HEIDENHAIN

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HEIDENHAIN

Operating Instructions

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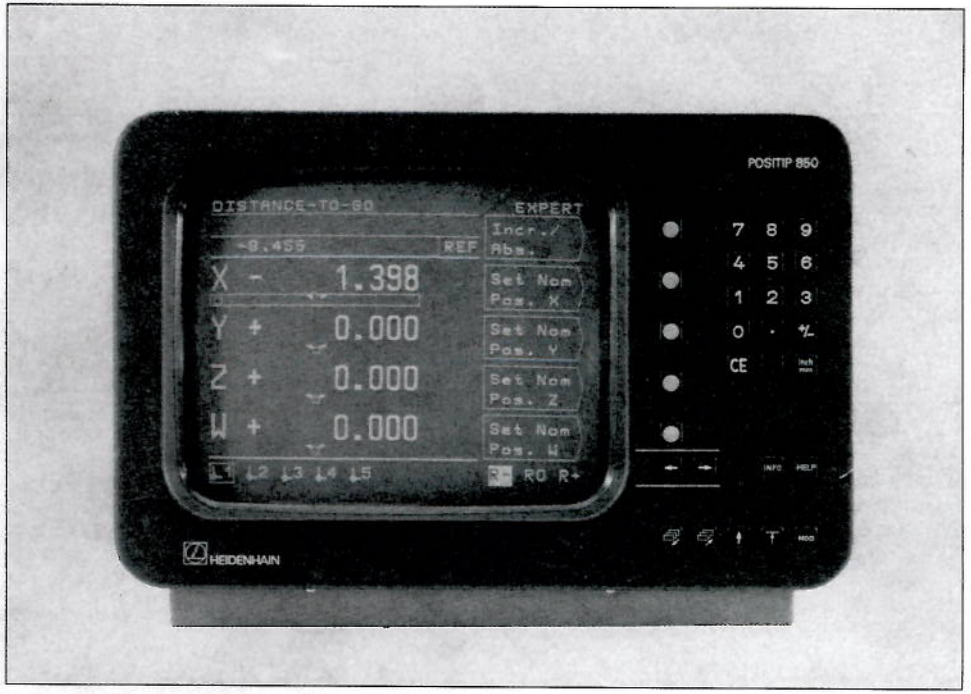
POSITIP 850 For Milling



12/91

Items Supplied

- POSITIP 850 Display Unit for 4 Axes
- Power Cable
- Operating Instructions
- Certificate of Inspection

Optional

- Connector, 25-pole, for D-subminiature socket X41 (EXT) external functions (Id.-Nr. 249154ZY)
- Data transfer cable, 25-pole, for D-subminiature socket X31 data output (Id.-Nr. 242869 01)
- KT 110 Edge Finder (Id.-Nr. 25102101)
- Angle bracket (Id.-Nr. 258 26101)

Manufacturer's Certificate

We hereby certify that the above unit is radioshielded in accordance with the German official register decree 1046/1984. The German postal authorities have been notified of the issuance of this unit and have been granted admission for examination of the series regarding compliance with the regulations.

Selecting Milling/Turning

As delivered, the POSITIP 850 can be set up for **either** milling or turning applications. The following screen appears after the **first** power-up:

After pressing the 0 key, the program for milling is permanently set (i.e., is not affected by power interruptions), and this screen display cannot be accessed again. Selection of the turning function is then only possible via parameter P99.0 "Milling, Turning".

Contents

Contents

General Information

The POSITIP 850 is a versatile programmable digital readout designed primarily for milling machines and lathes. POSITIP features easy-to-read displays and images on a 12-inch CRT screen as well as practical functions that provide powerful support to the machine operator. The POSITIP 850 adapts to varying to job requirements through three selectable modes of operation:

BASIC Mode

Digital Readout for simple machining tasks
- Automatic REF reference mark evaluation
- Actual position display with up to 20 freely-selectable datum points

EXPERT Mode

Digital Readout with expanded scope of functions
- Distance-To-Go display with radius compensation
- Bolt-hole circle
- Probing functions for the KT 110 Edge Finder or TS 120 Touch Probe System

PROGO Mode

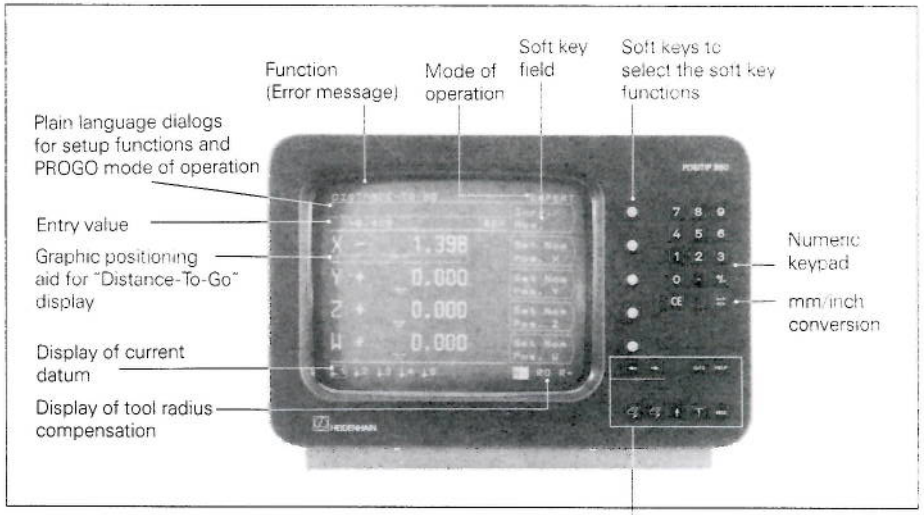
Programmable Digital Readout
- Storage of up to 20 different programs
- Easy programming with conversational guidance, subprograms and program section repeats

In all three modes of operation the POSITIP 850's integrated HELP function provides explanations of the current procedure, screen contents and functions of the individual keys.

Working with the POSITIP 850 For Milling

This part of the Operating Instructions illustrates the most important procedures for operation of the POSITIP 850. For a more detailed explanation of the individual modes of operation and the corresponding procedures, simply call the HELP functions.

Controls and Screen Displays



Symbol behind the display value: Ø: Diameter display
!: Scaling factor active

With these keys you select the datum (1 to 20), the desired tool radius compensation (R–, R0, R+), and the data interface (FE, EXT)

INFO — Selection of cutting data calculator, pocket calculator functions and stopwatch functions

HELP — All operating modes, procedures, functions of the individual keys, and error messages are explained

For paging through the individual screens

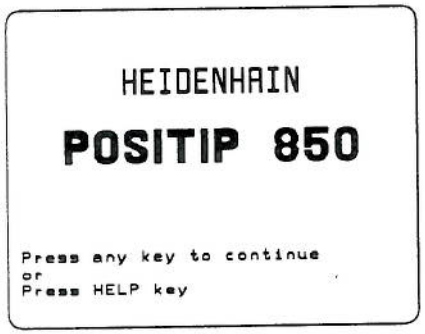
Return to the previous menu or

Return to the main menu

MOD — Display user parameters

Switch-On

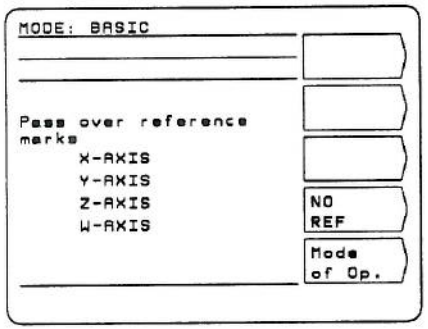
Before initial switch-on, please read the information in the chapter "Installation".
The power switch is located on the rear panel.



After approx. 5 seconds the opening screen appears and POSITIP conducts a memory test.

► **Press any key.**

Adjust brightness if necessary (control on rear panel)



POSITIP is in the mode of operation which was last selected (in this case BASIC).

► **Switch to a different mode of operation:**

Press [Mode of Op.]

and select desired mode.
On the screen the message appears:
Pass over reference marks

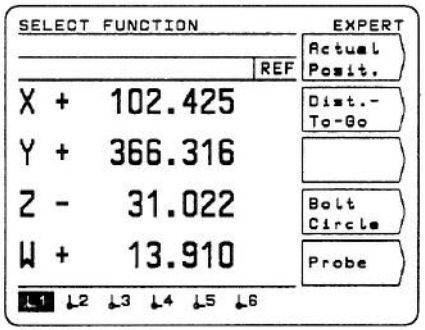
► **Working in REF mode:**
Traverse the reference marks

► **Otherwise:**

Press [No Ref]

All displays are zeroed, datum points are not in non-volatile storage.

After crossing the reference marks in all axes:



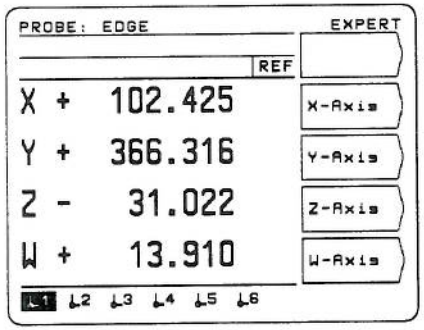
The main menu appears for the selected mode of operation. The abbreviation REF in the entry line indicates REF mode. The position data are referenced to the current datum.

Menu Keys 

Menu keys permit fast selection from among the individual functions and procedures.

Return to the main menu of the selected mode of operation (EXPERT or PROGO).

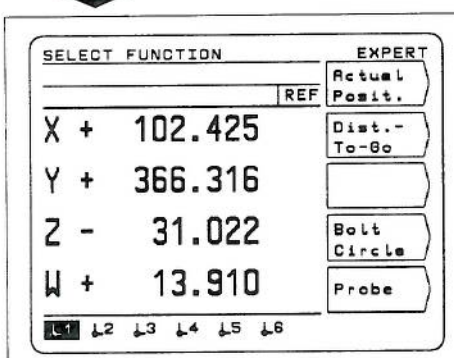
Example:



The PROBE: EDGE function has been selected

► **Select the EXPERT main menu**

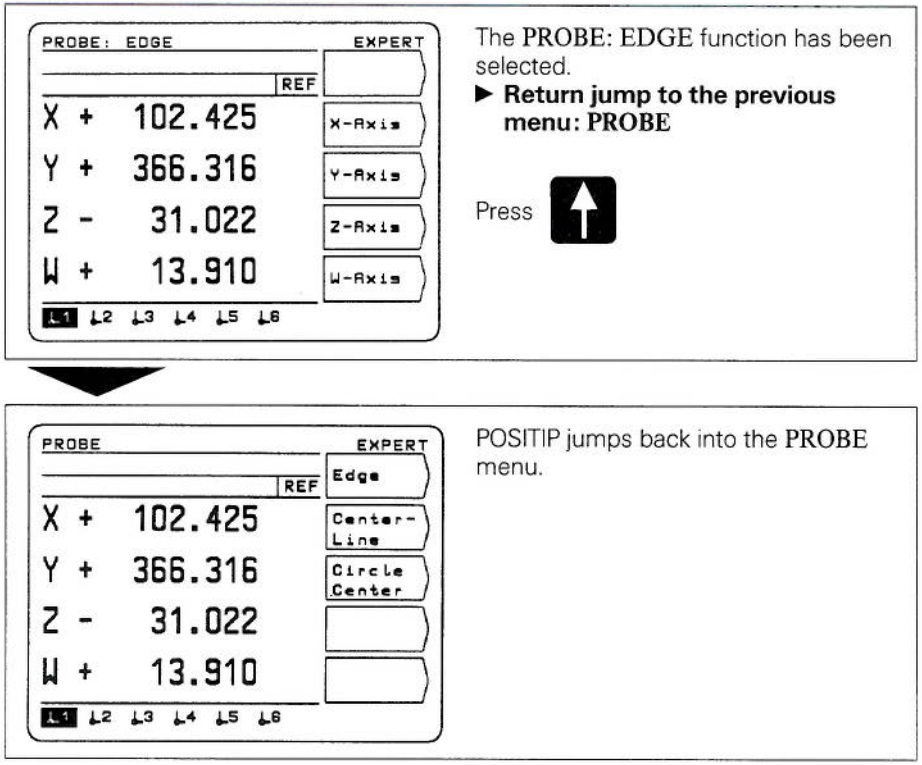
Press 



POSITIP jumps back into the main menu of the EXPERT mode.
A new function may now be selected.

Return to the previous menu

Example:



The PROBE: EDGE function has been selected.

► **Return jump to the previous menu: PROBE**

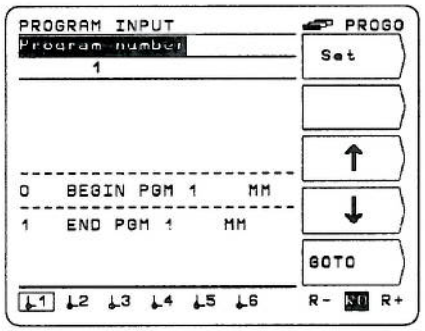
Press

POSITIP jumps back into the PROBE menu.

Each time you press the  key you jump back by one menu level until you reach the main menu of the selected mode of operation.

Paging forward and backwards, selection of work screens and soft key assignment.

