis and is not displayed.

The network marked below can also be positioned before the other two networks.

```
   F 233.0      I 1.4       I 1.5                                    Q 1.0
    ─┤ ├─        ─┤ ├─        ─┤ ├──────────────────────────────────( )─┤


   F205.6       I 1.7
    ─┤ ├─        ─┤ ├──
                                                                      * * *


    Q 1.0       I 1.6       I 3.7                                    Q 1.0
    ─┤ ├─        ─┤ ├─        ─┤ ├──────────────────────────────────( )─┤
                                                                      * * *


    F 20.4      F 2.0       F 3.0                                    Q 1.2
    ─┤ ├─        ─┤ ├─        ─┤ ├──────────────────────────────────( )─┤
                                                                      * * *
```
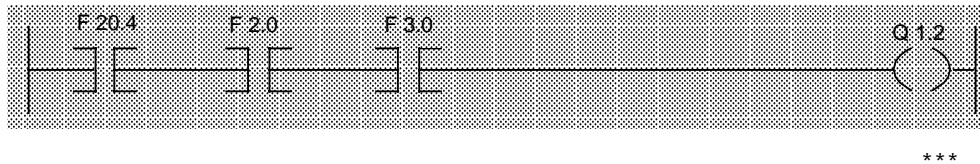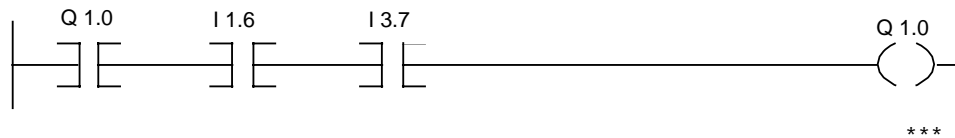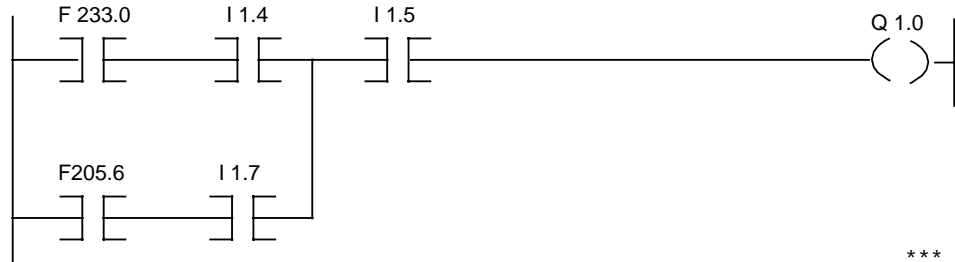
## Criteria analysis in a transition

– No F 233.0 or F 205.6 flag must be programmed in a transition.
Exception: The last statement in the detail display in LAD/STL is the assignment of F 233.0 (only appears in LAD/FBD).
The flag must only appear once.

– The start criterion in a transition is the first statement in the detail display.

– The end criterion is, as for a step,
the first assignment,
set statement or
reset statement without RLO carry.

Subsequent networks are no longer analyzed and displayed.

6ZB5 440-0QS02
WF 470 (Description)

## 4.5.5 Data block DBWF

- − Data block *DBWF* must be identical to the specification in the system data list of the WF 470 (data block transfer area).
- − The initial address for the diagnostics part of the *DBWF* is permanently set to DW 20.
- − The minimum length of *DBWF* is 172 data words (LEN = 175 + header)

### 4.5.5.1 Data words that can be changed by the user

Sound knowledge of sequence chain diagnostics procedures is required if the user is to change data words in the *DBWF* to avoid incorrect functioning of the diagnostics.

The following data words in the *DBWF* can be changed by the user:

DW 028 − DL = sequence block number, DR = sequence chain number

- − A particular sequence chain/block can be selected in DW 028 for diagnosis.
- − The assignment to the SB number must already exist if the sequence chain number is entered.
- − FB *81* overwrites the data word on a first fault.
- − The WF 470 transfers the sequence chains/steps selected in the diagnostics display into this data word.
- − The sequence chain number is automatically changed when the SB number is changed (and vice versa).
- − Only sequence blocks can be selected in mode "Only defective SBs".

DW 029 − DL = must be permanently set to KHFF, DR = diagnostics mode

- − DR = KHFF - "Only defective SBs"
- − DR = KH00 - "Diagnostics of all SBs"

DW 109 − DR = reserved for FB, DL = message flags

- − D 109.0 = 1 Processing of FB *82* disabled.
  FB *82* no longer writes to *DBWF* and the diagnostics is no longer updated.
  The bit is used by FB *81* (parameter CHAN) and overwritten.
  The message "storing" appears in the status line of the diagnostics display.
- − D 109.1 = 1 More than 64 criteria exist in the detail display currently being.
  Updated by FB *82*, must not be changed by the user program.
  The message "more than 64 criteria!" appears in the status line of the diagnostics display.

- D 109.6 = 1    GRAPH5 parameters A/M = 0 ($\hat{=}$ manual)
Updated by FB *82*, must not be changed by the
user program.

- D 109.7 = 1    GRAPH5 parameter A/M = 1 ($\hat{=}$ automatic)
Updated by FB *82*, must not be changed by the
user program.

DW 154    DL = internal FB area, DR = Diagnostics preselection with detail
display

- DL            internal FB area, must not be changed.
- DR            Diagnosis of the step             : KH 00
                Diagnosis of the transition       : KH 01..08
                (alternative branching (OR branch 1...8) counting
                from the left)
                Diagnosis of SUL (SA ... SZ)      KC = "A...Z"

In DR154 it is possible to define which detail display is accessed
first if a fault occurs. With default setting ($00_{Hex}$) the step detail
display is selected and diagnosed.

"1" must be entered in DR154 if the transition in question is to be
displayed as soon as a fault occurs.
If the default setting is "A" ($041_{Hex}$) the higher-level step detail
display (SUL) is first displayed.

If the detail display in each case is empty or not available
(assigned), the next detail display is automatically displayed.

The following processing sequence applies:

        1        -  step
        2        -  SUL (A...Z)
        3        -  transition (OR branch 1..8)

If the detail display is changed it is only transferred if a new step
or new branch is updated by FB *82*. Diagnostics preselection is
transferred automatically in mode "Only defective SBs".

## 4.5.5.2 DBWF assignment

| Bit<br>DW | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 020 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | SB state |
| 021 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | of current sequence chain no. |
| 022 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 1=̂started (=̂AUTO) |
| 023 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 0=̂stopped (=̂not AUTO) |
| 024 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | SBstate |
| 025 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | of current sequence chain no. |
| 026 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 1 =̂ defective |
| 027 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 0 =̂ not defective |
| 028 | SB number | | | | | | | | Sequence chain number | | | | | | | | |
| 029 | No. for DBWF: FF=̂finished<br>00=̂FB being processed int. | | | | | | | | FF=diagnostics of all SBs<br>00=diag. of def. SBs only | | | | | | | | |
| 030 | Branch to display (1...8) | | | | | | | | Step for display (1...127) | | | | | | | | |
| 031 | Total number of steps | | | | | | | | KH 00 = action,<br>KH 01... 08=step enabl. cond.,<br>A...Z=SUL | | | | | | | | |
| 032 | Step number for branch 1 | | | | | | | | Step number for branch 2 | | | | | | | | Current step numbers |
| 033 | Step number for branch 3 | | | | | | | | Step number for branch 4 | | | | | | | | for branches 1 to 8 |
| 034 | Step number for branch 5 | | | | | | | | Step number for branch 6 | | | | | | | | for diagnosed SB |
| 035 | Step number for branch 7 | | | | | | | | Step number for branch 8 | | | | | | | | during simultan. branching |
| 036 | Step number for branch 1 | | | | | | | | Step number for branch 2 | | | | | | | | Step number of defective |
| 037 | Step number for branch 3 | | | | | | | | Step number for branch 4 | | | | | | | | branches 1 to 8 |
| 038 | Step number for branch 5 | | | | | | | | Step number for branch 6 | | | | | | | | 1 =̂ defective |
| 039 | Step number for branch 7 | | | | | | | | Step number for branch 8 | | | | | | | | 0 =̂ not defective |
| 040 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | Bit coding of state |
| 041 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | for |
| 042 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | conditions 1 to 64 |
| 043 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | |
| 044<br>to<br>107 | MC5 code for condition 1<br>to<br>MC5 code for condition 64 | | | | | | | | | | | | | | | | KH 0000H = End of code entry<br>(no MC5 code) |
| 108 | Reserved | | | | | | | | | | | | | | | | |
| 109 | internal FB area | | | | | | | | Message flags | | | | | | | | |
| 110 | SB number for seq. chain 1 | | | | | | | | SB no. for seq. chain 33 | | | | | | | | |
| 111<br>to<br>140 | SB number for seq. chain 2<br>to<br>SB no. for seq. chain 31 | | | | | | | | SB no. for seq. chain 34<br>to<br>SB no. for seq. chain 63 | | | | | | | | |
| 141 | SB no. for seq. chain 32 | | | | | | | | SB no. for seq. chain 64 | | | | | | | | |
| 142 | FB version (KY format, e.g.: 4.0 = V4.0 | | | | | | | | | | | | | | | | |
| 143<br>to<br>149 | internal FB area | | | | | | | | | | | | | | | | |
| 150 | KY = bit, byte "MANUALFREE": KY 6,205 | | | | | | | | | | | | | | | | |
| 151 | KY = bit, byte "MANUALFREE": KY curr. step flag<br>(F234.0-249.7) | | | | | | | | | | | | | | | | For diagnosis of defective criteria<br>only |
| 152 | KY = MANUAL; AUTO--> activ = 1<br>(1,0 = MANUAL; 0,1 = AUTO) | | | | | | | | | | | | | | | | Via parameters A/M e.g. FB *72* |
| 153 | internal FB area | | | | | | | | | | | | | | | | |
| 154 | internal FB area | | | | | | | | 0 = Act.; 1 = Transition;<br>"A" = SUL | | | | | | | | Diagnostics preselection with<br>detail display |
| 155<br>to<br>172 | internal FB area | | | | | | | | | | | | | | | | |

## 4.6      **Computer Link** (Option)

### 4.6.1      **Functioning**

With the module you can use the WF 470 for the communication between an external device and the SIMATIC S5. The module runs in the background, parallel to the other functions of the WF 470. Picture"#07" is provided for the control and maintenance. The picture generation operation and the computer link are not possible at the same time. As external devices the following devices are admitted:

Terminal ES 120 with a bar code reader
Diskette drive DS 550
A further WF 470

The module is stored in the CRKO.SYS file on the options diskette.
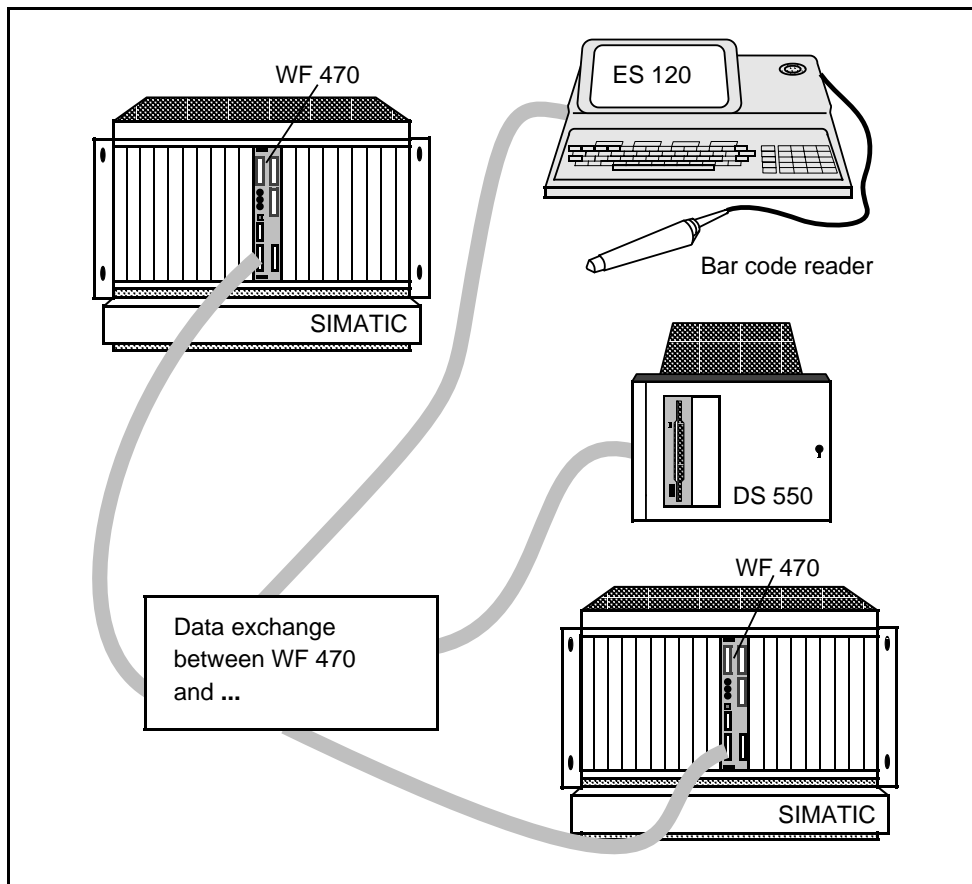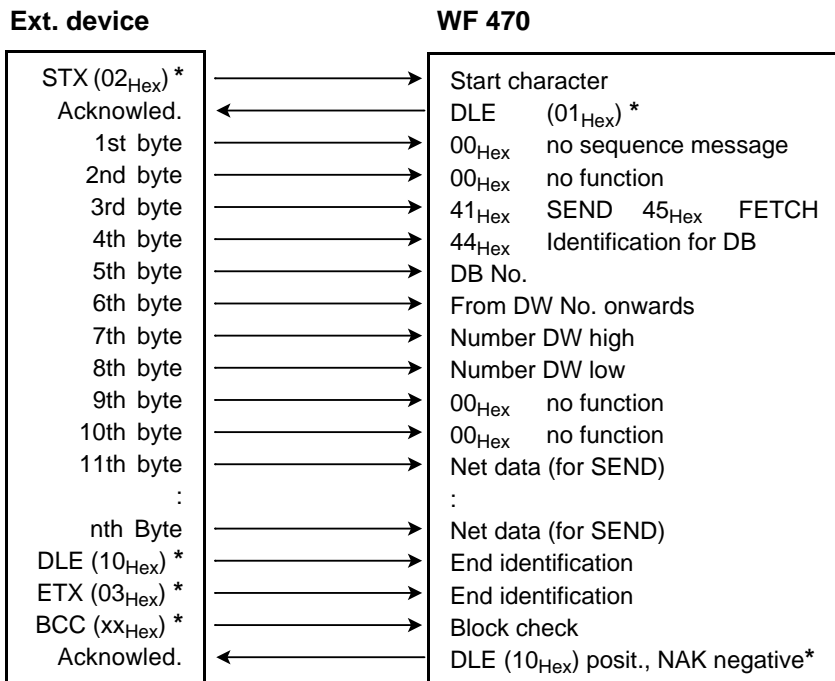


