HEIDENHAIN

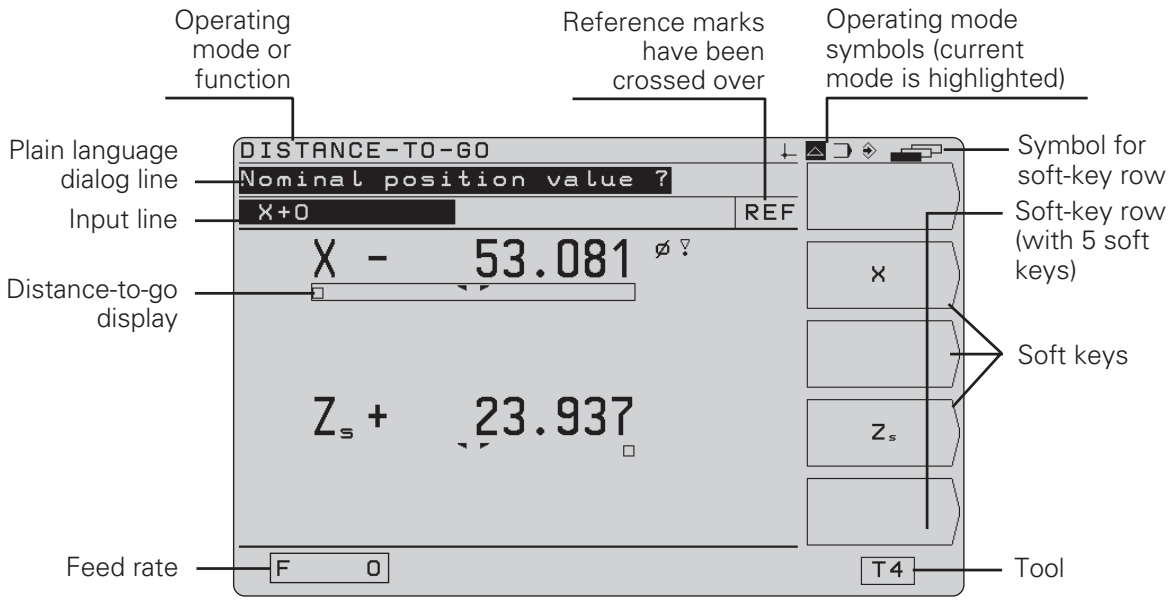
User's Manual

POSITIP 855

for Lathes

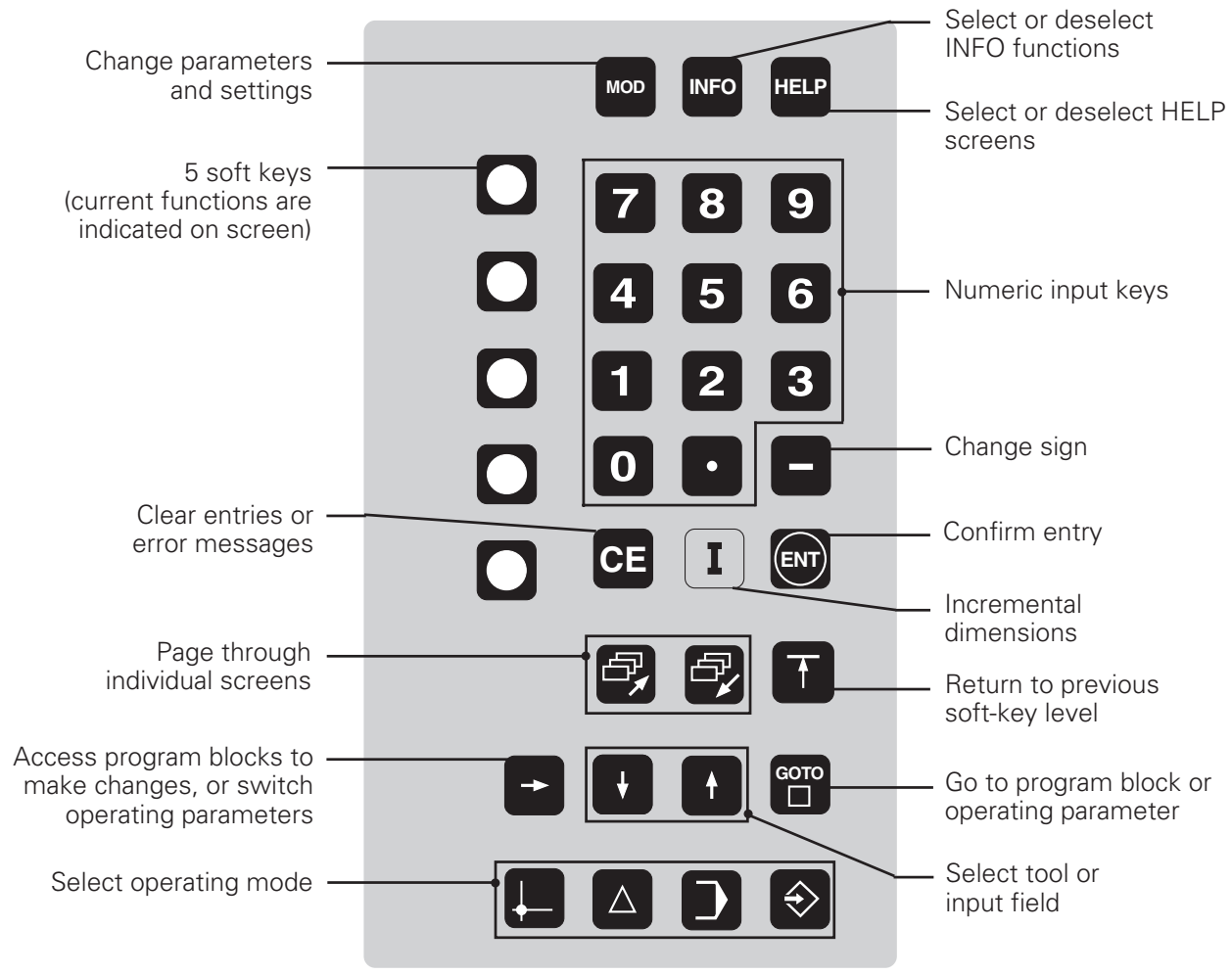
April 1996

Screen



Symbols
Behind the position display:
▽: Scaling factor or oversize active
Ø: Diameter display

Keyboard



Software version

This User's Manual is for POSITIP 855 models with the following software version:

Progr. 246 xxx **03**.

The x's can be any numbers. The software version of your unit is shown on a label on the rear panel.

This User 's Manual describes the POSITIP 855 for **turning**. A separate manual is available for **milling**.

Usage

This unit corresponds to class A in accordance with EN 55022 and will be used predominantly in industrially zoned areas

About this manual

This manual is divided into two parts:

- Part I: Operating Instructions .... starts on **page 5**
- Part II: Technical Information ..... starts on **page 57**

Operating Instructions

When using the POSITIP 855 in your work, you need only refer to the Operating Instructions (**Part I**).

If you're a **beginner** with POSITIP, you can use the operating instructions as a step-by-step workbook. This part begins with a short introduction to the basics of coordinate systems and position feedback, and provides an overview of the available features. Each feature is explained in detail, using an example which you can immediately try out on the machine — so you won't get "lost" too deeply in the theory. As a beginner you should work through all the examples presented.

If you're already an **expert** POSITIP user, you can use the operating instructions as a comprehensive review and reference guide. The clear layout and the subject index make it easy to find the desired topics.

Technical Information

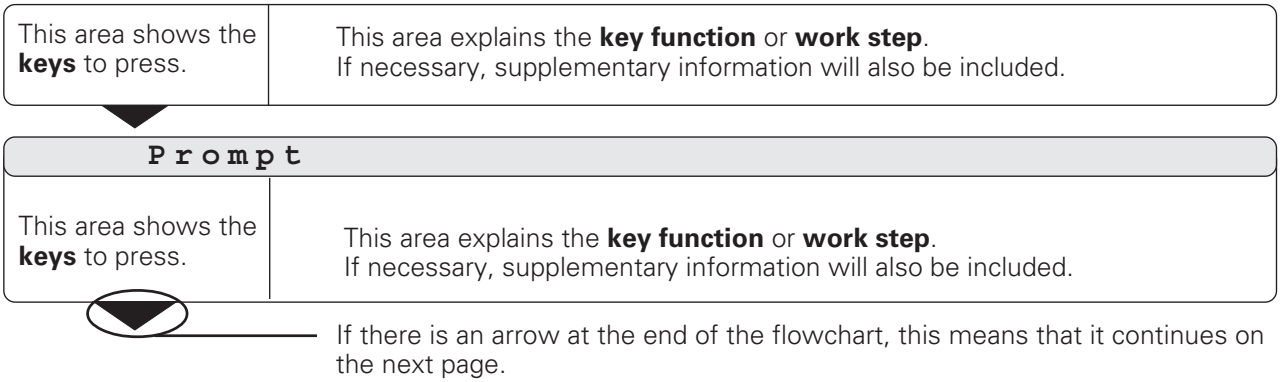
If you are interfacing the POSITIP 855 to a machine or wish to use the data interfaces, refer to the technical information in **Part II**.

Subject Index

A subject index for both parts of this manual starts on page 86.

Dialog flowcharts

Dialog flowcharts are used for each example in this manual.
They are laid out as follows:



If there is an arrow at the end of the flowchart, this means that it continues on the next page.

A **prompt** appears with some actions (not always) at the top of the screen. In the flowcharts the prompts always have a gray background.

If two flowcharts are divided by a **broken line**, this means that you can follow the instructions either above or below the broken line.

Some flowcharts also show the screen that will appear after you press the proper keys.

Abbreviated flowcharts

Abbreviated flowcharts supplement the examples and explanations. An arrow (⇒) indicates a new input or a work step.

Special Notes in This Manual

Especially important information is shown as a separate note in a gray box. Pay special attention to these notes. Ignoring them would prevent effective use of the control, or even result in damage to the tool or workpiece.

Symbols in the gray boxes

The symbols in the left of the gray boxes indicate the nature of the provided information.

General information
for example on the machine tool.function

Information for the machine tool builder
for example that he must implement a certain function

Essential information
for example that a certain tool is needed for the described function

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I - 1
Fundamentals of Positioning

You can skip this chapter if you are already familiar with the concepts of coordinate systems, incremental and absolute dimensions, nominal and actual positions, and distance-to-go.

Introduction

The geometry of a workpiece is described by a rectangular or *Cartesian* coordinate system (named in honor of the French mathematician and philosopher René Descartes, in Latin Renatus Cartesius, 1596 to 1650). The Cartesian coordinate system consists of three mutually perpendicular axes X, Y and Z. The point of intersection of these axes is called the datum (or origin) of the coordinate system.

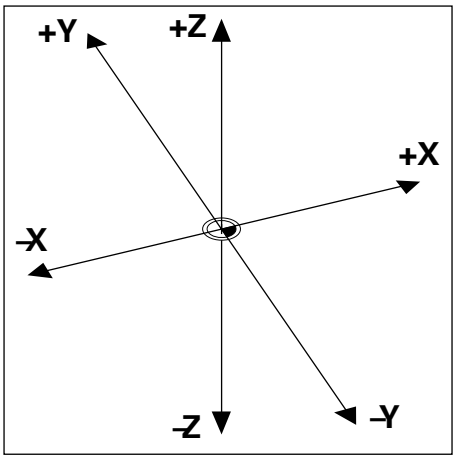


Fig. 1: The Cartesian coordinate system

To determine positions on a workpiece, the coordinate system is "laid" onto the workpiece. With lathe work (i.e., rotationally symmetrical workpieces), the Z axis move along the axis of rotation while the X axis moves in the direction of the radius or diameter. The Y axis can be disregarded since it would always have the same values as the X axis.

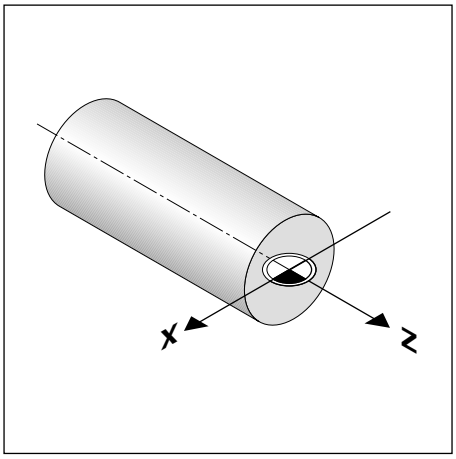


Fig. 2: The Cartesian coordinate system with lathe work

Cross slide, saddle and top slide

On conventional lathes, the tool is mounted on a slide that moves in the direction of the X axis (the cross slide) and in the direction of the Z axis (the saddle).

Most lathes have a top slide above the saddle. The top slide moves in Z axis direction and is designated Z_O.

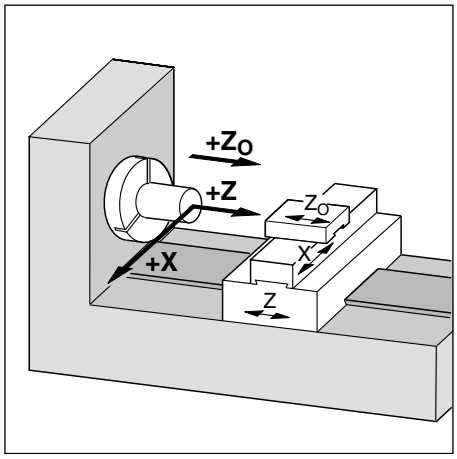


Fig. 3: Axes of movement on a lathe

Datum setting

The workpiece drawing normally specifies the workpiece face as the "absolute" datum, and indicates the axis of rotation. The datum setting procedure assigns the origin of the absolute coordinate system to this datum.

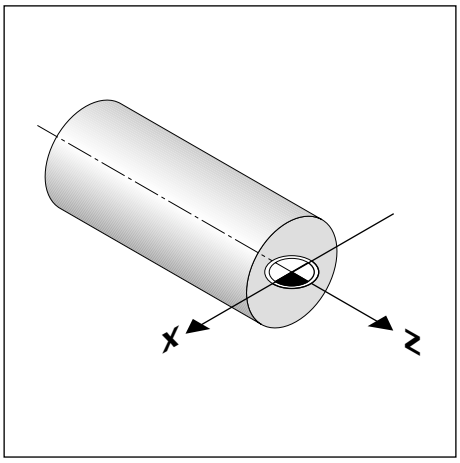


Fig. 4: The origin of the Cartesian coordinate system is the workpiece datum

Determining and entering tool data

Your POSITIP display unit should show you the absolute position of the workpiece regardless of the length and shape of the particular tool being used. For this reason you must determine the tool data (tool preset) and enter them. First touch the workpiece with the cutting edge of the tool and then enter the associated display value for that position.

You can enter tool data for up to 99 tools. When you have set the datum for a new workpiece, all tool data are referenced to the new workpiece datum.

See examples starting on page 19.

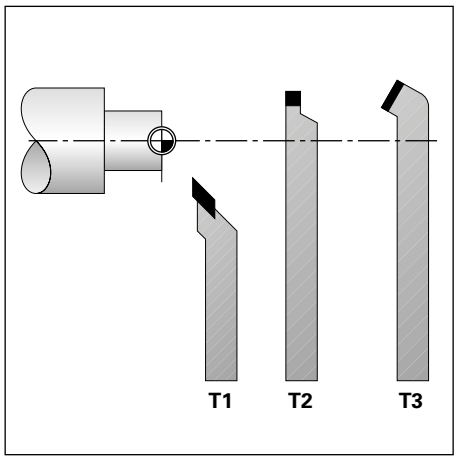


Fig. 5: These tools have different tool data

Nominal position, actual position and distance-to-go

The positions to which the tool is to move are called the **nominal** positions, while the position at which the tool is actually located at any given moment is called the **actual** position (see Figure 6). The distance from the nominal position to the actual position is called the **distance-to-go**.

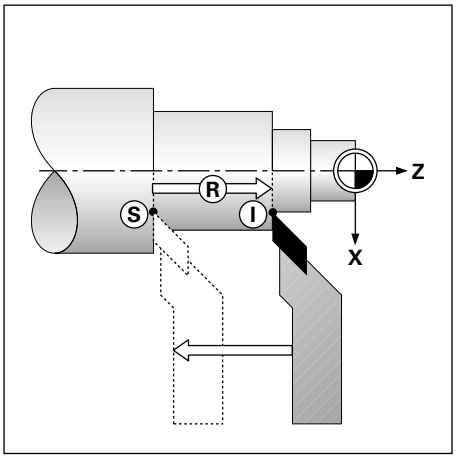


Fig. 6: Nominal position Ⓢ, actual position Ⓘ and distance-to-go Ⓡ

Sign for distance-to-go

The distance-to-go carries a **positive** sign when the path from the actual to the nominal position is in the negative axis direction.
The distance-to-go carries a **negative** sign when the path from the actual to the nominal position is in the positive axis direction.

Absolute workpiece positions

Each position on the workpiece is uniquely defined by its absolute coordinates (see Figure 7).

Example: Absolute coordinates of position ①:
X = 5 mm
Z = –35 mm

Absolute coordinates of position ②:
X = 15 mm
Z = –65 mm

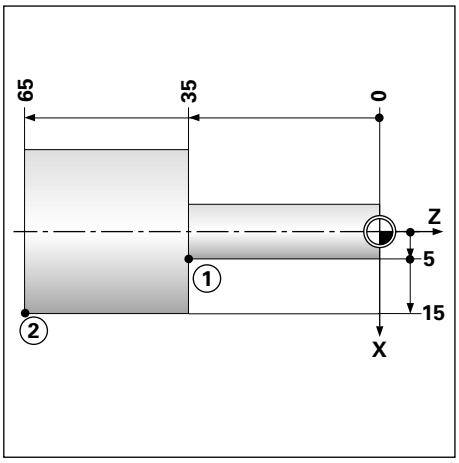


Fig. 7: Positions ① and ② are absolute workpiece positions

If you are working according to a workpiece drawing with absolute dimensions, you are moving the tool **to** the coordinates.

Incremental workpiece positions

A position can also be defined relative to the previous nominal position (see Figure 8). The datum for the dimension is then located at the previous nominal position. Such coordinates are termed **incremental coordinates** (increment = increase) or chain dimensions (since the position is defined by a chain of dimensions).

Incremental coordinates are identified by a preceding **I**.

