HEIDENHAIN

Operating Instructions

VRZ 714 B, 754 B
Bidirectional Counters

VRZ 714 B

VRZ 754 B

October '87

Contents

I. Setting up and maintenance

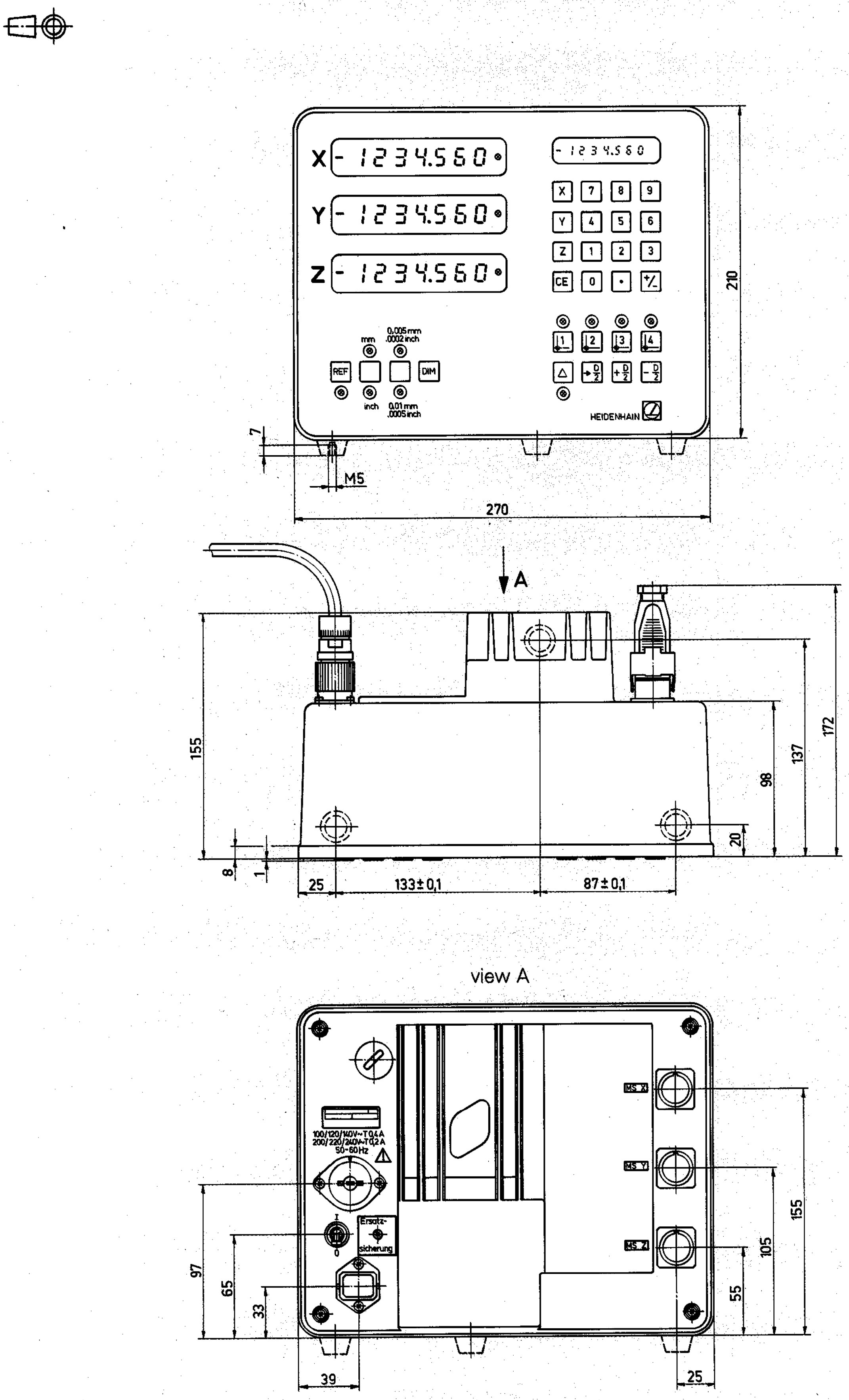
1.1 Items supplied

Bidirectional counter
VRZ 714 B for 2 axes or
Bidirectional counter
VRZ 754 B for 3 axes
Replacement fuse in compartment at rear
Mains coupling, separate
Operating instructions and certificate of inspection
Optional: mains cable 2.7 m long