*Fig. 4.11      Approved, external devices for COMPUTER LINK*

The link is effected via the PG interface on the basic module. The module does not contain any parameters. Therefore, the linked devices have to be adapted to the setting according to table 4.2.2:

Table 4.24

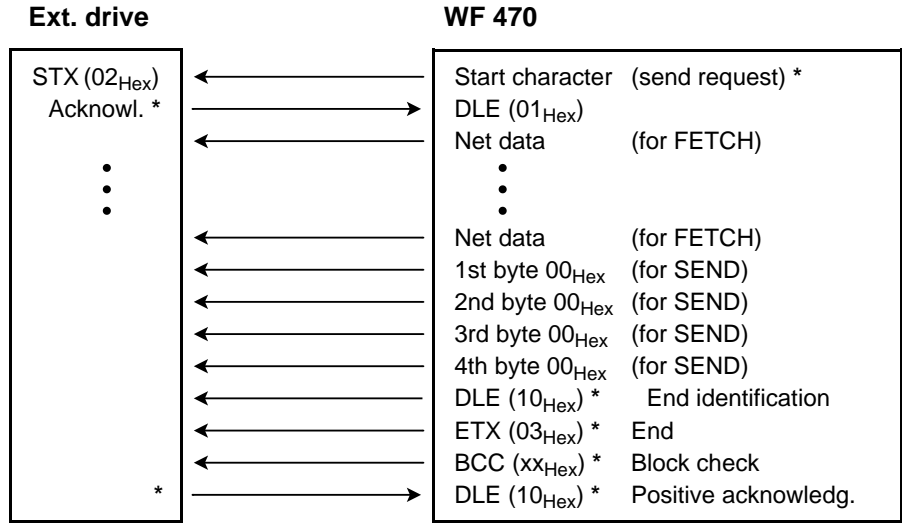| TTY parameter | | 3964R parameter | |
|---|---|---|---|
| Baud rate: | 9600 | Blocking: | none |
| Data bits: | 8 | Block check: | with BCC |
| Stop bits: | 1,5 | WF 470 is slave, external device is master | |
| Parity: | even | | |
| Transmitter and receiver of the WF 470 are passive | | | |

The data exchange with the external devices is effected via the 3964R driver after the protocol RK512:

**Ext. device**                                        **WF 470**

| | | |
|---|---|---|
| STX (02$_{Hex}$) * | →| Start character |
| Acknowled. | ←| DLE (01$_{Hex}$) * |
| 1st byte | →| 00$_{Hex}$ no sequence message |
| 2nd byte | →| 00$_{Hex}$ no function |
| 3rd byte | →| 41$_{Hex}$ SEND 45$_{Hex}$ FETCH |
| 4th byte | →| 44$_{Hex}$ Identification for DB |
| 5th byte | →| DB No. |
| 6th byte | →| From DW No. onwards |
| 7th byte | →| Number DW high |
| 8th byte | →| Number DW low |
| 9th byte | →| 00$_{Hex}$ no function |
| 10th byte | →| 00$_{Hex}$ no function |
| 11th byte | →| Net data (for SEND) |
| : | | : |
| nth Byte | →| Net data (for SEND) |
| DLE (10$_{Hex}$) * | →| End identification |
| ETX (03$_{Hex}$) * | →| End identification |
| BCC (xx$_{Hex}$) * | →| Block check |
| Acknowled. | ←| DLE (10$_{Hex}$) posit., NAK negative* |

*The characters marked * are added by the procedure 3964R.*

Data jobs for transfer are stored in a DB and activated via the key code FF$_{Hex}$ . The number of this DB and the first DW must be entered in the DBWF DW 13 (see section 3.5).

After a faultless transfer to the SIMATIC S5 the acknowledgement message follows:

**Ext. drive**                    **WF 470**

| | | |
|---|---|---|
| STX (02$_{Hex}$) | ← | Start character (send request) * |
| Acknowl. * | → | DLE (01$_{Hex}$) |
| | ← | Net data (for FETCH) |
| • | | • |
| • | | • |
| • | | • |
| | ← | Net data (for FETCH) |
| | ← | 1st byte 00$_{Hex}$ (for SEND) |
| | ← | 2nd byte 00$_{Hex}$ (for SEND) |
| | ← | 3rd byte 00$_{Hex}$ (for SEND) |
| | ← | 4th byte 00$_{Hex}$ (for SEND) |
| | ← | DLE (10$_{Hex}$) * End identification |
| | ← | ETX (03$_{Hex}$) * End |
| | ← | BCC (xx$_{Hex}$) * Block check |
| * | → | DLE (10$_{Hex}$) * Positive acknowledg. |

*The characters marked * are added by the procedure 3964R.*

The length of a data block is limited to 256 bytes, so that the net data length is 256 - 10 (head) = 246 bytes = 123 DW. If larger data blocks must be transmitted, the user must effect the blocking himself and start several transmissions one after the other.

The module for the computer link is loaded into the WF 470 together with the picture generation software.

For test purposes the mask "WF 470 Computer Link" can be called by means of "picture #07" from the process picture index. Then you can observe the data exchange and read the reasons of faults. It is, however, of no relevance for the running operation.

The status ONLINE/OFFLINE is displayed and can be changed by means of the transfer key or automatically by plugging/removing a cable with jumpered pins 6 - 7 (see section 2.6.9).

ONLINE          Interface is switched for computer link. Configuring mode and serial keyboard operating are not possible.

                The ONLINE mode is activated as follows:

                    via the KEY code EA$_{Hex}$
                    by closing the jumper between pin 6 and 7 in the X7 connector (when plugging the connector in)
                    by suitable selection in picture #07

OFFLINE         Interface is switched for PG operation. The computer link is active, picture #07 is displayed. Serial keyboard operating and loading of lists are possible. The selection of the picture generation is blocked. The ONLINE mode is activated as follows:

                    via the key code EB$_{Hex}$
                    by operating the jumper between pin 6 and 7 in the X7 connector (when unplugging the connector)

The current status or any faults that have occurred are displayed in a status line:

**Job executed**

– Busy

– Error in transmission to SIMATIC S5

– Error in 3964R procedure;
Error code: xxxx$_{Hex}$/yyyy$_{Hex}$ with the following meanings:

| xxxx$_{Hex}$ | | yyyy$_{Hex}$ |
|---|---|---|
| FFFF | | |
| FFFE | Invalid parameters | |
| FFFD | Interface occupied | |
| FFFC | Interface occupied | |
| FFFB | I/O requests were aborted | |
| FFFA | Buffer overrun upon reception | |
| FFF9 | Parity/ overrun/framing error after 3 attempts | |
| FFF8 | Block check/ error after 3 attempts | |
| FFF7 | Parity/ overrun/ framing error in RX__DLE routine | Number of |
| FFF6 | Upon sending:   invalid character was received | received/sent |
| | Upon reception: odd number of DLE's in data field | data bytes |
| FFF5 | Sending job was cancelled | |
| FFF4 | TQ time error | |
| FFF3 | TZ time error | |
| FFF2 | Reception error after 3 attempts | |
| FFF1 | – | |
| FFF0 | Opposite side not ready | |
| Other values not defined | | |

**Coordination**

On the SIMATIC S5 side, a data block (*DBN-RK)* with 12 DW can be set up for the coordination of the transmission. The DB No. is freely selectable; it must , however, be entered in DW 13 of the transfer data block *DBWF*.

| DBWF, DW 13 | |
|---|---|
| DL | DR |
| DB No. Computer Link | DW No. Computer Link (set up 12 data words) |

The transfer DB is the data block indicated in the system data list part 1.

The code EFh in the parameter TAST of the FB *S5-WF 470* causes the WF 470 to read the *DBN-RK* and to execute the transmission job stored in it.

Table 4.25　　Job format in the data block of the DBN-RK

| DWn + | Data word | | Remark |
|---|---|---|---|
| | DL | DR | |
| 0 | FF$_{Hex}$ if sequence mess., otherwise 00$_{Hex}$ | 00 | Source |
| 1 | SEND (41$_{Hex}$) **/** FETCH (45$_{Hex}$) | Data identification | |
| 2 | DB No. | Start adress | |
| 3 | Number (DW) | | |
| 4 | reserved | | |
| 5 | FF$_{Hex}$ if sequence mess., otherwise 00$_{Hex}$ | 00 | Destination |
| 6 | SEND (41$_{Hex}$) **/** FETCH (45$_{Hex}$) | Data identification | |
| 7 | DB No. | Start adress | |
| 8 | Number (DW) | | |
| 9 | reserved | | |
| 10 | Status word RECEIVE | | |
| 11 | Status word SEND | | |

**Data identifications:**

| | | | |
|---|---|---|---|
| 44$_{Hex}$ | Data block (DB) | 5A$_{Hex}$ | Counter word (ZW) |
| 4D$_{Hex}$ | Flag byte (MB) | 50$_{Hex}$ | Peripheral word (PW) |
| 45$_{Hex}$ | Input byte (EB) | 54$_{Hex}$ | Timer word (TW) |
| 41$_{Hex}$ | Output byte (AB) | | |

**Status words**

| Status word | Meaning of the bits | | |
|---|---|---|---|
| | Bit 0=1 | Bit 1 to Bit 7 | Bit 8 to Bit 15 |
| SEND | Start sending job | free | Error code SEND |
| RECEIVE | Ready for reception | free | Error code RECEIVE |

As long as in the status words SEND or RECEIVE bit 0, is unequal 0 the control must not intervene in the running transmission.

Sending bit and receiving bit may be set simultaneously. In that case, the sending job will be processed first, and afterwards the receiving job.

A fetch job is at present **not** possible.

6ZB5 440-0QS02

WF 470 (Description)

## 4.6.2    Link with Terminal ES 120

The terminal was used in connection with the bar code reader and the corresponding BASIC program.

The data exchange is initiated by the terminal. In the RK512 parameters it is stored in which data block the bar code data shall be stored.

If necessary, the DBN-RK can be set up for data security. In that case the terminal will only get a positive acknowledgement after the S5 user program has signaled its ready-to-receive state by setting bit 0 in the reception status and after the data block could be transmitted.

### 4.6.3　Link with the Diskette Station DS 550

The diskette station is used as an external mass storage for DB stored in the PLC. Individual DBs or a group of consecutive DBs can be stored on the diskette under an 11-digit file name. You can use the diskette station DS 550 for that purpose.

Before using the computer link the connector cable between WF 470 (X7) and DS 550 must be installed as well as the corresponding software in the SIMATIC S5. The assignment of the connector cables is given in the README.TXT file of the computer link option diskette.

Together with the module computer link we supply a process picture (USER 0) with the screen form for the operation of the diskette drive.

In the user area 1 of the software diskette you find the a sample file with a test program, more information in the DOK file to the DB 0.

Setting of the **DIL switches** (on the side of the drive DS 550) for operation with WF 470.
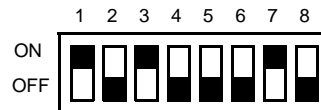


**SIMATIC S5 software**

The software for operation of the diskette drive consists of the FBs *202 to 205*. The FB *204* is called from OB *1*, and the FB *203* from OB *21*. FB *203* internally calls FB *202 (EINRDB)* and FB *205 (DIBL)*.

**Example of block call:**

```
OB 1
Network 1


        :JU FB 204
NAME    :DISK
        :BE


OB 21
Network 1
        :
        :JU FB 203
NAME    :AN-DISK
FEHL    :F4.1
TYPN    :KY 23,196
        :BE
```

　6ZB5 440-0QS02

WF 470 (Description)

Enter the following into the screen form (fig. 4.14):

DATEINAME:                          The name of the file which shall be written or
(File name)                         read.

ZIELDATEI BEI KOPIEREN:             The name of the destination file when copying
(Target file for copying)           from disk to disk.

ZEILE VON .... BIS:                 The No. of the DB to be copied. If only one
(From .... to)                      DB shall be copied, enter its DB No. in both
                                    fields.

                                    If you want to copy several data blocks enter
                                    the first DB No. after VON, the last DB No.
                                    after BIS. The DBs must be found without
                                    gaps in this order.



*Fig. 4.14    Screen form DSK-diskette drive*
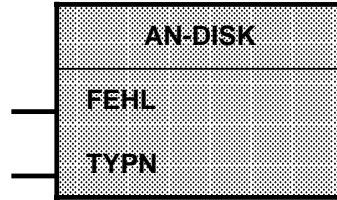
First, the diskette must be formatted:

Via <F1> (continue) and 2 x <F4> (FORM720) the MS-DOS formatting of a
diskette with 720 Kbytes is initiated (1.44 Mbytes capacity not possible at
present). It is not possible, as in MS-DOS, to enter a name for the diskette.

With <F2> you start WRITE, with <F3> READ (press the keys twice).

Via <F4> the output of the directory of the diskette is initiated.

WF 470 (Description)

## Parameterization

**FB 203**

```
        ┌─────────────────┐
        │    AN-DISK       │
        ├─────────────────┤
      ──┤    FEHL          │
        │                  │
      ──┤    TYPN          │
        └─────────────────┘
```

The FBs *202, 204* und *205* have no parameters.

