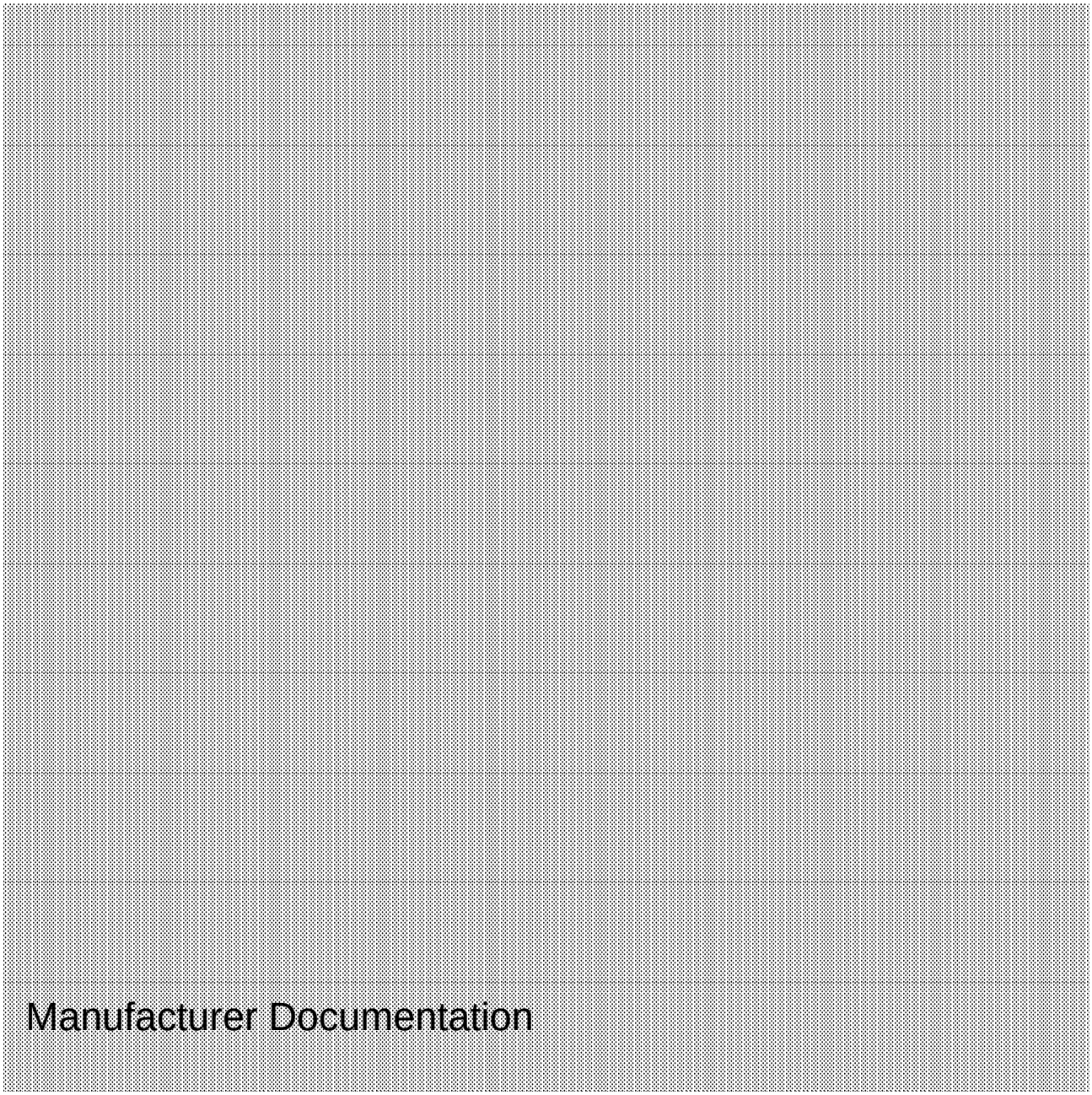
SIEMENS

# SINUMERIK 805
# Software Version 4
# Interface Description
# Part 1: Signals

Planning Guide 05.93 Edition



Manufacturer Documentation

# SINUMERIK 805
# Software Version 4
# Interface Description
# Part 1: Signals

**Planning Guide**

**Manufacturer Documentation**

**May 1993 Edition**

## SINUMERIK® documentation

### Printing history

Brief details of this edition and previous editions are listed below.

The status of each edition is shown by the code in the ”Remarks” column.

*Status code in* ”Remarks” *column*:

**A** . . . New documentation **B** . . . Unrevised reprint with new Order No.
**C** . . . Revised edition with new status. If factual changes have been made on the page since the last edition, this is indicated by a new edition coding in the header on that page.

| Edition | Order No. | Remarks |
|---|---|---|
| 01.90 | 6ZB5 410-0BU02-0BA0 | **A** |
| 09.90 | 6ZB5 410-0BU02-0BA1 | **C** |
| 01.91 | 6ZB5 410-0BU02-0AA2 | **C** |
| 11.91 | 6ZB5 410-0BU02-0AA3 | **C** |
| 05.93 | 6ZB5 410-0BU02-0AA4 | **C** |

Other functions not described in this documentation might be executable in the control. This does not, however, represent an obligation to supply such functions with a new control or when servicing.

This publication was produced on the Siemens 5800 Office System.
Subject to change without prior notice.

# Preliminary Remarks

## General Remarks

This manual is intended for the manufacturers of machine tools using SINUMERIK 805.

The Guide describes the interface signals which are transferred between the machine, the NC and the PLC. It also describes the signals which are made available by the PLC system.

This documentation is directed at qualified technical personnel who have been specifically trained in or possess the requisite knowledge of instrumentation and control technology, referred to in the following as automation technology.

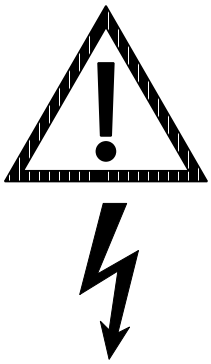
Familiarity with and technically correct observation of the safety instructions and warnings are essential for safe installation and start-up as well as for safety during operation and maintenance of the product. Only qualified personnel are in a position to correctly interpret and implement the safety instructions and warnings described in general terms in the documentation.

## Technical Comments

- As from Section 3, the interface signals in the Signal Descriptions are written in capital letters (e. g. READ IN DISABLE).
- The interface signals in the display of signal sequences are represented by thick lines. Thin lines represent symbolic signal sequences or internal messages.
- Signals whose names are preceded by a * are so-called inverse signals i.e. an effect is produced by a 0 signal and not a 1 signal (e.g. *DECELERATION)

***This documentation is valid for software version 4***

## Safety Guidelines

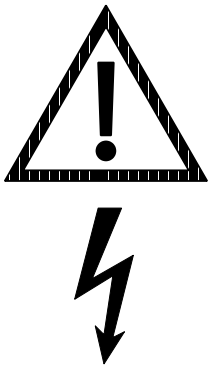


**WARNING**

When electrical devices are in operation, certain parts of them are inevitably subjected to hazardous voltages.

**Improper** interference with the device/system or failure to observe the warning advice can result in serious physical injury or material damage. Only appropriately **trained personnel** familiar with the assembly, installation, starting up or operation of the product are permitted to interfere with this device/system.

**Qualified personnel**



**WARNING**

As far as the safety advice (contained in the documentation or as a sticker on the product) is concerned, ”qualified personnel”refers to persons who, for instance:

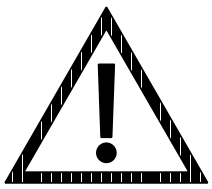
- have received training or instruction and authorization to energize and deenergize, earth and tag electric circuits and devices according to established safety practices.
- have received training or instruction according to established safety practices in the care, use and repair of appropriate safety equipment.
- have received training or instruction in working with electrostatically sensitive components or modules.
- have been instructed as operators to work with automation technology equipment and are familiar with the contents in the Operator's and/or Programming Guide referring to operation.

***When planning, installing, starting up and operating the control, the personnel concerned must be familiar with the documentation relevant to their jobs.***

**Notes on danger**

The following notes are provided for your personal safety and to protect the product described here or connected devices and machines against damage.

Safety advice and warnings intended to avert danger to human life and health and to avoid material damage are highlighted in this Manual by the terms defined here. The terms have the following meanings in the context of this Manual and the remarks on the product itself:



**WARNING**

As far as this Manual and the warning advice on the products themselves are concerned, ”warning” refers to instances where death, serious physical injury or considerable material damage **can** result if proper precautions are not taken.

**CAUTION**

As far as this Manual and the warning advice on the products themselves are concerned, ”caution” refers to instances where slight physical injury or material damage can result if proper precautions are not taken.

***”Note” refers to important items of information about the product or the part of the Manual to which particular attention must be paid.***

**Proper Usage**

- The equipment/system or the system components may only be used for the applications described in the catalog or the technical description, and only in combination with the equipment, components and devices of other manufacturers as far as this is recommended or permitted by Siemens.
- The product described has been developed, manufactured, tested and the documentation compiled in keeping with the relevant safety standards. Consequently, if the described handling instructions and safety guidelines described for planning, installation, proper operation and maintenance are adhered to, the product, under normal conditions, will not be a source of danger to property or life.

**Notes on configuring the product**

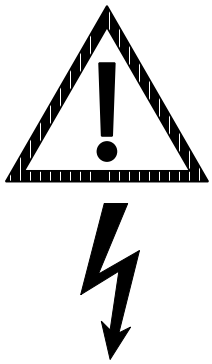
These notes are intended to serve as a guideline for avoiding dangers when integrating this product in its environment since the product is generally used as part of a greater system or plant.

The following facts are of particular importance:

***Even if a maximum degree of safety has been incorporated in the design of automation equipment, e.g. by the use of multiple channels, it is still essential to meticulously follow the instructions given in the documentation because incorrect handling can make ineffective any measures that have been provided to prevent the occurrence of dangerous faults and additional hazards can result.***

**Active and passive faults in an automation system**

- Depending on the type of automation system, both **active** and **passive** faults can be **dangerous**. In a drive control, for example, the active fault is generally dangerous because it results in the drive being switched on without authorization. By contrast, a passive fault can prevent a dangerous state of operation from being reported in the case of a signalling function.
- This distinction of possible faults and their task-specific characterization as dangerous or harmless is important for all safety considerations concerning the delivered product.



**WARNING**

Wherever faults in the automation equipment can cause substantial material damage or even physical injury, i.e. wherever dangerous faults can arise, additional external measures must be introduced or equipment must be provided to ensure or force safe operating conditions even if a fault occurs (e.g. by means of independent limit monitors, mechanical interlocks etc.).

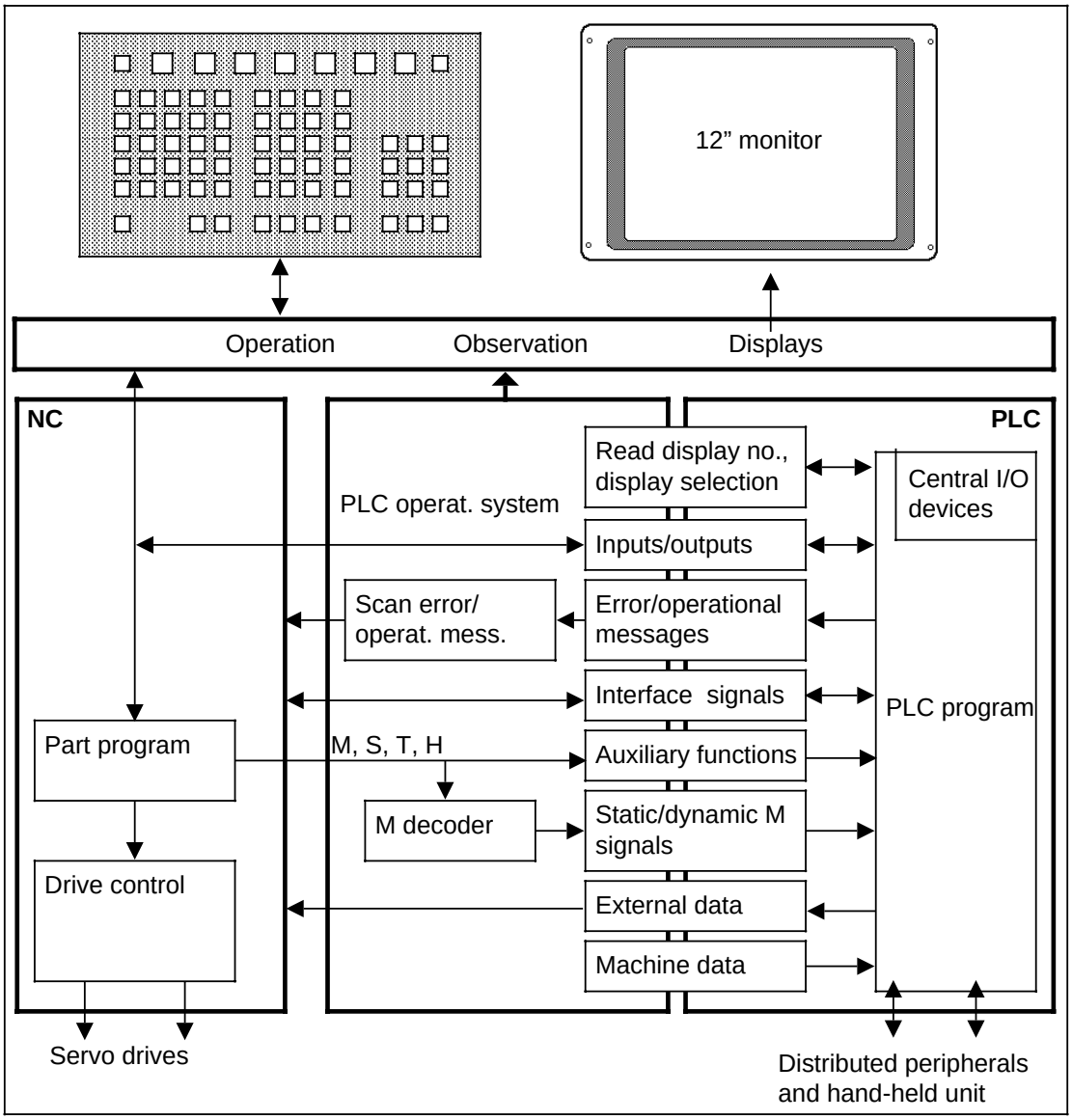
## Contents

# 1 Control Structure

The SINUMERIK 805 is a universal CNC automation unit and can be used in a large variety of applications. It consists of the following parts

- central controller
- operator keyboard
- monitor
- hand-held unit
- distributed machine peripherals

In addition to the NC control units, a programmable logic controller (PLC) in the form of a software PLC is also integrated in the compact central processing unit. The PLC program is executed by the NC processor which is supported by a specially developed coprocessor.




*SINUMERIK 805 functional structure*

A considerable load is taken off the PLC user memory by relocating standard functions, such as:

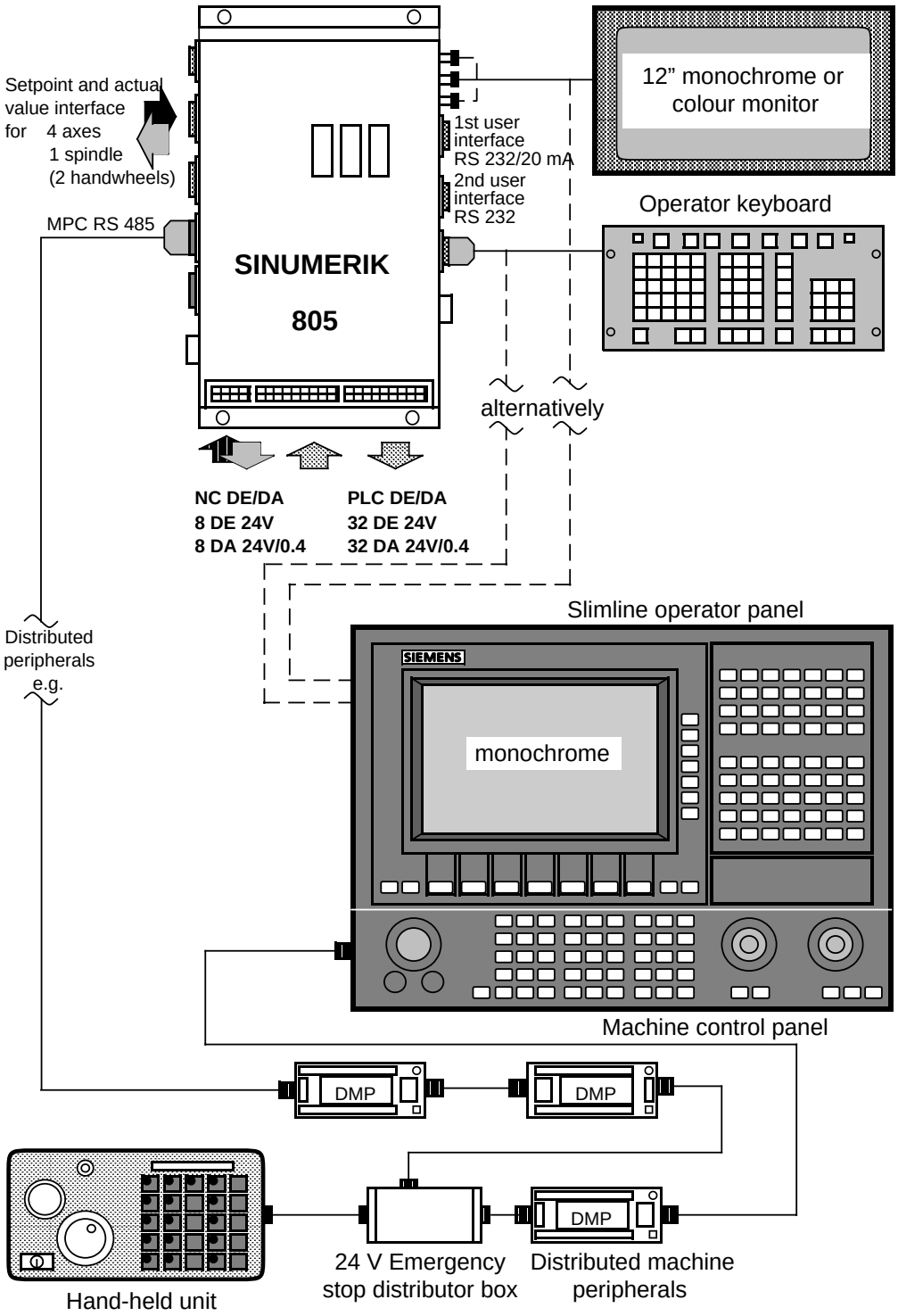
- decoding of auxiliary functions
- organization of NC PLC data transfer
- organization of the display of error and operational messages

from the PLC user memory to the system program memory, as no additional PLC programs are required for such functions.

This interface description covers an overview of the input, output and flag areas of the PLC, as well as a bit representation and description of the individual signals.

# 2 Assigned Input/Output Areas

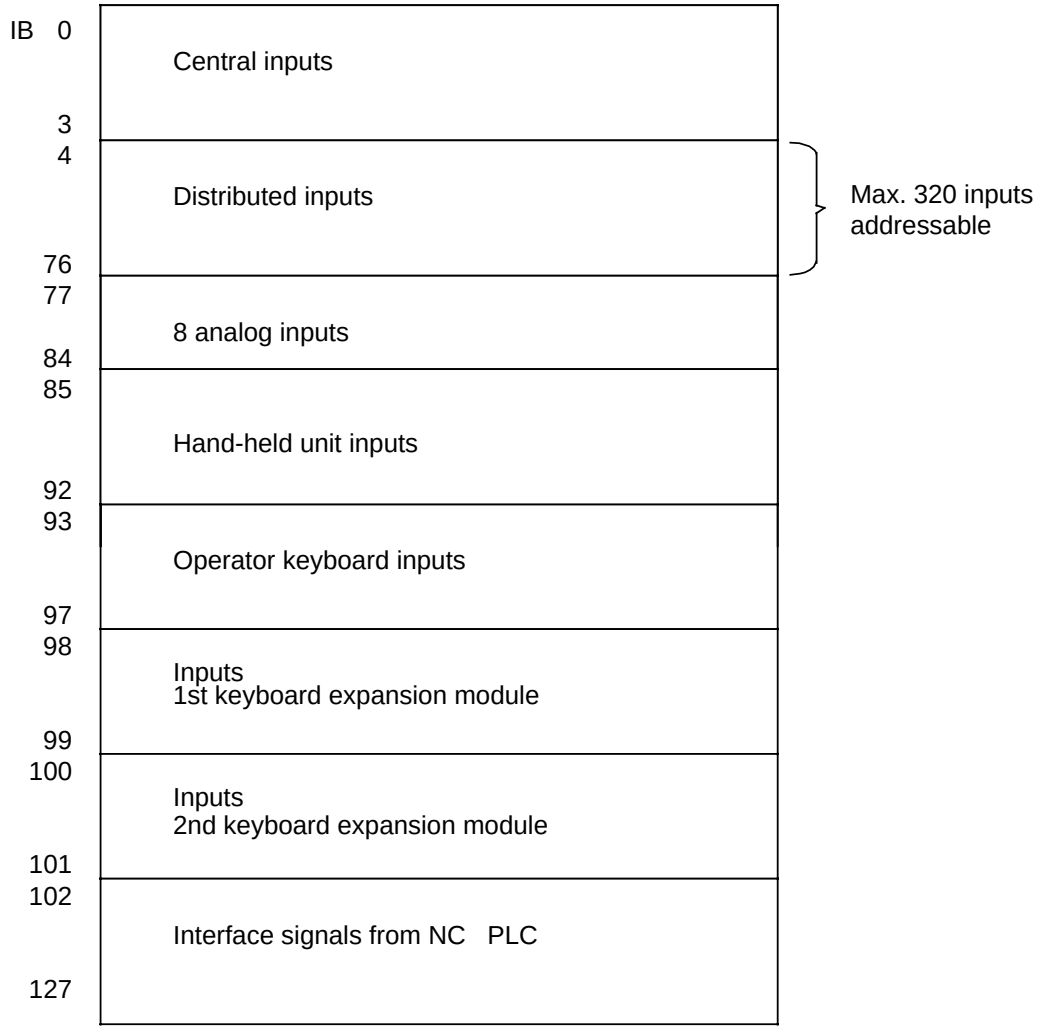
## 2.1 Connection facilities for peripherals



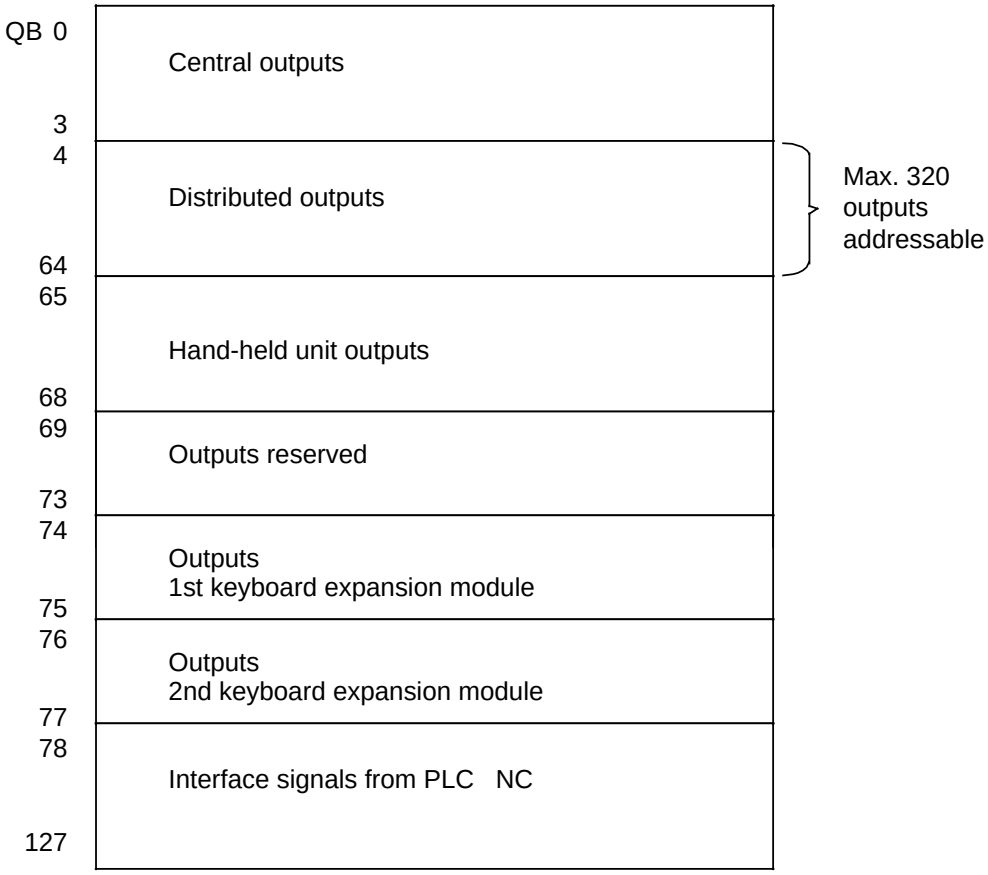

 

## 2.2 Overview PLC inputs, PLC outputs, PLC flags

### 2.2.1 PLC inputs



## 2.2.2 PLC outputs



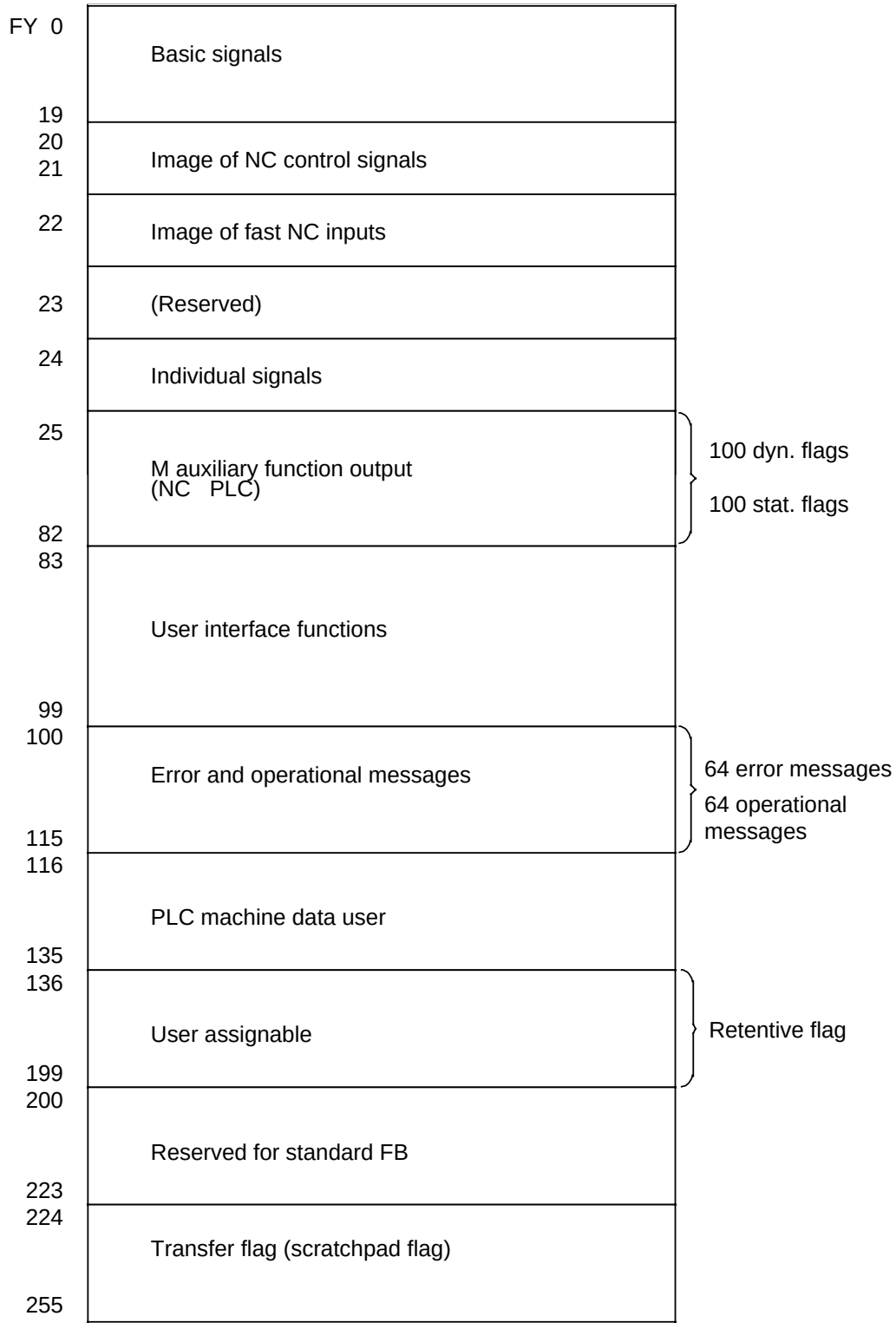

**CAUTION**

**PLC outputs are set to ”0” when the PLC is stopped!**

**The hardware outputs on the keyboard expansion modules maintain their current signal state on PLC STOP.**

## 2.2.3 PLC flags



## 2.2.4 Data blocks DB

| DB No. | DB Des. | DB Name |
|---|---|---|
| 0 | | Block address list (blocked for the user) |
| 1 | | DB diagnostics |
| 2 | | Reserved |
| : | | : |
| 27 | | Reserved |
| 28 | | Interface for analog output |
| 29 | | Reserved |
| : | | :: |
| 35 | | Reserved |
| 36 | | Interface for data transfer |
| 37 | | Interface for serial interface |
| 38 | | Reserved |
| : | | : |
| 80 | | Reserved |
| 81 | | User-assignable |
| : | | : |
| : | | : |
| 255 | | User-assignable |

## 2.2.5 Function blocks FB

| FB No. | FB Des | FB Name | |
|---|---|---|---|
| 0 | | Reserved | |
| : | | : | |
| 10 | | Reserved | |
| 11 | EINR-DB | Setting up data blocks | |
| 12 | | Reserved | |
| : | | : | |
| 59 | | Reserved | |
| 60 | BLOCK-TR | Block transfer | |
| 61 | NCD-LESE | Read NC data | |
| 62 | NCD-SCHR | Write NC data | |
| 63 | | Reserved | |
| 64 | | Reserved | |
| 65 | M-STACK | Transfer flags into flag stack | |
| 66 | STACK-M | Flag stack in transfer flag | |
| 67 | | Reserved | |
| : | | : | |
| 104 | SEND | Send data | for SINEC L2 only |
| 105 | RECEIVE | Receive data | |
| 106 | CONTROL | Processing control | |
| : | | : | |
| 199 | | Reserved | |
| 200 | | User-assignable | |
| : | | : | |
| 255 | | User-assignable | |

## 2.3 PLC input signals

### 2.3.1 Central I/O device inputs

| Central inputs (Section 3.1.1) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **IB 0** | | | | | | | | |
| **IB 1** | | | | | | | | |
| **IB 2** | | | | | | | | |
| **IB 3** | | | | | | | | |

IB 0 - IB 3 are available on the central controller

### 2.3.2 Distributed I/O device inputs

| Distributed inputs (Section 3.1.2) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **IB 4** | | | | | | | | |
| **IB 5** | | | | | | | | |
| Max. 320 distributed inputs usable | | | | | | | | |
| **IB 75** | | | | | | | | |
| **IB 76** | | | | | | | | |

## 2.3.3 Analog inputs

| Analog inputs (Section 3.1.3) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **IB 77** | Analog input 1 | | | | | | | |
| **IB 78** | Analog input 2 | | | | | | | |
| | | | | | | | | |
| **IB 83** | Analog input 7 | | | | | | | |
| **IB 84** | Analog input 8 | | | | | | | |

## 2.3.4 Hand-held unit inputs

| Hand-held unit inputs (Section 3.1.4) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **IB 85** | Key 8 | Key 7 | Key 6 | Key 5 | Key 4 | Key 3 | Key 2 | Key 1 |
| **IB 86** | Key 16 | Key 15 | Key 14<br>**4.** | Key 13<br>**Z** | Key 12<br>**Y** | Key 11<br>**X** | Key 10 | Key 9 |
| **IB 87** | Key 24<br>**–** | Key 23 | Key 22<br>**+** | Key 21 | Key 20 | Key 19 | Key 18 | Key 17 |
| **IB 88** | | Keyswitch | Feedrate override switch (23 positions)<br>5 bit Gray code<br>5th bit | 4th bit | 3rd bit | 2nd bit | 1st bit | Key 25 |
| **IB 89** | | | | | | | | |
| **IB 90** | | | | | | | | |
| **IB 91** | | | | | | | | |
| **IB 92** | | | | | | | | |

## 2.3.5 Operator keyboard inputs

| Operator keyboard inputs (Section 3.1.5) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **IB 93** | RESET  | SINGLE BLOCK  | | | | | NC-Stop  | NC-Start  |
| **IB 94** | | | | | | | | |
| **IB 95** | | | | | | | | |
| **IB 96** | | | | | | | | |
| **IB 97** | | | | | | | | |

## 2.3.6 1st and 2nd keyboard expansion module inputs

| 1st keyboard expansion module inputs (Section 3.1.6) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **IB 98** | Key 8 | Key 7 | Key 6 | Key 5 | Key 4 | Key 3 | Key 2 | Key 1 |
| **IB 99** | Key 16 | Key 15 | Key 14 | Key 13 | Key 12 | Key 11 | Key 10 | Key 9 |

| 2nd keyboard expansion module inputs (Section 3.1.6) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **IB 100** | Key 24 | Key 23 | Key 22 | Key 21 | Key 20 | Key 19 | Key 18 | Key 17 |
| **IB 101** | Key 32 | Key 31 | Key 30 | Key 29 | Key 28 | Key 27 | Key 26 | Key 25 |

## 2.3.7 Interface signals from NC PLC

| Program commands (Section 3.1.7.1) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **IB 102** | M 00/<br>M 01 | M 02/[1)]<br>M 30<br>RESET | G 33/<br>G 63 | G 00 | G 96 | | Program interrupted | Program running |
| **IB 103** | | | Acknowl. alarm | Data area selected | Operating modes - message from operator keyboard<br>D | C | B | A |
| **IB 104** | Softkey selection<br>Skip block selected | | DEC single bl. selected | Dry run feed selected | M01 actively selected | Override for rapid traverse selected | DRF selected | |
| **IB 105** | | | | | | | | |
| **IB 106** | | | | | | | | |
| **IB 107** | | Block search active | | | | | | |
| **IB 108** | | | | | | | | |
| | | | | | | | | |
| **IB 113** | | | | | | | | |

1) Signal length equal to PLC cycle time

## Spindle signals (Section 3.1.7.2)

| Byte No. | Bit: 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| IB 114 | Act. spindle rotation clockwise | Programmed speed too high | Spindle in set range | Spindle position reached | Spindle stop | Spindle synchronized | M 19 active | Speed limit exceeded |
| IB 115 | Change gear | | | | | Set gear stage C | Set gear stage B | Set gear stage A |
| IB 116 | | | | | | | | |
| IB 117 | | | | | | | | |

## Axis-specific signals (Section 3.1.7.3)

| Byte No. | Bit: 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| IB 118 Axis 1 | | Axis in position control | | Reference point reached | Travel command + | Travel command – | Position reached: Exact stop fine | Position reached: Exact stop coarse |
| IB 119 Axis 1 | | | | | | | | |
| IB 120 Axis 2 | | Axis in position control | | Reference point reached | Travel command + | Travel command – | Exact stop fine | Exact stop coarse |
| IB 121 Axis 2 | | | | | | | | |
| IB 122 Axis 3 | | Axis in position control | | Reference point reached | Travel command + | Travel command – | Exact stop fine | Exact stop coarse |
| IB 123 Axis 3 | | | | | | | | |
| IB 124 Axis 4 | | Axis in position control | | Reference point reached | Travel command + | Travel command – | Exact stop fine | Exact stop coarse |
| IB 125 Axis 4 | | | | | | | | |
| IB 126 | | | | | | | | |
| IB 127 | | | | | | | | |

## 2.4 PLC output signals

### 2.4.1 Central I/O device outputs

| Central outputs (Section 3.2.1) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **QB 0** | | | | | | | | |
| **QB 1** | | | | | | | | |
| **QB 2** | | | | | | | | |
| **QB 3** | | | | | | | | |

QB 0 - QB 3 are available on the central controller

### 2.4.2 Distributed I/O device outputs

| Distributed outputs (Section 3.2.2) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **QB 4** | | | | | | | | |
| **QB 5** | | | | | | | | |
| Max. 320 distributed outputs usable | | | | | | | | |
| **QB 63** | | | | | | | | |
| **QB 64** | | | | | | | | |

## 2.4.3 Hand-held unit outputs

| Hand-held unit outputs (Section 3.2.3) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **QB 65** | LED 8 | LED 7 | LED 6 | LED 5 | LED 4 | LED 3 | LED 2 | LED 1 |
| **QB 66** | LED 16 | LED 15 | LED 14 | LED 13 | LED 12 | LED 11 | LED 10 | LED 9 |
| **QB 67** | | | | | | | | |
| **QB 68** | | | | | | | | |

## 2.4.4 Outputs reserved

| Outputs reserved (Section 3.2.4) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **QB 69** | | | | | | | | |
| **QB 70** | | | | | | | | |
| **QB 71** | | | | | | | | |
| **QB 72** | | | | | | | | |
| **QB 73** | | | | | | | | |