1.2 Technical specifications

	Type	VRZ 714 B (2 axes display) VRZ 754 B (3 axes display)
Mechanical data	Housing design	table model, cast housing
	Dimensions	W 270 × H 221 × D 172 mm
	Weight	approx. 5.6 kg
	Operating temperature Storage temperature	0° to +45°C −30° to +70°C
	Inputs	for Heidenhain linear transducers grating pitch 40 µm or 20 µm
	Digital display: position value displays keyboard display	 7-segment LED's 7½ decades with sign
	Metric/Inch converter Display step	static, active for all displays 5 µm/10 µm or 0.0002"/0.0005" selectable
	Datum points Reference mark evaluation (REF)	4 floating datum points The reference mark positions for all datum points are automatically entered in a non-volatile memory. After power failure, all datum points can be reproduced by simply passing over the reference marks once.
	Display of "distance to go"	conversion of entered absolute dimensions into "distance to go" (= for "countdown" positioning)
	Dimmer switch	adjustment of display brightness
Electrical data	Operating voltage Power consumption Cable length	100, 120, 140, 200, 220, 240 V (selectable) approx. 30 W max. 20 m

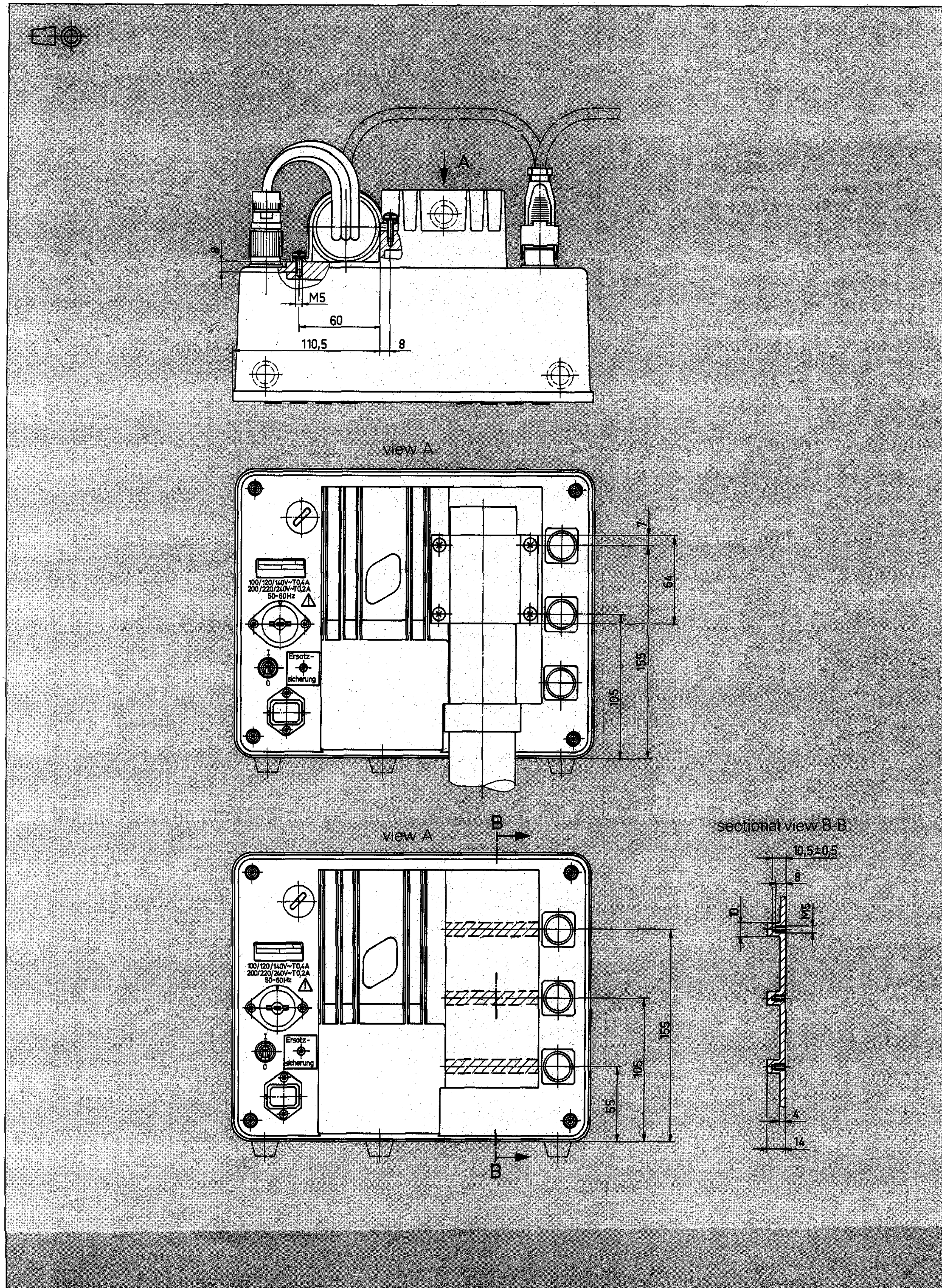
1.3
Dimensions mm



2. Mounting possibilities

The counter is cased in a cast aluminium housing. The feet of the unit are provided with M5- tapped holes which enable securing onto tables or consoles from underneath by means of screws.