Table 4.26        Parameters of *FB 203*

| Parameter | Meaning | Remark | Kind | Type | Admiss. values |
|-----------|---------|--------|------|------|----------------|
| FEHL | Error bit | | A | BI | F 0.0 to F 199.1 |
| TYPN | No. for COMPU-TER LINK | As parameter, indicate the number of the DBWF fixed in the system data list and the number of the FY "TAST". | B | KY | KY:       DB No., DW No. <br> DB No.: 3 to 253 <br> FY        0 t0 199 |

Table 4.27        Lengths of the function blocks COMPUTER LINK (words)

| | S5-155 U <br> CPU: 946, 947 | S5-115 U <br> CPU: 943, 944 | S5-135 U <br> CPU: 928 |
|--------|--------|--------|--------|
| FB *202* | 96 | 120 | 40 |
| FB *203* | 115 | 115 | 115 |
| FB *204* | 1136 | 1180 | 1135 |
| FB *205* | 161 | 162 | 162 |

WF 470 (Description)

## 4.6.4 Link from WF 470 to WF 470

With the link from WF 470 to WF 470, data can be copied from one SIMATIC S5 to another, provided that the active WF 470 is connected with the passive WF 470 by means of a cable.

Example of the sequence: "Sending data of controller 1 to controller 2":

1. The status word RECEIVE of controller 2 contains $0001_{Hex}$. Controller 1 stores indications regarding source and destination of the data.

Table 28:     Job format in *RK-DB*

| DWn + | Data word | | Remark |
|---|---|---|---|
| | DL | DR | |
| 0 | No sequence message: 0 | 0 | Source |
| 1 | SEND: $41_{Hex}$ | $44_{Hex}$ | |
| 2 | DB No.: 34 | Start address: 10 | |
| 3 | Number: 40 (DW) | | |
| 4 | Reserved | | |
| 5 | No sequence message: 0 | 0 | Destina-tion |
| 6 | SEND: $41_{Hex}$ | $44_{Hex}$ | |
| 7 | DB No.: 38 | Start address: 20 | |
| 8 | Number: 40 (DW) | | |
| 9 | Reserved | | |
| 10 | Status word RECEIVE: $0000_{Hex}$ | | |
| 11 | Status word SEND: $0001_{Hex}$ | | |

2. Controller 1 sends key code $EF_{Hex}$ to the WF 470/1.

3. WF 470/1 reads the DB Computer Link "RK-DB" in and evaluates:

   – Status word SEND bit 0 = 1 (sending job pending);

   – Parameter block destination/direction: SEND job, i.e. controller 1 wants to send data.

4. WF 470/1 fetches source data (40 DW from DB *34* as from DW 10 onwards).

5. WF 470/1 copies parameter block DESTINATION in RK512 header, appends the data just fetched and sends the entire package via the serial interface to the WF 470/2.

6.  WF 470**/**2 receives the data and evaluates the RK512 header:
    Direction = SEND, i.e. the data go to controller 2.

7.  WF 470**/**2 reads RK-DB into controller 2 and waits until status word RECEIVE
    bit 0 = 1 or time-out (abort).

8.  WF 470**/**2 writes data into *DB 38* from DW 20 onwards with length 40.

9.  WF 470**/**2 writes RK512 header into RK-DB destination parameter and resets
    status word RECEIVE bit 0.

10. WF 470**/**2 sends response message "everything okay" to WF 470**/**1.
    Controller 2 can now begin, due to status word RECEIVE bit 0 = 0 to
    evaluate the data, and after termination sets the bit again.

11. WF 470**/**1 resets in the RK-DB of controller 1 the status word SEND bit 0.

If an error occurs, an error code will be entered in the status word SEND or
RECEIVE (see section 4.6.5).

## 4.6.5    Error messages

Error messages are returned

– in the status line of the computer link mask
– in the status word "SEND" or "RECEIVE" of the DBN-RK
– in the first acknowledgement byte of the response message

Table 4.29      Possible error messages

| Signal | Error Code | Description |
|---|---|---|
| AUFTRAG_LÄUFT | 01$_{Hex}$ | A sending or receiving job was recognized, although a running job has not yet been terminated. |
| S5_ÜBETR_FEHLER | 02$_{Hex}$ | Error in data exchange between WF and S5; possible reasons: DB not existent, illegal area or acknowledgement delay. |
| WF_3964R_FEHLER | 03$_{Hex}$ | Error in data exchange between WF and the external device connected via 3964R; for possible reasons, see 3964R error of the status display line. |
| FUNKTION_FEHLER | 04$_{Hex}$ | Inadmissible parameters were entered in MANUAL operating mode. |
| KOORD_FEHLT | 06$_{Hex}$ | Coordination error, e.g. receiver not ready. |
| KOPF_PARAM_FEHLER | 07$_{Hex}$ | Erroneous message head or source/destination parameter in the RK-DB. |
| RIO_EMPF_FEHLER | 08$_{Hex}$ | An error occurred in the reception of data. |
| RIO_SEND_FEHLER | 09$_{Hex}$ | An error occurred in the sending of data. |

## 4.7    Memory Dump KA470

The user data of the WF 470 are stored on SIMATIC S5 storage modules
(cards). The software module KA 470, which is supplied together with the picture
generation software triggers the following functions on the cards:

– Storage of the files on diskette or hard disk (memory dumps)

– Re-transfer of the files to the WF 470

– Generation of a planning directory, with the name PINHV.SYS after the
memory dump.

The software module is executable on PG 685 and PG 7xx in PCP/M or
MS DOS. The module consists of the files KA 470xxx and GENPINHV.SYS.
Please carry out the installation of the software according to section 4.0 and
according to the specifications on the supply diskette.

You call the module via the input of:

**KA470** and actuating the **return key**.

**Notes referring to operation**

1. Help texts for the operation are activated with the function key  <Selection>.

2. The back-up can be started with BACK-UP and START. With LOAD and
   START the backed-up data can be transferred back into the WF 470. By the
   corresponding entries you determine which data are to be transferred
   whereto. Pre-select with key F1.

3. With PINHV GENERATE you generate a process index. The number of
   pictures and text groups must not exceed 50 each.

   The picture generation software expects a system data list on the picture
   diskette. Make sure that the list exists before the generation of the PINHV (if
   necessary, copy it from another diskette). The project name of the system
   data list which was available is entered for check.

4. Upon memory dump, separate files are set up for each protocol and each
   sequence-chain group. Only when generating the PINHV will the protocols be
   combined in the file PROP.SYS and the sequence-chain groups in the file
   LISA.SYS, and the individual files will be deleted.

5. KA470 is also available for MS DOS (with adapter for the serial interface).
   Please read the corresponding information in the file ”README.TXT” on the
   diskette delivered.

6. Once the PINHV has been generated, pictures and test lists can be
   processed with the picture generation software (only on diskette - not on hard
   disk).

   A new PINHV can also be generated with this software, in case that the
   PINHV of a data diskette was destroyed, but the files with pictures and text
   groups are still available.

## 4.8　　　Hardcopy

With the innovated hardware WF 470 it is possible to output hardcopies of the screen on a printer. You can use the following printers:

The function is activated through the key code or via the protocol output. During the printout the current screen content is frozen, flashing and time are stopped.

The printer type, printing format and printing parameters must be set according to section 2.7.3.3.

### Application

You can trigger the function

　　by key code $12_{Hex}$ or

　　via the "protocol output" interface. The protocol output interface is triggered
　　by the output request of the protocol No. 32 (picture flag @
　　$32 = 40_{Hex}$-$33_{Hex}$-$32_{Hex}$ or DW 9 in the transfer area).

If it cannot be excluded that at the moment of hardcopy output the protocol function is running, use this type of triggering, as in this case

– the system will wait for the termination of a possibly running protocol printout,

– the fault message output of the protocol will be disabled and will be activated again after termination of the hardcopy,

– the end command of the hardcopy will automatically be executed.

Upon first triggering, a reset according to (the system data list) is output to the printer.

The explicit terminating command (key code $13_{Hex}$) triggers a page feed and the resetting of the printer and is necessary if the sheet is supposed to be taken out incompletely printed. Otherwise the sheet setting and the internal counter of the module would be out of sync.

### 4.8.1 **Hardcopy with HP PaintJet** (GRACIS-Printer)

Colour mixtures in the WF 470 system data list are taken into account in the printout. The colours produced on the printer may differ from those displayed on the screen.

If parameter "inverse printout" is set (see system data list) the paint pots with the colour

– **black** (red, green, blue = 0%)               are printed out in **white** and

– **white** (red, green, blue = 100%)           are printed out in **black**.

| Print formats: | 1 ≙ | 3 displays per page, | display size (145 x 72) mm |
| | 2 ≙ | 1 display per page, | display size (145 x 144) mm |
| | 3 ≙ | 1 display per page in landscape, | |
| | | | display size (145 x 288) mm |

### 4.8.2 **Hard copy with PT 88** (or compatible printer)

A black-and-white hard copy is produced in normal print from the following colour assignments:

| Colour No. (s. system data list) | Colour assignment with parameter "invers"=0 | Colour assignment with parameter "invers"=1 |
|---|---|---|
| 1, 2, 5 and 6 | black | white |
| 3, 4, 7, and 8 | white | black |

The settings for the paint pots do not affect the printout.

| Print formats: | 1 ≙ | 3 displays per pag, | display size (180 x 90) mm |
| | 2 ≙ | 1 display per page, | display size (180 x 180) mm |
| | 3 ≙ | 1 display per page | display size (180 x 270) mm |

### 4.8.3 **Hard copy with HP DeskJet 550 C**
(display generation software V 5.2 and higher, firmware V 4.3 and higher)

A hard copy is always produced on this printer with the standard colour settings, i.e. changing the paint pots in the system data list does not affect the colours in the printout.

If parameter "inverse" = 1 is set, colours 1 (black) and 8 (white) are reversed.

| Print formats: | 1 ≙ | 3 displays per pag, | display size (174 x 87) mm |
| | 2 ≙ | 1 display per page, | display size (174 x 174) mm |
| | 3 ≙ | 1 display per page in landscape, | |
| | | | display size (130 x 260) mm |

## 4.9 **Display of Curves** (Functions of the V 4.x firmware)

### 4.9.1 **Overview**

From firmware version V 4.0 onwards, it is also possible to display curves with the WF 470 display module. Up to 16 curves with coordinate systems can be defined as single curves or in a set of curves.

A curve is either statically defined (polygon), or it represents the dynamic variation of process data. The variation of a process value can be displayed in dependence on the time or on another process value:

$$y = f(t) \text{ or } x = f(x).$$

Process values for curves are measured cyclically in blocks by the WF 470. By combining it with an appropriate SIMATIC S5 user program, it is, among other things, possible to emulate a plotter function on the screen.

The WF 470 displays polygon curves with predefined corner points. Corner points are defined by means of the SYMBOL picture element and, in process operation, interconnected to make a curve via linearly interpolated lines. The thickness and colour of lines as well as the picture level can be selected.

Curves and coordinate systems that overlap picture elements of a different type have a higher priority than the latter. Therefore, overlaps cause other picture elements to be overwritten. Curves and coordinate systems also can overlap one another. Unlike other picture elements, the WF 470 monitors these overlaps, i.e. if elements overwrite each other, the curve or the coordinate system is correctly updated according to the configured priority (picture level). This priority also determines the order in which curves are output, according to the symbol number selected for the curve. Therefore, when dynamic changes occur in a "low-priority" curve, any portion of a "higher-priority" curve that overlaps it is also replotted.

In order to adapt the output range to the process value or to set the length of the coordinate axes, one so-called scaling element has to be defined per curve. The curve output is limited to the area covered by the coordinate system. A limiting algorithm calculates the exact axis intersection points. The coordinate axes need not be displayed.

One axis of the coordinate system can have a maximum length of 512 pixels in x direction and of 256 or 512 pixels in y direction (depending on the selected screen resolution). The maximum resolution of a curve, i.e. the maximum number of corner points (multiple corner point) is 81. The distance between the corner points and thus the graduation of the axis is calculated automatically from the total number of corner points or - if no coordinate system has been preselected - fixed values are assumed.

When configuring, make sure that no DB limits are exceeded.

## 4.9.2 Configuring

For parameter input, the SYMBOL dialog familiar from picture generation is used. When configuring curves, the actual meaning of some parameters differs from their original meaning. Therefore, table 4.27 shows which values are expected to be entered for the various parameters.
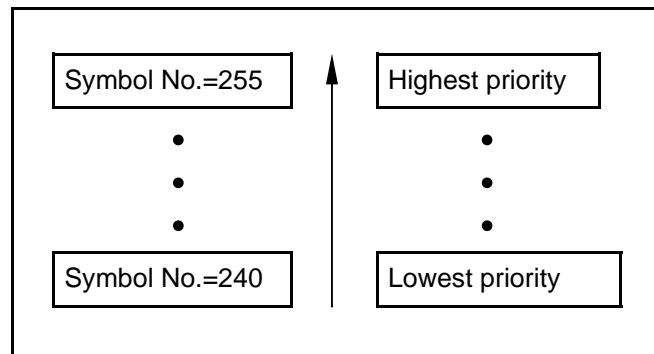
Table 4.31       SYMBOL dialog for configuration of curves

| Parameter | Permissible value range/ input | Meaning |
|---|---|---|
| Start position (X) Start position (Y) | **0 to 511** **0 to 255/511** | X/Y coordinates of the corner point, unit: pixels |
| Colour/symbol change | **N** | Input mandatory! |
| Background colour | **1 to 5** | Type of corner point |
| Foreground colour | | Colour of the curve line |
| Magnification (X) | | Width of the curve line |
| Magnification (Y) | **1 to 16** | Corner point repeat factor |
| Symbol number | **240 to 255** | No. of the curve (priority) |
| Symbol shifting | **Y** | Input mandatory! |
| DB number n DW number n | **1  n  255** | Process data interface    No. of the data block    No. of the first data word |

**Symbol number**          An identical symbol number is used to mark all corner points belonging to the same curve. This means that one picture can contain up to 16 curves.

A curve is always allocated to a picture level. Picture levels are updated according to their priority. By assigning a symbol number, a picture level is also given a level of priority:

| Symbol No.=255 | ↑ | Highest priority |
|---|---|---|
| • | | • |
| • | | • |
| • | | • |
| Symbol No.=240 | | Lowest priority |

WF 470 (Description)

A symbol is only assumed to be the corner point of a curve if no bit is set in the 6×8 matrix of the user symbol table.

**Start position**

The coordinates x and y determine the start position of a corner point. In dynamic updating, parts are added to these (absolute) coordinates that result from the process.

The abscissa and ordinate of the distance between two corner points must not exceed 255 pixels.

