SIEMENS

Equipment for Special Machines
WF 725/WF 726
Positioning Modules

Description

Edition 07.93

SIEMENS

WF 725/WF 726
Positioning Modules

Description

Edition July 1993

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Tous les efforts ont été faits pour fournir dans ce manuel une information complète et exacte. Néanmoins, pour des raisons de concision, ce manuel ne développe pas une information détaillée sur tous les types du produit et par conséquent n'envisage pas tous les cas de mise en service, d'utilisation et de maintenance du produit.

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Ce manuel a été édité sur le système de bureau "5800 Office".

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0 Overview

0.1 Notes for the reader

The description for positioning modules WF 725/WF 726 with order number E80850-J146-X-A1-7600 and the description part 2 -New functions- with order number 6ZB5 440-0KG01-0BA1 are combined and revised in this manual. The overview given in pervious manuals appears in section 6.

0.2 WF 725/WF 726 modules

The WF 725/WF 726 modules differ in functionality and in the position encoders that can be connected. The modules can be connected to the WF 725 A incremental position encoder, the WF 725 B/WF 726 B incremental position encoder and/or parallel absolute encoder and the WF 726 C incremental position encoder and/or serial absolute encoder.

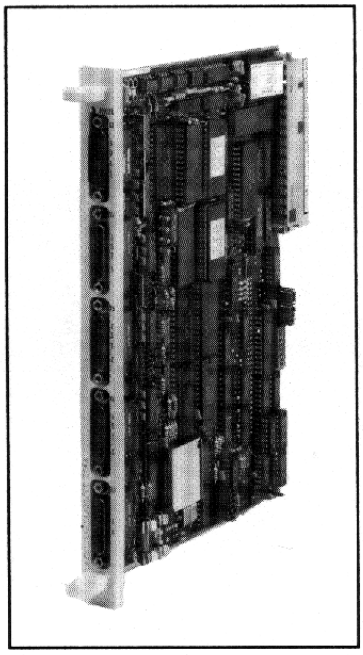


Fig. 0.1 WF 725 A

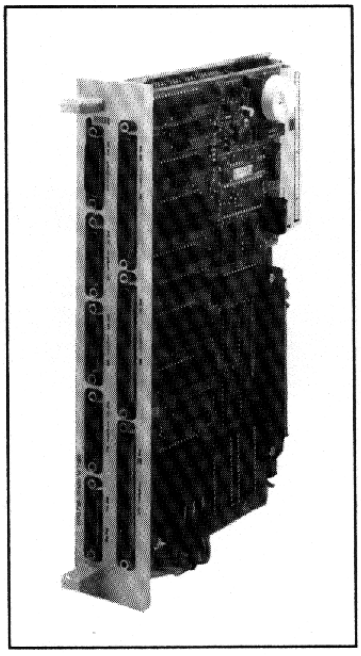


Fig. 0.2 WF 725 B / WF 726 B

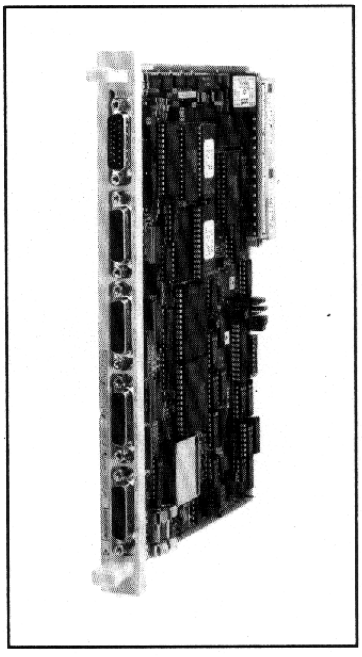


Fig. 0.3 WF 726 C

The following catalog provides an overview of the application and functions of all the WF modules:

Equipment for machine tools

WS/WF-technology • systems and components

catalog AR 10

0.3 Example of application (available only in German)

We offer an application example (only in German) for easier comprehension of the WF 726 technology which can be studied privately:

WF 725/WF 726 Positioning Modules
Planning Instructions part 4
Application example

- The project planning of a loading gantry is the main subject of the WF technology;
  e.g. Planning of the hard- and software
  Calculation of the machine data
  Programming of the traversing program

- The enclosed "Exercise" disc offers the possibility of practice in the laboratory; as equipment we recommended the programmable controller, the PLC, the drawing board and the simulator.

- Order number 6ZB5 440-0GM01-0AA3

1 Application

The WF 725 and WF 726 positioning modules are part of the intelligent periphery of the SIMATIC S5 programmable logic controllers. Therefore each card has its own microprocessor. Each module can control 3 axes simultaneously and independently, either in the closed or in the open loop mode. Typical applications for positioning with SIMATIC S5 and positioning modules are:

- Transfer lines
- Assembly lines
- Presses
- Wood working machines
- Material handling
- Loaders
- Multiaxes special machines
- Auxiliary axes for mills and lathes
- Packing machines
- Conveyors and transport installations

Advantages of using the WF 725/WF 726 are:

- **Economics**

  Simple and economical solutions are achieved by combining the programmable logic controller (SIMATIC S5) with a positioning controller (WF 725/WF 726) into a single system. This is specially valid for the following applications:

  - Set up and loading,
  - Machining,
  - Handling and transportation of materials

- **Flexibility**

  The position control together with the complete traversing program is located on the WF 725/ WF 726 modules. The memory of the SIMATIC S5 can be used as a background memory for the traversing programs. To set up the machine the programs are trans-ferred from the SIMATIC S5 to the WF 725/ 726 modules. An input over the keyboard is not necessary.

- **Good adaptation to the mechanics and to the production process**

  The WF 725/WF 726 are adapted to the particular process technologies by the input of machine specific parameters (machine data). The load on the machine can be influenced by the input of acceleration and deceleration distances.

The WF 725 A modules are designed for incremental encoders. The WF 725 B and the WF 726 B modules are designed for incremental and for digital absolute encoders (parallel interface). Mixed operation of incremental and absolute encoders is possible. The WF 726 C module offers the possibility of connecting either incremental or digital absolute encoders (serial interface). Mixed operation is also possible with the WF 726 C.

Fast reactions in the position control loop are possible because each module has its own microprocessor. A high positioning accuracy is achieved with the high resolution, which is important in transportation applications and in machining to achieve a good surface finish. The high traversing speed during machining and transportation allows a very efficient use of the machine and of completely integrated systems.

- **Simple Configuration**

  The time required to develop the STEP 5 software for the programmable controller is greatly reduced by the use of the standard software modules. The standard software modules do not depend on the number of axes controlled by the WF 725/WF 726. Therefore the number of axes can be increased without having to change the complete control logic.

- **Easy Start Up**

  Before or during start up the complete STEP 5 machine program, including the part for the WF 725/WF 726, can be tested in the "dry run" mode. The positioning loop is completely digital and, at first, it can be run with a standard set of machine data. A fast localization of errors is guaranteed by extensive error lists and error messages for the data transfer and for the measuring circuit.

- **User Friendly**

  As a specially user friendly operator and monitoring station the CRT-based display system WF 470 or GRACIS can be used. Some of its features are:

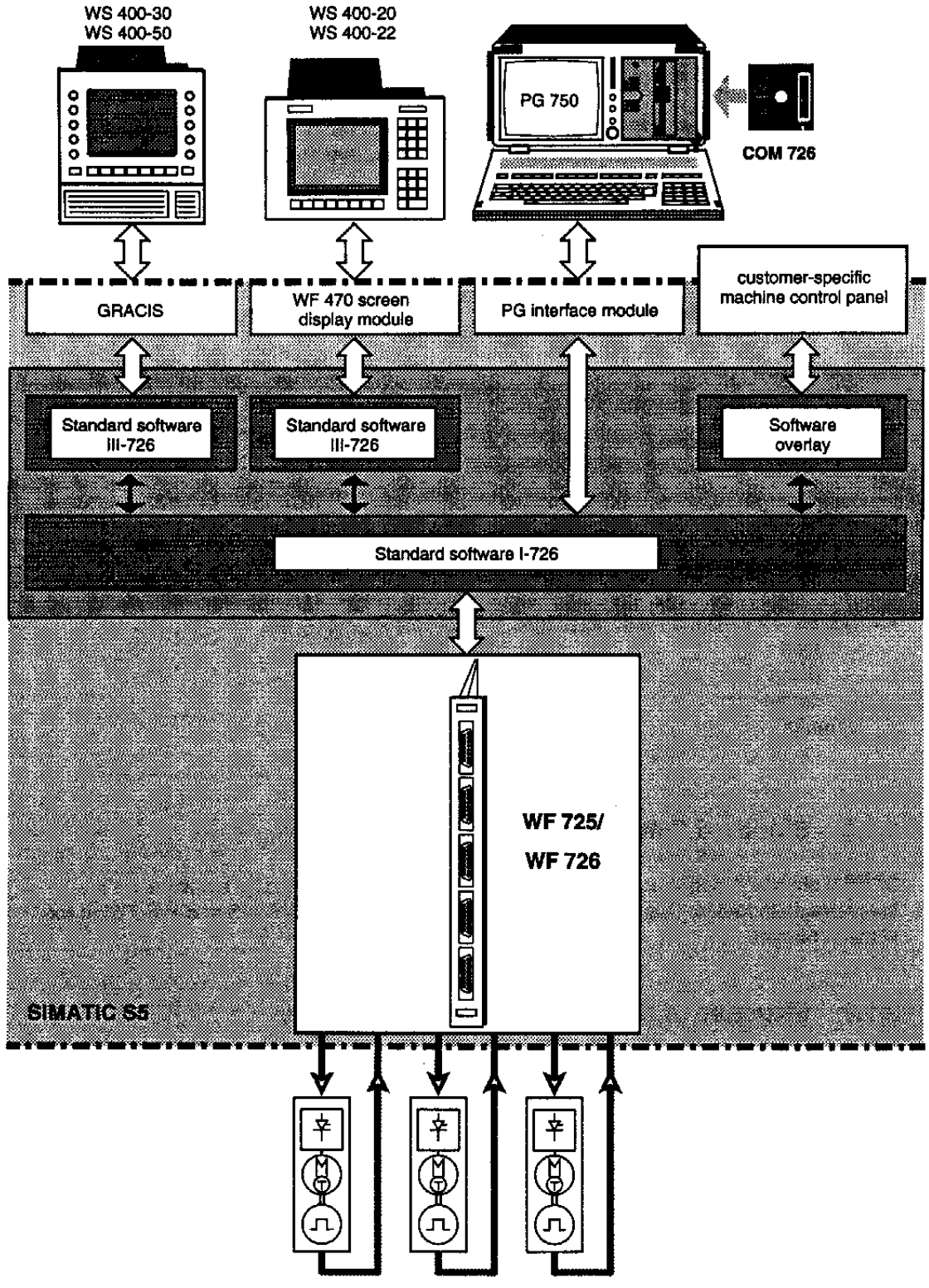
  - Extensive adaptation of the CRT screens to the machine or to the individual process.
  - Fixed screens for program input, machine data input, actual value display, teach-in, control of the data transfer and of the measuring circuit.
  - Freely configurable screens, for example for monitoring/control of the machine and the process.
  - Operator prompting with menu technique and softkeys.
  - Windows for the display of alarms, in clear text, printout of operator and error messages, fast error localization.

- **Training courses**

  Our training center offers courses and the opportunity to work on the systems.

2 Configuration

2.1 Application in the SIMATIC S5



2.1.1 Structure of the Standard Hardware

2.1.1.1 Standard I - Data Input without Operator Panel

In cases where the traversing distances are given by a computer or where there are few traversing data, an operator panel might not be necessary. In this case a programmer is enough for the data input and output.

2.1.1.2 Standard III - Application with Compact Operator Panel

The display system WF 470 or GRACIS with operator panel or stand alone monitor with keyboard is a very user friendly operator and diagnostic system. This system offers:

- extensive adaptation of the screen configuration to
  - the specific machine
  - the specific process
- operator prompting with
  - menu technique
  - softkeys
- display of
  - return messages
  - alarms
- printout of
  - operation messages
  - fault messages
- fast error localization with messages in clear text regarding the
  - type
  - place
  - cause

  of faults.

2.1.2 Standard Software I-726 and III-726

STEP 5 standard blocks are offered to simplify the programming. The software, as the hardware, is modular. The new standard blocks can work with WF 725 and WF 726 in the same controller.

2.1.3 Structure of the Standard Software Overlay

DThe STEP 5 program to operate the interface SIMATIC S5 - WF 725/726 can be simplified greatly by using the Overlay. The interface organization is done by simple parameterization of function blocks.

The *Overlay* includes the function blocks (FB) [Axis], [Data] and [Mode] and is available in connection with Standard I-726.

2.1.4 Connection with COM 726

The software package COM 726 is intended for comfortable project planning and programming of WF 725/WF 726 modules. The COM 726 software is practical for planning an installation as well as for the initial start-up or the diagnosis and repair of faults.

The easy and comfortable control panel enables the input/output of machine data, tool offsets, operation data and traversing programs.

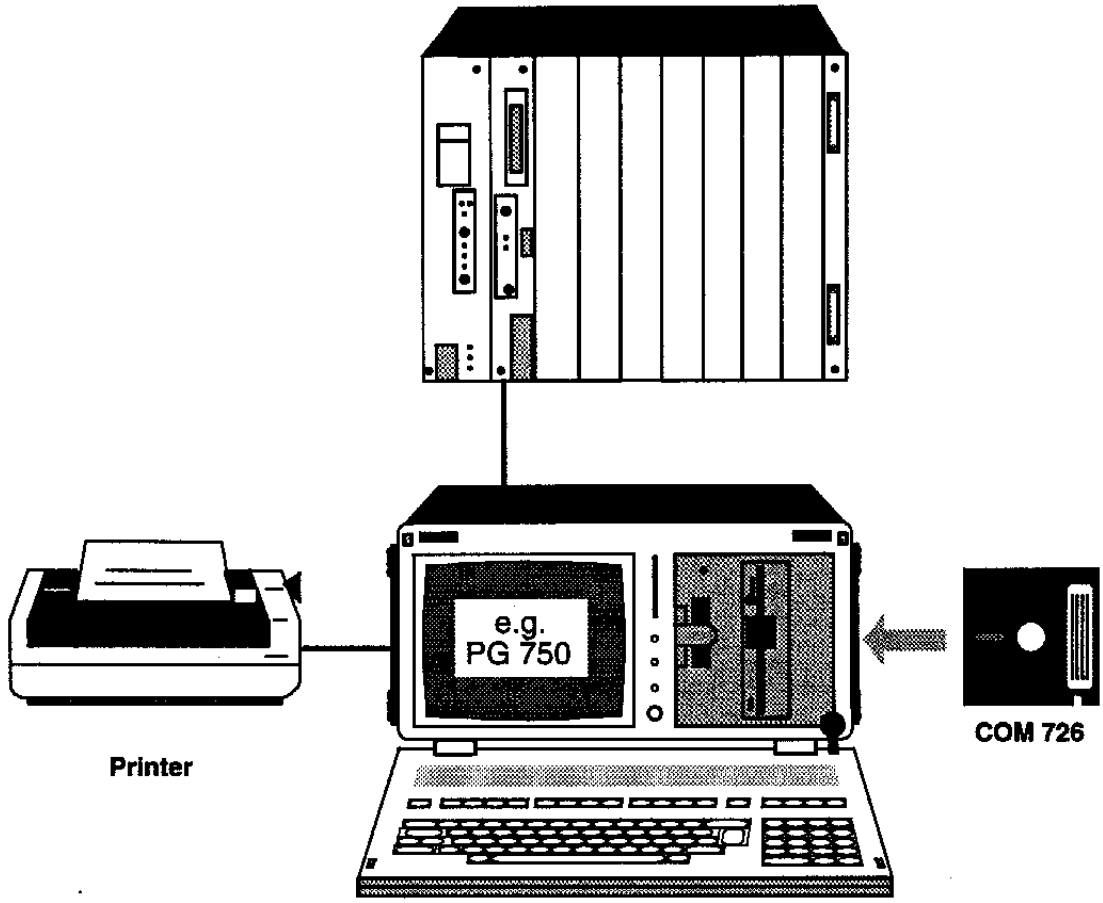


Figure 2.1 Connection with COM 726

The software package consists of two parts which must be installed in the appropriate devices.

- The **user part** of the software package must be loaded on the PG 730/PG 750/PG 770. It is called from the S5 DOS level. Data exchange with the WF 725/WF 726 module is realized by the PLC interface with which the normal S5 DOS functions are alsoexecuted. This means ONLINE operation can take place as an isolated operation or as part of the network using SINCE H1.
- The **direct data exchange** with the WF module is executed by a function block in the PLC. This block places the data desired by the PG (PC) in a data block to which the PG has direct access. A standard file with data blocks for the various WF versions is also available as a guide.

2.1.5 Use of WF modules in multiple-processor controls

WF module cannot be used with multiple-processor controls.

3 Functional Description

3.1 Technology and Geometry

The relationships between the movement data is shown in figure 3.1. Path and feed rate are entered as traversing block information. Acceleration and deceleration are stored in the machine data. The curve v(t) can be measured at the command value cable if the machine data "simulation" is set.