Example: Incremental coordinates of position ③ referenced to position ①:
IX = 10 mm
IZ = 0 mm

Incremental coordinates of position ② referenced to position ③:
IZ = –30 mm

Incremental coordinates of position ② referenced to position ①:
IX = 10 mm
IZ = –30 mm

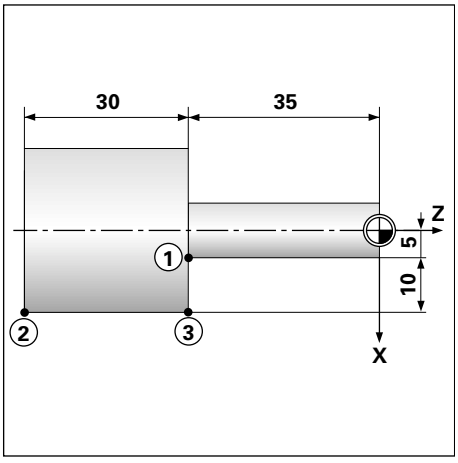


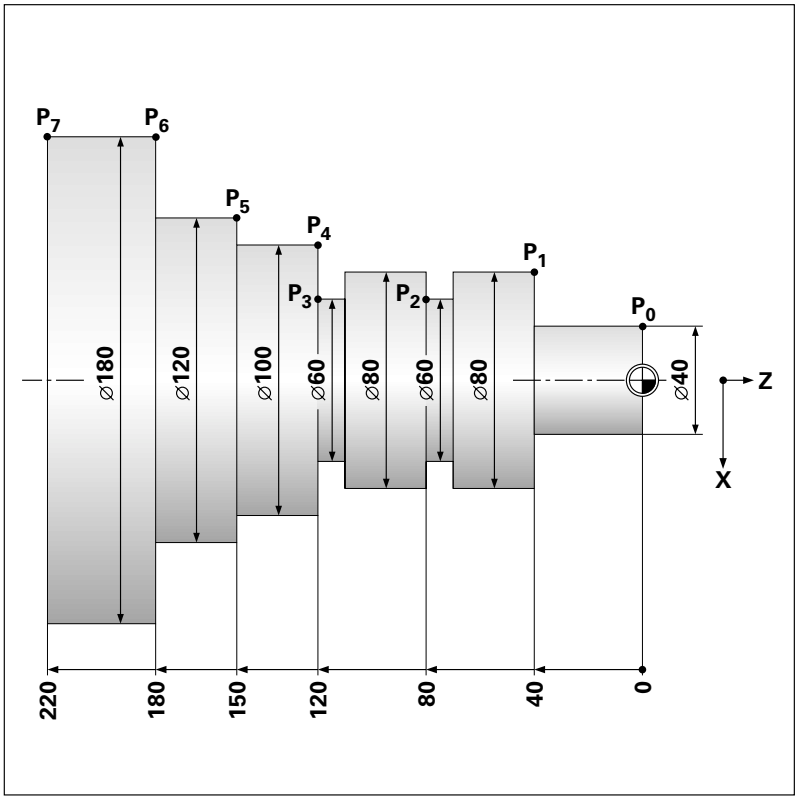
Fig. 8: Positions ① and ③ are ncremental workpiece positions

If you are working according to a workpiece drawing with incremental dimensions, you are moving the tool **by** the dimension.

Sign for incremental dimensioning

An incremental dimension has a **positive** sign when the axis is moved in the positive direction.
An incremental dimension has a **negative sign** when the axis is moved in the negative direction.

Example: Workpiece drawing with absolute dimensions (in accordance with ISO 129 standard)



A list of coordinates corresponding to this example is advantageous when you are working in the PROGRAMMING AND EDITING operating mode. The X-coordinate values are given as diameters.

Coordinates for	X⌀ [mm]	Z [mm]	Remarks
P0	40	0	Face
P1	80	– 40	
P2	60	– 80	Recess
P3	60	– 120	Recess
P4	100	– 120	
P5	120	– 150	
P6	180	– 180	
P7	180	– 220	

Position encoders

The position encoders convert the movements of the machine axes into electrical signals. POSITIP then evaluates these signals, determines the actual position of the machine axes, and displays the position as a numerical value.

If power is interrupted, the relationship between the machine axis positions and the calculated actual positions is lost. The reference marks on the position encoders and the reference mark evaluation feature (REF) enable POSITIP to re-establish this relationship again when the power is restored.

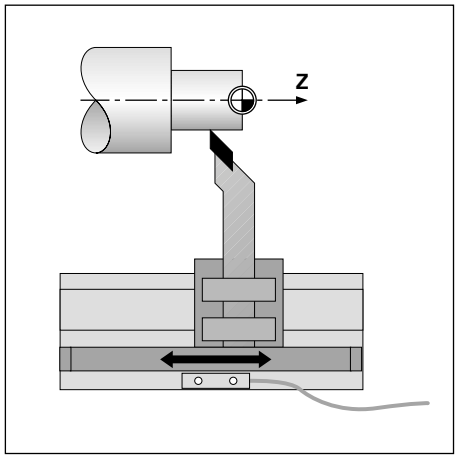


Fig. 9: Linear encoder, here for the Z axis

Reference marks

The scales of the position encoders contain one or several reference marks. When a reference mark is crossed over, a signal is generated identifying that position as a reference point (scale datum = machine datum).

When this reference mark is crossed over, the POSITIP's reference mark evaluation feature restores the relationship between axis slide positions and display values as you last defined it by setting the datum. If the linear encoders have **distance-coded** reference marks, you only need to move the machine axes a maximum of 20 mm to do this.

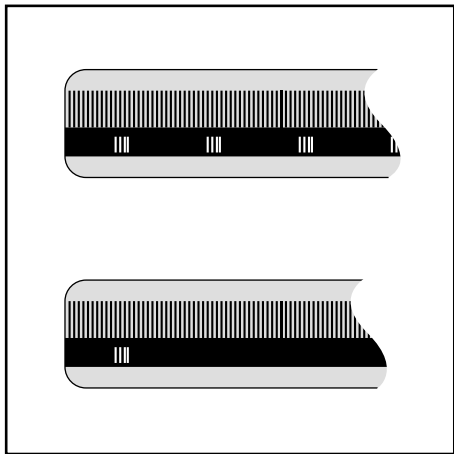


Fig. 10: Linear scales: with distance-coded reference marks (upper illustration) and one reference mark (lower llustration)

NOTES

I - 2
Working with POSITIP – First Steps

Before you start

You can **cross over the reference marks** after every switch-on. **REF** appears in the input line on the screen when all the reference marks have been crossed over. If you set a new datum, POSITIP automatically stores the new relationship between axis slide positions and display values.

Working without reference mark evaluation

You can also use POSITIP without crossing over the reference marks — simply press the soft key No REF.

Note that if you do **not** cross over the reference marks, a new datum point you set will not be stored. This means that after a power interruption the relationship between axis slide positions and display values **cannot be restored**.

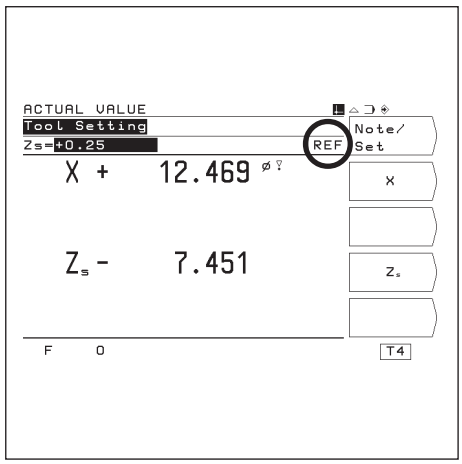
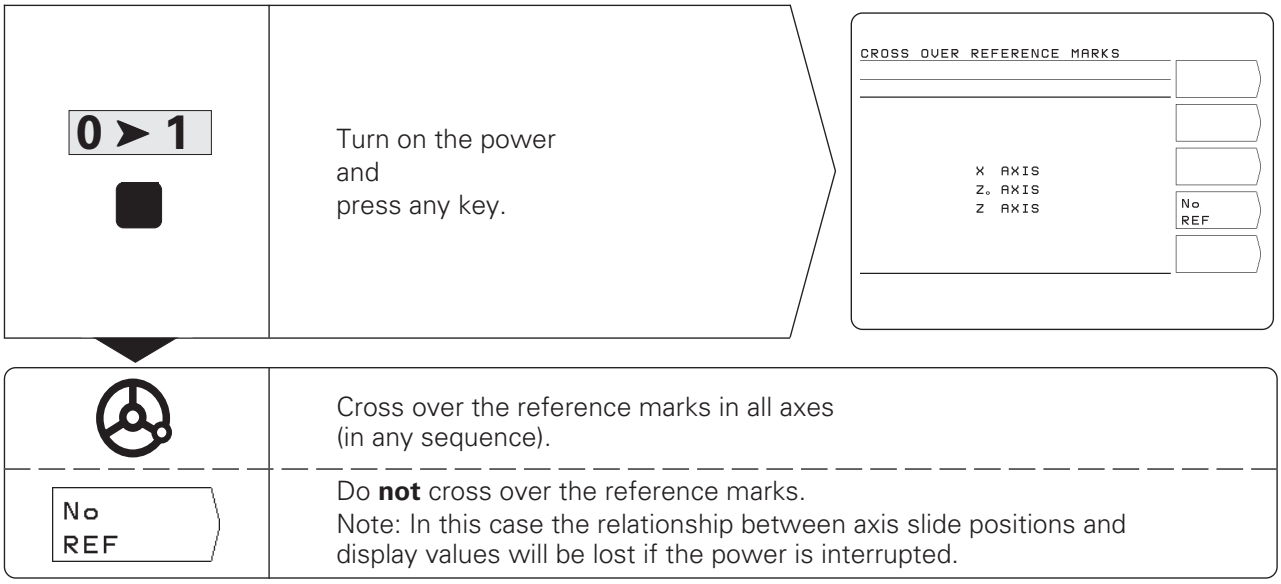


Fig. 11: REF display on screen

Switch-on



Your POSITIP is now ready for operation and is in the operating mode ACTUAL VALUE.

Operating Modes

The operating mode determines which functions are available to you.

Available functions	Mode	Key
Position display for basic machining tasks; Tool presetting; Datum setting	ACTUAL VALUE	
Distance-to-go display; Turning with oversize	DISTANCE-TO-GO	△
Storage of work steps for small-lot production	PROGRAMMING AND EDITING	
Run programs previously created in the PROGRAMMING AND EDITING mode	EXECUTE PROGRAM	

You can switch to another operating mode at **any time** by pressing the key for the desired mode.

The HELP, MOD and INFO functions

You can call the HELP, MOD and INFO functions at **any time**.

To **call** a function:

➤ Press the key for the desired function.

To **leave** a function:

➤ Press the same key again.

Available functions	Function name	Key
On-screen operating instructions: graphics and text keyed to the current screen contents	HELP	HELP
User parameters: To redefine POSITIP's basic operating characteristics	MOD	MOD
Taper calculator, stopwatch, pocket calculator	INFO	INFO

Selecting soft-key functions

The soft-key functions are grouped into one or more rows. The number of rows is indicated by a symbol at the upper right of the screen. If no symbol is shown, that means there is only one row for the function. The highlighted rectangle in the symbol indicates the current row being displayed.

Function	Key
Page forward through the soft-key rows	
Page backward through the soft-key rows	
Go back one level	

Whenever you press the key for an operating mode, POSITIP displays the soft keys with the main functions for that mode.

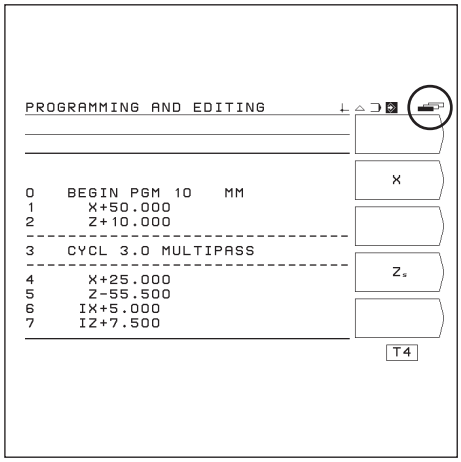


Fig. 12: The symbol for soft-key rows. Here, the first row is being displayed

On-screen operating instructions

The integrated operating instructions provide you with information and assistance in any situation.

To **call** the operating instructions:
- ➤ Press the HELP key.
- ➤ Use the paging keys if the explanation is spread over more than one screen page.

To **leave** the operating instructions:
- ➤ Press HELP again.

Example: On-screen operating instructions for NOTE/SET

The function NOTE/SET is described in this manual starting on page 21.

- ➤ Select NOTE/SET by pressing the soft key Note/Set in the operating mode ACTUAL VALUE.
- ➤ Press HELP.
  The first page of the operating instructions for NOTE/SET appears on the screen.

  Page reference at the lower right of the screen:
  The number in front of the slash is the current page; the number behind the slash is the total number of pages for this topic. The on-screen operating instructions now contain the following information on NOTE/SET:
  - General information on the function (page 1/2)
  - Sequence of entries (page 2/2)

To leave the operating instructions:
- ➤ Press HELP again.

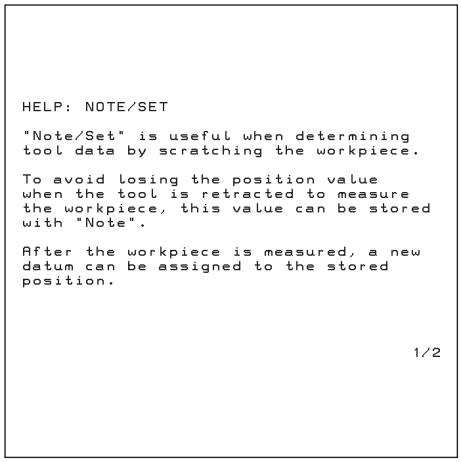


Fig. 13: On-screen operating instructions for NOTE/SET (page 1 of 2)

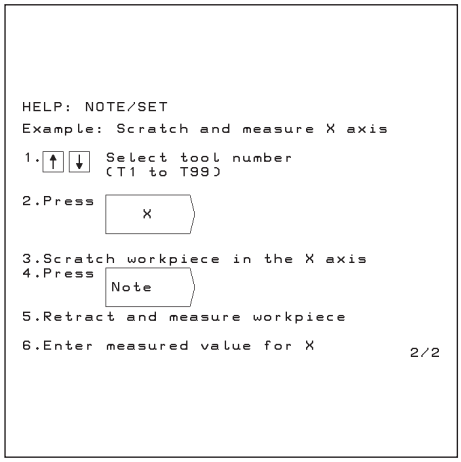


Fig. 14: On-screen operating instructions for NOTE/SET (page 2 of 2)

Error messages

If an error occurs while you are working with POSITIP, a message will come up on the screen in plain English.

To **call** an **explanation** of the error:

➤ Press the **HELP** key.

To **clear** the error message:

➤ Press the **CE** key.

Blinking error messages

W A R N I N G

Blinking error messages mean that the operational reliability of the POSITIP has been impaired.

If a blinking error message occurs:

➤ Note down the error message displayed on the screen.
➤ Switch off the power to the POSITIP.
➤ Attempt to correct the problem with the power off.
➤ If the blinking error message recurs, notify your customer service agency.

Selecting the unit of measurement

Positions can be displayed in millimeters or inches. If you choose inches, `inch` will be displayed at the top of the screen next to `REF`.

To **change** the unit of measurement:

➤ Press MOD.
➤ Page to the soft key row containing the user parameter `mm` or `inch`.
➤ Choose the soft key `mm` or `inch` to change to the other unit.
➤ Press MOD again.

For more information on user parameters, see Chapter I - 6.

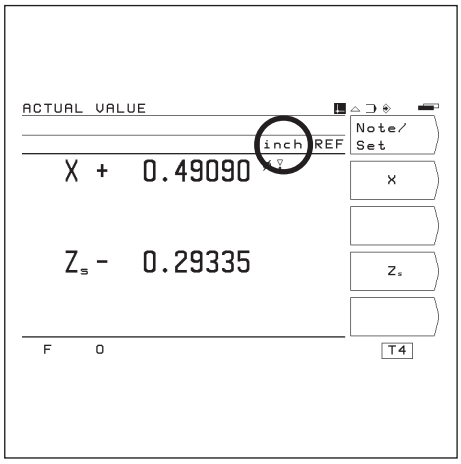


Fig. 15: The `inch` indicator

Selecting position display modes

Radius/diameter display

Drawings for lathe parts usually give diameter values. When you turn the part, however, you infeed the tool in radius values. POSITIP can display either the radius or the diameter for you.
When the diameter is being displayed, the diameter symbol (∅) is shown next to the position value.

Example: Radius display, position ① X = 20 mm
Diameter display, position ① X = 40∅ mm

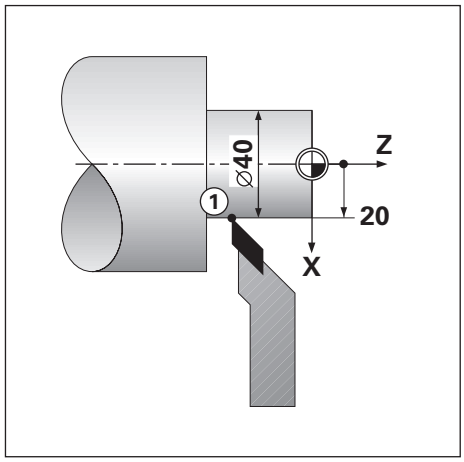


Fig. 16: Workpiece for radius/diameter display example

To switch over the display

- ➤ Press MOD.
- ➤ Page with the paging keys to the soft key row containing `Radius` or `Dia.`
- ➤ Press this soft key to switch from radius to diameter display or vice-versa.

Separate value/sum display

Separate value display
In this display mode the positions of the saddle and top slide are displayed separately. The position displays are referenced to the datum points which you set for the axes. When an axis slide moves, only the position display for that axis changes.
The top slide is identified with a small O, for example Z_O.

Sum display
In this mode the position values of the saddle and top slide are added together. The sum display shows the absolute position of the tool, referenced to the workpiece datum.
When the sum display mode is active, a small S is shown next to the axis designation, for example Z_S.

Example: Separate value (see Fig. 17): Z = +25.000 mm
Z_O = +15.000 mm
Sum display (see Fig. 17): Z_S = +40.000 mm

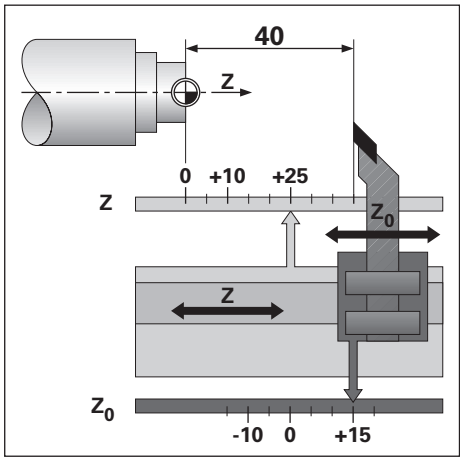


Fig. 17: Workpiece for separate value/sum display example

The sum display will show correct values only if the actual position values of both axis slides were correctly added and entered (with sign) when setting the datum for the "sum."

To switch over the display

- ➤ Press MOD.
- ➤ Page with the paging keys to the soft key row containing `Sum` or `Seprt`.
- ➤ Press this soft key to switch from separate value display to sum display or vice-versa.

Entering tool data and setting the datum

Before you can use a tool you must enter its **tool data** (cutting edge position). You can enter the data for up to 99 tools. A **workpiece datum** must also be entered before you can start machining. Normally the workpiece face (flat surface) is given the value Z = 0.