**Background colour**

The number has the following meaning:
1: static corner point of the curve ( polygon)
2: X axis, dynamic
3: Y axis, dynamic
4: X- and Y axis, dynamic
5: Scaling point
6: not used
7: not used
8: not used

Correspondingly, the numbers also stand for the following assignments of data that must be entered from DW n onwards (definition of n: see SYMBOL dialog):

1:          no process data evaluation
           (DB/DW No. is ignored)
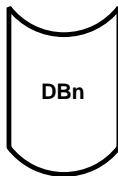
| | | 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 |
|---|---|---|
| 2: | DW n | **X position offset (pixels)** |
| 3: | DW n | **Y position offset (pixels)** |
| 4: | DW n | **X position offset (pixels)** |
| | DW n+1 | **Y position offset (pixels)** |
| 5: | DW n | **KS[1]**    **Length X (pixels)** |
| | DW n+1 | **100% value X** |
| | DW n+2 | **Length Y (pixels)** |
| | DW n+3 | **100% value Y** |

**DBn**

[1] Coordinate system KS, see next page

Data formats       Offset                  integer, dual
                         Lengths, 100% values    absolute, dual

The unit for all lengths is pixels.

Scaling point

Coordinate axes are output according to the definition of the scaling point contained in DW n. The lengths X (DWn and Y (DWn+2) are needed for scaling the curve values and determine at the same time the lengths of the coordinate axes.
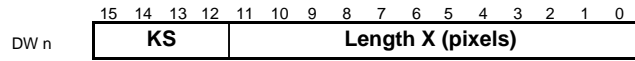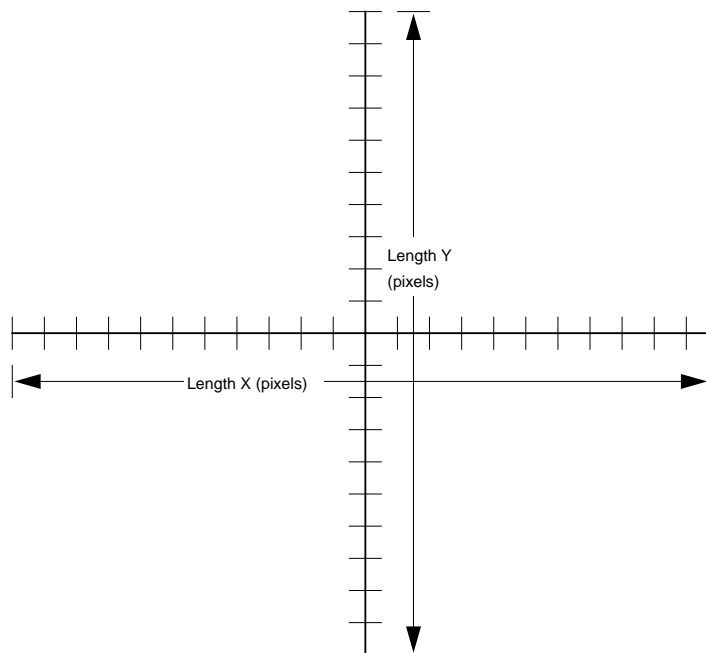
Coordinate system (KS)

| | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DW n | **KS** | | | | **Length X (pixels)** | | | | | | | | | | | |

Table 4.32    Structure of DW n when "5" is entered as "Background colour" parameter

| Bit | Meaning |
|---|---|
| 0 to 8 | Length X in pixels |
| 9 to 11 | not assigned |
| 12<br>13<br>14<br>15 | Coordinate system with   negative Y axis<br>positive Y axis<br>negative X axis<br>positive X axis<br>Any combination that makes sense is possible. |



The coordinate origin is the configured position of the pertinent symbol. The grid has 12 pixels in horizontal and 10 pixels in vertical direction; it is therefore within the range of the semi-graphic display.

6ZB5 440-0QS02
WF 470 (Description)

A coordinate system is only output for the first element of a curve, even if further elements have been defined and scaled and if the pertinent bits 12 to 15 (see above) have been set. Since the curve is output according to the order of entry of the symbols, the coordinate system is "below" the curve.

**Foreground colour**

The curve is plotted in the foreground colour configured in the symbol and deleted with the background colour.

**Magnification (X)**

This parameter defines the line width of the curve (in pixels).

The foreground colour and the X magnification are (re-)defined after each corner point. Thus, the two parameters determine the outward appearance of a curve between the corner points n and n+1 (in the case of a single corner point).

**Magnification (Y)**

With this parameter a corner point repeat factor is configured according to table 4.33. As a rule, the number of corner points is odd, so that the number of axis sections is always even.

Table 4.33        Relationship between repeat factor and number of corner points

| Repeat factor | No. of corner points | Comment |
|---|---|---|
| 1 | 1 | Single corner point |
| 2 | 11 | Multiple corner point |
| 3 | 15 | |
| 4 | 21 | |
| 5 | 25 | |
| 6 | 31 | |
| 7 | 35 | |
| 8 | 41 | |
| 9 | 15 | |
| 10 | 51 | |
| 11 | 55 | |
| 12 | 61 | |
| 13 | 65 | |
| 14 | 71 | |
| 15 | 75 | |
| 16 | 81 | |

These corner points occupy data words in ascending order, beginning with the first data word configured.
Please make sure that no DB limits are exceeded.

| Distances between corner points with coordinate display | The distances between the corner points are calculated with the following formula: |
|---|---|

$$DCP_x = |\,(x_{max} - x_{min}+1)\;/\;(NCP-1)\,|$$

$$DCP_y = |\,(y_{max} - y_{min}+1)\;/\;(NCP-1)\,|$$

with

| DCP | Distance between corner points |
|---|---|
| NCP | Number of corner points |
| $x_{max}$, $y_{max}$ | Coordinate length +configured position (of the multiple corner point) |
| $x_{min}$, $y_{min}$ | Configured position (of the multiple corner point) |

| Distances between corner points without coordinate display | If the coordinates are not displayed (scaling point), the distance between corner points is fixed: |
|---|---|

$$DCP_x = 6 \text{ pixels}$$

$$DCP_y = 10 \text{ pixels}$$

| Multiple corner points | Multiple corner points are placed evenly and with the calculated distance between points on the non-dynamic axis from the configured position onwards. They can be combined at will with single corner points. |
|---|---|
| | A limiting algorithm calculates the exact axis intersection points. |

## 4.9.3  Possible Errors

No curve display in process mode.
Possible causes:

The x/y axis is outside the display space (above 255 or 512 pixels)

User symbols erroneous or not loaded (no bit must be set in the 6×8 character matrix)

## 4.10 Scaling of Variable Fields
(Functions of the V 4.x firmware)

### 4.10.1 Overview

Process values which are displayed or entered in V fields of the module on the operator panel can be assigned a conversion (scaling) factor. The purpose of the conversion is to make most of the display range by using an appropriate scale.

The conversion factor has

an additive part $U_A$
a multiplying part $U_M$ = max. display value **/** max. process value

and is fixed by the control, along with the process data.

For the display of process data, the values are converted as follows:

$$\text{Display value}_i = (\text{process value}_i + U_A) \times U_M$$
(on the operator panel)

Analogously, the following applies for entering setpoints:

$$\text{Process value}_i = (\text{input value}_i / U_M) - U_A$$
(on the operator panel)

The values are calculated on the module on a double-word basis (4 bytes, 7 hexadecimal digits, with intermediate values keeping their 8-byte format. The range of possible values is shown in table 4.34.

Table 4.34    Value range for calculations in scaled V fields

| Data type | Value range | |
|---|---|---|
| | Hex. | Dec. |
| Absolute values | 0 to 0FFF FFFF | 0 to 268 435 455 |
| Integer values | − 0FFF FFFF=F000 0001 to +0FFF FFFF | − 268 435 455 to +258 435 455 |
| BCD transfer types | Permissible decimal digits with data type absolute**/**positive:            8 integer, fixed-point number:    7 | |

With the above data types and transfer type BCD, it is also possible to display hexadecimal numbers on the WF 470. These must not be scaled.

## 4.10.2 Configuring

Field types

The hitherto unused field types are now used *without cyclic updating:*

| Field types | Help text | New meaning |
|:---:|:---:|:---:|
| 3 | I/O field, otherwise like field type 1 | Scaled input/output of process data |
| 4 | Output field, otherwise like field type 2 | Scaled output of process data |

It is not possible to scale mere input fields.
Key-operated switch, mandatory field and automatic field jump cannot be configurated.

In the I/O field (field type 3), the scaling data of the last cycle before the beginning of the input (the cyclic updating is stopped) are taken over as valid.

Data types

Scaling can be used for the following data types:
1   Absolute value
2   Integer
3   Fixed-point number

A scaling of data type 0 (alpha numeric) does not make sense and is therefore not carried out by the module. However, the format of the data interface is not exceeded (see section 4.10.3).

Transfer type

The configured transfer type BCD**/**dual is valid for both process value and conversion factor.

Number of digits

The relevant guidelines apply. Please make sure, however, that the max. number of digits with scaled BCD types is less than with non-scaled fields.

WF 470 (Description)

## 4.10.3    Data Interface

Table 4.35        Memory areas of the data interface

| Data type | Number of digits | Number of reserved DWs |
|---|---|---|
| Absolute value, BCD | 1 to 4<br>5 to 8 | 1<br>2 |
| Sum of digits before and after the point, without sign.<br>Integer, BCD<br>Fixed-p. number, BCD | <br><br>2 to 3<br>4 to 7 | 1<br><br><br>2 |
| Absolute value, binary-coded | 1 to 4<br>5 to 9 | 1<br>2 |
| Sum of digits before and after the point, without sign.<br>Integer, dual<br>Fixed-p. no., bin.-coded | <br><br>1 to 4<br>5 to 9 | <br><br>1<br>2 |
| Alphanum. fields | Number of reserved DWs=No. of digits / 2 + remainder | |

Distribution of data
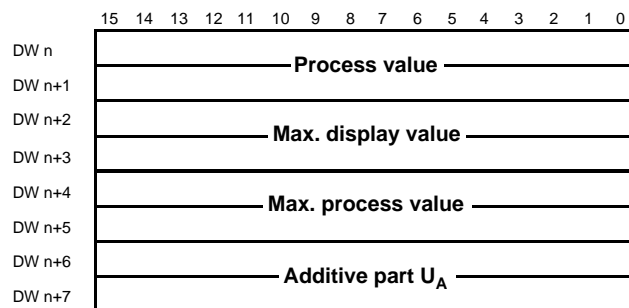


In order to obtain the maximum resolution, memory areas of equal length are created for process value $U_M$ and $U_A$.

WF 470 (Description)

**Example**

Be given: Variable field type 3, integer BCD (7 digits):

| | | | |
|---|---|---|---|
| Current process value | = | 1234567 | (decimal) |
| Max. display value | = | 10000 | (decimal) |
| Max. process value | = | 9999999 | (decimal) |
| Additive part $U_A$ | = | 1000 | (decimal) |

DB100/DWn, n=10

Use: For converting pulses in mm

**The above decimal numbers must be entered exactly as given in the KH format of the data words**.

| | 15 14 13 12 | 11 10 9 8 | 7 6 5 4 | 3 2 1 0 | |
|---|---|---|---|---|---|
| DW 10 | 0 | 1 | 2 | 3 | |
| DW 11 | 4 | 5 | 6 | 7 | KH |
| DW 12 | 0 | 0 | 1 | 0 | |
| DW 13 | 0 | 0 | 0 | 0 | KH |
| DW 14 | 0 | 9 | 9 | 9 | |
| DW 15 | 9 | 9 | 9 | 9 | KH |
| DW 16 | 0 | 0 | 0 | 0 | |
| DW 17 | 1 | 0 | 0 | 0 | KH |

**DB10**

The shown order must be observed.
The value displayed in integer BCD:

$$(1234567 + 1000) \times 100000 / 9999999 = 12355$$

(decimal)

## 4.10.4 Notes on Possible Errors

The algorithm for calculations in scaled V fields uses only integers. Rounding errors of some importance crop up mainly if $U_M$ is not an integer. If $U_M$ is less than 1, an input value can differ from the value calculated and displayed, even if this would not be so according to the mathematical calculation.

In calculation with a scaling factor >1, an overflow may occur in the fields for the (intermediate) results. This leads to erroneous results, although the overflow is not signalled.

When configuring, please bear in mind that rounding and overflow errors may occur, and work only within sensible value ranges.

## 4.11        Converting assignment lists (ZULIWF5)

### 4.11.1     Overview

S5 assignment lists can be converted to WF 470 sequence chain lists with program ZULIWF5. ZULIWF5 replaces program ZULIWF. ZULIWF is no longer compatible with assignment lists level 5.

ZULIWF5 can be run on PG 7xx under MS DOS (S5 levels 5 and 6) and PCP/M as well as on PG 685 under PCP/M (S5 level 5).

The MS DOS version consists of the following files:

>        ZULIWF5.EXE
>        ZULIWF5.TXT
>        ZULIWF5.INI  .

These files can be installed in any directory on the hard disk with the copy function.

The PCP/M version consists of the following files:

>        ZULIWF5.CMD
>        ZULIWF5.INI  .

These files can be installed in any directory on the hard disk, preferably on User 0, with the copy function.
**ZULIWF5.CMD should** be assigned the attribute "SYS".
**ZULIWF5.INI must** be assigned the attributes "DIR" and "RW" if it is to be run under PCP/M because the settings (e.g. drive name) are entered into this file each time it is called.

Calling the program from the PG:

- Input:   ZULIWF5
- Press:  return key

Languages:

-        German, English, French
         With WF 470 configuring package V 1.1 and higher these languages can
         be installed for PG 7xx under MS DOS.

-        German
         Only German is available under PCP/M on PG 7xx and the PG 685

SEQ source file

The assignment lists are not version-dependent and are therefore used exclusively for conversion.
However, they should first be converted without errors to avoid syntax errors.

Colours and texts can be edited in file ZULIWF5.TXT.

No display on LCD display (PG 730):        Command MODE C080 must be
                                           entered in the AUTOEXEC file.