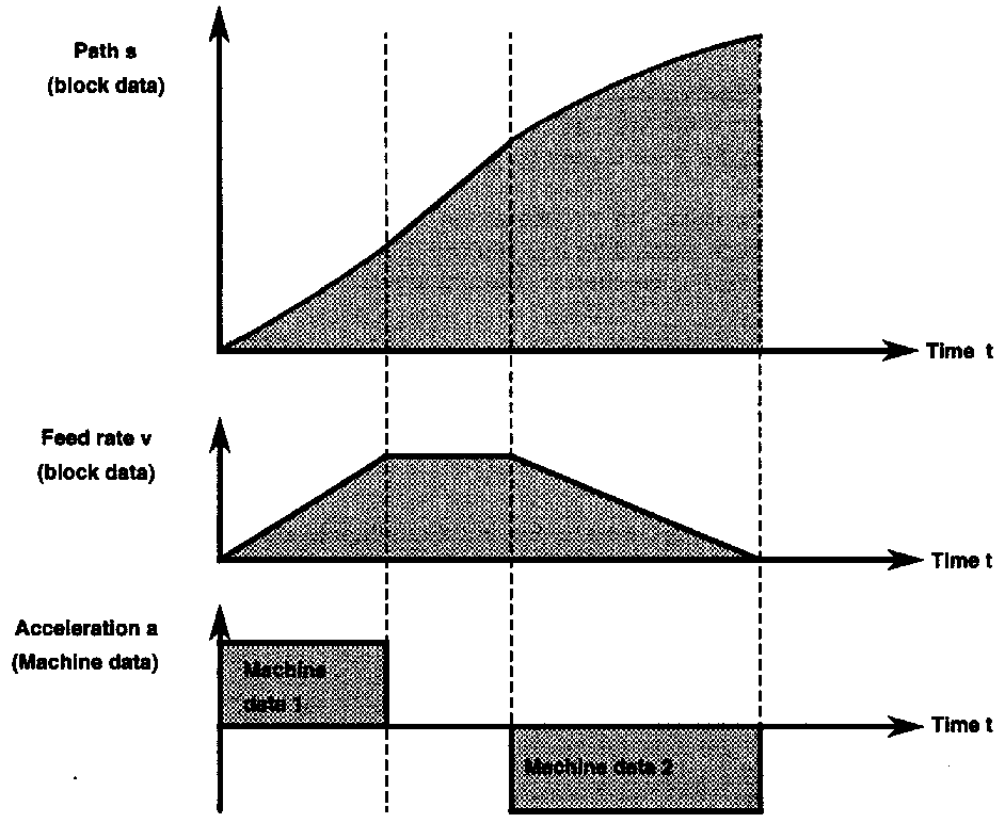


Figure 3.1 Command value output without jerk limit

The axes should traverse the programmed distances as fast as possible. However, the following conditions have to be observed:

- Limitation of the acceleration to reduce
  - the load on the mechanics
  - the load on the encoders
  - the size of motors and drive units
- Limitation of the feed rate because of
  - the speed limit of the motor
  - technological limits (e.g. type of material to be machined)
  - the frequency limit of the encoder and the counting electronics

3.1.1 Linear Interpolation

The WF 725 is well suited for typical one axis positioning applications in machining and transportation. In addition multi axes movements can beexecuted. The individual axes are monitored in the WF 725. Deviations from a programmed path are corrected and therefore compensated by the WF 726.

For example, to approach any point in the X-Y plane with a linear movement, the WF 726 contains:

- an interpolator to calculate intermediate path points, where the x:y relationship is preserved, and
- a speed regulator for the drive units, to preserve the speed relation Vx : Vy exactely.

The simultaneous and independent control of 2 axes is called two-axe path control (2D). However, if the interpolation - as in the WF 726 - can be switched to any plane within one program then the control is called a 2 1/2 D path control.

During positioning without interpolation two simultaneously started axes will move with their programmed speed,until they both reach their end position. All drives are started simultaneously but the end position is reached at different times, depending on the distances.

The interpolator coordinates the movement in such a way that the resulting movement is exactly the programmed path between the starting point and the end position. In the case of linear interpolation this path, between the starting and the end position, is a straight line (see figure 3.3).In order to be able to traverse different curves in one plane one has to approximate the curve with segments of a straight line.

The shorter the straight line segments the better the approximation to the desired curve. This, however, increases the amount of data the WF has to handle. Up to 200 segments (= 200 traversing blocks) can be used in the WF 726.

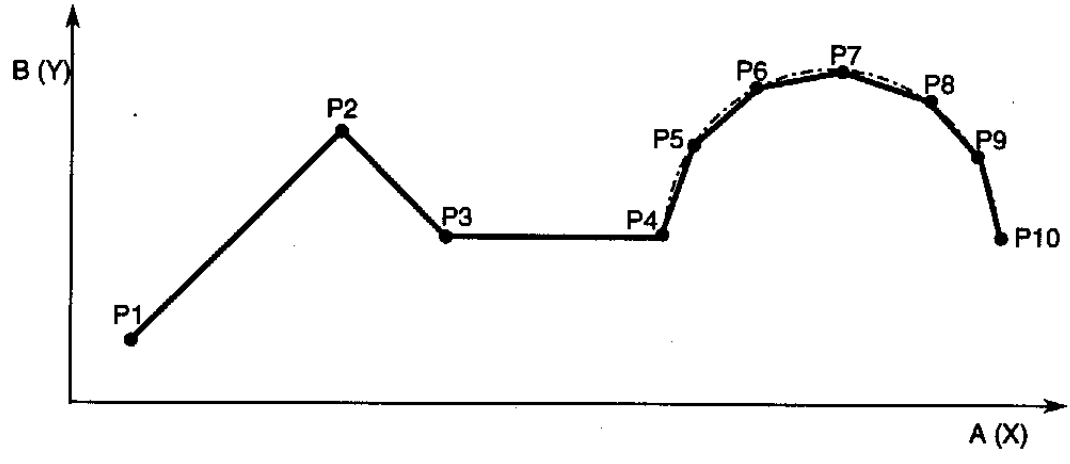


Figure 3.2 Movement with linear interpolation; P: Start or destiny points

3.1.2 Synchronization of Two Axes

Machine tool applications often require the close synchronization of several axes. The synchronization of 2 axes is required very frequently. Examples od this are:

- a loading gantry for a machine tool
- a turning device for a press.

The synchronous axes are coupled in one case by the mechanics of the loading gantry, and in the case of the turning device by the work piece.

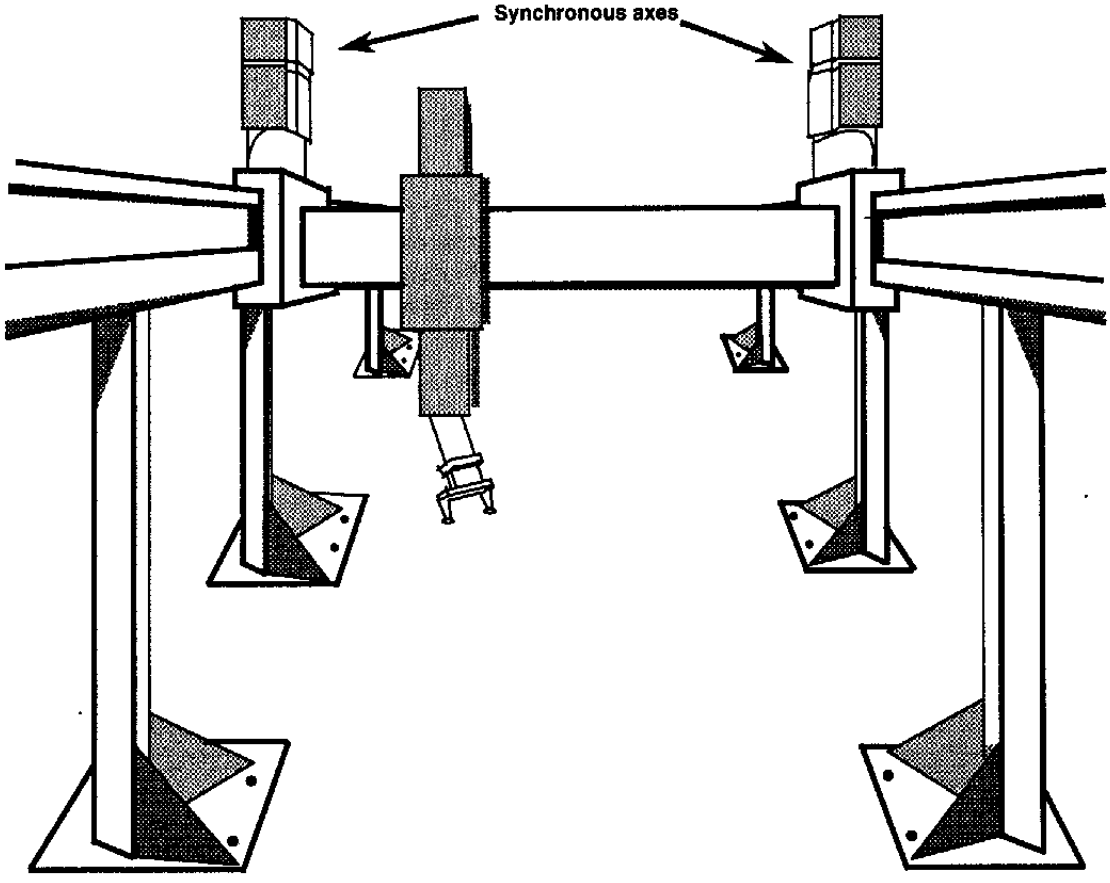


Figure 3.3 Synchronous axes

The synchronous axes function must guarantee the correct working of the machine in all operating modes. The two axes must remain synchronized at all times.

The synchronized movement must, of course, be maintained even in the case of a power failure. If an operation with reference point approach (homing) is not possible then two identical absolute encoders must be used.
Machine data in the WF 726B determine (permanent axes synchronization):

- Assignment of the synchronized axes
- Synchronization tolerance; if this value is exceeded, synchronisation offset the drives are stopped.
- Gleichlaufverschiebung

The SIMATIC interface sees the synchronous axes as a single axis. Compensation movements are possible to eliminate a misalignment during the first time start up.

Axes synchronization can be switched on/off with the G-functions (G07/08/09).

3.1.3 Jerk control

The maximum height of setpoint jumps is limited mechanically. If positioning tasks require high acceleration, a soft run-up is necessary, e.g. for lifting. For this reason, a jerk limit has been implemented on the WF 726. The jerk machine data (no. 38 and 39) enable the acceleration to be increased or decreased.

3.1.4 Rotary Axis

Machine data 18 determines if the axis is controlled as a linear or as a rotational axis. For a linear axis the machine data 18 must have the value 1.

If the rotational axis is selected then the machine data determines after how many encoder pulses the actual value counter of the WF 725 is reset to zero. Machine data 18 can be determined freely if incremental encoders are used. The entered number of pulses is not determined by the number of pulses of the encoder. However, if absolute encoders are used then the value of the machine data must be the total number of steps of the encoder.

With absolute programming the direction from which the new position is approached can be selected. If no direction is selected then the new position is approached from the direction with the shortest distance.

In incremental programming the sign of the programmed distance is used to determine the direction of rotation. Only in incremental programming can several rotations be programmed in one block.

3.1.5 Feed Rate Correction

The feed rate is programmed axis specific in mm/min, m/min or inch/min. There is no distinction between feed and rapid traverse. By using the software interface it is possible to influence the programmed feed rate with an override: the range of the override is from 1 % to 150 % with steps of 1 %; the override is based on the programmed feed rate. The override remains active if the operating mode is changed.

3.1.6 Tool Length Offset

The tool length offset makes it possible to correct the program if the tool length assumed in the program differs from the actual tool length,e.g. if the tool has been ground. The difference in length or the absolute tool length is entered into the tool length memory of the WF 725/726. The values are called with D1 ... D10 from the RAM, or with D11... D20 from the EEPROM. The direction of the correction is selected with G 43 or with G 44. .

3.1.7 Zero Offset

The zero offset (ZOF) shifts the zero of the coordinate system from the machine zero to the zero of the part, from where the measurements are made. There is a zero offset for each axis.

3.1.8 Backlash Compensation for Incremental Measuring Systems

The control is able to compensate for mechanical backlash in the ball screw of up to 65 mm (machine data 31). This is important for indirect measuring systems. The compensation is done whenever the direction of movement is reversed.

3.1.9 Drift Compensation of the Drive Unit

All standard drive units for electrical feed drives are implemented in analog technology. Even with good adjustments there is always some amount of drift and therefore a positioning error. This is avoided with the drift compensation in the WF 725/726.

3.1.10 Auxiliary Functions (M Functions)

M functions can be used to trigger switching commands in the PLC. Each axis can have up to three M functions. M functions are transferred in BCD to the PLC during the execution of the block in which they are programmed. They are stored in the PLC with a strobe signal.

The type of output is specified in the machine data:

- Machine data 8 determines if the output is handshake or time controlled.
- Machine data 9 determines if, in the time controlled output, the output occurs before, during or after the axis movement.

3.1.11 Fast inputs for process signals

The WF 725/WF 726 control system is used in many areas of automation technology. Through the conception of fast inputs of the WF 726, functions can now be realised which are marked by very short signal times or reaction times.

The WF 726 module has 6 inputs on the connector X7(I_1-I_6) to which certain functions can be assigned with machine data 15. Inputs I_1-I_3 are port inputs of the WF processor which can be called in the closed-loop state. Inputs I_4-I_6 are interrupt inputs. They are used for operations which need immediate reactions.

Start/Stop from external point

The SIMATIC S5 input cannot start positioning axes for installations which have a traversing time below 100 ms for a positioning sequence, e.g. in the case of a cutter (fig. 3.4)

The inputs I_1-I_3 can be used in this case to start WF axes. There are 2 options available for the processing of an external start for the WF 726 axis:

- Start/Stop alternatively to the Start/Stop-signal of the SIMATIC S5 interface
- Start only when also signalled in the SIMATIC S5 interface.

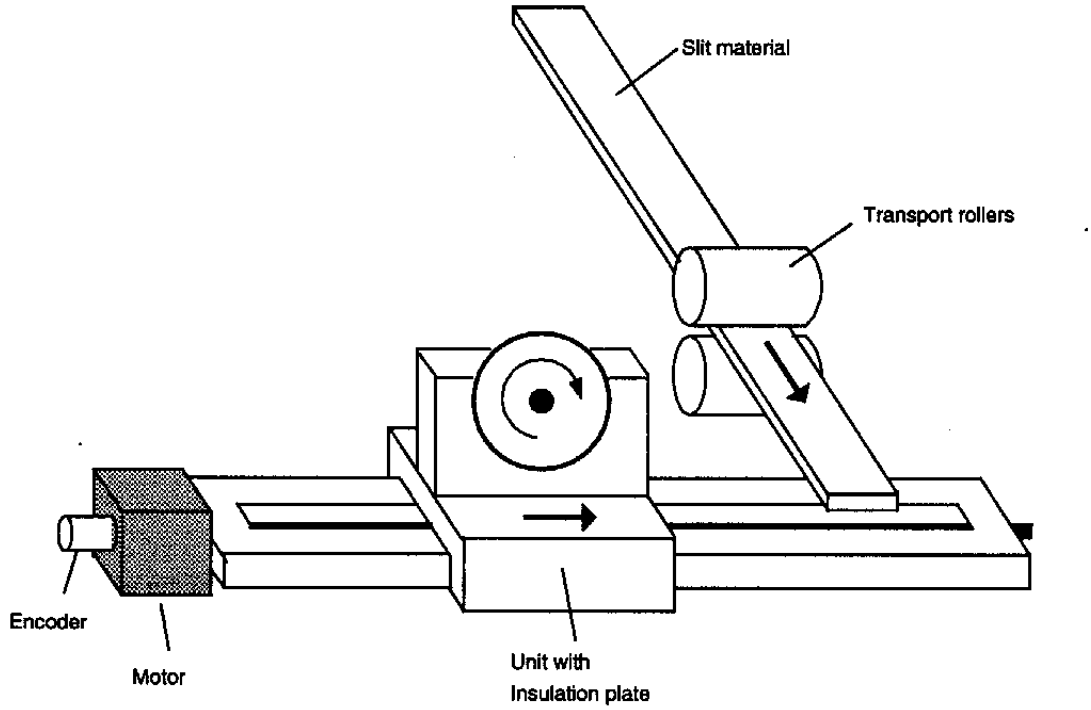


Figure 3.4 Structure of a cutter

Flying setting of actual value

For applications in the bearing automisation, the positioning systems used often have to traverse great distances. Because of the great traversing distances, the store hoisting-gear drive is not done with rack drive but with castors made of rubber or plastic.

Over larger distances, this will result in a positioning error because of the creep of the rollers. The positioning system must now be synchronized again when the approached store part is reached.