Example: Selection of Work Screens

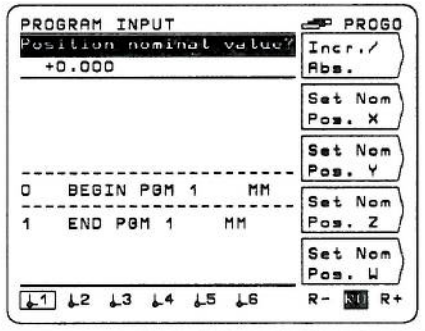


POSITIP is in the PROGRAM INPUT main menu.

The ☞ symbol indicates the currently-selected page (here, page 1).

▶ Select page 2:

Press 

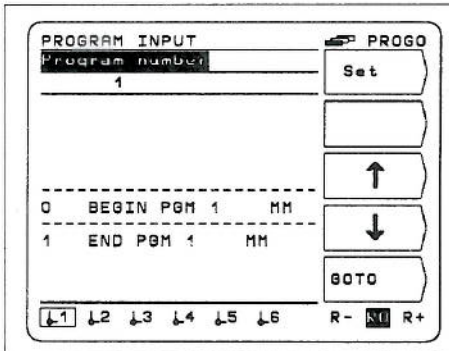


The second page of the PROGRAM INPUT main menu has been selected.

The ☞ symbol now indicates page 2 as current page.

▶ Return to page 1

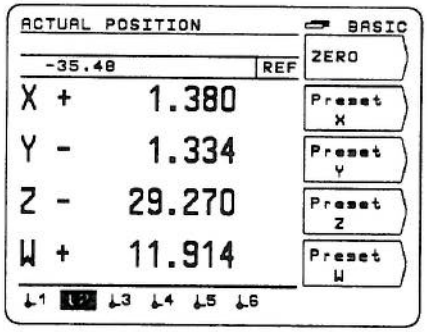
Press 



Display returns to the first page of PROGRAM INPUT.

Selection of datum points, tool radius compensation and data transfer protocol.

Example 1: Selection of Datum Points

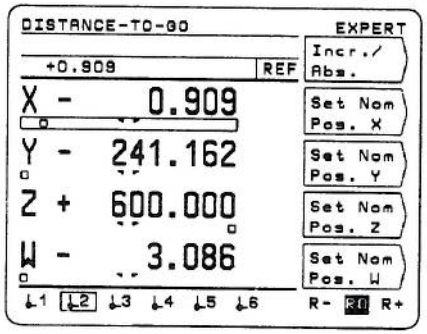


POSITIP is in the main menu of the BASIC mode of operation.
Example: Datum ⊥2 has been selected.

▶ Select new datum, e.g. ⊥12:

Press  or hold down until datum ⊥12 is selected. Out of 20 possible datums, 6 can be displayed at once.

Example 2: Selection of Tool Radius Compensation



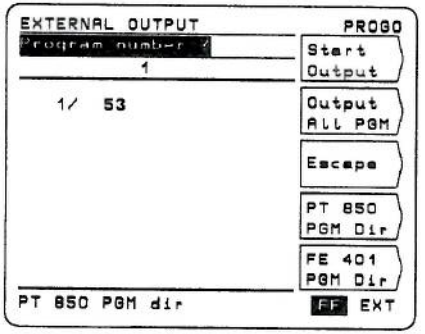
The DISTANCE-TO-GO function has been selected.
No tool radius compensation has been selected: Display R0

▶ Select tool radius compensation, e.g. R+:

Press 

Effective tool radius compensation: R+.

Example 3: Selection of the Data Transfer Protocol



In the PROGO operating mode, the function EXTERNAL OUTPUT has been selected. The data transfer protocol is set on the FE 401: display FE

▶ Set data transfer protocol to EXT, e.g. for printer

Press 

Active data transfer protocol: EXT.

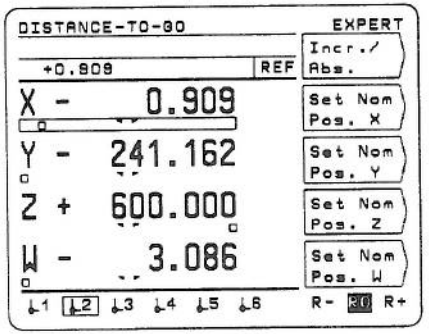
Parameter Input

POSITIP features non-volatile parameter storage: the parameters become effective immediately upon switch-on.

The parameters are divided into two groups: user parameters and operating parameters. **User parameters** are parameters that can be changed during operation by pressing the MOD key.

Operating parameters concern machine characteristics and are given a fixed setting. For more information on operating parameters see the "Technical Description" section of these instructions.

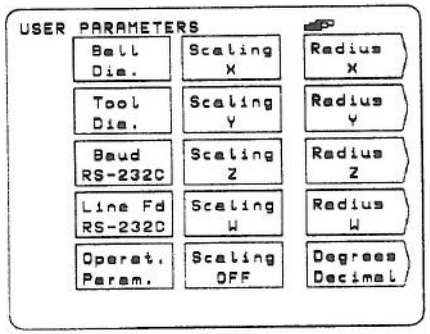
Example of User Parameters



The DISTANCE-TO-GO function has been selected.

▶ **Call user parameters**

Press MOD



An overview of available parameters appears on the screen.

▶ **Change parameter:**

Select desired column

▶ **Call parameter:**

Press soft key

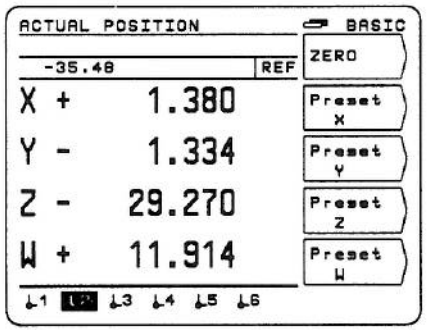
▶ **Depart user parameters**

Press MOD once again

HELP

The HELP function can guide you through the operation of the POSITIP 850. Think of it as integrated operating instructions. At **any time** during operation you can call up an explanation of the current screen image by pressing the HELP key. The HELP function can also tell you how to proceed when an **error message** occurs.

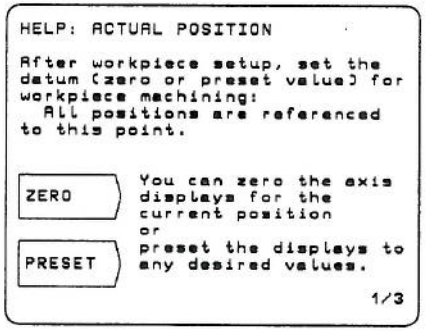
Example: Calling the HELP Function



POSITIP is in the main menu of the BASIC operating mode.

▶ **Call HELP:**

Press HELP



An explanation of ACTUAL POSITION appears on the screen.

A HELP text can consist of several pages. The current page and the total number of pages is displayed at the lower right-hand corner of the screen.

▶ **Page further:**

Press to page forward

Press to page backwards

▶ **Depart HELP**

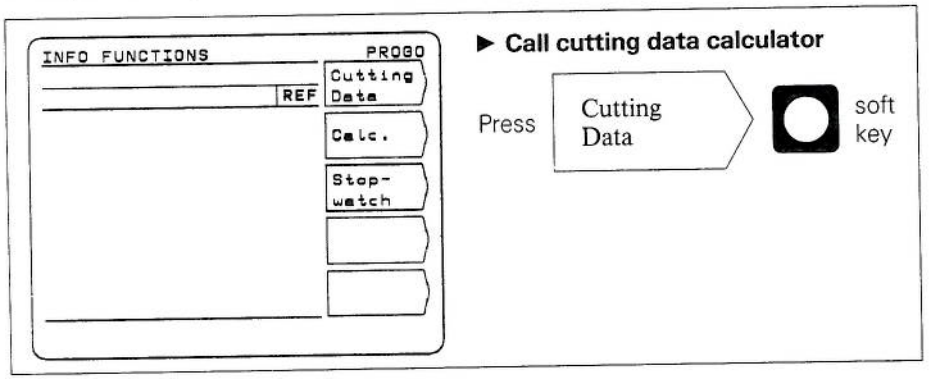
Press HELP once again

POSITIP returns to the original screen.

INFO Functions

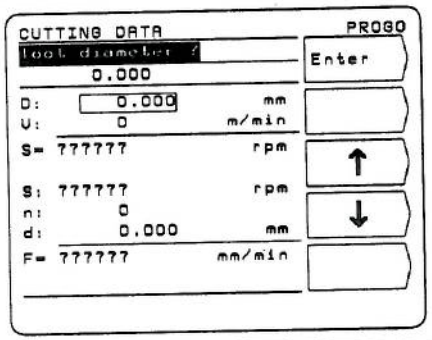
The INFO functions can be selected from any menu level by pressing the INFO key. The following functions are then available:

Example: Calling the Cutting Data Calculator



▶ **Call cutting data calculator**

Press Cutting Data soft key



The cutting data calculator for calculation of the spindle speed and feed rate appears on the screen.

Pressing the HELP key displays an explanation of this function.

▶ **Depart INFO**

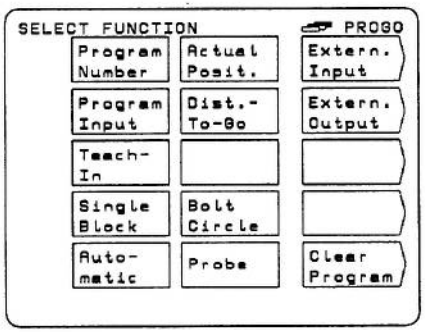
Press INFO once more

POSITIP returns to the original screen.

External Program Output

Using the EXTERNAL OUTPUT function in the operating mode PROGO, you can transfer one or all of the programs in the PT 850 to an external storage device via the RS-232-C data interface. Programs can be archived on diskette with the FE 401 Floppy Disk Unit from HEIDENHAIN.
Printers used with the PT 850 must have a serial RS-232-C interface (please refer to the Technical Description, section 2.5).

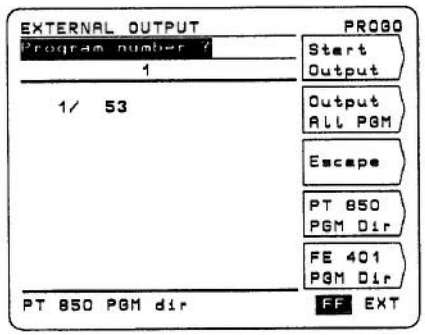
Example: Transferring a Program to the FE 401



The main menu of the PROGO operating mode has been selected.

▶ **Call "External Output"**

Press the Extern. Output soft key



The EXTERNAL OUTPUT menu appears on the screen.

▶ **Set the data interface to FE 401**

Press ← → ("FE" must appear as negative image)

Selecting "FE" sets the data interface and the correct baud rate for the FE 401 Floppy Disk Unit.

▶ **FE:** Data transfer rate is 9600 baud, regardless of the baud rate set via MOD.

▶ **EXT:** The baud rate set via MOD for printer output is in effect.

Output a single program

▶ Enter program number

▶ Start Output → soft key: Begin program output

Output all programs

▶ Output All PGM → soft key: Begin program output

If there are programs on the diskette with the same PGM number, they will be written over.

Directory of programs stored in the POSITIP program memory

▶ PT 850 PGM Dir → soft key: The program number as well as the number of program blocks is displayed.

Directory of programs stored on FE diskettes

▶ FE 401 PGM Dir → soft key: During read-in of the program directory, the dialog Reading FE directory is displayed.

Cancel data transfer

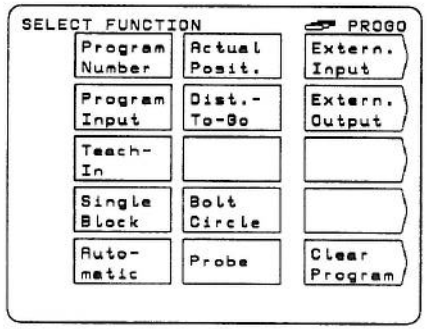
▶ Escape → soft key: Data transfer is cancelled.

External Program Input

Using the EXTERNAL INPUT function in the operating mode PROGO, you can transfer programs from an external storage device into the PT 850 via the RS-232-C data interface. Programs can be archived on diskette with the FE 401 Floppy Disk Unit from HEIDENHAIN.

Computers used with the PT 850 must have a serial RS-232-C interface (for the data format, please refer to the Technical Description, section 2.5).

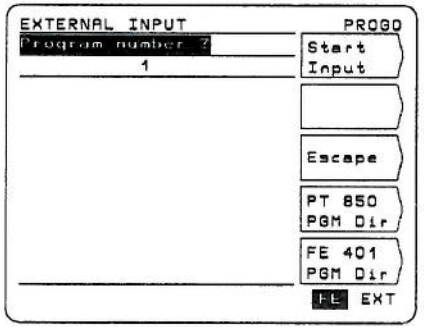
Example: Loading a Program from the FE 401



The main menu of the PROGO operating mode has been selected.

▶ **Call "External Input"**

Press the Extern Input soft key



The EXTERNAL INPUT menu appears on the screen

▶ **Set the data interface to FE 401**

Press ← → ("FE" must appear as negative image)

Selecting "FE" sets the data interface and the correct baud rate for the FE 401 Floppy Disk Unit.