"Freezing" a position when turning the first diameter

If you want to measure the diameter of the workpiece after turning the first diameter, you can store ("freeze") the actual position before retracting the tool. This is done in the `ACTUAL VALUE` operating mode with the `Note/Set` function. See page 21 for an explanation of this function and an example.

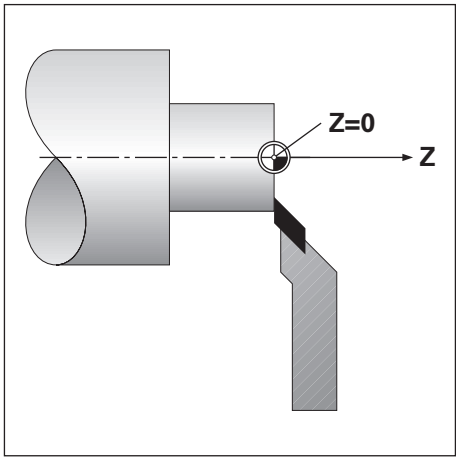
Tool table

When you preset tools, POSITIP automatically stores the tool data in a table. You can access the tool table with a user parameter. If you change values in the table, the position display will no longer show the values it displayed after tool presetting.

Selecting tools

The number of the current tool is shown in a small box at the lower right of the screen (next to the letter T). Use the vertical arrow keys to select another tool.

Example: Setting the workpiece datum (zero point)

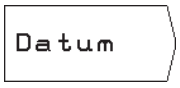
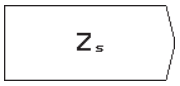


The datum is set to zero for the sum display of the Z axis. All tool data entered are automatically referenced to this datum.

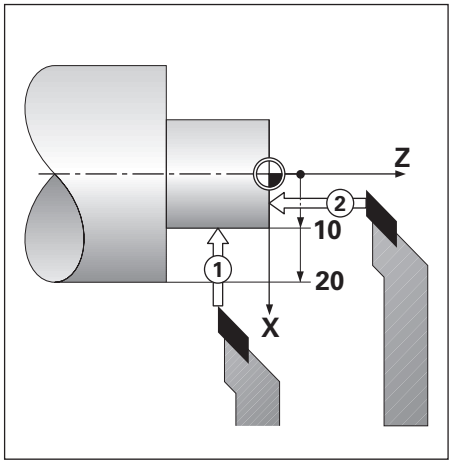
Preparation:

➤ Select the tool number (tool data) with the vertical arrow keys.

Operating mode: ACTUAL VALUE

	Machine the workpiece face. Leave the cutting edge of the tool at the face.
	Page to the function Datum.
	Select Datum.
	Select the axis (Z_S).
Datum Setting Z_S = +0	
	Set the datum (workpiece face) to the indicated value.
	Enter a value, for example 10. Confirm entry.

Example: Entering tool data when the workpiece diameter is known



Preparation:

➤ Select the tool number with the vertical arrow keys.

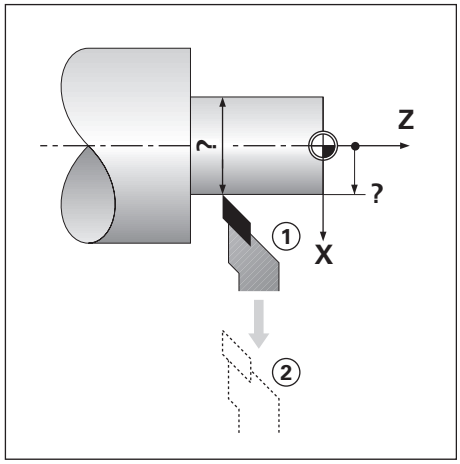
Operating mode: ACTUAL VALUE

	Turn the first diameter ① in the X axis.
X	Select the axis (X).
Tool Setting X = ...	
1 0 ENT	Enter the position of the tool tip, for example X = 10 mm. Confirm entry.
	Touch the workpiece face ② with the tool.
Z_S	Select the axis (Z_S).
Tool Setting Z_S = ...	
0 ENT	Set the position display for the tool tip to zero, Z_S = 0. Confirm entry.

POSITIP stores the tool data under the tool number in the tool table.

Set the tool data for all other tools as described here.

Example: Entering tool data when the workpiece diameter is unknown



Turn the first diameter and freeze the tool position with `Note`. Then retract the tool, measure the diameter and set the frozen position to the measured value.

The value to be entered will depend on whether you have selected radius or diameter display.

Preparation:

➤ Select the tool number with the vertical arrow keys.

Operating mode: `ACTUAL VALUE`

Note/ Set	Select `Note/Set`.
X	Select the axis, for example X.
Turn 1st diameter in X axis	
	Turn the first diameter in the X axis.
Note	Freeze the position.
	Retract, for example to position ②.
	Measure the workpiece.
Enter value for X + 0	
1 5 ENT	Enter the measured diameter or radius, for example 15 mm. Confirm entry.

POSITIP stores the tool data under the tool number in the tool table.

To cancel the Note/Set function

Press the soft key `Escape`.
You can cancel the function at any time.

Displaying and moving to positions

Distance-to-go

Although it is often sufficient to have POSITIP display the coordinates of the **actual position** of the tool, it is usually better to use the **distance-to-go** feature — this enables you to approach nominal positions simply by traversing to display value zero. Even when working with distance-to-go you can enter coordinates in absolute or **incremental dimensions**.

Graphic positioning aid

When you are traversing to display value zero, POSITIP displays a graphic positioning aid (see Figure 18).

The graphic positioning aid is located in a rectangle just below the display for the active axis. Two triangular marks in the center of the rectangle symbolize the nominal position you want to reach.

The small square symbolizes the axis slide. An arrow indicating the direction appears in the square while the axis is moving, so you can easily tell whether you are moving towards or away from the nominal position.

Note that the square does not begin to move until the axis slide is near the nominal position.

POSITIP can show the absolute position instead of the graphic positioning aid. You can switch between the two modes with operating parameter P 91 (see Chapter II - 2).

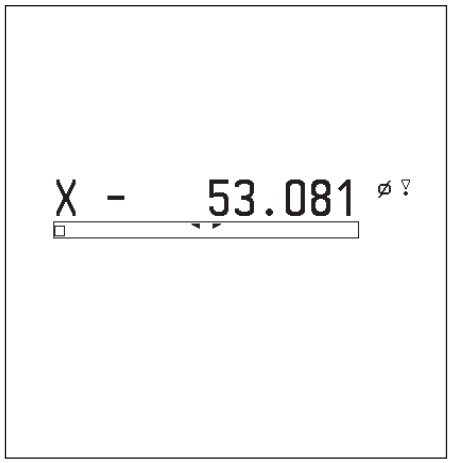


Fig. 18: The graphic positioning aid

Turning with oversizes

You enter oversizes in the user parameters (see Chapter I - 6). Oversizes are automatically taken into account in the distance-to-go mode. When the displayed distance-to-go is 0, only the finishing allowance remains to be machined.

When you have set the user parameter `Oversize On/Off` to `On`, a symbol for oversize (▽) appears behind the display value.

C A U T I O N

▽ will also appear if you've activated a scaling factor for the axis. If the symbol appears but you're not sure whether it indicates a scaling factor or an oversize, check the settings of the user parameters.

Entry values for oversize or undersize

Oversize: Positive entry value (up to 999.999 mm).
Undersize: Negative entry value (down to –999.999 mm).

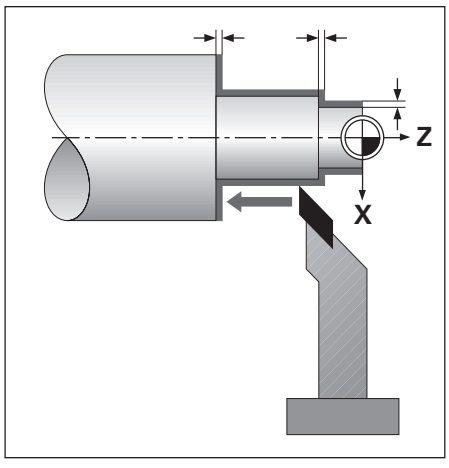


Fig. 29: Oversizes for X and Z

Entering oversizes

- ➤ Press MOD.
- ➤ Scroll to the user parameter `Oversize`.
- ➤ Press the soft key `Oversize X` (for example).
- ➤ Enter the desired oversize for the axis (including the sign).
- ➤ Press ENT.
  This returns you to the main menu for the user parameters.
- ➤ If desired, enter an oversize for the second axis.
- ➤ Switch the soft key `Ovrsize ON / OFF` to `ON`.
  This activates the oversizes you entered.
- ➤ Leave the user parameters:
  Press MOD.

The entered oversizes will now be taken into account when you traverse to display value zero with the distance-to-go display.

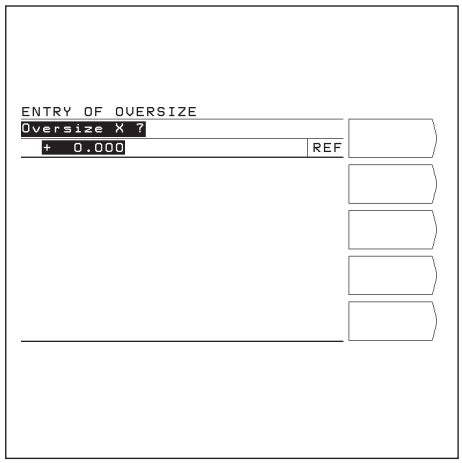


Fig. 20: Entering an oversize

To deactivate oversizes

When you want to work without oversizes again:

- ➤ Switch the soft key `Ovrsize ON / OFF` to `OFF`, **or** enter 0 for the oversize.

Example: Effect of an oversize in the X axis

1. Diameter display for X, position ①
   Position of the tool cutting edge:
   - without oversize: $X^{\varnothing}$ = +40.000 mm
   - with oversize (+2.000 mm): $X^{\varnothing}$ = +44.000 mm
   - with undersize (–2.000 mm): $X^{\varnothing}$ = +36.000 mm
2. Radius display for X, position ②
   Position of the tool cutting edge:
   - without oversize: X = +50.000 mm
   - with oversize (+2.000 mm): X = +52.000 mm
   - with undersize (–2.000 mm): X = +48.000 mm

C A U T I O N
When the soft key `Ovrsize ON / OFF` is set to `ON` oversizes will be effective on **every position** which you move to with `DISTANCE-TO-GO`.

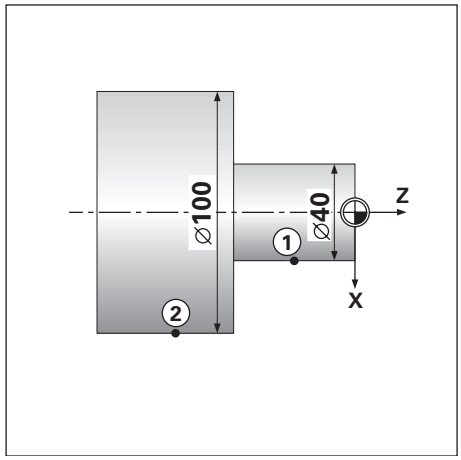
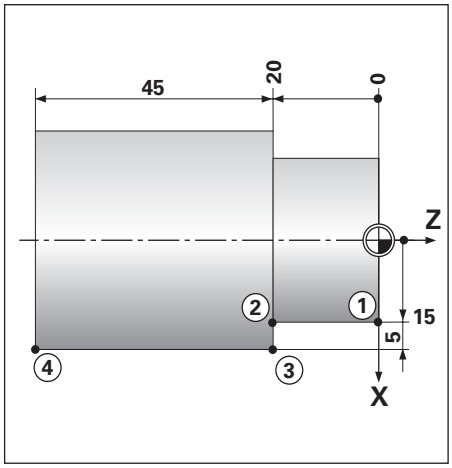


Fig. 21: Workpiece drawing for the example on Oversizes. Tool positions without oversize or undersize

Example: Turning a shoulder by traversing to display value zero

In this example, both incremental and absolute nominal position values are used.



Position ①	Z	=	0	mm	X	=	15 mm
Position ②	Z	=	–20	mm	X	=	15 mm
Position ③	Z	=	–20	mm	**I**X	=	+5 mm
Position ④	**I**Z	=	–45	mm	**I**X	=	0 mm

Preparation:

➤ Preset the tool and set the workpiece datum as described earlier in this chapter.

➤ Set the user parameters (see Chapter I - 6):
- Sum display Z_S or for both axes (X_S and Z_S)
- Radius display for both axes X and Z
- Set `Ovrsize ON / OFF` to `OFF`

➤ Preposition the tool appropriately (such as X = +20 mm, Z = +10 mm).

If you want to turn a larger shoulder, use the Multipass cycle (see Chapter I - 3). This cycle allows you to turn the shoulder in any number of infeeds without having to enter coordinates for each feed move.

Operating mode: `DISTANCE-TO-GO`

X	Select the axis (X).
Nominal position value ? **X + ...**	
1 5 ENT	Enter the coordinate for nominal position ①: X = 15 mm. Confirm entry. The positioning aid appears for the X axis; the nominal position remains at the top of the screen.
	Move the X axis until the display value is zero.
Zs	Select the axis (Z_S).
Nominal position value ? **Zs + ...**	
– 2 0 ENT	Enter the coordinate for nominal position ②: Z_S = –20 mm. Confirm entry. The positioning aid appears for the Z_S axis; the nominal position remains at the top of the screen.
	Move the Z_S axis until the display value is zero.

X	Select the axis (X).
Nominal position value ? **X + ...**	
5 I ENT	Enter the coordinate for nominal position ③: 5 mm and mark the entry as an incremental dimension: IX = 5 mm. Confirm entry. The positioning aid appears for the X axis; the nominal position remains at the top of the screen.
	Move the X axis until the display value is zero.
Zs	Select the axis (Z_S).
Nominal position value ? **Zs + ...**	
– 4 5 I ENT	Enter the coordinate for nominal position ④: Z_S = –45 mm and mark the entry as an incremental dimension: IZ_S = –45 mm. Confirm entry. The positioning aid appears for the Z_S axis; the nominal position remains at the top of the screen.
	Move the Z_S axis until the display value is zero.

NOTES

I - 3
Programming POSITIP

Operating mode PROGRAMMING AND EDITING

The available functions in the PROGRAMMING AND EDITING operating mode are divided into four groups:

- Programming mode
  for entering, running and editing programs
- Teach-in mode
- External mode
  for transferring programs to an external device
- Deleting programs

Programs contain the work steps for workpiece machining. You can edit programs, add work steps to them and run them as often as you wish. POSITIP can store a maximum of 20 programs with a total of 2000 nominal positions. A single program can contain a maximum of 1000 nominal positions.

The External mode enables you to store programs with the HEIDENHAIN FE 401 floppy disk unit and load them into POSITIP again on demand — you don't need to re-enter them manually. You can also transfer programs to a personal computer or printer.

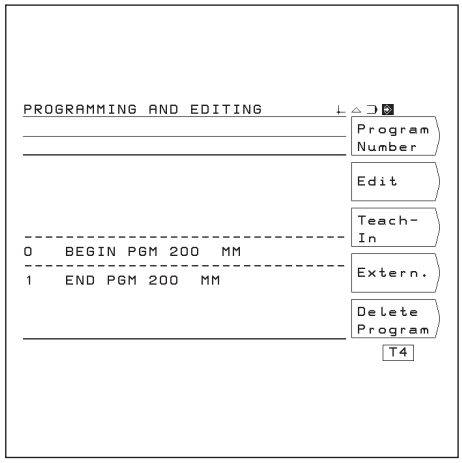


Fig. 22: The main menu in the operating mode PROGRAMMING AND EDITING

Programmable functions

- Nominal position values (axes with saddle and top slides: nominal value of the summed position, see "Selecting position display modes" in Chapter I - 2)
- Interrupt program
- Multipass cycle:
  Turning with any number of feed moves.
- Program section repeats:
  A section of a program only has to be entered once and can then be run up to 999 times in succession.
- Subprogramming:
  A section of a program only has to be entered once and can then be run at various places in the program.

Transfer position: Teach-in mode

This mode allows you to transfer the actual positions of the tool directly into a program. In many cases the Teach-in function will save you considerable keying effort.

What happens with finished programs?

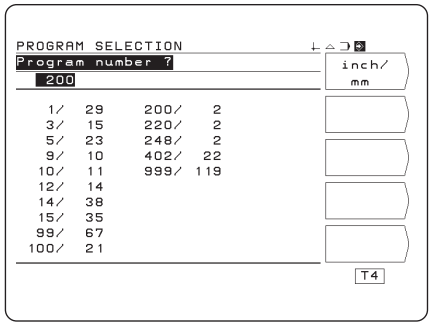
For workpiece machining, programs are run in the operating mode EXECUTE PROGRAM. See Chapter I - 4 for an explanation of this mode.

Selecting a program

Each program is identified by a number between 0 and 99 999 999 which you assign it.

Operating mode: PROGRAMMING AND EDITING

Program Number	Go to the program directory.



Program number ?

5	Select an existing program, such as program number 5.
1 9	Create a new program: Give it a number which is not yet in the directory, such as 19.
inch/ mm	Choose the unit of measurement.
ENT	Confirm your entry. The selected program can now be entered, edited or run.

Program directory

The program directory appears when you choose the soft key Program Number. The number in front of the slash is the program number, the number behind the slash is the number of blocks in the program.

A program always contains at least two blocks.

To delete a program

If you no longer wish to keep a program in memory, you can delete it:

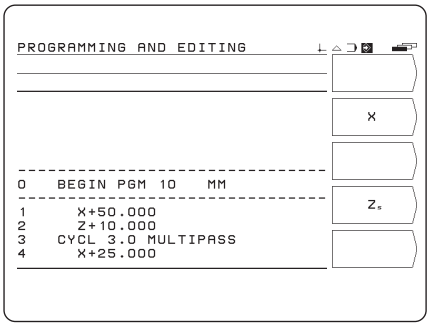
- In the operating mode PROGRAMMING AND EDITING, press the soft key Delete Program in the first soft key row.
- Enter the program number.
- Press ENT to delete the program.

Editing programs

Operating mode: PROGRAMMING AND EDITING

Edit

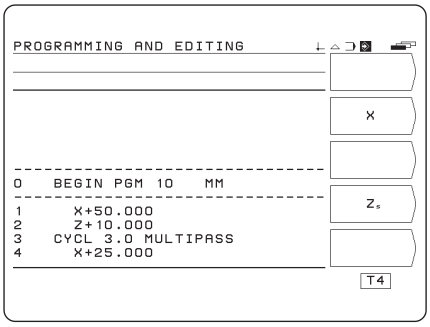
Edit the last program selected with Program Number, such as program number 10.



Use the paging keys to display the programmable **functions** in the different soft key rows. The screens shown at the right already contain some program blocks. Turn to the next page of this manual to learn how program blocks are entered.