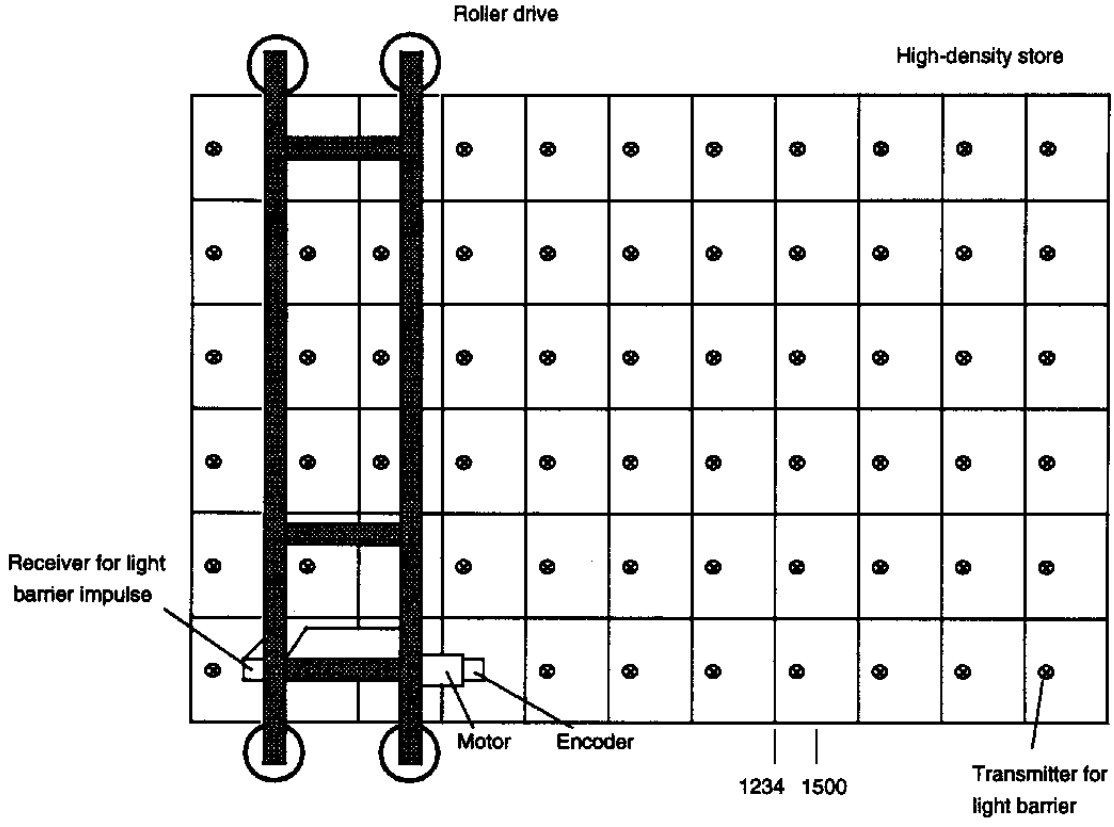
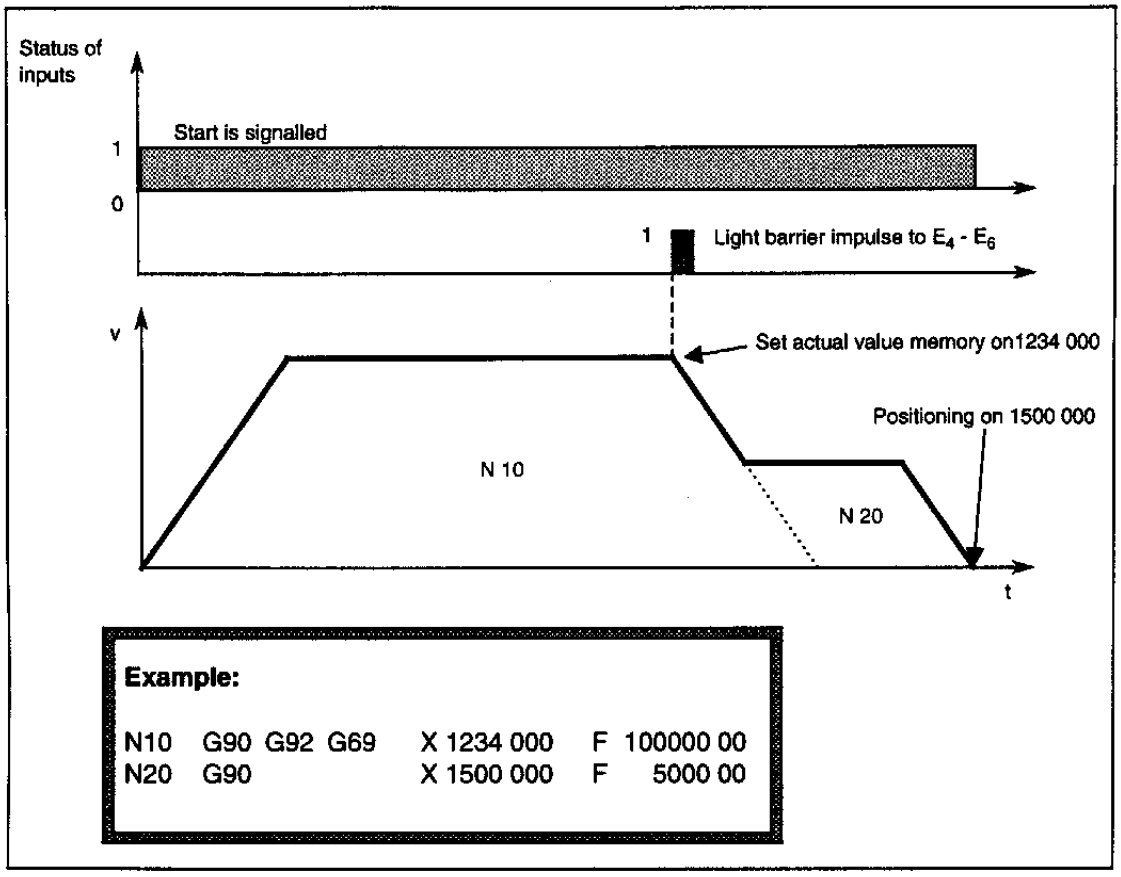


Figure 3.5 Store hoisting-gear

This can be done with a light barrier. This light barrier impulse is used for setting the actual value. This happens during traversing of the hoisting-gear by the axis. After the actual memory is set, the axis positions the hoisting-gear on the programmed position (figure 3.6).



Figurre 3.6 Positioning with actual value setting

The following has to be taken into account for the solution of the technology task of a WF 726 module:

- The impulse for the flying setting of actual value must be connected to connector X7 of the WF 726 at one of the interrupt inputs I_4-I_6.
- The traversing program should be programmed according to the example.
- Acceleration ramps and deceleration ramps should be chosen so that the rollers neither crank nor stop.

In the block N10, the store hoisting-gear is traversed over G69 in positive direction with a speed of 100 m/min. A brake start is not calculated.

If the store hoisting-gear reaches the light barrier, the impulse sets the actual value memory with the G92 function. As this point is also used as a braking point, the WF axis changes the block.

The position of the store middle to which positioning will be executed with smaller speed now stands in N20.

Flying measuring

With the function "Flying measuring", the WF 726 axis can fulfill measuring tasks. A drilling depth can be accurately analysed by mounting a measuring sensor to a positioning axis (figure 3.7).

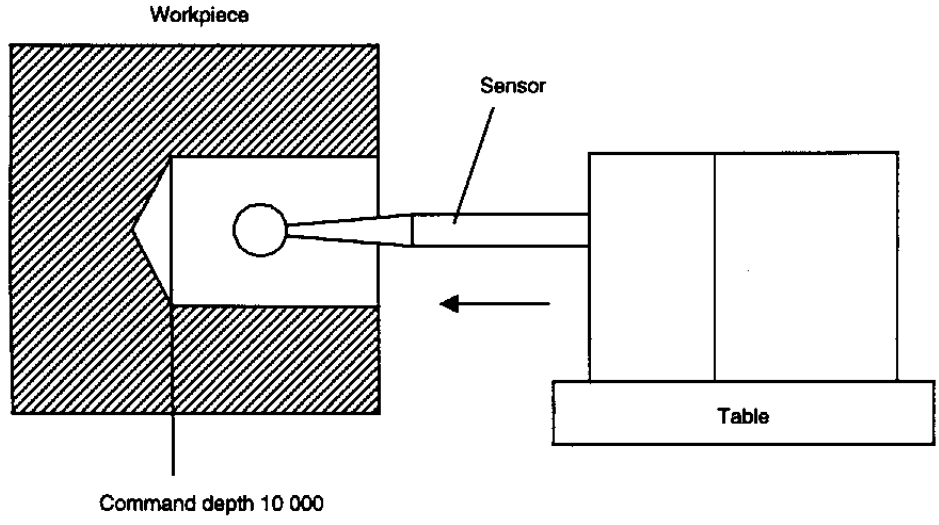


Figure 3.7 Measuring a drill hole

The measuring sensor delivers a signal which is registered by the WF 726 over interrupt inputs I_4 - I_6. This stops the axis, and the state of the actual value memory can be read out when the sensor is activated. This saved actual value now states the exact drilling depth, related to the reference point of the axis.

The traversing movement is programmed like the flying setting of actual value.

Example:

```
N10   G90 G92 G68   X 10000     F 1000 00    M00
```

However, the block is not changed immediately, but is stopped at block end via M00.

If the axis stands, the saved actual value can be read out in the MODE "Traversing". Following blocks will be processed by a new start signal.

External read-in enable

The fourth possibility of assigning a function to the inputs on connector X7 is the external read-in enable. Inputs I_1-I_3 can be used for this. If an input (e.g. I_1) of the axis A is assigned to the function "External read-in enable" with machine data 15, then the input of the next block to the main memory of the axis can be prevented with 0V at I_1. The axis positions at block end and waits for a HIGH signal (+24V) at the I_1 to continue processing of the traversing program. To call the input from the WF axis in the traversing program, this call must be activated during programming with condition G99 in the second G group (figure 3.8).

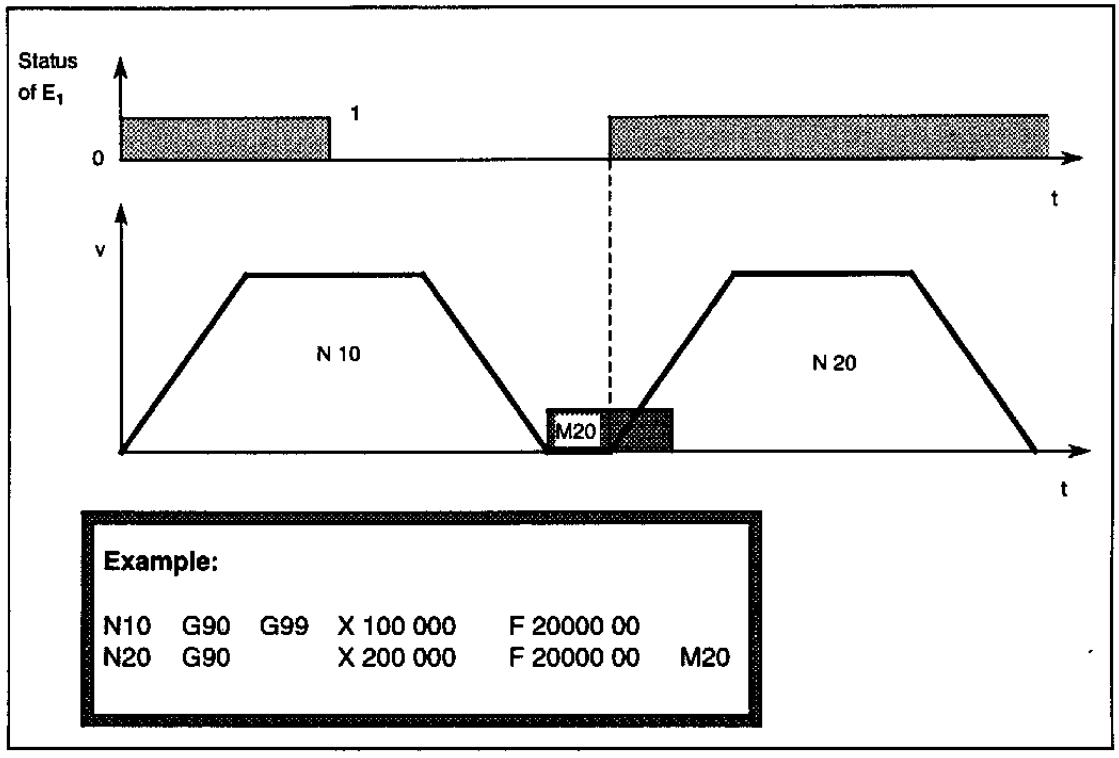


Figure 3.8 External read-in enable (interrupted enable)

The example shows that the position of the block N10 will be positioned when the external read-in enable is missing. But the M function programmed in block N20 will be read out from the axis. When the read-in enable is entered to I_1, the axis accelerates, and the position of block N20 will be approached.

When the read-in enable is signalled, the program will be processed normally with flying change of blocks (figure 3.9).

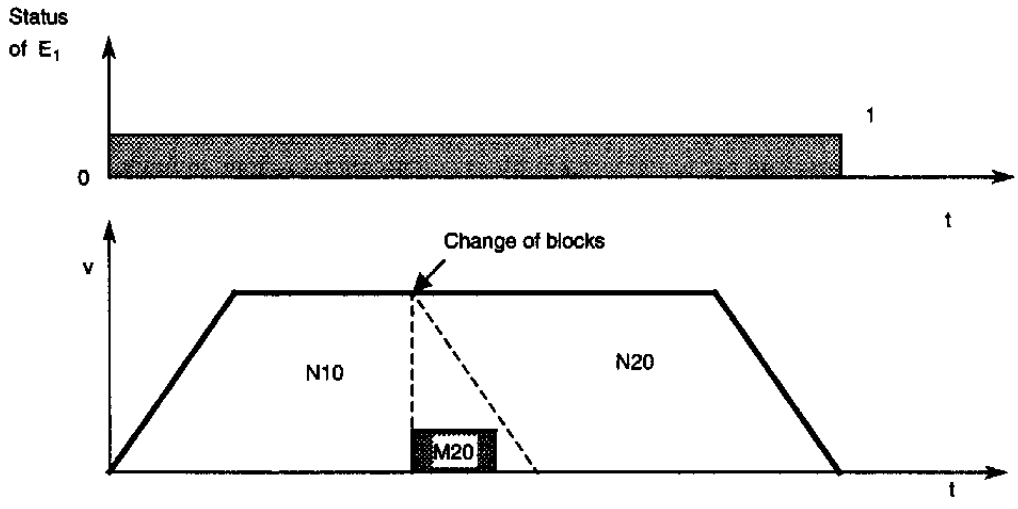


Figure 3.9 External read-in enable (permanent enable)

Through calling the input in the measuring circuit of the WF axis, the releases for continuation of an axis can be processed much faster. This is often necessary for axes with very high speeds (150 m/min), because the reaction over SIMATIC S5 cycle-time can lead to position shifts in the range of 1m (danger of collision).

Fast outputs

The positioning modules WF 725/WF 726 have 6 outputs on the connector X7 (O_1-O_6). Instead of cut-off points, signal functions can be assigned to these outputs with machine data 10.

These functions are:

- Position reached and stop (PEH)
- Traversing direction +
- Traversing direction –
- Last but one cut-off point reached - only for WF 726 open loop positioning

The outputs are supplied in the measuring circuit pulse of the WF axis and enable much faster operations (which saves time) than control with only S5 outputs.

The switching signal "PEH" realizes interlocking and parameterization in the control of tool turrets or chains much more quickly read the S5 cycle.

With the traversing signals Jog+ and Jog-, the directions can be traversed directly when positioning is with open-loop. This considerably reduces the programming expense in the S5.

When the WF 726 is used as the open-loop version, an additional last-but-one cut-off point can be processed before the last cut-off point. This enables easier switching from fast speed to slow speed for positioning.

Open-loop positioning over fast outputs offers, aside from the lower S5 planning expanse, a lower scatter band in the reached open-loop positions.

3.1.12 Spindle positioning

For certain operations it is necessary to position the tool spindle. The finished positioning may not be sufficient, depending on the tool and its position. The spindle then has to remain on this position in open-loop after positioning (figure 3.10).