## 2.4.5 1st and 2nd keyboard expansion module outputs

| 1st keyboard expansion module outputs (Section 3.2.5) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **QB 74** | Output 8 | Output 7 | Output 6 | Output 5 | Output 4 | Output 3 | Output 2 | Output 1 |
| **QB 75** | Output 16 | Output 15 | Output 14 | Output 13 | Output 12 | Output 11 | Output 10 | Output 9 |

| 2nd keyboard expansion module outputs (Section 3.2.5) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **QB 76** | Output 24 | Output 23 | Output 22 | Output 21 | Output 20 | Output 19 | Output 18 | Output 17 |
| **QB 77** | Output 32 | Output 31 | Output 30 | Output 29 | Output 28 | Output 27 | Output 26 | Output 25 |

## 2.4.6 Interface signals PLC NC

| Ready signals (Section 3.2.6.1) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **QB 78** | Transfer all cam values | Keyswitch | Data In Start 2nd interface | Data In Start 1st interface | | | *EMER-GENCY STOP | |
| **QB 79** | Keybard disable | Screen dark | | PLC display on hand-held module (SW 4.2 and higher) | Distance-to-go display on hand-held unit | Axis No. actual value hand-held unit | | |
| **QB 80** | Rapid NC inputs disabled [1)] | | | | | | | Rapid M function output (SW 4.1 and higher) |
| | Input 7 | Input 6 | Input 5 | Input 4 | Input 3 | Input 2 | | |
| **QB 81** | | | | | | | | |

1) with SW version 4.2 and higher

## Modes (Section 3.2.6.2)

| Byte No. | Bit: 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| QB 82 | DRF active | Reset | Acknow-ledge alarm | | Mode selection D | C | B | A |
| QB 83 | Skip block | Single block | Decode single block | Dry run feedrate | M 01 active | | | |

## Feedrate modification (Section 3.2.6.3)

| Byte No. | Bit: 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| QB 84 | Feedrate enable total | | Feedrate override active | Feedrate override E | D | C | B | A |
| QB 85 | | | Rapid traverse override active | Rapid traverse override (E) | (D) | C | B | A |

## Program modification (Section 3.2.6.4)

| Byte No. | Bit: 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| QB 86 | | | | | | Zero offset selection | | |
| QB 87 | | | Read-in enable | | Delete distance to go | Delete subroutine pass No. | NC Stop | NC Start |
| QB 88 | | | | | | | | |
| QB 89 | | | | | | | | |
| | | | | | | | | |
| QB 99 | | | | | | | | |

| Signals to spindle (Section 3.2.6.5) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **QB 100** | Spindle enable | Servo enable | Define zero setpoint | spindle override active | D | Spindle override C | B | A |
| **QB 101** | | | Spindle Reset | Invert M03/M04 | Gear speed sel. automatic | Actual gear speed C | B | A |
| **QB 102** | | | | | | | | |
| **QB 103** | Set dir. of rotation clockwise | Oscillation speed | Basic speed | Position spindle | Resynchro nize spindle | Acknow-ledge 19 | | PLC spindle control |

| Signals to analog outputs (Section 3.2.6.6) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **QB 104** [1)] | | RESET for NC analog outputs | | | | Setpoint+ servo enable analog 3 | Setpoint+ servo enable analog 2 | Setpoint+ servo enable analog 1 |
| **QB 105** [1)] | | | Invert voltage analog 3 | Invert voltage analog 2 | Invert voltage analog 1 | Setpoint from PLC analog 3 | Setpoint from PLC analog 2 | Setpoint from PLC analog 1 |
| **QB 106** | | | | | | | | |
| **QB 107** | | | | | | | | |

1) active with SW version 4.2 and higher

| Signals to axes (Section 3.2.6.7) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **QB 108** Axis 1 | Mirror | Follow-up mode | Feedrate enable | *Delay | Parking axis | Servo enable | 2nd softw. limit switch active + | 2nd softw. limit switch active – |
| **QB 109** Axis 1 | JOG + | JOG – | Rapid override | | Axis disable | | Hand-wheel 2 active (SW 4.1 and higher) | Hand-wheel 1 active |
| **QB 110** Axis 1 | | | | | Cam pairs active 4 | Cam pairs active 3 | Cam pairs active 2 | Cam pairs active 1 |
| **QB 111** Axis 1 | | | | | | | | |
| **QB 112** Axis 2 | Mirror | Follow-up mode | Feedrate enable | *Delay | Parking axis | Servo enable | 2nd softw. limit switch active + | 2nd softw. limit switch active – |
| **QB 113** Axis 2 | JOG + | JOG – | Rapid override | | Axis disable | | Hand-wheel 2 active (SW 4.1 and higher) | Hand-wheel 1 active |
| **QB 114** Axis 2 | | | | | Cam pairs active 4 | Cam pairs active 3 | Cam pairs active 2 | Cam pairs active 1 |
| **QB 115** Axis 2 | | | | | | | | |
| **QB 116** Axis 3 | Mirror | Follow-up mode | Feedrate enable | *Delay | Parking axis | Servo enable | 2nd softw. limit switch active + | 2nd softw. limit switch active – |
| **QB 117** Axis 3 | JOG + | JOG – | Rapid override | | Axis disable | | Hand-wheel 2 active (SW 4.1 and higher) | Hand-wheel 1 active |
| **QB 118** Axis 3 | | | | | Cam pairs active 4 | Cam pairs active 3 | Cam pairs active 2 | Cam pairs active 1 |
| **QB 119** Axis 3 | | | | | | | | |
| **QB 120** Axis 4 | Mirror | Follow-up mode | Feedrate enable | *Delay | Parking axis | Servo enable | 2nd softw. limit switch active + | 2nd softw. limit switch active – |
| **QB 121** Axis 4 | JOG + | JOG – | Rapid override | | Axis disable | | Hand-wheel 2 active (SW 4.1 and higher) | Hand-wheel 1 active |
| **QB 122** Axis 4 | | | | | Cam pairs active 4 | Cam pairs active 3 | Cam pairs active 2 | Cam pairs active 1 |
| **QB 123** Axis 4 | | | | | | | | |
| **QB 127** | | | | | | | | |

*Signal active at zero

## 2.5 Flags

### 2.5.1 Basic signals

| Basic signals (Section 3.3.1) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **FY 0** | Flashing frequency 1 Hz | | | | | | One | Zero |
| **FY 1** | Current OB No. | | | | | | | |
| **FY 2** | Basic setting or cold restart | | | | | OB2 | OB1 | |
| **FY 3** | Basic setting or cold restart | | | | | OB2 | OB1 | OB20 |
| **FY 4** | | | | | | | | |
| **FY 5** | | | | | | | | |
| **FY 6** | Processing time delay | | | | | OB2 | | |
| **FY 7** | | | | | | | | |
| **FY 8** | | | | | | | | Group error I/Os |
| **FY 12** | Negative edge | | | | | | | |
| | In.7 | In.6 | In.5 | In.4 | In.3 | In.2 | In.1 | In.0 |
| **FY 16** | Positive edge | | | | | | | |
| | In.7 | In.6 | In.5 | In.4 | In.3 | In.2 | In.1 | In.0 |
| **FY 19** | | | | | | | | |

n= alarm input byte (defined via PLC MD 0)

## 2.5.2 Image of NC control signals

| NC control signals (Section 3.3.2) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **FY 20** | Image control signal byte 1 | | | | | | | |
| | S 1.7 | S 1.6 | S 1.5 | S 1.4 | S 1.3 | S 1.2 | S 1.1 | S 1.0 |
| **FY 21** | Image control signal byte 2 | | | | | | | |
| | S 2.7 | S 2.6 | S 2.5 | S 2.4 | S 2.3 | S 2.2 | S 2.1 | S 2.0 |

## 2.5.3 Image of fast NC inputs

| Image of fast NC inputs (Section 3.3.3) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **FY 22** | Image fast input byte | | | | | | | |
| | 8 | 7 | 6 | 5 | 4 | 3 | Probe activated 2 | 1 |
| **FY 23** | | | | | | | | |

## 2.5.4 Ready signals from NC

| Ready signals (Section 3.3.4) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **FY 24** | 2nd interface busy | 1st interface busy | PC operation active (SW 4.2 and higher) | Keyboard ready | NC Ready 1 | NC Ready 2 | Battery failure | NC alarm |

## 2.5.5 Output of auxiliary functions (NC PLC)

### 2.5.5.1 Modification signals

| Modification signals (Section 3.3.5.1) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **FY 25** | | | H modi-fication | T modi-fication | S modi-fication | M word 3 modi-fication | M word 2 modi-fication | M word 1 modi-fication |
| **FY 26** | Last auxiliary function | | | | | | | |

### 2.5.5.2 Decoded M signals

| Decoded M signals (Section 3.3.5.2) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Byte No.** | | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **dynam.** | **static** | | | | | | | | |
| **FY 27** | **FY 28** | M 07 | M 06 | M 05 | M 04 | M 03 | M 02 | M 01 | M 00 |
| **FY 29** | **FY 30** | M 15 | M 14 | M 13 | M 12 | M 11 | M 10 | M 09 | M 08 |
| **FY 31** | **FY 32** | M 23 | M 22 | M 21 | M 20 | M 19 | M 18 | M 17 | M 16 |
| **FY 33** | **FY 34** | M 31 | M 30 | M 29 | M 28 | M 27 | M 26 | M 25 | M 24 |
| **FY 35** | **FY 36** | M 39 | M 38 | M 37 | M 36 | M 35 | M 34 | M 33 | M 32 |
| **FY 37** | **FY 38** | M 47 | M 46 | M 45 | M 44 | M 43 | M 42 | M 41 | M 40 |
| **FY 39** | **FY 40** | M 55 | M 54 | M 53 | M 52 | M 51 | M 50 | M 49 | M 48 |
| **FY 41** | **FY 42** | M 63 | M 62 | M 61 | M 60 | M 59 | M 58 | M 57 | M 56 |
| **FY 43** | **FY 44** | M 71 | M 70 | M 69 | M 68 | M 67 | M 66 | M 65 | M 64 |
| **FY 45** | **FY 46** | M 79 | M 78 | M 77 | M 76 | M 75 | M 74 | M 73 | M 72 |
| **FY 47** | **FY 48** | M 87 | M 86 | M 85 | M 84 | M 83 | M 82 | M 81 | M 80 |
| **FY 49** | **FY 50** | M 95 | M 94 | M 93 | M 92 | M 91 | M 90 | M 89 | M 88 |
| **FY 51** | **FY 52** | | | | | M 99 | M 98 | M 97 | M 96 |

## 2.5.5.3 Auxiliary function words

| Auxiliary function words (Section 3.3.5.3) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **FY 53** | | | | | | | | |
| **FY 54** | | | | | | | | |
| **FY 55** | | | | | | | | |
| **FY 56** | $10^1$ | | | M word 1 | | | $10^0$ | |
| **FY 57** | | | | | | | | |
| **FY 58** | | | | | | | | |
| **FY 59** | | | | | | | | |
| **FY 60** | $10^1$ | | | M word 2 | | | $10^0$ | |
| **FY 61** | | | | | | | | |
| **FY 62** | | | | | | | | |
| **FY 63** | | | | | | | | |
| **FY 64** | $10^1$ | | | M word 3 | | | $10^0$ | |
| **FY 65** | | | | | | | | |
| **FY 66** | | | | | | | | |
| **FY 67** | | | | | | | | |
| **FY 68** | | | | | | $10^4$ | | |
| **FY 69** | $10^3$ | | | S word | | $10^2$ | | |
| **FY 70** | $10^1$ | | | | | $10^0$ | | |
| **FY 71** | | | | | | | | |
| **FY 72** | | | | | | | | |
| **FY 73** | | | | | | | | |
| **FY 74** | | | | | | | | |
| **FY 75** | $10^3$ | | | T word | | $10^2$ | | |
| **FY 76** | $10^1$ | | | | | $10^0$ | | |
| **FY 77** | | | | | | | | |
| **FY 78** | | | | | | | | |
| **FY 79** | | | | | | | | |
| **FY 80** | | | | | | | | |
| **FY 81** | $10^3$ | | | H word | | $10^2$ | | |
| **FY 82** | $10^1$ | | | | | $10^0$ | | |

## 2.5.6 User interface functions

**User interface functions (Section 3.3.6)**

| Byte No. | Bit: 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| FY 83 | Monitor key code | | | | | | | |
| FY 84 | High byte | | | | | | | |
| FY 85 | Track code of current menu 1) Low byte | | | | | | | |
| FY 86 | High byte | | | | | | | |
| FY 87 | Track code of current window 1) Low byte | | | | | | | |
| FY 88 | | | | | | | | |
| FY 89 | | | | | | | | |
| FY 90 | Control byte | | GDF1) | CWD1) | OWD1) | | NLM1) | TC |
| FY 91 | Simulate key code | | | | | | | |
| FY 92 | High byte | | | | | | | |
| FY 93 | Simulate code of menu to be selected 1) Low byte | | | | | | | |
| FY 94 | High byte | | | | | | | |
| FY 95 | Simulate code of menu to be selected 1) Low byte | | | | | | | |
| FY 96 | | | | | | | | |
| FY 97 | PLC output | | | | | | | |
| FY 98 | on the handheld unit 1) | | | | | | | |
| FY 99 | | | $10^1$ | NC number | | | $10^0$ | |

1) SW Version 4.2 and higher

## 2.5.7 PLC error and operational messages

| Error messages (Section 3.3.7) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **FY 100** | 6007 | 6006 | 6005 | 6004 | 6003 | 6002 | 6001 | Error No. 6000 |
| **FY 101** | 6015 | 6014 | 6013 | 6012 | 6011 | 6010 | 6009 | 6008 |
| **FY 102** | 6023 | 6022 | 6021 | 6020 | 6019 | 6018 | 6017 | 6016 |
| **FY 103** | 6031 | 6030 | 6029 | 6028 | 6027 | 6026 | 6025 | 6024 |
| **FY 104** | 6039 | 6038 | 6037 | 6036 | 6035 | 6034 | 6033 | 6032 |
| **FY 105** | 6047 | 6046 | 6045 | 6044 | 6043 | 6042 | 6041 | 6040 |
| **FY 106** | 6055 | 6054 | 60053 | 6052 | 6051 | 6050 | 6049 | 6048 |
| **FY 107** | 6063 | 6062 | 6061 | 6060 | 6059 | 6058 | 6057 | 6056 |

| Operational messages (Section 3.3.7) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **FY 108** | 7007 | 7006 | 7005 | 7004 | 7003 | 7002 | 7001 | Message No. 7000 |
| **FY 109** | 7015 | 7014 | 7013 | 7012 | 7011 | 7010 | 7009 | 7008 |
| **FY 110** | 7023 | 7022 | 7021 | 7020 | 7019 | 7018 | 7017 | 7016 |
| **FY 111** | 7031 | 7030 | 7029 | 7028 | 7027 | 7026 | 7025 | 7024 |
| **FY 112** | 7039 | 7038 | 7037 | 7036 | 7035 | 7034 | 7033 | 7032 |
| **FY 113** | 7047 | 7046 | 7045 | 7044 | 7043 | 7042 | 7041 | 7040 |
| **FY 114** | 7055 | 7054 | 70053 | 7052 | 7051 | 7050 | 7049 | 7048 |
| **FY 115** | 7063 | 7062 | 7061 | 7060 | 7059 | 7058 | 7057 | 7056 |

## 2.5.8 PLC machine data for users

| Machine data bits (MD 3000 - 3003) (Section 3.3.8) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **FY 116** | MD 3000 | | | | | | | |
| **FY 117** | MD 3001 | | | | | | | |
| **FY 118** | MD 3002 | | | | | | | |
| **FY 119** | MD 3003 | | | | | | | |

| Machine data words (MD 1000 - 1007) (Section 3.3.8) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **FY 120** | Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 |
| **FY 121** | Bit 7 | Bit 6 | Bit 5 | MD 1000 Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| **FY 122** | | | | | | | | |
| **FY 123** | | | | MD 1001 | | | | |
| **FY 124** | | | | | | | | |
| **FY 125** | | | | MD 1002 | | | | |
| **FY 126** | | | | | | | | |
| **FY 127** | | | | MD 1003 | | | | |
| **FY 128** | | | | | | | | |
| **FY 129** | | | | MD 1004 | | | | |
| **FY 130** | | | | | | | | |
| **FY 131** | | | | MD 1005 | | | | |
| **FY 132** | | | | | | | | |
| **FY 133** | | | | MD 1006 | | | | |
| **FY 134** | | | | | | | | |
| **FY 135** | | | | MD 1007 | | | | |

## 2.5.9 Flags for users

| Flags for users (Section 3.3.9) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **FY 136** | | | | | | | | |
| This flag area is retentive | | | | | | | | |
| **FY 199** | | | | | | | | |

## 2.5.10 Flags for standard FBs

| Flags for standard FBs (Section 3.3.10) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **FY 200** | | | | | | | | |
| **FY 223** | | | | | | | | |

## 2.5.11 Transfer flags (scratchpad flags)

| Transfer flags (Section 3.3.11) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| **FY 224** | | | | | | | | |
| **FY 255** | | | | | | | | |

## 2.6 Data blocks

### 2.6.1 DB 1: Diagnostics DB

| Byte No. | Description |
|---|---|
| DW 0 | Current cycle time in ms 2) |
| DW 1 | Current interpreter run time OB 1+OB2 in µs 2) |
| DW 2 | Current interpreter run time only OB 1 in µs 2) |
| DW 3 | Current interpreter run time only OB 2 in µs 2) |
| DW 4 | Number of times an alarm was processed (OB 2) 2) |

| DL / Byte No. / DR | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |
|---|---|---|---|---|---|---|---|---|
| | Bit No. | | | | | | | |
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| DR 8 | | | DMP group fault | MD 10 – MD 19 start addr. DMP incorrect | | | Distributed transfer faulted | Station does not respond |
| DL 8 | | | | | | | Runtime OB2 exceeded | Runtime OB1+OB2 exceeded |
| DR 9 | | | | | | | | |
| DL 9 | Activation for diagnostics 3) | | | | | | | |
| DR 10 | | | | | | | | |
| DL 10 | MPC station (user address) belonging to DR 8) (e.g. 02=DMP station No. 2) | | | | | | | |
| DR 11 | | | | | | | | |
| DL 11 | | | | | | | | |
| DR 12 | | | | | | | | |
| DL 12 | | | | | | | | |
| DR 13 | | | | | | | | |
| DL 13 | | | | | | | | |
| DR 14 | | | | | | | | |
| DL 14 | | | | | | | | |
| DR 15 | Overtmp.* DMP station | 24V power supp. DMP not OK | | Module code belonging to DMP station 1) | | | | |
| DL 15 | | | | | | | | |

*1) DR 15: 1FHex=^DMP 16 inputs/16 outputs or IP-65 DMP; 1EHex=^DMP 32 I; 1CHex=^handheld unit;*
*19 Hex=^DMP compact with 4 input and 4 output modules*
*1AHex=^DMP compact with an alternative complement*
*2) DW 0 to DW 4: Timing/data are input as fixed point numbers*
*3) Activation bit only active if PLC-MD 2002.7 = "1"*

## 2.6.2 DB 28: Analog setpoint output

| DW No. | DB28 Analog setpoint output (Section 3.4.2) |
|---|---|
| **DW 0** | Preset with 0 |
| **DW 1** | PLC setpoint 1 |
| **DW 2** | Current setpoint 1 |
| **DW 3** | Weighting factor 1 |
| **DW 4** | Analog value 1 |
| **DW 5** | PLC setpoint 2 |
| **DW 6** | Current setpoint 2 |
| **DW 7** | Weighting factor 2 |
| **DW 8** | Analog value 2 |
| **DW 9** | PLC setpoint 3 |
| **DW 10** | Current setpoint 3 |
| **DW 11** | Weighting factor 3 |
| **DW 12** | Analog value 3 |

Notes:

- Range of values for PLC setpoints:
  8000H to 0000H ≙ -10V to 0V
  0000H to 7FFFH ≙ 0V to +10V
- Range of values for weighting factor:
  0 to 64H ≙ 0% to 100%
- Range of values for current setpoint and analog value:
  D8F0H to 2710H ≙ -10V to +10V
- This data block is available with SW Version 4.2 and higher

## 2.6.3 DB 36: Data transfer status

| DB 36 Data transfer status FB 61 / FB 62 (Section 3.4.3) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Interface Byte No. | DL Byte No. DR | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |
| | | Bit No. | | | | | | | |
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 1 | DL 0 | Fault Value 1-Value 3 | Number format | Message access disabled | Data transfer ended | Data transer assigned | Data transfer busy | Fifo full | Data transfer requested |
| 2 | DR 0 | Value 1-Value 3 | Number format | Message access disabled | Data transfer ended | Data transer assigned | Data transfer busy | Fifo full | Data transfer requested |
| 3 | DL 1 | Fault Value 1-Value 3 | Number format | Message access disabled | Data transfer ended | Data transer assigned | Data transfer busy | Fifo full | Data transfer requested |
| 4 | DR 1 | Fault Value 1-Value 3 | Number format | Message access disabled | Data transfer ended | Data transer assigned | Data transfer busy | Fifo full | Data transfer requested |
| 5 | DL 2 | Fault Value 1-Value 3 | Number format | Message access disabled | Data transfer ended | Data transer assigned | Data transfer busy | Fifo full | Data transfer requested. |
| | | | | | | | | | |
| 62 | DR 30 | Fault Value 1-Value 3 | Number format | Message access disabled | Data transfer ended | Data transer assigned | Data transfer busy | Fifo full | Data transfer requested |
| 63 | DL 31 | Fault Value 1-Value 3 | Number format | Message access disabled | Data transfer ended | Data transer assigned | Data transfer busy | Fifo full | Data transfer requested |
| 64 | DR 31 | Fault Value 1-Value 3 | Number format | Message access disabled | Data transfer ended | Data transer assigned | Data transfer busy | Fifo full | Data transfer requested |
| 65 | DL 32 | Fault Value 1-Value 3 | Number format | Message access disabled | Data transfer ended | Data transer assigned | Data transfer busy | Fifo full | Data transfer requested |

**Notes :**

1) If the PLC goes into the stop state because fo a parametering error, the number of the interface byte is entered in the high-order byte of ACCU 2.
2) If several jobs are entered in the buffer for data transfer, a job with the number 65 is processed before the others.
3) Data transfer is effected by function blocks FB61 (READ) and FB62 (WRITE).
4) A status byte in DB 36 is assigned to every FB 61 or FB 62 request in the parameter list.

## 2.6.4 DB 37: Serial interface

**Interface signals (Section 3.4.4)**

| DL Byte No. DR | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |
|---|---|---|---|---|---|---|---|---|
| | Bit No. | | | | | | | |
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| DL 0 | | | | | | | | V. 2 4 (RS 232C) running |
| DR 0 | | | | | | | 2 | 1 |

**Signals for data transfer initiative (Section 3.4.4)**

| DL Byte No. DR | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |
|---|---|---|---|---|---|---|---|---|
| | Bit no. | | | | | | | |
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| DL 1 | | | | | | V.24 (RS 232C) abort | Data start output | Data start input |
| DR 1 | | | | | | | Fault in data transfer | Data transfer ended |
| DW 2 | Type of data output | | | | | | | |
| DW 3 | Type of data output | | | | | | | |
| DW 4 | Start number | | | | | | | |
| DW 5 | End number | | | | | | | |
| DW 6 | Area | | | | | | | |

| Data type | DATA TYPE FOR DATA OUTPUT (DB37, DW2,3) | | START NUMBER (DB37;DW4) | END NUMBER (DB37;DW5) | (DB37;DW6) |
|---|---|---|---|---|---|
| Data format | KC | ASCII-Code | KF/BCD | KF/BCD | KF/BCD |
| Part program | MPF | 4D50 4620 | 0 - 9999 | 0 - 9999 | - |
| Subroutine | SPF | 5350 4620 | 1 - 999 | 1 - 999 | - |
| Tool offsets | TOA | 544F 4120 | 1 - 99 | 1 - 99 | 1 |
| R parameters | RPA | 5250 4120 | 0 - 999 | 0 - 999 | 1 |
| NC machine data | TEA1 | 5445 4131 | - | - | - |
| PLC machine data | TEA2 | 5445 4132 | - | - | - |
| Zero offsets (G54 - G57) | ZOA | 5A4F 4120 | - | - | - 1 |
| NC setting data | SEA | 5345 4120 | - | - | - |

**Note :**

The ASCII characters ”DATA TYPE FOR DATA OUTPUT” must be left-justified.

The selection of the data format for DW4,5,6 is effected by the PLC MD 2001.3.

# 3 Description of Signals

## 3.1 Description of PLC input signals

### 3.1.1 Central inputs (IB 0 - IB 3)

In terms of hardware, input bytes 0 - 3 are located on the central controller. The programmer has free access to these inputs in the STEP 5 user programm.

### 3.1.2 Distributed inputs (IB 4 - IB 76)

These input bytes are assigned to the DMP submodules. The PLC MD 10...19 are used to assign input bytes to the DMP submodules (address). The programmer has free access to these inputs in his STEP 5 user program.

### 3.1.3 Analog inputs (IB 77 - IB 84)

The voltages applied to the 8 analog inputs are digitized and converted to the appropriate input bytes.

Input voltage range: 0V ... +10V
Resolution: 8 bits (256 digits)

Prerequisite: The option "Analog inputs" is available.

***The user must ensure that the following voltages at the analog inputs are reached but not exceeded:***

***lower voltage limit = -0.5 V***
***upper voltage limit = +10.5 V***

**Example:** 6.47 V applied to the analog input 2 results in the following bit pattern in IB 78:

| **Byte No.** | **Bit: 7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
|---|---|---|---|---|---|---|---|---|
| **IB 78** | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| Decimal equivalent of the individual bits | $2^7$=128 | $2^6$=64 | $2^5$=32 | $2^4$=16 | $2^3$=8 | $2^2$=4 | $2^1$=2 | $2^0$=1 |
| Voltage [V] | 5 | 2.5 | 1.25 | 0.625 | 0.3125 | 0.15625 | 0.078125 | 0.0390625 |

The voltage of the analog input 2 can be determined as follows:

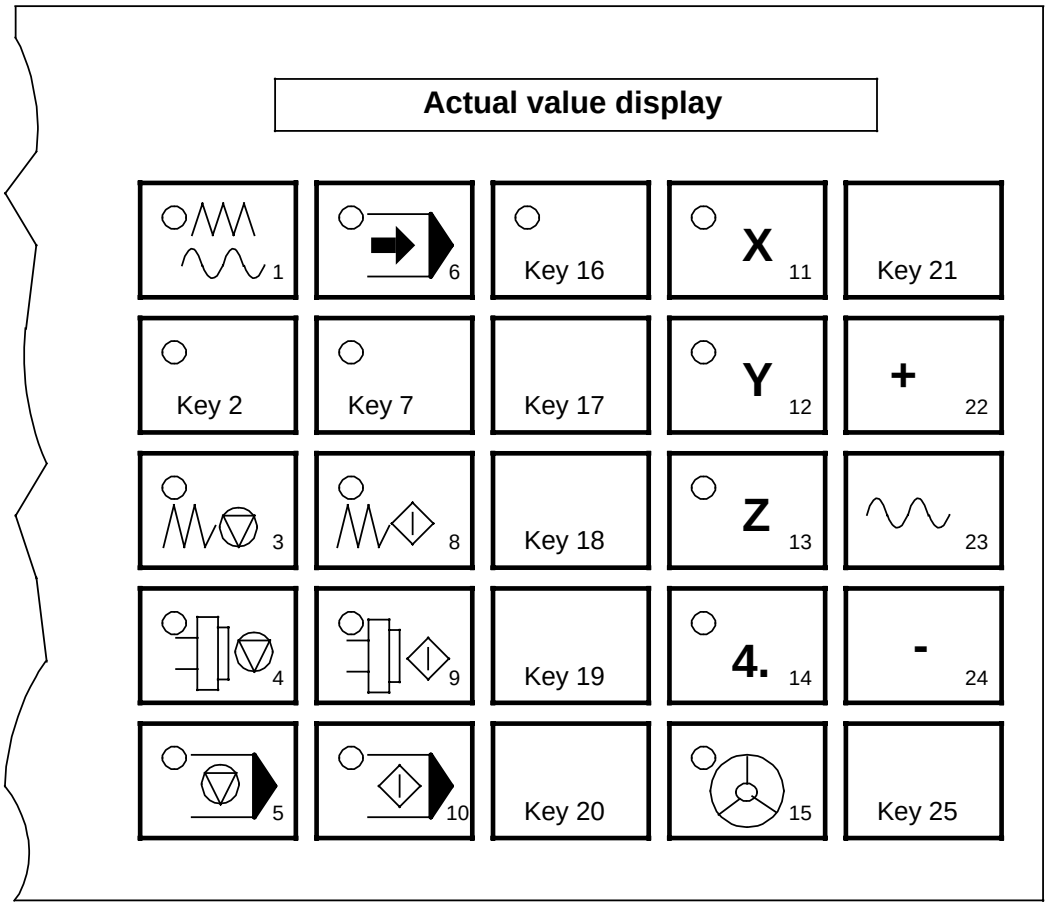
$$U_{analog} = \frac{128+32+4+1}{256} \times 10V \quad 6.44V$$

### 3.1.4 Hand-held unit inputs (IB 85-IB 92)

| **USER-CONFIGURABLE KEYS** | **IB 85 Bit 0 - IB 88 Bit 0** |
|---|---|

1 signal: The key concerned is pressed.
0 signal: The key is not pressed.

**The keys on the hand-held unit with "standard" labelling strip**



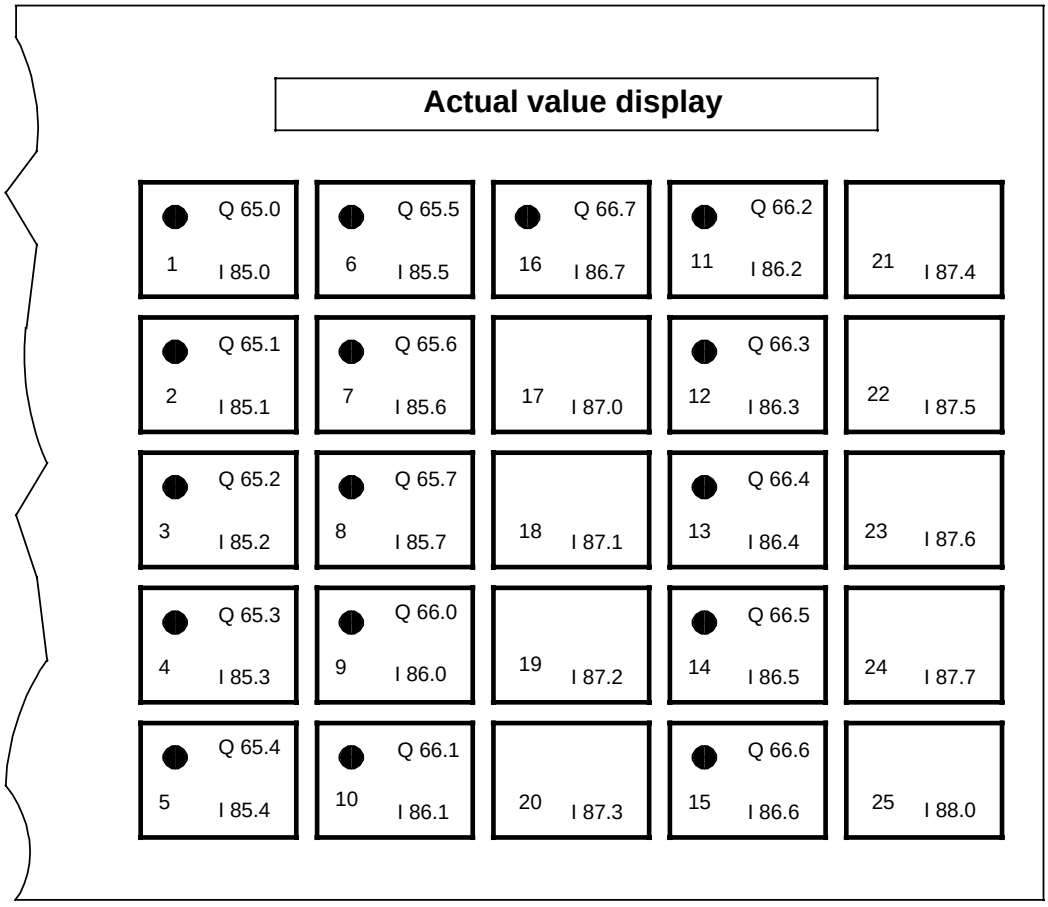

As is shown, certain functions are allocated to a certain number of the 25 keys on the hand-held unit by way of the standard labelling strip.

The manufacturer must incorporate these key functions in the PLC program. The remaining keys can be configured freely by the user (functions are allocated by extending the labelling strip and processing the respective input and output signals in the PLC program.)

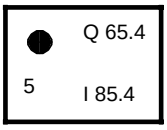
**Note:**

By inserting his own labelling strips, the user can also allocate his own functions to all 25 keys and process the signals concerned in the PLC program.

**Allocation of keys and LEDs on the hand-held unit to the inputs and outputs**

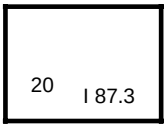



**Note:** - Key with LED e.g.:




LED 5 is controlled by Q 65.4
Key 5 is displayed in I 85.4

- Key without LED e.g.:




Key 20 is displayed in I 87.3

## FEEDRATE OVERRIDE SWITCH IB 88 Bit 1 - 5

The feedrate override switch on the hand-held unit provides the following 5-Bit Gray code according to the set position:

| Position | Bit No. 5 4 3 2 1 Code E D C B A | Override value in % |
|---|---|---|
| 1 | 0 0 0 0 1 | 0 |
| 2 | 0 0 0 1 1 | 1 |
| 3 | 0 0 0 1 0 | 2 |
| 4 | 0 0 1 1 0 | 4 |
| 5 | 0 0 1 1 1 | 6 |
| 6 | 0 0 1 0 1 | 8 |
| 7 | 0 0 1 0 0 | 10 |
| 8 | 0 1 1 0 0 | 20 |
| 9 | 0 1 1 0 1 | 30 |
| 10 | 0 1 1 1 1 | 40 |
| 11 | 0 1 1 1 0 | 50 |
| 12 | 0 1 0 1 0 | 60 |
| 13 | 0 1 0 1 1 | 70 |
| 14 | 0 1 0 0 1 | 75 |
| 15 | 0 1 0 0 0 | 80 |
| 16 | 1 1 0 0 0 | 85 |
| 17 | 1 1 0 0 1 | 90 |
| 18 | 1 1 0 1 1 | 95 |
| 19 | 1 1 0 1 0 | 100 |
| 20 | 1 1 1 1 0 | 105 |
| 21 | 1 1 1 1 1 | 110 |
| 22 | 1 1 1 0 1 | 115 |
| 23 | 1 1 1 0 0 | 120 |

**Notes:**

The percentage values given in the table are stored in the form of machine data. As standard, only the machine data for positions 1 to 23 are entered; If required however, the machine data not assigned can be assigned later. Accordingly, it is also possible to evaluate the codes of positions 24 to 31 which are supplied by a connecting coding switch or a PLC program.

## KEYSWITCH ON HAND-HELD UNIT IB 88 Bit 6

1 signal: Keyswitch actuated
0 signal: Keyswitch not actuated.

The interface signal "Keyswitch" (Q78.6) can be used to influence the signal keyswitch hand-held unit.

## 3.1.5 Inputs for operator keyboard (IB 93 - IB 97)

The following keys from the operator keyboard are represented in input byte 93.

**RESET, NC Start and NC Stop.**

1 signal: Key is pressed.
0 signal: Key is not pressed.

**Single block**

The single block key is connected to a flip-flop. The condition of the flip-flop is shown in input byte 93, i. e. whether the function ”Single Block” is currently selected or not.

1 signal: ”Single Block” function is selected by the operator keyboard.
0 signal: ”Single Block” function is not selected by the operator keyboard.

**Note:**

Observe PLC MD 2002.3 (transfer of signals from input image to output image).

## 3.1.6 1st and 2nd keyboard expansion module inputs (IB 98 - IB 101)

It is possible to connect 2 expansion modules to the operator keyboard, so as to include functions specifically required by the manufacturer. These keys are programmer-assignable for the STEP 5 user program.

| | | |
|---|---|---|
| Inputs | 1st keyboard expansion module: | IB 98, IB 99 |
| Inputs | 2nd keyboard expansion module: | IB 100, IB 101 |

1 signal: Key is pressed
0 signal: Key is not pressed.

**Note:**

In the case of the signal "Keyboard disable" (Q 79.7), the transfer of input and output signals of the expansion module to and from the central controller are disabled.