WF 470 (Description)

## 4.11.2 Limit values

| | |
|---|---|
| Maximum size of a sequence chain group | 24 Kbytes |
| Maximum number of lists in one group | 50 |
| Maximum number of operands in one list | 84 |
| Maximum number of characters per line (symbol characters + 1 space (fixed) + comment characters = 50) | 50 |

The following limit values are stored in ZULIWF5.INI in addition to program-resident parameters:

| | |
|---|---|
| Maximum number of operands in a list | 84 MaxOp |
| Maximum number of lists in a group | 50 MaxGr |
| Maximum size of a sequence chain group | 24 Kbyte |

The limiting values are adapted to the current configuration and therefore should not be changed.

## 4.11.3 Screen form "ZULIWF5" display on the PG

```
ZULIWF5                        Version 1.x            Version: xx.x.xx
Drive source:    C: (A,B,C....)            Target: C:   (A,B,C....)
-------------------------------------------------------------------------------
.Seq file:       _____.SEQ    _ .te th of _ files (max 99)
                                 select with (+/-)
transferred files:             available files:       number:
E area:   E___._ - E___._       E___._ - E___._       (E = INPUT)
A area:   A___._ - A___._       A___._ - A___._       (A = OUTPUT)
M area:   M___._ - M___._       M___._ - M___._       (M = MARKER)
T area:   T___   - T___         T___   - T___         (T = TIMER)
Z area:   Z___   - Z___         Z___   - Z___         (Z = COUNTER)

-------------------------------------------------------------------------------
Seq. chain group:    G      _ th of _files   (max 99)
Seq. chain list:     Type: _ _ th of _lists  (max 50)
          < select with (+/-); (tab) for overwriting >
-------------------------------------------------------------------------------
Group name: _____
List name:_____
Symbol transfer:  J(YES='J', NO='N')Comment transfer:J(YES='J', NO='N')
-------------------------------------------------------------------------------
    F1       F2       F3      F4      F5      F6      F7      F8
  Convert  Convert                                        End of
   list     all                                          program
-------------------------------------------------------------------------------
```

## 4.11.4    Notes on operation

### Source/target drive

When the program has been called first select the source and target drive.
The source drive contains the assignment lists, the converted lists are stored on the target drive.
The setting is stored residently and is available for a new program call.

### Cursor/tabulator key

You can select the fields in the screen form vertically with the CURSOR UP and DOWN keys and horizontally with the TAB key.
A set value is accepted every time you leave a field.

### SEQ file selection

Once you have set the drives and selected the field "SEQ file selection" you can select the SEQ file to be converted with the "+" and "-" keys.

### Operand areas

When you exit the "SEQ file selection" field downwards, the SEQ list is loaded and the available operand areas are displayed.

In the left table you can set the areas to be accepted on each pass.

When you have keyed through the operand area table you reach the sequence chain group selection field. Here you can either add to existing sequence chain groups or create new sequence chain groups.
To add to existing groups, select a group by operating the "+" and "-" keys.
To create new groups, enter a new group identifier (after selecting the field "Group identifier" with the TAB key).

### F2: "Convert all"

If you create a new sequence chain group you can trigger automatic conversion by pressing "F2". This function divides into lists and converts **all** the operand areas to be transferred, automatically generating the group designations, list numbers and list designation.

It is **not** possible to add to existing sequence chain groups with the automatic conversion function! In this case the group is completely overwritten after asking for confirmation.

**F1: "Convert list"**

In order to convert individual areas, sequence chain lists, possibly also the type, group and list designation also have to be entered before conversion can be triggered with "F1".

In each case the operand area selected in "Type" is converted.

**Accept symbol/comment**

In fields "Accept symbol" and "Accept comment" you select which information is to be transferred from the SEQ file.

**Storing the sequence chain lists**

Depending on the files that already exist on the target drive, the sequence chain lists are stored as follows after leaving the program:

PINHV.SYS or PINHV.SYS and LISA.SYS exist (standard data diskette of WF 470 display generation software):

– The sequence chain groups are packed into LISA.SYS, the project name set in PINHV.SYS is entered.

– PINHV.SYS is updated.

Processing of the sequence chain groups can then continue with the WF 470 display generation software.

Neither PINHV.SYS nor LISA.SYS exist:

– The sequence chain groups are stored as individual files Gxxx.SYS.

– The sequence chain groups can be loaded onto the module with KA 470.

It is not possible to continue processing of the sequence chain groups with the WF 470 configuring software.

**Leaving the program ZULIWF5**

Press the function key "F8 - End of program".

The F list must always be configured after conversion to the sequence chain group.

     6ZB5 440-0QS02

WF 470 (Description)

## 4.12 Additions to the WF 470 display generation software V 5.2 and higher

### 4.12.1 System data list

The 2nd page of the system data list of

WF 470 display generation software V 5.2 and higher and
WF 470 firmware V 4.3 and higher

has been extended by the following functions:

**Hard copy settings:**   (see Sections 4.8 and 2.7.3.3)

– Printer types:      1 ≙ GRACIS printer (HP PaintJet)
                        2 ≙ PT 88 (or compatible printer, black-and-white hard copy)
                        3 ≙ HP DeskJet 550 C

– Format:               1 ≙ Single height
                        2 ≙ Double height
                        3 ≙ Landscape/portrait format in double width and double height.

The print format is not absolutely proportional to the display on the screen.
Differences can result because of the various possible printer resolutions.

– Inverse display:

                        0 ≙ normal
                        1 ≙ inverse

**Cursor parameters** (cursor type)

| | | |
|---|---|---|
| – Field cursor | 0 ≙ "Old" field cursor, | block with 5 x 3 matrix does not blink |
| | 1 ≙ "New" field cursor, | block with 6 x 9 matrix does not blink |
| | 2 ≙ "Old" field cursor, | block with 5 x 3 matrix blinks |
| | 3 ≙ "New" field cursor | block with 6 x 9 matrix blinks |
| – Window cursor | 0 ≙ "Old" window cursor, | block with 5 x 3 matrix does not blink |
| | 1 ≙ "New" window cursor, | frame in pixel width does not blink |
| | 2 ≙ "Old" window cursor, | block with 5 x 3 matrix blinks |
| | 3 ≙ "New" window cursor | frame in pixel blinks |

## 4.12.2 Cyrillic character set

Cyrillic character set

WF470FNT.MAP (display generation software V 5.1 or
WF470FNT.KYR (display generation software V 5.2)

is loaded with display generation software WF 470 under MS DOS on PG 7xx
only, based on the PG 685 keyboard.

All differences between the display generation software with and without the
Cyrillic character set are only in the above mentioned file. The basic version of
the WF 470 display generation software in each language is not affected.

Capital letters remain unchanged, small letters are output as Cyrillic letters.

**Keyboard assignment using the example of the PG 750:**

| Latin script small letters | a | b | c | d | e | f | g | h | i | j | k | l | m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cyrillic characters | | | | | | | | | | | | | |
| Latin script small letters | n | o | p | q | r | s | t | u | v | w | x | y | z |
| Cyrillic characters | | | | | | | | | | | | | |

Special characters:

| Key | ∧ | Shift ∧ | \ | Shift \ | Shift 6 | Shift { | Shift } |
|---|---|---|---|---|---|---|---|
| Cyrillic characters | | | | | ◯ | | |

The German key assignment must be switched off: **D = OFF**

WF 470 (Description)

**Installation**

– Load file WF470FNT.MAP/KYR, Cyrillic character set for the WF 470 files, in the SIMATIC S5 directory.

– All WF 470 files must be loaded onto drive C only. No other drives are allowed.

– Delete file WF470FNT.MAP/KYR to return to the loaded language versions German, English or French.

– Append command

    This command is used to define a search path for the WF 470 data files so that the display generation software can be called from any directory.

    Called by entering: **WF470** and pressing the
    **return key**

**Printer**

SICOMP printers can be used if the following fonts are installed:

    CYRILLIC SI NLQ,
    DRAFT CYRIL SIE or with a
    CYRILLIC MODULE

for output (see Section 2.7.3.3)


## 4.12.3    Printer driver for WF 470 documentation

File WFDRTRI.EXE is supplied with WF 470 configuring package V 1.2 and higher. With this file, printers that have the IBM control characters stated in Section 2.7.3.1 can be used for WF 470 documentation.

This driver must not be loaded if printers with ECMA control characters are used.

This driver can only be run under MS DOS.

**Activating/deactivating the driver**

– Call with WFDRTRI.EXE        Display: "WFDRTRI.EXE..... installed",
                                i.e. printer driver active

– Renewed call                  Display: "WFDRTRI.EXE....re-installed
                                i.e. printer driver not active

## 4.12.4    Languages

The following languages have been combined for PG 7xx and PG 685 (two separate order nos.) in WF 470 configuring package V 1.2 and higher:

German
English
French

The languages can be loaded under MS DOS or PCP/M.

**Installation**

– PG 7xx / MS DOS

From diskette 1:  • transfer all files in directory DOS/WF470 and
            • all files in the directory of the language version in question
                DOS/DT or
                DOS/ENGL or
                DOS/FRANZ

to the WF 470 directory.

– PG 685 / PCP/M

From diskette 1:  • transfer all files in directory PCPM/WF470 and for language version
                GERMAN copy USER 0 or

From diskette 2:  • for ENGL copy USER 1 or
            for FRANZ copy USER 2.

– APPEND command

This command is used to define a search path for the WF 470 data files so that the display generation software can be called from any directory.

Called by entering:      **WF470** and pressing the
                **return key**

# 5 Commissioning

## 5.1    Prerequisites

Commissioning and handling only by trained personnel and under observation of the local safety regulations.

Floor coverings and plastic shoe soles can effect in persons an electrostatic charging up to many kilovolts. Integrated circuits are, however, very sensitive to such high-voltage dircharges. Therefore, a potential equalization is absolutely necessary.

For the commissioning of the WF 470 the following

- **preparations** have to be made:

    the controllers must have been installed as described in the device manual

    the devices must have been connected

    the configuration must have been made in accordance with the SIMATIC S5 directives.

- **components** have to be available:
    – Module WF 470
    – Memory module 377 (not for WF 470 C)
    – Monitor
    – Programmer
    – Operating keyboard
    – Connection cables from the individual devices
    – Software packages for PG
    – Software package for the SIMATIC S5 (function blocks)
    – Options

---

⚠ CAUTION
_____

*Never touch conductors and components without having yourself discharged before on an earthed part of the plant.*

*Remove or plug in components, modules, bus cables and power supply lines only when the switchboard is switched off (exception: programmers and BAS connectors).*

---

6ZB5 440-0QS02                                 5 – 3
WF 470 (Description)

## 5.2 Visual Check of the Plant

**Overall condition of control and printed-circuit boards**

1. Check the controller for transport damage.

2. Check whether all printed-circuit boards are of the valid version (hardware **and** software).

3. Check all intern cable connection for secure fit of the connectors.

4. The modules should be firmly plugged in the rack. The screws of the holding rails must be tightened.

**Earthing**

5. Connections have to be laid without returns and with the necessary cross section.

**Cable Laying Shielding**

6. An incorrect earthing or no earthing at all will cause interfering signals on the lines.

7. The video cable has to be laid in a seperate channel. The monitor must be connected on the same phase as the central unit or the expansion unit which contains the WF 470.

8. The outer shields of all cables leading from or to modules have to be earthed on suitable shield bars of the controller at the entry into the switchboard.

---

⚠ CAUTION

*Lay power and control lines on principle separately, avoid earth returns.*

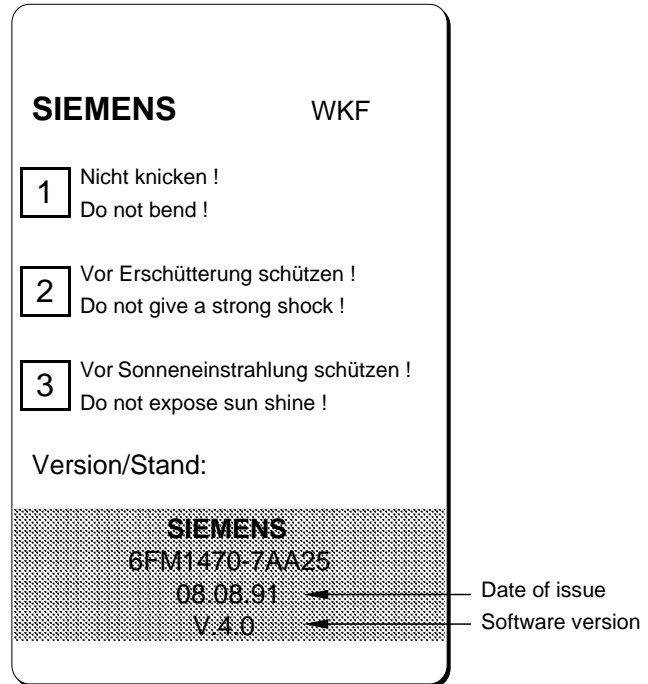*A perfect earthing for bleeding off external interferences is indispensable for a trouble-free operation.*

---

6ZB5 440-0QS02
WF 470 (Description)

## 5.3      Versions

**Hardware**

The version is indicated on the nameplate (front panel).

Updates are communicated by means of revision memos.

**Software**



The software version is also indicated in the system screen form of the WF 470.