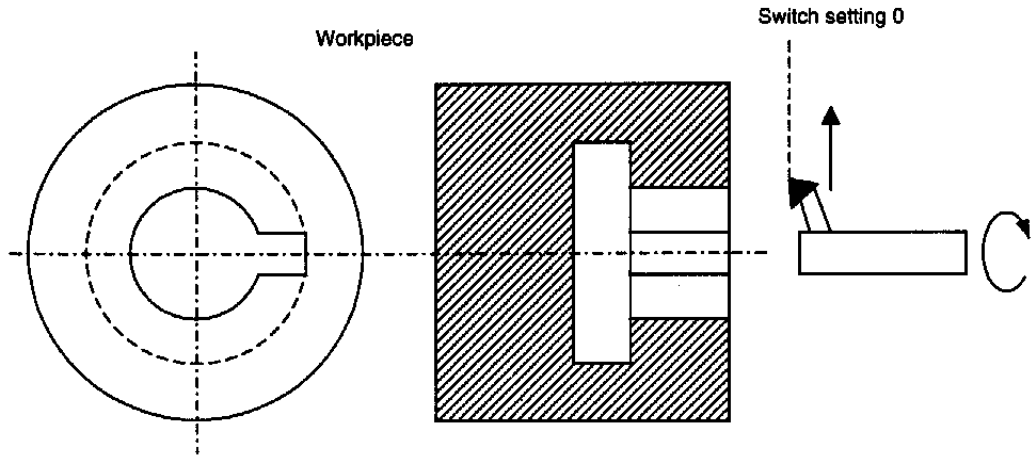


Figure 3.10 Machining an undercut

In these cases, a WF 726 axis can fulfill this task. When such a system is conceived, some basic conditions should be taken into account:

- The WF 726 axis must be operated as a rotary axis (MD18>1).
- This rotary axis should not be set by encoders and adjustments to the actual value of 360 degrees per revolution but to 1000 increments per revolution. This offers the advantage that the spindle speed can be programmed directly in revolutions per minute in the speed value of the traversing block.
- As this spindle is always in closed loop, the capacity limits of the axis must not be reached. This means the acceleration values and deceleration values as well as the drop of cutting must be selected to prevent the drive from reaching the voltage limit.
- For incremental encoders, the limit frequencies of the encoder and the actual value counter of the WF axis (220 kHz) must be considered.

The WF 726 offers 2 new G functions for spindle positioning which can be programmed in the third G group.

G68 Continuous loop negative direction
G69 Continuous loop positive direction

For programming of G68 or G69 in a block, the programmed speed is kept until the jump bit is taken from the interface (figure 3.11). This results in the immediate change to the next block (N20), and the position programmed there will be approached.

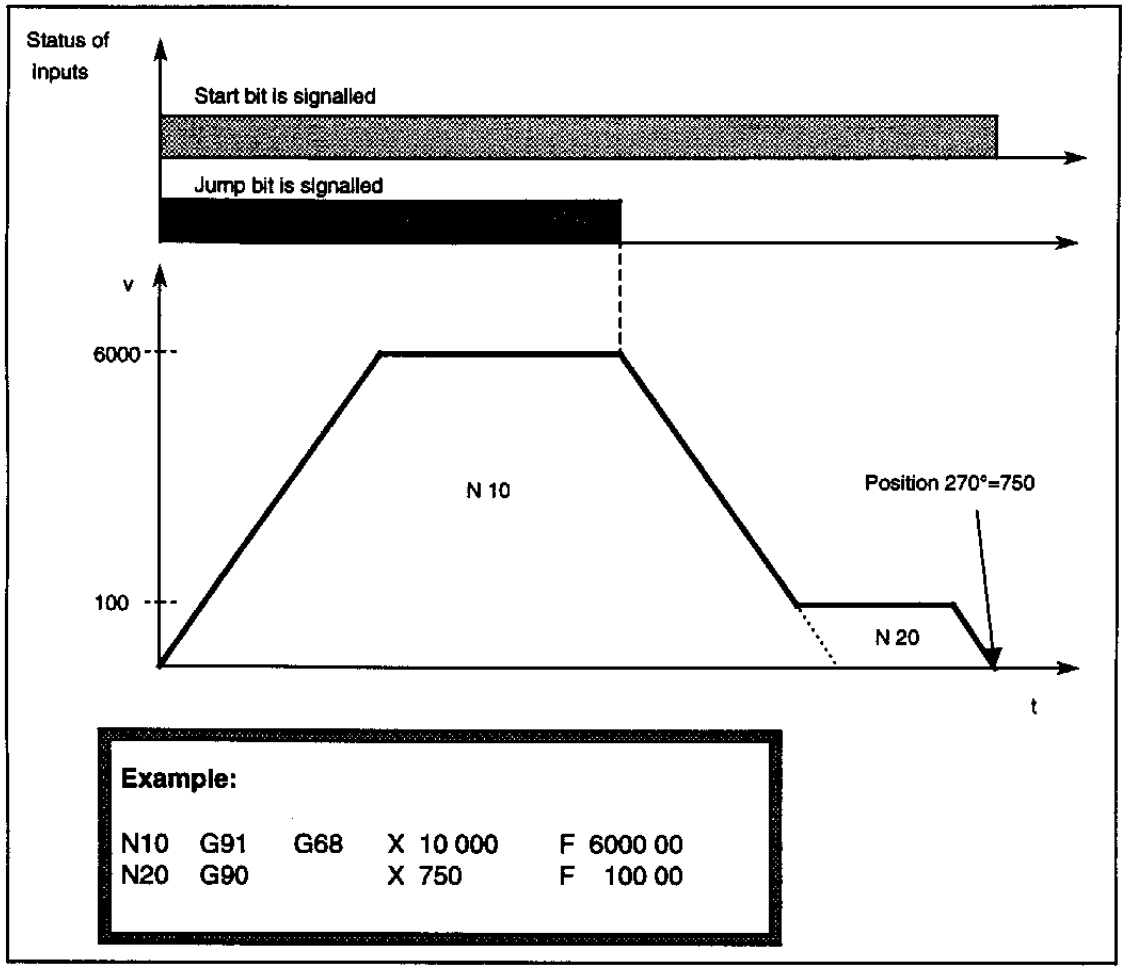


Figure 3.11 Functions of the jump bit in spindle positioning

3.1.14 Approximate positioning tolerance

The block change position and the brake start position are normally identical. However, the brake start position is dependent on the speed with variable greeds, the following block is read in at different times, meaning that the traversing movement starts at different positions on the axis which is still in motion. The traversed are of both axes varies according to speed.

MD 46 can be used to extablish how far before the bolck end position the next block should be processed, llowing positioning on the next axis to be approximated. Since the block change position is established from maschine data, point-to-point control is independent of speed with G 23 to G 29.

3.2 Measuring circuit

3.2.1 Incremental Measuring System

All WF 725/726 modules can be used with incremental measuring systems. Incremental measuring systems consist of rotary encoders or of digital linear scales (figure 3.12). One measuring system is required for each axis.

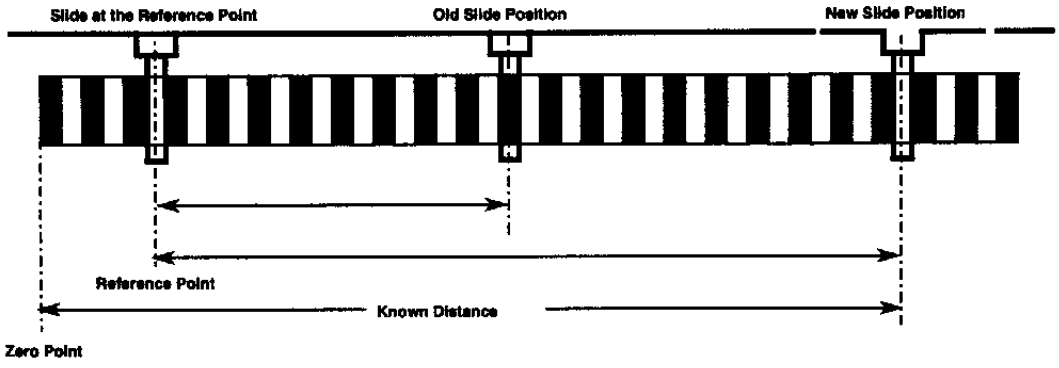


Figure 3.12 Principle of incremental measuring systems

3.2.2 Digital-Absolute Measuring System

Digital absolute measuring systems can be used with the modules WF 725B/726B/726C. With these modules any combination of incremental or absolute encoders can be used. Each axis requires one measuring system.

With digital absolute encoders each position of the traversing range has its own unique bit combination (see figure 3.13). Rotary absolute encoders normally use coded disks. The position output from the encoder is in parallel. It is then decoded in the WF 725/726B. When the WF 726C is used the position is converted from parallel to serial in the encoder. A counting operation like in the incremental version is not required. The smallest measuring unit is one step T. This step is the equivalent to an increment in the incremental encoders.

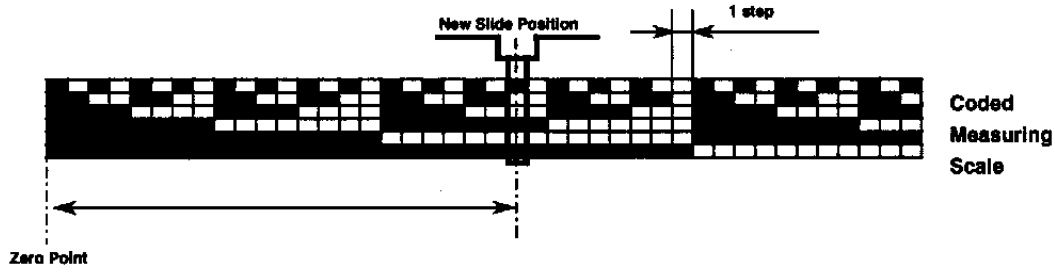


Figure 3.13 Principle of absolute measuring systems

3.2.3 Synchronous Serial Interface (SSI)

This new interface finds use with absolute angle-encoders. The synchronous serial interface does not transfer the absolute path-measuring value parallel but serially to the positioning system with a data driver. This has the advantage that only 4 circuits are necessary for the transfer of the measure value, not depending on the resolution (word width) of the encoder. The actual position is registered optically with a Gray-coded wafer and then passed on to a parallel-serial shift register which takes the code value and then transmits it serially in pulses to the closed loop measuring system (gray code) (figure 3.14).Then, the WF 726C must deliver a pulse, depending on the word width of the encoder, until the last bit has been read. After this, the data driver switches the data line to the signal LOW and shows the positioning system that no data must be read out at the moment. After the monoflop time tw has elapsed, the data line is set to the HIGH level again. Now, the closed-loop system can order new measuring values.

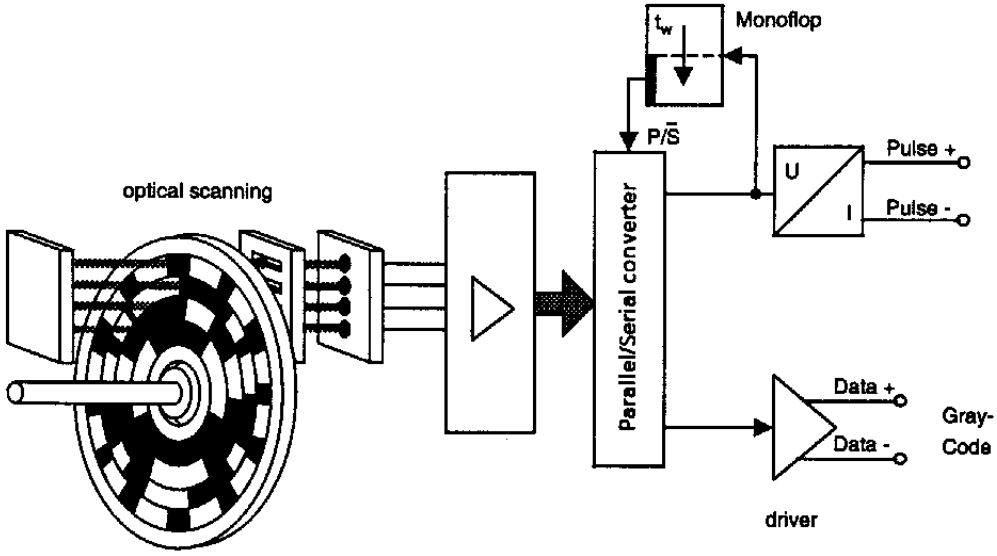


Figure 3.14 Principle display of an SSI encoder

3.2.4 Programmable Cut Off Points

In many positioning applications in the metal or wood working industry and in many transportation applications the requirements for speed and accuracy are limited. In those cases it might be possible to use less sophisticated DC drives, electro-hydraulic control valves or pole switchable three phase motors.

3.2.5 Gradual Command Value Output and Position Control

Positioning systems are required to have a very fast response and to be very accurate. This is normally achieved with a digital controller with positioning loop and a subordinate analog speed or RPM regulator.

The digital position control loop of the WF 725/726 works with a very high time and speed resolution. It has proportional characteristics, i.e. it reacts to changes in the actual path value without any delay. The proportional characteristics of the control loop works with the Kv factor, which is the speed amplification of the regulator. The deviation from the position, called following error ΔS, is the difference between the position command value and the actual position value. It is given by the programmed speed v and by the Kv factor:

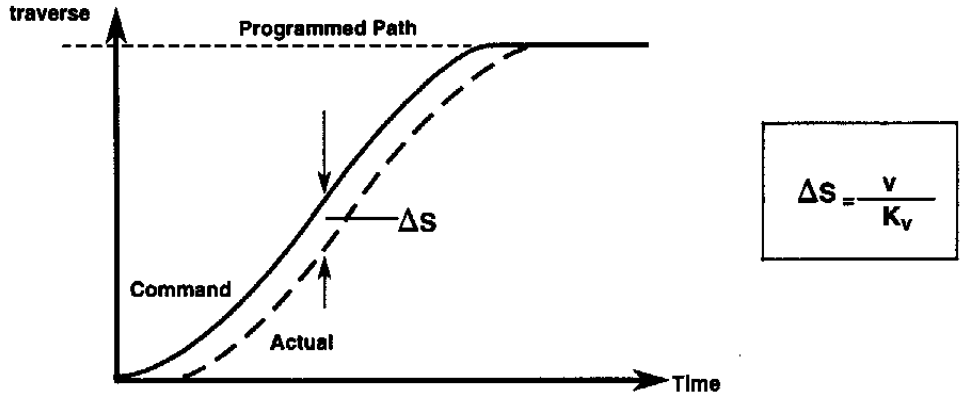


Figure 3.15 Following error ΔS and speed amplification K_v

The K_v factor is entered into machine data 22. The maximum value which can be entered is determined by the stability and the response of the total system.

The position control loop is designed for stepless drive units, which are controlled by an analog voltage of ±10V, 2mA. The drive units can be either for electrical feed drives, or for electro-hydraulic servo valves.

Because of the non-linear characteristics of the drive and the feedback loop, a subordinate PI-regulator is required in both cases to support the position control loop. In the case of the electrical feed drive the subordinate regulator is the speed control loop. If no speed or RPM controller exists then the response time of the drive system increases and the positioning accuracy is reduced.

The machine data 3, 22, 23 and 49 are related to the DAC factor. Position control is only possible if the factor is smaller than 3 (see Start Up Instructions).

3.2.6 Acceleration encoder for voltage increment / decrement

For operation of the WF 726 axis in the open loop version with use of the command value output, the change of the value was read out abruptly with new speed. Now, the command value can be changed in a ramp function. In the open loop version (MD 4=3), the machine data MD1 and 2 have the significance of voltage change in mV per second (mV/s). MD1 determines the acceleration encoder for voltage increment, and MD2 determines the acceleration encoder for voltage decrement. The other machine data relevant for the open loop version remain valid.

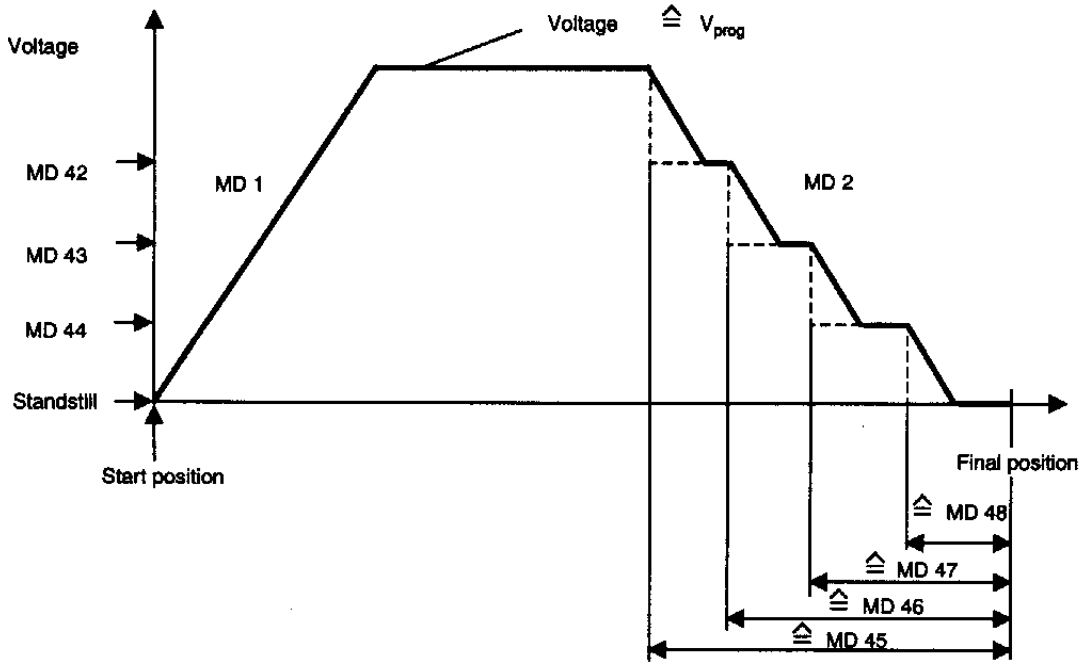


Figure 3.16 Ramp-shaped output of setpoint voltage

With the change of command value voltage in ramp form the load on the mechanic system is considerably reduced when the speed is changed. Another advantage is that the hydraulic proportional valve can be triggered better. Now, low-priced positioning systems can be realised with high flexibility and great accuracy.