/

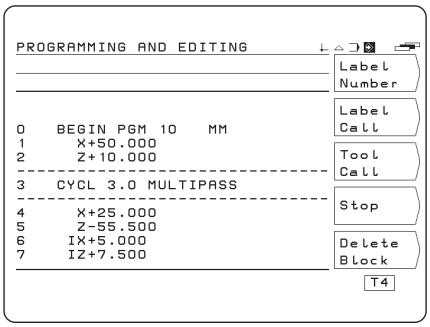
The first soft key row provides functions for entering and changing coordinates.



/

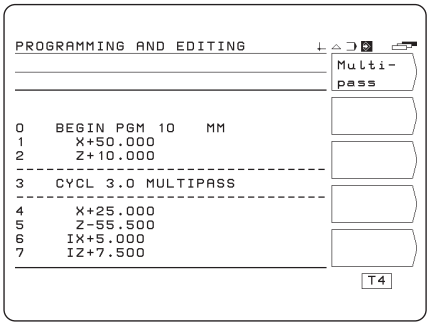
The second soft key row provides the following functions:

- Enter labels for subprograms and program section repeats
- Interrupt program
- Call tool data
- Delete program blocks



/

The third soft key row contains the Multipass cycle for turning with any number of feed moves.



Entering program blocks

Current block

The current block is shown between the two dashed lines. New blocks are inserted behind the current block. When the `END PGM` block is between the dashed lines, **no** new blocks can be inserted.

Function	Soft key/Key
Go up one block	↑
Go down one block	↓
Cancel numerical entry	CE
Delete current block	Delete Block

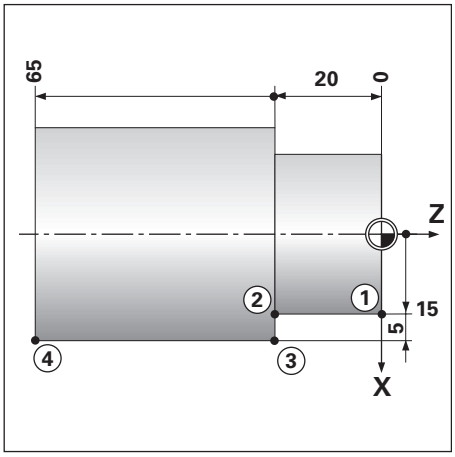
Going directly to a program block

Scrolling to the desired block with the arrow keys can be time-consuming with long programs. A quicker way is to use the GOTO function. This enables you to move directly to the block you wish to change or add new blocks behind.

Operating mode: `PROGRAMMING AND EDITING`

Edit	Select `Edit`.
GOTO	Press the GOTO key.
Block number ?	
5 8	Enter a block number, such as 58.
ENT	Confirm your entry. Block number 58 is now the current block.

Example: Milling a shoulder



The datum is the workpiece zero.

Position ①	Z	=	0	mm	X	= 15	mm
Position ②	Z	=	–20	mm	X	= 15	mm
Position ③	Z	=	–20	mm	IX	= +5	mm
Position ④	Z	=	–65	mm	X	= 20	mm

Summary of programming steps

- In the main menu `PROGRAMMING AND EDITING` use the `Program Number` soft key to access the program directory.
- Key in the number of the program you want to work on, and press ENT.
- Select `Edit` in the main menu `PROGRAMMING AND EDITING`.
- Enter the nominal positions.

Running a finished program

When a program is finished it can be run in the `EXECUTE PROGRAM` operating mode (see Chapter I - 4).

Example of entry: Entering a nominal position into a program (block 3 in the example)

X	Select the coordinate axis (X axis).

`Nominal position value ?`

1 5 ENT	Enter the nominal position value (X = 15 mm). Confirm entry. The nominal position is now the current block (between the dashed lines).

Program blocks

0	BEGIN PGM 10	MM	Start of program, program number and unit of measurement
1	X+50.000		Pre-position the tool in the X axis
2	Z+20.000		Pre-position the tool in the Z axis
3	X+15.000		X coordinate, position ①
4	Z–20.000		Z coordinate, position ②
5	IX+5.000		Incremental X coordinate, position ③
6	Z–65.000		Z coordinate, position ④
7	END PGM 10	MM	End of program, program number and unit of measurement

Calling tool data from a program

Chapter I - 2 explained how to enter tool data (lengths) into the tool table.

The tool lengths stored in the table can also be called from a program — you don't need to select the new tool lengths from the table with the vertical arrow keys every time you change the tool during program run.

The TOOL CALL command automatically pulls the tool lengths from the table.

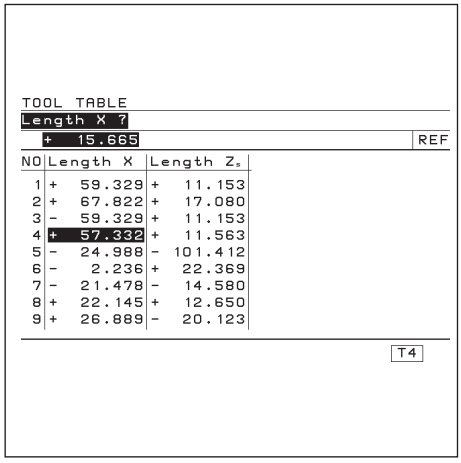


Fig. 23: The tool table on the screen

If you enter a different tool axis in the program than is stored in the table, POSITIP will store the new tool axis in the table.

Operating mode: PROGRAMMING AND EDITING

Tool Call	Call tool data from the tool table.
Tool number ?	
4 ENT	Enter the tool number (4, for example) under which the tool lengths are stored in the tool table. Confirm your entry.

Transferring positions: Teach-in mode

Teach-in programming offers the following two options:

- Enter nominal position, transfer nominal position into program, move to positions by traversing to display value zero:
  TEACH-IN / DISTANCE TO GO
- Move to a position and transfer the actual value into a program:
  TEACH-IN / ACTUAL POSITION

You can change transferred position values with TEACH-IN / PROGRAM.

Preparation

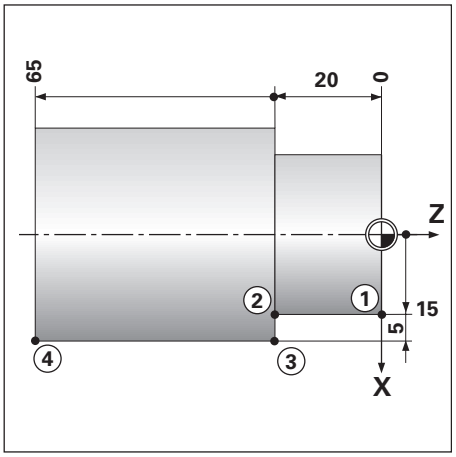
➤ With Program number select the program you want to transfer positions into.

➤ Select the tool number (tool data) with the vertical arrow keys.

Programming example for TEACH-IN / DISTANCE TO GO
Generating a program while turning a shoulder

With Teach-in you machine a workpiece according to the workpiece drawing. POSITIP transfers the nominal position coordinates directly into the program while you machine. Pre-positioning and retraction moves can be selected as desired and entered like drawing dimensions.

Position ①	Z = 0 mm	X = 15 mm
Position ②	Z = –20 mm	X = 15 mm
Position ③	Z = –20 mm	IX= +5 mm
Position ④	Z = –65 mm	X = 20 mm



Operating mode: PROGRAMMING AND EDITING

Teach-In	Select Teach-In. The functions for TEACH-IN / DISTANCE TO GO are available immediately in the first soft key row.

Example: Transfer the X coordinate of corner point ① into a program.

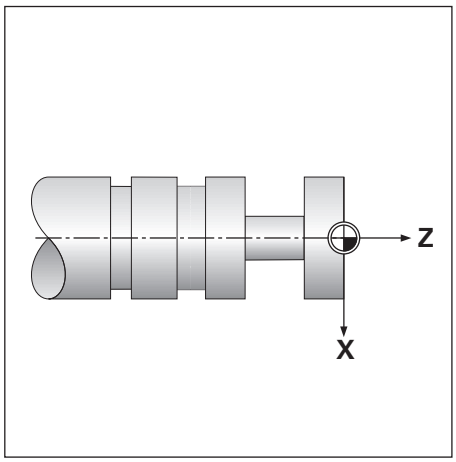
X	Select the coordinate axis (X).

Nominal position value ?

1 5 ENT	Enter the nominal position value (X = 15 mm). Confirm entry. POSITIP displays the positioning aid for traversing to zero. The entered nominal position value appears in the input line at the top of the screen.
	Move the entered axis until the display value is zero. Then enter and transfer further coordinates.

Programming example for TEACH-IN / ACTUAL POSITION
Transfer position and depth of grooves into a program

With TEACH-IN / ACTUAL POSITION you can generate a program that contains the actual positions of the tool.



Operating mode: PROGRAMMING AND EDITING

Teach-In	Select Teach-In.
/	Go to TEACH-IN / ACTUAL POSITION.

Example: Transfer the depth of a groove

	Machine the groove on the workpiece.
X	Select the coordinate axis (X).
Transfer actual value X ?	
ENT	Transfer the actual value for the X axis into the program. The transferred program block appears in the input line at the top of the screen.

Changing nominal positions after they have been transferred

Positions which you have transferred into a program with Teach-in can be changed. It is not necessary to leave the Teach-in mode to do so. Enter the new value in the input line.

Example: Changing a block transferred with Teach-in

Operating mode: `PROGRAMMING AND EDITING, Teach-In`

PROGRAM / PROGRAM	Go to `TEACH-IN / PROGRAM`. The current program appears on the screen.
↑ / ↓	With the arrow keys (or GOTO), move to the block you wish to change.
→	Select the block.
Nominal position value ?	
0	Enter a new nominal position value (such as 0).
ENT	Confirm your changes.

Functions for changing a Teach-in program

Function	Soft key
Abort and return to main menu PROGRAMMING AND EDITING	Escape
Delete current block	Delete Block

Multipass cycle

The multipass cycle enables you to turn a shoulder in any number of infeeds.

You only need to enter three blocks into a program:

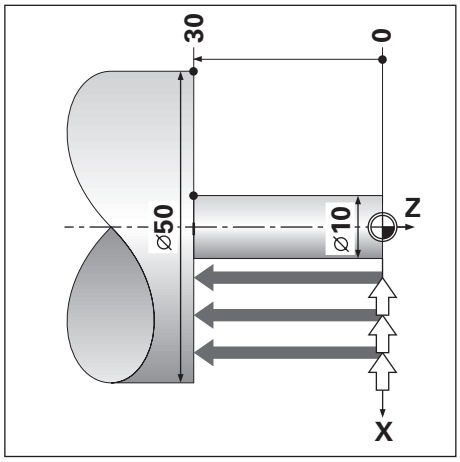
- CYCL block
- X coordinate
- Z coordinate

The multipass cycle contains all information required for the operation.

Do not delete any blocks from the cycle.

When the program is run, POSITIP always displays the distance-to-go to the two nominal positions immediately following the CYCL block.

Example: Turning a shoulder in any number of infeeds

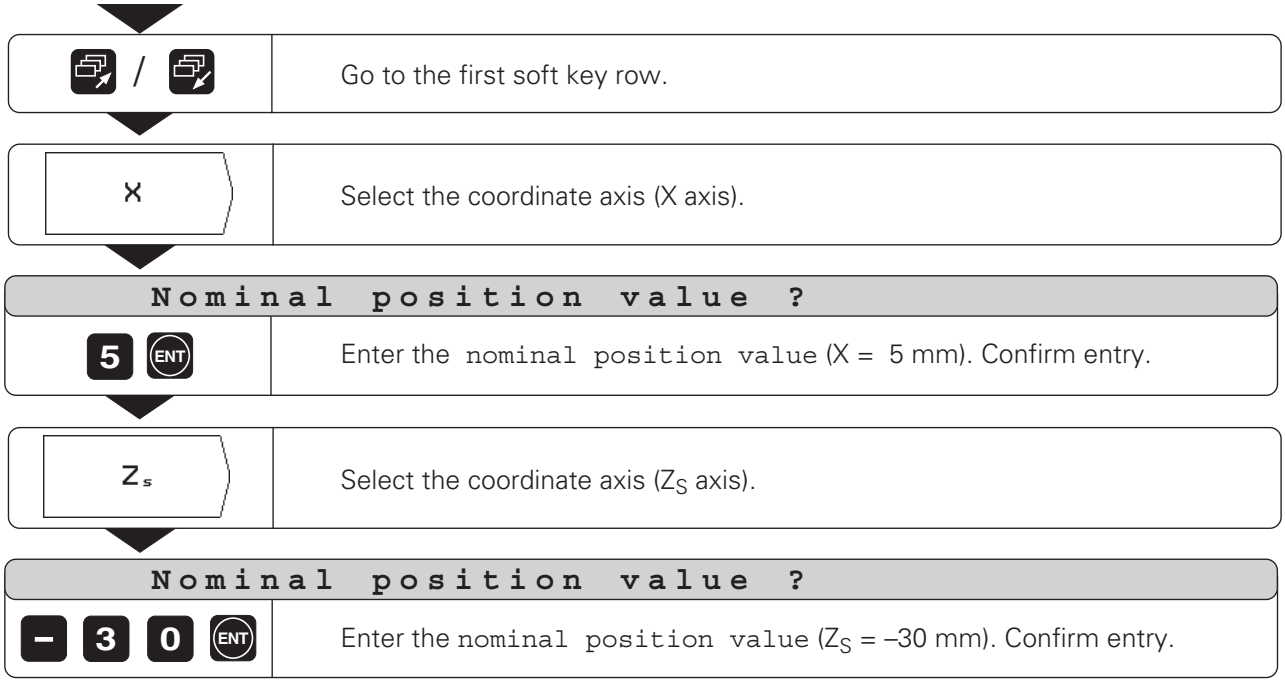


Workpiece diameter before machining:	X =	50	mm
Shoulder diameter:	X =	10	mm
Start of shoulder:	Z =	0	mm
End of shoulder:	Z =	–30	mm

Example: Entering the Multipass cycle into a program

Operating mode: PROGRAMMING AND EDITING

Edit	Select Edit.
/	Go to the third soft key row.
Multi-pass	Select the Multipass cycle. The program block CYCL 3.0 MULTIPASS appears on the screen.



Program blocks

0	BEGIN PGM 20 MM	Start of program, program number and unit of measurement
1	X+80.000	Pre-position tool in the X axis
2	Z+20.000	Pre-position tool in the Z axis
3	X+50.000	Approach the workpiece (X axis)
4	Z+0.000	Approach the workpiece (Z axis)
5	**CYCL 3.0 MULTIPASS**	**Coordinates for a Multipass cycle follow this block**
6	**X+10.000**	**X coordinate of the shoulder**
7	**Z–30.000**	**Z coordinate of the shoulder**
8	X+80.000	Retract (X axis)
9	Z+20.000	Retract (Z axis)
10	END PGM 20 MM	End of program, program number and unit of measurement

The cycle is performed in the operating mode EXECUTE PROGRAM (see Chapter I - 4) by traversing to display value zero with any number of infeeds.

Entering program interruptions

You can divide a program into sections with stop marks. POSITIP then executes the next block only after you press the soft key `Next Block`.

Operating mode: `PROGRAMMING AND EDITING`

`Edit`	Select `Edit`.
/	Go to the second soft key row.
`Stop`	Press `STOP` to insert a program interruption.

Subprograms and program section repeats

Subprograms and program section repeats only need to be entered once in the program. You can then run them up to 999 times.

Subprograms can be run at any point in the program; program section repeats are run several times in direct succession.

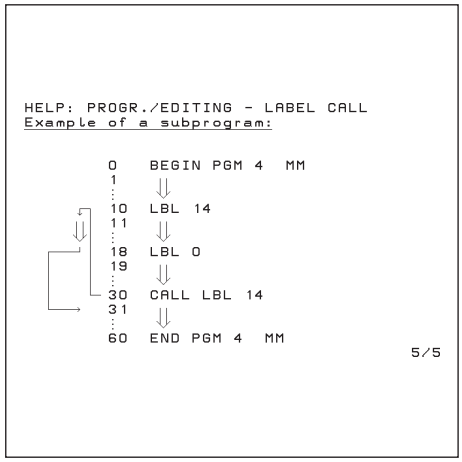


Fig. 24: On-screen operating instructions for subprograms (page 5 of 5)

Inserting program marks (labels)

You mark subprograms and program section repeats with labels (abbreviated in the program with LBL).

Labels 1 to 99
Labels 1 to 99 mark the beginning of a subprogram or program section repeat.

Label 0
Label 0 is used only to identify the end of a subprogram.

Label call
In the program, subprograms and program section repeats are called with the command CALL LBL.
The command CALL LBL 0 is not allowed.
Subprogram:
A subprogram called with CALL LBL is executed immediately after the CALL LBL block.

Program section repeat:
The program section located before the CALL LBL block is executed. You enter the number of desired repeats with the CALL LBL command.

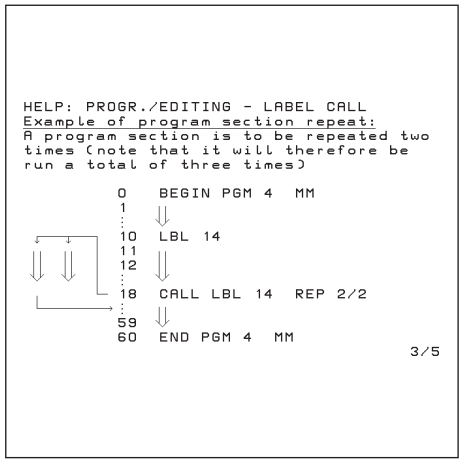


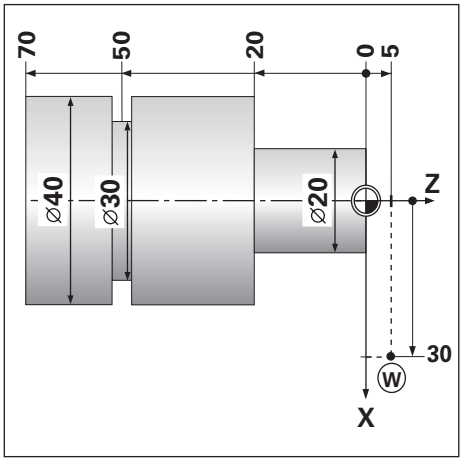
Fig. 25: On-screen operating instructions for program section repeats (page 3 of 5)

Nesting program sections

Subprograms and program section repeats can also be "nested." For example, a subprogram can in turn call another subprogram or repeat a program section repeat.

Maximum nesting depth: 8 levels.

Example: Subprogram for tool change



The coordinates of the tool change position are written in a subprogram. To activate the tool change process you just call the subprogram.

Coordinates of the
tool change position Ⓦ: X = +30 mm
Z = +5 mm

Remark
A recessing tool (width 4 mm) is inserted to turn the groove. The tool is moved back to the change position after the groove is turned.

Example: Setting a label for a subprogram

Operating mode: PROGRAMMING AND EDITING

Edit	Select Edit.
/	Go to the second soft-key row.
Label Number	Insert a label (LBL) for a subprogram. POSITIP offers the lowest available label number as a default entry.
Label number ?	
ENT	Accept the default label number.
9 ENT	Enter a label number (such as 9). Confirm entry. The current block now contains the set label LBL 9.