▶ **FE:** Data transfer rate is 9600 baud, regardless of the baud rate set via MOD.

▶ **EXT:** The baud rate set via MOD for printer output is in effect.

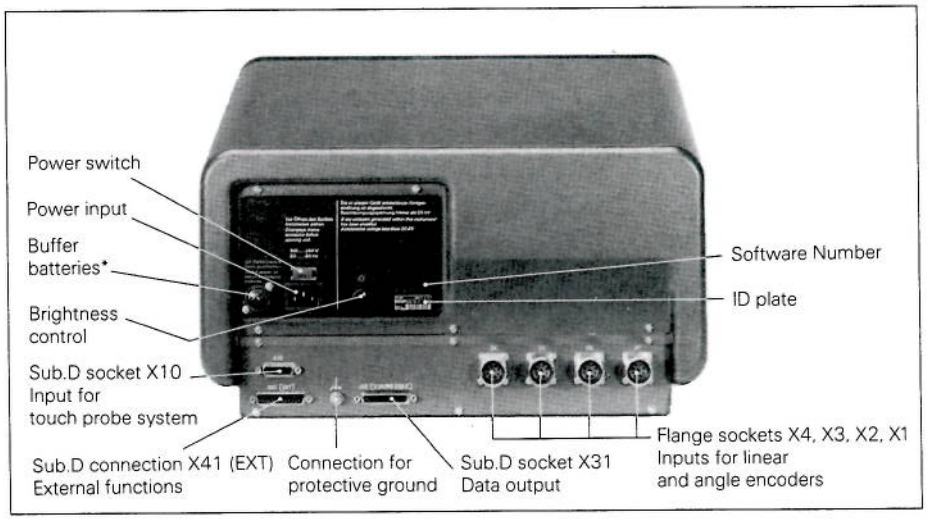
Enter the program number of the program to be transferred. If necessary, call up the directory of programs on the diskette using the soft key FE 401 PGM Dir (see "Program Output").

Start Input

Start transfer of program from floppy disk unit to POSITIP.

Installation

1 Connections and Controls (Rear of Unit)



* The buffer batteries (three AA size 1.5 V batteries) serve as a power supply for the program memory. Exchange the batteries if the error message EXCHANGE BUFFER BATTERY appears.

The unit must be switched on during battery exchange to prevent erasure of stored programs.

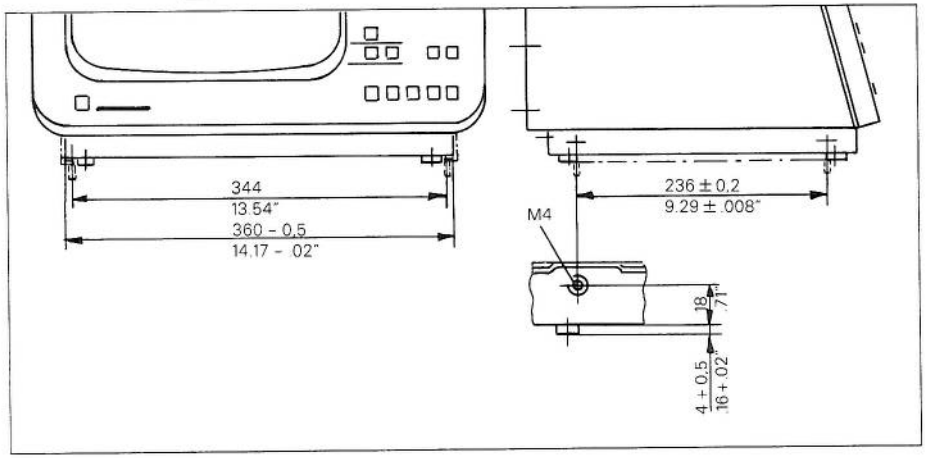
It is very important that you follow this sequence of steps when installing the unit for the first time.

Do not engage or disengage any connectors while the unit is under power.

2 Mounting the POSITIP 850

▶ Place the display unit in its intended location. The unit can be fixed laterally to a base surface via its M4 tapped fixing holes (see illustration for dimensions).

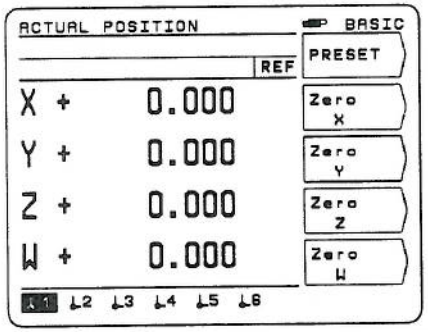
An angle bracket for mounting the PT 850 on a table is available from HEIDENHAIN (Id.-Nr. 258 26101).



3 Connecting Linear and Angle Encoders

▶ Connect the encoders for the machine axes to the flange sockets for encoder input on the rear panel (see illustration on page I1). Connect the machine axes to the flange sockets according to the following table:

Example:	Machine Axis	Flange Socket
	X →	X1 →
	Y →	X2 →
	Z →	X3 →
	W →	X4 →



4 Connecting the KT 110 Edge Finder

▶ Connect the KT 110 Edge Finder (available as accessory Id.-Nr. 25102101) to the D-subminiature socket X10 on the rear panel.
The PT 850 can also be connected to the TS 120 Touch Probe System (see Technical Description, section 6).

5 Power Connection

▶ Check whether there is a protective ground for the power connection. An M5 threaded pin on the rear panel provides an additional connection for protective ground.
▶ Connect power cable to the power input socket at rear of unit and switch on power.

6 Switch-On and Function Check

The unit is adapted to the machine tool by means of parameters. These parameters are described in section 1 of the Technical Description. The unit is delivered with **preset parameters** to facilitate commissioning (see Technical Description, section 1.2.4).

Proceed in the following sequence to commission the machine:

▶ Switch on power (see section 1).
▶ Adjust desired screen image brightness with control on rear panel.
▶ Select desired language. The menu for language selection appears only **once** after initial switch-on.
▶ Press any key (except the HELP key).
▶ Choose BASIC mode of operation (see Working with the POSITIP).
▶ Press NO REF soft key. You need not traverse over the reference points (ignore error messages).
▶ Use MOD key and the code number 95148 to access the operating parameters (see Technical Description, section 1.2).
▶ Optimize operating parameters (see section 7).
▶ Switch power off and then on again.
▶ Cross over the reference marks (see Working with the POSITIP).

Error Messages

After the reference marks have been crossed over there should be no error message in the display.

If an error message is displayed, press the HELP key for more information and then correct the error. Switch power off and then on again.

If several errors occur at once you can display the error messages one after the other by repeatedly pressing the CE key.

7 Optimizing the Parameters

You can adapt the functions of the POSITIP to the machine tool by optimizing the parameters. Proceed in the sequence given in the following checklist. Write the axis designations of the connected machine axes onto the checklist and check off each point after you have completed the step.

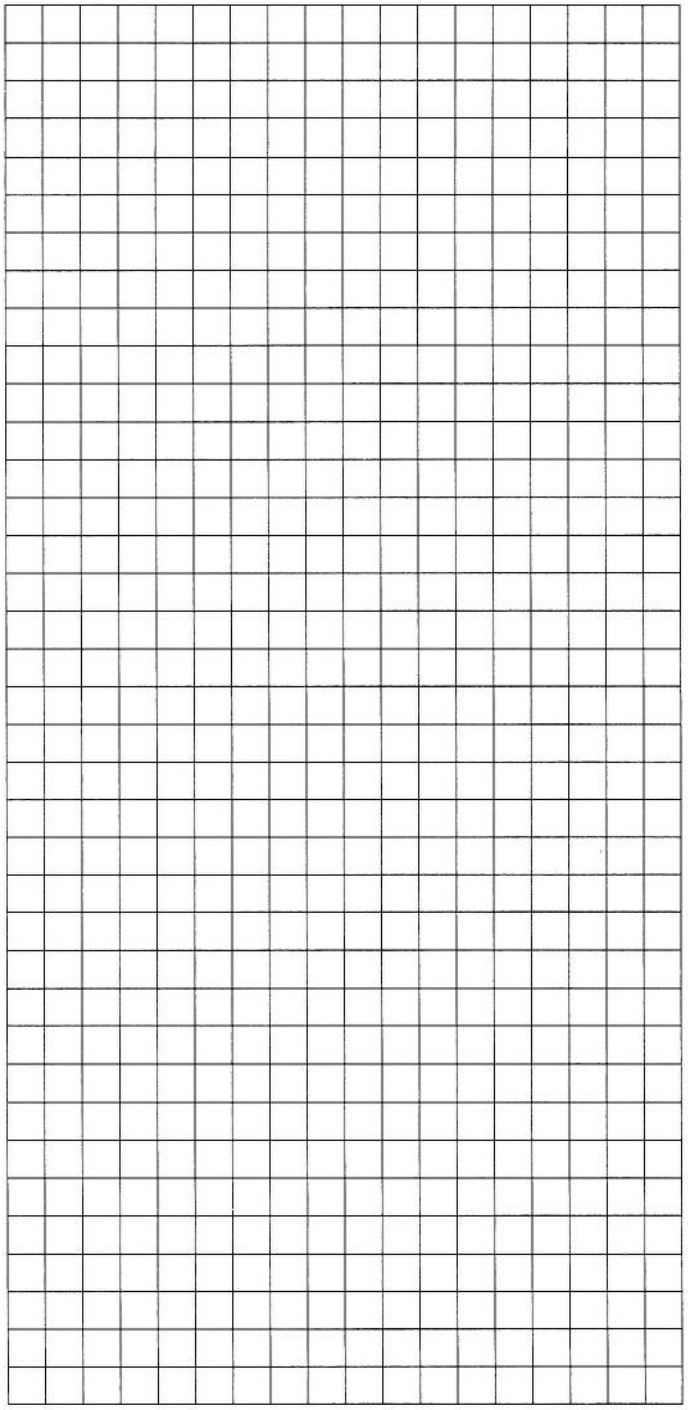
Parameters which must be frequently changed during machine operation are entered as user parameters (see Technical Description). If the KT 110 Edge Finder or the TS 120 3D-Probe System is connected, the ball diameter must be entered in the user parameters.

Checklist	Parameter	Encoder Inputs/Axes			
		X1	X2	X3	X4
		Machine Axes			
▶ Are the encoders connected in the proper sequence (see section 3)?					
▶ Do the axis designations of the ACTUAL POSITION display match the machine axes? Change if necessary.	P 50.*	○	○	○	○
▶ Check axis definition. The axes are set as linear axes. If a rotary axis is connected (for a rotary table), the axis must be set to "rotary". (The rotary axis display can be switched from degrees to degrees/minutes/seconds via the user parameters).	P 48.*	○	○	○	○
▶ Enter parameter value for reference marks (see Technical Description, table 1.3.3).	P 45.*	○	○	○	○
▶ Set counting direction of the machine axes according to the "Right Hand Rule". Increasing positive display values must correspond to the positive direction of machine axis traverse in relation to the workpiece.	P 40.*	○	○	○	○
▶ Approach a datum on the machine table and set the datum on the POSITIP. Then move the table parallel to the axis and compare the actually traversed length or angle with the value displayed on the POSITIP.	P 41.* P 42.*	○	○	○	○
▶ Check display step (see Technical Description, tables 1.3.1 and 1.3.2).	P 43.* (linear) P 44.* (angle)	○	○	○	○
▶ Set the counting mode of the rotary axes (for rotary tables). (Presetting = 360°).	P 49.*	○	○	○	○

* The asterisk „*" signifies parameters which are specified according to axis by a number behind the decimal point (e.g. 1.1, 1.2 etc.).

(For parameter descriptions see Technical Description, section 1.4).

Technical Description



Technical Description

1 Parameters

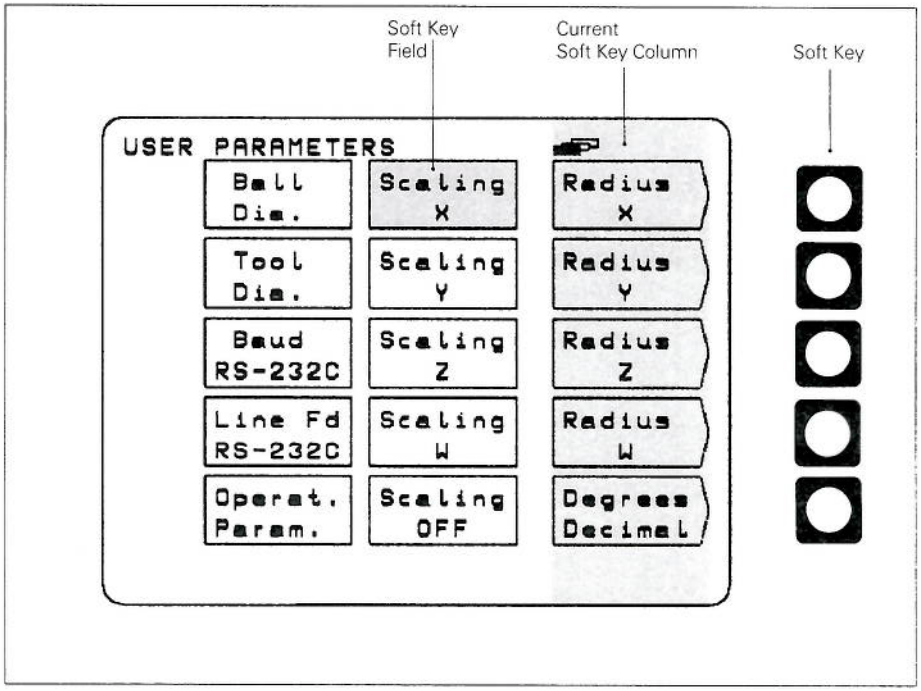
The operational characteristics of the POSITIP 850 can be modified via user parameters and operating parameters. While user parameters can be changed by the operator, operating parameters are given a fixed setting which corresponds to the details of the specific machine tool. The parameters are given a standard presetting in the factory.