3.3 Operating Modes

3.3.1 Set Up and Teach-In

In the operating mode "Set Up" the movements of the axes are controlled by hand with directional keys on the machine operator panel. Two speeds can be selected on the machine operator panel. Numerical values are entered over the operator panel or over the keyboard and CRT screen. The programmed feed rates for the automatic mode are not active. The maximum speed is determined by machine data 3. The feed override is active. The drives are controlled by the positioning loop. The movements of the axis can be checked with the actual value display of the operator panel or the CRT screen.

In the operating mode "Set Up" the axes can be moved to a position with the directional keys. This position can then be transferred into a user part program (Teach In). Feed rates and auxiliary functions are added later in the mode "Program Input".

3.3.2 Reference Point Approach

In order to synchronize (home) the control with the mechanics there is one machine reference point somewhere in the traversing range of each axis. When digital rotary encoders are used the deceleration cam (rough) and the zero mark of the encoder (fine) are used to evaluate the reference point.

The reference point should be located so that it can be approached easily and quickly after a power-on. The deceleration cam is approached, with the programmed speed Vrapid, with the start signal and the selection of a direction (+/-). The axis continuous with speed Vred. until it leaves the deceleration cam. Then the zero mark is approached and the shift is traversed with the speed Vapp. The speeds Vred and Vapp are also programmable. Machine data 15 determines if the signal of the deceleration cam comes over the PLC-WF interface or if it is connected to the front side of the positioning module (fast input).

The axes on a WF 725 module are referenced (homed) one after another. The software limits are active once an axis has been referenced. In addition the signal ("Axis Referenced") is set in the interface to the PLC (enable for positioning).

3.3.3 Manual Data Input (MDI)

In this operating mode a traversing distance with its speed are entered and executed with the start signal (actual data, position, speed and G functions). No output of M functions occurs. The first G functions is set, latched, to absolute programming G90. Allowed are only G90 and G91 (incremental programming). Dwell times and tool length offsets are not possible. The traversing distance and speed are not stored in the user program for Automatic or Single Step.

3.3.4 Setting of Actual Value

In this operating mode it is possible to shift the control zero to any point of the machine coordinate system. The position stored in machine data is transferred into the actual value memory of the axis. The setting of the actual value memory does not cause a movement of the axis.

3.3.5 Control Operation

In this operating mode the position control loop is disabled. Constant voltages are selected with the block selection of the machine operator panel and transferred from the control to the drive unit as a speed command value. The traversing movements can be checked on the actual value display.

3.3.6 Following Mode

In this operating mode it is possible to control the drive unit with command values from external devices. The control remains referenced (homed). The traversing movements can be checked with the actual value display.

3.3.7 Clamping

In this operating mode the postion control is disabled with the "Start" signal - command value permanently 0 volts. The actual value is compared cyclically with the clamping tolerance (machine data 32). Error message 23 is transferred to the PLC if this tolerance is exceeded.

3.3.8 Single Block

There is a difference between Single Block and Single Step (see chapter 3.3.9). Traversing in Single Block is possible with the program numbers 91, 92 and 93. It is possible to work with four G functions, three M functions, one D function and position and speed. The control calls the block selected on the machine control panel and executes it. If the traversing distance is entered in incremental then the execution of the block can be repeated with another start signal.

3.3.9 Automatic-Single Step

In the operating mode Automatic-Single Step the selected program is executed one block at a time. A start signal must be given to the WF 725 for each block. At the end of each block the WF outputs the signal PEH and waits for another start signal. After the last block in a program the control jumps back to the first block. Jumps to subprograms are possible.

3.3.10 Automatic-Cycle

In the operating mode Automatic-Cycle the complete program is executed in numerical order if the start signal remains high. The program configuration is described in chapter 5.1. During the program input it is possible to select wether the programs are stored in RAM or in EEPROM. Program interruption is possible with the deselection of the program number.

The sequentcial execution of an automatic program can be interrupted at the end of a block, by programming the first M function with the value zero (stop at block end). The program is continued with another start signal.

3.3.11 Automatic-Buffer (WF 726)

In some positioning applications the cycle time of the machine is in the range of seconds. If the traversing blocks are transferred from a computer during machining, then the short cycle time makes it often impossible to use a SIMATIC S5 PLC with WF 725. This problem is solved with the function Automatic-Buffer in the WF 726 with its adjustable DUAL PORT RAM length of 32 or 64 bytes:

In the operating mode Automatic-Buffer, single blocks or programs can be transferred to the WF 726 while the axis is simultaneously executing automatic programs. Even a reloading into the same program which the axis is executing is possible.

Block search, block skipping and subprogram technique are, however, not possible in the operating mode Automatic-Buffer. Certain parameters, like the number of blocks reloaded into a buffer, have to be specified during start up.

3.3.12 Special Operating Requirements

- **Change of Operating Mode**

  If the mode is changed from Automatic to any other mode then all corrections (zero offset, G92, tool length) are deselected and the programmed sequence is interrupted. The operation can be continued in the old operating mode from the same block if a block search is done. If the mode is changed during an axis movement then the program execution is interrupted and the axis is stopped with the deceleration ramp. This is also valid for operating modes without a program.

- **Fast Stop**

  Changing from the automatic operating modes to the following mode causes the command value to be switched to zero. The control remains referenced.

- **Cancel Residual Path**

  The programmed axis movement can be interrupted with the stop signal. The residual path information of this programmed block (residual path) can be deleted from the work memory by setting, over the PLC - WF 725 interface, the bit "Cancel Residual Path". This bit works block by block. The user memory is not affected.

- **Simulation**

  To test STEP 5 machine programs and WF 725 geometry programs and coordination, it is a great advantage to be able to work without the machine in the office or without any axis movements. The machine data "Simulation" switches the position control loop off. The interface to the SIMATIC is operated in real time (all operating modes, including reference point approach).

- **Block Search**

- **Block Skipping**

4 Operation

4.1 Operation with PG 675/PG 685/PG 730/PG 750/PG 770 (Standard I-726)

All WF functions can be programmed with the PG 675/PG 685/PG 730/PG 750 or PG 770. Operation with the programmer alone, however, is only done if the data have to be change exclusively during start up, and are stored permanentely on the WF module during normal operation.

4.2 Operation with WF 470 and Compact Operator Panel (Standard III-726)

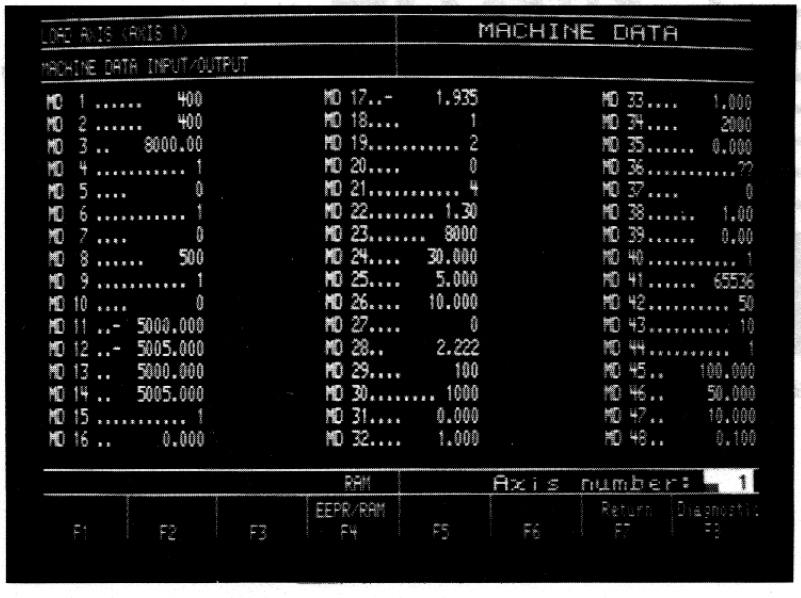
The Standard Software III-726 provides fixed screens for:

- Machine data input
- Actual Value Input and Teach-In
- Program Input
- Startup
- Display and Control of the Data Transfer
- Display and Control of the Measuring System
- Logging of machine data, operating data and traversing programms.

These screens together with menu technique simplify the operation significantely.

The screens are available in the following languages:

- German
- English
- French
- Italian
- Spanish



Machine Data

After selecting the desired axis in the screen "Machine Data" one of the 49 displayed machine data can be selected with the cursor and changed.

The machine data can be adapted to the individual machine and so provide optimal safety of operation.

Figure 4.1 Screen: Machine Data

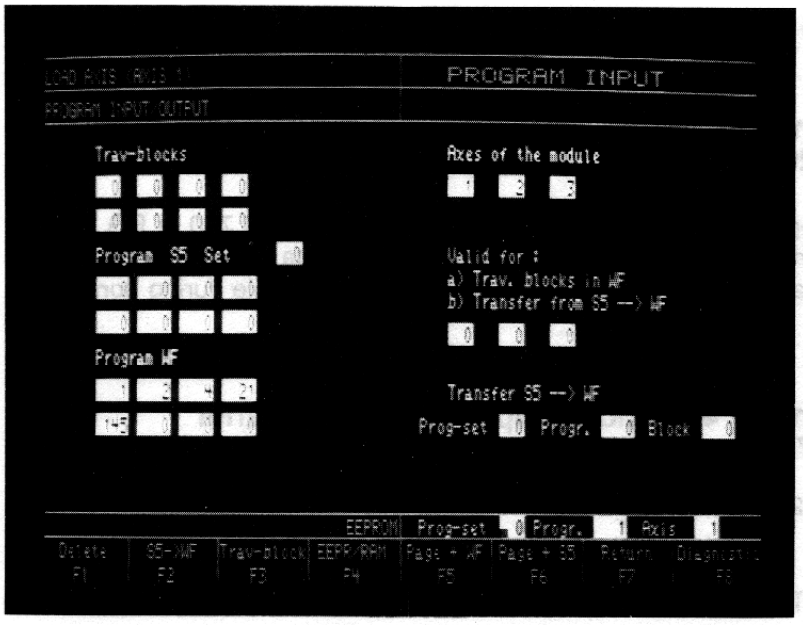


Figure 4.2 Screen: Program Input

Program Input

With the selection of the screen "Program Input" up to eight groups of programs are displayed under the heading "Groups", if the integrated virtual memory is used. Of course, the same is valid for S5 and WF programs.

In the case of WF programs it is possible to work with programs on RAM and on EEPROM.

To display the next program group or program numbers the screen can be paged forward. The screen is immediately updated if a different axis number is selected. Complete programs or groups can be deleted or transferred into the selected type of memory.

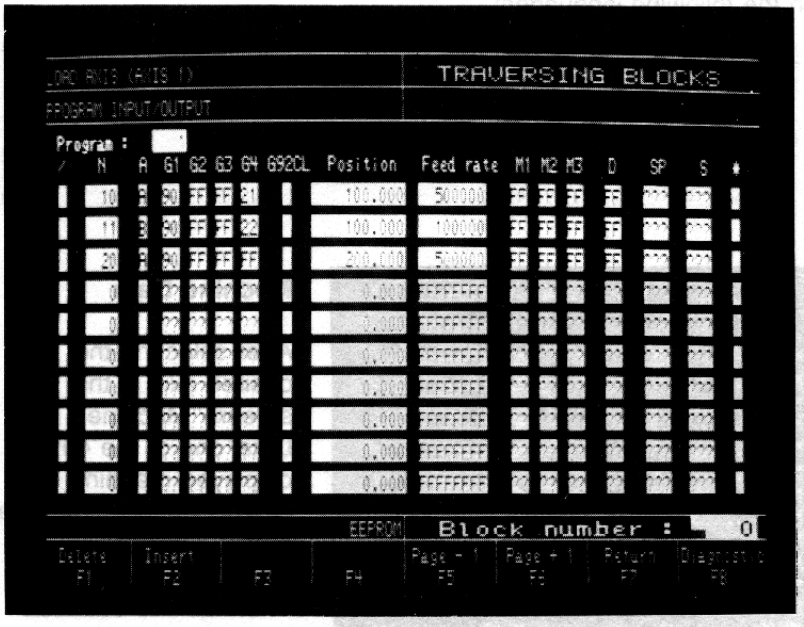


Figure 4.3 Screen: Traversing Blocks

Traversing blocks

The screen "Traversing Blocks" displays up to 10 blocks. Those can be either changed or deleted. It is also possible to insert new blocks.

There is a simple way of including additional auxiliary functions (coolant etc.), or path conditions (e.g. dwell times) into the program.

4.3 Operating with COM 726

With the development of the software package COM 726 there are even more user media. The software package COM 726 supports and extends the communication with the modules WF 725/WF 726 easily and comfortably with:

- menu-driven operation
- help function for set up and programming
- info masks
- powerful NC editor
- clear program listing through the comment lines
- display of axis faults
- central data storage
- fast module swap since data files are stored externally
- comparing of data contents
- on-screen advices helping to correct a faulty data entry
- hard copy or data logging

The software package is available on disk and can be operated with the programmable controllers PG730, PG 750 or PG 770.

Operation of COM 726 is started over the S5 DOS level in the basic menu. From the basic menu, the next operating menu can be called. The following data is processed:

- Machine data
- Tool offsets
- Operating data
- Traversing programs
- Controller configuration

All data can be stored in a freely selectable data file and transferred to different memory media. The corresponding data can be transferred to the WF module in the ONLINE operation of the automation unit. Automatic comparing of data is possible for control.

Various presettings are necessary prior to machining.

- Drive allocation
- Plant file
- Title block/Print file/Title block width
- Control configuration
- ON- /OFFLINE operating mode
- Interface selection

Efficient planning with COM 726

Machine data, program data, operating data and control data can be generated and documented already during the configuring phase of an installation by storing all data on disk or hard disk. Transmitting the data to the WF modules at a later stage, i. e. during commissioning, saves a considerable amount of time.