The beginning of a subprogram or program section repeat is now marked with the label. Enter the program blocks for the subprogram after the LBL block.

Label 0 (LBL 0) is used **only** for the **end of a subprogram**.

Example: Entering a subprogram call – `CALL LBL`

← / →	Go to the second soft-key row.
Label Call	Call the label. POSITIP offers the label number which was last set.
Label number ?	
ENT	Accept the default label number.
9 ENT	Enter the label number (9). Confirm entry. The current block now contains the called label `LBL 9`.
Sub-program	For subprograms you can ignore the question "`Repeat REP ?`". Press the soft key to confirm that a subprogram is being called.

After the `CALL LBL` block in the operating mode `EXECUTE PROGRAM`, POSITIP executes the blocks in the subprogram that are located between the `LBL` block with the called number and the next block containing `LBL 0`.

Note that the subprogram will be executed **at least once** even without a `CALL LBL` block.

Program blocks

0	`BEGIN PGM 30 MM`	Start of program, program number and unit of measurement
1	**`LBL 9`**	Beginning of subprogram 9
2	**`X+60.000`**	X coordinate of the tool change position (diameter)
3	**`Z+5.000`**	Z coordinate of the tool change position
4	**`LBL 0`**	End of subprogram 9
5	`Z+2.000`	Pre-position, Z coordinate
6	`X+64.000`	Pre-position, X coordinate
7	`CYCL 3.0 MULTIPASS`	Coordinates for a multipass cycle follow
8	`X+20.000`	X coordinate of the first shoulder (for the diameter)
9	`Z-20.000`	Z coordinate of the first shoulder
10	`X+40.000`	X coordinate of the second shoulder (diameter)
11	`Z-70.000`	Z coordinate of the second shoulder
12	`CALL LBL 9`	Call subprogram 9: go to tool-change position, blocks 1 to 4 are executed
13	`STOP`	Program interruption for tool change
14	`Z-52.000`	Pre-positioning for recess operation
15	`X+30.000`	Machine recess (diameter)
16	`IX+40.000`	Retract
17	`CALL LBL 9`	Call subprogram 9: return to tool-change position, blocks 1 to 4 are executed
18	`END PGM 30 MM`	End of program, program number and unit of measurement

Entering and calling program section repeats

A program section repeat is entered like a subprogram. Since the end of the program section is identified simply by the command to repeat the section (CALL LBL), label 0 is not set.

Display of the CALL LBL block with a program section repeat

The screen displays (for example): CALL LBL 6 REP 10 / 10

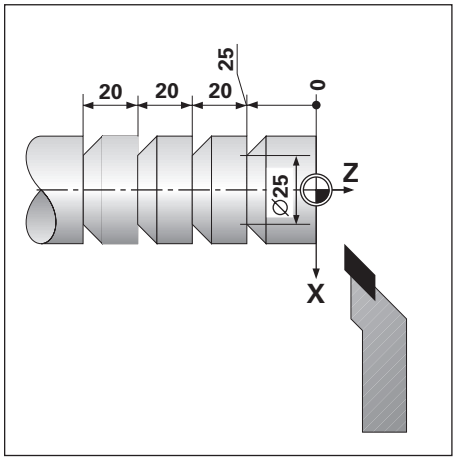
The two numbers with the slash between them indicate that this is a program section repeat.

The number in front of the slash is the number of repeats you entered.

The number behind the slash is the number of repeats remaining to be performed.

Example: Program section repeat for several identical grooves

Spacing between grooves	20 mm
Coordinates of first groove	Z = –25 mm X = 25 mm
Number of grooves	4



Example: Insert a label for a program section repeat

Operating mode: PROGRAMMING AND EDITING

Edit	Select Edit.
/	Go to the second soft-key row.
Label Number	Set a program mark (LBL) for a program section repeat. POSITIP offers the lowest available label number as a default entry.
Label number ?	
ENT	Accept the default label number.
8 ENT	Enter a label number (8). Confirm entry. The current block now contains the set label: LBL 8.

Enter the blocks for the program section repeat after the LBL block.

Example: Entering a program section repeat – CALL LBL

/	Go to the second soft-key row.
Label Call	Call label. POSITIP offers the label number that was last set.
Label number ?	
ENT	Accept the default label number.
8 ENT	Enter label number (8). Confirm entry. The called label is now in the current block: CALL LBL 8.
Repeat REP ?	
3 ENT	Enter the number of repeats (3). Confirm entry.

After a CALL LBL block in the operating mode PROGRAMMING AND EDITING, POSITIP repeats the program blocks that are located **behind** the LBL block with the called number and **before** the CALL LBL block.

Note that the program section will always be executed one more time than the programmed number of repeats.

Program blocks

0	BEGIN PGM 40 MM	Start of program, program number and unit of measurement
1	X+80.000	Pre-position the tool (X axis)
2	Z+20.000	Pre-position the tool (Z axis)
3	X+40.000	X coordinate for pre-positioning
4	Z–5.000	Z coordinate for pre-positioning
5	**LBL 8**	Beginning of program section 8
6	**IZ–20.000**	Move to groove position
7	**X+25.000**	Turn groove
8	**X+40.000**	Retract
9	**CALL LBL 8 REP 3/3**	Repeat program section 8 between blocks 5 and 9 three times
10	X+80.000	Retract
11	END PGM 40 MM	End of program, program number and unit of measurement

Editing existing programs

You can edit existing programs, for example to correct keying errors. POSITIP supports you with plain language dialogs — just as when you are creating a new program.

Program numbers can be changed by selecting the BEGIN or END block and entering a new program number.

Confirm your changes

You **must** confirm each change with the ENT key for it to become effective.

Example: Editing a program block

Operating mode: `PROGRAMMING AND EDITING`

↑ / ↓	Move to the block you wish to edit.
→	Select the block.
2 0	Edit the block, for example enter a new nominal position value (20).
ENT	Confirm the change.

Function	Key
Select the next-lowest program block	↑
Select the next-highest program block	↓
Go directly to block number	GOTO □
Select program block to edit	→
Confirm change	ENT

Deleting program blocks

You can delete any blocks in existing programs except the BEGIN and END blocks.

When a block is deleted, POSITIP automatically renumbers the remaining blocks. The block **before** the deleted block then becomes the current block.

Example: Deleting a program block

Operating mode: PROGRAMMING AND EDITING

Edit	Select Edit.
↑ / ↓	Move to the block you wish to delete (or use the GOTO key).
/	Go to the second soft-key row.
Delete Block	Press Delete Block.

It is also possible to delete an **entire program section**:

- ➤ Select the last block of the program section.
- ➤ Press the soft key Delete Block repeatedly until all blocks in the section have been deleted.

Transferring programs over the data interface

The RS-232-C interface on the rear panel allows you to utilize a device such as the HEIDENHAIN FE 401 floppy disk unit or a PC for external data storage.

Programs can also be archived on diskette and downloaded back into POSITIP again as required.

Pin layout, wiring and connections for the data interface are described in Chapter II - 4.

Function	Soft key/Key
Directory of programs stored in POSITIP	POSITIP PGM Dir
Directory of programs stored on the FE	FE 401 PGM Dir
Abort data transfer	Escape
• Switching between FE and EXT mode • Show further programs	→

It is not possible for POSITIP to display a directory of programs stored on a PC.

Example: Transferring a program into POSITIP

Operating mode: PROGRAMMING AND EDITING

Extern.	Select Extern.
Program number ?	
5	Enter the program number, for example 5.
→	Select external device (for diskette unit or PC with HEIDENHAIN data transfer software TNC.EXE use FE setting; for PC without TNC.EXE use EXT setting).
Start Input	Press Start Input to transfer the program to POSITIP. The message Loading program: appears on the POSITIP screen.

If you are transferring programs into POSITIP from a PC (EXT setting), the PC must **send** the programs.

If POSITIP's memory already contains a program with the same number as that being transferred, the error message PROGRAM ALREADY EXISTS will appear on the screen.

In this case, before you can transfer the program you must either **rename** or **delete** the program in POSITIP.

For program output, POSITIP automatically displays all programs stored in its memory.

Example: Reading a program out of POSITIP

Operating mode: PROGRAMMING AND EDITING

Extern.	Select Extern.
/	Go to EXTERNAL OUTPUT.
Program number ?	
1 0	Enter the program number, for example 10.
→	Select the external device. For diskette unit or PC with HEIDENHAIN data transfer software TNC.EXE use FE setting; for PC without TNC.EXE (or printer) use EXT setting.
Start Output	Press Start Output to transfer the program to the external device. The message Reading out program: appears.

CAUTION

A program on the external device with the same number as that being read out will be overwritten. No confirmation to overwrite will be requested.

To read all programs out of POSITIP's memory:

➤ Press Output All PGM

NOTES

I - 4
Executing Programs

Programs are run in the operating mode EXECUTE PROGRAM.
The current program block is displayed at the top of the screen.

There are two ways to run programs:

Single Block
When you have moved the axis to the displayed position, call the next block with the soft key Next Block. It is recommended that you use Single Block when running a program for the first time.

Automatic
In this mode the display automatically shows the next program block as soon as you have moved to the displayed position. Use Automatic when you are sure the program contains no errors and you want to run it quickly.

Preparation

- Clamp the part to be turned.
- Press MOD.
- Check the settings of the user parameters Oversize OFF/ON and Scaling Factor OFF/ON. Normal setting: OFF.
- Select the user parameters for the position display that are appropriate for the values entered in the program. Normal: Sum Z, Radius Z, Diameter X
- Press MOD again.
- Select the tool with the vertical arrow keys.
- Set the workpiece datum.
- Select the program to be executed with Program Number in the main menu EXECUTE PROGRAM.

Single block

Operating mode: EXECUTE PROGRAM

Single Block	Select Single Block.
	Move to the position by traversing to display value zero.
Next Block	Call the next program block.

Continue calling blocks with the soft key Next Block until machining is complete.

An overview of functions is shown on the next page.

Automatic

Operating mode: EXECUTE PROGRAM

Auto- matic	Select Automatic. The program block and graphic positioning aid appear.
	Move to the position by traversing to display value zero.

The next program block will appear as soon as you have moved to the displayed position. The positioning aid automatically switches to the coordinate axis of the new block.

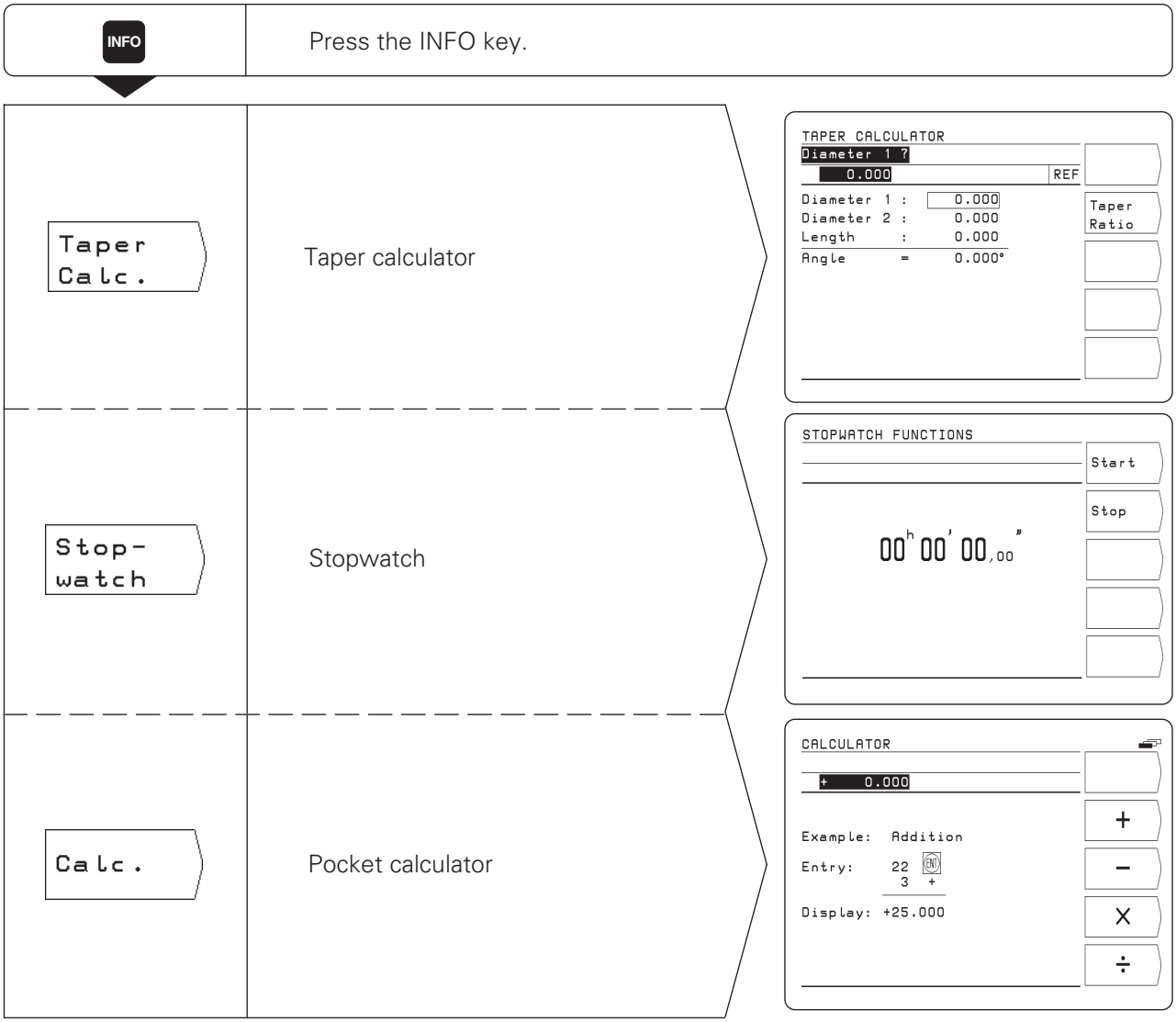
Function	Soft key/Key
Start with the block above the current block	
Start with the block below the current block	
Select the start block directly	
After the Multipass cycle: Execute the next work step	Next Block
After Starting: Escape — return to main menu	Escape

I - 5
The INFO Functions: Pocket Calculator, Stopwatch and Taper Calculator

Press the INFO key to access the following functions:

- **Taper calculator**
  Calculates half the taper angle for setting the top slide or guide plate.
  Entries: Taper ratio or diameter and length.
- **Stopwatch**
- **Pocket calculator**
  Basic arithmetic (+ , – , ×, ÷)
  Trigonometric functions (sin, cos, tan, arc sin, arc cos, arc tan)
  Square roots
  x^2
  Reciprocals (1/x)
  π (3.14159...)

To access the INFO functions



Taper calculator: half the taper angle for top slide or guide plate

Use the taper calculator to calculate half the taper angle.
A graphic display is shown along with the result.

As soon as you conclude an entry with ENT, you are prompted for the next entry.

Entry values

From the taper ratio, calculation of the:
- Radius of the taper
- Length of the taper

From both diameters and the length, calculation of the:
- Starting diameter
- End diameter
- Length of the taper

Function	Soft key/Key
Switchover for calculation from the taper ratio	Taper Ratio
Switchover for calculation from the diameter and the length	D1/D2/ Length
Confirm entry	ENT
Go to the next-higher input line	↑
Go to the next-lower input line	↓
Switch over the input field for the taper ratio	→

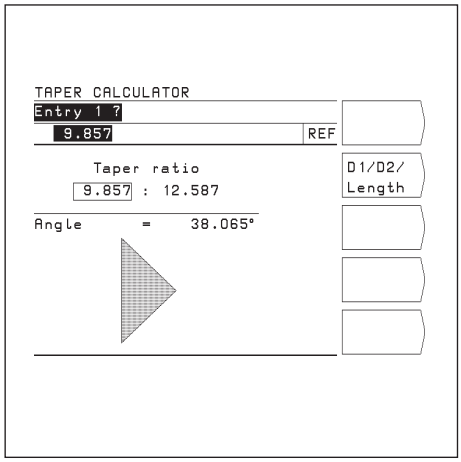


Fig. 26: Calculating the taper angle from the taper ratio

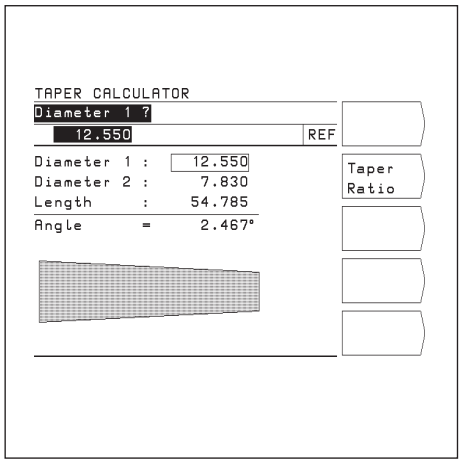


Fig. 27: Calculating the taper angle from the taper diameters and length

Stopwatch

The stopwatch shows the hours (h), minutes (‘), seconds (’’) and hundredths of a second. The stopwatch continues to run even when you leave INFO. When the power is interrupted (switch-off), POSITIP resets the stopwatch to zero.

Function	Soft key
Reset the stopwatch to zero and start timing	Start
Stop timing	Stop

Pocket calculator

The pocket calculator functions are spread over three soft key rows :

- Basic arithmetic (first soft key row)
- Trigonometry (second row)
- Square root, x^2, 1/x, π (third row)

Use the paging keys to go from one soft key row to the next. POSITIP always shows an example entry — you don't have to press the HELP key.

Transferring the calculated value

The calculated value remains in the input line even after you leave the calculator. This allows you to transfer the calculated value directly into a program as a nominal position —without having to re-enter it.

Entry logic

For calculations with **two** operands (addition, subtraction, etc.):

➤ Key in the first value.
➤ Press ENT.
➤ Key in the second value.
➤ Press the soft key for the desired operation.
POSITIP displays the result of the operation in the input line.

For calculations with **one** operand (sine, reciprocal, etc.):

➤ Key in the value.
➤ Press the soft key for the desired operation.
POSITIP displays the result of the operation in the input line.

Example: See the next page.

Example: (3 × 4 + 14) ÷ (2 × 6 + 1) = 2

3 ENT	Key-in the first value in the first parenthesis: 3; confirm entry. The display shows +3.000.
4 ×	Key-in the second value in the first parenthesis: 4 and combine the second value with the first value: ×. The display now shows +12.000.
1 4 +	Key-in the third value in the first parenthesis: 14 and combine the third value with the displayed value 12.000: +. The display now shows +26.000.
2 ENT	Key-in the first value in the second parenthesis: 2; confirm entry. This automatically closes the first parenthesis. The display shows +2.000.
6 ×	Key-in the second value in the second parenthesis: 6 and combine the second value with the first value: ×. The display now shows +12.000.
1 +	Key-in the third value in the second parenthesis: 1 and combine the third value with the displayed value 12.000: +. The display now shows +13.000.
÷	Close the second parenthesis and simultaneously combine with the first parenthetical expression: ÷. The display now shows the result: +2.000.