## 3.1.7 Interface signals NC PLC

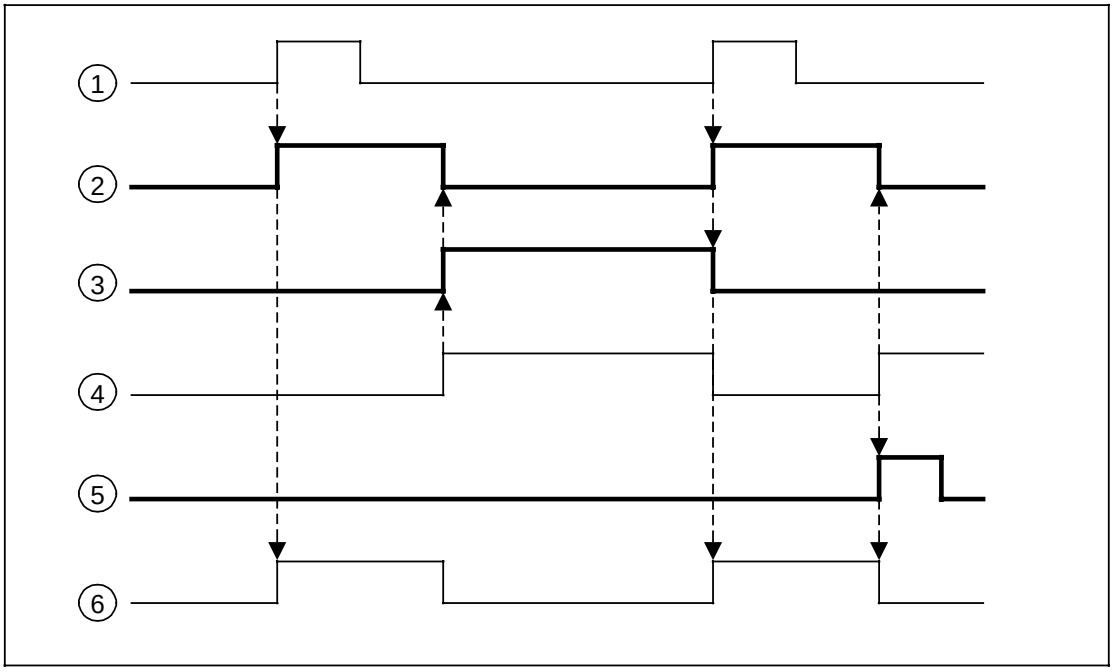
### 3.1.7.1 Program commands (IB 102 - IB 113)

| PROGRAM RUNNING | IB 102 Bit 0 |
|---|---|

**AUT, MDA modes**

1 signal: Program started (NC START)
0 signal: a) Program interrupted by:
- programmed stop (M00/M01)
- NC STOP or
- mode change.

b) Block executed during single block operation.
c) Program end reached (M02/M30).
d) Program abort by RESET
e) No further block in the memory (e.g. in MDA mode).
f) Current block not executable.




1: NC START signal
2: PROGRAM RUNNING signal
3: M00/M01 signal
4: Arrival at position to be reached
5: M02/M30 signal
6: "PROGRAM RUNNING"display

**Notes:**

The PROGRAMM RUNNING indicator does not switch off if workpiece machining is stopped by the following events:

- removal of TOTAL FEED ENABLE, axis-specific FEED ENABLE or SPINDLE ENABLE,
- removal of READ-IN ENABLE,
- FEED OVERRIDE set to 0%,
- reaching the software limit switches or working area limits,
- response of the spindle or axis monitors,
- selection of position setpoints in the NC program for axes in FOLLOW-UP OPERATION, for axes without CONTROLLER ENABLE or for PARKING AXES,
- EMERGENCY STOP.

**PROGRAM INTERRUPTED** **IB 102 Bit 1**

## AUT, MDA modes

1 signal: Program interrupt by means of NC STOP or mode change.
0 signal: a) Program not started.
b) Program ended or aborted with RESET.
c) After NC STOP or mode change the program was restarted.

**Note:**

The PROGRAM INTERRUPTED signal means that the program can be continued after a restart.

**G96; CONSTANT CUTTING SPEED** **IB 102 Bit 3**

1 signal: Constant cutting speed selected with G96
0 signal: Constant cutting speed not selected.

**G00; RAPID TRAVERSE** **IB 102 Bit 4**

## AUT, MDA modes

1 signal: Rapid traverse selected with G00.
0 signal: Block ended or aborted with G00.

## JOG mode

1 signal: Rapid traverse and directional keys operated simultaneously.
0 signal: Rapid traverse or directional keys not operated.

**Example:**

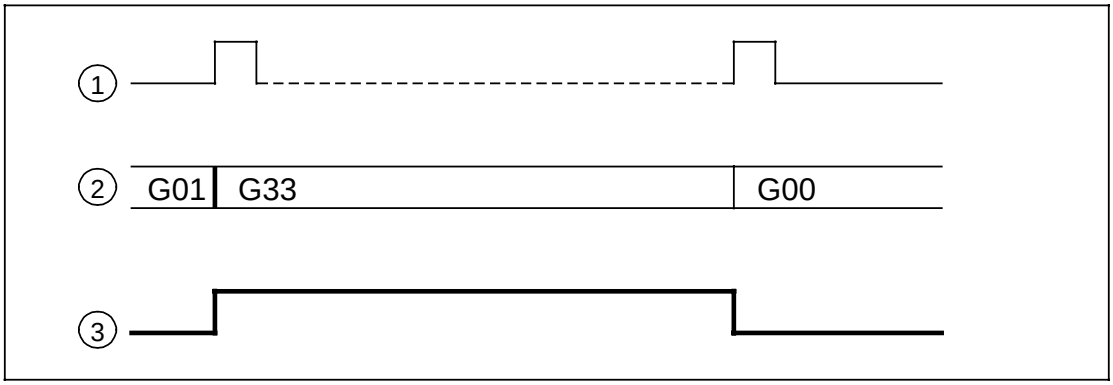
Activating bed lubrication.

**G33/G63; THREAD** **IB 102 Bit 5**

1 signal: Thread cutting selected with G33 or G63.

0 signal: a) Thread cutting selected with G00, G01, G02, G03, G10 and G11.
b) Program ended or aborted.




1: Transfer of data to main memory
2: Contents of main memory
3: Signal G33/G63

**Notes:**

1) The following are ineffective with G33:
   a) Feedrate override switch;
   b) Feedrate hold; (TOTAL FEEDRATE ENABLE is not evaluated);
   c) Single block;
   hold does not come into effect until the end of the next block.

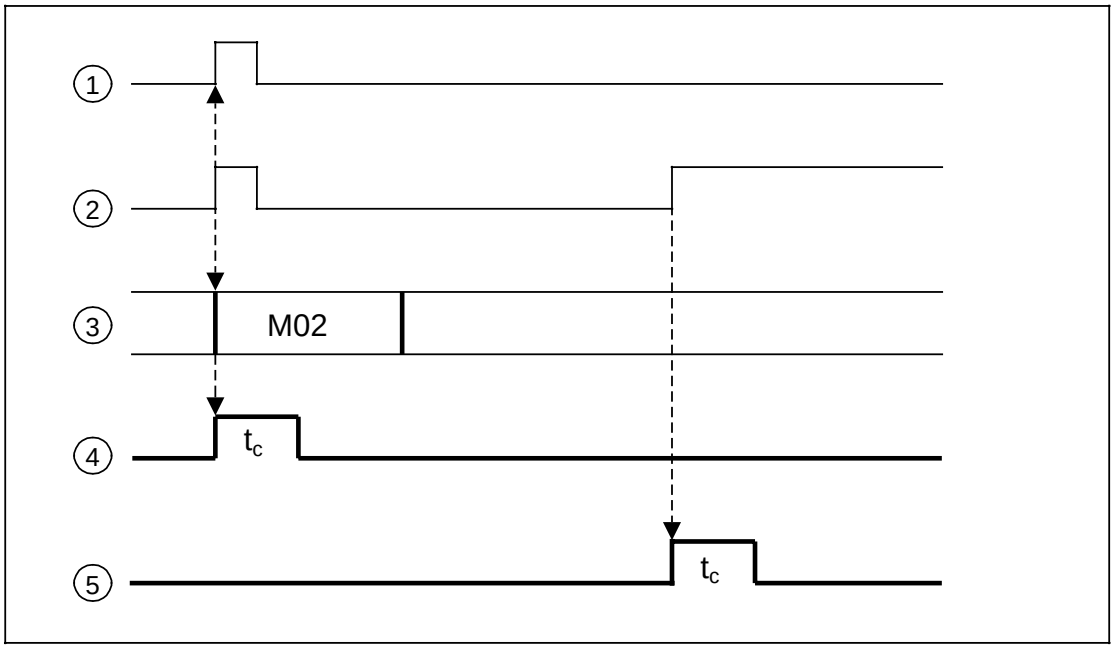
2) The following are ineffective with G63:
   a) Feedrate override switch

In the case of G33 (Thread), FEEDRATE HOLD can be effected by combining G33 and TOTAL FEEDRATE ENABLE to remove the signal SPINDLE ENABLE.

With G63, the NC reacts directly to the signal TOTAL FEEDRATE ENABLE.

**M02 / M30; PROGRAM END, PROGRAM ABORT IB 102 Bit 6**

1 signal: a) An NC block is executed fully with M02/M30; if traversing movements are also programmed in this block, the signal will not be emitted until the target position has been reached.
b) RESET activated
0 signal: No program end or program abort.




1: Data transfer into main memory
2: Block executed
3: NC block with M word M02
4: M modification signal (tc = PLC cycle time)
5: Signal M02/M30

**Notes:**

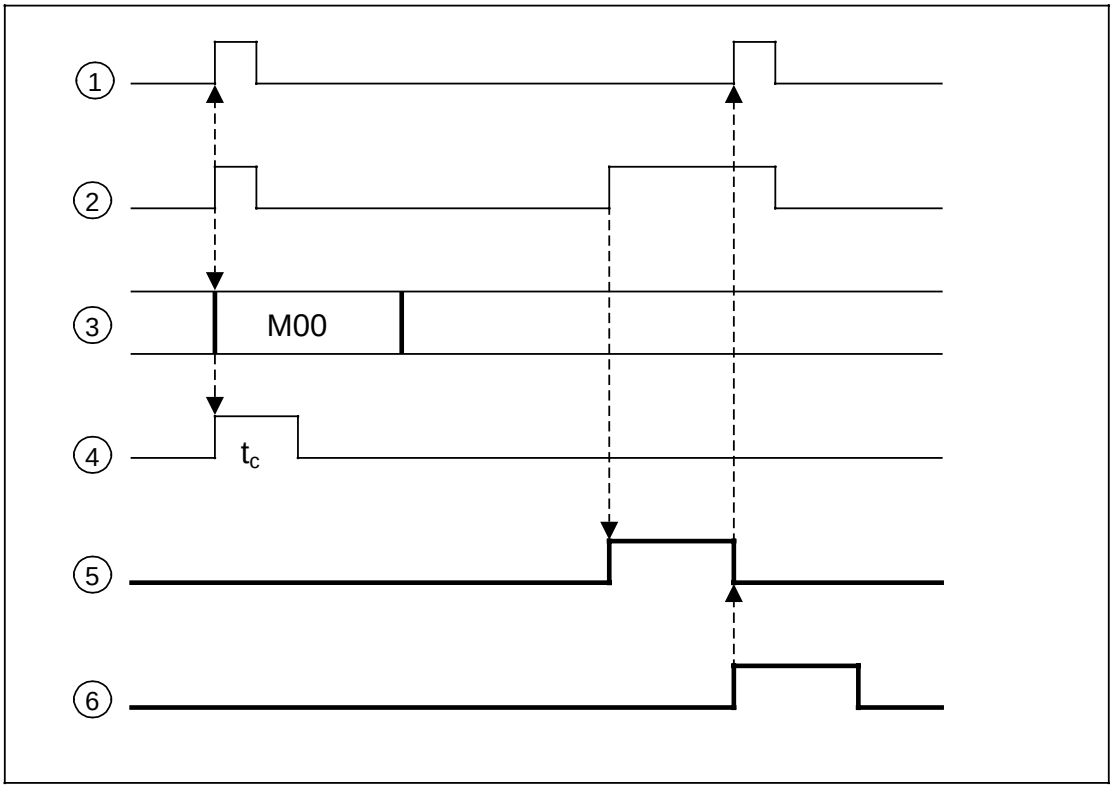
1) The functions M02 and M30 have the same effect in the NC.
2) Signal M02/M30 applies only for one cycle.
3) The signal M02/M30; END OF PROGRAM, PROGRAM ABORT is not suitable for automatic sequential functions, such as: workpiece counting, bar feed, opening of protective guards, etc.
   For these functions
   a) M02/M30 must be written in a block of its own and
   b) the BCD word M02/M30 or the decoded M signal M02/M30 must be used (see auxiliary function output).
4) In the last block of the program, the following are not permitted:
   a) the writing of auxiliary functions which disable read-in or
   b) the writing of S values which are intended to be active beyond M02/M30.

**Example:**
Deleting functions initiated by M, T and H words.

**M00 / M01; PROGRAMMED STOP IB 102 Bit 7**

1 signal: Block executed, auxiliary functions output and
a) M00 in main memory or
b) M01 in main memory and M01 EFFECTIVE (QB 83 Bit 3 = ”1”).
0 signal: a) with NC Start.
b) Program abort by RESET.




1: Data transfer into main memory
2: Block executed
3: NC block with M word M00
4: M modification signal ($t_c$ = PLC cycle time)
5: Signal M00/M01
6: NC Start

**Note:**

If the operating mode is changed while the M00/M01 signal is ”1”, this status continues until the NC START or RESET signal is given.

**Application example:**

Stopping the main spindle, e.g. when checks are to be made.

## MODES - MESSAGE FROM OPERATOR KEYBOARD IB 103 Bit 0 - 3

Selecting a mode by key or softkey produces a 4-bit code which is stored in IB 103 bit 0 to 3 as follows:

| Bit No. 3 | 2 | 1 | 0 | Mode | |
|---|---|---|---|---|---|
| 0 | 1 | 1 | 0 | JOG | |
| 0 | 1 | 1 | 1 | JOG - INC | |
| 1 | 1 | 1 | 1 | JOG - REPOS | |
| 1 | 0 | 1 | 1 | JOG - REF | |
| 1 | 0 | 1 | 0 | AUT | |
| 0 | 0 | 1 | 0 | MDA | |
| 0 | 0 | 0 | 1 | PRESET | |
| 1 | 1 | 0 | 0 | TEACH - IN | TEACH-IN from SW 4.1 |

**Notes:**

- The mode message from the operator keyboard IB 103 bit 0 - 3 is only transferred automatically as a mode selection into the output byte 82 bit 0 - 3 when the PLC machine data 2002 bit 3 is set.
- If the SINUMERIK 19” slimline operator panel is implemented, the operating mode code for AUTOMATIC is entered here when the key is operated.

## DATA AREA SELECTED MESSAGE IB 103 Bit 4

When the data area is selected, the message is displayed on this input byte.

1 signal: Data area is selected.
0 signal: Data area is not selected.

## ALARM ACKNOWLEDGMENT IB 103 Bit 5

The softkey QUIT which appears in the menu display "Messages", is represented on this input bit.

1 signal: Softkey QUIT is operated
0 signal: Softkey QUIT is not operated.

This input signal is automatically transferred to output bit Q 82.5 ("Acknowledge alarm"), when the PLC MD 2002.3 (transfer from input to output display) is set at position "1".

**SOFTKEY SELECTION IB 104**

The following input signals can be activated using the softkeys. If PLC MD 2002.3 (transfer from input to output area) is active, these signals are transmitted to the NC. The user can, however, influence these signals via the PLC NC interface (QB 83, QB 85) with high priority.

DRF-shift (DRF) selected (I 104.1)
Rapid traverse override switch (RV0) selected (I 104.2)
M01 effectively selected (I 104.3)
Dry run feed (DRY) selected (I 104.4)
Decode single block (DBL) selected (I 104.5)
Skip block (SKP) selected (I 104.7)

1 signal: Function has been selected
0 signal: Function is not selected

**BLOCK SEARCH ACTIVE IB 107 Bit 6**

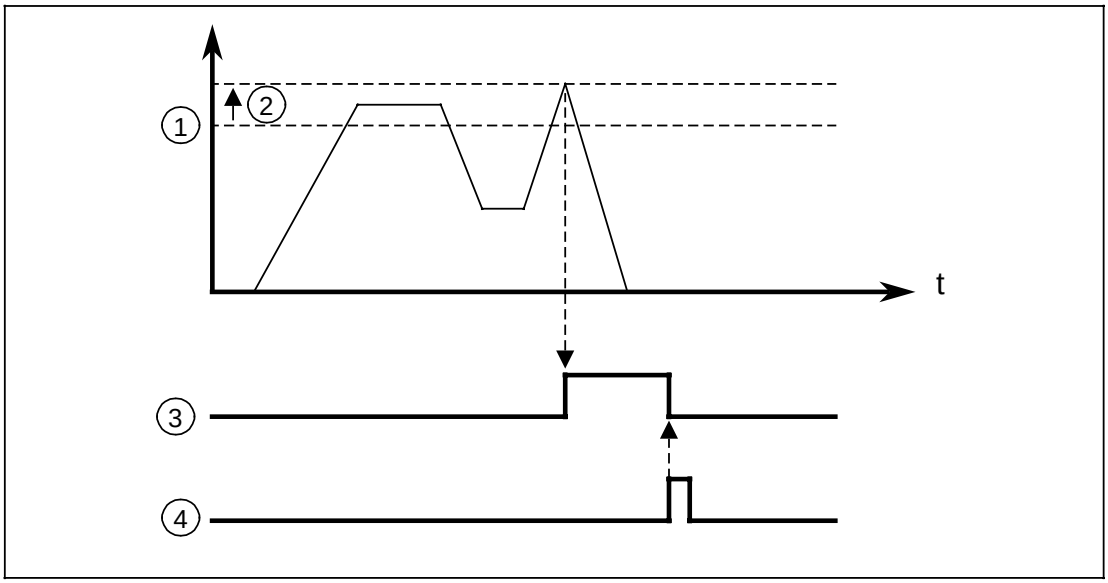
1 signal: Block search started
0 signal: Block search not started or block search ended

## 3.1.7.2 Spindle signals (IB 114 - IB 117)

**SPEED LIMIT EXCEEDED** **IB 114 Bit 0**

1 signal: The spindle speed has exceeded the following limits by the permitted tolerance:
a) Maximum permitted speed of the chuck (in the case of lathes) or of the tool (in the case of milling machines) which is stipulated via NC MD 4510 (max. spindle speed).
b) The maximum permitted speed for the selected gear.
c) The spindle speed limitations given in the setting data.

0 signal: a) The spindle speed lies below the permitted limit.
b) After RESET




1: Maximum spindle speed (NC MD 4510)
2: Max. spindle speed tolerance (NC MD 4450)
3: Speed limit exceeded signal
4: RESET signal

**Note:**

If the spindle exceeds one of the speed limits, then the spindle and all axes are stopped by the NC and alarm 2152 (Spindle speed too high) is emitted. The SPEED LIMIT EXCEEDED signal modal and must be cancelled with RESET.

**M 19 ACTIVE** **IB 114 Bit 1**

1 signal: Function M19 (oriented spindle stop) is active.
0 signal: Function M19 is not active.

**SPINDLE SYNCHRONIZED IB 114 Bit 2**

1 signal: The spindle has reached the measuring system zero.
The spindle is synchronized.
0 signal: The spindle is not synchronized.

**SPINDLE STATIONARY IB 114 Bit 3**

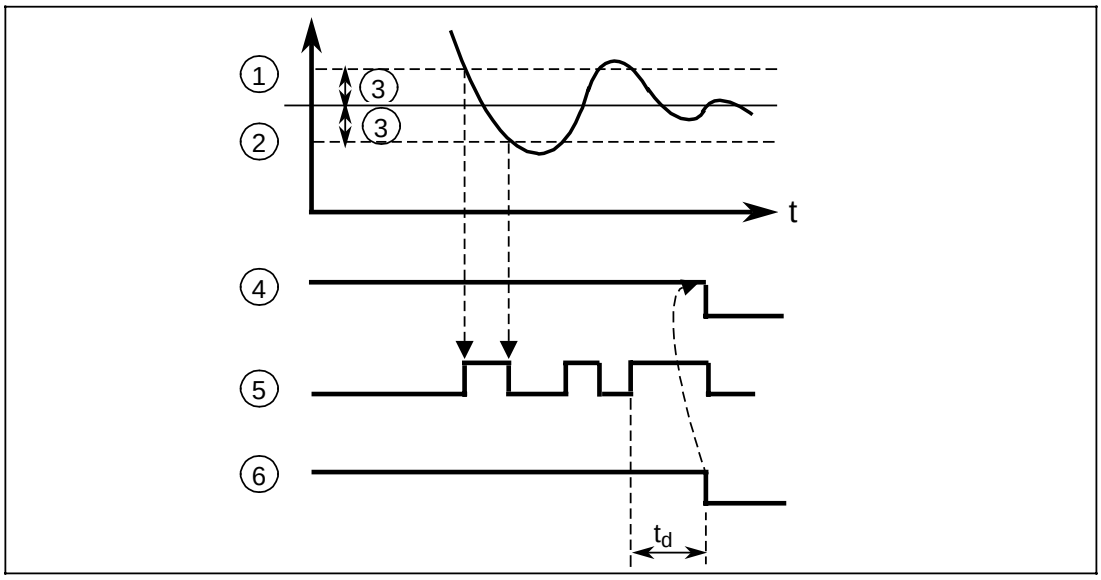
1 signal: Actual speed is in zero speed range (can be set with NC MD 4460 (zero speed tolerance).
0 signal: Actual speed is outside the zero speed range.

**Example:**

Enabling the opening of a guard

**SPINDLE POSITION REACHED IB 114 Bit 4**

1 signal: Actual position of the spindle is within position tolerance at oriented spindle stop.
0 signal: Actual position is outside the position tolerance at oriented spindle stop.




1: Actual position of spindle
2: Set position
3: Position tolerance
4: Position control switched on
5: SPINDLE POSITION REACHED signal
6: SPINDLE ENABLE signal (from the PLC, td = deceleration time)

**Notes:**

1) In the case of a position tolerance overshoot the SPINDLE POSITION REACHED signal is withdrawn (e.g. overshoot resulting from incorrect optimization of the spindle control).
2) The SPINDLE ENABLE signal may only be withdrawn from the PLC when the spindle has settled (e.g. after deceleration time td, which is programmed by the user).

**Example:**

To enable tool change for milling machines.

**SPINDLE WITHIN SET RANGE, (see figure below) IB 114 Bit 5**

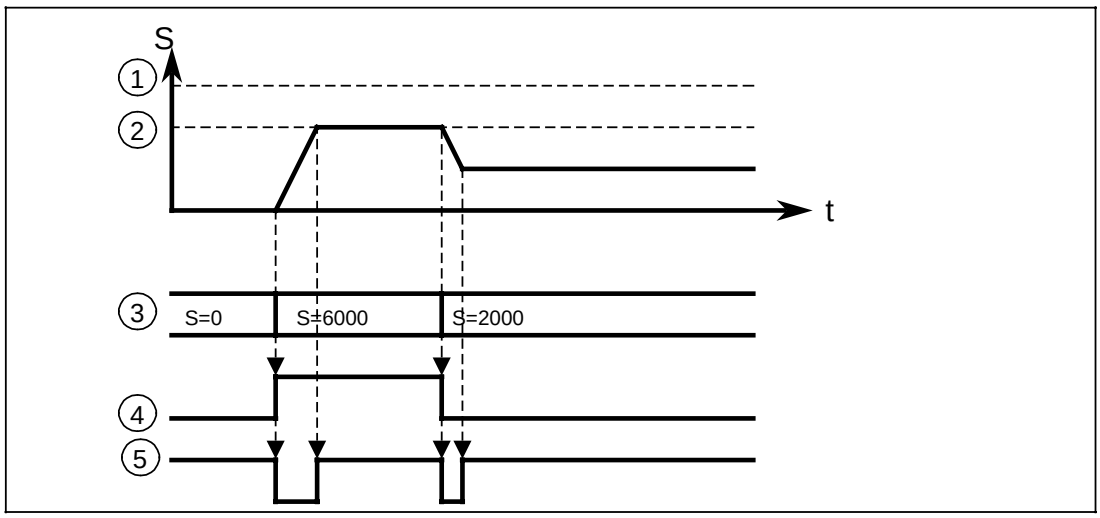
1 signal: Actual speed is within set range (window).
0 signal: Actual speed is not within set range, the spindle override being taken into account.

**Example:**

Enabling of axis movements e.g. via TOTAL FEEDRATE ENABLE after a speed change or by setting a new value for S or by changing gear.

**PROGRAMMED SPEED TOO HIGH IB 114 Bit 6**

1 signal: The programmed speed or speed calculated for v = const. (G96) is too high.
0 signal: The programmed speed or speed calculated for v = const. (G96) is below the permitted limits.




1: Speed limit of selected gear stage, e.g. 5000 rev/min$^{-1}$
2: Speed limit in NC MD 4510 (max. spindle speed) (e.g. permitted chuck speed limit = 4000)
3: Programmed values for S in main memory
4: PROGRAMMED SPEED TOO HIGH signal
5: SPINDLE IN SET RANGE signal

**Example:**

Using the PROGRAMMED SPEED TOO HIGH signal, continued execution of the NC program can be suppressed and a corresponding message given.

**Notes:**

1) The speed calculated for v = const. can be limited via G92 S...
2) If the programmed speed or the speed determined for v = const. is above one of the specified limits (specified as machine data or for the selected gear stage), the speed is then only given as a set value which corresponds to the lowest limit.
3) The SPINDLE OVERRIDE is taken into account when checking the limit values.

**ACTUAL DIRECTION OF SPINDLE ROTATION CW IB 114 Bit 7**

1 signal: Actual direction of rotation clockwise
0 signal: Actual direction of rotation counterclockwise

**Notes:**

1) The signal is derived from the rotational direction of the pulse encoder. When the spindle is stationary, the signal corresponds to the last direction of rotation.
2) If the spindle is not equipped with a pulse encoder, the signal remains andefined.

**SET GEAR STAGE IB 115 Bit 0 - 2**

With automatic gear changing (s. Section 3.6.2.5, AUTOMATIC GEAR CHANGING signal), the SET GEAR STAGE is output in code at the same time as the CHANGE GEAR signal as follows:

| Gear stage | Bit No. 2 1 0 Code C B A |
|---|---|
| 1 | 0 0 0 |
| 2 | 0 0 1 |
| 3 | 0 1 0 |
| 4 | 0 1 1 |
| 5 | 1 0 0 |
| 6 | 1 0 1 |
| 7 | 1 1 0 |
| 8 | 1 1 1 |

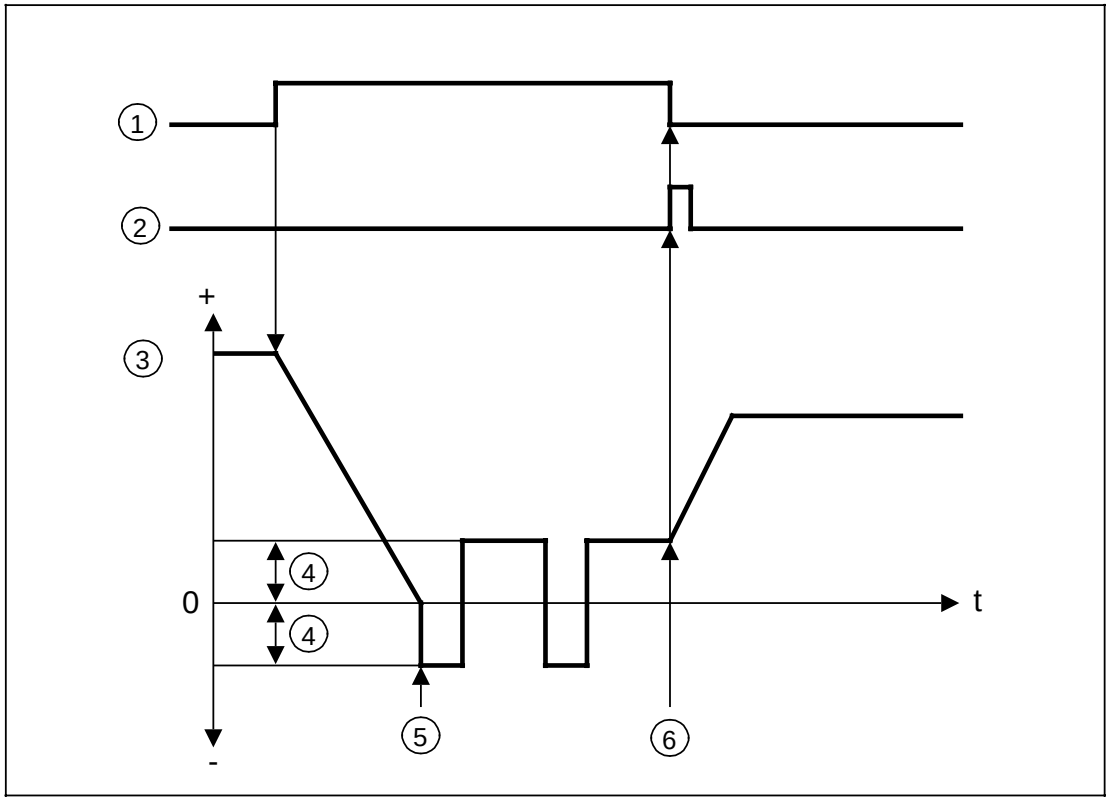
**CHANGE GEAR** **IB 115 Bit 7**

The CHANGE GEAR signal is output only if automatic gear changing has been activated (S analog option) and enabled (AUTOMATIC GEAR CHANGING signal).

1 signal: Start of gear change; the new gear speed is valid and supplied to the interface.
0 signal: End of gear change.

**Note:**

The spindle accelerates or decelerates (although the ”Change gear” bit is set) in the actual gear speed if an S value has been programmed and M03/M04 is active.




1: CHANGE GEAR signal
2: ”Gear engaged” checkback signal from the gear to the PLC
3: Actual speed of the spindle motor
4: Oscillating speed setpoint
5: Oscillation, change gear
6: Gear engaged, accelerate spindle motor

## 3.1.7.3 Axis specific signals (IB 118 - IB 127)

| POSITION REACHED | IB 118, 120, 122, 124 Bit 0 and 1 |
|---|---|

### AUT mode

**Exact stop coarse (I 118.0, I 120.0, 122.0, I 124.0):**

1 signal: a) The axis has reached the programmed position up to the tolerance of the coarse exact stop window (NC MD 204* or NC MD 380* for standard motor axes) or
b) is already within the fine exact stop window.
0 signal: The axis is outside the coarse exact stop window.

**Exact positioning fine (I 118.1, I 120.1, I 122.1, I 124.1):**

1 signal: The axis has reached the programmed position up to the tolerance of the fine exact stop window (NC MD 208* or NC MD 384* for standard motor axes).
0 signal: The axis is outside the fine exact stop window.

**Note:**
The coarse or fine POSITION REACHED signals are also at "1" if the automatic mode has been interrupted by RESET, NC alarm or mode change (AUTO INTERRUPTED).

**Example:**
Enabling of tool change after the axis has reached the change position.

### JOG mode

**Exact hold coarse (I 118.0, I 120.0, I 122.0, I 124.0):**

1 signal: a) The axis has reached the specified position up to the tolerance of the coarse exact stop window (NC MD 204*) or
b) is already situated within the fine exact stop window; no direction key and no handwheel has been operated.
0 signal: The axis is outside the coarse stop window; a direction key or a handwheel has been operated.

**Exact hold fine (I 118.1, I 120.1, I 122.1, I 124.1)**

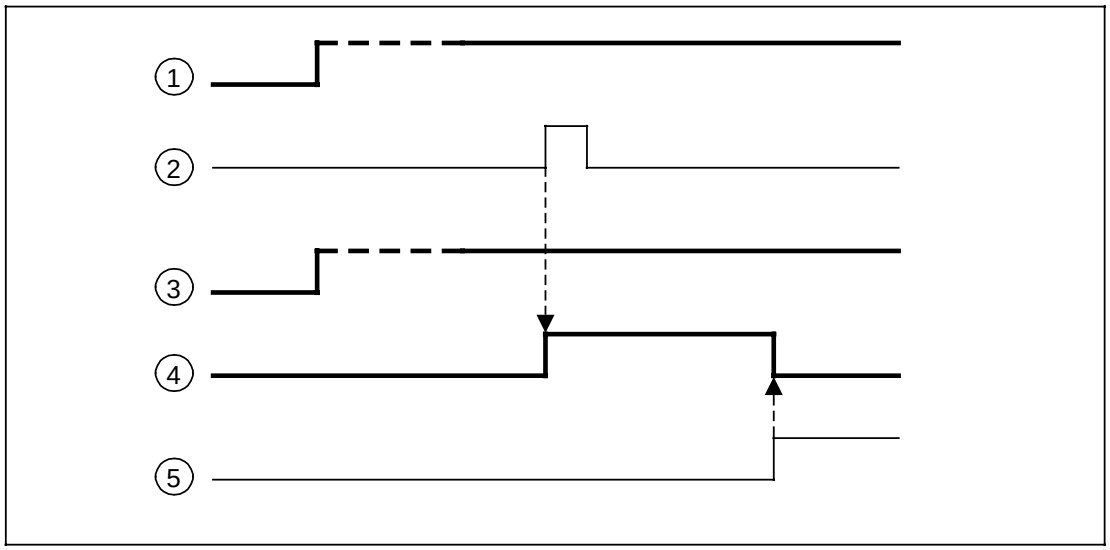
1 signal: The axis has reached the specified setpoint up to the tolerance of the fine exact stop window (NC MD 208*); no direction key and no handwheel has been operated.
0 signal: The axis is outside the fine exact stop window; a direction key or a handwheel has been operated.

| | |
|---|---|
| **TRAVEL COMMAND –** | **IB 118, 120, 122, 124 Bit 2** |
| **TRAVEL COMMAND +** | **IB 118, 120, 122, 124 Bit 3** |

### AUT/MDA mode

1 signal: Exists if a movement is to take place in the respective axis direction, for instance after transfer of a block into the main store which contains a coordinate value for the respective axis.

0 signal:
a) Block executed, (i.e. distance to go=0),
b) Axis disable exists
c) Abort by RESET.




1: READ-IN ENABLE signal
2: Data transfer into the main memory
3: TOTAL FEED ENABLE signal
4: TRAVEL COMMAND signal (e.g. X+, I 118.3)
5: Block executed

### JOG mode

1 signal: Axis selected and direction key pressed.

0 signal:
a) Direction key no longer pressed and output of the interpolator is 0,
b) Traversing via handwheel
c) In the INCR mode, if traversed with incremental feed,
d) Abort by RESET.

### JOG-REFPOINT mode

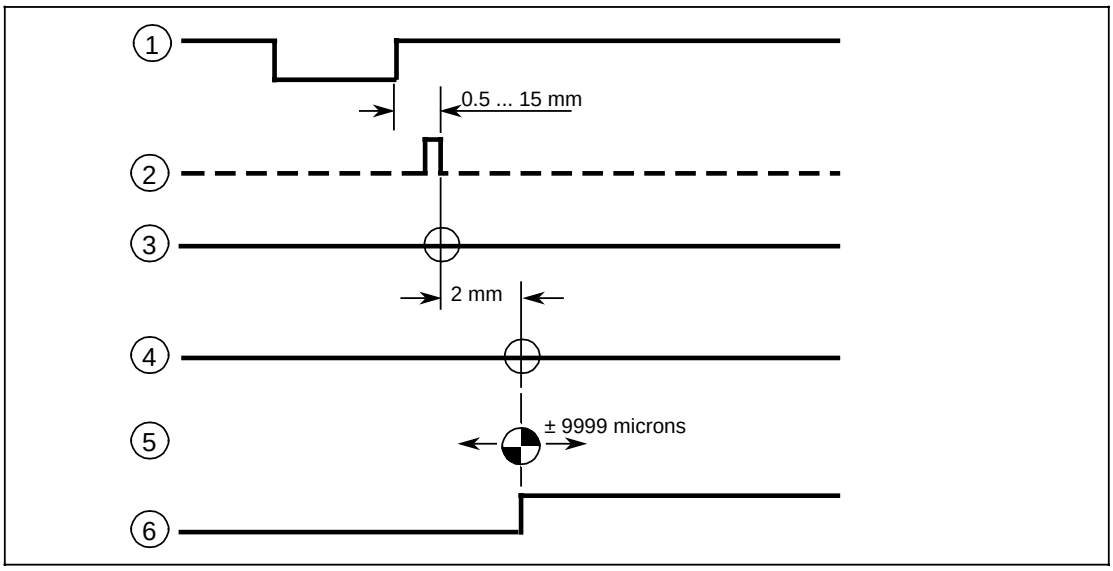
1 signal:
a) Approach to reference point without automatic detection of direction: pressing the direction key in the direction of reference point to be approached.
b) Approach of reference point with automatic detection of direction: a direction key is pressed.

0 signal: Reference point has been reached.

**REFERENCE POINT REACHED** **IB 118, 120, 122, 124 Bit 4**

1 signal: Reference point reached and axis synchronized. Signal is active until the power supply is switched off.
0 signal: Before synchronizing of axis.




1: DECELERATION signal
2: Zero mark measuring system mark signal
3: Zero mark of measuring system
4: Zero mark plus a distance of 2 mm in reference point approach direction
5: Reference point in the range: zero mark plus 2 mm ± 9999 microns
6: REFERENCE POINT REACHED signal

**Note:**

The reference point can be shifted via the machine data "Reference point shift" in the ± 9999 micron area, as referred to the 2 mm point.

When the reference point position has been reached, the actual value memory of the axis is placed on the reference point value (specified in the machine data) and the REFERENCE POINT REACHED signal is output.

**Example:**

Suppression of start signal, for example, when, on activation of a parking axis, the latter is not yet synchronized.

**AXIS IN POSITION CONTROL** **IB 118, 120, 122, 124 Bit 6**

1 signal: The axis concerned is in position control
0 signal: The axis is not in position control.

**Example:**

This signal can be used to allow the brake to be applied on vertical axes if SERVO ENABLE is taken away.

## 3.2 Description of PLC output signals

### 3.2.1 Central I/O device outputs (QB 0 - QB 3)

32 outputs (24V/0.4A/ short-circuit-proof) on the central controller are user-assignable.