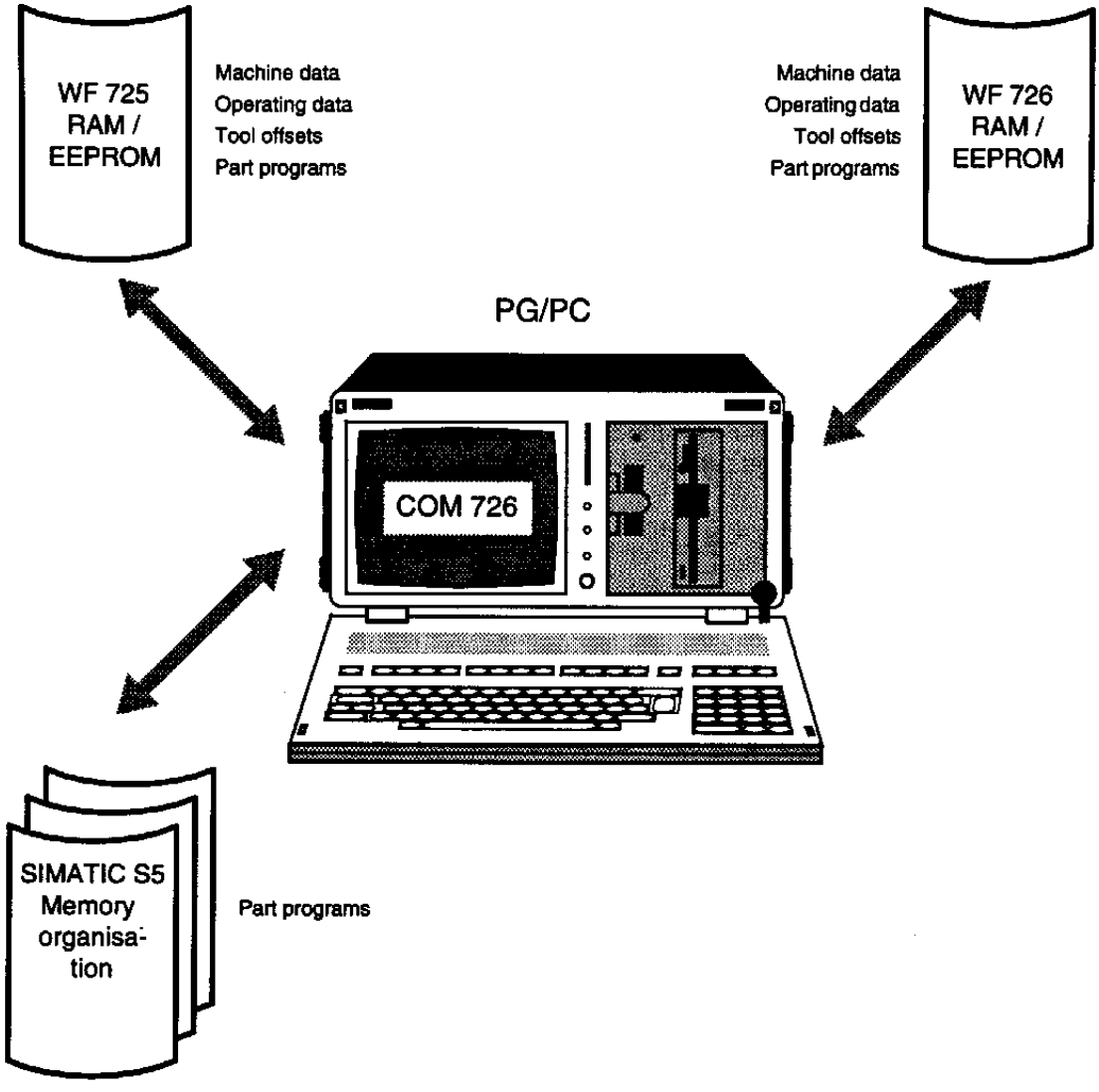


Figure 4.4 *Configuring and programming with the COM 726 software package*

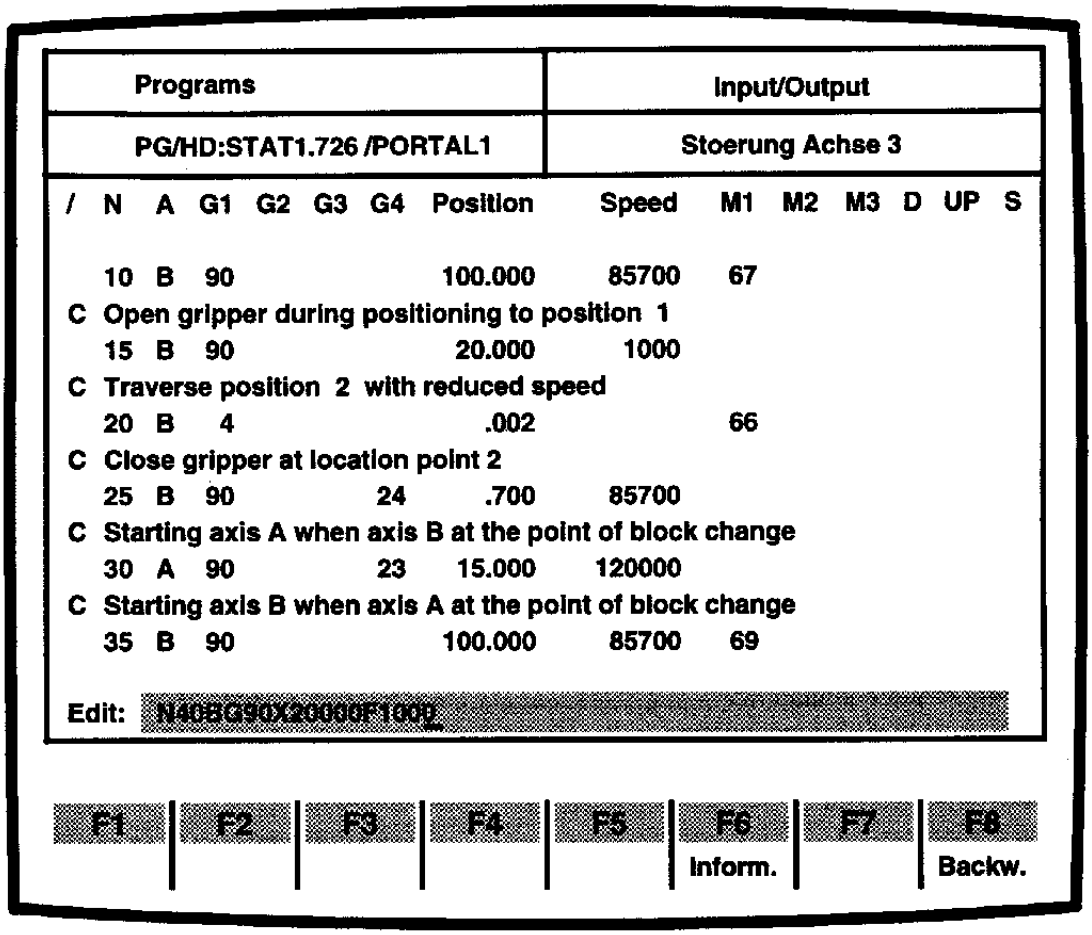
The data can be generated more easily because the COM 726 checks completeness, limit values and plausibility of the input. Problems can be recognized early and prevented as they will be shown on a message line.

Improving the programming comfort

A high-capacity NC editor was implemented in the COM 726 software package with a multitude of functions like copy, delete, search and insert block data.

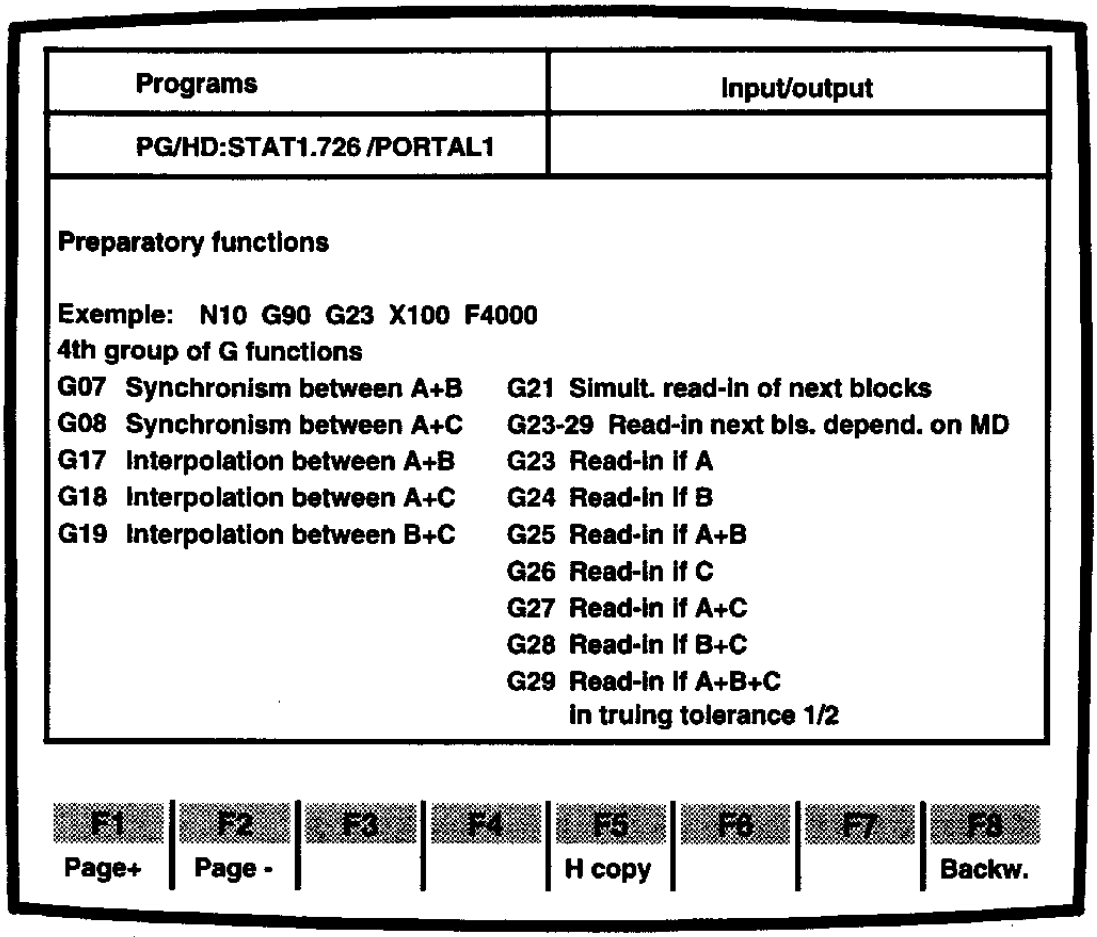
In addition, an Edit line makes it possible to enter blocks without a fixed block format and cursor positioning. When the input is completed the editor checks the plausibility and takes the block into the fixed block format. Also, extensive traversing programs can be entered fast and easily through the Edit line.

For better documentation of the traversing programs, commentary lines can be assigned to the NC blocks. They make the traversing programs more readable and they help with the start-up or service.



Info screens

Often, certain definitions, functions or facts are forgotten after long periods of not using the application. Therefore, the software package COM 726 supports the user with info masks which contain the information of the function which is being processed at the moment. The functions are explained shortly and illustrated with the help of examples in traversing blocks.



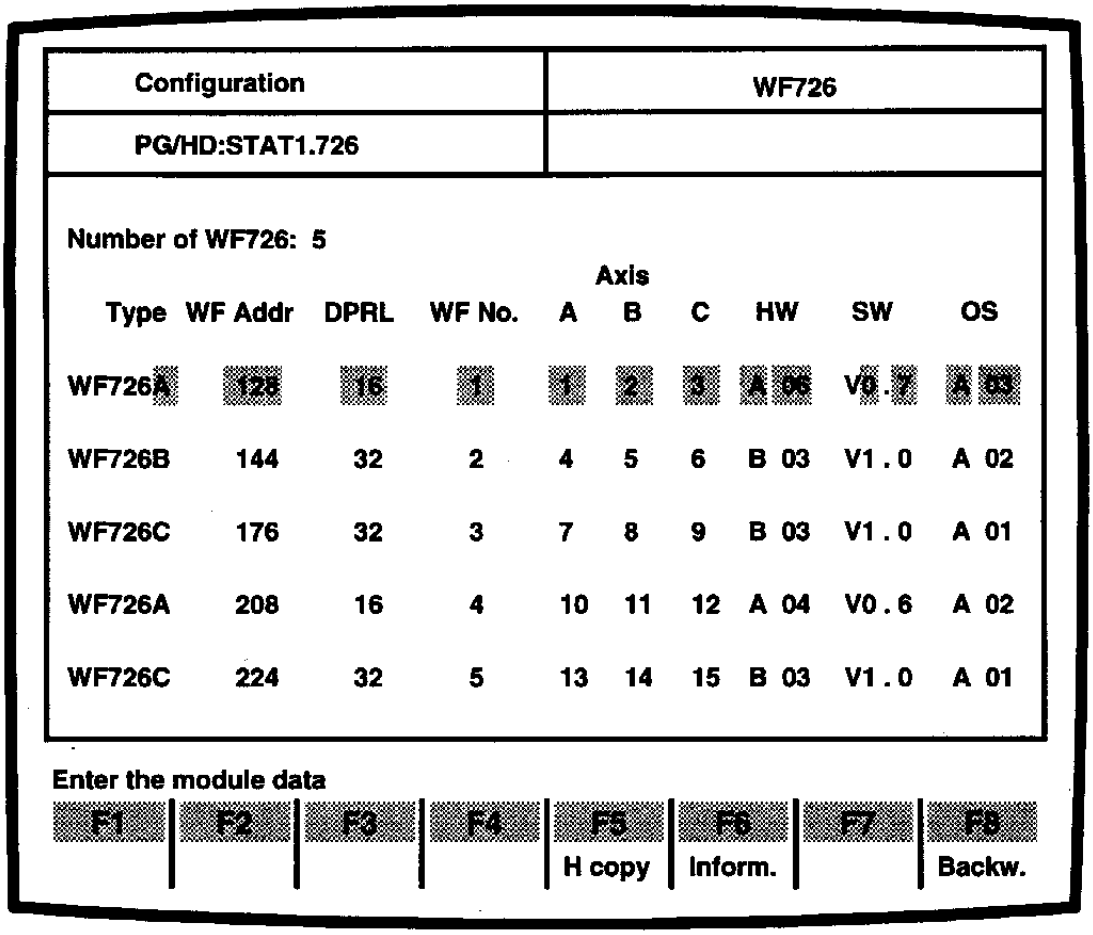
Short start-up and service times

Because of the rising complexity of the installations, a clear representation of the control configuration is more and more important. A faster fault detection is guaranteed through the documentation of the components available in the device and its different hardware and software versions.

The software package COM 726 registers in "Control configuration" the most important data:

- CPU type and version of SIMATIC S5
- With WF components
  - number of modules
  - address
  - size of the dual port RAM
  - axis numbers
  - versions
- versions of the SIMATIC S5 packages

This data is placed in the control data file in which machine data, operating data, traversing data and tool offset data are also located.



Configuration				WF726					
PG/HD:STAT1.726									

Number of WF726: 5

				Axis					
Type	WF Addr	DPRL	WF No.	A	B	C	HW	SW	OS
WF726A	128	16	1	1	2	3	A 06	V0.7	A 03
WF726B	144	32	2	4	5	6	B 03	V1.0	A 02
WF726C	176	32	3	7	8	9	B 03	V1.0	A 01
WF726A	208	16	4	10	11	12	A 04	V0.6	A 02
WF726C	224	32	5	13	14	15	B 03	V1.0	A 01

Enter the module data

F1	F2	F3	F4	F5	F6	F7	F8
				H copy	Inform.		Backw.

The software package COM 726 is a sufficient tool for the projector, the installer, the service technician and the machine setter because of the easy operating, the high flexibility and the comfort.

Saving function

The "saving" function can be used, in the case of module exchange, to save all data in EEPROM on the WF 725/WF 726 (such as traversing blocks, machine data, tool offsets and operating data) to

- floppy disk
- hard disk.

Comparison

This function enables the comparison of two data blocks. The following data may be compared with similar types of data:

- machine data
- operating data
- tool offsets
- traversing programs

The comparison function is started by softkey. If differences occur, the number of the appropriate item of data is output, along with the message "Comparison with errors". If the data are identical, no message is displayed. If a large number of differences are recognized that cannot all be display simultaneously, the first part of the results is visualized. By selecting the "browse" function, specific information can be displayed. The "hard copy" softkey can be pressed to print out each part of the results.

Further information can be found in the operating instructions for the software package COM 726.

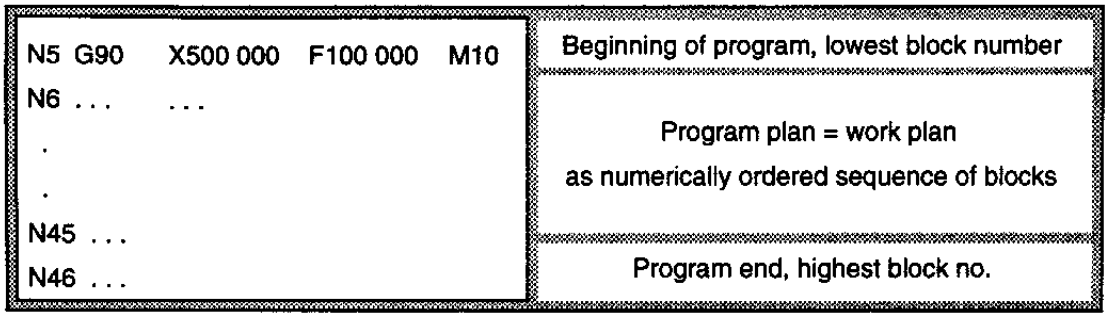
5 Programming

5.1 Program Configuration

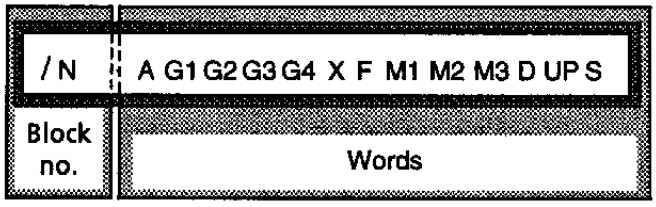
A traversing program consists of a number of blocks, which belong to a certain program number.

The block with the lowest block number is automatically the beginning of the program. The block with the highest block number is the end of the program. The program is executed in the sequence of increasing block numbers.

5.2 Program Structure



5.3 Block Structure



A block includes all data necessary for a work step.

- Block number "N.."
- a number of words

The significance of the individual symbols is:

/	...	Symbol for skippable block
N	...	Block number from 1 through 255
A	...	Selection for which axis (A, B or C) the block is valid
G1	...	First group of G functions
G2	...	Second group of G functions
G3	...	Third group of G functions
G4	...	Fourth group of G functions (WF 726 only)
X	...	Position value or dwell time
F	...	Feed rate
M1	...	First M function
M2	...	Second M function
M3	...	Third M function
D	...	Tool correction number 1 - 20
UP	...	Subprogram number
S	...	Number of cycles for the subprogram

5.4 G and M Functions

The following functions can be used for programming:

First G group:
04 Dwell time
90 Absolute programming
91 Increm.programming
92 Setting of actual value

Second G group:
30 100% of MD1/MD2
31 10% of MD1/MD2
:
39 90% of MD1/MD2
53 Deselection of zero offset
54 Selection of zero offset
99 External read in enable (MD 15)

Third G group:
43 Tool length offset (+)
44 Tool length offset (--)
68 Endless rotation, negative direction
69 Endless rotation, positive direction

Fourth G group: (WF 726 only)
07 Axis synchronization A + B
08 Axis synchronization A + C
17 Axes A + B (linear interpolation)
18 Axes A + C (linear interpolation)
19 Axes B + C (linear interpolation)
21 Execute next block simultaneously

23/73 next block, when A
24/74 next block, when B
25/75 next block, when A + B
26/76 next block, when C
27/77 next block, when A + C
28/78 next block, when B + C
29/79 next block, when A, B + C in in-process block change

M functions 1, 2 and 3:
M00: Stop at end of block
M11/ M12: Buffer–1/Buffer+1
M18: Endless loop
M99: Synchronization of axes

5.4.1 First G Group

A movement to a certain point can be described by

- incremental programming (G91)
- absolute programming (G90).