I - 6
User Parameters: The MOD Function

User parameters are operating parameters which you can change without having to enter a code number.
The machine builder decides which operating parameters are available to you as user parameters as well as how the user parameters are arranged in the soft keys.

The functions of user parameters are described in Chapter II - 2.

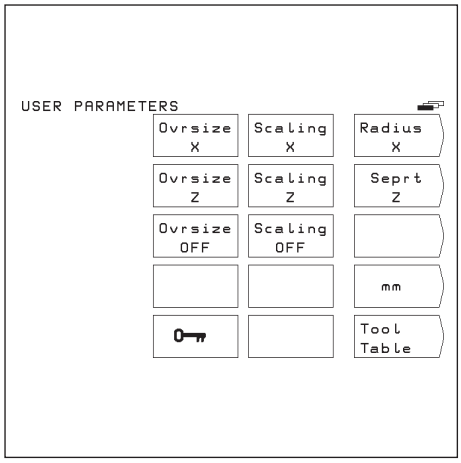


Fig. 28: The user parameters on the POSITIP screen

To access the user parameter menu

- ➤ Press MOD.
  The user parameters appear on the screen.
- ➤ Go to the soft key row with the desired user parameter.
- ➤ Press the soft key for the desired user parameter.

To leave the user parameter menu

- ➤ Press MOD.

Scaling factors

The user parameter `Scaling Factor` enables you to increase or decrease the size of workpieces. POSITIP divides the displayed value by the scaling factor you entered.

Scaling factors change the workpiece size symmetrically about the datum. The workpiece datum should therefore be located at an edge when you are working with scaling factors.

Input range: 0.1 to 9.999 999

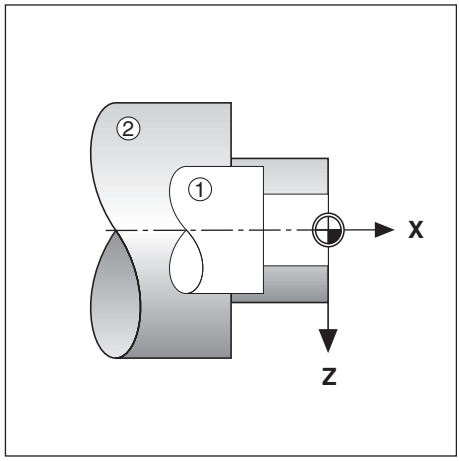


Fig. 29: ① Original workpiece
② After enlargement with scaling factor

To activate scaling factors

- ➤ Switch the user parameter `Scaling Factor OFF/ON` to `ON`.

To deactivate scaling factors

- ➤ Switch the user parameter `Scaling Factor OFF/ON` to `OFF`.

Please turn to the next page for instructions on entering scaling factors.

Entering user parameters

Choosing settings

Some user parameter settings are chosen directly with soft keys. You simply switch from one setting to the other.

Example: Radius/diameter display (X axis)

➤ Press MOD.
The MOD main menu now contains either the soft key `Dia. X` or `Radius X`.

➤ Press the displayed soft key.
The soft key changes to the other setting, for example from `Dia. X` to `Radius X`.

➤ Press MOD again.
This ends the MOD function.
The new setting in now in effect.

Entering values

Some user parameters require that you enter a value or select a setting from a number of possible settings. When you press the soft key, a menu for the parameter is displayed.

Example: Scaling factor for the Z axis

➤ Press MOD.
➤ Press the soft key `Scaling Factor Z`.
POSITIP now displays an input screen for the scaling factor.

➤ Enter a scaling factor, for example 0.75.
➤ Press ENT.
If you want this scaling factor to apply to all coordinate axes, press the soft key `Set All`.
The MOD menu appears again.

➤ Press MOD again.
This ends the MOD function.
The scaling factor is now in effect.

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II

Technical Information

II - 1
Installation and Electrical Connection

Items supplied

- POSITIP 855 Display Unit
- Power connector
- User's Manual

Installation

M4 screws are required for securing POSITIP to a support or a tilting base from HEIDENHAIN (Id.-Nr. 281 619 01). See Chapter II - 8 for the hole dimensions.

Electrical connection

Danger of electrical shock!
Unplug the power cord before opening the housing. Connect a protective ground. This connection must never be interrupted.

Danger to internal components!
Do not engage or disengage any connections while the unit is under power. Use only original replacement fuses.

Power connection

POSITIP requires AC voltage between 100 V and 240 V (48 Hz to 62 Hz). No voltage adjustment is required.

Wiring the power connector

See Fig. 30
Power leads: Ⓛ and Ⓝ
Ground: ⏚

Minimum cross-section of the power cable: 0.75 mm^2

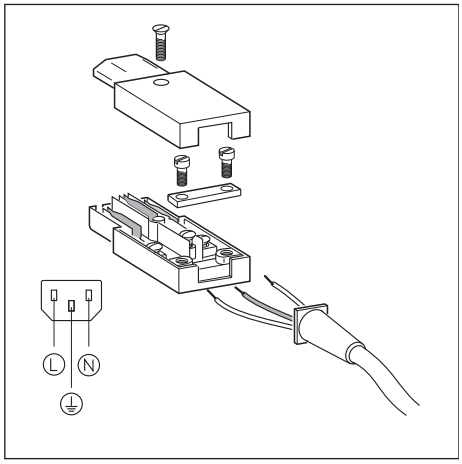


Fig. 30: Wiring the power connector

Grounding

Noise immunity can be increased by connecting the ground screw on the rear panel to the central ground of the machine. Minimum cross-section of the connecting wire: 6 mm².

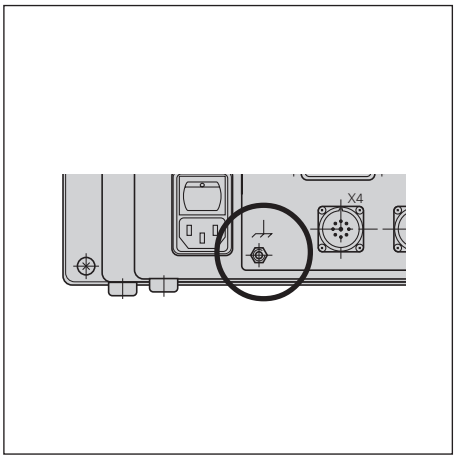


Fig. 31: The ground screw on the rear panel

Connecting the encoders

POSITIP can be used with HEIDENHAIN linear encoders that provide sinusoidal output signals. The encoder inputs on the rear panel are designated X1, X2, X3 and X4.

The connecting cable length may not exceed 30 m (100 ft).

Danger to internal components!
Do not engage or disengage any connections while the unit is under power.

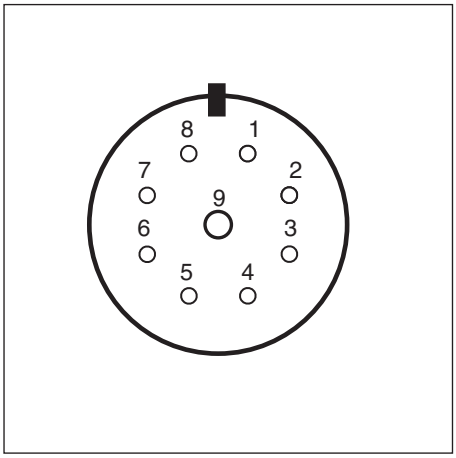


Fig. 32: Flange socket on POSITIP for encoder signal input

Pin layout for encoder inputs

Pin	Assignment
1	0°+
2	0°–
3	+5 V (U_P)
4	0 V (U_N)
5	90°+
6	90°–
7	Reference mark signal RI+
8	Reference mark signal RI–
9	Internal shield
Housing	External shield

The encoder inputs are permanently assigned to the four axes. Use operating parameter P49.* to designate the axes, for example axis 1 = X axis, axis 2 = Y axis.

Axis	Encoder input
1	X1
2	X2
3	X3
4	X4

Interfaces X1, X2, X3 and X4 comply with the recommendations in VDE 0160, 5.88 for separation from line power.

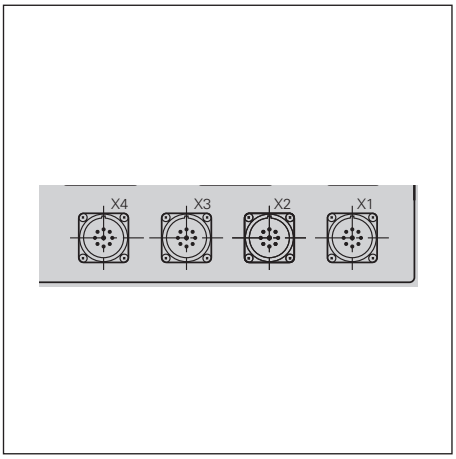


Fig. 33: Encoder inputs on rear panel

Initial switch-on

When you switch on your POSITIP for the first time, the screen shown in Figure 34 appears. You can now select the type of application (milling or turning).

For **turning**:
➤ Press the 1 key.

For **milling**:
➤ Press the 0 key.

POSITIP automatically provides the functions appropriate to the selected application.

You can change the application later with operating parameter P 99.

Fig. 34: POSITIP screen after initial switch-on

II - 2
Operating Parameters

Operating parameters adapt the POSITIP to the machine. They are identified with the letter P, a three-digit number and a name.

Axis-specific operating parameters
Some parameters require separate entries for each axis. Such parameters are identified in the following descriptions with a star (∗).
Example: Operating parameter for the counting direction: P30.∗
For this parameter you enter the counting direction separately for each axis in parameters P30.1, P30.2, P30.3 and P30.4.

Factory settings
The factory settings for the operating parameters in the overview on the next pages are set in ***bold italics***.

Numerical input, dialog input
The current setting of an operating parameter is shown in plain language under the parameter designation in the on-screen operating parameter list. In addition, each parameter setting has a number in the input line at the top. These numbers are transferred when you read out the operating parameters over the data interface.

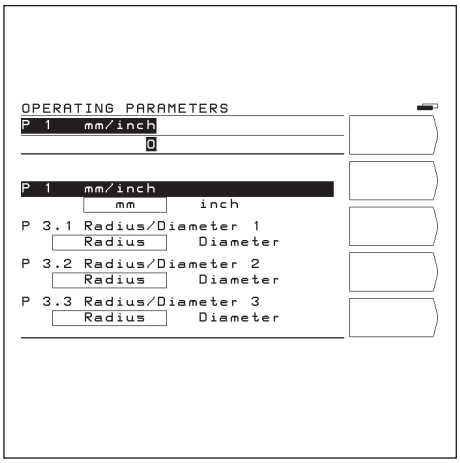


Fig. 35: Example of operating parameters

To access the operating parameters

- ➤ Press MOD.
- ➤ Go to the soft key row containing `Code Number` (soft key with the key symbol)
- ➤ Press the soft key `Code Number`
- ➤ Enter the code number 95148.
- ➤ Confirm your entry by pressing the ENT key
- ➤ Display the operating parameters one after the other with the vertical arrow keys; **or**
- ➤ Go directly to an operating parameter:
  Press GOTO, enter the parameter number and confirm with ENT.

To change parameter settings

Operating parameter settings can be changed by selecting the new setting or entering a numerical value.

- ➤ Select a new setting: Press the horizontal arrow key.
  or
- ➤ Enter a numerical value directly and confirm your entry with ENT.

The horizontal arrow key has no function with parameters which only allow direct numerical entry.

Transferring operating parameters over the data interface

You can save the operating parameters on the FE 401 B floppy disk unit or a PC and read them into the POSITIP again whenever required. For further information on the data interface and data transfer, see Chapter II - 4.

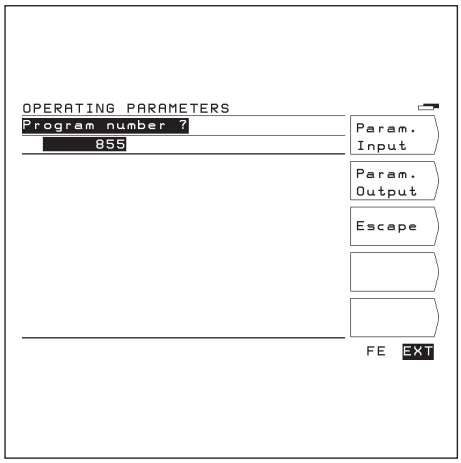


Fig. 36: Screen for transfer of operating parameters

Preparation

- ➤ Access the operating parameters as described above.
- ➤ Go to the second soft key row.

To read out parameters

- ➤ Enter the program number under which you wish to save the operating parameters.
- ➤ Press the soft key `Param. Output`.
  POSITIP reads out all operating parameters.

To download parameters

- ➤ Enter the program number under which the operating parameters are stored on the diskette.
- ➤ Press the soft key `Param. Input`.
  POSITIP replaces all operating parameter settings in its memory with those on the diskette.

User parameters

The machine manufacturer has defined certain operating parameters as user parameters. You can change the settings of user parameters without having to enter a code number (see Operating Instructions section, Chapter I - 6).

Position of user parameters in the menu

In operating parameters P100 to P120, the machine manufacturer defines how the user parameters are arranged in the soft key displays.

Field 15 is reserved for the soft key `Code Number`

If a parameter is assigned to field number 0, it will **not** appear in the user parameter menu.

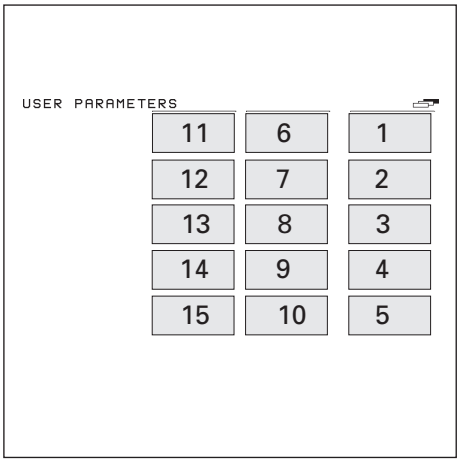


Fig. 37: Field numbering for user parameters

Operating parameter	User parameter designation *	Standard field	✍
P 100	mm / inch (P 1)	***4***	.....
P 101.1	Radius / diameter 1 (P 3.1)	***1***	
P 101.3	Radius / diameter 3 (P 3.3)	***0***	.....
P 102.1	Separate / sum 1 (P 5.1)	***0***	.....
P 102.3	Separate / sum 3 (P 5.3)	***2***	.....
P 104	Scaling factor On / Off (P 11)	***8***	.....
P 105.1	Scaling factor 1 (P 12.1)	***6***	.....
P 105.3	Scaling factor 3 (P 12.3)	***7***	.....
P 106	Oversize On / Off (P 14)	***13***	.....
P 107.1	Oversize 1 (P 15.1)	***11***	.....
P 107.3	Oversize 3 (P 15.3)	***12***	.....
P 112	RS-232 baud rate (P 50)	***0***	.....
P 113	RS-232 blank lines (P 51)	***0***	.....
P 120	Tool table	***5***	.....

* The corresponding operating parameters are indicated in parentheses.

List of operating parameters

Parameter	Page	Function and allowed entries	Numerical entry *	
P 1 mm/inch	*72* *16*	Dimensions in millimeters: **mm** • Dimensions in inches: **inch**	***0*** 1	P 1 .....
P 3.1 Radius/diameter 1 **P 3.3 Radius/diameter 3**	*72* *17*	**Radius** display **Diameter** display	***0*** 1	P 3.1 ..... P 3.3 .....
P 5.1 Separate/sum 1 **P 5.3 Separate/sum 3**	*72* *17*	**Separate value** display **Sum** display	***0*** 1	P 5.1 ..... P 5.3 .....
P 11 Scaling factor OFF/ON	*55*	Scaling factor inactive: **OFF** Scaling factor active: **ON**	***0*** 1	P 11 1
P 12.1 Scaling factor 1 **P 12.3 Scaling factor 3**	*55*	Scaling factor 0.1 to 9.999 999	 ***1.0***	P 12.1 ..... P 12.3 .....
P 14 Oversize OFF/ON	*22*	Oversize inactive: **OFF** Oversize active: **ON**	***0*** 1	P 14 .....
P 15.1 Oversize 1 **P 15.3 Oversize 3**	*22*	Amount of oversize – 199.999 to + 199.999 [mm]	 ***0.0***	P 15.1 ..... P 15.3 .....
P 23 Display freeze Influence position display by signal for measured value output	*78*	Ignore signal: **Off** Stop display: **Concrnt** Freeze display: **Frozen**	***0*** 1 2	P 23 .....
P 30.1 Counting direction 1 **P 30.2 Counting direction 2** **P 30.3 Counting direction 3** **P 30.4 Counting direction 4**	*69*	**Positive** counting direction with positive traverse direction **Negative** counting direction with positive traverse direction	***0*** 1	P 30.1 ..... P 30.2 ..... P 30.3 ..... P 30.4 .....
P 31.1 Signal period 1 **P 31.2 Signal period 2** **P 31.3 Signal period 3** **P 31.4 Signal period 4**	*70*	Signal period of linear encoder (see operating instructions for encoder)	***20***	P 31.1 ..... P 31.2 ..... P 31.3 ..... P 31.4 .....
P 32.1 Linear subdivision 1 **P 32.2 Linear subdivision 2** **P 32.3 Linear subdivision 3** **P 32.4 Linear subdivision 4**	*70*	Linear subdivision of the encoder signals	***20***	P 32.1 ..... P 32.2 ..... P 32.3 ..... P 32.4 .....
P 40.1 Error compensation 1 **P 40.2 Error compensation 2** **P 40.3 Error compensation 3** **P 40.4 Error compensation 4**	*73*	No axis error compensation: **OFF** Linear axis error comp.: **Linear** Non-linear axis error compensation: **Non-linear**	***0*** 1 2	P 40.1 ..... P 40.2 ..... P 40.3 ..... P 40.4 .....
P 41.1 Linear compensation 1 **P 41.2 Linear compensation 2** **P 41.3 Linear compensation 3** **P 41.4 Linear compensation 4**	*73*	Amount of a linear axis error compensation [ppm]	***+0.0***	P 41.1 ..... P 41.2 ..... P 41.3 ..... P 41.4 .....
P 43.1 Distance coding 1 **P 43.2 Distance coding 2** **P 43.3 Distance coding 3** **P 43.4 Distance coding 4**	*68*	No distance coding: **None** **500** × GP, **1000** × GP **2000** × GP, **5000** × GP	0 500, ***1000*** 2000, 5000	P 43.1 ..... P 43.2 ..... P 43.3 ..... P 43.4 .....
P 44.1 Reference mark 1 **P 44.2 Reference mark 2** **P 44.3 Reference mark 3** **P 44.4 Reference mark 4**	*68*	Evaluate reference marks: **Yes** Do not evaluate: **No**	***0*** 1	P 44.1 ..... P 44.2 ..... P 44.3 ..... P 44.4 .....