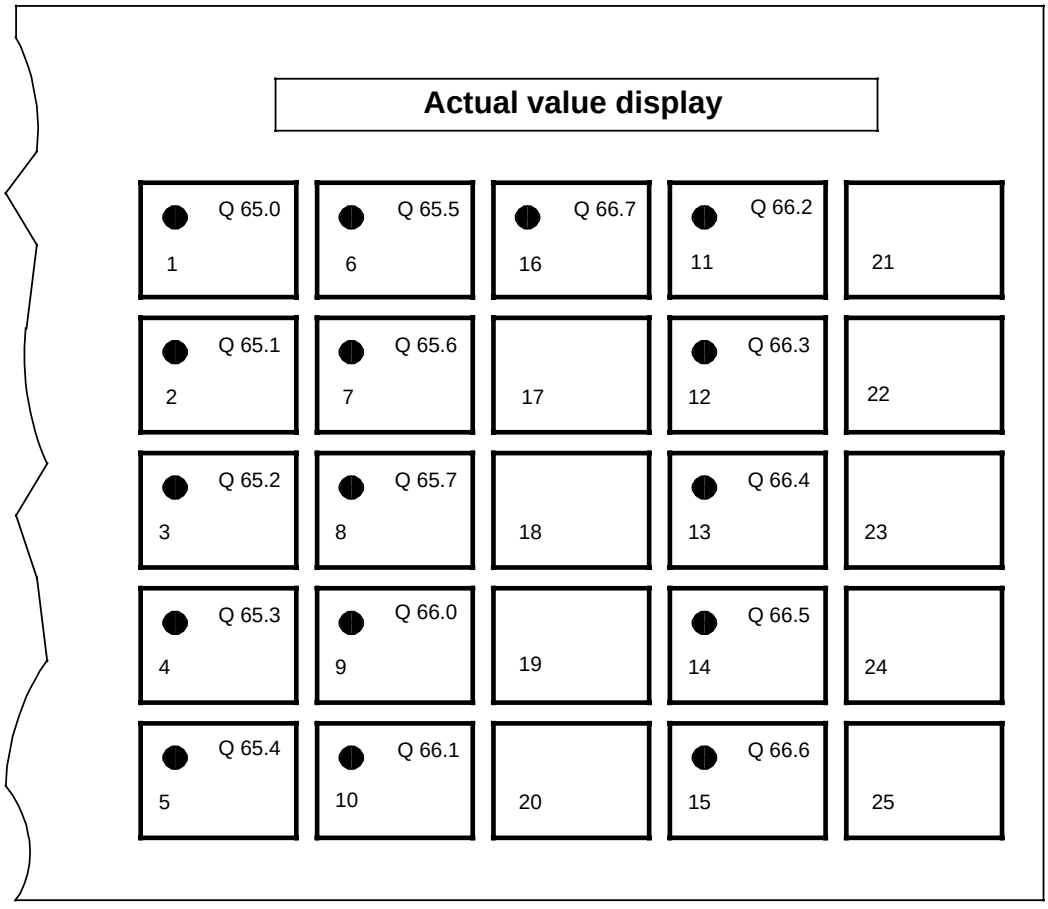
### 3.2.2 Distributed I/O device outputs (QB 4 - QB 64)

Here again, 32 outputs are user-assignable.
They are allocated as follows:

- DMP module via PLC MD 10 to 19
  (1st byte of the DMP module)

### 3.2.3 Outputs hand-held unit (QB 65 - QB 68)

This output range is used to control the LEDs on the hand-held unit. The following overview shows the allocation of output signals to the LEDs.



## 3.2.4 Outputs (reserved) (QB 69 - QB 73)

This output range is reserved and is not available to the PLC user.

## 3.2.5 Outputs 1st and 2nd keyboard expansion module (QB 74 - QB 77)

With each expansion submodule the PLC user can control 16 outputs (24V/100mA not short-circuit-proof).

**CAUTION**

- If the signal DISABLE KEYBOARD (Q79.7) is set, the transfer of output signals from the PLC to the expansion modules is also disabled.
- On PLC STOP the hardware outputs are still controlled by the PLC according to their signal state.

## 3.2.6 Interface signals from PLC NC (QB 78 - QB 127)

### 3.2.6.1 Ready signals of the PLC (QB 78 - QB 81)

| | |
|---|---|
| ***EMERGENCY STOP** | **QB 78 Bit 1** |

The EMERGENCY STOP switch is located either on the standard hand-held unit or on the customer operator panel in an easily accessible position. It is designed as a normally closed switch, the signal of which is wired up to an input in the central or distributed input range.

1 signal: Operational state of the control; EMERGENCY STOP button has not been actuated.
0 signal: EMERGENCY STOP state of the control; EMERGENCY STOP button has been actuated.

**Notes:**

1) 0 signal causes rapid deceleration with maximum brake current of the feed drives and the spindle drive. After a period fixed by the NC MD 156 has elapsed, the position control loops are opened and the NC goes into follow-up mode. The actual positional values are then also followed up in the emergency stop state.
2) The feed and spindle drive converters should remain under power until completion of the braking process.
3) If the NC was not isolated in the EMERGENCY STOP state, the axes need not be resynchronized (reference point approach) after cancelling the EMERGENCY STOP state.

**WARNING**

In addition to the software evaluation of the emergency stop loop, a hardware evaluation of the emergency stop loop is required.

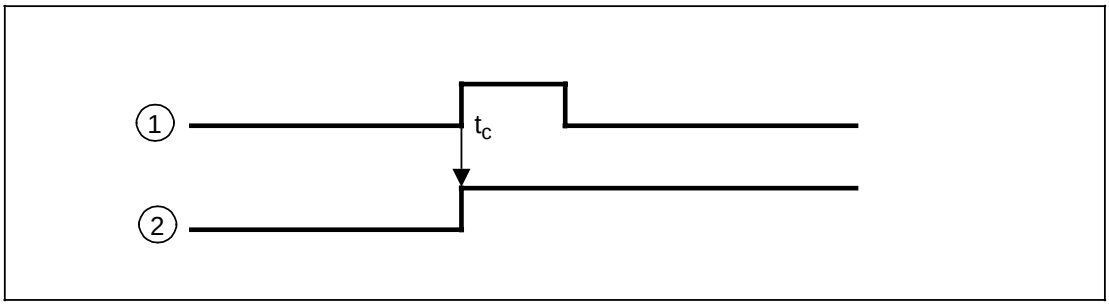
**DATA IN START 1st INTERFACE** **QB 78 Bit 4**

**DATA IN START 2nd INTERFACE** **QB 78 Bit 5**

1 signal: Start data input via the 1st and 2nd universal interface (e.g. NC part programs etc.).
0 signal: No start to data input.

**Note:**

The DATA IN START signal must be available for at least one PLC cycle.




1: DATA IN START signal ($t_c$ > 1 PLC cycle time)
2: Signal INTERFACE busy.

**KEYSWITCH** **QB 78 Bit 6**

0 signal: The NC keyboard input is disabled according to the specified machine data (NC MD 5005, 5006).
1 signal: The NC keyboard input is enabled.

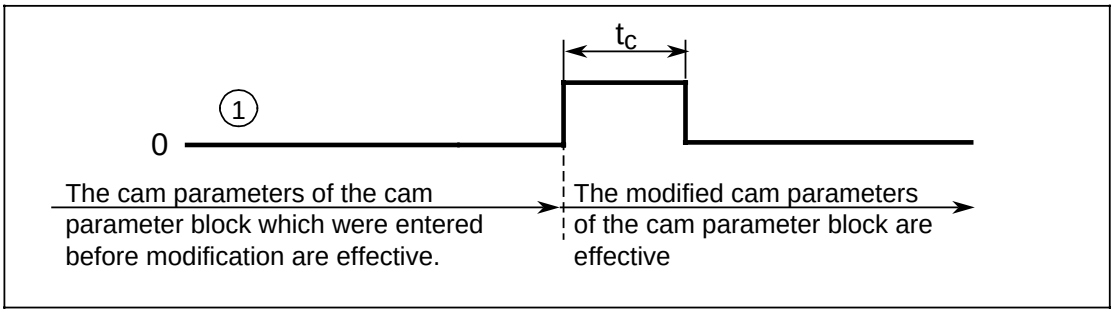
**Note:**

The KEYSWITCH signal can, for example, be influenced by the PLC program, according to a correspondingly hard-wired distributed input.

**TRANSFER OF ALL CAM VALUES** **QB 78 Bit 7**

1 signal: With the 0/1 edge, the modified parameter values of the cam parameter bvlock becomes active.
0 signal: No effect.




1: TRANSFER ALL CAM VALUES ($t_c$ 1 PLC cycle time)

**Note:**

The OUTPUT OF CAM SIGNALS function is an option (see also Installation Guide, Instructions, SINUMERIK 805, Section 11).

**AXIS NO., ACTUAL VALUE, HAND-HELD UNIT QB 79 Bit 0 - 2**

When allocating the actual values to the selected axis on the hand-held unit, these bits must be written by the PLC program according to the following table:

| Bit No.: | 2 | 1 | 0 | |
|---|---|---|---|---|
| Reset position | 0 | 0 | 0 | =^Screen dark |
| 1st axis | 0 | 0 | 1 | |
| 2nd axis | 0 | 1 | 0 | |
| 3rd axis | 0 | 1 | 1 | |
| 4th axis | 1 | 0 | 0 | |

**DISTANCE-TO-GO DISPLAY ON HAND-HELD UNIT Q 79 Bit 3**

The actual value or distance to go of the axis can be displayed on the hand-held unit, depending on the type of signal.

0 signal: Axis actual values are displayed on hand-held unit.
1 signal: Axis distances to go are displayed on hand-held unit.

**PLC DISPLAY ON HAND-HELD UNIT Q 79 Bit 4**

available with SW version 4.2 and higher

The contents of flag bytes FY96 to 98 can be displayed on the 7 $^1/_2$-digit LED display of the hand-held unit, if this bit is selected. A ”P” is displayed at the 7th position for the attention of the user.

0 signal: The hand-held unit LED display is used to display actual axis values or distances to go.
1 signal: The contents of flag bytes FY96 to 98 are displayed on the hand-held unit.

**Example:**

With this function, NC alarm numbers can be displayed on the hand-held unit if an operator panel is not used. Simply output the active NC alarms via FB61 from the NC and then put them into flag bytes FY96 to 98.

**SCREEN DARK** **QB 79 Bit 6**

0 signal: Operational state of control, screen on
1 signal: Screen dark

**Note**:

This function can, for example, be used during unattended shifts to prevent the monitor from burning in and can be automatically activated again by means of NC or PLC alarms.

**KEYBOARD DISABLE** **QB 79 Bit 7**

0 signal: Operational state of control, keyboard enabled.
1 signal: Keyboard disabled. Data exchange with the control is no longer taking place. The keyboard expansion modules will no longer be operated with.
necessary for operation of SINUMERIK 805 without operator keyboard.

**Notes**:

- If the keyboard is enabled, an acknowledgement message is given via FY 24 Bit 4
- This interface signal is not evaluated with the option ”Operator control and process monitoring via external PC”

**FAST M FUNCTION OUTPUT** **QB 80 Bit 0**

available with SW 4.1 and higher

This bit is used for enabling or disabling the transmission of fast M function signals from the NC control signal bits to the flag bytes 21 and 22 and to the NC outputs.

0 signal: Transmission of fast M function signals disabled.
1 signal: Transmission of fast M function signals enabled.

**Note**:

For function description, please refer to the Installation Instructions, Section 11.9.

**RAPID NC INPUTS DISABLED** **QB 80 Bits 2 to 6**

implemented with SW version 4.2 and higher

By setting this bit you can disable the functions of the rapid NC input in question. The functions are assigned via NC MD 322 to 327. The NC input signals are also displayed if the functions in flag byte 22 are disabled.
Q 80.2 is responsible for rapid NC input 2, Q 80.3 for rapid NC input 3 etc.

1 signal: The functions of the NC input in question are disabled.
0 signal: The functions of the NC input in question are active.

### 3.2.6.2 Modes (QB 82 - QB 83)

The modes can be selected via an external selector switch or via the integrated mode keys as follows:

| Position | Bit No. 3 2 1 0<br>Code D C B A | | | | Modes NC MD 5148 Bit 7= 0 | Modes NC MD 5148 Bit 7 = 1 |
|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 1 | PRESET | PRESET |
| 2 | 0 | 0 | 1 | 1 | MDA | MDA |
| 3 | 0 | 0 | 1 | 0 | MDA | MDA |
| 4 | 0 | 1 | 1 | 0 | JOG | JOG |
| 5 | 0 | 1 | 1 | 1 | JOG-INC variable | JOG-INC 1 |
| 6 | 0 | 1 | 0 | 1 | JOG-INC variable | JOG-INC 10 |
| 7 | 0 | 1 | 0 | 0 | JOG-INC variable | JOG-INC 100 |
| 8 | 1 | 1 | 0 | 0 | JOG-INC variable | JOG-INC 1000 |
| 9 | 1 | 1 | 0 | 1 | JOG-INC variable | JOG-INC 10000 |
| 10 | 1 | 1 | 1 | 1 | JOG-REPOS | JOG-REPOS |
| 11 | 1 | 1 | 1 | 0 | TEACH IN | TEACH IN |
| 12 | 1 | 0 | 1 | 0 | AUT | AUT |
| 13 | 1 | 0 | 1 | 1 | JOG-REF | JOG-REF |
| 14 | 1 | 0 | 0 | 1 | JOG-REF | JOG-REF |
| 15 | 1 | 0 | 0 | 0 | JOG-REF | JOG-REF |
| 16 | 1 | 0 | 0 | 0 | JOG-REF | JOG-REF |

TEACH IN mode as from SW 4.1

**Note:**

The signals of the mode selection, e.g of the integrated mode keys, are stored in input byte 103, bit 0 to 3. From here, the mode codings can be transferred independently of the PLC MD 2003 bit 3 to the PLC/NC interface QB 82 bit 0 to 3 without being modified. If required, direct mode selection via the PLC program is also possible.

**ACKNOWLEDGE ALARM** **QB 82 Bit 5**

1 signal: With the 0/1 edge, the NC alarms are acknowledged by nos. 3000 to 3081 and the PLC user alarms by nos. 6000 to 6063.
0 signal: No effect.

**Notes:**

- When PLC MD 2002 bit 3 is set (transfer from I/O image of inputs (PII) to I/O image of outputs (PIQ)), the ACKNOWLEDGE ALARM signal will also be influenced by the RESET signal.
- By operating the QUIT softkey in the alarm listing, this signal will be influenced and the above mentioned alarms acknowledged.
- The PLC user can reproduce this signal, for example, also by pressing a key on the hand-held unit.

**RESET** **QB 82 Bit 6**

1 signal: With the 0/1 edge the NC is reset and the reset positions are set (e.g. in the case of G functions).
0 signal: NC is not reset.

**Note:**

The RESET signal can be selected either using the RESET key or the PLC program.

**DRF ACTIVE** **QB 82 Bit 7**

1 signal: In the AUT or MDA mode, handwheel operation (Differential Resolver Function) also becomes active.
0 signal: Handwheel operation not possible during AUT or MDA mode.

**Note:**

In the AUT and MDA modes it is possible to set a permanent path offset (in accordance with the smallest defined input resolution) via handwheel. The offset is displayed separately and is maintained even following absolute blocks and Reset.

**M01 ACTIVE** **QB 83 Bit 3**

1 signal: The M01 in the part program leads to a programmed stop.
0 signal: The M01 in the part program does not lead to a programmed stop.

**DRY RUN FEED** **QB 83 Bit 4**

1 signal: Traversing takes place at the dry run feedrate selected by setting data instead of at the programmed feedrate (for G01, G02, G03). The dry run feedrate is also valid in place of the rotational and the thread cutting feedrate.
0 signal: Traversing takes place at the programmed feedrate. If the signal changes to "0" during a G33 block, then the programmed feedrate will only become effective at the end of the block.

**Example:**

Checking the workpiece program with increased feedrate.

**SINGLE BLOCK DECODING** **QB 83 Bit 5**

1 signal: Execution of all program block by block in AUT mode.
0 signal: No effect.

**Note:**

Usually only those blocks which contain traverse movement and/or auxiliary functions are executed block by block in single block mode. Even pure arithmetic blocks can be tested in single block mode using the DECODE SINGLE BLOCK signal.

**SINGLE BLOCK** **QB 83 Bit 6**

1 signal: Execution of a program block by block in AUT mode.
0 signal: No effect.

**Notes:**

1) If a contour definition is given in a program block, only one contour element will be traversed in the SINGLE BLOCK mode. If cutter radius compensation is selected intermediate blocks are inserted if required and also started one by one.
2) In the case of a series of G33 blocks, the SINGLE BLOCK mode is only effective if the DRY RUN FEEDRATE mode has been selected.
3) Arithmetic blocks are not processed in single steps.

**SKIP BLOCK** **QB 83 Bit 7**

1 signal: Those blocks marked with "/" (oblique) in the workpiece program are skipped, i.e. not executed. In the case of a series of skip blocks, the signal is only effective if it is given prior to the decoding of the first block, preferably before NC-START.

0 signal: No effect.
The execution of a series of skip blocks only takes place if the signal is at "0" before decoding of the first block of the series, preferably prior to NC-START.

**Note:**

As several blocks are executed in advance with block decoding, (in the case of pure arithmetic blocks the quantity is not limited), the decision whether to skip a block or not can be taken several blocks before actual execution is to take place. In order to ensure that the skip blocks are skipped at the correct moment, @714 "STOP DEC" must be programmed in the NC part program before the skip block. If several skip blocks follow directly one after the other, the command only needs to be programmed before the first skip block.

## 3.2.6.3 Feedrate modification (QB 84 - QB 85)

**FEEDRATE OVERRIDE** **QB 84 Bit 0 - 4**

Feedrate override can be set with the selection switch or on the hand-held unit, or can be specified as follows: The transfer of the 5-bit Gray code from the input to the output area must be programmed in the PLC program.

| Position | Bit No. 4 3 2 1 0<br>Code E D C B A | Override value in % |
|---|---|---|
| 1 | 0 0 0 0 1 | 0 |
| 2 | 0 0 0 1 1 | 1 |
| 3 | 0 0 0 1 0 | 2 |
| 4 | 0 0 1 1 0 | 4 |
| 5 | 0 0 1 1 1 | 6 |
| 6 | 0 0 1 0 1 | 8 |
| 7 | 0 0 1 0 0 | 10 |
| 8 | 0 1 1 0 0 | 20 |
| 9 | 0 1 1 0 1 | 30 |
| 10 | 0 1 1 1 1 | 40 |
| 11 | 0 1 1 1 0 | 50 |
| 12 | 0 1 0 1 0 | 60 |
| 13 | 0 1 0 1 1 | 70 |
| 14 | 0 1 0 0 1 | 75 |
| 15 | 0 1 0 0 0 | 80 |
| 16 | 1 1 0 0 0 | 85 |
| 17 | 1 1 0 0 1 | 90 |
| 18 | 1 1 0 1 1 | 95 |
| 19 | 1 1 0 1 0 | 100 |
| 20 | 1 1 1 1 0 | 105 |
| 21 | 1 1 1 1 1 | 110 |
| 22 | 1 1 1 0 1 | 115 |
| 23 | 1 1 1 0 0 | 120 |
| 24 | 1 0 1 0 0 | |
| 25 | 1 0 1 0 1 | |
| 26 | 1 0 1 1 1 | |
| 27 | 1 0 1 1 0 | |
| 28 | 1 0 0 1 0 | |
| 29 | 1 0 0 1 1 | |
| 30 | 1 0 0 0 1 | |
| 31 | 1 0 0 0 0 | |

**Note:**

The override percentage values given in the table are stored in the form of machine data. As standard, only the machine data for positions 1 to 23 are entered; the machine data not assigned can, however, be entered at a later stage. Accordingly, it is possible to evaluate the codes of positions 24 to 31 which are supplied by a coding switch or a PLC program.

**FEEDRATE OVERRIDE ACTIVE** **QB 84 Bit 5**

1 signal: The feedrate override set at the hand-held unit is active.
0 signal: The feedrate override values set at the hand-held unit are not active; the override value of 100 % is preset.

**Example:**

Using the FEEDRATE OVERRIDE ACTIVE signal, the feedrate override switch can be enabled during installation of a new NC program, e.g. by means of the keyswitch.

**Note:**

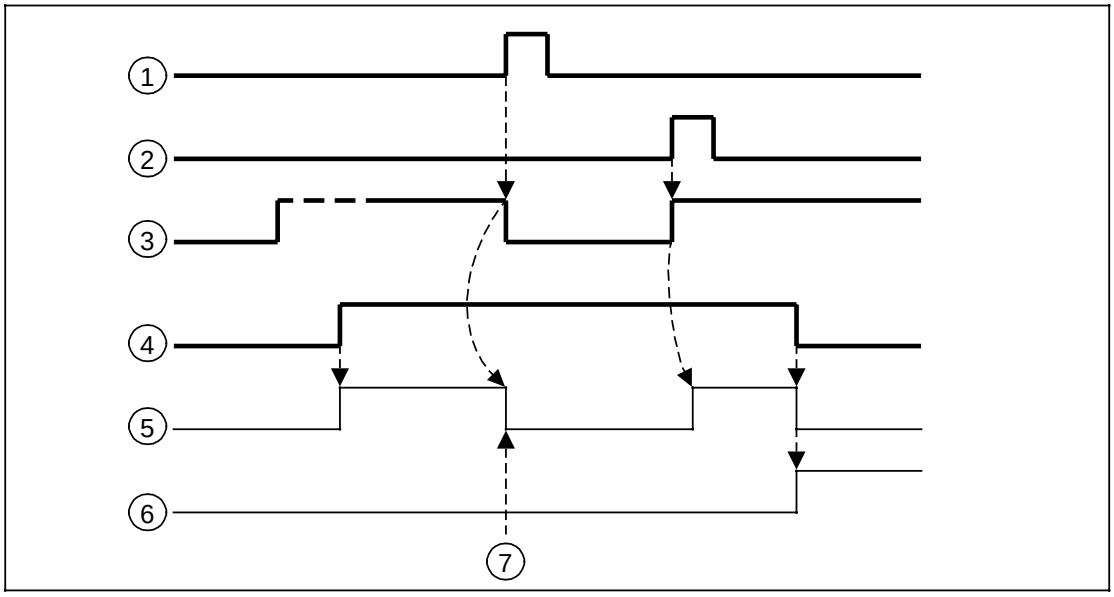
Even if output Q84.5=0 (i.e. feedrate override switch not active), the switch position 1, that is the code for position 1 (00001 or 00000), is active. As soon as this feedrate override code is active, the feedrate enable is cancelled internally.

**TOTAL FEEDRATE ENABLE** **QB 84 Bit 7**

1 signal: Causes feedrate enable of all axes
0 signal: Cause feedrate stop of all axes, as long as no G33 (thread) is in effect.

**Note:**

On removal of feedrate enable, the moving axes are stopped whilst the contour is maintained. The position control is maintained, i.e. the following error is eliminated.




1: FEEDRATE HOLD signal
2: FEEDRATE START signal
3: FEEDRATE ENABLE TOTAL signal
4: Travel command (e.g. X+)
5: (X-) axis moving
6: Block executed
7: Controlled approach

**Example:**

Stopping machining by issuing a FEEDRATE HOLD signal via the hand-held unit.

## RAPID TRAVERSE OVERRIDE QB 85 Bit 0 - 3

The rapid traverse override can be specified by means of selector switch on an external customer operator panel as follows:

| Position | Bit No. 3 2 1 0<br>Code D C B A | Override value in % |
|---|---|---|
| 1 | 0 0 0 1 | 1 |
| 2 | 0 0 1 1 | 10 |
| 3 | 0 0 1 0 | 50 |
| 4 | 0 1 1 0 | 100 |
| 5 | 0 1 1 1 | |
| 6 | 0 1 0 1 | |
| 7 | 0 1 0 0 | |
| 8 | 1 1 0 0 | |

**Notes:**

1) The percentage values given in the table are stored under NC MD 147 - 154. As standard, only the machine data for positions 1 to 4 are entered; the machine data not assigned, however, can be entered at a later stage. Thus, it is also possible to evaluate the codes of positions 5 to 8 which are supplied by a coding switch or PLC program.
2) The values given in the table are only effective when NC MD 5004 bit 4 (separate rapid traverse override switch) is set and the RAPID TRAVERSE OVERRIDE ACTIVE signal type is "1".

## RAPID TRAVERSE OVERRIDE ACTIVE QB 85 Bit 5

Depending on the NC MD 5004 Bit 4 (separate rapid traverse override switch), this signal has the following effect:

| | Signal type for RAPID TRAVERSE OVERRIDE ACTIVE | |
|---|---|---|
| | 1 signal | 0 signal |
| NC MD 5004 Bit 4 =”1” | The values with rapid traverse switch are active | The values set with rapid traverse switch are not active, the override value 100 % is preset |
| NC MD 5004 Bit 4 =”0” | The value of the feedrate override switch limited to 100 %, is valid for the rapid traverse override | Rapid traverse override is not possible the override value 100 % is preset |

**Note:**

The RAPID TRAVERSE OVERRIDE ACTIVE signal can be affected by the "Program modification" softkey and by activating ROV (RAPID TRAVERSE OVERRIDE), on condition that PLC MD 2002 Bit 3 (transferred from the input to output display) is set.

**Example:**

By using the RAPID TRAVERSE OVERRIDE ACTIVE signal, it is possible to enable the rapid traverse override switch during installation of a new NC program, e.g. by means of a keyswitch switch.

### 3.2.6.4 Program modification (QB 86 - QB 91)

| INITIAL SETTING ZERO OFFSET | QB 86 Bit 0 - 2 |
|---|---|

**Standard**
Normally, G53 (deselect all ZOs) and D0 (deselect TO) affects the control and the actual value display of the control at the end of the program (M02/M30) or on program abort (reset).

As soon as the processing of a part program is started (Automatic/MDA), however, the standard program initial setting G54 takes immediate effect on the control actual value system.

Only when the setting data "workpiece-related actual value system" is set, are the zero offset (G54 - G57) and the tool offsets (D numbers) taken into account in the actual value display.

**Function**
It is now possible for the user to define an alternative zero offset (G54 - G57) programmable initial setting, using the "initial setting zero offset via PLC function", i.e. when a part program has been processed, the ZO selected via the PLC takes immediate effect and not G54, as is usually the case.

This programmable initial setting, however, also affects the actual value display when the control is in the reset condition, i.e. the selected zero offset is taken into account.

Additionally, the length compensation for the last selected D number is maintained in the actual value display.

If a part program is executed, the zero offset selected by the PLC remains effective (exception: if G53 has been selected via the PLC, then G54 is automatically activated on NC start). The tool offset is, however, immediately deselected by the initial setting D0.

The following table shows the bit combinations to be entered and the effect they have:

| Bit combination | | | | Activated initial setting | Effect |
|---|---|---|---|---|---|
| Bit: | 2 | 1 | 0 | | |
| | 0 | 0 | 0 | G 53 | All zero offsets are deselected (irrespective of mode). After activation of NC start in the MDA and Automatic modes, the programmable initial setting G54 is immediately valid for the parts program which is to be processed. |
| | 0 | 0 | 1 | G 53 | All zero offsets are deselected (irrespective of mode). After activation of NC start in the MDA and Automatic modes, the programmable initial setting G54 is immediately valid for the parts program which is to be processed. |
| | 0 | 1 | 0 | G 54 | G54 is activated as initial setting in all modes |
| | 0 | 1 | 1 | G 55 | G55 is activated as initial setting in all modes |
| | 1 | 0 | 0 | G 56 | G56 is activated as initial setting in all modes |
| | 1 | 0 | 1 | G 57 | G57 is activated as initial setting in all modes |

**Prerequisites for the function "Initial setting ZO via PLC":**

1) NC MD bit 5148.1 (initial setting ZO via PLC) must be preset.
2) The function WORKPIECE-RELATED ACTUAL VALUE SYSTEM must be activated (setting data bit).

**Notes:**

1) Modification of the initial setting via PLC does not take effect until the NC is in the RESET condition (after program end (MO2, M30) or after program abort (RESET)).
2) The zero offsets programmed in the part program act as programmed.

**NC START** **QB 87 Bit 0**

## AUT mode

0/1 transition: The selected NC program is initiated or continued. The programmed auxiliary functions are displayed.
1/0 transition: No effect.

## MDA mode

0/1 transition: The entered block information is enabled for execution.
1/0 transition: No effect.

## JOG mode

0/1 transition: The entered M, S, T and H functions are enabled for execution.
1/0 transition: No effect.

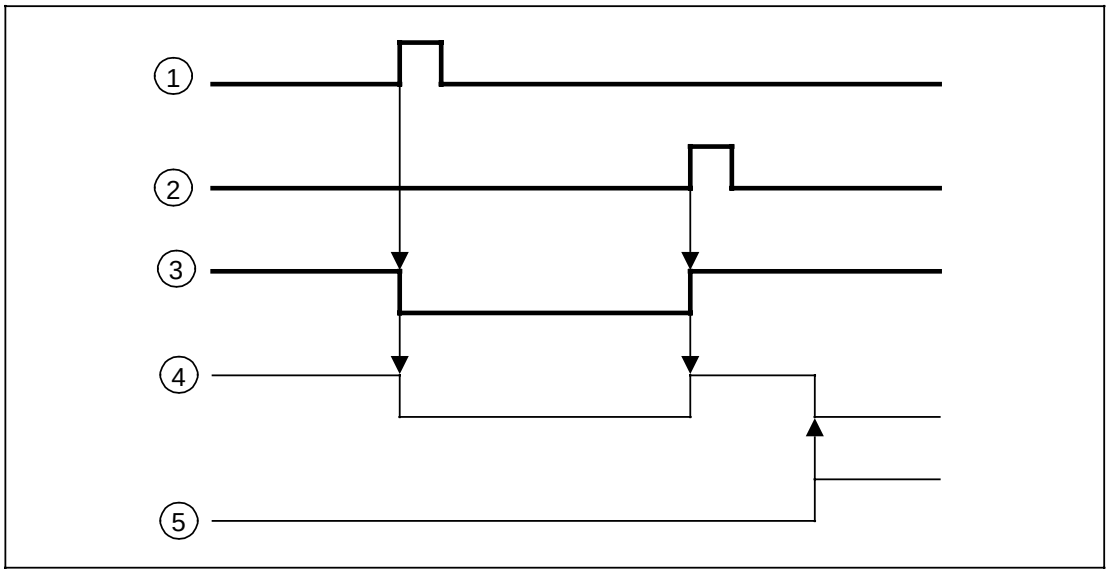
**Notes:**

1) The NC START signal must exist for at least one PLC scan.
2) Subroutines can be selected and started without calling up the main program.

**NC STOP** **QB 87 Bit 1**

0/1 transition: The current NC program is stopped immediately and the current block is not executed further. Distances to go are traversed only after NC START.
1/0 transition: No effect.




1: NC STOP signal
2: NC START signal
3: PROGRAM RUNNING signal
4: Axis moving
5: Block executed

**Notes:**

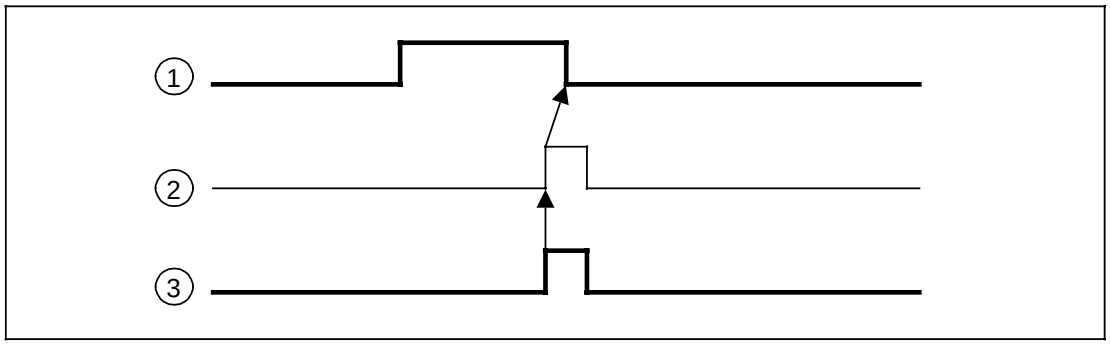
1) The NC STOP signal must exist for at least one PLC scan.
2) If the NC program has been stopped, additional auxiliary functions (for example) can be put into memory. They are executed at the next NC START.
3) The program is continued from the point of interruption with NC START. If additional auxiliary functions have been put into memory while a program was interrupted, only these are effective with the first Start signal. The program is then continued with the second NC Start.

**DELETE SUBROUTINE PASS NUMBER** **QB 87 Bit 2**

1 signal: The current remaining number of subroutine passes is deleted.
0 signal: No effect.

**Notes:**

1) By deleting the remaining number of subroutine passes, the NC can be synchronized with a machine position signalled from outside.
2) The subroutine currently running is executed normally up to M17.
3) The 1 signal must exist up to the end of the subroutine and must be cancelled with M17.
4) To abort the subroutine execution deliberately, it is necessary to program @ 714 (clear buffer) in the last block before M17.




1: DELETE NUMBER OF SUBROUTINE PASSES signal
2: Valid M17 decoded
3: M modification signal

**DELETE DISTANCE TO GO** **QB 87 Bit 3**

0/1 transition: The distances to go (differences between set and actual positions) of all axes are deleted. Any following error is reduced. Any active dwell blocks are aborted.
1/0 transition: No effect.

**Notes:**

1) The DELETE DISTANCE TO GO signal must exist for at least one PLC scan.
2) After DELETE DISTANCE TO GO a program block containing G90 must follow at least for the deleted axis.

**READ-IN ENABLE** **QB 87 Bit 5**

## AUT/MDA modes

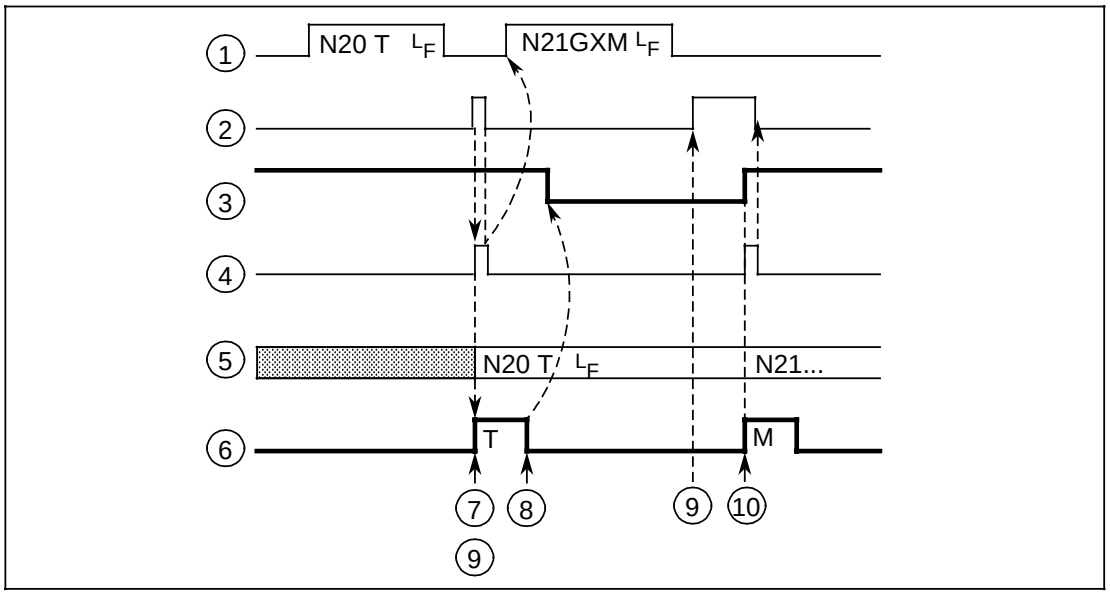
1 signal: Data transfer of next block into main memory is enabled.
0 signal: Data transfer of next block into main memory is disabled.

### JOG/AUT mode interrupted with NC STOP

1 signal: Activation of auxiliary functions entered throught the NC keyboard with NC start is enabled.
0 signal: Activation of auxiliary functions disabled.

**Note:**

If the execution of the auxiliary function must be completed for the processing of the next NC block (e.g for tool change), automatic block change must be prevented by removing READ-IN ENABLE.




1: Read-in in buffer memory
2: Block executed
3: READ-IN ENABLE signal
4: Data transfer into main memory
5: Contents of main memory
6: Auxiliary function output
8: Read-in disable for tool change
9: Scan point of read-in enable on NC side
10: Reset READ-IN ENABLE

## 3.2.6.5 Signals to spindle (QB 100 - QB 103)

**SPINDLE OVERRIDE** **QB 100 Bit 0 - 3**

The spindle override can be set via selector switch or customer operator panel. The NC assigns the 4 bit code of the selector switch to the override values irrespective of SPINDLE OVERRIDE ACTIVE (Q 100.4) according to the following table:

| Position | Bit No. 3 2 1 0<br>Code D C B A | Override value in % |
|---|---|---|
| 1 | 0 0 0 1 | 50 |
| 2 | 0 0 1 1 | 55 |
| 3 | 0 0 1 0 | 60 |
| 4 | 0 1 1 0 | 65 |
| 5 | 0 1 1 1 | 70 |
| 6 | 0 1 0 1 | 75 |
| 7 | 0 1 0 0 | 80 |
| 8 | 1 1 0 0 | 85 |
| 9 | 1 1 0 1 | 90 |
| 10 | 1 1 1 1 | 95 |
| 11 | 1 1 1 0 | 100 |
| 12 | 1 0 1 0 | 105 |
| 13 | 1 0 1 1 | 110 |
| 14 | 1 0 0 1 | 115 |
| 15 | 1 0 0 0 | 120 |
| 16 | 1 0 0 0 | 120 |

**Note:**

The override values given in the table are standard values which are stored in NC MD 131 - 146. These MDs can be modified, if required.