- **Absolute Programming (G90)**

The position in absolute programming is absolute and is related, in most cases, to the zero of the part W (figure 5.1).

- **Incremental programming (G91)**

The position in incremental programming is incremental and is related to the last actual position (figure 5.2).

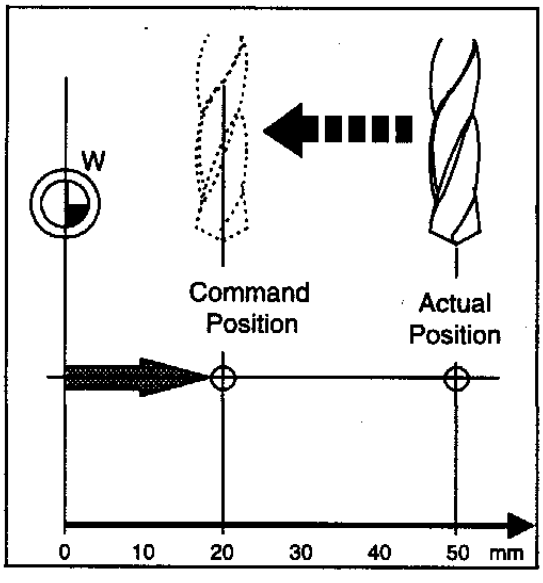


Figure 5.1 Absolute dimension

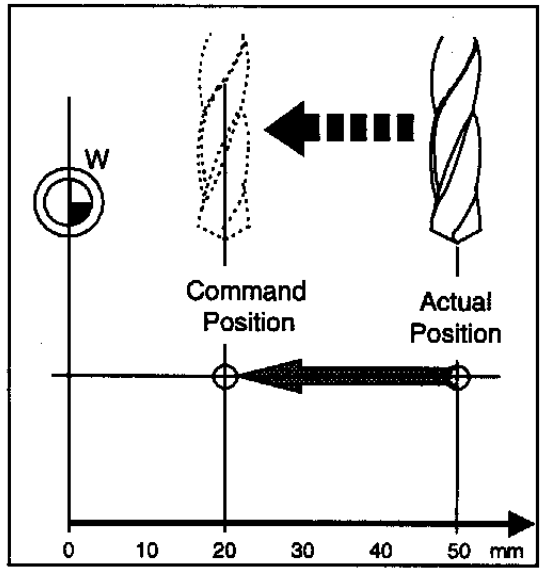
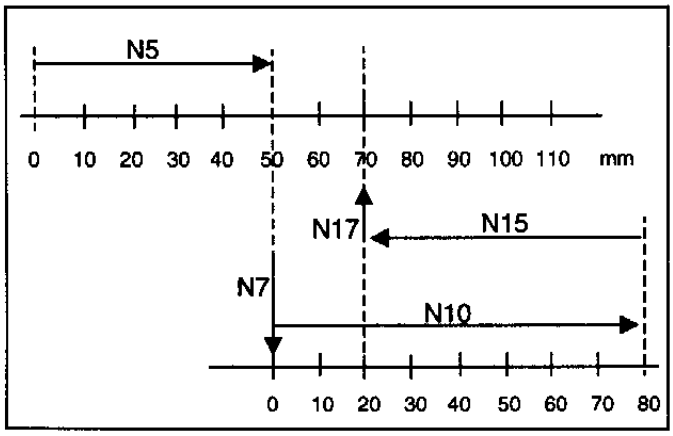


Figure 5.2 Inkremental dimension

- **G92 Setting of the Actual Value Memory**

The function G92 should only be used for special applications. For normal applications the settable zero offset G 53 and the tool length offset D.. should be used



Programming G92 and a position value causes an absolute shift in the measuring system (N7).

This shift is cancelled by:

G92 without position (N17) (figure 5.3.).

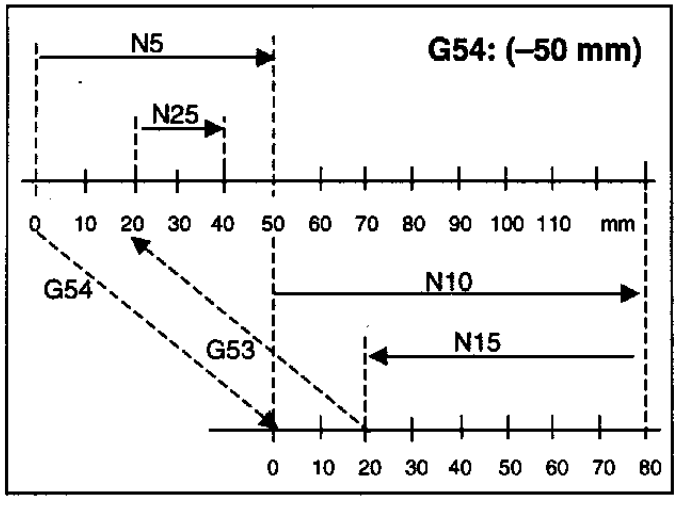
Figure 5.3 Absolute measuring system offset

- **G04 dwell time**

The dwell time function is used to paux in a program for a specified time. The time must be in the range 6 to 9999 ms.

5.4.2 Second G Group

The zero offset is the distance between the zero of the part, on which the program is based, to the zero of the machine. A zero offset is available for each axis. The zero offset is used to calculate the end point of each block for absolute and incremental programming.



- **G54 Selection of ZOF**

The zero offset is selected with G54.

- **G53 Deselection of ZOF**

The deselection is done with G53.

The deselection of the zero offset with G53 brings the coordinate system back to its old position.

Figure 5.4 Zero offset

- **G30 to G39 acceleration value or delay value overstore (WF 726 only)**

By overstoring the acceleration or the braking value, the acceleration or braking can be controlled during positioning.

These G functions are an advantage when transport fixtures are driven with and without a load. When loaded, they are driven with reduced acceleration and delay.

The acceleration and barking values are set via the MD 1 and MD 2 machine data. It is possible to specify by how many perceent the MD 1 or MD 2 value should be accelerated or braked by entering this block information using G 30-39.

- **G99 external read-in enable (WF 726 only)**

On the WF 726 it is possible to program highspeed inputs via MD 15. The enabling of a traversing program can be dynamically controlled from outside if the value 4 is entered in MD 15 (external read-in enable). Blocks in the machining program that require the external read-in enable as a condition for processing must also be marked with G 99.

5.4.3 Third G Group

- **G43 Tool Length Offset (+)**
- **G44 Tool Length Offset (–)**

The tool length offset makes it possible to use a program even if the length of the tool has changed.

In the normal case the program is related to the tip of the tool. If the tool wears or if the tool is changed, the tip of the tool changes position.

This change can be compensated with the tool length offset, without having to change the program.

Several D functions can be called in an automatic program. The differences are calculated automatically by the WF 726. The deselection is done with D00, which is, the same as the selection, axis specific. Tool offsets are active, for several blocks, until they are deselected. In the automatic operating modes the tool offset is activated immediately after the start of the block where it is selected. It also changes the actual value display accordingly.

Normally the tool points to the part in the negative direction. If the tool approaches the part the absolute position value becomes smaller.

The tool offset is positive if the real tool length is greater than the length used to develop the program. If the real tool length is shorter, then the tool offset is negative.

With G43 the WF module uses the value in the correction memory in such a way that when positioning in the negative direction the tip of the tool reaches the desired command position - see figure 5.5.

If the tool points into the positive direction (positioning to greater coordinate), then with G44 the offset value called by the D number is used with the opposite sign.

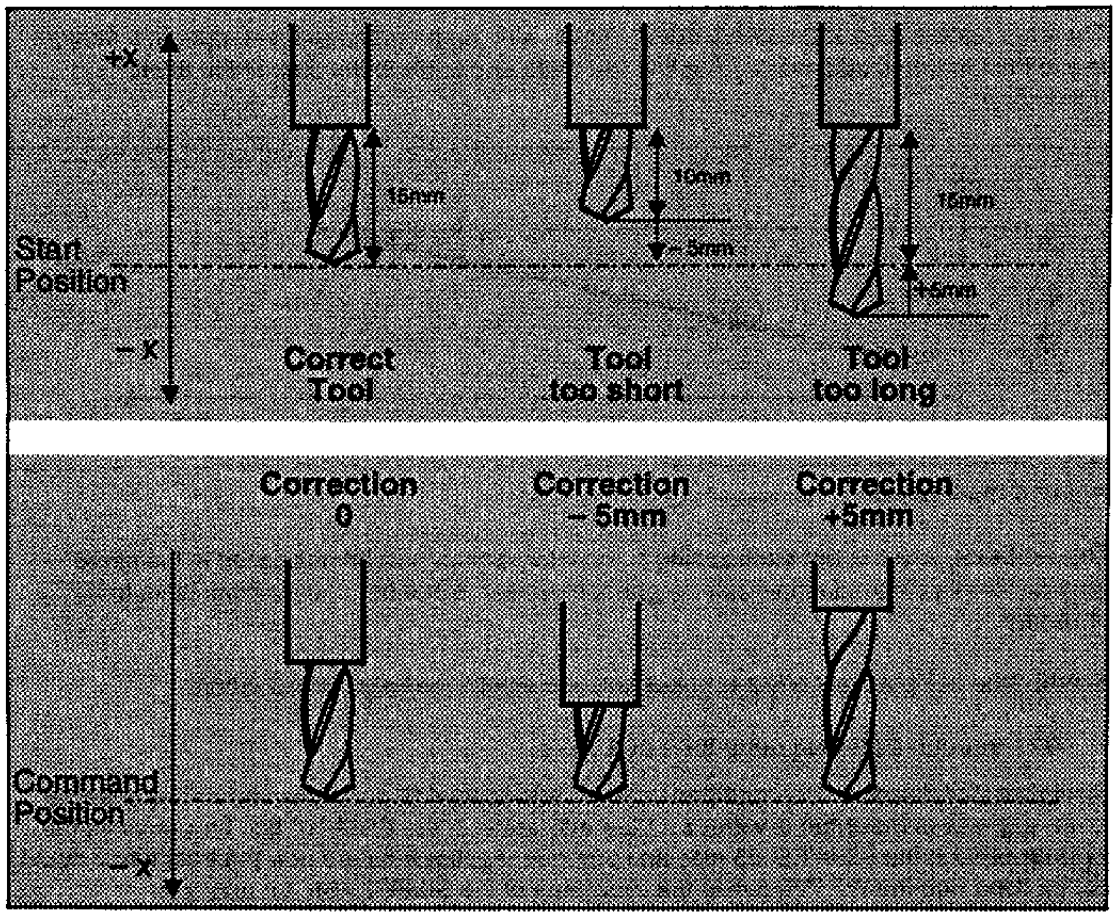


Figure 5.5 Positioning with tool length offset, representation before and after the execution of the block.

- **G68/G69 Endless rotation in negative/positive direction (WF 726 only)**

  G68 or G69 allows a tool spindle to start up an endlessly rotating movement. This function is required to spindle position, in-process actual value setting and in-process measurement.

5.4.4 Fourth G Group (only WF 726)

- **G17, G18, G19 Linear Interpolation**

The axes participating in the interpolation, move, with the programmed feed rate, in a straight line to the programmed position. The line can have any angle to the coordinate axes (figure 5.6).

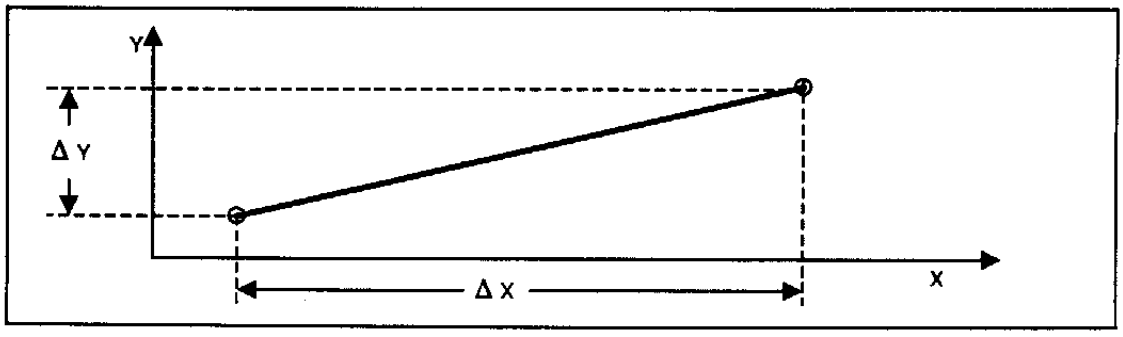


Figure 5.6 Traversing path in interpolation

The third axis, which is not participating in the interpolation, can be positioned in the same program or in a different single axis program. However, a number of conditions have to be observed.

For the time being no tool offset is possible together with the linear interpolation.

- **G21 through G29 Programs for 2 or 3 Axes**

Blocks for 2 or 3 axes can be grouped together with special G- functions and so it is possible to develope axes movements without a PEH evaluation of the SIMATIC S5. This reduces the logic required in the SIMATIC S5 machine program. Applications are now possible which could not be done with the WF 725 due to the cycle time of the SIMATIC S5, for example:

2 axes feeder on presses
3 axes loading gantry for machine tools

- **G07/G08 Synchronous movement of A+B or A+C**

This function allows two axes to traverse the same path at the same time with the same instantaneous speed. G07/G08 allows you to traverse two axes simultaneously as an alternative to permanent synchronous movement, which is selected via machine data.

5.5 M Functions

Auxiliary functions offer the possibility to output special instructions to the SIMATIC S5, which for example cause technological functions, e.g. spindle on/off, chip conveyor, coolant, hydraulic.

The output of the auxiliary functions is done over the interface DB - axis as a two decade BCD number. Machine data 8 + 9 determine the type of output, timed or handshake, and the time of output, before, during or after the traversing movement.

6 Technical Data

6.1 Adaption to the technology and mechanical system

The most important data for adaption of WF 725 and WF 726 to the technology and mechanical system of positioning is presented here:

Input/output resolution (Basic resolution)		1 µm	10 µm	100 µm
Traversing range		±80 m	±80 m	±80 m
Traversing speed	from	0.01 mm/min	0.1 mm/min	1.0 mm/min
	to	30 m/min	300 m/min	300 m/min
Acceleration	from	1 mm/s^2	10 mm/s^2	10 mm/s^2
	to	20 m/s^2	200 m/s^2	200 m/s^2
Jerk factor (only WF 726)	from	1 mm/s^3	10 mm/s^3	100 mm/s^3
	to	1.95 m/s^3	19.5 m/s^3	195 m/s^3

Table 6.1 Data on the WF 725/WF 726

6.2 Characteristics of the WF 725/WF 726

- Positioning with closed loop and open loop
- 1 reference point per axis for incremental measuring
- Zero offset for every axis
- 2 limit switches and 2 pre-limit switches per axis
- Manœuvrable rotary axis
- Pulse evaluation factor (for adaption of gear ratios)
  Value range : 0.1 ... 9.99999999
- Backlash compensation when incremental encoders are used
- Technological corrections:
  - tool length (20)
  - (short-term) over-writing of programmed values
  - drift compensation of the final controlling element
  - speed override
- Switch functions (M functions):
  - BCD output in 2 decades, 3 following functions at the most
  - Output possibilities:
    - acknowledge-controlled
    - time-controlled
- Teach In (in the set up mode "JOG")

Additional characteristics of the WF 726

- fast inputs for process signals:
  - in-process setting of actual value/ in-process measuring
  - Start/stop from external point
  - External read-in enable
- Linear interpolation of two axes
- Synchronous movement with two linear axes
- Acceleration controllable with G functions
- Spindle positioning (similar to oriented stop of spindle)
- Traversing from point to point (PTP) of 2 or 3 axes
- Two approximate positioning tolerances

6.3 Program structure / program storage on the WF 725/WF 726

- 99 main programs are addressable (with additional memory in connection with SIMATIC S5)
- Storing of a maximum of 64 main programs on the WF 726 (10 with WF 725)
- Subroutine method by program junp (Nesting depth of 2)
- The maximum program length is 200 blocks for WF 726 (40 for WF 725)
- Fixed length of blocks with 4 G functions, 3 M functions and 1 D function with display of position and speed with programs for 1 axis; additional axis identification with programs for two or three axes.
- Memory capacity WF 726: 400 automatic blocks for 3 axes (350 in EEPROM, 50 in unbuffered RAM)
- Memory capacity WF 725: 100 automatic blocks for 3 axes (50 in EEPROM, 50 in unbuffered RAM)

6.3.1 Operating modes

- **manual operating modes:**
  - Setup
  - Reference point approach
  - Manual data input (MDI)
  - Follow-up mode
  - Clamping
  - Setting of actual value
  - Control
- **automatic modes:**
  - Automatic cycle
  - Automatic single-step
  - Single block
  - Automatic buffer (for WF 726)

6.3.2 Special functions for program processing

- Simulation of traversing programs
- Delete residual path (block by block)
- Block search
- Masking of block
- Retroloading of program blocks from the SIMATIC S5 memory in the "Automatic buffer" mode

6.4 Monitoring

- Voltage (5 V, 10 V, 24 V)
- Measuring circuit cables
- Position encoders
- Interface to the drive
- Limit switches
- PEH positioning tolerance[1)]
- PEH time-out monitor[1)]
- Monitoring of following error
- Monitoring synchronous movement

6.5 Control

The positioning modules WF 725 and WF 726 belong to the intelligent periphery of the SIMATIC S5 (medium and upper performance range) programmable controllers.