## 5.4 Jumper and Switch Positions
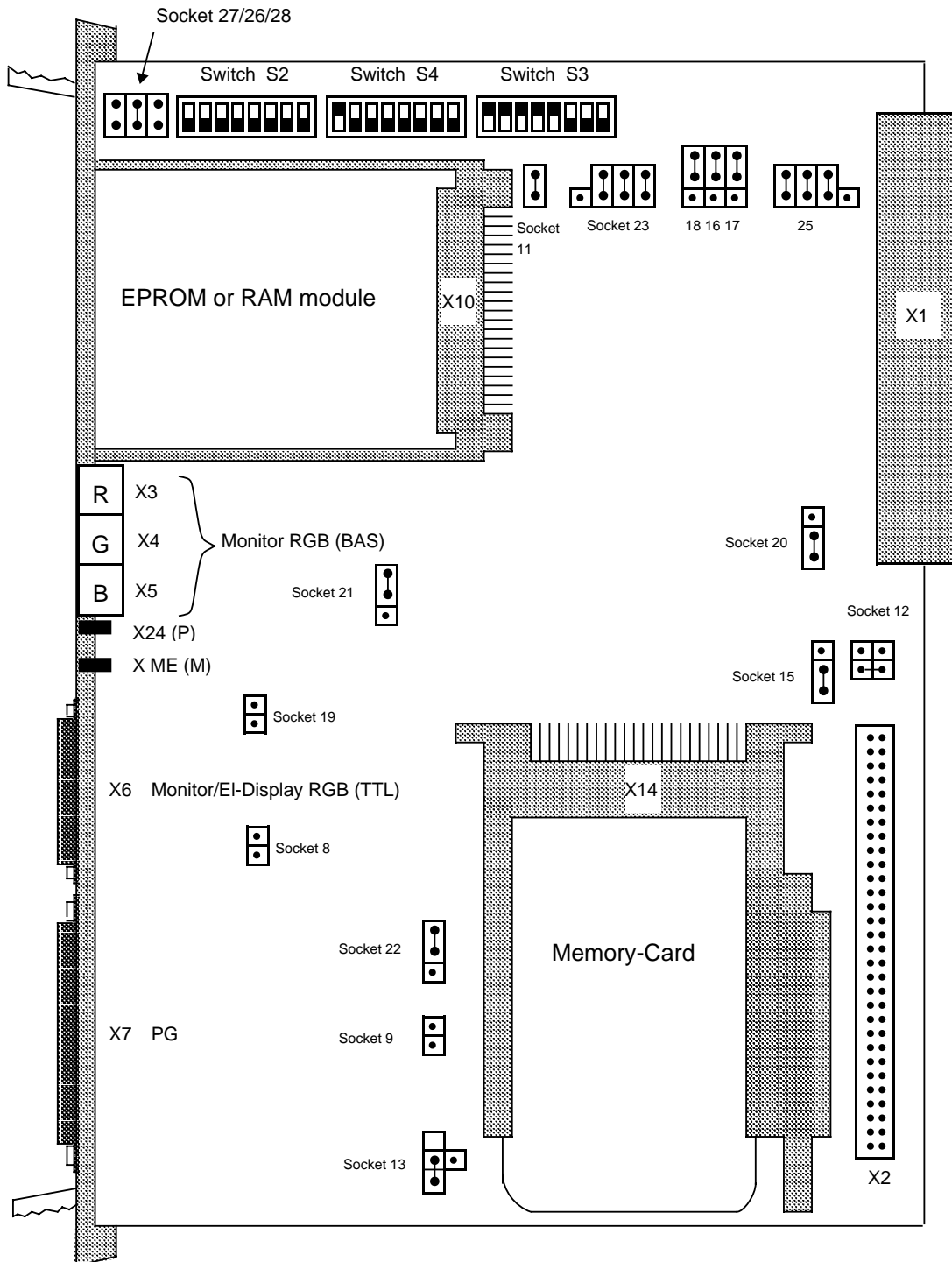
## 5.4.1 Basic Module WF 470 A



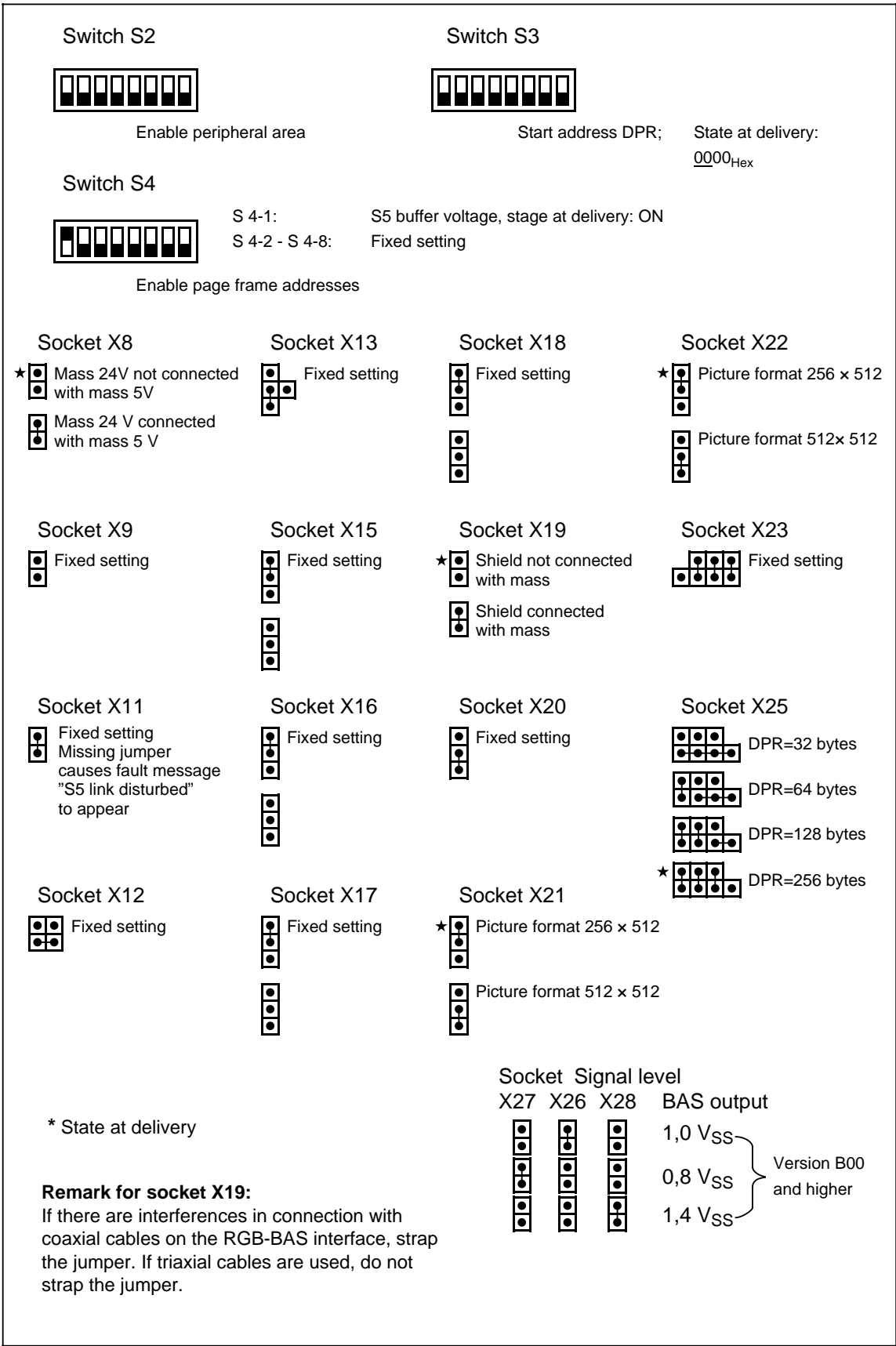*Fig. 5.1     WF 470 basic module: jumper assignment*

WF 470 (Description)

**Switch S2**

Enable peripheral area

**Switch S3**

Start address DPR;  State at delivery:

$0000_{Hex}$

**Switch S4**

S 4-1:  S5 buffer voltage, stage at delivery: ON
S 4-2 - S 4-8:  Fixed setting

Enable page frame addresses

**Socket X8**

★ Mass 24V not connected with mass 5V

Mass 24 V connected with mass 5 V

**Socket X13**

Fixed setting

**Socket X18**

Fixed setting

**Socket X22**

★ Picture format 256 × 512

Picture format 512× 512

**Socket X9**

Fixed setting

**Socket X15**

Fixed setting

**Socket X19**

★ Shield not connected with mass

Shield connected with mass

**Socket X23**

Fixed setting

**Socket X11**

Fixed setting
Missing jumper causes fault message "S5 link disturbed" to appear

**Socket X16**

Fixed setting

**Socket X20**

Fixed setting

**Socket X25**

DPR=32 bytes

DPR=64 bytes

DPR=128 bytes

★ DPR=256 bytes

**Socket X12**

Fixed setting

**Socket X17**

Fixed setting

**Socket X21**

★ Picture format 256 × 512

Picture format 512 × 512

Socket  Signal level
X27 X26 X28  BAS output

1,0 $V_{SS}$

0,8 $V_{SS}$

1,4 $V_{SS}$

Version B00 and higher

**\* State at delivery**

**Remark for socket X19:**
If there are interferences in connection with coaxial cables on the RGB-BAS interface, strap the jumper. If triaxial cables are used, do not strap the jumper.

*Fig. 5.1a  Explanations of Fig. 5.1, variations of jumper settings*
.

6ZB5 440-0QS02  5 – 7
WF 470 (Description)

## 5.4.2    Expansion Module WF 470 B, C

PAL (*programmable array logic)* is a PROM containing the logic for the module selection. PAL D 11 selects module X20, PAL D 14 selects module X30.

X20 (Interface for memory modules)

PAL D 11

X30 (Interface for memory module)

PAL D 14

D 18 (RAM address coding, fixed setting)

Jumper strapped: • T
Buffer battery "on"  • S

X9 (Serial interface)

A    B

Watchdog active

Lithium battery
LS 12420CNA
3,5V-0,8Ah

Switch  102
(not yet used)

*Fig. 5.2     Jumper assignment of the WF 470 expansion module*

## 5.5      Slots in SIMATIC S5 Devices

### 5.5.1      SIMATIC S5-115U

In case of power failure the RAM data will only be buffered correctly by the WF 470 if the latter receives the DSI signal from the power supply unit.

No DSI signal:
  is present on module rack CR 700-0LA12, CR 700-1 of the SIMATIC S5-115U,
  is emitted by the PS 951/31 power supply modules.

Module rack:

CR 700-0LA12

| WF 470 Type | Slots in the central unit | | | | | | |
|---|---|---|---|---|---|---|---|
| | PS | CPU | 0 | 1 | 2 | 3 | IM |
| A | | | ▓ | | | | |
| B, C | | | ▓ | | | | |

Module rack:

CR 700-0LB11

| WF 470 Type | Slots in the central unit | | | | | | |
|---|---|---|---|---|---|---|---|
| | PS | CPU | 0 | 1 | 2 | 3 | IM |
| A | | | ▓ | ▓ | ▓ | | |
| B, C | | | ▓ | ▓ | ▓ | | |

Module rack:

CR 700-1

| WF 470 Type | Slots in the central unit | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PS | CPU | 0 | 1 | 2 | 3 | 4 | 5 | 6 | IM |
| A | | | ▓ | | | | | | | |
| B, C | | | ▓ | | | | | | | |

Module rack:

CR 700-2

| WF 470 Type | Slots in the central unit | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PS | CPU | 0 | 1 | 2 | 3 | 4 | 5 | 6 | IM |
| A | | | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | | |
| B, C | | | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | | |

Module rack:

CR 700-3

| WF 470 Type | Slots in the central unit | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PS | CPU | 0 | 1 | 2 | 3 | 4 | 5 | 6 | IM |
| A | | | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | | |
| B, C | | | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | | |

The admissible slots are marked in grey.

WF 470 (Description)

### 5.5.2  SIMATIC S5-135U (6ES5135-xxxxx)

| Pluggable unit | Slots in the central unit | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 11 | 19 | 27 | 35 | 43 | 51 | 59 | 67 | 75 | 83 | 91 | 99 | 107 | 115 | 123 | 131 | 139 | 147 | 155 |
| **WF 470 A, B, C** | | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▧ | ▧ | ▧ | ▧ | ▧ | ▧ | ▧ | ▧ | ▧ | ▧ | ▧ |

The slots 3 and 163 are not indicated as they are not occupied.

▨ *Address bus 16 bits*  **WF 470 can be operated as a CP module.**

▧ *Address bus 8 bits*  **WF 470 can only be operated as a peripheral module.**

### 5.5.3  SIMATIC S5-155U (6ES5155-xxxxx)

| Pluggable unit | Slots in the central unit | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 11 | 19 | 27 | 35 | 43 | 51 | 59 | 67 | 75 | 83 | 91 | 99 | 107 | 115 | 123 | 131 |
| **WF 470 A, B, C** | | | | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ |

The slots 3 and 139 to 163 are not indicated as they are not occupied.

▨ *Address bus 16 bits*

### 5.5.4  SIMATIC S5-135/155U (6ES5188-xxxxx)

| Pluggable unit | Slots in the central unit | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 11 | 19 | 27 | 35 | 43 | 51 | 59 | 67 | 75 | 83 | 91 | 99 | 107 | 115 | 123 | 131 | 139 | 147 | 155 |
| **WF 470 A, B, C** | | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▧ | ▧ | ▧ |

The slots 3 and 163 are not indicated as they are not occupied.

▨ *Address bus 16 bits*  **WF 470 can be operated as a CP module.**

▧ *Address bus 8 bits*  **WF 470 can only be operated as a peripheral module.**

WF 470 (Description)

## 5.5.5 Expansion units

Module rack:

CR 701-3

| WF 470 Typ | Slots in the expansion unit | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PS | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | IM |
| **A, B, C** | | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | | |

Expansion unit:

EG 185 U

The slots 3, 11 and 147 to 163 are not shown as they are not occupied.

| WF 470 Typ | Slots in the expansion unit | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 19 | 27 | 35 | 43 | 51 | 59 | 67 | 75 | 83 | 91 | 99 | 107 | 115 | 123 | 131 | 139 |
| **A, B, C** | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ |

## 5.6 Address Areas in the SIMATIC S5

The selected address area may not be occupied by another module (pay attention when addressing the page frame!)