**SPINDLE OVERRIDE ACTIVE** **QB 100 Bit 4**

1 signal: The spindle override specified by means of spindle override switch is active
0 signal: The spindle override specified by means of spindle override switch is inactive; the override value of 100 % is preset.

**Example:**

Using the SPINDLE OVERRIDE ACTIVE signal, the spindle override switch can be enabled during installation of a new NC program by means of keyswitch, for example.

**DEFINE ZERO SETPOINT** **QB 100 Bit 5**

1 signal: The current speed setpoint is overwritten with ZERO and thus causes deceleration of the spindle in accordance with the ramp characteristic. The old setpoint is erased.
0 signal: No effect.

**Note:**

Normally the speed setpoint ZERO is defined automatically at the end of the program or on program abort. If it is suppressed by machine data, then this must be done via the ZERO SETPOINT INPUT signal, in accordance with criteria which must be given in the PLC program.

**SERVO ENABLE** **QB 100 Bit 6**

1 signal: Causes spindle SERVO ENABLE. The control loop is closed.
0 signal: a) Causes control loop to open when spindle is stationary.
b) Causes rapid deceleration when spindle is traversing.The spindle is brought to a halt with max. braking current and the interface to the drive is opened after a time specified by the NC MD 4470 (waiting time for SERVO ENABLE).

**Note:**

If the SERVO ENABLE is removed whilst the spindle is running, no NC alarm is output.

**SPINDLE ENABLE** **QB 100 Bit 7**

1 signal: Causes spindle drive enable, the spindle speed being increased via the ramp characteristic.
0 signal: Causes the spindle to stop, the spindle speed being reduced via the ramp characteristic.

**Notes:**

1) If the spindle enable is removed, the specified speed setpoint is ZERO.
2) If the spindle is re-enabled, the previous speed setpoint applies.

## ACTUAL GEAR STAGE QB 101 Bit 0 - 2

A large speed range of the main spindle is obtained by means of a multiple stage gear unit positioned on the output side of the d.c. motor. The set speed defined with the S value via the NC program is always related to the speed of the main spindle and not to the speed of the d.c. motor. Consequently, the current gear stage must be taken into account when calculating the speed setpoint which is output via S-Analog. The actual gear stage is therefore communicated to the NC in coded form as follows:

| Bit No. | 2 1 0 |
|---|---|
| Gear stage | Code<br>C B A |
| 1 | 0 0 0 |
| 2 | 0 0 1 |
| 3 | 0 1 0 |
| 4 | 0 1 1 |
| 5 | 1 0 0 |
| 6 | 1 0 1 |
| 7 | 1 1 0 |
| 8 | 1 1 1 |

**Notes:**

1) The lowest spindle speed range is allocated to gear stage 1.
2) In cases where there are less than 8 gear stages, the codes for nonexistent gear stages must not be transferred to the NC.
3) The signals for the actual gear stage are in each case transferred to the NC at the end of the PLC cycle and thus cause the spindle speed to change immediately.

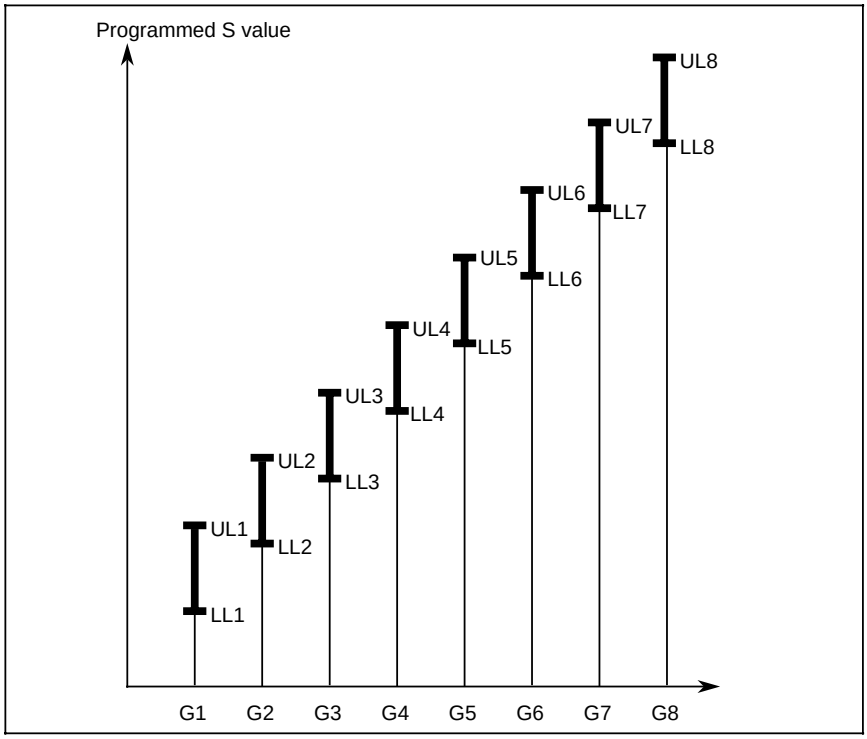
## AUTOMATIC GEAR STAGE SELECTION QB 101 Bit 3

1 signal: Generally, this signal must be set statically to "1" if the gear stages required for the execution of the NC program are to be selected automatically.
0 signal: The set gear stage is not selected automatically.

**Note:**

In the case of the 1 signal, the gear stage is automatically chosen via the NC using the programmed S value, when a constant cutting speed is not being used (G96). The speed limits of the individual gear stages are defined via machine data and may overlap in the region of the gear change boundary. Alternation between the gear stages should take place as little as possible, i.e. the spindle should be operated at the same gear stage until the upper or lower speed limit within that speed range has been reached. Only when the set gear stage limit at that point has been reached, is a new gear selected by the NC.
Normally, the gear change boundaries will, depending on the operating range of the motor controller, more or less overlap, so that a wide spindle speed range is available within one gear stage.
(See Section 3.1.7.2, CHANGE GEAR signal)




UL : Upper speed limit of gear stage
LL : Lower speed limit of gear stage
G1-G8 : Gear stage 1 - 8
S-Prog : Programmed S value

**INVERT MO3/M04** **QB 101 Bit 4**

1 signal: The setpoint voltage defined for M02/M04 is inverted.
0 signal: No inversion

**Example:**

In the case of mechanical back gear units (e.g. drill-heads) the gearing inverts the direction of rotation. Using the INVERT M03/M04 signal produces the correct direction of rotation.

**SPINDLE RESET** **QB 101 Bit 5**

This bit only operates when NC MD 5210 Bit 6 = "1" (separate spindle reset).
A separate reset command can thus be given to the spindle when the control is already in the reset state.

**PLC SPINDLE CONTROL** **QB 103 Bit 0**

1 signal: VDI signals from PLC - NC (SET DIRECTION OF ROTATION CW, OSCILLATION SPEED, BASIC SPEED, POSITION SPINDLE, RESYNCHRONIZE SPINDLE, ACKNOWLEDGE M19).
0 signal: Spindle control via NC.

**Notes:**

- If only the PLC SPINDLE CONTROL is set, the set direction of rotation is clockwise!
- If a new S word is passed on by the NC program during the PLC spindle control, it only becomes active when PLC SPINDLE CONTROL has been removed.

**ACKNOWLEDGE M19** **QB 103 Bit 2**

1 signal: The position control of the spindle is cancelled. The signal is only active if "M19 active" (I114.1) has previously been passed from the NC to the PLC.
0 signal: No effect.

**Notes:**

1) If the "M19 active" (I114.1) function has been selected, "acknowledge M19" cancels the spindle position control. The signal must be formed as follows in the PLC program:
   A I114.1 (M19 active)
   A I114.4 (spindle position reached)
   A "user signal"
   = Q103.2 (acknowledge M19)
   = Q103.0 (PLC spindle control)

2) ACKNOWLEDGE M19 is only active in combination with PLC SPINDLE CONTROL (Q103.0).

3) ACKNOWLEDGE M19 is only active in combination with NC MD 5210 bit 4 (acknowledge M19 with PLC or M03/M04).

**Example:**

Moving the spindle to the tool change position; tool change can also be programmed with M06 **only** (without M19) if the PLC signals POSITION SPINDLE (Q103.4) to the NC on account of M06.

| **RESYNCHRONIZE SPINDLE** | **QB 103 Bit 3** |
|---|---|

1 signal: The spindle is resynchronized in line with the encoder.
0 signal: No effect.

**Note:**

RESYNCHRONIZE SPINDLE is only active in combination with PLC SPINDLE CONTROL (Q 103.0)

**Example:**

Resynchronization of encoder and spindle control, when in the case of drill-heads, the encoder is resynchronized at the same time as the drill-head.

**POSITION SPINDLE** **QB 103 Bit 4**

1 signal: Positioning of spindle (e.g. for tool change) is started.
0 signal: No effect.

**Notes:**

1) The set position of the spindle is defined via NC MD 4520 (spindle position with external M19).
2) If the spindle is turning, positioning is performed without changing the direction of rotation.
3) If the spindle is initially stationary, positioning is performed in the direction of the smallest angle of rotation.
4) The spindle rotates at creep speed which has been defined in the machine data (as in option "M19" (oriented spindle stop).
5) POSITION SPINDLE is only active in combination with PLC SPINDLE CONTROL (Q 103.0).

**Example:**

Positioning of spindle into tool or workpiece change position.

**BASIC SPEED** **QB 103 Bit 5**

The BASIC SPEED signal is active in all modes.

1 signal: No fixed basic speed is defined for the spindle.
0 signal: No effect.

**Notes:**

1) The basic speed, a fixed, very low set speed, is defined by NC MD 4490 (basic speed); SPINDLE OVERRIDE is active.

2) The spindle speed is defined together with the basic speed, i.e. the current gear stage is taken into account when calculating the set speed of the spindle drive.

3) BASIC SPEED is only active in combination with PLC SPINDLE CONTROL (Q 103.0).

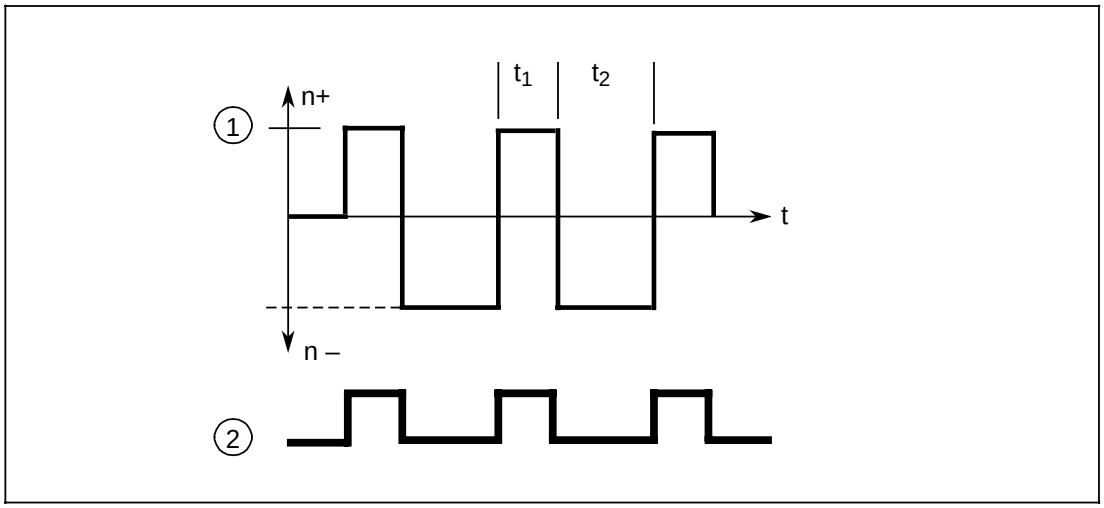
**Example:**

Rotating spindle for measuring processes at very low speed.

**OSCILLATION SPEED** **QB 103 Bit 6**

1 signal: The set value in MD 4500 (oscillation speed setpoint) is output to the drive unit of the spindle.
0 signal: No effect.




1: Oscillation speed of motor
2: SET DIRECTION OF ROTATION CW ($t_1$, $t_2$ unequal)

**Notes:**

1) The spindle override is active.
2) This set value does not determine the spindle speed but the motor speed.
3) The time periods t1 and t2 for each direction of rotation are defined by the SET DIRECTION OF ROTATION CW signal from the user program in the PLC. When the direction of rotation is changed, the ramp characteristic is not taken into account.
4) If oscillation is not required, the direction of rotation must be preset.
5) OSCILLATION SPEED is on active in combination with PLC SPINDLE CONTROL (Q103.0).

**Example:**

Changing gear by oscillating the drive motor in order to facilitate gear stage engagement (see section 4.1.4, description of CHANGE GEAR SIGNAL (Q 103.0)

**SET DIRECTION OF ROTATION CW** **QB 103 Bit 7**

1 signal: PLUS set voltage is output (direction of rotation clockwise).
0 signal: MINUS set voltage is output (direction of rotation counterclockwise)

**Notes:**

1) The SET DIRECTION OF ROTATION CW signal is only active in combination with the OSCILLATION SPEED or BASIC SPEED signals.
2) When the spindle is controlled by the NC, i.e. when the spindle speed is defined using the NC program or the NC keyboard, the SET DIRECTION OF ROTATION CW signal is not active.
3) SET DIRECTION OF ROTATION is only active in combination with PLC SPINDLE CONTROL (Q 103.0).

### 3.2.6.6 Signals to analog outputs (QB 104 - QB 107)

**SETPOINT AND SERVO ENABLE ANALOG 1/2/3** **QB 104 Bit 0/1/2**

available with SW version 4.2 and higher

1 signal: Setpoint and servo enable for the analog output in question is active. A programmed NC or PLC setpoint can be output.

0 signal: The analog output in question is disabled. A programmed NC or PLC setpoint is not output or an applied analog voltage is not output until the 0 signal is applied.

**Note:**

The function in ”3 Analog setpoint outputs” is described in the Installation Instructions, Section 11.12.

**RESET FOR NC ANALOG OUTPUTS** **QB 104 Bit 6**

available with SW version 4.2 and higher

1 signal: The analog outputs which were programmed with H functions H11=, H12= and H13= are reset to 0V.

0 signal: The analog outputs are not reset.

**Notes:**

1) This signal is only active when NC MD 5148 bit 2 is set to 1 (same RESET for analog outputs).
2) The function in ”3 Analog setpoint outputs” is described in the Installation Instructions, Section 11.12.

**SETPOINT OUTPUTS FROM PLC ANALOG 1/2/3 QB 105 Bit 0/1/2**

available with SW version 4.2 and higher

1 signal: The setpoint output from the PLC (DB 28 DW 1/5/9) is used for the analog output in question.

0 signal: The setpoint output from the NC is used for the analog output in question. Values programmed with auxiliary functions H11=**/**H12=**/**H13=.

**Note:**

The function in ”3 Analog setpoint outputs” is described in the Installation Instructions, Section 11.12.

**INVERT ANALOG VOLTAGE 1/2/3 QB 105 Bit 3/4/5**

available with SW version 4.2 and higher

1 signal: The polarity of the voltage resulting from the current setpoint and the weighting factor is inverted.

0 signal: The resulting voltage is output with its programmed polarity.

**Note:**

The function in ”3 Analog setpoint outputs” is described in the Installation Instructions, Section 11.12.

## 3.2.6.7 Signals to axes (QB 108 - QB 127)

**2ND SOFTWARE LIMIT SWITCH +/- ACTIVE** **QB 108, 112, 116, 120 Bit 0, 1**

1 signal: Second software limit switch is active for direction +/- / first software limit switch is not active.
0 signal: First software limit switch is active.

**Example:**

Reduction of the permissible traversing range with tailstock swivelled in.

**Note:**

The values for the 1ST and 2ND SOFTWARE LIMIT SWITCH PLUS and MINUS for the axes are stored in NC MD 224* and 232* or NC MD 228* and 236* accordingly.

**SERVO ENABLE** **QB 108, 112, 116, 120 Bit 2**

### AUT/MDA mode:

1 signal: Causes the position control loop of each axis concerned to close.
0 signal:
a) Causes the position control loop to open when the axis is stationary.
b) Causes rapid deceleration when the axis is traversing. The drive is brought to a halt with maximum braking current and the position control loop is opened after a time specified by the machine data.
c) All interpolating axes are stopped when SERVO ENABLE for **one axis** is cancelled. The axes for which the SERVO ENABLE signals still apply can, however, only be stopped by specifying the speed setpoint ZERO. The following error of these axes is eliminated. Continued execution of the NC program is then no longer possible as the axes are not able to reach their programmed set position (NC block not processed).

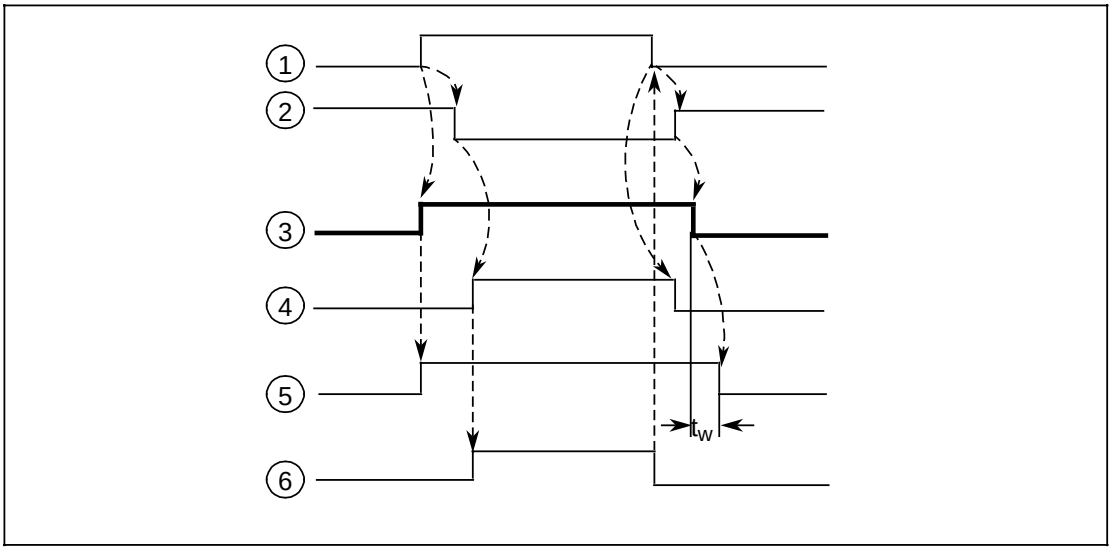
### Setup modes:

1 signal: Causes SERVO ENABLE of each axis
0 signal:
a) Causes the position control loop to open when the axis is stationary.
b) Causes rapid decelaration when axis is traversing.

**Notes:**

1) A following error remaining after rapid deceleration is stored and is corrected after a renewed SERVO ENABLE.
2) If SERVO ENABLE is removed whilst the axis is traversing, then NC alarm 168* (Servo Enable refused for travelling axis).
3) During normal operations, the SERVO ENABLE signals must be active for all interpolating axes.




*Servo enable*

1: TRAVEL COMMAND signal (e.g. + X)
2: X axis clamp
3: SERVO ENABLE X signal
4: FEEDRATE ENABLE X signal
5: *SERVO DISABLE X
6: X AXIS traversing (tw = deceleration time)

**Sequence:**

1) When the axis travel command (e.g. X axis) is output, the clamp is released and SERVO ENABLE is possible.
2) SERVO ENABLE cancels servo disable.
3) As soon as the clamp is released feedrate enable is output and the axis traverses.
4) If the travel command is removed the axis stops and is again clamped.
5) After clamping the SERVO ENABLE is removed; after the deceleration time tw (NC MD 4470, deceleration time for SERVO ENABLE), servo disable is again output.

**PARKING AXIS** **QB 108, 112, 116, 120 Bit 3**

1 signal: Axis is in parking position
0 signal: No effect.

**Notes:**

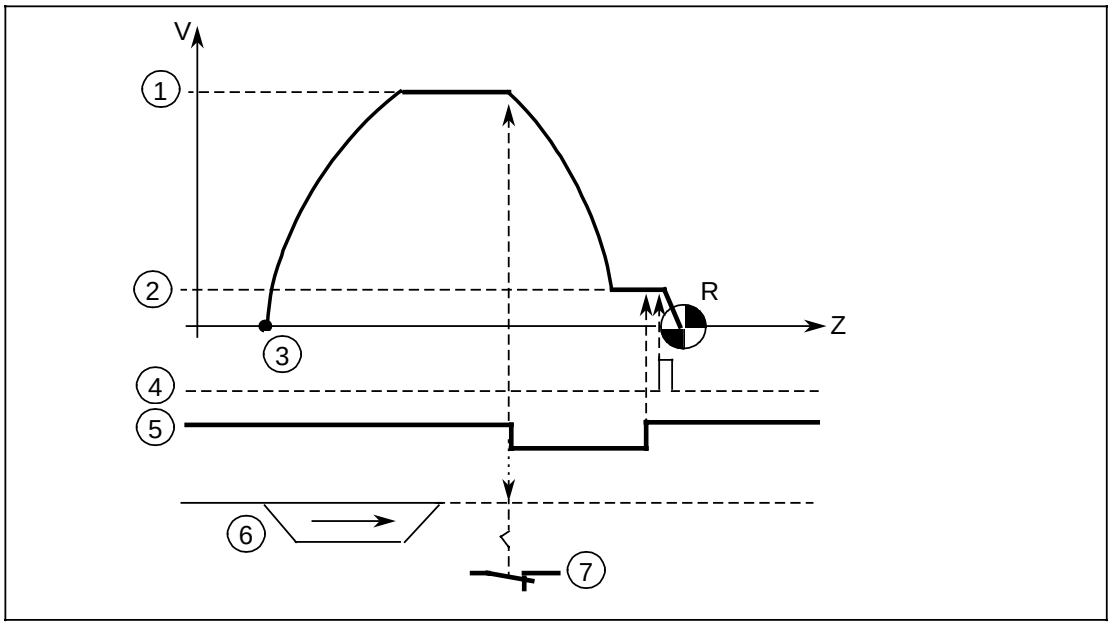
1) If an axis is declared a parking axis, the monitoring of the encoder -> measuring circuit module connection is disabled. No alarm is given if this link is disconnected (for instance to detach the axis, e.g. a rotary table, from the machine).
2) A setpoint is output while the signal PARKING AXIS is active and the position control monitoring is cancelled. Incoming actual position pulses are no longer counted.
3) The signal REFERENCE POINT REACHED is deleted when the signal PARKING AXIS becomes active. When the signal PARKING AXIS is removed, the reference point must be approached again.

| ***DECELERATION** | **QB 108, 112, 116, 120, Bit 4** |
|---|---|

**Only active in the JOG-REFPOINT mode:**

1/0 transition: Causes the selected axis to decelerate to creep speed which can be set internally (machine data).
0/1 transition: Causes the approach to the zero point of the measuring system plus (2 mm path +/- reference point offset).

**Reference point approach without automatic direction recognition:**




1: Reference point approach speed (NC MD 296*)
2: Reference point creep speed (NC MD 284*)
3: Starting point for reference point approach
4: ZERO POINT signal of measuring system
5: *DECELERATION signal
6: Actuating cam
7: Position switch.

**Sequence:**

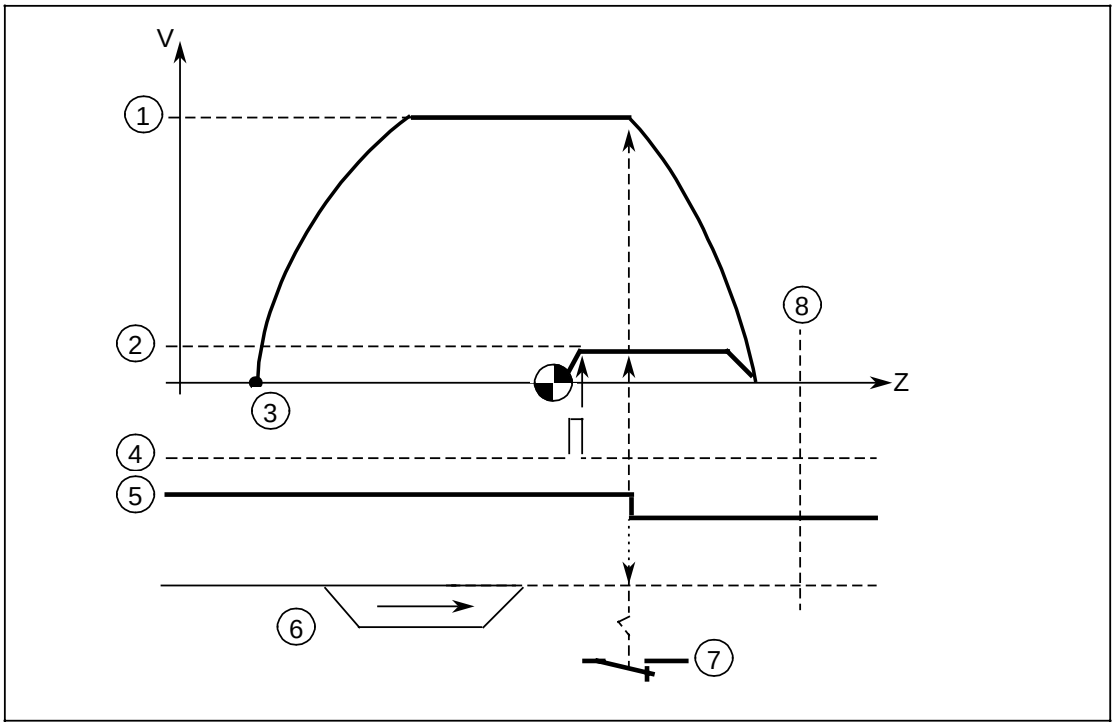
The Z axis, for example, is positioned at the start point in minus direction from the reference point. The user presses the direction key Z+, the axis travels towards the reference point. As soon as the actuating cam crosses the limit switch, the DECELERATION signal changes from 1 to 0. The axis decelerates to creep speed. If the cam again leaves the limit switch, the next zero point of the measuring system is approached on 0/1 transition of the *DECELERATION signal. As soon as the signal for the zero point appears, the axis moves towards the reference point.

**Comments:**

The limit switch which defines the *DECELERATION signal must be an NC contact. If the lead to the limit switch is broken, this can be recognized and the axis approach prevented.

**Reference point approach with automatic direction recognition**




1: Reference point approach speed (NC MD 296*)
2: Reference point creep speed (NC MD 284*)
3: Starting point for reference point approach
4: ZERO POINT signal of measuring system
5: *DECELERATION signal
6: Actuating cam
7: Limit switch
8: Machine end, limit of traversing path

**Sequence 1:**

The Z axis is positioned, for example, at the start point, in minus direction from the reference point. The user presses the Z+ direction key which is defined by machine data as the start key for reference point approach. The axis travels towards the machine end where the reference point lies; direction recognition is caused by the signal *DECELERATION = 1. As soon as the actuation cam crosses the limit switch the *DECELERATION signal moves from 1 to 0. The axis decelerates to zero speed and accelerates in the reverse direction to the creep speed. If the cam again leaves the limit switch, the next zero point of the measuring system is approached on 0/1 transition of the *DECELERATION signal. As soon as the zero point signal appears the axis approaches the reference point.

**Sequence 2:**

If the Z+ key is pressed when the axis is already positioned between the machine end and the reference point at the start of reference point approach (signal *DECELERATION = 0), the Z axis approaches the reference point at creep speed in the minus direction.

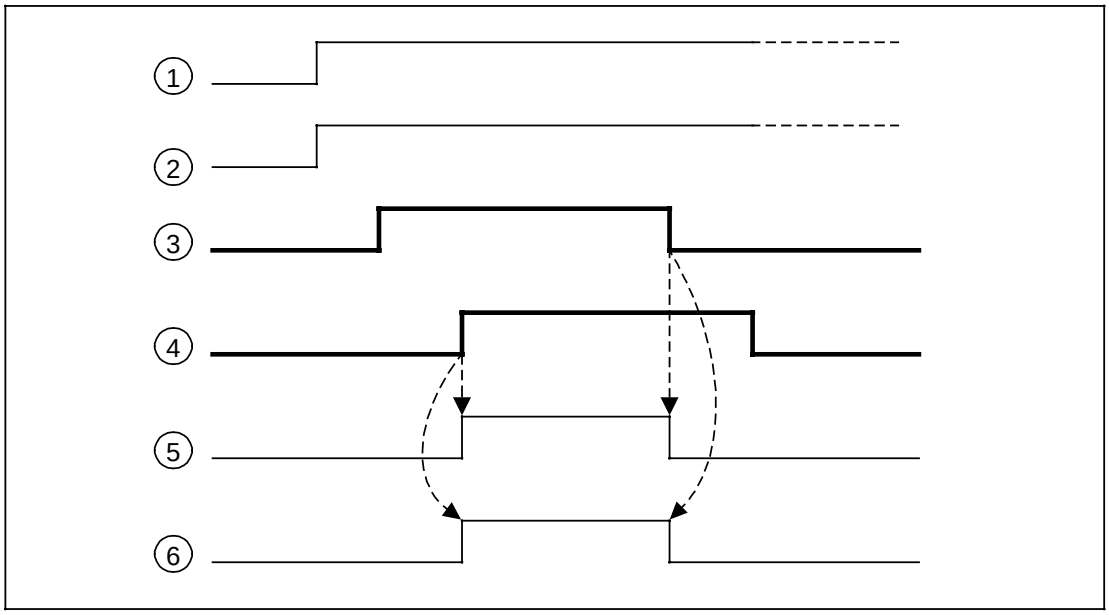
**Comments:**

- This process is only suitable for reference points which are close to the machine end because of the special actuating cam (length: from the machine end to the switch point).
- The cam must not leave the limit switch anywhere between the transition point to the machine end (end of traversing path), i.e. the *DECELERATION signal remains at "0".
- The limit switch which defines the *DECELERATION signal must be an NC contact. If the lead to the limit switch is broken (signal *DECELERATION = 0), the axis can only accelerate to the creep speed.

**FEEDRATE ENABLE** **QB 108, 112, 116, 120 Bit 5**

**AUT/MDA mode**

1 signal: Activates feedrate enable of each axis
0 signal: a) Activates feedrate hold of each axis
b) Activates feedrate hold of **all interpolating axes** if the feedrate enable for **one axis** is cancelled. In this case, all axes are stopped whilst maintaining the path. The position control is maintained, i.e. the following error is eliminated.




1: TRAVEL COMMAND (e.g. +X)
2: TRAVEL COMMAND (e.g. +Z)
3: FEEDRATE ENABLE X command
4: FEEDRATE ENABLE Z command
5: X axis traversing
6: Z axis traversing

**Setting-up modes:**

1 signal: Activates feedrate enable of each axis.
0 signal: Activates feedrate hold of each axis.

**FOLLOW-UP MODE** **QB 108, 112, 116, 120 Bit 6**

1 signal: NC position control loop is open; the drives are operated by an external speed setpoint.
0 signal: Normal conditions; the NC position control loops are closed

**Notes:**

1) 1 signal causes the position control loop to close when axis is stationary.
2) 1 signal causes rapid deceleration with maximum braking current when the axis is travelling and causes the position control loop to open after elapse of a time defined by NC MD 156 (Servo Enable Cutoff Delay). After this point only the position setpoint is maintained.
3) All interpolating axes are stopped if FOLLOW-UP mode is specified for one axis. Those axes which do not have the designation FOLLOW-UP mode, can only be halted by selecting the speed setpoint ZERO. The following error of these axes is eliminated.
4) Selecting the FOLLOW-UP mode for an interpolating axis will result in a NC error message. The NC program can no longer be processed.
5) When the FOLLOW-UP mode has been cancelled (0 signal) the axis does not have to be resynchronized (reference point approach).
6) In order to avoid incorrect positioning, the FOLLOW-UP mode in the STOP condition of the NC program must be cancelled in the AUT mode.

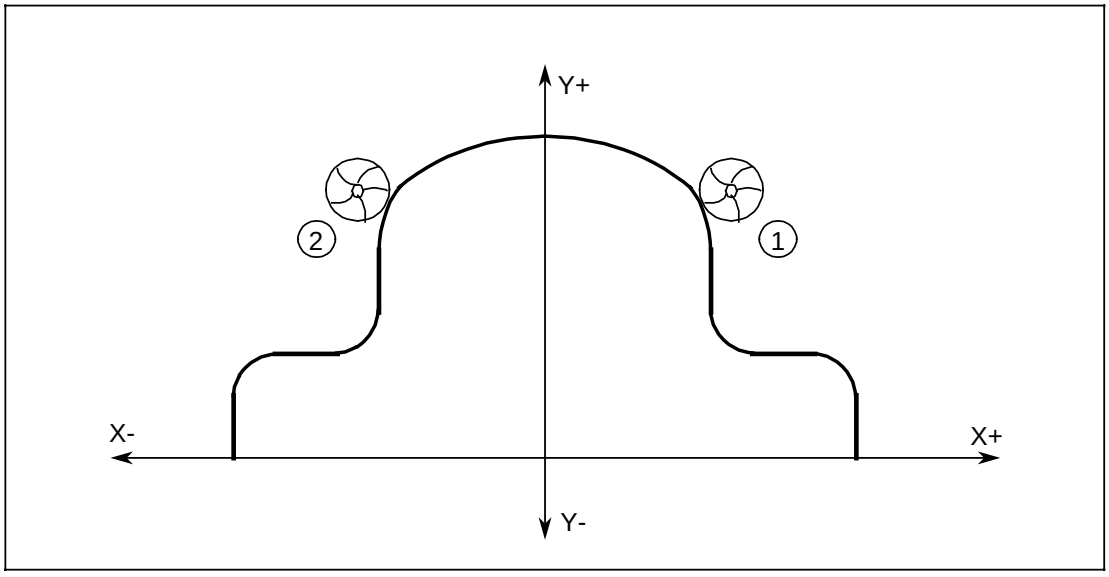
**MIRRORING** **QB 108, 112, 116, 120 Bit 7**

Mirroring in axes X, Y and Z is possible (all combinations).
The following applies in the case of the main axes:

1 signal: mirroring of programmed values
- cutter radius compensation (G41, G42)

**No mirroring** of
- zero point offset
- tool length compensation

**Note:**
When mirroring the main axes X, Y and Z the tool is always mirrored.




1: Normal operation
2: Tool mirrored on X

**HANDWHEEL 1 ACTIVE** **QB 109, 113, 117, 121 Bit 0**

1 signal: JOG mode: The axis concerned can be operated with the help of the 1st handwheel.
AUTOMATIC mode: A superimposed speed can be made with the help of the 1st handwheel in the axis selected, i.e. a speed which is determined by handwheel impulses per time unit, is added to/subtracted from the programmed speed of the axis.
0 signal: The 1st handwheel has no effect on the axis concerned

**Note:**
1) The handwheel can only be allocated to 4 axes at a time.
2) The handwheel function must be enabled via NC MD 5004 Bit2.

**HANDWHEEL 2 ACTIVE** **QB 109, 113, 117, 121 Bit 1**

available as from SW 4.1

| | | |
|---|---|---|
| 1 signal: | JOG mode: | The axis concerned can be operated with the help of the 2nd handwheel. |
| | AUTOMATIC mode: | A superimposed speed can be made with the help of the 2nd handwheel in the axis selected, i.e. a speed which is determined by handwheel impulses per time unit, is added to/subtracted from the programmed speed of the axis. |
| 0 signal: | The 2nd handwheel has no effect on the axis concerned | |

**Note:**

1) The handwheel can only be allocated to 4 axes at a time.
2) The handwheel function must be enabled via NC MD 5004 Bit2.
3) The 2nd handwheel is an option. See also Installation Instructions, Section 11.10.

**AXIS DISABLE** **QB 109, 113, 117, 121 Bit 3**

| | |
|---|---|
| 1 signal: | No new position setpoint is output to the machine axis concerned (axis disabled). The position control loop remains closed. |
| 0 signal: | Normal operation. |

**Note:**

In order to avoid incorrect positioning, AXIS DISABLE must not be cancelled until after the program has been ended or terminated.

**Example:**

Initial installation of a new PC program when axes are stationary.

**RAPID OVERRIDE** **QB 109, 113, 117, 121 Bit 5**

| | |
|---|---|
| 1 signal: | If the signal RAPID TRAVERSE OVERRIDE is entered when the JOG mode or JOG-REPOS mode is in operation, rapid traverse comes into effect. The speed set by NC MD 292* (normal rapid traverse) is effective. |
| 0 signal: | In normal operation, the speed set by the NC MD 288* (Feed Jog) is effective. |

**JOG +** **QB 109, 113, 117, 121 Bit 7**
**JOG –** **QB 109, 113, 117, 121 Bit 6**

1 signal: The axis is moved in the prescribed direction in the setting-up modes. (JOG, JOG-INC).
0 signal: No effect

**Notes:**

1) The speed at which the axis is to travel is defined by the machine data according to the mode.
2) No travel command is released if the plus (+) and minus (-) keys of an axis are pressed simultaneously.
3) A maximum of 2 axes can be moved simultaneously; if direction keys for more than 2 axes are operated at the same time, the keys are effective in the order in which they were operated.