All parameters are in non-volatile storage (i.e., they are not affected by power interruptions). All changes are effective immediately!

1.1 User Parameters

User parameters are parameters which must be entered or changed frequently during normal machine operation. Press the MOD key to call the menu for user parameters. To leave the menu, press the MOD key again.

Menu: User Parameters

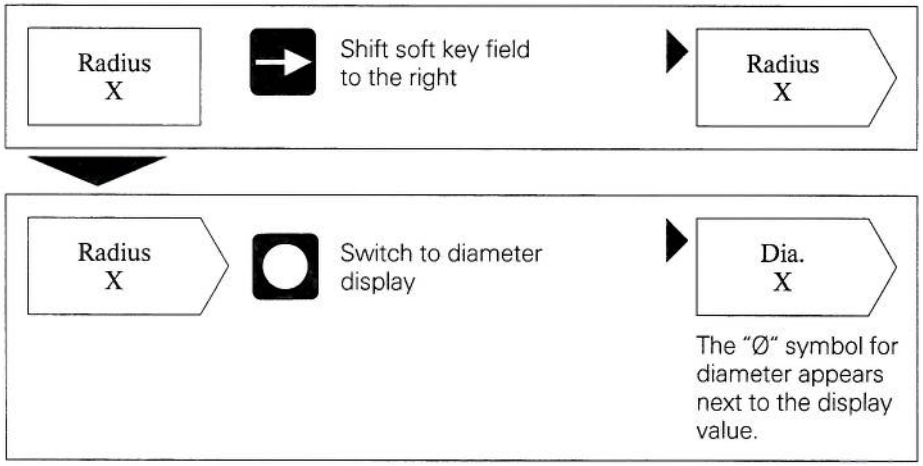


1.1.1 Changing User Parameters

■ Via soft key

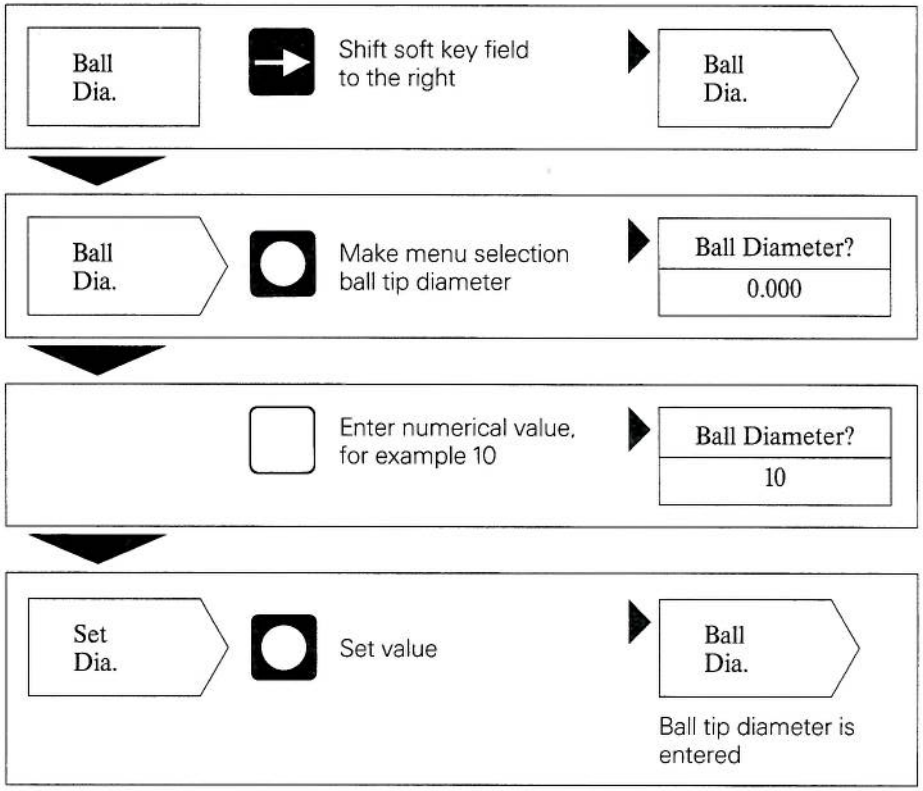
Soft keys are used to change from radius to diameter display, from degrees to degrees/minutes/seconds display and to select scaling factor ON or OFF.

Example: Radius or Diameter Display



■ Changing user parameters via numerical input

Example: Ball Tip Diameter



1.1.2 Overview of User Parameters

Selection via MOD key

Function	Axis	Change	Input
Radius/Diameter	X Y Z W	Soft key	–
Degrees Decimal or Degrees/min/sec	X Y Z W	Soft key	–
Scaling Factor	X Y Z W	Numerical input	(0.100000 to 9.999999)
Scaling Factor ON/OFF		Soft key	–
Ball Tip Diameter		Numerical input	(0 to 199.999 mm)
Tool Diameter		Numerical input	± (0 to 1999.999 mm)
Baud Rate RS-232-C		Numerical input	110; 150; 300; 600; 1200; 2400; 4800; 9600; 19200; 38400 baud
Line Feed RS-232-C		Numerical input	(0 to 99)

(For descriptions of user parameters see section 1.4.1)

If "Diameter" or "Scaling Factor ON" have been selected, the following symbols appear behind the display value:

Ø: Diameter display
!: Scaling factor active

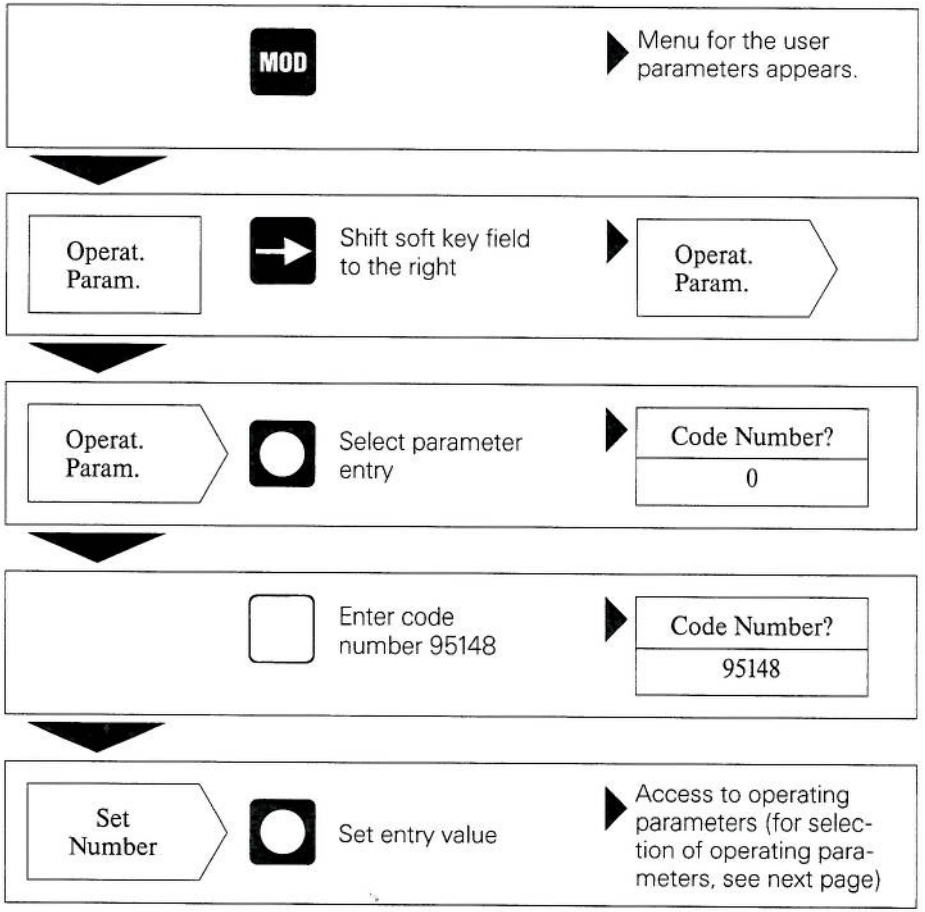
1.2 Operating Parameters

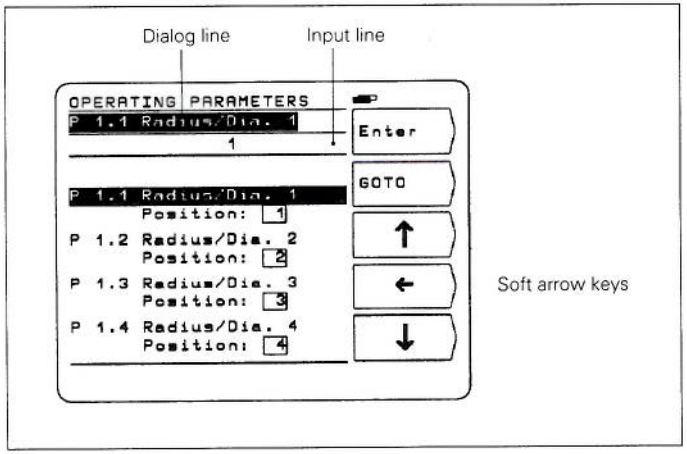
There are three groups of operating parameters:
- ▶ P 1.1 to P 9.0 – configuration of the user parameters
- ▶ P21.1 to P28.0 – presetting of the user parameters
- ▶ P40.1 to P99.0 – operating parameters for machine interface

These configuration and settings are made once during commissioning and then remain fixed.

Operating parameters can only be selected through the code number **95148** and should not be changed by the machine operator. We recommend that you keep a written copy of the entry values for the operating parameters or store them on an external data medium.

1.2.1 Accessing the Operating Parameters

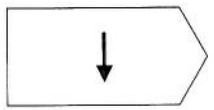




Selecting the Operating Parameters

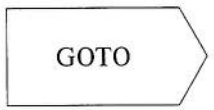
■ Selection via vertical soft arrow keys

Select desired operating parameter with vertical soft arrow keys.



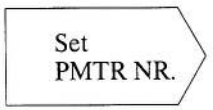
or

■ Selection via GOTO



Press soft key (the last selected parameter number will appear in the input line).

Enter desired parameter number.



Select operating parameter.

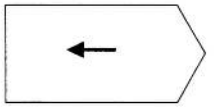
Changing Operating Parameters

■ Changing operating parameters by entering numerical value

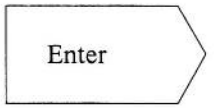
Example: P 25.0 ball diameter
Enter numerical value (e.g. 5).

Pressing the soft key Enter transfers the entry value; the next parameter is then displayed.

■ Changing operating parameters with the horizontal soft arrow key



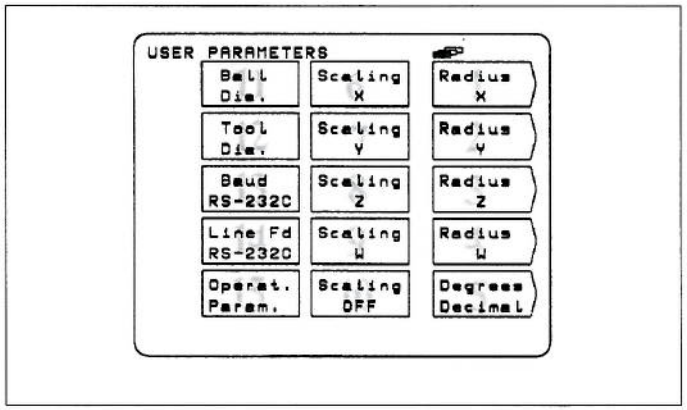
The frame in the parameter line indicates the current parameter entry value. Press the soft key to bring the next parameter entry into the frame.



Pressing the soft key Enter transfers the entry value; the next parameter is then displayed.

1.2.2 Configuring the User Parameters

Pressing the MOD key calls the user parameters to the display. These parameters are located in soft-key fields in a certain arrangement of field positions. The field positions are indicated by the numbers in the illustration below. (Factory presetting as it appears after switch-on.)



The field position of any user parameter can be changed by means of the operating parameters P 1.1 to P 9.0. (Exception: field position 15 – operating parameters.) By entering a position of 0, the selected user parameter can be locked from access.