## 5.6.1 SIMATIC S5-115U
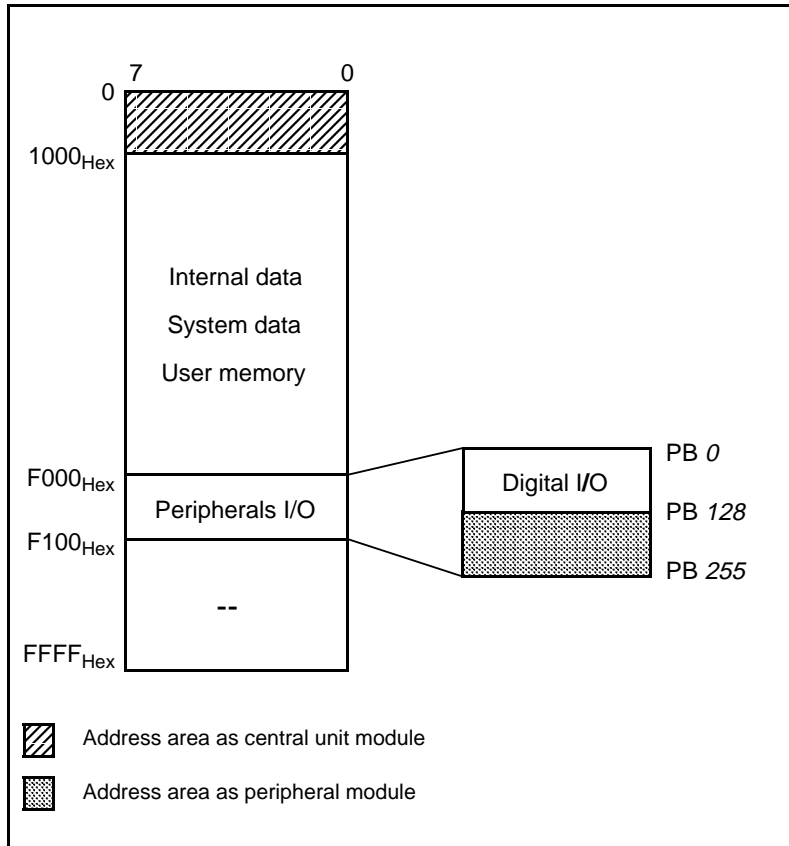


*Fig. 5.3    Address area*

Recommendations for the operation with the SIMATIC S5-115 U:

The WF 470 should

– preferably be used in the address area 0 to $0FFF_{Hex}$ and

– for reasons of cycle time and capacity of the user memory be used with a high-capacity CPU.

WF 470 (Description)

## 5.6.2    SIMATIC S5-135U
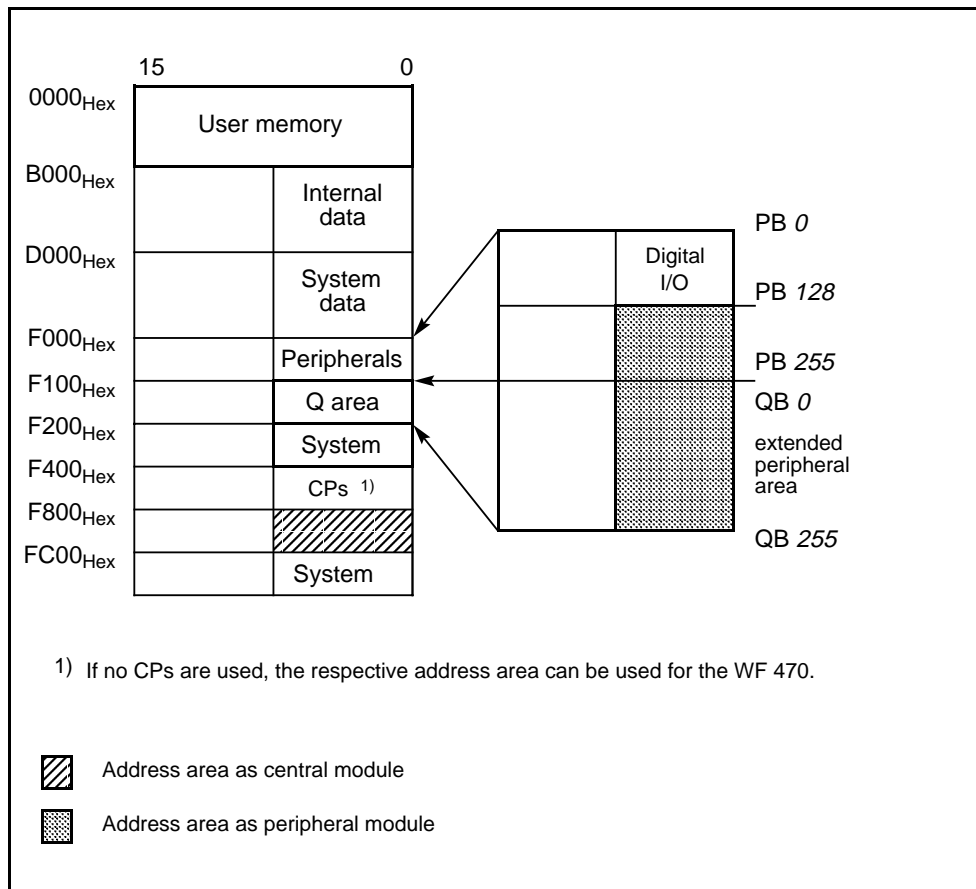


*Fig. 5.4      Address area*

The extended peripheral area is only provided in one expansion unit, which is connected to the central unit via a separate EG interface.

If the extended peripheral area ($F100_{Hex}$ to $F1FF_{Hex}$) is used as a central module for the WF 470, you have to observe the following:

> Peripheral modules must not be plugged into the central unit.
> In the Q area there must be no expansion unit.

Preferably, the WF 470 should be set to $F800_{Hex}$.

For multi-processor operation, the WF 470 has to be allocated to one CPU, as far as the software is concerned.

## 5.6.3  SIMATIC S5-155U



| | |
|---|---|
| F0000<sub>Hex</sub> | |
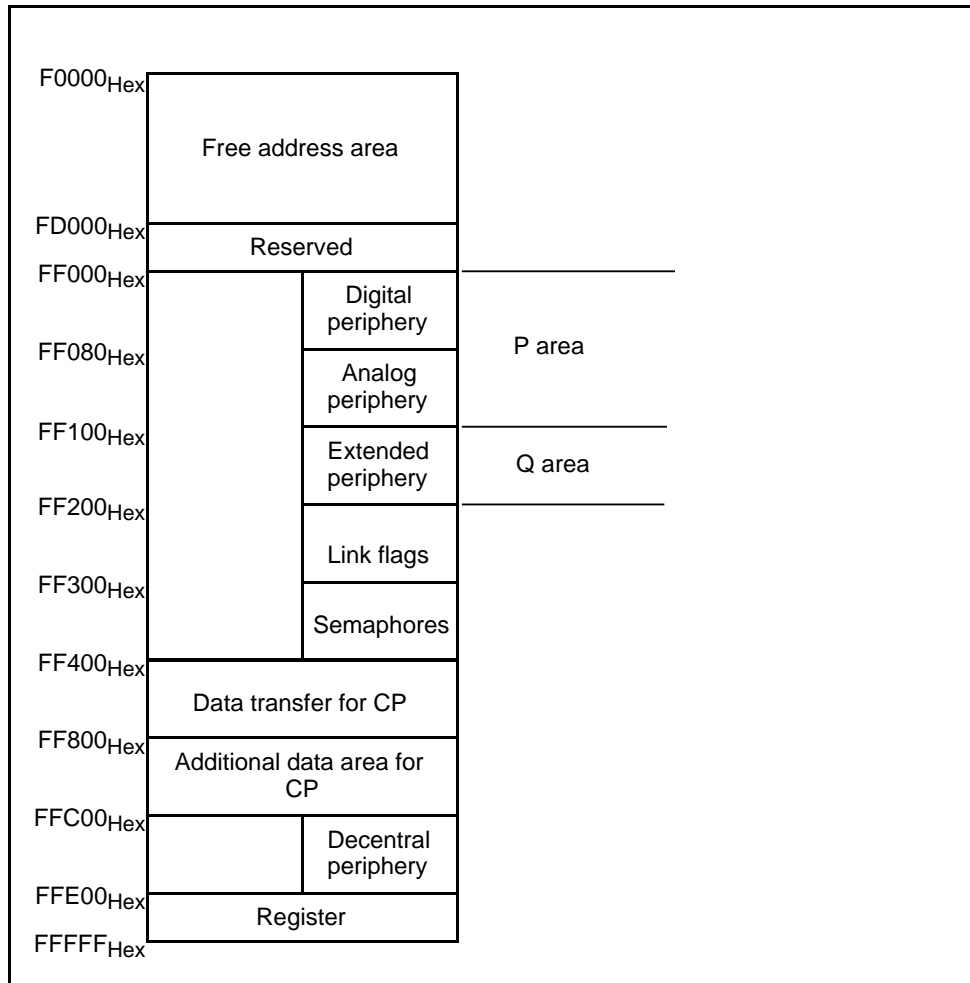
*Fig. 5.5  Address area*

For the addressing of the WF 470 an address area of 52 KB is provided. The free address area goes from F0000$_{Hex}$ to FCFFF$_{Hex}$.

Only the 3rd and the 4th digit of the start address have to be set (as in other SIMATIC S5 controllers); the 5th digit will be automatically filled with F$_{Hex}$.
Example:    F**CF**00$_{Hex}$
                    Address setting on the switch 3:  **CF**
For more detailed information about addressing see section 5.7.

WF 470 (Description)

## 5.7 WF 470 as a Module in the Central Unit

For the operation as a module in the central unit, the WF 470 has to be plugged into one of the slots according to section 5.5.

The DPR has a fixed length of 256 bytes and is preset on socket 25 when the module is delivered. The start address has to be set according to the central unit type (section 5.6) and can be changed with switch S3 on the basic module: as the address is only selectable in increments of 256 bytes ($100_{Hex}$), only the first two hexadecimal digits are to be set.
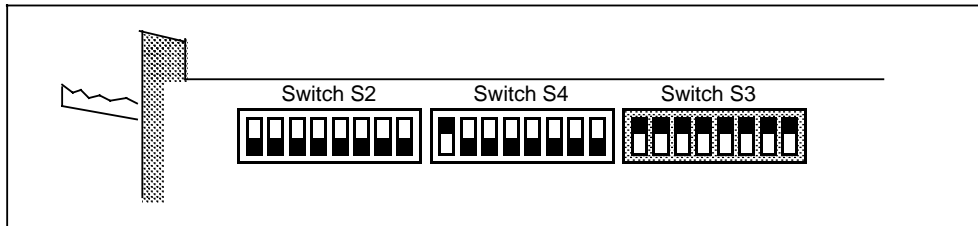


### Start Address DPR on Switch S3

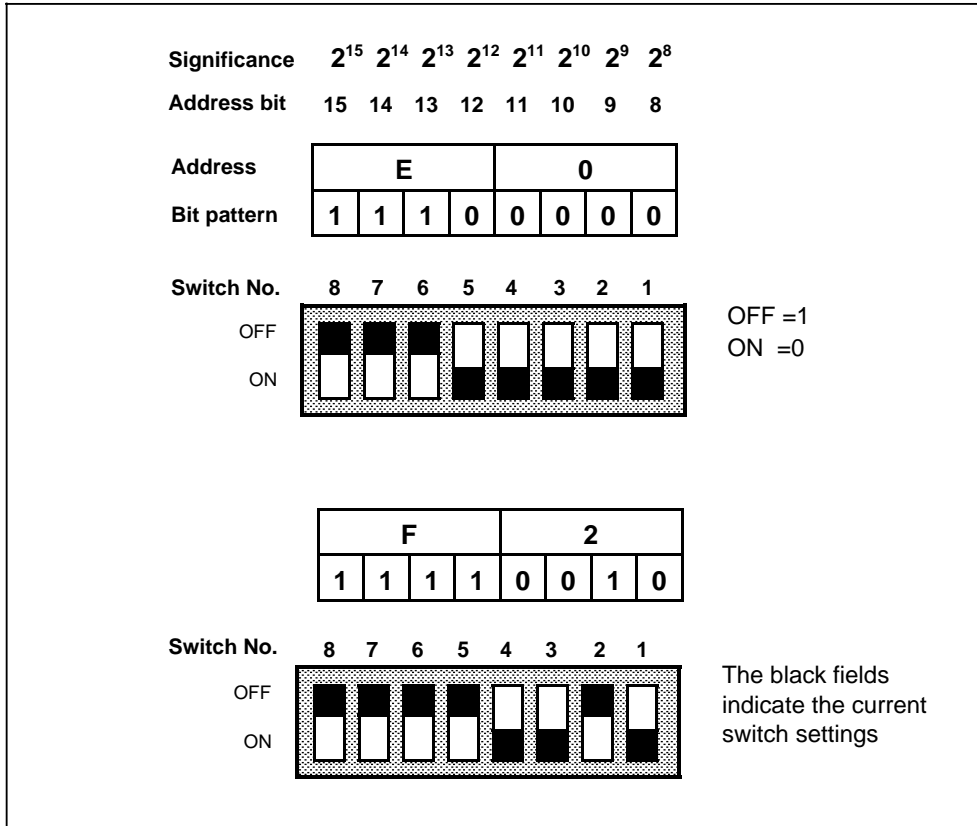- **State at delivery ($0000_{Hex}$)**
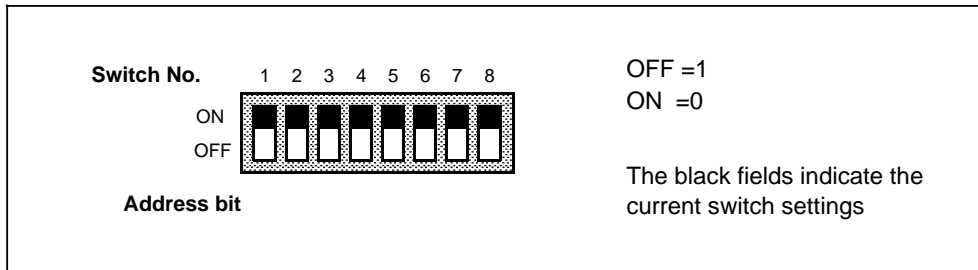


For allocating bit patterns to switch positions (coding of an address as a switch position), the module must be rotated like this:
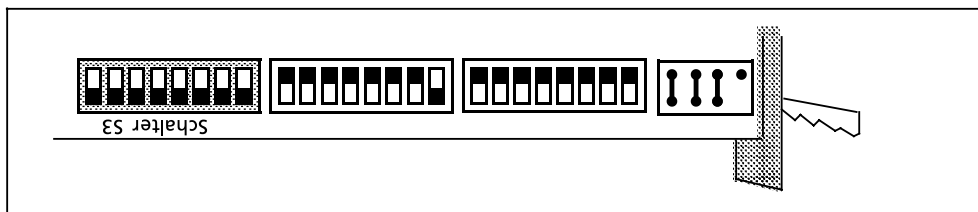


Now:    Switch top position (OFF):    Bit=1
        Switch bottom position (ON):    Bit=0

WF 470 (Description)

• **Examples of Other Settings**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Significance** | | $2^{15}$ | $2^{14}$ | $2^{13}$ | $2^{12}$ | $2^{11}$ | $2^{10}$ | $2^9$ | $2^8$ |
| **Address bit** | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |

**Address**

| E | | | 0 | | | |
|---|---|---|---|---|---|---|

**Bit pattern**

| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|

**Switch No.**   8  7  6  5  4  3  2  1

OFF

ON

OFF =1
ON =0

| F | | | 2 | | | |
|---|---|---|---|---|---|---|---|

| 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 |
|---|---|---|---|---|---|---|---|

**Switch No.**   8  7  6  5  4  3  2  1

OFF

ON

The black fields
indicate the current
switch settings

Set all jumpers and switches not mentioned here according to the state at
delivery (see fig. 5.1 and 5.2).