**CAM PAIR ACTIVE 1,2,3 or 4** **QB 110, 114, 118, 122 Bit 0 -3**

Cam pairs can be activated for each axis using the following PLC outputs.

| Bit No. 3 | 2 | 1 | 0 | Function |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | Cam pair function not active |
| * | * | * | 1 | Cam pair 1 active |
| * | * | 1 | * | Cam pair 2 active |
| * | 1 | * | * | Cam pair 3 active |
| 1 | * | * | * | Cam pair 4 active |

**Note:**

1) The OUTPUT OF CAM SIGNALS must be available.
2) For a description of the function see Installation Guide, Instructions, SINUMERIK 805, Section 11
3) More than one cam pair can be activated simultaneously for each axis.

## 3.3 Description of PLC flag signals

### 3.3.1 Basic flag signals (FY 0 - FY 19)

#### 3.3.1.1 Basic signals (FY 0)

| **ZERO** | **FY 0 Bit 0** |
|---|---|

Flags with defined zero signal.

| **ONE** | **FY 0 Bit 1** |
|---|---|

Flags with defined one signal.

The flags are used as for the FB parameters which are not required but which must adopt a certain signal state and also produce a defined result of logic operation (RLO).

| **FLASHING FREQUENCY 1 Hz** | **FY 0 Bit 7** |
|---|---|

Here the PLC system program supplies a 1 Hz flashing frequency. The pulse/no-pulse ratio is 1:1.

**Example:**

A flashing lamp signals machine stoppage.

### 3.3.1.2 Current OB No. (FY 2)

| **CURRENT OB NO.** | **FY 2** |
|---|---|

OB no. of the OB which is currently being processed (fixed-point number).

| No. | Assigned OBs | |
|---|---|---|
| 1 | OB 1 | Cyclic PLC user program |
| 2 | OB 2 | Interrupt-controlled PLC user program |

### 3.3.1.3 Basic setting or cold start (FY 2 Bit 1 and 2)

| **BASIC SETTING or COLD START FY OB 1** | **FY 2 Bit 1** |
|---|---|

| **BASIC SETTING or COLD START FY OB 2** | **FY 2 Bit 2** |
|---|---|

1 signal: After cold start (e.g. with power-up) these flags are set at one.
0 signal: After the first complete processing of the organization block concerned.

Note: The functions of the signals from flag byte 2 and flag byte 3 are identical.

### 3.3.1.4 Basic setting or cold start (FY 3 Bit 2, 1 and 0)

| **BASIC SETTING or COLD START OB 20** | **FY 3 Bit 0** |
|---|---|

| **BASIC SETTING or COLD START OB 1** | **FY 3 Bit 1** |
|---|---|

| **BASIC SETTING or COLD START OB 2** | **FY 3 Bit 2** |
|---|---|

1 signal: After the cold start (e.g. power-up) these flags are set at one.
0 signal: After first complete processing of the organization block concerned.

**Example:**
Using this signal, program sections can be given a defined basic setting after cold start.

### 3.3.1.5 Processing time delay OB 2 (FY 6 Bit 2)

| PROCESSING TIME DELAY OB | FY 6 Bit 2 |
|---|---|

This bit is set if the alarm-driven processing of a program is required again before it is ended.

E.g. Edge change at an alarm input bit calls up OB 2. OB 2 requires 3 ms for processing (according to the length of the program). After 2 ms, however, yet another edge change takes place at another alarm input bit, OB 2 is still being processed flag 6.2 is set.

### 3.3.1.6 Group error I/Os (FY 8 Bit 0)

| GROUP ERROR I/0s | FY 8 Bit 0 |
|---|---|

This flag is set when the PLC does not go to stop because of an error in the PLC (e.g. a fault in the distributed I/Os, please observe PLC MD 2003). In the case of signal one, the data word 8 in data block 1 should be evaluated.

### 3.3.1.7 Signals for interrupt-controlled processing (FY 12, FY 16)

| NEGATIVE EDGE | FY 12 |
|---|---|

1 signal: When a signal state change from 1 to 0 appears at the relevant bit of and alarm input byte.

| POSITIVE EDGE | FY 16 |
|---|---|

1 signal: When a signal state change from 0 to 1 appears at the relevant bit of an alarm input byte.

These signals remain in this state until OB 2 is processed, only then do they change back.

## 3.3.2 Image of NC control signals

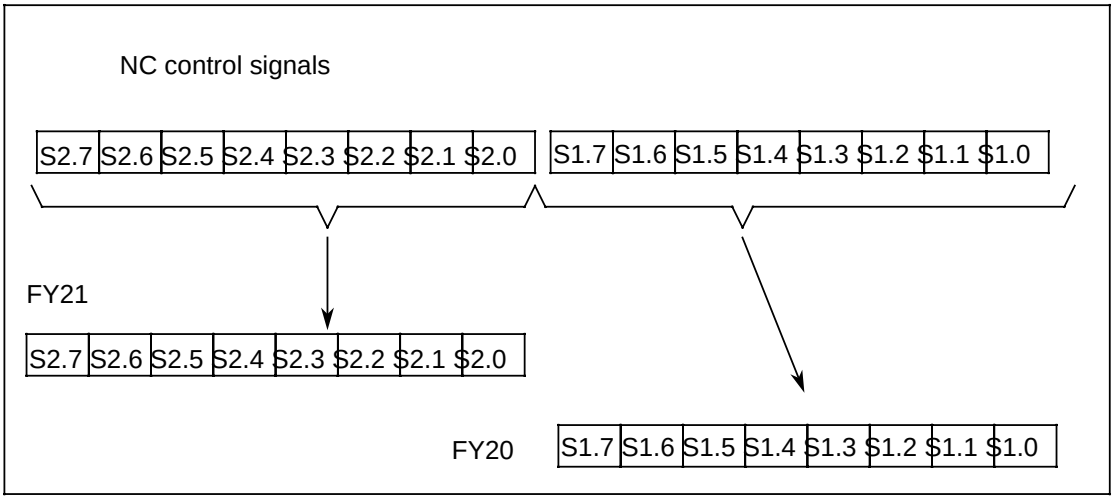
| NC CONTROL SIGNALS | FY 20,21 |
|---|---|

NC control signals are produced by the following functions:

- Ouput of cam signals (option)
- Fast M functions (option)
- Connection of standard motors (option)

For further description of these functions, please refer to the Installation Instructions, Section 11, Function Descriptions.

The two control signal bytes (bytes 1.0 - 1.7 and 2.0 - 2.7) are transferred to the flag bytes FY20 and FY21 as follows:




1 signal: The NC control signal is on 1
0 signal: The NC control signal is on 0

**Note:**

With the option ”fast NC inputs and outputs”, the NC control signals S 1.0 to S 1.7 are transferred at position control frequency to the NC outputs (output 0 to output 7, terminal block X 271.1) as well as to FY 20.

## 3.3.3 Image of fast NC inputs

| **NC INPUTS** | **FY 22 Bit 0 - 7** |
|---|---|

1 signal: The NC input is on 1

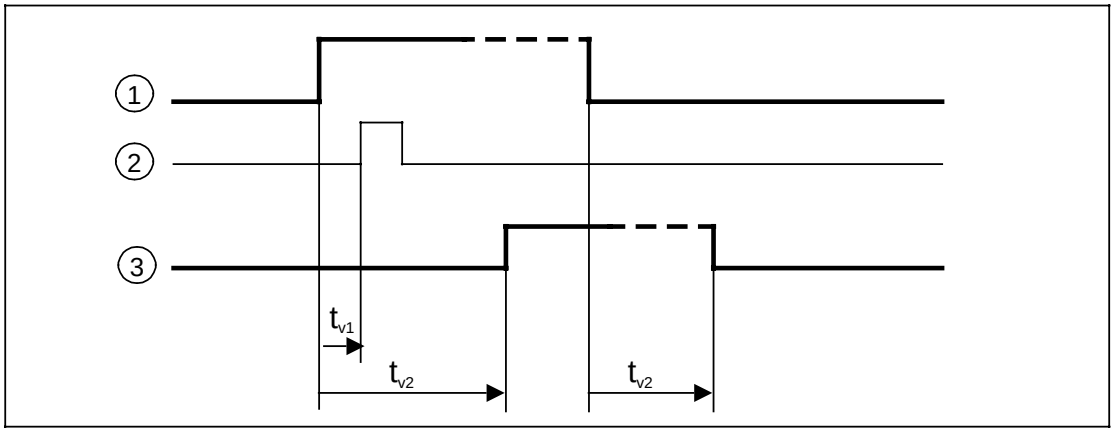
0 signal: The NC input is on 0

The NC inputs 1 to 8 are shown as an image in this flag byte. The NC inputs 1 and 2 are also used as probe inputs.

| **PROBE ACTIVATED, 1 and 2** | **FY 22 Bit 0 and 1** |
|---|---|

1 signal: Probe activated ($t_{v2}$ approx. 40 - 140 ms)

0 signal: Probe not or no longer activated ($t_{v2}$ approx. 40 - 140 ms).




1: Probe signal at NC input
2: Recognition of probe signal in NC (setpoint stored) $t_{v1}$ 300 ns min.
3: PROBE ACTIVATED signal at the interface ($t_{v2}$ approx. 40 - 140 ms)

**Notes:**

The probe must emit a signal which is held for longer than 20 ms at the NC input, so that the interface signal can be output. The probe signal causes:
Prerequisite: active @ 720 function.

a) Delete distance to go
b) The current position of the axis is stored in the intermediate memory without delay and from there is transferred to an R parameter.

**Example:**

Checking that the probe is in the starting position before measuring is started.

## 3.3.4 Ready signals from the NC (FY 24)

| **NC ALARM** | **FY 24 Bit 0** |
|---|---|

1 signal: An NC alarm is active (all alarms from 1 to 3081)
0 signal: No alarm

**Example:**

Triggering a lamp which, for example, indicates a machine stoppage caused by a fault.

| **BATTERY FAILURE** | **FY 24 Bit 1** |
|---|---|

The voltage of the installed battery is tested cyclically for the permissible lower limit when the NC is in operation. Thus, a battery failure will be recognized in good time during longer NC operating periods.
1 signal: Voltage of battery is below the limit value, alarm 1 (battery failure) is active.
0 signal: Battery voltage is above the lowest limit value.

**Note:**

The battery may only be replaced when the NC is switched on, so as to avoid the loss of data due to absence of memory backup.

| **NC READY 1 (NC R1)** | **FY 24 Bit 2** |
|---|---|

1 signal: After POWER UP and build-up of all voltages.
0 signal: On PLC-STOP, missing tension.

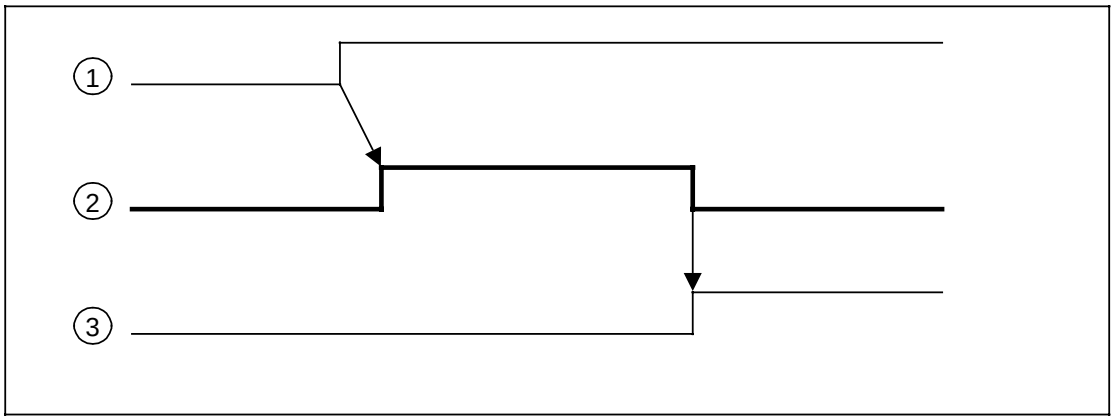
**Note:**

There is no temperature control with SINUMERIK 805.
The manufacturer can implement his own temperature control using a temperature sensor and an analog input.

| NC READY 2 | FY 24 Bit 3 |
|---|---|

1 signal: After POWER UP and build-up of all voltages.
0 signal: Measuring circuit error




1: Supply voltage
2: NC Ready 2
3: Fault message (e.g. measuring circuit error)

**Notes:**

1) If NC Ready 2 changes to 0, then:
   a) The feedrate drive and spindle drive are halted by active emergency braking (i.e. with maximum brake current) and
   b) all signals which are transmitted from the NC to the PLC are transferred to the inactive state (reset position).
2) All commands which are transmitted to the NC must be cancelled when NC Ready 2 has state 0.
3) NC Ready 2 only changes to "1" after elimination of the cause of the fault if the NC RESET key is activated or if the NC is restarted after removal of the power supply.
4) All stored functions in the back-up memory of the NC are deleted.

**KEYBOARD READY** **FY 24 Bit 4**

1 signal: After initialization of the keyboard when SINUMERIK 805 is switched on or when keyboard disable is removed via the signal "KEYBOARD DISABLE" (Q 79.7)).

0 signal: After initialization of keyboard or when "KEYBOARD DISABLE" signal is given.

**Note:**

The initialization of the keyboard is completed approx. 4 seconds after the SINUMERIK 805 has been switched on and approx. 2 seconds after the keyboad disable has been removed.

**Example:**

The KEYBOARD READY signal can be used for connected keyboard expansion modules to check when the binary inputs and outputs are again updated by the keyboard and can be processed in the PLC program.

**PC OPERATION ACTIVE** **FY 24 bit 5**

available with SW version 4.2 and higher

1 signal: The external PC has established the connection to the SINUMERIK 805 and data transfer is busy.

0 signal: The function in "Operator control and monitoring via external PC" (option) is not active or the PC is not connected to the control (Example: Software has not been activated or cable is not plugged in).

**Note:**

The function "Operator control and monitoring via external PC" is described in the Installation Instructions, Description of Functions.

**1ST INTERFACE OR 2ND INTERFACE RUNNING** **FY 24 Bit 6 and 7**

1 signal: Data transfer on the universal interface 1st Interface or 2nd interface from or to the NC is busy.

0 signal: Data transfer from or to NC is not busy.

**Note:**

The signal 1ST INTERFACE or 2ND INTERFACE RUNNING only indicates the transfer of NC data (part programs, machine data etc.), as well as the assignment of the 1st interface by means of a PLC programmer in online operation.

**Example:**

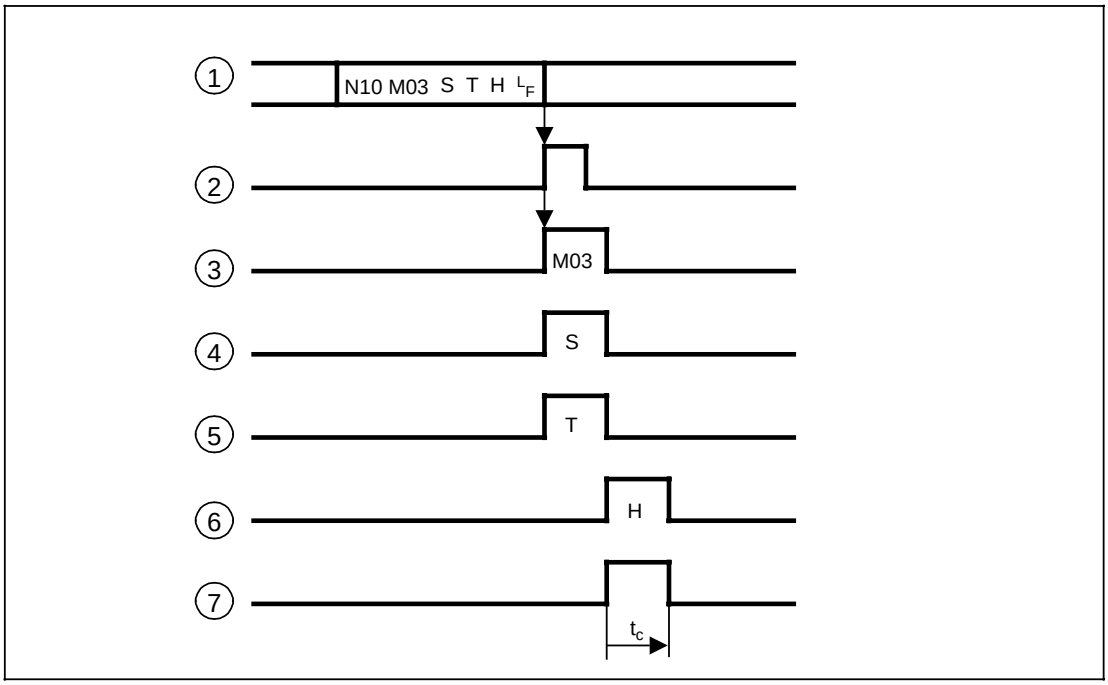
For single DNC the signals 1ST INTERFACE RUNNING or 2ND INTERFACE RUNNING can be used to check whether the read-in process of a new NC program has been successfully started.

## 3.3.5 Output of auxiliary functions NC PLC (FY 25 - FY 82)

The auxiliary functions M, S, T and H are output together with the appertaining modification signals to the interface, and the modification signals show that the value concerned is valid. The modification signals are active for the duration of one PLC cycle. If several items of information are programmed in one NC block, up to three items can be output to the interface within one PLC cycle.
This is also the case when 3 M functions are programmed in one block. If more than 3 items of information are programmed in one NC block, the output is divided up between a maximum of 3 PLC cycles. If **all** the information is output, then the "last auxiliary function" signal is additionally output.
The order of output is: M word 1, M word 2, M word 3, S, T, H.

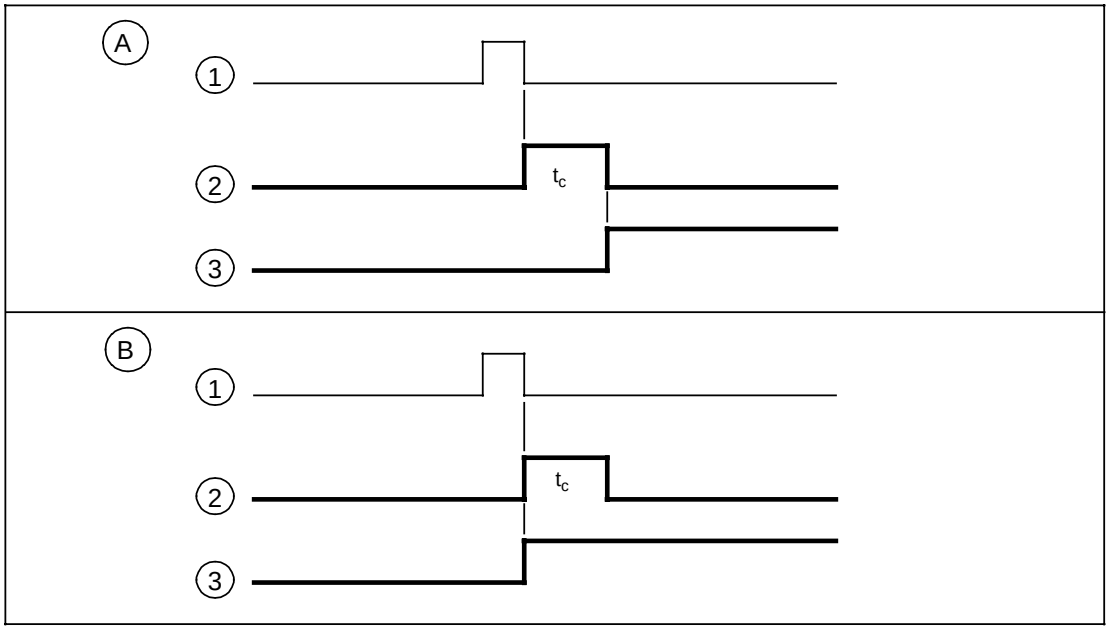
**Example of the output of several items of information which are programmed in one NC block;**




1: NC block with information in buffer memory
2: Data transfer to main memory
3: M modification signal
4: S modification signal
5: T modification signal
6: H modification signal
7: LAST AUXILIARY FUNCTION signal

**The following can be determined by machine data:**

a) Output of information before or on commencement of NC axis movement (NC MD 5003.2).
b) Which information is output during block search (NC MD 546*).
c) Output of binary or BCD information (PLC MD 2001).




A: Information output before axis movement
B: Information output on axis movement
1: NC block read-in into main memory
2: Information on interface (word and modification signal); $t_c$ = PLC cycle time).
3: TRAVEL COMMAND signal

In the case of M functions, decoded signals are **always** output **statically and dynamically** in addition to the words.
Static signals are set by the basic program once after decoding.
The following M functions are decoded: M00 - M99.

A static M function is maintained until it is deleted by the PLC user; a dynamic M function is automatically deleted by the PLC operating system after one PLC cycle.

**Behaviour in different modes**

**BLOCK SEARCH mode**

Three auxiliary function types can be selected via NC MD 546*:

a) During block search the auxiliary functions are not stored and not output;
b) During block search the programmed auxiliary functions are immediately output with a modification signal;
c) During block search the NC always stores the last auxiliary function of one address; after NC START, these stored auxiliary functions are output together with the relevant modification signals (see Fig. "Output of M functions"). Up to three M functions are stored and output if these have been programmed **in one block** (!) and **no additional M functions** followed between **this block** and the selected block.

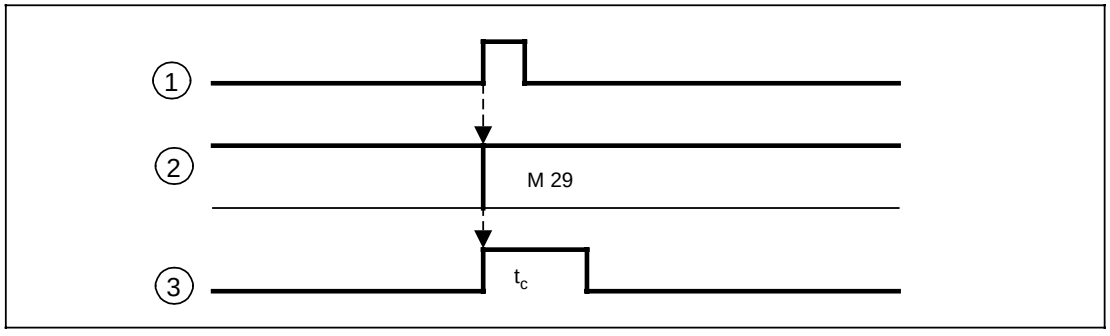
When the preselected block has been reached, auxiliary functions can subsequently be stored by the operator.

**AUTOMATIC mode**

After the auxiliary functions have been decoded in the NC, they are output to the interface together with the relevant modifications signals.
The modification signal is only active for the duration of one PLC cycle. The modification function words are active until a new block, programmed with M, S, T and H functions, has been decoded by the NC.

**JOG, MDA, AUT modes interrupted**

M, S, T and H functions can be subsequently stored by the user.
Using the input key (INPUT), the new auxiliary function value is transferred to the basic display of the mode concerned. Any mistakes made in the input of the values can be cleared with the CLEAR key. Only on NC start is the auxiliary function output to the interface together with the accompanying modification signal (duration: one PLC cycle).




1: NC START
2: Auxiliary function e.g. M29
3: M modification signal ($t_c$ = PLC cycle time)

### 3.3.5.1 Modification signals (FY 25 - FY 26)

| M WORD 1, M WORD 2, M WORD 3 AND S, T, H MODIFICATIONS | FY 25 Bit 0 - 5 |
|---|---|

1 signal: The M, S, T or H functions are output to the interface with a new value.
0 signal: The value of each auxiliary function is not valid.

**Note:**

The modification signals are in each case active for the duration of one PLC cycle.

| LAST AUXILIARY FUNCTION | FY 26 Bit 7 |
|---|---|

1 signal: The last auxiliary function to be programmed in the NC block (M, S, T or H function) is active on the interface as a valid word with its accompanying modification signal.
0 signal: The last auxiliary function of the NC block is not yet active or no auxiliary function is output (non have been programmed).

**Note:**

This signal together with the output modification signal is only active for the duration of one PLC cycle.

### 3.3.5.2 Decoded M signals (FY 27 - FY 52)

| DYNAMIC M SIGNALS |
|---|

The dynamic M signal flags are set by decoded M functions, but only remain on "1" for the duration of one PLC cycle and are then reset by the PLC operating system. A maximum of three M signals are output per PLC cycle.

| STATIC M SIGNALS |
|---|

The static M signal flags are set by decoded M functions in the same way as the dynamic M signal flags. These flags are, however, not reset by the PLC system but must be reset by the PLC user program.

## 3.3.5.3 Auxiliary function words (FY 53 - FY 82)

***Please observe:***

***The auxiliary function word output in BCD format must be selected via PLC MD 2001.***

| | |
|---|---|
| **M WORD 1** | **FY 55 - FY 56** |
| **M WORD 2** | **FY 59 - FY 60** |
| **M WORD 3** | **FY 63 - FY 64** |

The M functions, of which up to three can be programmed in one block, are displayed here as a fixed-point number or BCD number (range of values 0-99) as soon as the M word modification signals are active.

| | |
|---|---|
| **S WORD** | **FY 67 - FY 70** |

The S value programmed in the NC is made available as soon as an S modification signal is active.

Format: fixed-point number or BCD number (range of values 0-99999).

**Note:**

If an S value is programmed which exceeds the selected range of values (BCD or fixed-point), then only the maximum value is output. This also applies to the analog value output.

**Example:**

Gear stage selection via the PLC.

**T WORD** **FY 73 - FY 76**

Here, the tool number (T No.) programmed in the NC is made available as soon as a T modification signal is active.

Format: Fixed-point number or BCD number (range of values 0-9999)

**Example:**

Automatic tool selection control.

**H WORD** **FY 79 - FY 82**

Here, the auxiliary function programmed in the NC is made available as soon as a H modification signal is active.

Format: Fixed-point number or BCD number (range of values 0-9999)

**Example:**

Machine switching function.

## 3.3.6 User interface functions (FY 83 - FY 99)

**KEY CODE TRACKING** **FY 83**

After operating the keys on the operator keyboard the corresponding key code is transferred to the control and at the same time additionally stored in flag byte 83.

**Notes:**

1) The following table shows the possible key codes:
2) NC MD 5150.0 must be ”1” (activates ”Track key code, menu code and window code”).

**TRACK CODE OF CURRENT MENU** **FY 84, FY85**

available with SW version 4.2 and higher

The system always transfers the code of the current menu displayed in these flag bytes as soon as flag F90.5 undergoes a 0/1 transition. NC MD 5150 bit 0 must be set to ”1” for this.

Example: Tool offset menu (code: 001 E)

| FY 84 | FY 85 |
|---|---|
| 00 | 1E |

**TRACK CODE OF CURRENT WINDOW** **FY 86, FY 87**

available with SW version 4.2 and higher

The system always enters the code of the current window displayed in these flag bytes as soon as flag F90.5 undergoes a 0/1 transition. NC MD 5150 bit 0 must be set to ”1” for this.

Example: Window program control (code: 00CE)

| FY 86 | FY 87 |
|---|---|
| 00 | CE |

**CONTROL BIT TC** **FY 90 bit 0**

Operation of the keys on the operator keyboard can also be simulated on the PLC. The corresponding key code must be written into FY91 for this purpose. By setting the CONTROL BIT TC (F90.0), the key code in FY91 is accepted and becomes active in the control.

**Notes:**

1) The CONTROL BIT TC signal must be active for the duration of at least one PLC cycle.
2) All possible key codes are listed in the following table.
3) After code transfer, the CONTROL BIT TC is reset by the system.The key code, however, only becomes active after a delay. Therefore do not attempt to trigger the function of this or other control bits immediately after.

**CONTROL BIT NLM** **FY 90 bit 1**

available with SW version 4.2 and higher

With this control bit it is possible to select a menu on the user interface via the PLC. This is only possible if the correct menu code is stored in flag bytes FY 92 and FY 93. The menu code is transferred and becomes active in the control when CONTROL BIT NLM is set (0/1 transition).

**Note:**

1) The signal CONTROL BIT NLM must be active for at least one PLC cycle.
2) The CONTROL BIT NLM is reset by the system after the code transfer. The menu code, however, only becomes active after a delay. Therefore do not attempt to trigger the function of this or other control bits immediately after.

**CONTROL BIT OWD** **FY 90 bit 3**

available with SW version 4.2 and higher

A window on the user interface can be selected and opened via the PLC when this control bit is set. This is only possible if the correct window code is stored in flag bytes FY 94 and FY 95. The window code is transferred and the window on the user interface is opened when CONTROL BIT OWD is set (0/1 transition).

**Notes:**

1) The signal CONTROL BIT OWD must be active for at least one PLC cycle.
2) CONTROL BIT OWD is reset by the system after the code transfer. However, the window can only be opened after a delay. Therefore do not attempt to trigger the function of this or other control bits immediately after.

**CONTROL BIT CWD** **FY 90 bit 4**

available with SW version 4.2 and higher

A window on the user interface can be selected and closed via the PLC when this control bit is set. This is only possible if the correct window code is stored in flag bytes FY 94 and FY 95. The window code is transferred and the window on the user interface is closed when CONTROL BIT CWD is set (0/1 transition).

**Note:**

1) The signal CONTROL BIT CWD must be active for at least one PLC cycle.
2) CONTROL BIT CWD is reset by the system after the code transfer. However, the window is only closed after a delay. Therefore do not attempt to trigger the function of this or other control bits immediately after.

**CONTROL BIT GDF** **FY 90 bit 5**

available with SW version 4.2 and higher

Transfer of the code of the current menu and opened window into flag bytes FY 84 to FY 87 is triggered with the 0/1 transition of this control bit.

**Notes:**

1) The signal CONTROL BIT GDF must be active for at least one PLC cycle.
2) The CONTROL BIT GDF is reset by the system. Transfer, however, only takes place after a delay. Therefore do not attempt to trigger the function of this or other control bits immediately after.

**SIMULATE KEY CODE** **FY 91**

The key code stored in flag byte 91 is active in the control when CONTROL BIT TC is set (F90.0).

**Note:**

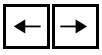
NC MD 5150.1 must be ”1” (”Simulate key/menu and window code” activated).

Key codes of the SINUMERIK slimline operator panel and standard keyboard

| Code Hex. | Character |
|---|---|
| 41 | A |
| 42 | B |
| 43 | C |
| 44 | D |
| 45 | E |
| 46 | F |
| 47 | G |
| 48 | H |
| 49 | I |
| 4A | J |
| 4B | K |
| 4C | L |
| 4D | M |
| 4E | N |
| 4F | O |
| 50 | P |
| 51 | Q |
| 52 | R |
| 53 | S |
| 54 | T |
| 55 | U |
| 56 | V |
| 57 | W |
| 58 | X |
| 59 | Y |
| 5A | Z |
| 61 | a |
| 62 | b |
| 63 | c |
| 64 | d |
| 65 | e |
| 66 | f |
| 67 | g |
| 68 | h |
| 69 | i |
| 6A | j |
| 6B | k |
| 6C | l |
| 6D | m |
| 6E | n |
| 6F | o |
| 70 | p |
| 71 | q |
| 72 | r |
| 73 | s |
| 74 | t |
| 75 | u |
| 76 | v |
| 77 | w |
| 78 | x |
| 79 | y |
| 7A | z |

| Code Hex. | Character |
|---|---|
| 26 | & |
| 0A | LF |
| 40 | @ |
| 25 | % |
| 2F | / |
| 3D | = |
| 28 | ( |
| 29 | ) |
| 20 | BLANK |
| 8D | +/- |
| 3A | : |
| 2A | x |
| 2D | - |
| 2B | + |
| 2E | . |
| 22 | ” |
| 5B | [ |
| 5D | ] |
| 3F | ? |
| 27 | ' |
| 3C | < |
| 3E | > |
| 21 | ! |
| 5E | ^ |
| 3B | ; |
| 2C | , |
| 5F | _ |
| 30 | 0 |
| 31 | 1 |
| 32 | 2 |
| 33 | 3 |
| 34 | 4 |
| 35 | 5 |
| 36 | 6 |
| 37 | 7 |
| 38 | 8 |
| 39 | 9 |
| 87 | ^ RECALL |
| 89 | > MORE |
| 80 | F1 Softkey |
| 81 | F2 Softkey |
| 82 | F4 Softkey |
| 84 | F5 Softkey |
| 85 | F6 Softkey |
| 86 | F7 Softkey |
| D0 | Softkey 8 |
| D1 | Softkey 9 |
| D2 | Softkey 10 |
| D3 | Softkey 11 |
| D4 | Softkey 12 |
| D5 | Softkey 13 |
| D6 | Softkey 14 |
| D7 | Softkey 15 |

| Code Hex. | Character | Meaning |
|---|---|---|
| 91 |  | DELETE |
| 90 |  | CANCEL |
| 8F |  | EDIT |
| 8E |  | INPUT |
| 93 |  | Page up |
| 94 |  | Page down |
| 97 |  | Cursor up |
| 98 |  | Cursor down |
| 95 |  | Cursor left |
| 96 |  | Cursor right |
| A8 |  | Home |
| 99 |  | Actual position |
| 9B |  | Channel switchover |
| 9A |  | Acknowledge alarm |
| 92 |  | Search key |
| 8C |  | Data area |
| 8B |  | Machine area |
| 88 |  | Info |
| 9C |  | Mode group |
| A4 |  | Increment |
| AA |  | Decrement |
| A5 |  | JOG |
| A7 |  | MDA |
| A6 |  | TEACH IN |
| A9 |  | AUTOMATIC |
| AC |  | Single block |
| E8 |  | Colour setting window |

## SIMULATE THE CODE OF THE MENU TO BE SELECTED FY 92, FY 93

available with SW version 4.2 and higher

The code of the menu which is to be selected via the PLC by setting CONTROL BIT NLM (F90.1) must be entered in these flag bytes. However, NC MD 5150 bit 1 must be set to ”1”.

Example: Tool offset menu (code: 001E)

| FY 92 | FY 93 |
|---|---|
| 00 | 1E |

List of available codes:

| **Menu** | **Code (Hex)** |
|---|---|
| Main programs | 03FC |
| Subroutines | 0410 |
| R parameters | 0015 |
| Setting data | 0016 |
| Tool offsets | 001E |
| Zero offsets | 0028 |
| Interface parameters | 0043 |
| All messages | 0047 |
| Time/date | 004A |
| PLC status | 004B |
| Service axes | 004C |
| Initialization | 004E |
| Data area | 0096 |

**Note:**

If an illegal menu code is entered, access to the data area is disabled by the system. Access is re-enabled on Power On.

## SIMULATE CODE OF WINDOW TO BE SELECTED FY 94, FY 95

available with SW version 4.2 and higher

The code of the window which is to be opened and/or closed by setting control bits OWD (F90.3) or CWD (F90.4) respectively must be entered in these flag bytes. NC MD 5150 bit 1 must be set to ”1”.

Example: Window program control (code: 00CE)

| FY 94 | FY 95 |
|---|---|
| 00 | CE |

List of available codes:

| **Window** | **Code (Hex)** |
|---|---|
| Program control | 00CE |
| Block search | 00CF |
| Overstore | 00D0 |
| Large actual value display | 00D2 |
| Program selection | 03F1 |
| Path word | 08FD |
| Data output | 1773 |

## PLC OUTPUT ON HAND-HELD UNIT FY 96/97/98

available with SW version 4.2 and higher

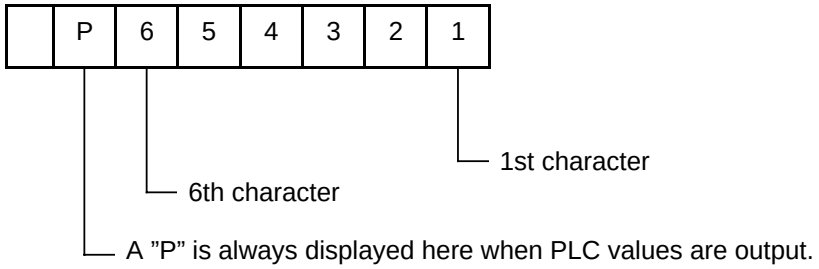
When output Q79.4 is set, the contents of this flag byte are output via the 7 $^1/_2$-digit LED display on the hand-held unit. A ”P” is always displayed at the 7th position.