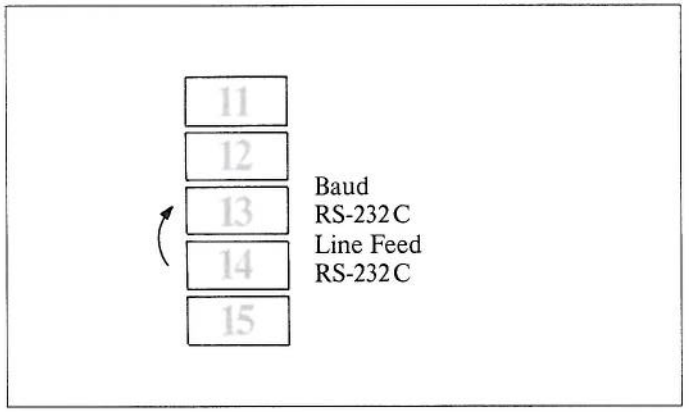
Changing the Field Position

► First you must gain access to the operating parameters using the procedure described above in point 1.2.1. Then select the desired soft-key field.

Example:

You wish to transfer the parameter in field position 14 to field position 13.

Original Display



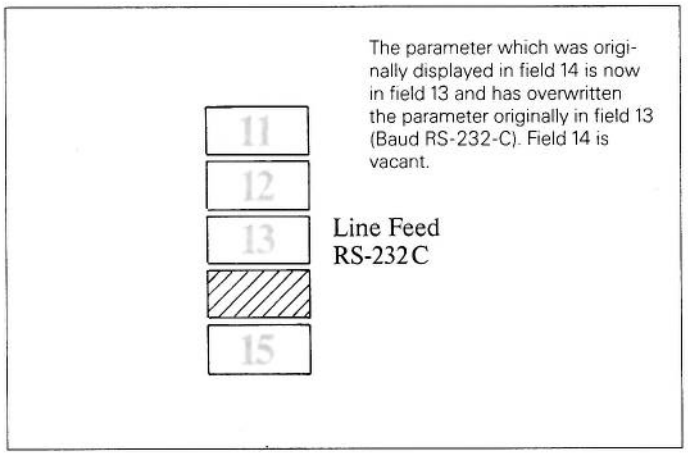
Procedure

► Select the parameter in field position 14 (factory preset to P 8.0).

► Enter the new field position (position 13) with numeric keypad and press the soft key Enter.

Pressing the ↑ key recalls the menu for the user parameters.

New Display



The overwritten parameter (Baud RS-232C) can be re-entered into the table as follows:

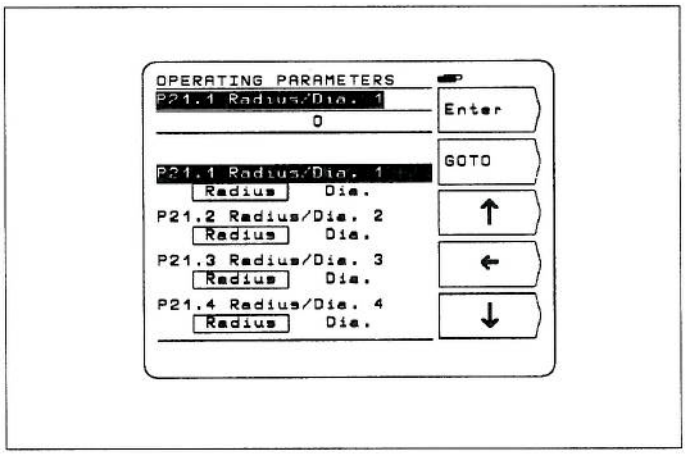
► Repeat procedure for access to operating parameters and select the overwritten parameter (P 7.0 Baud Rate RS-232C). This parameter has assumed the Position: 0.

Access to user parameters via the MOD key can be locked by entering Position: 0.
Note: Locked user parameters can only be changed via the operating parameters P21.1 to P28.0.

If you wish to transfer the locked user parameter (P 7.0) to the vacant field position 14, then enter the field position 14 for this parameter.
The parameter that was originally in position 13 is now in position 14 and vice versa.

1.2.3 Presetting the User Parameters

User parameters can also be set with the operating parameters (P21.1 to P28.0). This makes it possible to change locked user parameters. Changing these parameters is effective regardless of whether they are changed in the "User Parameters" menu or the "Operating Parameters" menu.



1.2.4 Overview of Operating Parameters

Function	Parameter	Axis*		Entry**
Radius/Diameter X1	P 1.1	X		**1**
Radius/Diameter X2	P 1.2	Y		**2**
Radius/Diameter X3	P 1.3	Z		**3**
Radius/Diameter X4	P 1.4	W		**4**
Angle Format	P 2.0			**5**
Scaling Factor X1	P 3.1	X		**6**
Scaling Factor X2	P 3.2	Y		**7**
Scaling Factor X3	P 3.3	Z		**8**
Scaling Factor X4	P 3.4	W		**9**
Scaling Factor ON	P 4.0			**10**
Ball Diameter	P 5.0			**11**
Tool Diameter	P 6.0			**12**
Baud Rate RS-232-C	P 7.0			**13**
Line Feed RS-232-C	P 8.0			**14**
Mode of Operation	P 9.0			**0**
Radius/Diameter X1	P 21.1	X		**radius,** diameter
Radius/Diameter X2	P 21.2	Y		
Radius/Diameter X3	P 21.3	Z		
Radius/Diameter X4	P 21.4	W		
Angle Format	P 22.0			**degrees decimal,** degrees/min/sec
Scaling Factor X1	P 23.1	X		**1.000000** (0.100000 to 9.999999)
Scaling Factor X2	P 23.2	Y		
Scaling Factor X3	P 23.3	Z		
Scaling Factor X4	P 23.4	W		
Scaling Factor ON	P 24.0			**OFF,** ON
Ball Diameter	P 25.0			**10.000** (0 to 199.999 mm)
Tool Diameter	P 26.0			**0.000** ± (0 to 1999.999 mm)
Baud Rate RS-232-C	P 27.0			**9.600** (110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400 baud)
Line Feed RS-232-C	P 28.0			**1** (0 to 99)

Operating Parameters (cont'd.)

Function	Parameter	Axis*		Entry**
Counting Direction X1	P 40.1	X		**normal,** inverse
Counting Direction X2	P 40.2	Y		
Counting Direction X3	P 40.3	Z		
Counting Direction X4	P 40.4	W		
Signal Period X1	P 41.1	X		4 µm, 10 µm, **20 µm,** 40 µm, 100 µm, 200 µm
Signal Period X2	P 41.2	Y		
Signal Period X3	P 41.3	Z		
Signal Period X4	P 41.4	W		
Line Count X1	P 42.1	X		**1800,** 3600, 9000, 18000, 36000, 72000
Line Count X2	P 42.2	Y		
Line Count X3	P 42.3	Z		
Line Count X4	P 42.4	W		
Linear Subdivision X1	P 43.1	X		100, 80, 50, 40, **20,** 10, 8, 5, 4, 2, 1, 0.8, 0.5, 0.4, 0.2, 0.1 (depends on grating period set)
Linear Subdivision X2	P 43.2	Y		
Linear Subdivision X3	P 43.3	Z		
Linear Subdivision X4	P 43.4	W		
Angle Subdivision X1	P 44.1	X		100, 50, 25, **20,** 10, 8, 5, 4, 2.5, 2, 1, 0.4, 0.2 (depends on line count set)
Angle Subdivision X2	P 44.2	Y		
Angle Subdivision X3	P 44.3	Z		
Angle Subdivision X4	P 44.4	W		
Distance Coding X1	P 45.1	X		none, 500, **1000,** 2000
Distance Coding X2	P 45.2	Y		
Distance Coding X3	P 45.3	Z		
Distance Coding X4	P 45.4	W		

(For description see section 1.4.2)

* For the sake of simplicity, the axis designations are assumed to be those set in parameter P50.* (X1= X, X2 = Y, X3 = Z, X4 = W). X1, X2, X3, X4 are the corresponding designations of the encoder inputs (see back of unit).

** Factory presettings are indicated in **bold type.**

Operating Parameters (cont.'d.)

Function	Parameter	Axis*		Entry**
Monitoring X1	P 46.1	X		off, **on**
Monitoring X2	P 46.2	Y		
Monitoring X3	P 46.3	Z		
Monitoring X4	P 46.4	W		
Linear Correction X1	P 47.1	X		± (**0** to 99999 µm/m)
Linear Correction X2	P 47.2	Y		
Linear Correction X3	P 47.3	Z		
Linear Correction X4	P 47.4	W		
Axis Definition X1	P 48.1	X		off, **linear,** rotary
Axis Definition X2	P 48.2	Y		
Axis Definition X3	P 48.3	Z		
Axis Definition X4	P 48.4	W		
Angle Counting Mode X1	P 49.1	X		**360°,** ± 180°, ± ∞°
Angle Counting Mode X2	P 49.2	Y		
Angle Counting Mode X3	P 49.3	Z		
Angle Counting Mode X4	P 49.4	W		
Axis Designation X1	P 50.1	X		A, B, C, U, V, **W, X, Y, Z**
Axis Designation X2	P 50.2	Y		
Axis Designation X3	P 50.3	Z		
Axis Designation X4	P 50.4	W		
Axis Combination	P 51.0			**off,** 1+4, 2+4, 3+4, 1–4, 2–4, 3–4
Dialog Language	P 52.0			2 languages can be selected (see section 1.4.2)
Bolt Circle Plane	P 53.0			**X/Y,** Y/Z, Z/X
Mirror Graphics	P 54.0			**off,** vertical and/or horizontal
Direction of Rotation, Bolt Circle Graphics	P 55.0			**normal,** inverse
Zero Range X1	P 56.1	X		**0** (0 to 99.999 mm)
Zero Range X2	P 56.2	Y		
Zero Range X3	P 56.3	Z		
Zero Range X4	P 56.4	W		

Operating Parameters (cont'd.)

Function	Parameter	Axis*		Entry**
Display Freeze	P 57.0			**off,** concurrent, stopped
Distance-To-Go Mode	P 58.0			**bar,** actual value
Sleep Delay	P 59.0			**15** 5 to 98 min. 99 = no protective standby mode
Counter Application	P 99.0			**milling,** turning

(For description see section 1.4.2)

* For the sake of simplicity, the axis designations are assumed to be those set in parameter P50.* (X1 = X, X2 = Y, X3 = Z, X4 = W). X1, X2, X3, X4 are the corresponding designations of the encoder inputs (see back of unit).

** Factory presettings are indicated in **bold type.**

1.3 Tables

1.3.1 Display Step, Signal Period and Subdivision Factor for Linear Encoders

Signal Period	4 µm	10 µm	20 µm	40 µm	100 µm	200 µm
Display Step	**Subdivision Factor**					
0.00005 mm/0.000002 in.	80	–	–	–	–	–
0.0001 mm/0.000005 in.	40	100	–	–	–	–
0.0002 mm/0.00001 in.	20	50	100	–	–	–
0.0005 mm/0.00002 in.	8	20	40	80	–	–
0.001 mm/0.00005 in.	4	10	20	40	100	–
0.002 mm/0.0001 in.	2	5	10	20	50	100
0.005 mm/0.0002 in.	0.8	2	4	8	20	40
0.01 mm/0.0005 in.	0.4	1	2	4	10	20
0.02 mm/0.001 in.	–	0.5	1	2	5	10
0.05 mm/0.002 in.	–	0.2	0.4	0.8	2	4
0.1 mm/0.005 in.	–	0.1	0.2	0.4	1	2

1.3.2 Display Step, Line Count and Subdivision Factor for Angle Encoders

Line Count		72000	36000	18000	9000	3600	1800
Display Step		**Subdivision Factor**					
Degrees Decimal	**Degrees/ Min/Sec**						
0.0001°	0°00'01"	50	100	–	–	–	–
0.0002°	0°00'01"	25	50	100	–	–	–
0.0005°	0°00'01"	10	20	40	–	–	–
0.001°	0°00'05"	5	10	20	40	–	–
0.002°	0°00'05"	2.5	5	10	20	–	–
0.005°	0°00'10"	1	2	4	8	20	–
0.01°	0°00'30"	–	–	2	4	10	20
0.02°	0°01'	–	–	–	–	5	10
0.05°	0°05'	–	–	–	–	2	4
0.1°	0°05'	–	–	–	–	1	2
0.5°	0°30'	–	–	–	–	–	0.4
1.0°	1°	–	–	–	–	–	0.2

1.3.3 Distance-Coded Reference Marks

Linear Encoder	Max. Traverse for Recovery of the Datum	Parameter
No distance-coded reference marks	Depends on position of the encoder	P 45.* = none
LS 101C	10 mm	P 45.* = 1000
LS 107C LS 303C LS 403C LS 404C LS 603C LS 704C	20 mm	
ULS 300C	10 mm (grating period 10 µm) 20 mm (grating period 20 µm)	
LID 311C LID 351C	20 mm	P 45.* = 2000

Angle Encoder	Max. Rotation for Determination of the Absolute Position	Parameter
No distance-coded reference marks	1 rotation	P 45.* = none
ROD 250C (18000) RON 255C (18000) ROD 700C (18000) ROD 800C (18000)	20°	P 45.* = 1000
ROD 700C (36000) ROD 800C (36000)	10°	
ROD 700C (9000)	20°	P 45.* = 500

1.4 Parameter Description

1.4.1 User Parameters

Radius/ Diameter

With this parameter you can select radius or diameter display for linear axes.
If you select diameter, the symbol "Ø" will appear behind the display value.