WF 470 (Description)

## 5.8    WF 470 as a Peripheral Module

The WF 470 should only be used as a peripheral module if this is inevitable, as peripheral locations are assigned in the analog area and data transmission is slower because of the small DPR length.

For the operation as a peripheral module, the WF 470 has to be plugged into a slot according to section 2.4.2 or 5.5.
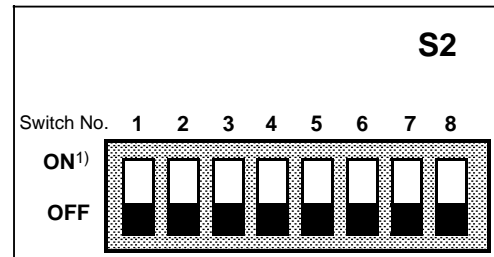
**DPR length:**

The DPR length can be set to 32, 64, 128 or 250 bytes via socket X25.



32 byte    **X25**

64 byte

128 byte

256 byte
(legal only in the Q area)
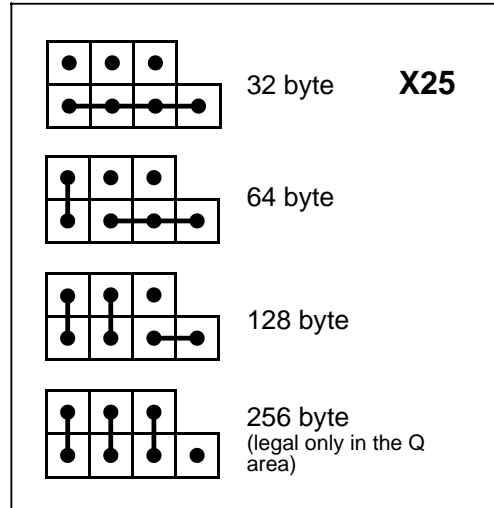
**Enabling of the DPR:**

The enabling of the DPR area is set via switch 2. Areas larger than 32 bytes are set by switch combinations according to table 5.1 (example see next page).
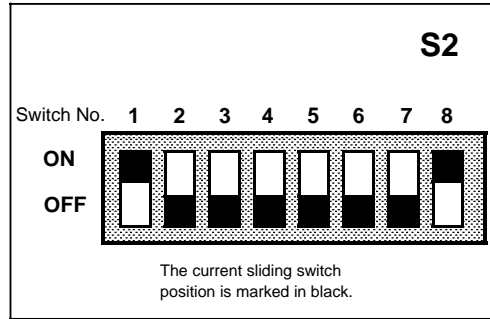


**S2**

Switch No.    **1    2    3    4    5    6    7    8**

**ON**[1)]

**OFF**

1) ON = Enable

Tab. 5.1

| Switch | Peripheral byte | Remark |
|--------|-----------------|--------|
| 1 | 192 to 223 | |
| 2 | 160 to 191 | |
| 3 | 128 to 159 | |
| 4 | 96 to 127 | |
| 5 | 64 to 95 | Only for use in the **Q area**, otherwise all OFF |
| 6 | 32 to 63 | |
| 7 | 00 to 31 | |
| 8 | 224 to 255 | |

WF 470 (Description)

**Example:**

DPR area of peripheral byte
(PB) *192 to 255 =*
*PB 192 to 223+PB 224 to 225:*
Length: 64 bytes
Start address F0C0$_{Hex}$

All jumpers and switches not
mentioned here remain in the
state at delivery.

| | | | | | | | | | S2 |
|---|---|---|---|---|---|---|---|---|---|---|
| Switch No. | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | |

ON
OFF

The current sliding switch
position is marked in black.

The DPR must not lie in the peripheral area with process picture.

The start address can only be set in increments of the DPR length (socket 1).

For the different DPR lengths, the following addresses apply:

Tab. 5.2

| Start address | | DPR length (bytes) | | | | Remark |
|---|---|---|---|---|---|---|
| PB | Absolute (Hex) | 256 | 128 | 64 | 32 | |
| 128 | F080 | | x | x | x | **P area** (all controllers, analog area) |
| 160 | F0A0 | | | x | x | |
| 192 | F0C0 | | | x | x | |
| 224 | F0E0 | | | | x | |
| 0 | F100 | x | x | x | x | **Q area** (only in the extended peripheral area) |
| 32 | F120 | | x | x | x | |
| 64 | F140 | | x | x | x | |
| 96 | F160 | | x | x | x | |
| 128 | F180 | | x | x | x | |
| 160 | F1A0 | | | x | x | |
| 192 | F1C0 | | | x | x | |
| 224 | F1E0 | | | | x | |

## 5.9 Hints for Troubleshooting

This section only deals with eliminating gross malfunctions.
When trouble occurs, we recommend that you do the following:

1. Find out first whether the reason of the fault lies in the SIMATIC S5 or in the WF 470.

   An analysis of the DPR (section 5.12) is very useful for this.

2. Check whether the prerequisites are fulfilled for such an analysis:

   Module correctly addressed?

   Standard software correctly parameterized?

   Are these prerequisites not met or does the SIMATIC S5 go into STOP state with acknowledgement delay?

3. Make sure that the SIMATIC S5 is running cyclically and that it processes the dual-port RAM.

   If the module responds to keyboard signals from the standard software (e.g. 11h via TAST=Reset), it may fairly be assumed that this is true.

4. If it is not possible to spot and eliminate trouble, consult your nearest serving department.

## 5.10 Error Messages of the WF 470

| Error No. | Meaning | Comment |
|---|---|---|
| 01 | Superfluous processing function | |
| 02 | Processing function missing | |
| 03 | Direct and indirect symbol select. parameterized | |
| 04 | System RAM too small | |
| 06 | Illegal area indication via DPR | DB too short |
| 07 | Illegal data request via DPR | DB missing |
| 08 | SIMATIC S5 does not process DPR | Acknowledgement delay |
| 09 | Symbol list missing | |
| 10 | Selected picture does not exist | |
| 11 | Symbol outside screen | |
| 12 | Composite symbol outside screen | |
| 13 | Text group missing for called picture | |
| 14 | System data list missing | |
| 15 | Option Protocol not loaded | |
| 16 | Protocollable elements missing | |
| 17 | Protocol messages through more than 3 DB | |
| 18 | RAM (modules) too small | |
| 19 | Printer unclear | |
| 20 | System RAM request fault | Remedy: initial reset, RAM in 3rd slot |
| 21 | System RAM return fault | Remedy: initial reset, RAM in 3rd slot |
| 22 | Hardware configuration insufficient | |
| 23 | Option "Sequence-Chain Analysis" not loaded | |
| 24 | Option " Service Module" not loaded | |
| 25 | Protocol output not possible | |
| 26 | GRAPH5 missing | |
| 27 | Selected option missing | |
| 28 | RK_3964R fault | |
| 31 | No plain text | Faulty protocol list |
| 35 | More than 254 lists | |
| 100 to 115 | Error messages in the system message line (on the screen), to be used by the user | Text in text group "#SK" text list 006, see sect. 4.0 |

WF 470 (Description)

## 5.11    Analysis of the Dual Port RAM

The data exchange between the SIMATIC S5 and the WF 470 is organized via the coordination area of the DPR. Tables 5.3 to 5.5 show the layout of the coordination area and the meaning of the individual lists.

The data exchange between the SIMATIC S5 and the WF 470 is usually initiated by the module. For example, a data block is requested

–  by the module assigning 08h to byte 0,
–  by entering in byte 1 the desired DB No.,
–  by entering in bytes 2 and 3 the first data word to be transferred and
–  by entering in byte 4 the number of the data words desired.
–  Additionally the job bit 4 in byte 7 is set to 1.

Due to this job, the link FB transfers the desired data block to the DPR from byte 12 onwards and acknowledges on byte 6 with bit 4. The transferred data are processed by the WF 470 and the request bit in byte 7 is reset.

The SIMATIC S5 in its turn acknowledges by resetting bit 4 in byte 6. Then the module can give a new job.

Only picture selection and the "TAST" byte are initiated by the SIMATIC S5.

Table 5.3        Structure of the DPR

| DPR Byte | Name | Comment |
|---|---|---|
| 0 | Data identification | See table 5.4 |
| 1 | DB No. | The DB number is valid in connection with the data identification $08_{Hex}$ or $88_{Hex}$ (transfer of a data block). Value range: 1 to 255 |
| 2<br>3 | Start address of the data transmission<br>(Byte 2: higher order,<br>Byte 3: lower order) | Address from which onwards the data shall be transferred (e.g. for a DB: from which DW onwards). The interpretation depends on the data identification. |
| 4 | Number of data/area | The information depends<br>– on the length of the DPR<br>– on the admissible value range  (FW 240) |
| 5 | Key byte | The keyboard signals are transferred to the module via this byte. |
| 6 | S5 acknowledgement | Via these bytes, information transfers are requested and acknowledged. Each bit of a byte corresponds to a bit in the other byte. Either partner (SIMATIC S5/ WF 470) writes only in the byte allocated to it, the other byte can only be read by it (exception: reset during start-up through the WF 470). If a partner recognizes the change of a bit through the other partner, it will acknowledge this by setting its correspondent bit to the same level. For details, see table 5.5. |
| 7 | WF acknowledgement | |
| 8 | Picture No. 1 | Bytes 8, 9, 10 correspond to the parameters BLD1 to BLD3 of the FB *S5-WF470*. Purpose: Direct picture selection through the SIMATIC S5 or the acknowledgement of the picture number. |
| 9 | Picture No. 2 | |
| 10 | Picture No. 3 | |
| 11 | Status byte | This byte must be set by the slave before acknowledgement of a transfer request.<br><br>Status        Meaning<br><br>$00_{Hex}$        Tranfer terminated without displays<br>            Send:              Data are valid<br>            Receive:          Data are accepted<br>$FE_{Hex}$        Dta request illegal<br>            (Data not existent)<br>$FD_{Hex}$        Illegal area indication<br>$FC_{Hex}$        Illegal picture number (picture number was refused by the SIMATIC S5) |

WF 470 (Description)

**Details concerning table 5.3:**

Table 5.4 Data identification in byte 0

| Bit | Data identification | |
| --- | --- | --- |
| | Value | Meaning |
| 0 to 3 | 1 | Input word |
| | 2 | Output word |
| | 3 | Flag word |
| | 4 | Counter |
| | 5 | Timer |
| | 6 | Peripheral word |
| | 7 | (illegal) |
| | 8 | Data block |
| | 9 | Data transfer WF 470   SIMATIC S5: Picture No. |
| 4 to 6 | – | – |
| 7 | 0 | Data transfer SIMATIC S5   WF470 |
| | 1 | Data transfer WF 470   SIMATIC S5 |

Table 5.5 Assignment of bytes 6 and 7

| Bit | Meaning of the bits | |
| --- | --- | --- |
| | SIMATIC S5 acknowledgement | WF 470 acknowledgement |
| 0 | No function | No function |
| 1 | No function | No function |
| 2 | Request to WF 470: read keyboard byte | Acknowl. to SIMATIC S5: keyboard byte processed |
| 3 | Key-operated switch SIMATIC S5 | |
| 4 | Acknowl. to WF 470: data processed | Request to SIMATIC S5: read/write data |
| 5 | Picture selection SIMATIC S5 | Acknowl. of picture selection |
| 6 | Acknowl. of the start-up bit | Start-up bit |
| 7 | Coordination SIMATIC S5 – WF 470 | Coordination SIMATIC S5 – WF 470 |

Bits x.7: Coordination and start-up bit are set (in the DPR) by the module in byte 7 upon switch-on of the plant and acknowledged by the SIMATIC in byte 6.

Bits x.5: In connection with bytes 8 to 10, the direct process picture selection is effected with this bit by the SIMATIC S5.

WF 470 (Description)

WF 470 (Description)

# 6      Appendix

WF 470 (Description)

## 6.1 Abbreviations

| | |
|---|---|
| **DB** | Data block |
| **DE** | Data input |
| **DL** | Left-hand data byte (of a DW) |
| **DPR** | Dual Port RAM |
| **DR** | Right-hand data byte (of a DW) |
| **DW** | Data words (2 bytes) |
| **<F1>** | Strings like this mean: use function key F1 |
| **FB** | Function block |
| **FW** | Flag word |
| **KA** | Criteria analysis |
| **KBI** | Sequence block |
| **OB** | Organization block |
| **PB** | Program block |
| **PG** | Programmer |
| **PLC** | Programmable controller |
| **SB** | Sequence block |
| **Terminal** | I/O device |

## 6.2 Literature on the WF 470

| Documentation | Order No. |
|---|---|
| **/1/** WF 470 Display System<br>**Planning Guide** | 6ZB5 440-0FH02-0AA0 |
| **/2/** WS 495/WS 496 Operator Interface System<br>**Description** | 6ZB5 440-JX02-0BA1 |
| **/3/** WS 400-10/20/22 Operator Panels<br>**Product Brief** | 6ZB5 440-0AK02-0BA1 |
| **/4/** WS 400-10/20/22 Operator Panels<br>**Description** | 6ZB5 440-0AR02-0BA3 |
| **/5/** WS 400-30/WS 400-50 Operator Panels<br>**Description** | 6ZB5 440-0KP02-0BA3 |
| **/6/** WF 470 Display System<br>**Product Brief** | 6ZB5 440-0TM02-0BA0 |
| **/7/** WF 470 Display System<br>**Technical Description** | 6ZB5 440-0QS02-0AA5 |
| **/8/** WS/WF Series - Systems and Components<br>**Catalog AR 10** | E86060-K6310-A101-A4-7600 |

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# Equipment
# for
# special
# machines

## WS 400/WF 470

# Handbook
## Technical
## Description