***** Standard factory settings are in ***bold italics***

Parameter	Page	Function and allowed entries	Numerical entry*	
P45.1 Encoder monitoring 1 **P45.2 Encoder monitoring 2** **P45.3 Encoder monitoring 3** **P45.4 Encoder monitoring 4**	*69*	Monitoring **off** Monitoring **on**	0 ***1***	P45.1 ..... P45.2 ..... P45.3 ..... P45.4 .....
P48.1 Axis definition 1 **P48.2 Axis definition 2** **P48.3 Axis definition 3** **P48.4 Axis definition 4**	*69*	Do not display axis: **off** Display axis: **on**	0 ***1***	P48.1 ..... P48.2 ..... P48.3 ..... P48.4 .....
P49.1 Axis designation 1 **P49.3 Axis designation 3**	*72*	Axis is coordinate axis **A** Axis is coordinate axis **B** Axis is coordinate axis **C** Axis is coordinate axis **U** Axis is coordinate axis **V** Axis is coordinate axis **W** Axis is coordinate axis **X** Axis is coordinate axis **Y** Axis is coordinate axis **Z**	65 **2)** 66 **2)** 67 **2)** 85 **2)** 86 **2)** 87 **2)** 88 **2)** 89 **2)** 90 **2)**	P49.1 ..... P49.3 ....
P50 RS-232-C baud rate	*76*	Speed of data transfer 150 [Baud] ≤ P 50 ≤ 38 400 [baud]	***9 600***	P50 .....
P51 RS-232-C blank lines	*78*	Number of line feeds after output of measured value [0 to 99]	***1***	P51 .....
P60.0 Switching output 0 **P60.1 Switching output 2** **P60.2 Switching output 2** **P60.3 Switching output 3** **P60.4 Switching output 4** **P60.5 Switching output 5** **P60.6 Switching output 6** **P60.7 Switching output 7**	*81*	**Off** Assigned to axis **1** Assigned to axis **2** Assigned to axis **3** Assigned to axis **4**	***0*** 1 2 3 4	P60.0 ..... P60.1 ..... P60.2 ..... P60.3 ..... P60.4 ..... P60.5 ..... P60.6 ..... P60.7 .....
P61.0 Switching range 0 **P61.1 Switching range 2** **P61.2 Switching range 2** **P61.3 Switching range 3** **P61.4 Switching range 4** **P61.5 Switching range 5** **P61.6 Switching range 6** **P61.7 Switching range 7**	*81*	Enter the switching range symmetrically to zero in [mm]	***0.0***	P61.0 ..... P61.1 ..... P61.2 ..... P61.3 ..... P61.4 ..... P61.5 ..... P61.6 ..... P61.7 .....
P69 Switching signal	*78*	**Mode 1** (Signal delay 80 ms) **Mode 2** (Signal delay 5 ms)	***0*** 1	P69 .....
P81.1 16/40µA switchover 1 **P81.2 16/40µA switchover 2** **P81.3 16/40µA switchover 3** **P81.4 16/40µA switchover 4**	*68*	Encoder signal **16 µA** Encoder signal **40 µA**	***0*** 1	P81.1 ..... P81.2 ..... P81.3 ..... P81.4 .....

1) Standard factory settings are in ***bold italics***

2) Factory setting for P 49.∗: P49.1 = ***88***; P 49.3 = ***90***

Parameter	Page	Function and allowed entries	Numer entry [1)]	
P 83 Sleep delay Screen saver (periodically reverses the screen image)	–	Screen saver starts after 5 to 98 [min] No screen saver	 ***15*** 99	P 83 .....
P 90 Graphic positioning aid Direction of traverse in positioning aid when traversing to zero	–	Positive to the right: **Normal** Positive to the left: **Inverse**	***0*** 1	P 90 .....
P 91 Distance-to-go In DISTANCE-TO-GO mode, display either graphic positioning aid or actual position of tool	–	Graphic positioning aid: **Graphic** Tool position: **Actual value**	***0*** 1	P 91 .....
P 92 Feed rate display Display of feed rate F in status line at bottom of screen	–	Do not display feed rate: **Off** Display feed rate: **On**	***0*** 1	P 92 .....
P 98 Dialog language	–	First language, e.g. **German** Second language, e.g. **English**	***0*** 1	P 98 .....
P 99 Counter application	–	Lathe: **Turning** Milling machine: **Milling**	***1*** 0	P 99 .....

)** Standard factory settings are in ***bold italics.
Operating parameters **P 100 to P 120** are listed on page 64

II - 3
Encoders and Measured Value Display

This chapter describes all operating parameters which you must set for the encoders and measured value display. Most entries can be found in the operating instructions for your encoder. Chapter II - 2 contains a list of operating parameters in which you can record your entries.

- **Adapting the encoder**
  - Encoder output signals 16 µA or 40 µA
  - Reference marks on the encoder: distance-coded or one reference mark
  - Deactivation of reference mark evaluation
  - Definition of the coordinate axes
  - Counting direction of the encoder signals
  - Encoder monitoring
  - Linear axis error compensation
- **Selection of display step**
- **Setting the measured value display**
  - Designations of the coordinate axes
  - Unit of measurement
  - Radius/diameter display
  - Separate value/sum display

Adapting the encoders

Encoder output signal: P 81.*	
Encoder with **16 µA** output signal:	P 81.* = 0
Encoder with **40 µA** output signal:	P 81.* = 1

The position feedback encoders on the machine may have one reference mark or several distance-coded reference marks.

Reference marks on the encoder: P 43.*	
One reference mark (**None**):	P 43.* = 0
Distance-coded reference marks (**500** x GP):	P 43.* = 500
Distance-coded reference marks (**1000** x GP):	P 43.* = 1000
Distance-coded reference marks (**2000** x GP):	P 43.* = 2000
Distance-coded reference marks (**5000** x GP):	P 43.* = 5000

Reference mark evaluation can be deactivated separately for each axis. Note that the datum points for those axes are then no longer stored in nonvolatile memory.

Reference mark evaluation: P 44.*	
Evaluate reference mark(s) (**Yes**):	P 44.* = 0
Do not evaluate reference mark(s) (**No**):	P 44.* = 1

Definition of the coordinate axes: P 48.*	
Do not display axis **off**:	P 48.* = 0
Display axis **on**:	P 48.* = 1

You can define separately for each axis whether the encoder signals are counted positive or negative in positive direction of traverse.

Counting direction of the encoder signals: P 30.*	
Positive counting direction:	P 30.* = 0
Negative counting direction:	P 30.* = 1

Monitoring of encoder:
- cable and connectors
- traversing speed
- measuring signals

Encoder monitoring: P 45.*
Encoder monitoring **off**: P 45.* = 0
Encoder monitoring **on**: P 45.* = 1

Setting the display step with linear encoders

With linear encoders, the display step depends on the
- signal period of the encoder (**P31**.∗) and the
- linear subdivision (**P32.**∗).

Both parameters are entered separately for each axis. The linear subdivision can range from 0.1 to 128 depending on the signal period of your encoder.

For linear measurement using nut/ballscrew arrangements and rotary encoders, calculate the signal period as follows:

$$\text{Signal period [µm]} = \frac{\text{Drivescrew pitch [mm] x 1000}}{\text{Line count}}$$

Display step, signal period and linear subdivision for linear encoders

Signal period [µm]		**2**	**4**	**10**	**20**	**40**	**100**	**200**	**12 800**
Display step [mm]	**[inch]**	**Linear subdivision**							
0.000 02	0.000 001	100	–	–	–	–	–	–	–
0.000 05	0.000 002	40	80	–	–	–	–	–	–
0.000 1	0.000 005	20	40	100	–	–	–	–	–
0.000 2	0.000 01	10	20	50	100	–	–	–	–
0.000 5	0.000 02	4	8	20	40	80	–	–	–
0.001	0.000 05	2	4	10	20	40	100	–	–
0.002	0.000 1	1	2	5	10	20	50	100	–
0.005	0.000 2	0.4	0.8	2	4	8	20	40	–
0.01	0.000 5	0.2	0.4	1	2	4	10	20	–
0.02	0.001	–	–	0.5	1	2	5	10	–
0.05	0.002	–	–	0.2	0.4	0.8	2	4	–
0.1	0.005	–	–	0.1	0.2	0.4	1	2	128
0.2	0.01	–	–	–	–	–	–	–	64

Example settings for HEIDENHAIN linear encoders

Encoder	P31.* Signal period	P43.* Reference marks	Display step mm	Display step inch	P32.* Linear subdiv.
LIP 40x	2	0	0.001 0.000 5 0.000 2 0.000 1 0.000 05 0.000 02	0.000 05 0.000 02 0.000 01 0.000 005 0.000 002 0.000 001	2 4 10 20 40 100
LIP 101A LIP 101R	4	0	0.001 0.000 5 0.000 2 0.000 1 0.000 05	0.000 05 0.000 02 0.000 01 0.000 005 0.000 002	4 8 20 40 80
LIF 101. LF 401	4	0	0.001 0.000 5 0.000 2 0.000 1	0.000 05 0.000 02 0.000 01 0.000 005	4 8 20 40
LID xxx LID xxxC	10	0 2 000	0.001 0.000 5	0.000 05 0.000 02	10 20
LS 103. LS 103C LS 405. LS 405C ULS/10		0 or 1 000	0.000 2 0.000 1	0.000 01 0.000 005	50 100
LS 303. LS 303C **LS 603. LS 603C**	20	0 or 1 000	0.01 0.005	0.000 05 0.000 02	2 4
LS 106. LS 106C LS 406. LS 406C LS 706. LS 706C ULS/20	20	0 or 1 000	0.01 0.005 0.002 0.001 0.000 5	0.000 5 0.000 2 0.000 1 0.000 05 0.000 02	2 4 10 20 40
LIDA 190 LB 101	40	0	0.002 0.001 0.000 5	0.000 1 0.000 05 0.000 02	20 40 80
LIDA 2xx LB 3xx	100	0	0.01 0.005 0.002 0.001	0.000 5 0.000 2 0.000 1 0.000 05	10 20 50 100
LIM 102	12 800	0	0.2 0.1	0.01 0.005	64 128

Setting the measured value display

Designation of the coordinate axes: P49.*	
Axis is coordinate axis **A**:	P 49.* = 65
Axis is coordinate axis **B**:	P 49.* = 66
Axis is coordinate axis **C**:	P 49.* = 67
Axis is coordinate axis **X**:	P 49.* = 85
Axis is coordinate axis **Y**:	P 49.* = 86
Axis is coordinate axis **Z**:	P 49.* = 87
Axis is coordinate axis **U**:	P 49.* = 88
Axis is coordinate axis **V**:	P 49.* = 89
Axis is coordinate axis **W**:	P 49.* = 90

Unit of measurement: P 1 (user parameter)	
Display dimensions in millimeters (**mm**):	P 1 = 0
Display dimensions in inches (**inch**):	P 1 = 1

In the diameter display mode, the symbol for the diameter (Ø) appears next to the display value, and the display value doubles.

Radius/diameter display: P 3.* (user parameter)	
Display position values as **radius**:	P 3.* = 0
Display position values as **diameter**:	P 3.* = 1

In the separate value display mode, POSITIP displays the positions of the saddle and top slide separately. In the sum display mode, the position values of the two axes are added together.

Separate value/sum display: P 5.* (user parameter)	
Separate value display mode:	P 5.* = 0
Sum display mode:	P 5.* = 1

Axis error compensation

Linear and non-linear errors can occur on the axes of a machine, e.g. errors in drivescrew pitch, or errors caused by axis sag and tilt. These errors can be detected with a comparator system such as the VM 101 from HEIDENHAIN. POSITIP can compensate these errors. You can activate error axis compensation using parameter P40.

Axis error compensation: P40.*	
Axis error compensation (**Off**):	P40.* = 0
Linear axis error compensation (**Linear**):	P40.* = 1
Non-linear axis error compensation **(Non-linear)**:	P40.* = 2

Linear axis error compensation

A factor that you enter in operating parameter P41.* compensates for this error.

Example calculation of compensation factor k
Displayed distance: L_D = 620 mm
Actual distance as determined
with comparator system: L_A = 619.876 mm
Difference: $\Delta l = L_A - L_D$ = –0.124 mm Δl = –124 µm
Compensation factor **k** = $\Delta l / L_D$ = **–200 µm / m = –200 ppm**

Linear axis error compensation: P 41.*	
Compensation factor k –99 999 [ppm] < P 41.* < 99 999 [ppm]	P 41.* = 0

Non-linear axis error compensation

Working with non-linear axis error compensation
To activate the non-linear axis error compensation you have to:
- ➤ Activate the function using working parameter P40 .
- ➤ Enter the compensation values in the table.
- ➤ Traverse the reference points every time you turn the machine on .

Selection of the operating mode COMPENSATION VALUE TABLE
In the operating mode COMPENSATION VALUE TABLE enter the compensation values for non-linear axis error compensation as follows:
- ➤ Press the "MOD" key.
- ➤ Select "Code Number" soft key.
- ➤ Enter code number 105 296 and confirm with ENT.

The POSITIP 855 automatically switches the position display to REF when the compensation value table is selected (the datum for the display is the scale reference point).

The functions are in two soft-key rows and can be selected using the "paging" keys.
Row 1: Enter the compensation value using the keyboard.
Row 2: Read in or output the compensation value table using data interface.
You can enter compensation values at 64 compensation points for each axis — as a function of the positions in the axis causing the error.

Input data
Select the individual input fields with the arrow keys and enter:
- ➤ The axis which is to be corrected under "faulty axis?". Press axis soft key.
- ➤ The axis which is causing the error under "axis causing error?" Press axis soft key.
- ➤ The datum for the axis causing the error under "datum."
- ➤ The distance between the compensation points for the axis causing the error under "compensation point distance?" as an exponent to the base 2 :
  e.g. 14 = 2^{14} = 16 384 µm.
- ➤ Compensation values: compensation point 0 is preassigned the value 0.000 and cannot be changed.

Delete the table
You can delete the table values as follows:
- ➤ Select the table to be deleted under "faulty axis?" and press the axis soft key.
- ➤ Press "delete table."

II - 4
Data Interface

The POSITIP's data interface allows you to save programs and operating parameters on diskette, or print out or save coordinates. Chapter I - 3 describes how to **transfer programs**, and Chapter II - 2 describes how to **transfer operating parameters**.

This chapter covers what you need to know about **setting up** the data interface:

- Pin layout of the data interface
- Signal levels
- Wiring of the connecting cable and connectors
- Baud rate (data transfer speed)
- Data format

Connections

The RS-232-C/V.24 serial port is located on the POSITIP's rear panel. The following devices can be connected to this port:

- HEIDENHAIN FE 401 floppy disk unit
- Printer with serial data interface
- Personal computer with serial data interface

The HEIDENHAIN FE 401 floppy disk unit is immediately ready for operation at the data interface.

Interface X31 complies with the recommendations in VDE 0160, 5.88 for separation from line power.

Pin layout on the POSITIP data interface

Pin	Assignment	
1	CHASSIS GND	– Chassis ground
2	TXD	– Transmitted data
3	RXD	– Received data
4	RTS	– Request to send
5	CTS	– Clear to send
6	DSR	– Data set ready
7	SIGNAL GND	– Signal ground
20	DTR	– Data terminal ready
8 to 19	Do not assign	
21 to 25	Do not assign	

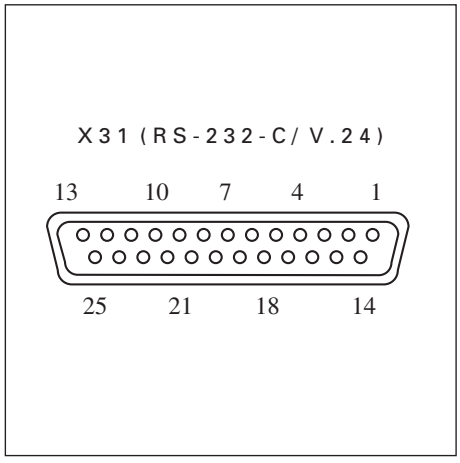


Fig. 38: Pin layout of RS-232-C/V.24 data interface

Signal levels

Signal	Signal level 1 = active	Signal level 0 = not active
TXD, RXD	– 3 V to – 15 V	+ 3 V to + 15 V
RTS, CTS DSR, DTR	+ 3 V to + 15 V	– 3 V to – 15 V

Wiring the connecting cable

The wiring of the connecting cable depends on the device being connected (see technical documentation for external device).

Full wiring

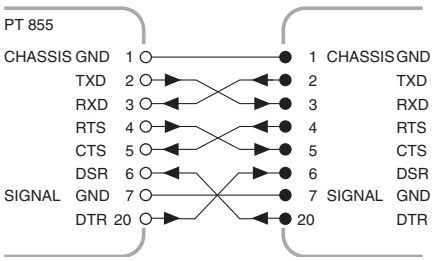


Fig. 39: Diagram for full wiring

Simplified wiring

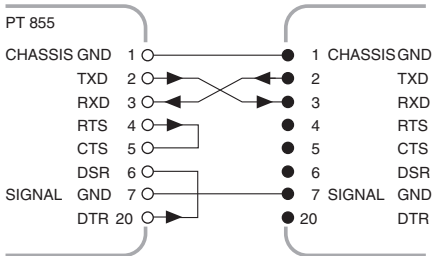


Fig. 40: Diagram for simplified wiring

Setting the baud rate: P 50

The baud rate set on the POSITIP must be the same as that of the external device. The external device must be capable of processing the selected baud rate. The baud rate for the data interface on the POSITIP is set with an operating parameter. The machine manufacturer can also make this parameter available as a user parameter (see I - 6).

Settings for the baud rate
P 50 = 110, 150, 300, 600, 1200, 2400,
4800, 9600, 19 200, 38 400 [baud]

The baud rate for data transfer between POSITIP and the FE 401 floppy disk unit is always 9600.

Data format

Data is transferred in the following sequence:
1. Start bit
2. Seven data bits
3. Parity bit (even parity)
4. Two stop bits

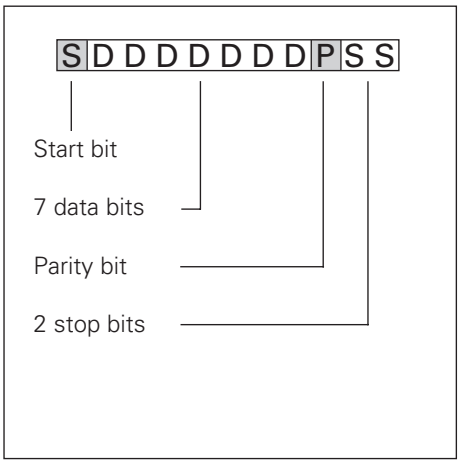


Fig. 41: Data transfer format

Interrupting data transfer

There are two ways to interrupt data transfer from the external device and restart it:

- Start/Stop over input RXD
  DC3 = XOFF = CTRL S: interrupt data transfer
  DC1 = XON = CTRL Q: resume data transfer
- Start/Stop over control line CTS

When the stop signal CTS or DC3 has been received, POSITIP sends up to two further characters.