Angle Format

The display for a rotary axis can be switched between degrees decimal and degrees/minutes/seconds.

Scaling Factor

With the scaling factor you can enter a correction to the workpiece to be machined. The correction range is (0.100000 to 9.999999). A scaling factor greater than 1 will enlarge the workpiece, while a scaling factor less than 1 will reduce it. You can enter a separate scaling factor for each axis.

Scaling Factor OFF/ON

By entering scaling factor OFF, all scaling factors are deactivated. When scaling factor ON is entered, the symbol "!" appears behind the display value.

Ball Tip Diameter (Probing)

In the probing edge operating mode the position value must be corrected by the radius of the ball tip.
The entry range for the ball tip diameter of the edge finder is 0 to 199.999 mm.

Tool Diameter

The tool diameter can be entered in the user parameters and in the operating mode PROGO (single block, automatic and teach-in). The tool diameter value last entered becomes effective automatically whenever radius compensation is entered.

Baud Rate RS-232-C

With this parameter you can set the data transfer rate (baud rate) for the data interface (see section 2.3).

Line Feeds RS-232-C

With this parameter you can set the number of additional line feeds (blank lines) between values for an external device (maximum of 99 line feeds).

Special Case: Mode of Operation

This parameter is not configured as a user parameter in the factory presetting. With the Mode of Operation parameter you can choose among the BASIC, EXPERT and PROGO modes of operation via the MOD key without switching the unit off.

The Mode of Operation user parameter is only active if operating parameter P 9.0 is configured as a user parameter (see section 1.4.2).

1.4.2 Operating Parameters P

In the following description, **axis-specific parameters** are indicated by a parameter number with decimal point and asterisk (example: P 1.*).

The asterisk signifies the axis-specific designation after the decimal point (e.g. P 1.1, P 1.2 etc.).

Parameters which are **not axis-specific** are indicated by a **0** behind the decimal point (e.g. P 5.0).

P 1.* to P 9.0

The "User Parameters" menu is configured by entering positions in the operating parameters P 1.* to P 9.0. The user parameters can be configured in any desired sequence within the positions 1–14. Position: 0 locks the respective parameter from access via the MOD key (see section 1.2.2).

Special Case: Parameter 9.0 Mode of Operation

In order to prevent an inexperienced operator from making mistakes, the mode selection (BASIC, EXPERT, PROGO) should be made accessible immediately after switch-on and then remain unchangeable during machine operation. The parameter P 9.0 is therefore not active as a user parameter **(position = 0).** If parameter P 9.0 is configured as a user parameter, the operating mode can be selected both before and during machining.

With parameters P 1.* to P 8.0 as user parameters, all 14 freely selectable field positions are occupied. If you wish to define parameter P 9.0 as a user parameter, you must overwrite an already occupied user parameter (e.g. parameter 8.0 Line Feed).

P 21.* to P 28.0

User parameters can also be set in the operating parameters (P 21.1 to P 28.0), making it possible to change even locked user parameters. Changing these parameters is effective regardless of whether they are changed in the "User Parameters" or in the "Operating Parameters" menu. (For description, see section 1.4.1.)

P 40.* Counting Direction

With parameter P 40.* you can set the counting direction separately for each axis.

P 41.* Signal Period

The signal period of the connected encoder must be entered in parameter P 41.*.
If linear axis movement is measured using a rotary encoder with nut and spindle, the signal period must be calculated with the following formula:

$$\text{Signal Period [µm]} = \frac{\text{Spindle Pitch [mm]} \cdot 1000}{\text{Line Count}}$$

Line count (P 42.*) and angle subdivision (P 44.*) are necessary only for rotary axes. For linear axes whose traverse is measured via rotary encoders with nut and spindle, the axis must be defined as a linear axis in parameter P 48.*.

P 42.*
Line Count

The line counts of rotary encoders connected to rotary axes must be entered in parameter P 42.*.

P 43.*
Linear Subdivision

The subdivision factor is entered in parameter P 43.*. The subdivision factor determines the display step and depends on the setting of the signal period (see Table 1.3.1).

P 44.*
Angle Subdivision

The angle subdivision determines the display step for rotary axes and depends on the line count setting (see Table 1.3.2).

P 45.*
Distance Coding

Parameter P 45.* defines whether the display unit is to evaluate signals from encoders with single or with distance-coded reference marks. For encoders with single reference marks enter **none** in parameter P 45.*. For distance-coded reference marks the entry value depends on the encoder model (see Table 1.3.3).

P 46.*
Monitoring

With parameter P 46.* **on**, the corresponding encoder input signal is checked for the following errors:

- excessive traversing speed
- cable break
- measuring signal error

These errors are then indicated in the visual display.

P 47.*
Linear Correction

Machine error can be measured with the aid of a comparator measuring system (e.g. VM 101 from HEIDENHAIN). These errors can be entered in parameter P 47.* as a linear correction factor in parts per million (ppm) measuring length.

Example: Measuring length 620 mm

Value actually measured (e.g. via VM 101) 619.876 mm

Difference = – 124 µm

Conversion to 1 m measuring length

$$\frac{-124\ \mu m \cdot 1000\ mm}{620\ mm} = -200\ \mu m$$

Correction factor – 200 µm

Linear Compensation	Parameter Input Range
"Lengthening" the encoder	P47: 0 to + 99999 [µm/m]
"Shortening" the encoder	P47: 0 to – 99999 [µm/m]

P 48.*
Axis Definition

Parameter P 48.* defines whether the axis input is inhibited (**off**) or the axis functions as a linear or rotary axis.

For unused encoder inputs enter **off** in parameter P 48.*.

P 49.*
Angle Counting Mode

Parameter P 49.* defines the way in which angular measurements are displayed.
Possible settings: **360°, ± 180°, ± ∞°**.

P 50.*
Axis Designation

Parameter P 50.* defines the assignment of axis names to inputs.
Possible settings: **A, B, C, U, V, W, X, Y, Z**.

P 51.0
Axis Combination

Parameter P 51.* permits the following settings:

off: no combination
1+4: Axes X1 and X4 added and displayed on axis X1
2+4: Axes X2 and X4 added and displayed on axis X2
3+4: Axes X3 and X4 added and displayed on axis X3
1–4: Axis X4 subtracted from X1, result displayed on axis X1
2–4: Axis X4 subtracted from X2, result displayed on axis X2
3–4: Axis X4 subtracted from X3, result displayed on axis X3

P 52.0
Dialog Language

The dialog language can be chosen from two available languages. Which two languages are available depends on the program number:

Program No.	Languages	
246060–	German	English
246061–	French	English
246062–	Dutch	English
246063–	Italian	English
246064–	Spanish	English
246065–	Danish	English
246066–	Swedish	English
246067–	Finnish	English
246068–	Turkish	English
246069–	German	French
246070–	Dutch	French

P 53.0
Bold Circle Plane

Parameter P 53.0 defines the working plane for the bolt hole circle function.
Possible settings: **X/Y, Y/Z, Z/X**

P 54.0 Mirror Graphics

Display of the bolt hole circle graphics can be set in parameter P 54.0 in the case that it deviates from the normal coordinate system.

off: no mirroring
ver: the vertical coordinate axis is mirrored
hor: the horizontal coordinate axis is mirrored
ve + ho: both coordinate axes are mirrored

When an axis is mirrored, the direction of rotation for hole numbering is changed in the graphics.

P 55.0 Direction of Rotation, Bolt Circle Graphics

Depending on the setting of parameter P 54.0, parameter P 55.0 defines the direction of rotation of the holes in the bolt hole circle graphics.

normal: direction of rotation (in the graphics) is from the first to the second axis.
inverted: direction of rotation (in the graphics) is from the second to the first axis.

P 56.* Zero Range

Parameter P 56.* defines a range around "zero" in which a zero crossover signal will be generated (see External Functions, section 4).
Input range: 0 to 99.999 mm.

P 57.0 Display Freeze

The current measured value is stored and output over the RS-232-C data interface with every storage procedure (CTRL, pulse, contact). The display on the **screen** can be set with parameter P 57.0:

off: the display is not stopped during a storage signal
concrnt: the display is stopped only for the duration of the storage signal
stopped: the display is stopped, but is updated by every storage signal

P 58.0 Distance-To-Go Mode

In the distance-to-go function, the actual value can be displayed instead of the graphic positioning aid.

bar: graphic positioning aid
actual value: display of the absolute position in small type beneath the distance-to-go display.

P 59.0 Sleep Delay

Parameter P 59.0 allows input of a delay time (in minutes) for protective standby mode. If no keys are pressed and no axis movements take place for the length of time entered as the delay time, the screen image is reversed. This prevents screen burning.

5 – 98: delay time in minutes
99: no protective standby mode.

P 99.0 Counter Application

With parameter P 99.0 the POSITIP 850 is set up either for milling or for turning.

2 RS-232-C/V.24 Data Interface

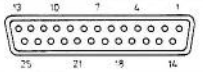
POSITIP is equipped with a data interface according to EIA standard RS-232-C (CCITT standard V.24).

2.1 Definition of the RS-232-C/V.24 Interface

The data transfer code is ASCII with even parity bit. The RS-232-C data interface is designed for serial data transfer; devices with parallel data interfaces cannot be connected. Levels for $\overline{\text{TXD}}$ and $\overline{\text{RXD}}$ (negative level for "1"):

Logic Level	Working Level
"1": – 3 V ... – 15 V	– 5 V ... – 15 V
"0": + 3 V ... + 15 V	+ 5 V ... + 15 V

2.2 Pin Layout/ Signal Description



RS-232-C/V.24 port

Contact No.	Signal	Meaning
1	CHASSIS GND	Protective Ground
2	$\overline{\text{TXD}}$*	Transmit Data
3	$\overline{\text{RXD}}$*	Receive Data
4	RTS	Request To Send
5	CTS	Clear To Send
6	DSR	Data Set Ready
7	SIGNAL GND	Signal Ground
8–19		(vacant)
20	DTR	Data Terminal Ready
21–25		(vacant)

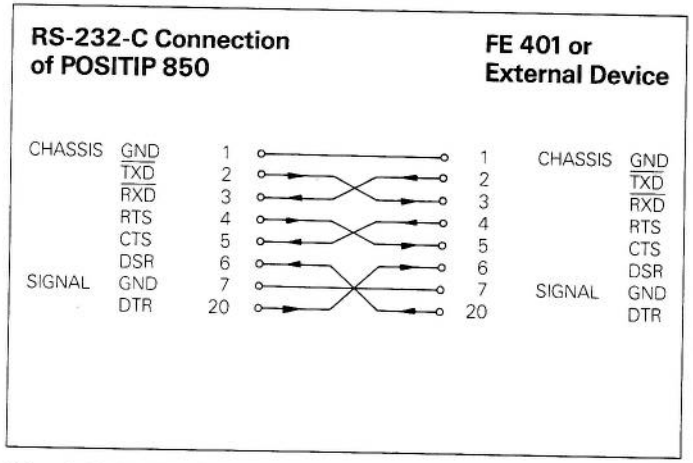
* The designations TXD, RXD indicate negative levels for "1".

2.3 Connection of External Units (Wiring)

The connecting cables must be wired in accordance with the type of data device employed. Pin layouts are sometimes non-standard.

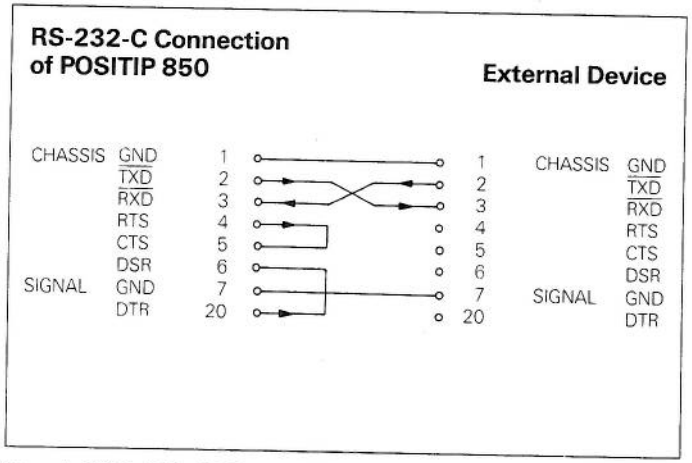
Frequently used wiring:

Complete wiring



Signals RTS, CTS, DSR and DTR must have working level "1" (+ 5 to + 15 V) for data transfer.

Simplified wiring



Signals RTS, CTS, DSR and DTR have permanent working level "1" (+5 V to +15 V) due to bridges 4/5 and 6/20.

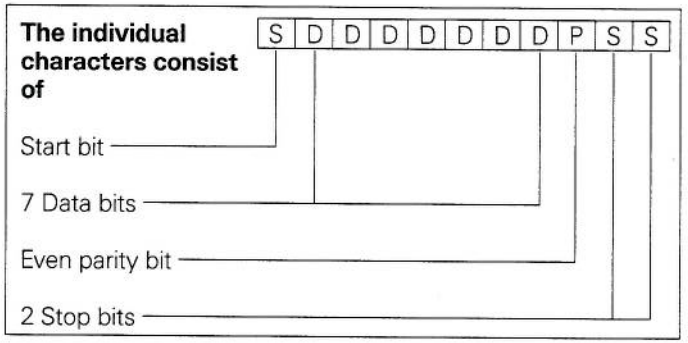
2.4 Data Transfer Rate (Baud Rate)

The baud rate indicates the number of bits which can be transferred per second.