The bits entered in the flag bytes are interpreted as hexadecimal code. The following characters can be displayed.

| | | |
|---|---|---|
| 0 | ≙ | 0000 |
| 1 | ≙ | 0001 |
| 2 | ≙ | 0010 |
| | : | |
| 9 | ≙ | 1001 |
| – (Minus) | ≙ | 1010 |
| E | ≙ | 1011 |
| H | ≙ | 1100 |
| L | ≙ | 1101 |
| P | ≙ | 1110 |
| Blank | ≙ | 1111 |

| | | |
|---|---|---|
| FY96 | 2nd character | 1st character |
| FY97 | 4th character | 3rd character |
| FY98 | 6th character | 5th character |

Hand-held unit display:




**Example of use:**

This function can be used to display NC alarm numbers on the hand-held unit when an operator panel is not used. Simply output the active NC alarms via FB61 from the NC and then put them into flag bytes FY96 to 98.

| NC NUMBER | FY 99 |
|---|---|

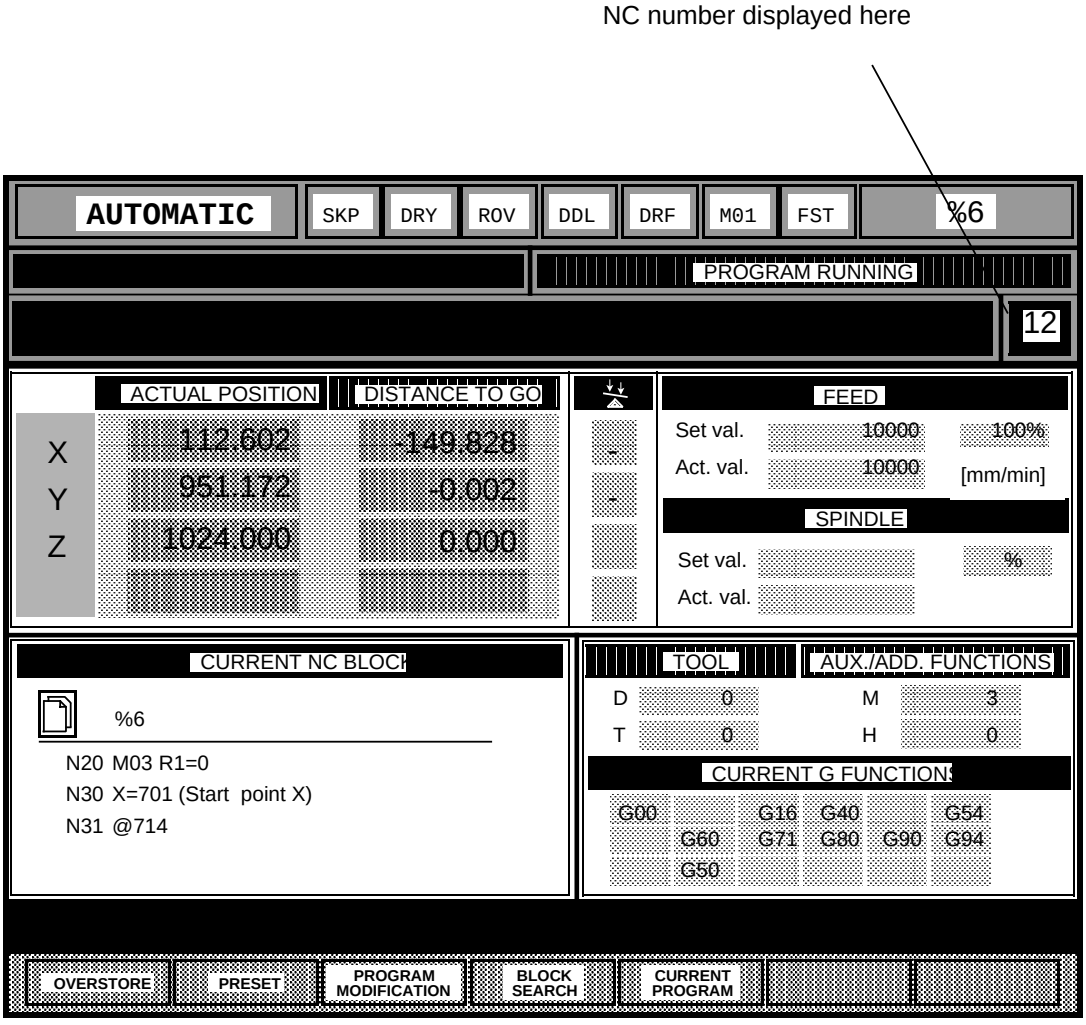
If the operator keyboard and the monitor are connected to several NCs by way of a changeover switch, the PLC user can carry out the following:

He enters the NC number in the form of BCD code in flag byte 99 of the PLC concerned. This NC number is displayed on the monitor in the top right-hand side.

It the operator transfers to another NC, its NC number is displayed on the monitor.

**Example:**

The NC number of the NC currently being displayed is 12
FY 99 0001 0010 = 1
FY 99 0000 0000 = no display

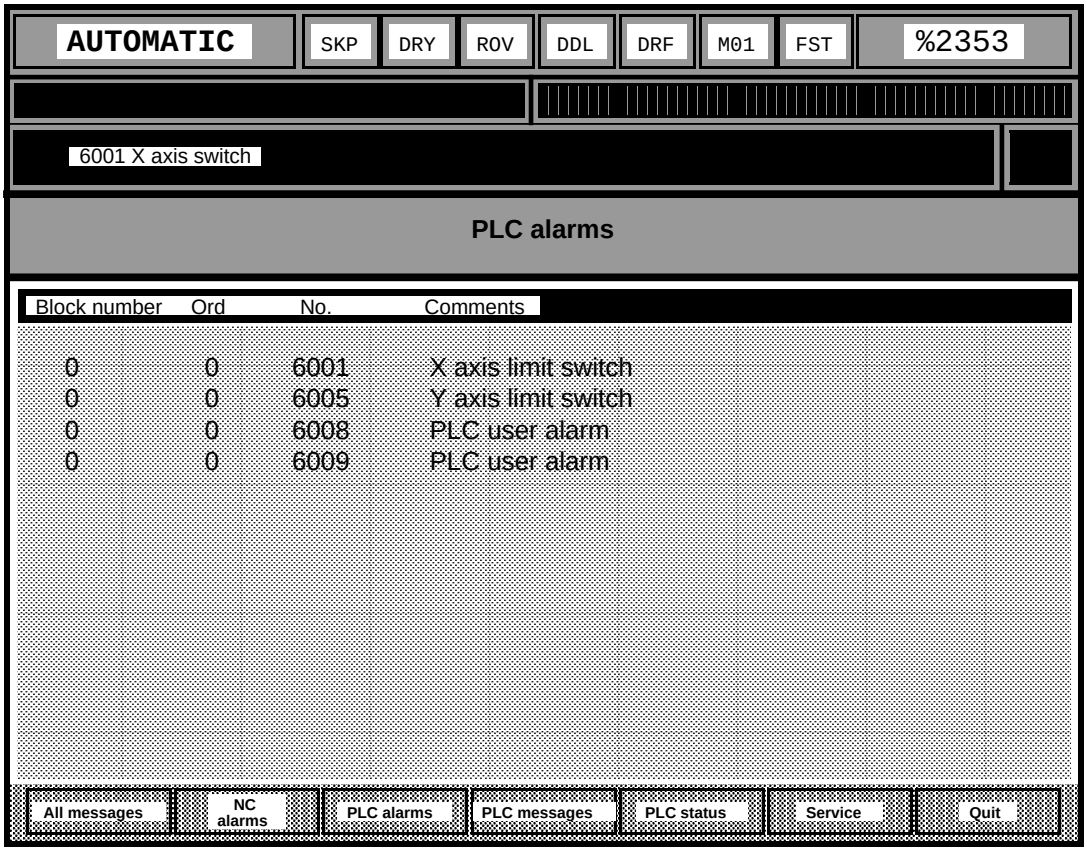



**Note:**
The modification of the contents of FY99 is only effective after POWER ON.

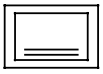
## 3.3.7 PLC error and operational messages (FY 100 - FY 115)

**Operation:**

PLC error and operational messages can be displayed on the monitor by setting flags. Single-line displays only are possible in the message line for NC alarms and PLC messages.



An overview of all active PLC errors or operational messages can be selected using the following operator input sequence:

- Data storage area key 
- Softkey Diagnostics
- Softkey Messages
- Softkey PLC errors or PLC messages

A subroutine assigns the flags to the messages. This program can be entered directly through the keyboard or via the interface. The number of the subroutine is determined by NC MD 30.

```
%SP800
N6001 (X axis limit switch)
N6002 (text max. 50 characters)
:
:
M17
```

The number 6001 in the display corresponds to F 100.1 in the error message flag area. If flag 100.1 is activated, the message "6001 X axis limit switch" is displayed.

**ERROR MESSAGES** **FY 100 - FY 107**

Display numbers 6000 to 6063 are assigned to the error flags.

1 signal: The display number together with its assigned text is given in the display line.

0 signal: Cause of error eliminated and error acknowledged or error not present.

Error messages must be acknowledged with the RESET key or the QUIT softkey after the cause of the error has been eliminated.

**OPERATIONAL MESSAGES** **FY 108 - FY 115**

Display numbers 7000 to 7063 are assigned to the operational flags.

1 signal: The display number together with its assigned text is given in the display line or is run sequentially.

0 signal: The conditions required to activate the flag do not apply; the operational message is not shown in the display line.

The operational messages do not have to be acknowledged.

## 3.3.8 PLC Machine data for users (FY 116 - FY 135)

The PLC user machine data comprise a flag area into which a machine data list stored in the NC memory can be copied on a PLC cold start. This list is situated in the same area as the NC machine data and can in the same way be modified through the keyboard.

The machine manufacturer can here preset single bits and words which he scans in his PLC program. In this way he can, for example, allow program parts to be processed according to the state of a flag or define certain values, e.g. lubrication duration, for processing using the machine data words. Similarly to NC machine data, the user's PLC program can be adapted optimally to the machine tool in question.

The PLC user machine data can be entered in bit sequence (single bits):

FY 116
: e.g.: 1 0 0 1 0 0 1 1
FY 119

or word by word (machine data words) as a fixed-point number:

FY 120
: e.g.: 32767
FY 135

The values in MD 1000 to MD 1007 can also be transferred BCD coded to the corresponding flag words (please observe PLC MD 2000).

### 3.3.9 Flags for users (FY 136 - FY 199)

This flag area is manufacturer/user-assignable in the step 5 program. This area has a battery back-up when the control is switched off (retentive flag).

### 3.3.10 Flags for standard FBs (FY 200 - FY 223)

The standard function blocks are assigned to this flag area, which may not be used by the manufacturer/user.

### 3.3.11 Transfer flags (scratchpad flags)

This flag area is used by the resident FBs 11, 60, 61, 62, 65, and 66, as a transfer flag area.

This user should only use this area for "scratchpad flags" (flags which are only used within a block).

## 3.4 Description of data blocks

### 3.4.1 DB 1: Diagnostics block

***Diagnostics block DB 1 is only required for installation and fault elimination and is therefore described in the PLC Programming Guide, Section 8.1.***

### 3.4.2 DB 28: Analog setpoint

available with SW version 4.2 and higher

**PLC SETPOINT 1/2/3** **DW 1/5/9**

The setpoint output by the PLC must be entered in these data words.

Value range: 8000H to 0000H correspond to –10 V to 0 V
0000H to 7FFFH correspond to 0 V to +10 V

| Examples: | | | | | | |
|---|---|---|---|---|---|---|
| | 7FFFH | = | 10 V | 8000H | = | –10 V |
| | 1FFFH | = | 2.5 V | E000H | = | –2.5 V |
| | 0001H | = | 0.305 mV | FFFFH | = | –0.305 mV |

**CURRENT SETPOINT 1/2/3** **DW 2/6/10**

The setpoint (NC or PLC setpoint) selected by the PLC via outputs 105.0/1/2 is entered in these data words by the system.

Value range: -10000(dec) to +10000(dec) correspond to -10 V to +10 V
D8F0(hex) to 2710(hex) correspond to -10 V to +10 V (in the case of hexadecimal or binary representation the negative values are represented in two's complement)

**WEIGHTING FACTOR 1/2/3** **DW 3/7/11**

The weighting factor that has to be entered here is multiplied by the current setpoint to produce the output voltage. The maximum output voltage is still +/–10 V.

Value range: 0 to 64(hex) correspond to 0% to 100%
0 to 100(dec.) correspond to 0% to 100%

**ANALOG VALUE 1/2/3** **DW 4/8/12**

The current analog value to be output is entered in this data word.

Value range: as for current setpoint.

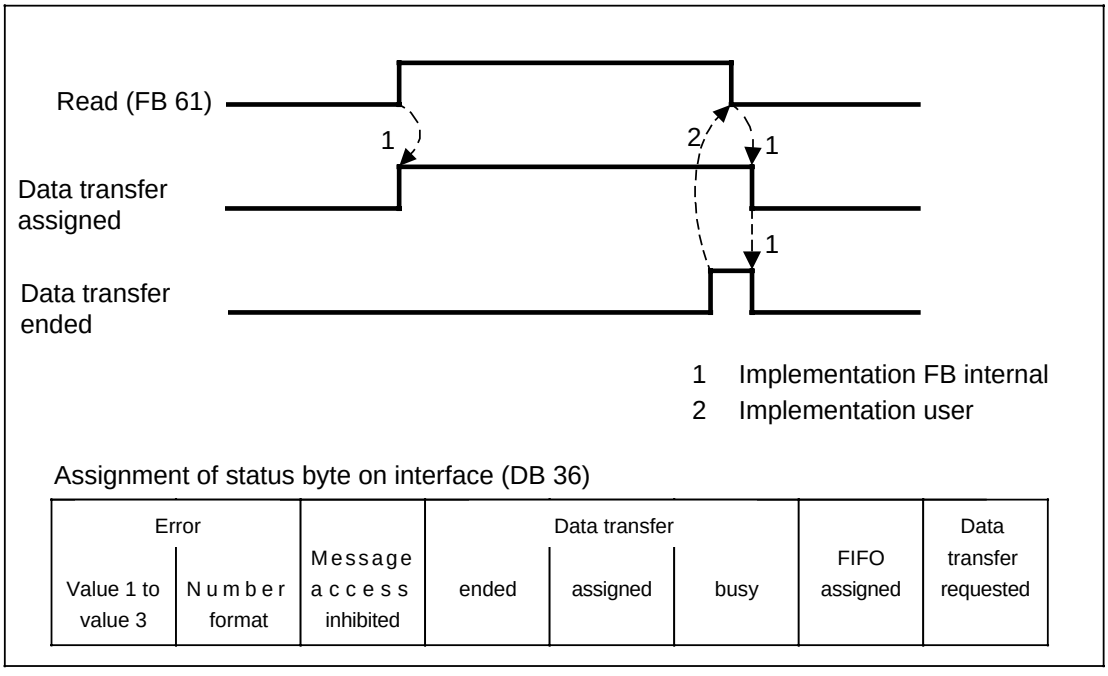
***Additional information regarding the function "3 analog setpoint outputs" is to be found in the Installation Instructions, Description of Functions.***

## 3.4.3 DB 36: Data transfer status

***Further information concerning parameterizing the FBs 61 and 62 is given in the PLC Programming Guide.***

### 3.4.3.1 Data transfer structure with example

Data can be exchanged between PLC and NC via data channels. Function blocks are available in basic program 2 for activating data transfer:
Read NC data (FB 61) and write NC data (FB 62).
The function blocks enter the parameters for data transfer (data type, data source, data target) into an internal interface. The interface is a first-in/first-out (FIFO) register and can hold up to 8 jobs. This ensures that, even when there are several jobs, they are executed in the correct sequence.
A job must still be assigned an interface byte showing the status of data transfer (DB36, DW0-DL32 corresponds to 65 interface bytes). Data transfer can be checked and branches performed in the user program according to these acknowledgements.
The figure below shows the main signal diagrams.

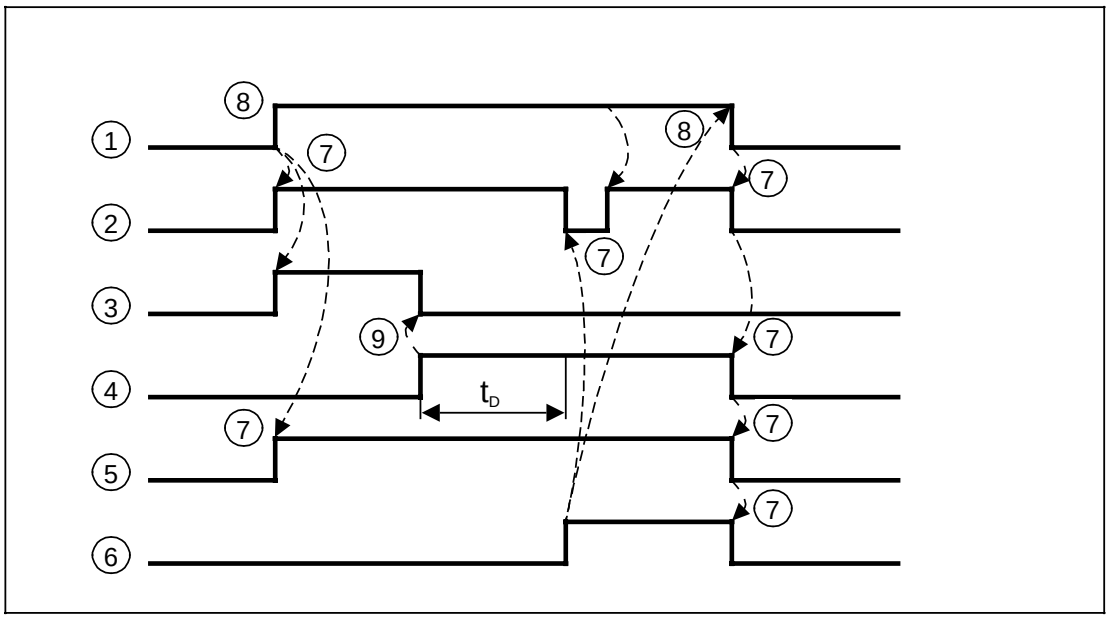



Assignment of status byte on interface (DB 36)

| Error | | Message access inhibited | Data transfer | | | FIFO assigned | Data transfer requested |
|---|---|---|---|---|---|---|---|
| Value 1 to value 3 | Number format | | ended | assigned | busy | | |

*Main signal diagrams, data transfer NC/PLC*

If data transfer is initiated on FB61 at the READ input, for example, the ”DATA TRANSFER ASSIGNED” signal is immediately output on the interface. Because this signal exists until the end of data transfer, it can be used among other things for purposes of read-in disable. When data transfer has ended, the ”DATA TRANSFER ENDED” signal is output. This signal is not reset until the user cancels the READ signal on the FB.
In order to reduce the load on the PLC program when calling the FB61/62 function blocks more than once, FB61/FB62 can be called either unconditionally or conditionally.
The advantage of an unconditional block call is that the FB can be initialized simply.
The figure below shows the signal diagrams of all signals at an unconditional block call.

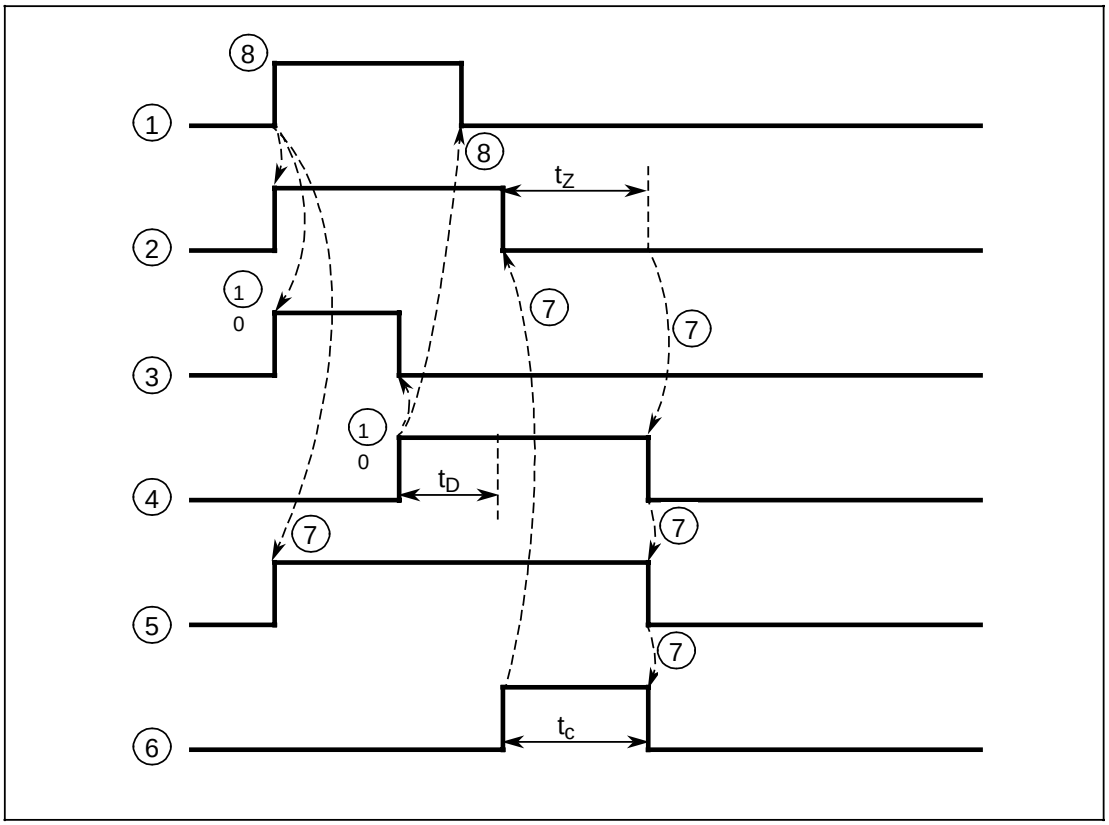



*Signal diagrams for unconditional block call*

1: READ/WRITE
2: DATA TRANSFER REQUESTED
3: FIFO ASSIGNED
4: DATA TRANSFER BUSY
5: DATA TRANSFER ASSIGNED
6: DATA TRANSFER ENDED and fault (if any)
7: Signal change by FB
8: Signal change by user
9: Signal change by FB; omitted if FIFO not yet full
$t_D$: Assignment of internal interface by data transfer

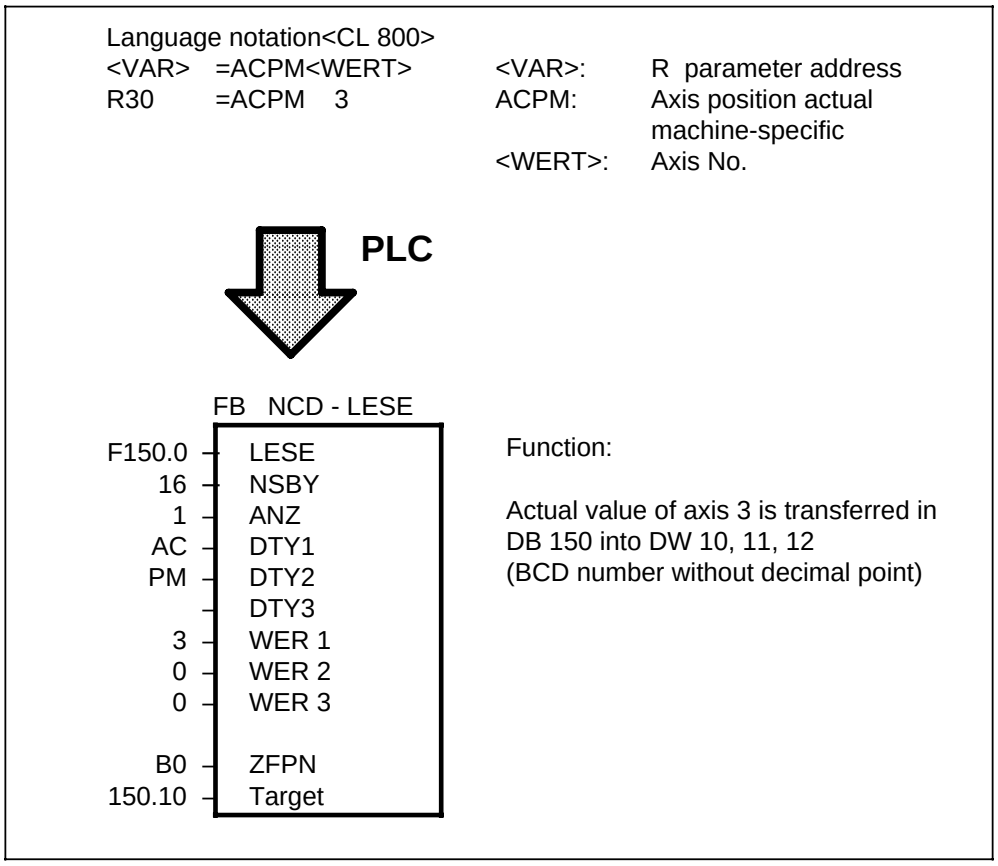
The FBs can, optionally, also be called conditionally, i.e. processing of the FBs only takes place up until the point when the job has been transferred to the job buffer (FIFO). This is notified by DATA TRANSFER BUSY.
The figure below shows the related signal diagrams.




*Signal diagrams for conditional block call*

1: READ/WRITE
2: DATA TRANSFER REQUESTED
3: FIFO ASSIGNED
4: DATA TRANSFER BUSY
5: DATA TRANSFER ASSIGNED
6: DATA TRANSFER ENDED and fault (if any)
7: Signal change by FB
8: Signal change by user
9: User no longer calling block
10: Signal change by FB; omitted if FIFO not yet full
$t_c$: PLC cycle time
$t_D$: Assignment of internal interface by data transfer

If the function blocks are incorrectly parameterized (e.g. data source unknown in the PLC), the PLC branches into the stop loop. The number of the interface byte and an error ID are stored in accu 2 of the interrupt stack.
The figure below shows as an example the parameterization of FB 61 for reading the ”Machine-specific actual value of axis” for the 3rd axis. (Data type, AXPM). The actual value should be stored in DB 150 in data words 10, 11, 12.



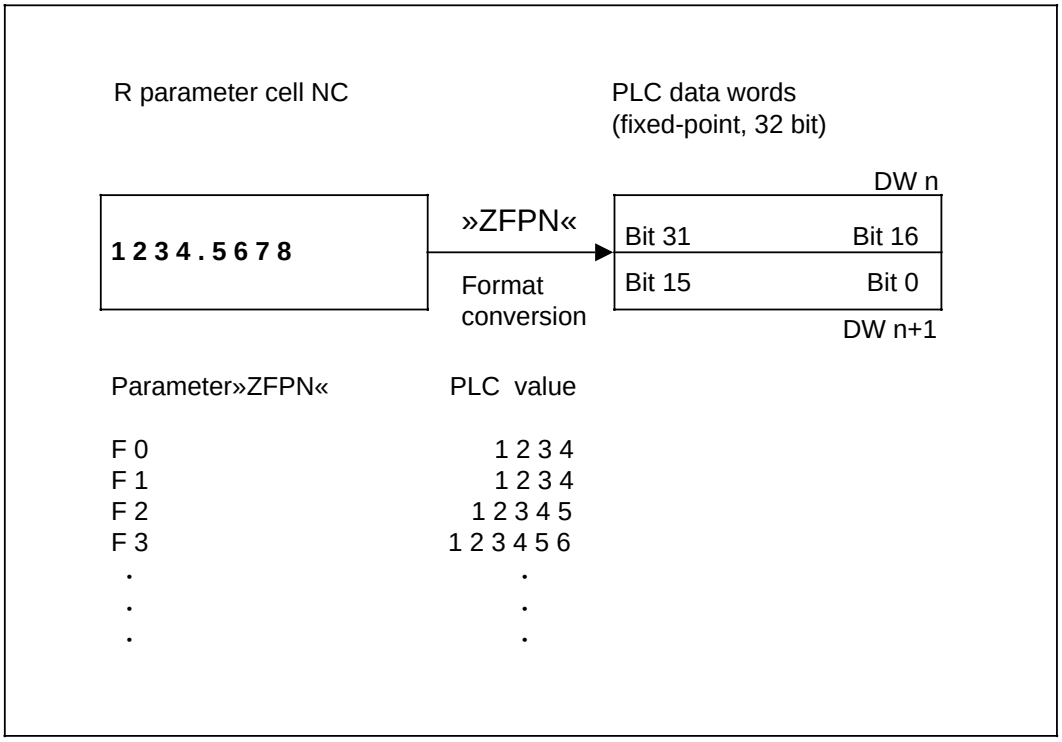

*Example: Read actual axis value*

When transferring data via the PLC, the number format is converted depending on parameter ZFPN of FBs 61 and 62. The following number formats are possible:

| Parameter ZFPN | Format | Target/source in PLC DBs |
|---|---|---|
| BI<br>F.<br>B. | Bit pattern<br>Fixed-point number 32 bit<br>BCD number with sign and comma | DR n<br>DW n, DW n+1<br>DW n, DW n+1, DW n+2<br>(DW n+3 for time of day) |

The figure below shows an example for format conversion with fixed-point representation in the PLC.




*Example: Data transfer NC/PLC, format conversion*

### 3.4.3.2 Description of job-specific interface signals (DB 36)

**Note:**

Signal diagrams are given in Section 3.4.3.1.

**DATA TRANSFER REQUESTED**

1 signal: 'READ ' and 'WRITE' signals of the FBs are'1'
0 signal: a) When 0 -->1, signal edge of 'Data transfer ended' and 'Fault during data transfer'.
b) 'READ' and 'WRITE' signals are '0' (see also pulse diagrams, Section 3.4.1).

**FIFO ASSIGNED**

1 signal: Job cannot be entered in FIFO at present time. When 'READ' and 'WRITE' = 1, the attempt is repeated until entry is possible.
0 signal: Otherwise

**DATA TRANSFER BUSY**

1 signal: Job has been entered in buffer or job being processed.
0 signal: After 1 signal, when 'DATA TRANSFER ENDED is '1'

**DATA TRANSFER ASSIGNED**

1 signal: 'FIFO ASSIGNED' and 'DATA TRANSFER BUSY' signals are '1'.
0 signal: Otherwise

**Note:**

Application of READ-IN INHIBIT during data transfer.

**DATA TRANSFER ENDED**

1 signal: Job has been processed without or with NC fault message.
0 signal: After 1 signal, when READ or WRITE are '0' on FB 61/62.

**ACCESS DISABLED MESSAGE**

Available soon

**NUMBER FORMAT ERROR**

1 signal: Job processed with NC fault message. The FB number format parameter is inadmissible (e.g. an axis actual value has been read as bit pattern).
0 signal: After 1 signal only if 'READ/WRITE' signal is again '0'.

**VALUE 1 - VALUE 3 ERROR**

1 signal: Job processed with NC error message. The FB VALUE 1 to VALUE 3 parameters cannot be interpreted by the NC (e.g. a non-existent machine data is addressed).
0 signal: After 1 signal only if 'READ/WRITE' signal is again '0'.

## 3.4.4 DB 37: Serial interface

On SINUMERIK 805 an interface is assigned by PLC MD 8 (interface for DB37) which is responsible for serial data transfer (activated by the PLC).

**V.24 (RS 232 C) BUSY: 1 or 2**

1 signal: Data input/output via interface running.
0 signal: otherwise

**Note:**

The signal V.24 (RS 232 C) BUSY is ”1”, if data input/output is running via one of the two V.24 (RS 232 C) BUSY interfaces regardless of whether it was inactivated by the PLC or NC (operator).

**DATA START INPUT**

1 signal: Start of data input via V.24 (RS 232 C).
0 signal: By user on:
a) TRANSFER TERMINATED
b) ERROR ON DATA INPUT/OUTPUT

**Note:**

If ”Time Control” is selected in menu PARAMETER, the following is valid:

After start of data input data must arrive at the interface at least within 60 seconds. Otherwise monitoring response (V.24 (RS 232 C) error).

**DATA START OUTPUT**

1 signal: Start of data output via V.24 (RS 232 C).
0 signal: By user on:
a) TRANSFER TERMINATED
b) ERROR ON DATA INPUT/OUTPUT

**Note:**

Before activation of data output, the parameters DATA TYPE, START NUMBER and END NUMBER must be supplied.

**V.24 (RS 232 C) ABORT**

1 signal: Termination of data input/output
0 signal: By user:
a) otherwise
b) on TRANSFER TERMINATED

**DATA TRANSFER TERMINATED**

1 signal: After detection of the end criterion of data input/output
0 signal: a) otherwise
b) after 1 signal if the signals
- DATA START INPUT
- DATA START OUTPUT
- ABORT

are on 0

**ERROR ON DATA TRANSFER**

1 signal: After erroneous V.24 (RS 232 C) activation
0 signal: After 1 signal if the signals
- DATA START INPUT
- DATA START OUTPUT
- ABORT

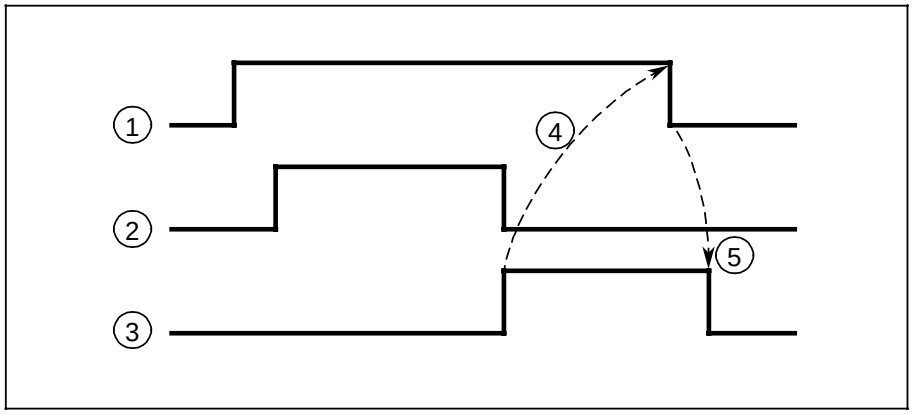
are on 0

**Note:**

The error message can be triggered by:

a) no or incorrect data at data input
b) data type for data output incorrect

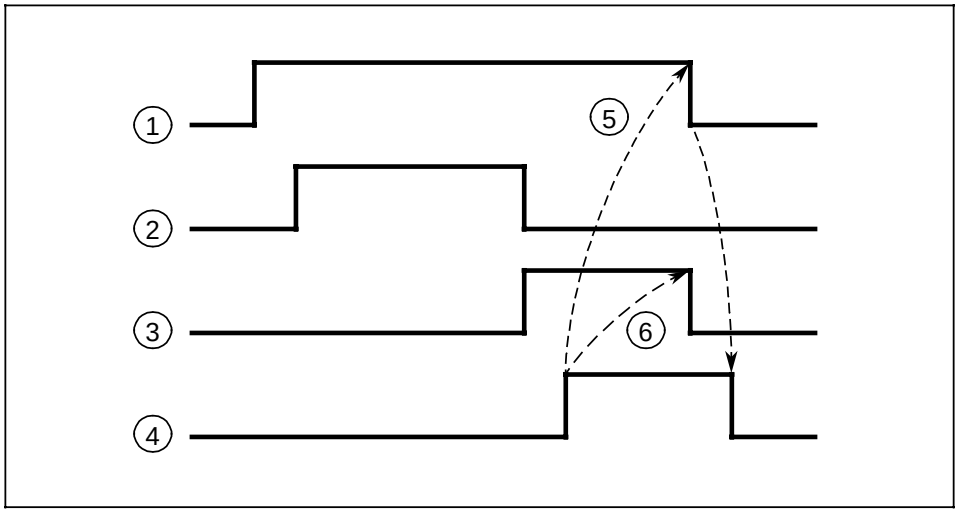
**Signal timing:**




*P 3568.0*

Data input/output without abort

1. Data start output or input
2. V.24 (RS 232 C) BUSY
3. TRANSFER TERMINATED or ERROR ON DATA TRANSFER
4. User deletes signal 1
5. Basic program deletes signal 3




**Data intput/output with abort**

1. DATA Start output or input
2. V.24 (RS 232 C) BUSY
3. V.24 (RS 232 C) abort
4. Data transmission terminated
5. User deletes signal 1 and 3
6. Basic program deletes signal 4

**Program example:**

Output of part programs 10 to 20. To control transmission (DATA start output and V.24 (RS 232 C) abort) buttons are used

```
.
.
.
Q   DB 37
L   KSMP
T   DW 2
L   KCF                  Load data type ”MPF” into DW 2 and DW 3
T   DW 3
L   KF 10                Load start number 10 into DW 4
T   DW 4
L   KF 20
T   DW 5                 Load end number 20 into DW 5
L   KF 1
T   DL 6                 Load 1 into DL 6
A   I 0.6
S   D 1.9                DATA start output with I 0.6
A   I 0.7
S   D 1.10               V.24 (RS 232 C) abort with I 0.7
A   D 1.0
R   D 1.9                Delete signal DATA start and V.24 (RS 232 C) abort
                         with signal
R   D 1.10               data transfer terminated
```

# 4 Examples

**SETTING AN OUTPUT**

Activating an output via hand-held unit key.
Output status signal through the associated LED.
Resetting of the output at program end or RESET.

```
0012    :A    I    85.1    HAND-HELD UNIT KEY 2
0013    :S    Q    7.0     OUTPUT
0014    :
0015    :A    Q    7.0     OUTPUT
0016    :=    Q    65.1    HAND-HELD UNIT LED 2
0017    :
0018    :A    I    102.6   M02/M30
0019    :O    Q    82.6    RESET STATE
001A    :R    Q    7.0     OUTPUT
```

**OUTPUT EDGE EVALUATION**

For each 0/1 edge of the input I9.3 an impulse signal is required (F 182.0) with a duration of one PLC cycle.

```
000A    :A    I    9.3     INPUT SIGNAL
000B    :AN   F    184.0   AUXILIARY FLAG STATUS
000C    :=    F    182.0   IMPULSE SIGNAL FLAG
000D    :U    F    182.0   IMPULSE SIGNAL FLAG
000E    :S    F    184.0   AUXILIARY FLAG STATUS
000F    :AN   I    9.3     INPUT SIGNAL
0010    :R    F    184.0   AUXILIARY FLAG STATUS
```

**M FUNCTION CONTROL**

The PLC is required to set an output (e.g. lubrication on) when the block in which the M function M29 was programmed is being processed in the part program. M29 is cancelled with M31 and therefore the output is reset. the decoded M signals are used in this example.

```
0000    :A    F    33.5    M29, DYNAMIC FLAG
0001    :R    F    34.7    M31, STATIC FLAG
0002
0003    :A    F    34.7    M31, DYNAMIC FLAG
0004    :R    F    34.5    M29, STATIC FLAG
0005
0006    :A    F    34.5    M29, STATIC
0007    :=    Q    15.3    "VALVE LUBRICATION" SET
0008:
```

**AUXILIARY FUNCTION CONTROL**

The PLC is required to set an output (e.g. valve on) when the block in which H.357 was programmed is being processed in the NC part program. Every other H function resets the output.