SIMATIC S5	Recommended number of axes *	Processing time
S5 115U with CPU 943, 944	12/24	3 ms
S5 135U with CPU 928 **	12	10 ms
S5 155 U **	36	3 ms

Table 6.2 SIMATIC S5 - Device versions and possible numbers of axes

* **The maximum number of axes depends on the current supply, the addressing range and the cycle time of the SIMATIC S5.**

** **Only monoprocessor operation allowed.**

Allowed subracks for 115U: CR 700-2, CR 700-3
Extension racks: 183U, 185U
Interface connections: 304/314

1) PEH: Position reached and stop.

6.6 Measuring systems

- WF 725 A:

  3 incremental encoders
  Supply voltage: 5 V

- WF 725 B/WF 726 B:

  3 incremental or digital-absolute encoders (parallel interface)
  Supply voltage of the absolute encoders: 24 V (asynchronous balanced mode is possible)
  Absolute encoder with Gray Code or Binary Code allowed

- WF 726 C:

  3 incremental or digital-absolute encoders (serial interface)
  Supply voltage of the absolute encoders: 24 V (asynchronous balanced mode is possible)
  Absolute encoder with Gray Code allowed

Type of module	applicable encoders		
	incremental	absolute parallel	absolute serial
WF 725 A	■		
WF 725 B	■	■	
WF 726 B	■	■	
WF 726 C	■		■

6.7 Dual port RAM length of 16 or 32 bytes

The length of the DPR must be 32 bytes for buffer operations.

6.8 Characteristics of the Module

Electrical and Mechanical Characteristics (5V)	WF 725 A	WF 725 B WF 726 B	WF 726 C **
Voltage Level 5V (±5%)	Voltage supplied by SIMATIC	Voltage supplied by SIMATIC	Voltage supplied by SIMATIC
Internal Power Consumption at 5V (without encoders) *	2.5 A	3.0 A	1.3A
Current code from the Internal Power Supply for Each Encoder	max. 0.3 A	max. 0.3 A	max. 0.3 A
Required Input Current from the Encoder	5 mA	5 mA	10 mA

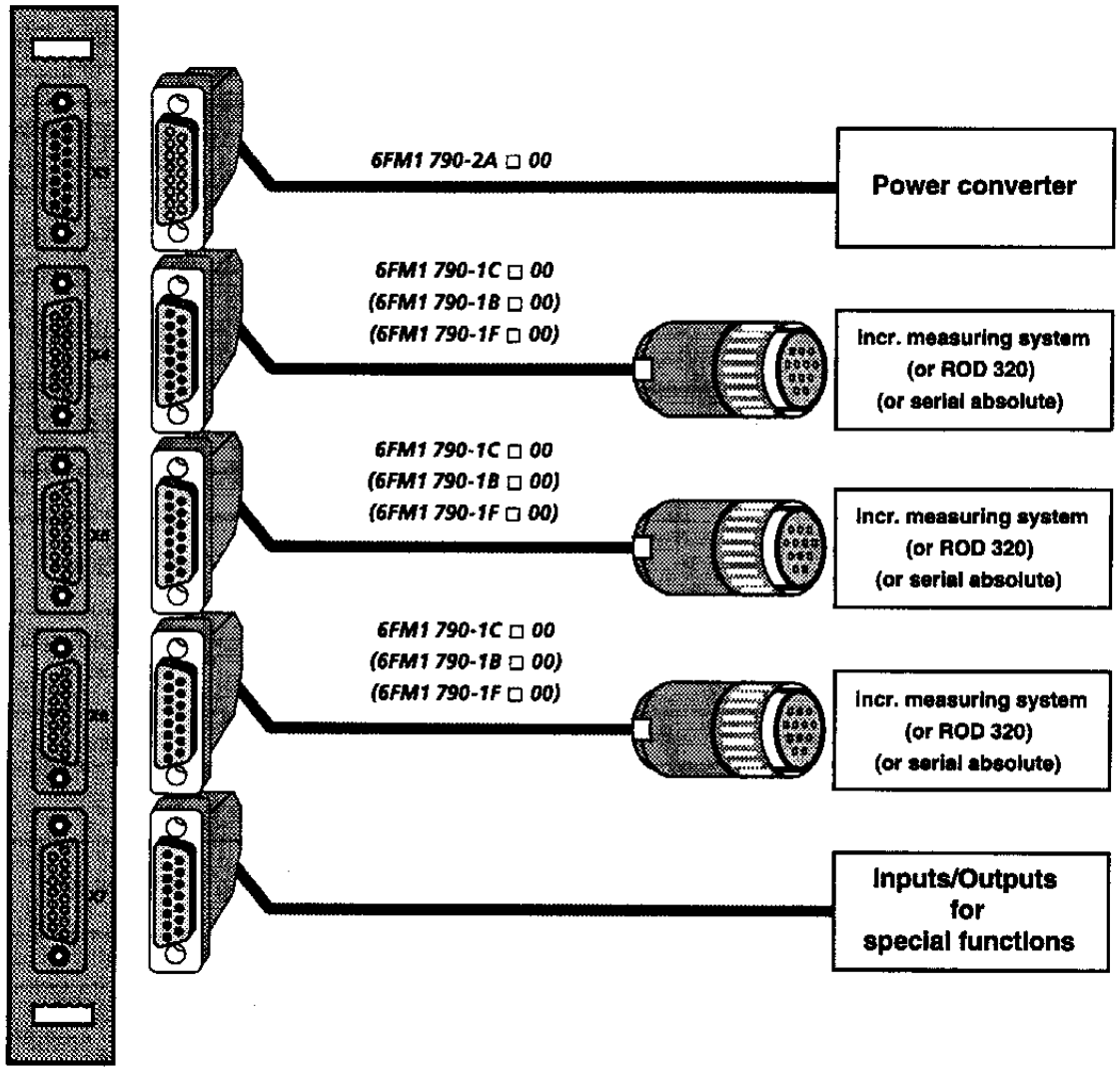
Electrical and Mechanical Characteristics (10V)	WF 725 A	WF 725 B WF 726 B	WF 726 C
Voltage Level ±10 V (Command Value Output)	Voltage produced internally	Voltage produced internally	Voltage produced internally
Maximum Output Current	2 mA	2 mA	2 mA

Electrical and Mechanical Characteristics (24V)	WF 725 A	WF 725 B WF 726 B	WF 726 C
Voltage Level 24V (±5%)	24 V	24 V	24 V
Inputs	5 mA	5 mA	5 mA
Outputs	0.4 A	0.4 A	0.4 A
Permitted Power Consumption for Each Encoder	max. 0.3 A	max. 0.3 A	max. 0.3 A
Required Input Current for Each Encoder	5 mA	5 mA	10 mA
Required Space in the SIMATIC rack	1 ⅓ SEP	2⅔ SEP	1 ⅓ SEP
Frequency Limit Encoder Input (before multiplication by 4)	200 kHz	200 kHz	200 MHz
Transmission speed	-	-	-

*) **For each incremental encoder 0.25 A must be supplied on the 5 V side of the total current.**

) **A fan subassembly is not required for the WF 726 C.

6.9 Overview of cables and devices (e.g. WF 726 C)



WF 726C

6FM1 790-1B 00

Position for lenght code

7 Ordering data and documentation

7.1 Ordering data

Devices and modules	Order number
WF 725 A (Connection of incremental encoders)	6FM1 725-3AA00
WF 725 B (Connection of parallel absolute encoders)	6FM1 725-3BA00
WF 726 B (Connection of parallel absolute encoders)	6FM1 726-3BA00
WF 726 C (Connection of serial absolute encoders)	6FM1 726-3CA10

Software COM 726 for the programmable controller	Order number 3 " -Disk
PG 730/PG 750/PG 770 or IBM AT0.3 compatible standard PC	6FM1 726-6UA30-1BA0 1)

Software for the automatic controller	Order number 3 " -Disk
Standard I-726 with shell Link of SIMATIC S5 with WF 726	6FM1 726-7UA31-1AA0 1)
Standard III-726 for WF 470 STEP5 modules for WF 470. link of Standard I-726 with WF 470 software for data exchange Masks for WF 470 Visualization of Standard III-726 in the following languages: German, English, French Italian, Spanish, Russian Screen masks for WF 470	6FM1 726-8UB31-1MA0 1)
Standard III-726 for GRACIS STEP5 modules for WF 470 Link of Standard I-726 with GRACIS basic software Masks for GRACIS Visualization of Standard III-726 in German language	6FM1 726-8UC30-1AA0 1)2)

1) For quantity rebates and software licenses see Cataloge AR 1

2) This software is only available in German

Accessories	Order number
Path-measure encoders Incremental encoder for external mounting (without coupling and floor clamp; axial cable output)	
1000 pulses/rev 2000 pulses/rev 2500 pulses/rev	6FC9 320-3KA01 6FC9 320-3KK01 6FC9 320-3KN01
Built-in version available for 1FT motors	on request

Connecting cable	Order number	Max. length(m.)
Encoder 6 FC 9320-3 K - WF 725, WF 726		
Length 5 m	6FM1 790-1CB00	
Length 10 m	6FM1 790-1CC00	35
Length 18 m	6FM1 790-1CD00	
Special length	6FM1 790-1CZ	
Encoder build-in - WF 725, WF 726		
Length 5 m	6FM1 790-1BB00	
Length 10 m	6FM1 790-1BC00	35
Length 18 m	6FM1 790-1BD00	
Special length	6FM1 790-1BZ	
Absolute (parallel) encoder WF 725, WF 726		
Length 5m	6FM1 790-1DB00	
Length 10 m	6FM1 790-1DC00	70
Length 18 m	6FM1 790-1DD00	
Special length	6FM1 790-1DZ	
Absolute (serial) encoder WF 726		
Length 2 m	6FM1 790-1FA00	
Length 5m	6FM1 790-1FB00	
Length 10 m	6FM1 790-1FC00	
Length 18 m	6FM1 790-1FD00	120
Special length	6FM1 790-1FZ	
Converter unit- WF 725, WF 726		
Length 2 m	6FM1 790-2AA00	
Length 5 m	6FM1 790-2AB00	30
Length 10 m	6FM1 790-2AC00	
Length 18 m	6FM1 790-2AD00	
Special length	6FM1 790-2AZ	

7.2 Bibliography

7.2.1 Additional Documentation for WF 725/WF 726

/1/	WF 725/WF 726 Positioning modules **Planning instructions part 4:** Application example	6ZB5 440-0GM01-0AA3 [1]
/2/	WF 725/WF 726 Positioning modules **Planning instructions part 6:** Lexicon	6ZB5 440-0GP01-0AA1 [1]
/3/	WF 725/WF 726 Positioning modules **Description** Printing report of WF 470	6ZB5 440-0AW01-0AA0 [1]

7.2.2 Documentation notes for the WS 400 system

/4/	WS 495/496 Operating system **Description**	6ZB5 440 0JX02-0BA1
/5/	WF 400-10/20/22 Operator panels **Description**	6ZB5 440-0AR02-0BA3
/6/	WF 470 Video Display System **Planning Guide**	6ZB5 440-0QS02-0AA5
/7/	WF 470 Video Display System **Planning Guide** Display generation	6ZB5 440-0FH02-0AA0
/8/	GRACIS **Description**	6ZB5 440-0TY02-0BA0

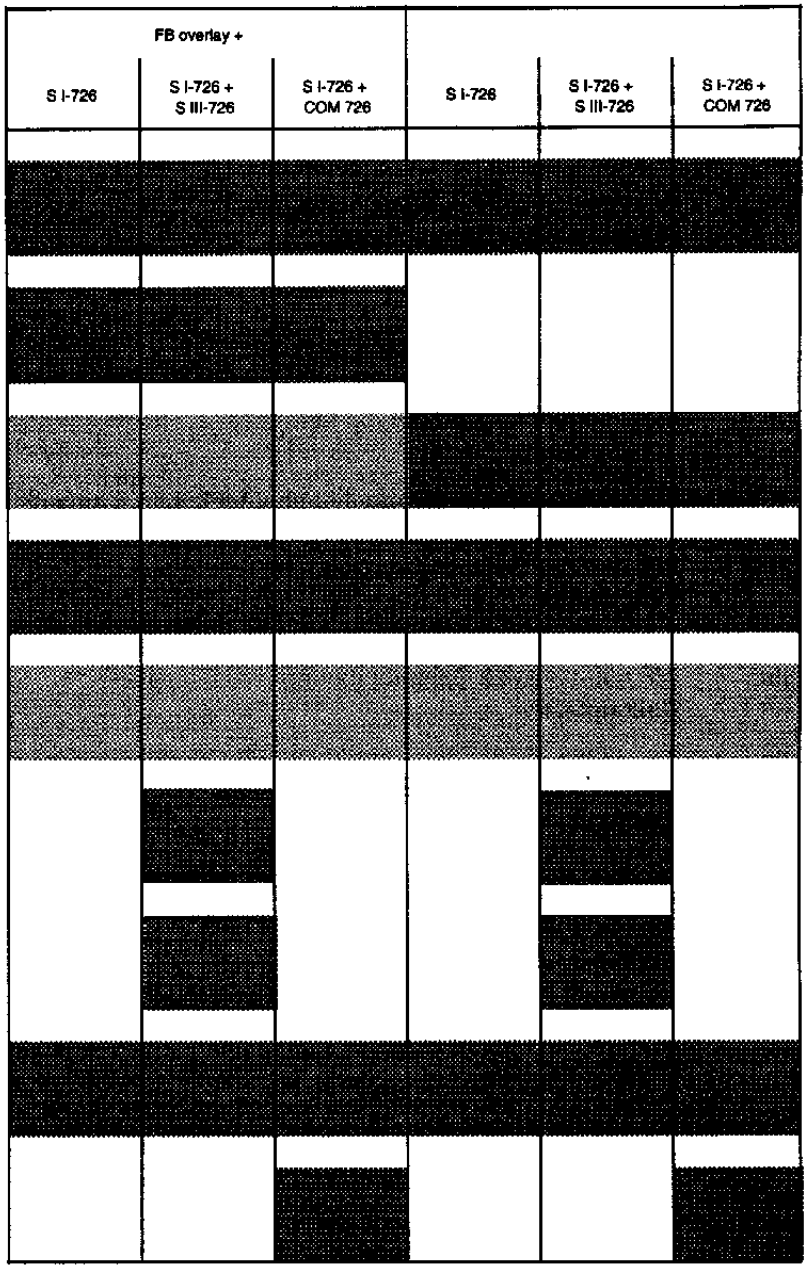
The current order numbers can be called over PRODOK.

Note:
[1] These documents are only available in German.

Documentation:

necessary ■ **or useful** ▒ **for using the software for**

WF modules with SIMATIC S5



Planning Instructions
Hardware
6ZB5 440-0GJ02-0AA5

Planning Instructions
Software Overlay
6ZB5 440-0GK02-0AA2

Planning Instructions
Software I, III
6ZB5 440-0GL02-0AA3

Installation Instructions
Description
6ZB5 440-0FW02-0AA3

Installation Instructions
Lists
6ZB5 440-0JQ02-0AA2

Operating Instructions
Standard III with WF 470
6ZB5 440-0FX02-0AA1

WF 470 Description
Video Display Module
6ZB5 440-0JF02-0BA5

Programming Instructions
6ZB5 440-0GA02-0AA1

Description
Software COM 726
6ZB5 440-0AX02-0AA5

Siemens AG

AUT V240
Postfach 3180
D-91050 Erlangen

Fed. Rep. of Germany

Suggestions

Corrections

For Publication/Manual:

WF 725/WF 726
Video Display Module

Planning Guide

Order-No.: 6ZB5 440-0JH02-0BA1
Edition: 07.93

From:

Name

Company/Dept.

Address

Telephone /

If you find any printing errors when reading this publication, please let us know, using this form. We also welcome any suggestions to improve the manual.

Suggestions and/or corrections

Equipment for Special Machines

WF 725/WF 726

Manual

Siemens AG
Automation Group
Automation Systems
for Machine Tools, Robots
and Special-Purpose Machines
P.O. Box 3180, D-91050 Erlangen
Federal Republic of Germany

5700933001l2

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Order No. 6ZB5 440-0JH02-0BA1
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RGWE/640053 BS 10950.1

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