Peripheral devices must be fully able to process the selected baud rate in order to avoid errors in data transfer. The desired baud rate is selectable under the user parameters (via the MOD key). The selected baud rate must be identical to the baud rate of the peripheral device.

In FE mode (for the FE 401 Floppy Disk Unit from HEIDENHAIN), the data transfer rate is always 9600 baud regardless of the baud rate set via the MOD key.

2.5 Data Format



The connected unit must be set to "even parity" because of the error monitoring employed in this output. A data transfer cable (Id.Nr. 242869..) is available from HEIDENHAIN.

3 Data Transfer

Measured values, part programs and operating parameters can transferred over the PT 850's RS-232-C data interface. The data interface can operate with two different data transfer protocols:

- External data transfer protocol (EXT) for printers, punching units, readers and other peripherals.
- FE data transfer protocol (FE) for the HEIDENHAIN FE 401 Floppy Disk Unit or a suitably adapted computer.

	Data Transfer Protocol	Start Data Transfer With
Measured value output	EXT	RS-232-C interface (CTRL B) Ext. functions (pulse, contact)
Program input	*FE or EXT	"EXTERNAL INPUT" menu
Program output	*FE or EXT	"EXTERNAL OUTPUT" menu
Input and output of operating parameters	*FE or EXT	"OPERATING PARAMETERS" menu

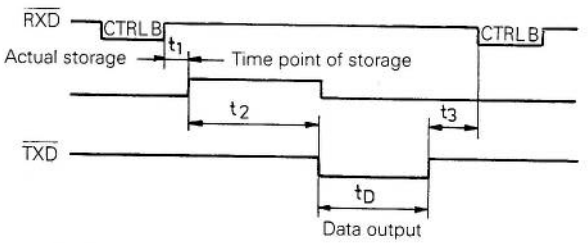
* Select FE or EXT protocol via the arrow keys in the corresponding menus.

3.1 Measured Value Output

The current display value can be transferred over the RS-232-C data interface to peripheral equipment such as a printer. After an external storage command, the measured value is output (for a maximum of 4 axes) through an internal buffer. The storage signal can be generated via the RS-232-C interface or via the "external functions".

3.1.1 Storage via RS-232-C Interface

When the control character CTRL B (= STX) is transmitted, a storage signal is generated and the measured value is transmitted over the TXD output of the RS-232-C data interface. The duration of data transfer depends on the selected baud rate, the number of axes and the number of line feeds.



$t_1 \leqq 0.5$ ms
$t_2 \leqq 30$ ms + (5 ms x N)
$t_3 \geqq 0$ ms

$$t_D = \frac{176 \times M + (L \times 11)}{\text{Baud rate}} \text{ s}$$

L = Number of line feeds
M = Number of axes
N = Number of rotary axes (degrees/min/sec)

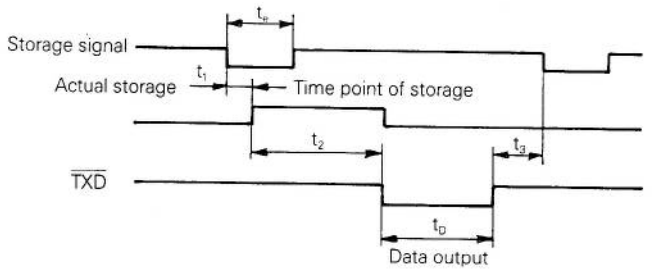
Interruption of Data Transfer

The receiving device can interrupt and restart data transfer by
- Start/stop via the $\overline{\text{RXD}}$ input of the data interface
  DC3 = X OFF = CTRL S: interrupt data transfer
  DC1 = X ON = CTRL Q: resume data transfer
- Control line CTS

After the stop signal CTS or the stop character DC3 has been received, no more than 2 additional characters can be output.

3.1.2 Storage via External Functions

Contact closing against 0 V on the 25-pole D-subminiature socket X41 causes a storage signal to be generated and the measured value to be transmitted over the TXD output of the RS-232-C interface. The time required for data transfer depends on the selected baud rate, the number of axes, the number of line feeds and the type of storage signal (pulse or contact).



$t_1 \leqq 0.8$ µs — Delay between storage signal and actual storage (pulse)

$t_1 \leqq 4.5$ ms — Delay between storage signal and actual storage (contact)

$t_e \geqq 1.2$ ms — Input signal (pulse)

$t_e \geqq 7$ ms — Input signal (contact)

$t_2 \leqq 30$ ms + (5 ms x N)

$t_3 \geqq 0$ ms

$$t_D = \frac{176 \times M + (L \times 11)}{\text{Baud rate}}\ \text{s}$$

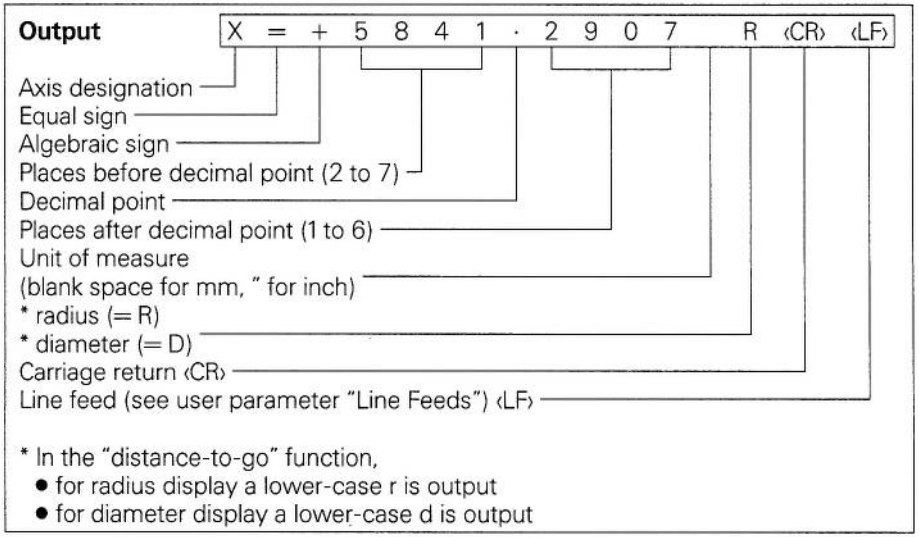
L = Number of line feeds
M = Number of axes
N = Number of rotary axes (degrees/min/sec)

The transit time of the encoder signals from input to the internal buffer is approximately 4 µs. The measured value which is stored is therefore the value which existed approximately 4 µs prior to the time point of storage.
(For description of the "External Functions", see section 4.)

3.1.3 Sequence of Character Output

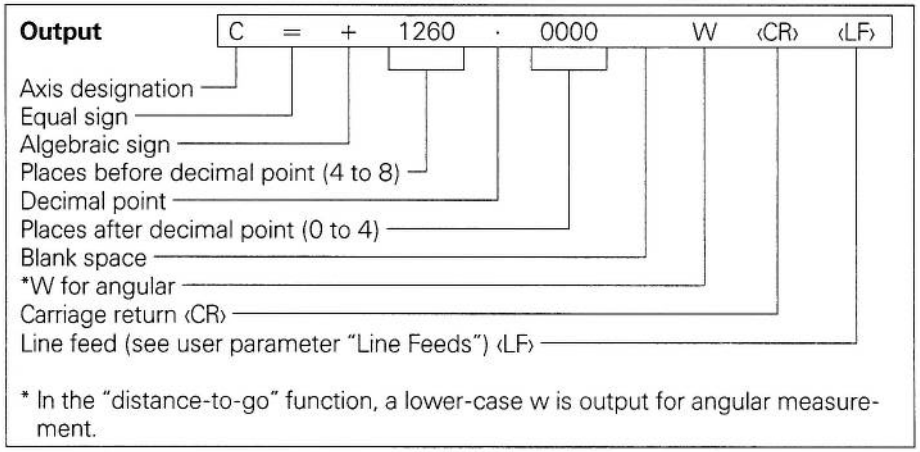
Depending on the axis definition, the characters for measured value output are generated in the following order:

Sequence of Character Output (example for linear axis)



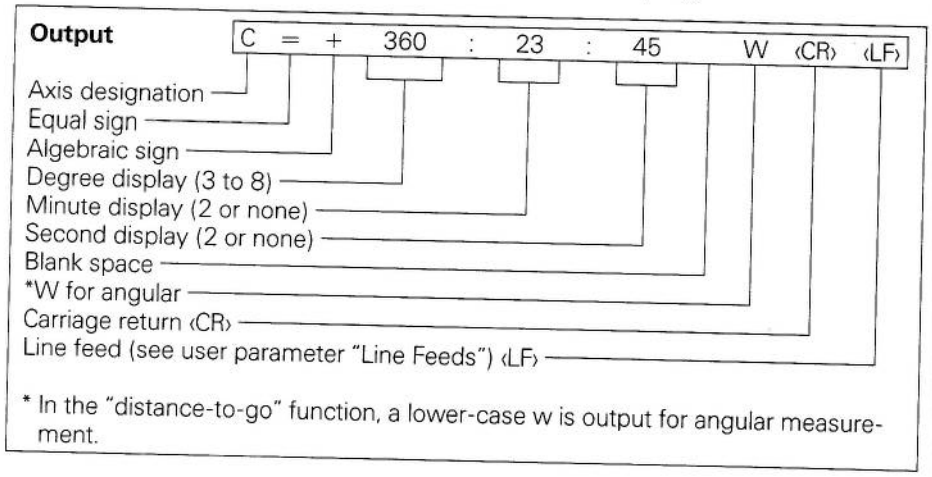
* In the "distance-to-go" function,
  - for radius display a lower-case r is output
  - for diameter display a lower-case d is output

Sequence of character output (example for rotary axis/degree decimal display)



* In the "distance-to-go" function, a lower-case w is output for angular measurement.

(Example for rotary axis/degree-minutes-seconds display)



* In the "distance-to-go" function, a lower-case w is output for angular measurement.

If the linear or angle encoder is defective, no display values are output. For the algebraic sign and the display value, question marks "**?**" are output.

3.2 External Input/ Output of Programs

In the PROGO mode of operation, it is possible to read programs into or out of POSITIP over the RS-232-C data interface (see Working with the POSITIP 850).

3.3 Input/Output of Operating Parameters

Operating parameters can be input and output over the RS-232-C data interface. Printers connected to the PT 850 must be equipped with a serial RS-232-C interface (for the data format see the Technical Description, section 2.5).

Programs and operating parameters with the same program number can be stored with the FE 401 Floppy Disk Unit from HEIDENHAIN. When loading operating parameters, POSITIP automatically generates program number 850 unless a different number is entered.

Sequence:

- Select operating parameter (see section 1.2)
- Select page 2 (menu for parameter input/output)
- Set interface to **FE** (FE 401 Floppy Disk Unit) or **EXT** (for printer or other peripheral device).

In FE mode, the data transfer rate is always 9600 baud, independent of the baud rate set via MOD. When EXT is selected, the baud rate set via MOD for printer output is effective.

- ▶ Param. Output — Operating parameters are read out with program number 850.
- ▶ Param. Input — Operating parameters with program number 850 are read in.

If you do not wish to input or output the operating parameters with program number 850, then the desired program number must be entered before pressing the "Param. Output" and "Param. Input" soft keys.

- ▶ FE 401 PGM Dir — Displays the program directory of the FE 401. During read-in of the directory, the dialog Reading FE Directory: is displayed.
- ▶ Escape — Data transfer is terminated.

4.1 Pin Layout X41 (EXT) (25-pole D-Subminiature Socket)

Pin	Assignment	Duration of pulse/ contact closing
1/10	0 V	
2	E Set axis 1 to zero	$t \geqq 100$ ms
3	E Set axis 2 to zero	$t \geqq 100$ ms
4	E Set axis 3 to zero	$t \geqq 100$ ms
5	E Set axis 4 to zero	$t \geqq 100$ ms
14	A Zero crossover axis 1	
15	A Zero crossover axis 2	
16	A Zero crossover axis 3	
17	A Zero crossover axis 4	
21	A EMERGENCY STOP	
22	E Storage pulse	$t \geqq 1.2$ µs
23	E Storage contact	$t \geqq 7$ ms

E = Input
A = Output

4.2 External Zero Reset

The inputs (pins 2, 3, 4, 5) are active LOW (open = high level).
$U_{eH} \geqq 3.9$ V (max. 15 V)
$U_{eL} \leqq 0.9$ V at $-I_{eL} \leqq 6$ mA
Switching via TTL components (e.g. SN 74LSXX) is made possible by an internal **1 kΩ** pull-up resistor. Contact closing against 0 V (pin 1 or 10) clears display of the corresponding axis.

External zero reset is only possible during display of actual position.

4.3 Storage (Pulse, Contact)

Contact closing against 0 V (pin 1 or 10) causes a storage signal to be generated and a measured value to be output over the RS-232-C data interface (see section 3.1.2).