NAME: EXAMPLE

```
0005          :AN   F      25.5      H MODIFICATION SIGNAL
0006          :JC   =M001            CONDITIONAL JUMP TO M001
0007          :
0008          :
0009          :                      THE NEXT BLOCK IS ONLY
                                     PROCESSED
000A          :                      IF AN H FUNCTION IS SIGNALLED
                                     FROM
000B          :                      THE NC TO THE PLC.
000C          :
000D          :
000E          :U    F       0.1      ONE-FLAG
000F          :R    F     200.0      STATUS FLAG H357
0010          :L    KH     0357      LOAD VALUE 0357
0011          :L    FW       81      LOAD THE H VALUE
0013          :!=F
0014          :S    F     200.0      STATUS FLAG H357
0015          :
0016 M001     :
0017          :A    F     200.0      STATUS FLAG H357
0018          :=    Q       6.5      SET "VALVE ON"
```

**Caution:**

Because of the conditional jump, this example can only be entered as a function block (FB).

## 4.1 Example: Standard PLC program

The program is written in the programming language STEP 5 (statement list for the control system SIMATIC S5) and assumes prior knowledge of same. This program is not integrated in the system and must be input by means of a programming device. If the PLC program is extended beyond the size described, the relevant routines can be incorporated into the new program. This greatly reduces the programming requirements and is restricted to the implementation of special machine functions.

Prerequisites: hand-held unit
PLC MD 2002.6 = 1
PLC MD 2002.3 = 1
PLC MD 2003.5 = 0
NC MD 5004.2 = 1 or external handwheel
NC MD 5150.1 = 1

In addition to the operator keyboard functions, the following functions are implemented in this program:

1) Operating mode selection of JOG and automatic mode using the hand-held unit
2) Selection of feed ON/OFF
3) Selection of spindle ON/OFF
4) Selection of NC-START/STOP using the hand-held unit
5) Selection of axis and feed direction
6) Selection of handwheel function
7) Provision of functions for servo enable for axes/spindles, feed enable and read-in enable
8) Hardware axis switch
9) EMERGENCY STOP switch
10) Clearance logic
11) Reference point approach
12) Selection of a basic speed

This program therefore implements basic functions which make the immediate application of SINUMERIK 805 with a tool machine without additional programming by the machine manufacturer possible.

In this standard program the following user flag bytes were used:

FY 186, FY 192, FY 193 and FY 194.

The input bytes IB0 and IB1 must be wired to the signal encoders as follows in order to ensure the function of this program:

| | | |
|---|---|---|
| I0.0 | Software limit switch in plus direction of the 1st axis | (NO switch) |
| I0.1 | Software limit switch in minus direction of the 1st axis | (NO switch) |
| I0.2 | Software limit switch in plus direction of the 2nd axis | (NO switch) |
| I0.3 | Software limit switch in minus direction of the 2nd axis | (NO switch) |
| I0.4 | Software limit switch in plus direction of the 3rd axis | (NO switch) |
| I0.5 | Software limit switch in minus direction of the 3rd axis | (NO switch) |
| I0.6 | Software limit switch in plus direction of the 4th axis | (NO switch) |
| I0.7 | Software limit switch in minus direction of the 4th axis | (NO switch) |

| | | |
|---|---|---|
| I1.0 | EMERGENCY STOP switch (open) | |
| I1.1 | Drive device ready for operation | |
| I1.2 | Selection of control speed (only if spindle is present) | |
| I1.3 | Reference position cam 1st axis | (NO switch) |
| I1.3 | Reference position cam 2nd axis | (NO switch) |
| I1.3 | Reference position cam 3rd axis | (NO switch) |
| I1.3 | Reference position cam 4th axis | (NO switch) |

**Note:**

If limit switches are not present, they must be replaced by a protective circuit of + 24V at the inputs or alternatively removed from the PLC program.

**OB 1**

```
NETWORK 1    0000

0000          :JU    PB      1          CALL PB1
0001          :JU    FB      1          CALL FB1
0002 NAME     :HAND-HELD UNIT
0003          :BE
```

**PB 1**

```
NETWORK 1    0000

THE LIMIT SWITCH SIGNAL BECOMES 1 WHENEVER AT LEAST ONE LIMIT SWITCH IS
ACTIVE. THE LIMIT SWITCHES MUST BE OF THE NO SWITCH TYPE.

0000        :ON   I      0.0        LIMIT SWITCH 1ST AXIS  PLUS
0001        :ON   I      0.1        LIMIT SWITCH 1ST AXIS  MINUS
0002        :ON   I      0.2        LIMIT SWITCH 2ND AXIS  PLUS
0003        :ON   I      0.3        LIMIT SWITCH 2ND AXIS  MINUS
0004        :ON   I      0.4        LIMIT SWITCH 3RD AXIS  PLUS
0005        :ON   I      0.5        LIMIT SWITCH 3RD AXIS  MINUS
0006        :ON   I      0.6        LIMIT SWITCH 4TH AXIS  PLUS
0007        :ON   I      0.7        LIMIT SWITCH 4TH AXIS  MINUS
0008        :=    F    193.0        LIMIT SWITCH ACTIVE
0009        :***
NETWORK 2       000A

IF THE MODE SELECTED IS JOG, THE SIGNAL FOR OPERATING MODE IS JOG=1.

000A        :AN   Q     82.0        OPERATING MODE SELECTION   BIT A
000B        :A    Q     82.1        OPERATING MODE SELECTION   BIT B
000C        :A    Q     82.2        OPERATING MODE SELECTION   BIT C
000D        :AN   Q     82.3        OPERATING MODE SELECTION   BIT D
000E        :=    F    193.1        OPERATING MODE JOG SELECTED
000F        :***
NETWORK 3       0010

AN EMERGENCY STOP CONDITION OF THE CONTROL (LIMIT SWITCH ACTIVE) CAN BE
BYPASSED IN THE JOG OPERATING MODE BY PRESSING THE RESET KEY ON THE
OPERATOR KEYBOARD. IN THIS WAY AXES CAN BE TRAVERSED TO THEIR TRAVEL
RANGE.

0010        :AN   F    193.0        LIMIT SWITCH ACTIVE
0011        :A    I      1.0        EMERGENCY STOP KEY
0012        :O
0013        :A    F    193.1        JOG OPERATING MODE SELECTED
0014        :A    Q     82.6        INTERFACE SIGNAL RESET
0015        :A    F    193.0        LIMIT SWITCH ACTIVE
0016        :=    Q     78.1        INTERFACE SIGNAL *EMERGENCY STOP
0017        :***
NETWORK 4       0018

IN NETWORKS 4 TO 11 THE AXIS TRAVEL COMMANDS ARE SET UP FOR TRAVELLING
IN THE JOG OPERATING MODE.

0018        :A    F    194.0        DIRECTION SELECT 1ST AXIS+
0019        :A    Q     78.1        INTERFACE SIGNAL *EMERGENCY STOP
001A        :AN   F    193.0        LIMIT SWITCH ACTIVE
001B        :0
001C        :A    F    194.0        DIRECTION SELECT 1ST AXIS+
001D        :AN   I      0.1        LIMIT SWITCH 1ST AXIS-
001E        :A    Q     78.1        INTERFACE SIGNAL *EMERGENCY STOP
001F        :=    Q    109.7        JOG 1ST AXIS (+)
0020        :***
NETWORK 5       0021
```

```
0021        :A    F    194.1      DIRECTION SELECT 1ST AXIS-
0022        :A    Q     78.1      INTERFACE SIGNAL *EMERGENCY STOP
0023        :AN   F    193.0      LIMIT SWITCH ACTIVE
0024        :0
0025        :A    F    194.1      DIRECTION SELECT 1ST AXIS-
0026        :AN   I      0.0      LIMIT SWITCH 1ST AXIS PLUS
0027        :A    Q     78.1      INTERFACE SIGNAL *EMERGENCY STOP
0028        :=    Q    109.6      JOG 1ST AXIS (-)
0029        :***
NETWORK 6       002A

002A        :A    F    194.2      DIRECTION SELECT 2ND AXIS+
002B        :A    Q     78.1      INTERFACE SIGNAL *EMERGENCY STOP
002C        :AN   F    193.0      LIMIT SWITCH ACTIVE
002D        :0
002E        :A    F    194.2      DIRECTION SELECT 2ND AXIS+
002F        :AN   I      0.3      LIMIT SWITCH 2ND AXIS MINUS
0030        :A    Q     78.1      INTERFACE SIGNAL *EMERGENCY STOP
0031        :=    Q    113.7      JOG 2ND AXIS (+)
0032        :***
NETWORK 7       0033

0033        :A    F    194.3      DIRECTION SELECT 2ND AXIS -
0034        :A    Q     78.1      INTERFACE SIGNAL *EMERGENCY STOP
0035        :AN   F    193.0      LIMIT SWITCH ACTIVE
0036        :0
0037        :A    F    194.3      DIRECTION SELECT 2ND AXIS-
0038        :AN   I      0.2      LIMIT SWITCH 2ND AXIS PLUS
0039        :A    Q     78.1      INTERFACE SIGNAL *EMERGENCY STOP
003A        :=    Q    113.6      JOG 2ND AXIS (-)
003B        :***
NETWORK 8       003C

003C        :A    F    194.4      DIRECTION SELECT 3RD AXIS+
003D        :A    Q     78.1      INTERFACE SIGNAL *EMERGENCY STOP
003E        :AN   F    193.0      LIMIT SWITCH ACTIVE
003F        :0
0040        :A    F    194.4      DIRECTION SELECT 3RD AXIS+
0041        :AN   I      0.5      LIMIT SWITCH 3RD AXIS MINUS
0042        :A    Q     78.1      INTERFACE SIGNAL *EMERGENCY STOP
0043        :=    Q    117.7      JOG 3RD AXIS (+)
0044        :***
NETWORK 9       0045

0045        :A    F    194.5      DIRECTION SELECT 3RD AXIS-
0046        :A    Q     78.1      INTERFACE SIGNAL *EMERGENCY STOP
0047        :AN   F    193.0      LIMIT SWITCH ACTIVE
0048        :0
0049        :A    F    194.5      DIRECTION SELECT 3RD AXIS-
004A        :AN   I      0.4      LIMIT SWITCH 3RD AXIS PLUS
```

```
004B        :A    Q     78.1        INTERFACE SIGNAL *EMERGENCY STOP
004C        :=    Q    117.6        JOG 3RD AXIS  (-)
004D        :***
NETWORK 10      004E

004E        :A    F    194.6        DIRECTION SELECT 4TH AXIS+
004F        :A    Q     78.1        INTERFACE SIGNAL *EMERGENCY STOP
0050        :AN   F    193.0        LIMIT SWITCH ACTIVE
0051        :0
0052        :A    F    194.6        DIRECTION SELECT 4TH AXIS+
0053        :AN   I      0.7        LIMIT SWITCH 4TH AXIS MINUS
0054        :A    Q     78.1        INTERFACE SIGNAL *EMERGENCY STOP
0055        :=    Q    121.7        JOG 4TH AXIS (+)
0056        :***
NETWORK 11      0057

0057        :A    F    194.7        DIRECTION SELECT 4TH AXIS-
0058        :A    Q     78.1        INTERFACE SIGNAL *EMERGENCY STOP
0059        :AN   F    193.0        LIMIT SWITCH ACTIVE
005A        :0
005B        :A    F    194.7        DIRECTION SELECT 4TH AXIS-
005C        :AN   I      0.6        LIMIT SWITCH 4TH AXIS PLUS
005D        :A    Q     78.1        INTERFACE SIGNAL *EMERGENCY STOP
005E        :=    Q    121.6        JOG 4TH AXIS (-)
005F        :***
NETWORK 12      0060
```

THE INTERFACE SIGNALS ”CONTROLLER ENABLE 1ST TO 4TH AXIS” ARE SET BY ENTERING 1.1 (DRIVE DEVICES READY FOR OPERATION).

```
0060        :A    I      1.1        DRIVE SETTER READY FOR OPERATION
0061        :A    Q     78.1        INTERFACE SIGNAL *EMERGENCY STOP
0062        :=    Q    108.2        CONTROLLER ENABLE FOR 1ST AXIS
0063        :=    Q    112.2        CONTROLLER ENABLE FOR 2ND AXIS
0064        :=    Q    116.2        CONTROLLER ENABLE FOR 3RD AXIS
0065        :=    Q    120.2        CONTROLLER ENABLE FOR 4TH AXIS
0066        :***
NETWORK 13      0067
```

THE INTERFACE SIGNALS ”FEED ENABLE ALL” AND ”FEED ENABLE FOR 1ST TO 4TH AXIS” CAN BE SET USING THE KEY ”FEED ON” ON THE HAND-HELD UNIT.

```
0067        :A    F    193.3        FEED START FLAG
0068        :=    Q     84.7        INTERFACE SIGNAL FEED ENABLE ALL
0069        :=    Q    108.5        FEED ENABLE FOR 1ST AXIS
006A        :=    Q    112.5        FEED ENABLE FOR 2ND AXIS
006B        :=    Q    116.5        FEED ENABLE FOR 3RD AXIS
006C        :=    Q    120.5        FEED ENABLE FOR 4TH AXIS
006D        :***
NETWORK 14      006E
```

THE INTERFACE SIGNAL ”READ IN ENABLE” IS SET USING THE NC-READY FOR OPERATION 2 (E.G. FEEDBACK LOOP MONITORING).

```
006E        :A    F     24.3      NC-READY FOR OPERATION 2
006F        :=    Q     87.5      INTERFACE SIGNAL READ-IN ENABLE
0070        :***
NETWORK 15      0071
```

THE INTERFACE SIGNAL ”CONTROLLER ENABLE SPINDLE” IS SET BY ENTERING 1.1 (DRIVE DEVICES READY FOR OPERATION).

```
0071        :A    I      1.1      DRIVE SETTER READY FOR OPERATION
0072        :A    Q     78.1      INTERFACE SIGNAL *EMERGENCY STOP
0073        :=    Q    100.6      INTERFACE SIGNAL CONTROLLER ENABLE
                                  SPINDLE
0074        :***
NETWORK 16      0075
```

THE INTERFACE SIGNAL ”SPINDLE ENABLE” IS SET BY PRESSING THE KEY ”SPINDLE ON” ON THE HAND-HELD UNIT.

```
0075        :A    F    193.5      SPINDLE START FLAG
0076        :A    Q     78.1      INTERFACE SIGNAL *EMERGENCY STOP
0077        :=    Q    100.7      INTERFACE SIGNAL SPINDLE ENABLE
0078        :***
NETWORK 17      0079
```

THE INTERFACE SIGNAL ”NC-START” IS SET UP HERE.

```
0079        :A    F    192.6      FLAG HAND-HELD UNIT NC-START
007A        :O    I     93.0      OPERATOR KEYBOARD NC-START
007B        .=    Q     87.0      INTERFACE SIGNAL NC-START
007C        :***
NETWORK 18      007D
```

THE INTERFACE SIGNAL ”NC-STOP” IS SET UP HERE.

```
007D        :A    F    192.7      FLAG HAND-HELD UNIT NC-STOP
007E        :0    I     93.1      OPERATOR KEYBOARD NC-STOP
007F        :=    Q     87.1      INTERFACE SIGNAL NC-STOP
0080        :***
NETWORK 19      0081
```

THE INTERFACE SIGNAL ”KEYSWITCH” IS CONTROLLED USING THE ”KEYSWITCH” ON THE HAND-HELD UNIT.

```
0081        :A    I     88.6      KEYSWITCH HAND-HELD UNIT
0082        :=    Q     78.6      INTERFACE SIGNAL PLC NC KEYSWITCH
0083        :***
NETWORK 20      0084
```

THE INTERFACE SIGNAL ”BASIC SPEED” IS CONTROLLED BY THE ENTRY 1.2.

```
0084        :A    I      1.2      SELECTION OF SPINDLE BASIC SPEED
0085        :=    Q    103.5      INTERFACE SIGNAL BASIC SPEED
0086        :***
NETWORK 21      0087
```

IN THE FOLLWING 4 NETWORKS THE INTERFACE SIGNAL *DECELERATION OF THE 4 AXES IS SET UP. THE SIGNAL OF THE CURRENT OPERATING ENCODER (NO SWITCH) IS CONNECTED TO THE INPUTS 1.3 TO 1.6.

```
0087        :A    I      1.3      REFERENCE POSITION CAM 1ST AXIS
0088        :=    Q    108.4      * DECELERATION FOR 1ST AXIS
0089        :***
NETWORK 22      008A
008A        :A    I      1.4      REFERENCE POSITION CAM 2ND AXIS
008B        :=    Q    112.4      * DECELERATION FOR 2ND AXIS
008C        :***
NETWORK 23      008D
008D        :A    I      1.5      REFERENCE POSITION CAM 3RD AXIS
008E        :=    Q    116.4      * DECELERATION FOR 3RD AXIS
008F        :***
NETWORK 24      0090
```

```
0090        :A    I      1.6      REFERENCE POINT CAM 4TH AXIS
0091        :=    Q    120.4      * DECELERATION FOR 4TH AXIS
0092        :BE
NETWORK 1       0000
```

**FB 1**

THIS MODEL PROCESSES THE KEYS AND LEDS OF THE HAND-HELD UNIT. THE FOLLOWING KEY CONFIGURATION IS IN USE:

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| I | JOG | I | AUT | I | | I | X | I | | | I |
| I | | I | | I | | I | Y | I | + | | I |
| I | VS STOP | I | VS START | I | | I | Z | I | RAPID TRAVERSE | | I |
| I | SP STOP | I | SP START | I | | I | 4 | I | – | | I |
| I | NC-STOP | I | NC-START | I | | I | HANDWHEEL | I | | | I |

APART FROM THE PLUS-, MINUS- AND RAPID TRAVERSE KEYS, ALL THE KEYS IN USE HAVE KEY LEDs.

NAME: HAND-HELD UNIT

```
0005        :***
NETWORK 2       0006

REQUIREMENTS OF THE BASIC POSITION OF THE HAND-HELD UNIT

0006        :A    F      2.1        BASIC POSITION OR RESTART OB1
0007        :S    F    192.0        1ST AXIS SELECTED FLAG
0008        :R    F    192.1        2ND AXIS SELECTED FLAG
0009        :R    F    192.2        3RD AXIS SELECTED FLAG
000A        :R    F    192.3        4TH AXIS SELECTED FLAG
000B        :
000C        :S    F    193.4        FEED STOP FLAG
000D        :S    F    193.6        SPINDLE STOP FLAG
000E        :R    F    193.3        FEED START FLAG
000F        :R    F    193.5        SPINDLE START FLAG
0010        :
0011        :R    F    186.6        HANDWHEEL SELECTED FLAG
0012        :
0013        :***
NETWORK 3       0014
```

FEED OVERRIDE SWITCH

```
0014        :A    F      0.1      ONE FLAG
0015        :=    Q     84.5      INTERFACE SIGNAL FEED OVERRIDE ACTIVE
0016        :
0017        :A    I     88.1      HAND-HELD UNIT FEED OVERRIDE SWITCH 1ST BIT
0018        :=    Q     84.0      INTERFACE SIGNAL FEED OVERRIDE BIT A
0019        :A    I     88.2      HAND-HELD UNIT FEED OVERRIDE SWITCH 2ND BIT
001A        :=    Q     84.1      INTERFACE SIGNAL FEED OVERRIDE BIT B
001B        :A    I     88.3      HAND-HELD UNIT FEED OVERRIDE SWITCH 3RD BIT
001C        :=    Q     84.2      INTERFACE SIGNAL FEED OVERRIDE BIT C
001D        :A    I     88.4      HAND-HELD UNIT FEED OVERRIDE SWITCH 4TH BIT
001E        :=    Q     84.3      INTERFACE SIGNAL FEED OVERRIDE BIT D
001F        :A    I     88.5      HAND-HELD UNIT FEED OVERRIDE SWITCH 5TH BIT
0020        :=    Q     84.4      INTERFACE SIGNAL FEED OVERRIDE BIT E
0021        :***
NETWORK 4       0022
```

ACTUAL VALUE OF AXIS DISPLAY

```
0022        :A    F    192.0      FLAG 1ST AXIS SELECTED
0023        :S    Q     79.0      HAND-HELD UNIT AXIS NO. ACTUAL POSITION BIT0
0024        :R    Q     79.1      HAND-HELD UNIT AXIS NO. ACTUAL POSITION BIT1
0025        :R    Q     79.2      HAND-HELD UNIT AXIS NO. ACTUAL POSITION BIT2
0026        :
0027        :A    F    192.1      FLAG 2ND AXIS SELECTED
0028        :R    Q     79.0      HAND-HELD UNIT AXIS NO. ACTUAL POSITION BIT0
0029        :S    Q     79.1      HAND-HELD UNIT AXIS NO. ACTUAL POSITION BIT1
002A        :R    Q     79.2      HAND-HELD UNIT AXIS NO. ACTUAL POSITION BIT2
002B        :
002C        :A    F    192.2      FLAG 3RD AXIS SELECTED
002D        :S    Q     79.0      HAND-HELD UNIT AXIS NO. ACTUAL POSITION BIT0
002E        :S    Q     79.1      HAND-HELD UNIT AXIS NO. ACTUAL POSITION BIT1
002F        :R    Q     79.2      HAND-HELD UNIT AXIS NO. ACTUAL POSITION BIT2
0030        :
0031        :A    F    192.3      FLAG 4TH AXIS SELECTED
0032        :R    Q     79.0      HAND-HELD UNIT AXIS NO. ACTUAL POSITION BIT0
0033        :R    Q     79.1      HAND-HELD UNIT AXIS NO. ACTUAL POSITION BIT1
0034        :S    Q     79.2      HAND-HELD UNIT AXIS NO. ACTUAL POSITION BIT2
0035        :***
NETWORK 5       0036
```

```
INTERROGATION AS TO CURRENT OPERATING MODE

0036        :AN   Q     82.0        OPERATING MODE SELECTION BIT A
0037        :A    Q     82.1        OPERATING MODE SELECTION BIT B
0038        :AN   Q     82.2        OPERATING MODE SELECTION BIT C
0039        :A    Q     82.3        OPERATING MODE SELECTION BIT D
003A        :=    F    193.2        AUTOMATIC MODE SELECTED
003B        :
003C        :AN   Q     82.0        OPERATING MODE SELECTION BIT A
003D        :A    Q     82.1        OPERATING MODE SELECTION BIT B
003E        :A    Q     82.2        OPERATING MODE SELECTION BIT C
003F        :AN   Q     82.3        OPERATING MODE SELECTION BIT D
0040        :=    F    193.1        JOG MODE SELECTED
0041        :
0042        :***
NETWORK 6       0043


ACTUATE LEDS

0043        :A    F    186.6        FLAG HANDWHEEL SELECTED
0044        :=    Q     66.6        HAND-HELD UNIT LED 15 (HANDWHEEL)
0045        :
0046        :A    F    192.0        FLAG 1ST AXIS SELECTED
0047        :=    Q     66.2        HAND-HELD UNIT LED 11 (X.AXIS)
0048        :A    F    192.1        FLAG 2ND AXIS SELECTED
0049        :=    Q     66.3        HAND-HELD UNIT LED 12 (Y-AXIS)
004A        :A    F    192.2        FLAG 3RD AXIS SELECTED
004B        :=    Q     66.4        HAND-HELD UNIT LED 13 (Z-AXIS)
004C        :A    F    192.3        FLAG 4TH AXIS SELECTED
004D        :=    Q     66.5        HAND-HELD UNIT LED 14 (4.AXIS)
004E        :
004F        :A    F    193.1        JOG MODE SELECTED
0050        :=    Q     65.0        HAND-HELD UNIT LED 1 (JOG MODE)
0051        :A    F    193.2        AUTOMATIC MODE SELECTED
0052        :=    Q     65.5        HAND-HELD UNIT LED 6 (AUTOMATIC MODE)
0053        :
0054        :A    F    193.3        FEED START FLAG
0055        :=    Q     65.7        HAND-HELD UNIT LED 8 (FEED START)
0056        :A    F    193.4        FEED STOP FLAG
0057        :=    Q     65.2        HAND-HELD UNIT LED 3 (FEED STOP)
0058        :
0059        :A    F    193.5        SPINDLE START FLAG
005A        :=    Q     66.0        HAND-HELD UNIT LED 9 (SPINDLE START)
005B        :A    F    193.6        SPINDLE STOP FLAG
005C        :=    Q     65.3        HAND-HELD UNIT LED 4 (SPINDLE STOP)
005D        :
005E        :A    I    102.0        SIGNAL NC PLC PROGRAM RUNNING
005F        :=    Q     66.1        HAND-HELD UNIT LED 10 (NC-START)
0060        :A    I    102.1        SIGNAL NC PLC PROGRAM INTERRUPTED
0061        :=    Q     65.4        HAND-HELD UNIT LED 5 (NC-STOP)
0062        :***
NETWORK 7       0063
```

SELECTION OF AXIS

```
0063      :A    I     86.2      HAND-HELD UNIT KEY X-AXIS
0064      :S    F    192.0      FLAG 1ST AXIS SELECTED
0065      :R    F    192.1      FLAG 2ND AXIS SELECTED
0066      :R    F    192.2      FLAG 3RD AXIS SELECTED
0067      :R    F    192.3      FLAG 4TH AXIS SELECTED
0068      :
0069      :A    I     86.3      HAND-HELD UNIT KEY Y-AXIS
006A      :R    F    192.0      FLAG 1ST AXIS SELECTED
006B      :S    F    192.1      FLAG 2ND AXIS SELECTED
006C      :R    F    192.2      FLAG 3RD AXIS SELECTED
006D      :R    F    192.3      FLAG 4TH AXIS SELECTED
006E      :
006F      :A    I     86.4      HAND-HELD UNIT KEY Z-AXIS
0070      :R    F    192.0      FLAG 1ST AXIS SELECTED
0071      :R    F    192.1      FLAG 2ND AXIS SELECTED
0072      :S    F    192.2      FLAG 3RD AXIS SELECTED
0073      :R    F    192.3      FLAG 4TH AXIS SELECTED
0074      :
0075      :A    I     86.5      HAND-HELD UNIT KEY 4TH AXIS
0076      :R    F    192.0      FLAG 1ST AXIS SELECTED
0077      :R    F    192.1      FLAG 2ND AXIS SELECTED
0078      :R    F    192.2      FLAG 3RD AXIS SELECTED
0079      :S    F    192.3      FLAG 4TH AXIS SELECTED
007A      :***
NETWORK 8      007B
```

SELECTION OF DIRECTION

```
007B      :A    F    192.0      FLAG 1ST AXIS SELECTED
007C      :A    I     87.5      HAND-HELD UNIT KEY+
007D      :=    F    194.0      DIRECTION SELECT 1ST AXIS+
007E      :A    F    192.0      FLAG 1ST AXIS SELECTED
007F      :A    I     87.7      HAND-HELD UNIT KEY -
0080      :=    F    194.1      DIRECTION SELECT 1ST AXIS-
0081      :
0082      :A    F    192.1      FLAG 2ND AXIS SELECTED
0083      :A    I     87.5      HAND-HELD UNIT KEY +
0084      :=    F    194.2      DIRECTION SELECT 2ND AXIS+
0085      :A    F    192.1      FLAG 2ND AXIS SELECTED
0086      :A    I     87.7      HAND-HELD UNIT KEY -
0087      :=    F    194.3      DIRECTION SELECT 2ND AXIS-
0088      ;
0089      :A    F    192.2      FLAG 3RD AXIS SELECTED
008A      :A    I     87.5      HAND-HELD UNIT KEY +
008B      :=    F    194.4      DIRECTION SELECT 3RD AXIS+
008C      :A    F    192.2      FLAG 3RD AXIS SELECTED
008D      :A    I     87.7      HAND-HELD UNIT KEY -
008E      :=    F    194.5      DIRECTION SELECT 3RD AXIS-
008F      :
0090      :A    F    192.3      FLAG 4TH AXIS SELECTED
0091      :A    I     87.5      HAND-HELD UNIT KEY +
0092      :=    F    194.6      DIRECTION SELECT 4TH AXIS+
0093      :A    F    192.3      FLAG 4TH AXIS SELECTED
0094      :A    I     87.7      HAND-HELD UNIT KEY -
```

```
0095        :=    F   194.7       DIRECTION SELECT 4TH AXIS-
0096        :
0097        :A    I    87.6       HAND-HELD UNIT KEY RAPID TRAVERSE OVERRIDE
0098        :=    Q   109.5       INTERFACE SIGN. RAP. TRAV. OVERRIDE 1ST AXIS
0099        :=    Q   113.5       INTERFACE SIGN. RAP. TRAV. OVERRIDE 2ND AXIS
009A        :=    Q   117.5       INTERFACE SIGN. RAP. TRAV. OVERRIDE 3RD AXIS
009B        :=    Q   121.5       INTERFACE SIGN. RAP. TRAV. OVERRIDE 4TH AXIS
009C        :***
NETWORK 9       009D
```

SELECTION OF FEED ENABLE

```
009D        :A    I    85.7       HAND-HELD UNIT KEY FEED START
009E        :S    F   193.3       FLAG FEED START
009F        :R    F   193.4       FLAG FEED STOP
00A0        :A    I    85.2       HAND-HELD UNIT KEY FEED STOP
00A1        :R    F   193.3       FLAG FEED START
00A2        :S    F   193.4       FLAG FEED STOP
00A3        :
00A4        :A    I    86.0       HAND-HELD UNIT KEY SPINDLE START
00A5        :S    F   193.5       FLAG SPINDLE START
00A6        :R    F   193.6       FLAG SPINDLE STOP
00A7        :A    I    85.3       HAND-HELD UNIT KEY SPINDLE STOP
00A8        :R    F   193.5       FLAG SPINDLE START
00A9        :S    F   193.6       FLAG SPINDLE STOP
00AA        :
00AB        :A    I    86.1       HAND-HELD UNIT KEY NC-START
00AC        :=    F   192.6       FLAG HAND-HELD UNIT NC-START
00AD        :A    I    85.4       HAND-HELD UNIT KEY NC-STOP
00AE        :=    F   192.7       FLAG HAND-HELD UNIT NC-STOP
00AF        :***
NETWORK 10      00B0
```

SELECTION OF HANDWHEEL FUNCTION

```
00B0        :A    I    86.6       HAND-HELD UNIT KEY HANDWHEEL
00B1        :AN   F   186.0       STATUS FLAG HANDWHEEL KEY
00B2        :=    F   186.1       HANDWHEEL FLAG 1 PLC CYCLE LONG
00B3        :A    F   186.1       HANDWHEEL FLAG 1 PLC CYCLE LONG
00B4        :S    F   186.0       STATUS FLAG HANDWHEEL KEY
00B5        :AN   I    86.6       HAND-HELD UNIT KEY HANDWHEEL
00B6        :R    F   186.0       STATUS FLAG HANDWHEEL KEY
00B7        :A    F   186.1       HANDWHEEL FLAG 1 PLC CYCLE LONG
00B8        :A    F   186.6       HANDWHEEL FLAG SELECTED
00B9        :=    F   186.2       AUXILIARY FLAG
00BA        :A    F   186.1       HANDWHEEL FLAG 1 PLC CYCLE LONG
00BB        :AN   F   186.6       HANDWHEEL FLAG SELECTED
00BC        :AN   F   186.2       AUXILIARY FLAG
00BD        :S    F   186.6       HANDWHEEL FLAG SELECTED
00BE        :A    F   186.2       AUXILIARY FLAG
00BF        :R    F   186.6       HANDWHEEL FLAG SELECTED
00C0        :***
NETWORK 11      00C1
```

SELECTION OF HANDWHEEL FOR AN AXIS

```
00C1          :A    F    192.0        FLAG 1ST AXIS SELECTED
00C2          :A    F    186.6        HANDWHEEL FLAG SELECTED
00C3          :=    Q    109.0        INTERFACE SIGNAL HANDWHEEL ACTIVE 1ST AXIS
00C4          :
00C5          :A    F    192.1        FLAG 2ND AXIS SELECTED
00C6          :A    F    186.6        HANDWHEEL FLAG SELECTED
00C7          :=    Q    113.0        INTERFACE SIGNAL HANDWHEEL ACTIVE 2ND AXIS
00C8          :
00C9          :A    F    192.2        FLAG 3RD AXIS SELECTED
00CA          :A    F    186.6        HANDWHEEL FLAG SELECTED
00CB          :=    Q    117.0        INTERFACE SIGNAL HANDWHEEL ACTIVE 3RD AXIS
00CC          :
00CD          :A    F    192.3        FLAG 4TH AXIS SELECTED
00CE          :A    F    186.6        HANDWHEEL FLAG SELECTED
00CF          :=    Q    121.0        INTERFACE SIGNAL HANDWHEEL ACTIVE 4TH AXIS
00D0          :***
NETWORK 12    00D1
```

SELECTION OF OPERATING MODES JOG AND AUTOMATIC VIA KEY CODE

```
00D1          :A    F      0.0        ZERO FLAG
00D2          :=    F     90.0        CONTROL BIT TC (FY91) PLC NC
00D3          :AN   I     85.0        HAND-HELD UNIT KEY JOG
00D4          :JC   =M012
00D5          :L    KH   00A5
00D7          :T    FY     91
00D8          :A    I     85.0        HAND-HELD UNIT KEY JOG
00D9          :=    F     90.0        CONTROL BIT TC (FY91) PLC NC
00DA M012     :AN   I     85.5        HAND-HELD UNIT KEY AUTOMATIC
00DB          :JC   =M013
00DC          :L    KH   00A9
00DE          :T    FY     91
00DF          :A    I     85.5        HAND-HELD UNIT KEY AUTOMATIC
00E0          :=    F     90.0        CONTROL BIT TC (FY91) PLC NC
00E1 M013     :BE
```

# 5 Alphabetical List of Signal Names

| Signal name | Chart | Description |
|---|---|---|
| | | |
| **A** | | |
| Acknowledge alarm | 2.4.6 | 3.2.6.2 |
| Acknowledge M19 | 2.4.6 | 3.2.6.5 |
| Actual gear stage, coding | 2.4.6 | 3.2.6.5 |
| Actual spindle rotation clockwise | 2.3.7 | 3.1.7.2 |
| Analog inputs | 2.3.3 | 3.1.3 |
| Axis disable | 2.4.6 | 3.2.6.6 |
| Axis in position control | 2.3.7 | 3.1.7.3 |
| Axis No. actual value hand-held unit | 2.4.6 | 3.2.6.1 |
| | | |
| **B** | | |
| | | |
| Basic setting | 2.5.1 | 3.3.1.3 |
| Basic setting zero offset | 2.4.6 | 3.2.6.4 |
| Basic speed | 2.4.6 | 3.2.6.5 |
| Battery failure | 2.5.4 | 3.3.4 |
| Block search active | 2.3.7 | 3.1.7.1 |
| | | |
| **C** | | |
| | | |
| Cam pairs active | 2.4.6 | 3.2.6.6 |
| Central I/O device inputs | 2.3.1 | 3.1.1 |
| Central I/O device outputs | 2.4.1 | 3.2.1 |
| Change gear | 2.3.7 | 3.1.7.2 |
| Cold start | 2.5.1 | 3.3.1.3 |
| Control bit TC | 2.5.6 | 3.3.6 |
| Current OB No. | 2.5.1 | 3.3.1 |
| Cycle disable | 2.4.6 | 3.2.6.1 |
| | | |
| **D** | | |
| Data are selected | 2.5.4 | 3.3.4 |
| Data In start, 1st and 2nd RS232 | 2.4.6 | 3.2.6.1 |
| Deceleration | 2.4.6 | 3.2.6.6 |
| Decoded M signals | 2.5.5.2 | 3.3.5.2 |
| Define zero setpoint | 2.4.6 | 3.2.6.5 |
| Delete distance to go | 2.4.6 | 3.2.6.4 |
| Delete subroutine pass number | 2.4.6 | 3.2.6.4 |
| Disable keyboard | 2.4.6 | 3.2.6.1 |
| Distance-to-go display on hand-held unit | 2.4.6 | 3.2.6.1 |
| Distributed I/O device inputs | 2.3.2 | 3.1.2 |
| Distributed I/O device outputs | 2.4.2 | 3.2.2 |
| DRF active | 2.4.6 | 3.2.6.2 |
| DRF selected (via softkey) | 2.3.7 | 3.1.7.1 |
| Dry run feedrate | 2.4.6 | 3.2.6.2 |
| Dry run feedrate selected (via softkey) | 2.3.7 | 3.1.7.1 |

| Signal name | Chart | Description |
|---|---|---|
| | | |
| **E** | | |
| | | |
| Emergency stop | 2.4.6 | 3.2.6.1 |
| Error messages (Nos. 6000 to 6063) | 2.5.7 | 3.3.7 |
| Exact stop coarse | 2.3.7 | 3.1.7.3 |
| Exact stop fine | 2.3.7 | 3.1.7.3 |
| | | |
| **F** | | |
| | | |
| Feedrate enable (axis specific) | 2.4.6 | 3.2.6.6 |
| Feedrate enable total | 2.4.6 | 3.2.6.3 |
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| Signal name | Chart | Description |
|---|---|---|
| | | |
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| | | |
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| Signal name | Chart | Description |
|---|---|---|
| | | |
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| | | |
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| | | |

| Signal name | Chart | Description |
|---|---|---|
| | | |
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| | | |
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