II - 5
Measured Value Output

POSITIP can output measured values over the data interface.

Starting measured value output

There are two ways to start measured value output:
- Transmit control character to the data interface
- Send signal to switching input

The delay between the latch signal and measured value output depends on the selected signal.

Transit time of encoder signals

After approximately 4 µs the encoder signals are present in a buffer that is interrogated by the internal latch signal. The measured value that is output is therefore the value that existed approximately 4 µs prior to the internal latch.

Starting measured value output over external switching input

You can start measured value output over the switching input at the D-sub connection EXT by sending a pulse or by make contact.

Contact at pin 9: make contact against 0 V
Pulse at pin 8: pulse duration $t_e \geq 1.2$ µs

The contact or pulse can also be sent over a TTL logic device (such as SN 74 LS XX):
$U_H \geq 3.9$ V ($U_{MAX} = 15$ V)
$U_L \leq 0.9$ V with $I_L \leq 6$ mA

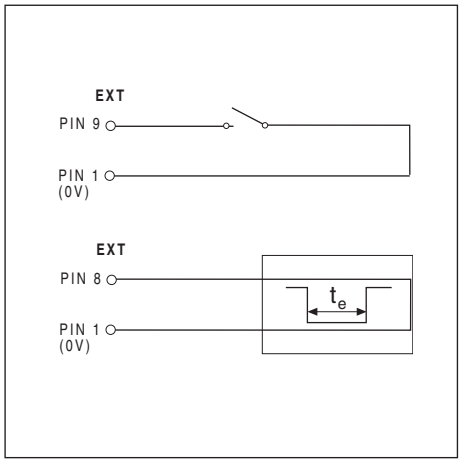


Fig. 42: Signal by make contact against 0 V

t_e: Minimum duration, **pulse**
$t_e \geq 1.2$ ms
t_e: Minimum duration, **contact**
$t_e \geq 7$ ms
t_1: Delay between **pulse** and internal latch
$t_1 \leq 0.8$ µs
t_1: Delay between **contact** and internal latch
$t_1 \leq 4.5$ ms
t_2: Delay between internal latch and measured value output
$t_2 \leq 30$ ms
t_3: Delay between end of data output and next latch over external switching input
$t_3 \geq 0$ ms
t_D: Duration of measured value output

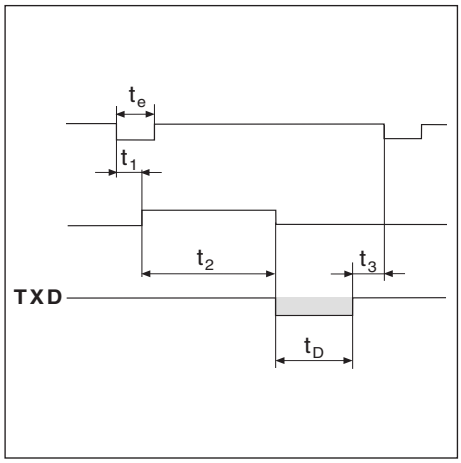


Fig. 43: Time diagram for measured value output over external switching input

The duration of measured value output (t_D) depends on:
- The selected baud rate (BR)
- The number of axes (M)
- The number of blank lines (L)

$$t_D = \frac{187 \times M + L \times 11}{BR} \text{ [s]}$$

Starting measured value output with Ctrl B

t_1: Delay between Ctrl B command and internal latch
$t_1 \leq 0.5$ ms
t_2: Delay between internal latch and measured value output
$t_2 \leq 30$ ms
t_3: Time between end of data output and next latch with Ctrl B
$t_3 \geq 0$ ms
t_D: Duration of measured value output

The duration of measured value output (t_D) depends on
- The selected baud rate (BR),
- The number of axes (M)
- The number of blank lines (L)

$$t_D = \frac{187 \times M + L \times 11}{BR} \quad [s]$$

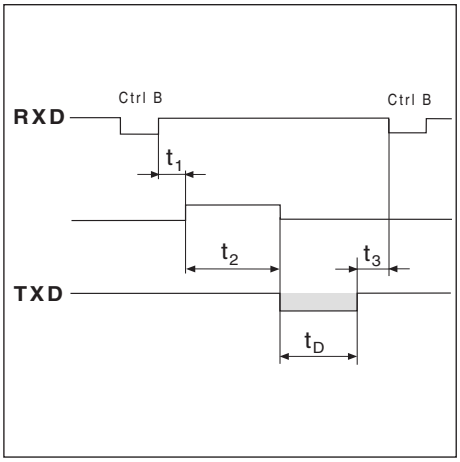


Fig. 44: Time diagram for measured value output with Ctrl B

Operating parameters for measured value output

The following operating parameters will influence measured value output — regardless of how you start it.

Number of blank lines after each measured value: P51
Number of blank lines after measured value: P51 = 0 to 99

You can also use the signal for measured value output to influence position display.

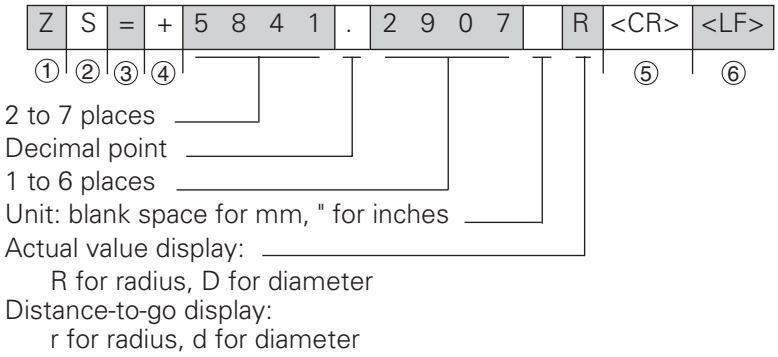
Screen display during measured value output: P23	
The display is not stopped during measured value output (**Off**):	P23 = 0
The display is stopped during measured value output and remains stopped as long as the switching input "output measured value" is active (**Concrnt**):	P23 = 1
The display is stopped but is updated by every measured value output (**Frozen**):	P23 = 2

Example of character output at the data interface

The numbers stand for

① Coordinate axis
② Blank space (separate value mode), S (sum mode) or O (top slide)
③ Equality sign
④ +/– sign
⑤ Carriage return
⑥ Line feed

Example: Linear axis with sum display mode Z = + 5841.2907 mm



II - 6
Switching Inputs and Outputs

Switching signals at the D-sub connection EXT allow you to

- reset the actual value display of a coordinate axis to zero
- control motor cutoff
- start measured value output (see Chapter II - 5)

Interface X41 (EXT) complies with the recommendations in VDE 0160, 5.88 for separation from line power.

The outputs for the switching ranges are metallically isolated from the device electronics by means of optocouplers.

Danger to internal components!
Voltage from external circuitry must conform to the recommendations in VDE 0100, Part 410 for low-voltage electrical separation.

Connect inductive loads such as relays only with a quenching diode. Shield against electromagnetic fields. Connect with a shielded cable with the shield extended to the connector housing.

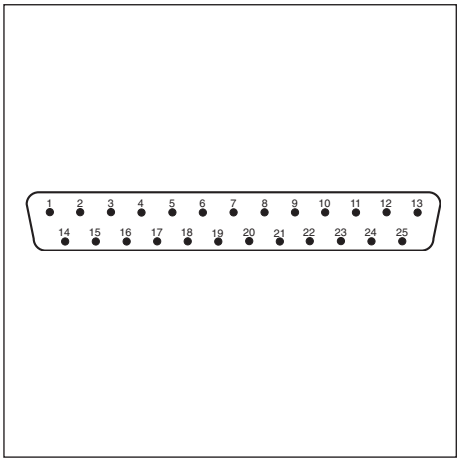


Fig. 45: The D-sub connection EXT

Pin layout of D-sub connection EXT (X41)

	Pin	Assignment
Outputs	10	0 V for switching range
	23, 24, 25	24 V DC for switching range
	11	POSITIP ready for operation
	14	Display value outside of switching range 0
	15	Display value outside of switching range 1
	16	Display value outside of switching range 2
	17	Display value outside of switching range 3
	18	Display value outside of switching range 4
	19	Display value outside of switching range 5
	20	Display value outside of switching range 6
	21	Display value outside of switching range 7
Inputs	1	0 V (internal)
	2	Reset axis 1 to zero
	3	Reset axis 2 to zero
	4	Reset axis 3 to zero
	5	Reset axis 4 to zero
	8	Pulse: output measured value
	9	Contact: output measured value
	6, 7, 12, 13, 22	Do not use

Reset actual value display to zero

You can reset the actual value display of each axis to zero through one of the inputs at pin 2 to pin 5 (see previous page).

Minimum pulse duration for zero reset: $t_{min} \geq 100$ ms

Zero reset signal: make contact against 0 V **or**
input pulse over TTL logic device (such as SN 74 LS XX):
$U_H \geq 3.9$ V ($U_{MAX} = 15$ V)
$U_L \leq 0.9$ V with $I_L \leq 6$ mA

Using the switching signals

If you wish to use the switching signals, you must supply POSITIP with 24 V DC at the D-sub connection EXT (pins 23 to 25; 0 V to pin 10). Pins 14 to 21 will then be supplied with 24 V as long as the display value is **not** within a switching range.

These pins are then assigned to the axes with operating parameter P60.x. As soon as a display value is within the switching range, the voltage to the corresponding pin will be cut off. Define the switching range in operating parameter P61.x symmetrically around zero.

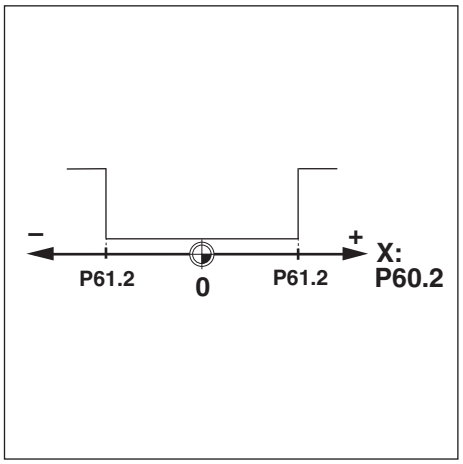


Fig. 46: The switching ranges are symmetrical around zero

If the location of the datum point changes, move the switching ranges correspondingly.

Axis assignment: P60.x	
No axis assigned (**Off**):	P60.x = 0
Assigned to axis **1**:	P60.x = 1
Assigned to axis **2**:	P60.x = 2
Assigned to axis **3**:	P60.x = 3
Assigned to axis **4**:	P60.x = 4

Define the switching range: P 61.x	
0 to 99 999.999 [mm] symmetrically around zero	P61.x

Permissible load at switching outputs

$I_{MAX} = 100$ mA
DC resistance
Connect inductive load only with quenching diode.

Danger to internal components!
Connect inductive loads only with a quenching diode parallel to the inductance.

Accuracy of switching ranges and switching delay: P 69

You can select the switching delay and the accuracy with which the switching outputs are switched.

You can choose between

- Accuracy = display step; switching delay = 80 ms
  This is mode 1: P 69 = 0

- Accuracy = $\frac{\text{Grating period GP of encoder}}{128}$

  Switching delay = 5 ms. This is mode 2: P 69 =1

"POSITIP ready for operation" Output

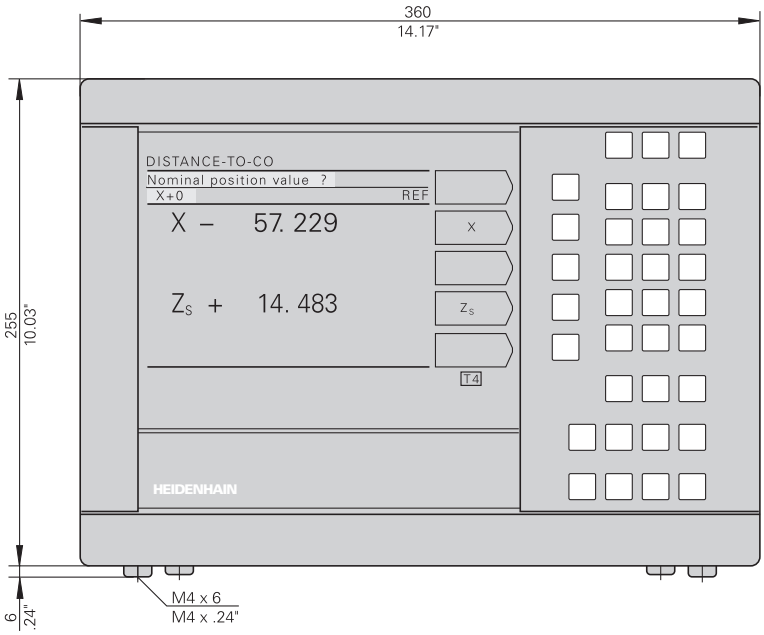
In order to use the "POSITIP is ready for operation" signal you must supply 24 V DC to pins 23, 24 and 25 (0 V to pin 10). During **normal operation**, **pin 11** of D-sub connection EXT has **24 V**.

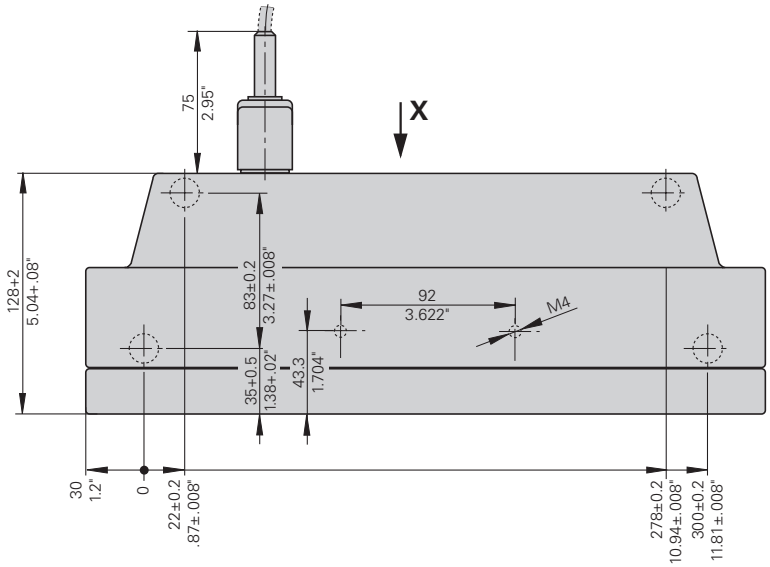
If an **error** occurs which impairs the functioning of POSITIP (such as a hardware or checksum error), POSITIP switches the output at **pin 11** off.

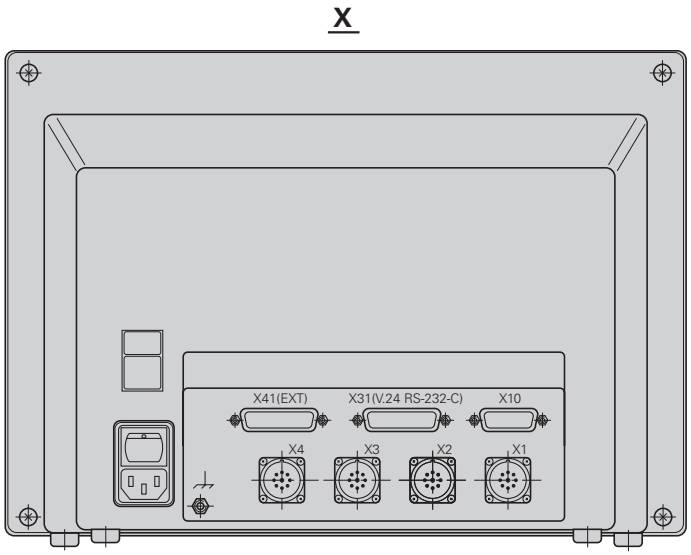
II - 7
Specifications

POSITIP	
Axes	Up to 4 axes from X, Y, Z, A, B, C, U, V, W
Display	Flat luminescent screen: position values, dialogs, entries, graphics
Status display	Operating mode, REF, inches, scaling factor Graphic positioning aid with distance-to-go display Oversize, feed rate, tool number Diameter display, sum display Z_S and/or X_S
Position encoders	Incremental HEIDENHAIN linear encoders with sinusoidal output signals
Display step	Linear axes: 5 µm, 1 µm or finer (to 0.02 µm)
Functions	• REF reference mark evaluation • Distance-to-go mode, nominal position absolute or incremental • Scaling factor • Linear machine error compensation • **HELP:** on-screen operating instructions • **INFO:** pocket calculator, stopwatch, taper calculator
	• One datum point and table for up to 99 tools • Oversizes • Freezing the displayed tool position during retraction (note/set)
Programming	Memory for up to 20 programs and a total of 2000 program blocks Up to 1000 blocks per program Subprogramming; Teach-in (actual-position capture)
	Multipass cycle in the program
Data interface	RS-232-C/V.24; for output of programs, measured values and parameters Baud rate: 110 / 150 / 300 / 600 / 1200 / 2400 / 4800 / 9600 / 19200 / 38400
Accessories	• Floppy disk unit for external storage of programs • Tilting base
Switching outputs	• 8 digital outputs (24 V), assigned to the axes with parameters • 1 "POSITIP is ready for operation" digital output
Switching inputs	• 1 input for each axis for zero reset • 2 inputs for measured value output (pulse or contact)
Power source	Switching power supply 100 V to 240 V (–15% to +10%), 48 to 62 Hz
Power consumption	24 W
Operating temperature	0° to 45° C (32° to 113° F)
Storage temperature	–30° to 70° C (–22° to 158° F)
Weight	4.8 kg

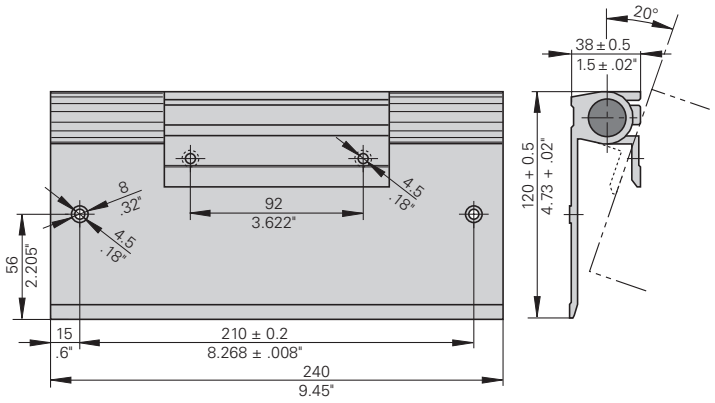
II - 8
Dimensions







Tilting base



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NOTES

HEIDENHAIN

DR. JOHANNES HEIDENHAIN GmbH
Dr.-Johannes-Heidenhain-Straße 5
83301 Traunreut, Germany
☏ +49/86 69/31-0
FAX +49/86 69/50 61
e-mail: info@heidenhain.de

☏ **Service** +49/86 69/31-12 72
☏ TNC-Service +49/86 69/31-14 46
FAX +49/86 69/98 99
e-mail: service@heidenhain.de

http://www.heidenhain.de

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