4.4 Zero Crossover Signal

A zero crossover signal is produced when the display value of the corresponding axis is zero. A zero recognition range (0 to 99.999 mm) can be entered in parameter P 56.*. If the zero recognition range is moved over quickly, signal duration is approximately 180 ms.

Technical Data

Open-collector output
Zero crossover signal active HIGH (open-collector transistor inhibited).

Permissible Load Types

Resistive load
Inductive load only with quenching diode
High level output voltage $U_{oH} \leqq 32$ V
(32 V = absolute maximum value of the voltage applied over external resistor or relay)
Low level output voltage $U_{oL} \leqq 0.4$ V at $I_{oL} \leqq 100$ mA
Low level output current $I_{oL} \leqq 100$ mA
(100 mA = absolute maximum value)
Signal triggering delay $t_{an} = 60 \pm 20$ ms
Signal duration $t_s = 180$ ms

4.5 EMERGENCY STOP Signal

If a critical error occurs within POSITIP, the EMERGENCY STOP signal is sent over an open-collector output.

Technical Data

Open-collector output
EMERGENCY STOP signal active HIGH (open-collector transistor inhibited).

Permissible Load Types

Resistive load
Inductive load only with quenching diode
High level output voltage $U_{oH} \leqq 32$ V
(32 V = absolute maximum value of the voltage applied over external resistor or relay)
Low level output voltage $U_{oL} \leqq 0.4$ V at $I_{oL} \leqq 100$ mA
Low level output current $I_{oL} \leqq 100$ mA
(100 mA = absolute maximum value)
Signal triggering delay $t_{an} \leqq 50$ ms

5 Linear and Angle Encoders

All HEIDENHAIN linear encoders with sinusoidal scanning signals and single or distance-coded reference marks can be connected to POSITIP.

Possible signal periods for linear encoders:

4, 10, 20, 40, 100 and 200 µm

Possible line counts for rotary and angle encoders:

1800, 3600, 9000, 18000, 36000 and 72000

The display step is adjusted to the signal period of the connected linear encoder via parameter P 43.* Subdivision. For rotary axes the display step is adjusted to the line count of the connected rotary/angle encoder via parameter P 44.* Angle Subdivision (see section 1.4).

5.1 Layout of Encoder Flange Sockets X1 – X4

Contact Designation	3	4	1	2	5	6	7	8	9
	+	–	+	–	+	–	+	–	
Assignment	Lamp U_L		Measuring signal I_{e1} (0° el.)		Measuring signal I_{e2} (90° el.)		Reference signal I_{e0}		Shielding

6 Connection of Probe Systems

The PT 850 has been factory-prepared for connection of the HEIDENHAIN KT 110 2D-Edge Finder and the TS 120 3D-Probe System. In the EXPERT and PROGO modes of operation, the PT 850 can utilize its software for evaluation of the scanning signals. Select the PROBE menu with the function "Probe". The HELP key calls up the appropriate HELP screens with information and guidance on using this menu.

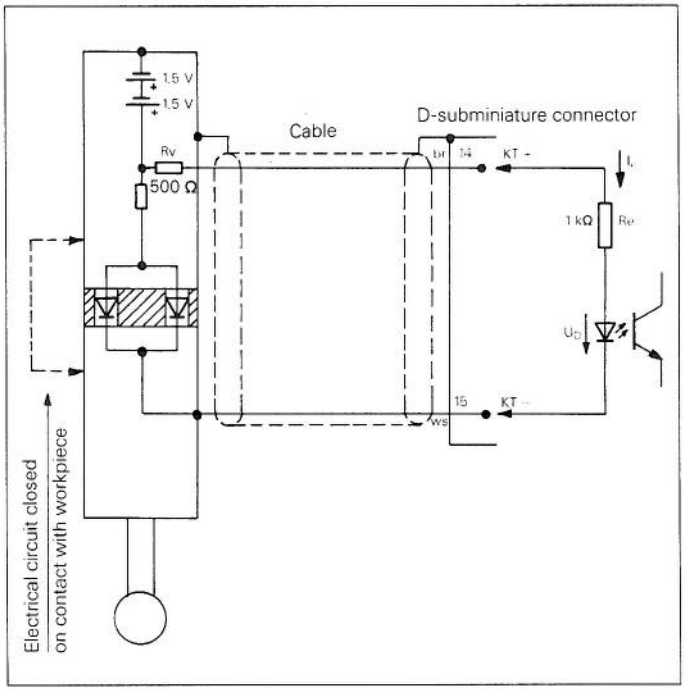
KT 110 Edge Finder

The KT 110 2D-Edge Finder is used for probing electrically conductive materials. The KT 110 is inserted into a 20 mm collet. Connection is via the X10 D-subminiature socket on the rear panel of the PT 850.

Technical Data KT 110

Minimum duration of scanning signal: $t \geqq 5$ µs
Interval between two probes: $t \geqq 100$ ms
For a complete technical description, please refer to the operating instructions for the KT 110.

Basic Circuit Diagram



Output voltage of edge finder: $U_{KT} = 3$ V
Input current (assumed value): $I_e = 1$ mA
On-state voltage at optocoupler
(assumed value): $U_D = 1.5$ V

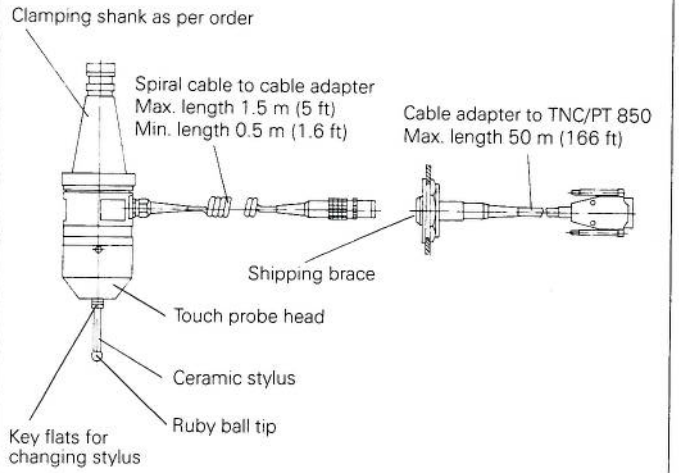
TS 120 Touch Probe System

The TS 120 Triggering 3D Touch Probe System for HEIDENHAIN controls can be connected via a cable adapter to the X 10 D-subminiature socket on the rear of the unit. The material of the workpiece to be scanned must be electrically non-conducting. The stylus can deflect in the directions ± X, ± Y, and –Z. Upon stylus deflection, the TS 120 generates two triggering signals for differential line transmission.

Technical Data TS 120

The stylus can be deflected beyond the triggering point:
The maximum stylus deflection in both X/Y direction and in Z direction is 20 mm (when the standard 47 mm stylus is used).
Various stylus lengths available
Various ball diameters available
Triggering signals: TTL square-wave pulses
For a complete technical description, please refer to the TS 120 operating instructions.

TS 120 Touch Probe Head



6.1 Pin Layout X10 (15-pole D-Subminiature Socket)

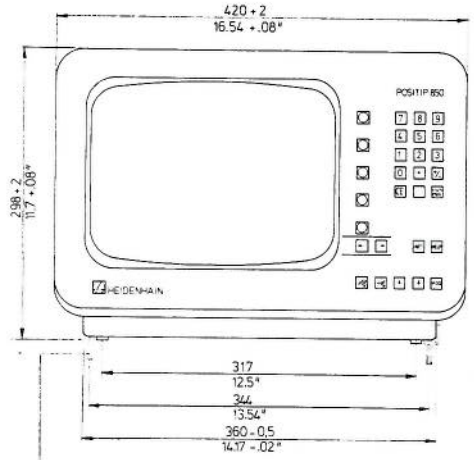
Pin	Assignment	Probe System
1	Internal shield	KT 110/TS 120
3	Standby signal	TS 120
5	+ 15 V	TS 120
6	+ 5 V	TS 120
8	0 V	KT 110/TS 120
9	Triggering signal	TS 120
10	Triggering signal	TS 120
14	KT +	KT 110
15	KT –	KT 110

Mechanical Data	
Housing	Tabletop model, sheet metal chassis; Dimensions (W x H x D) 420 mm x 298 mm x 330 mm (16.5 in. x 11.7 in. x 13.0 in.)
Weight	Approx. 11.7 kg (25.7 lb)
Operating Temperature	0 to 45° C (32 to 113° F)
Storage Temperature	– 30 to 70° C (– 22 to 158° F)
Visual Display	12-inch monochrome CRT
Electrical Data	
Power Supply	Variable-voltage switch mode power supply 100 V – 240 V (– 15 to + 10%) Line frequency 48 to 62 Hz
Power Consumption	Approx. 31 W
Encoder Inputs	For all HEIDENHAIN linear encoders with sinusoidal scanning signals, also with distance-coded reference marks
Signal Amplitudes	7 to 16 μA_{PP}
Permissible Input Frequency	Max. 100 kHz
Data Interface	RS-232-C/V.24, for measured values, programs and operating parameters 110/150/300/600/1200/2400/4800/9600/19 200/38 400 baud

Features	
Axes	Number: 4 Axes Choice of axis designations: A B C U V W X Y Z Combinations: X1 ± X4 or X2 ± X4 or X3 ± X4
Display Step/ Signal Period	(see Technical Description, tables 1.3.1 and 1.3.2)
Modes of Operation	BASIC, EXPERT, PROGO
Program Memory	20 different programs or 2000 program blocks
Datum Points	Five independent datum points, selectable as desired via keyboard
Reference Mark Evaluation	For linear encoders with one, several or distance-coded reference marks. After a power interruption the relationship between the encoder position and the display value is lost; this relationship is quickly and easily re-established by crossing the reference points.
Functions	• Tool radius compensation • Distance-To-Go display (traversing to display value 0) • Bolt-hole circle with graphics • Radius/Diameter display in 4 axes • Probe functions for datum acquisition (workpiece edge, centerline or circle center) • mm/inch display • Scaling factor in 4 axes (0.100000 to 9.999999) • Linear machine error compensation ± (0 to 99 999 µm/m)
Auxiliary Functions	• INFO: cutting data, pocket calculator functions, stopwatch • HELP: built-in operating instructions
External Functions	• Zero reset • Storage command • Signal output with display value of zero (zero recognition range: ± 99.999 mm)
Edge Finder	Connection of KT 110 (edge finder) or TS 120 (3D Touch Probe System) from HEIDENHAIN
Languages	2 languages can be selected (see section 1.4.2)

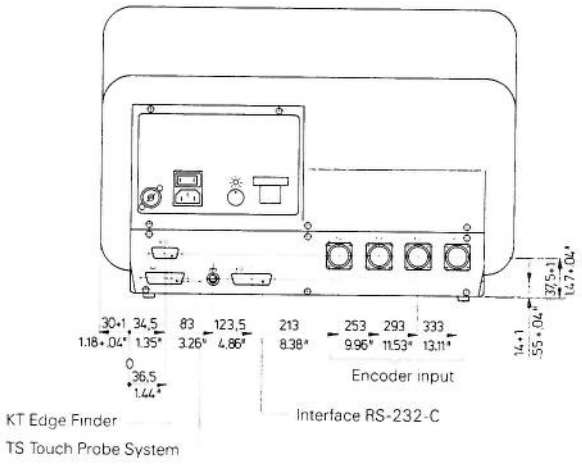
8 Dimensions
mm/inch

Front



Angle bracket with threaded bolt M5 x 20

Rear



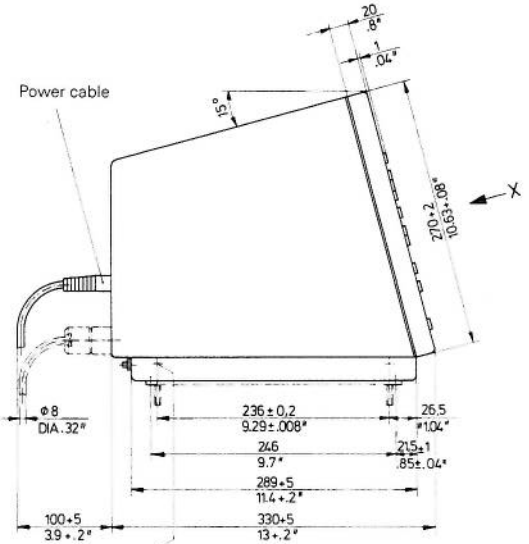
Encoder input

KT Edge Finder

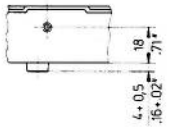
TS Touch Probe System

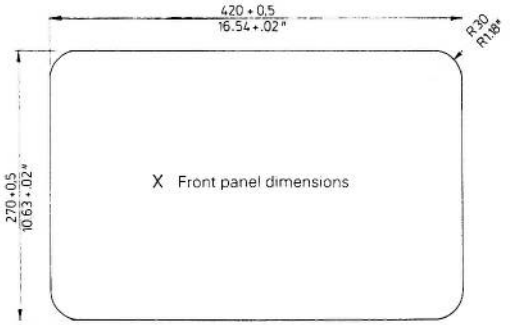
Interface RS-232-C

External functions only
with versions -2, -3



Mounting hole M4





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