A further mounting possibility is provided by securing the counter rear onto an angle iron or pipe. Drill and tap required holes in accordance with dimensions as indicated in drawing of "rear panel" at any location within the shaded areas. If the indicated dimensions are not strictly observed then this might result in penetration of the housing and swarf entering the counter interior may cause malfunctions!



3. Connect transducers, mains connection

CAUTION: Do not engage or disengage any connectors whilst equipment is under power.

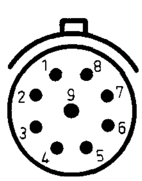
3.1 Protection

The front panels and the operating panel of the counters are splashwater-proof. Counters VRZ 714 B/754 B correspond to protection classification I of the VDE-regulations VDE 0411 and are built and tested in accordance with DIN 57411 part 1/VDE 0411 part 1 "Protective measures for electronic measuring equipment".
In order to maintain this condition and to ensure safe operation, the operator must comply with the **instructions and warnings** which are contained in these operating instructions.

3.2 Connection of transducers

All transducers with 20 µm (e.g. LS 303, LS 603) and LIDA transducers with 40 µm grating pitch, as well as Heidenhain angle encoders with sinusoidal signals (e.g. ROD 450) can be connected to VRZ 714 B/745 B.

Connector
20071701



Contact designation	3	4	1	2	5	6	7	8	9
	+	−	+	−	+	−	+	−	
Use	Lamp U_L		Measuring signal (0° el.) I_{e1}		Measuring signal (90° el.) I_{e2}		Reference mark signal I_{e0}		⏚

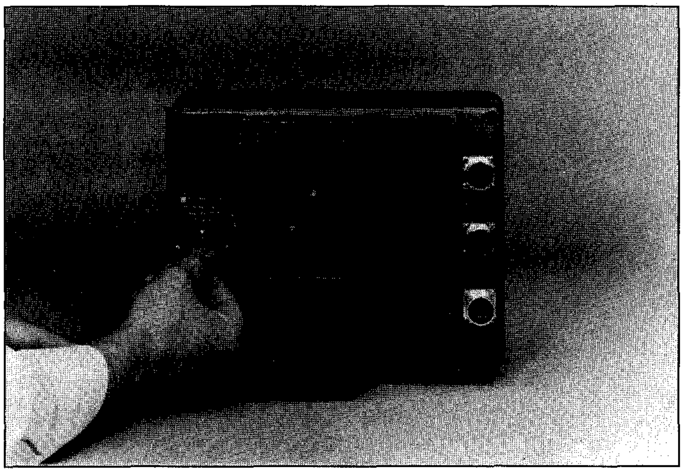
The HEIDENHAIN linear transducers are provided with 9-pole connectors (Id.-No. 21235601) as a standard feature and are connected via 9-pole flange sockets at counter rear.

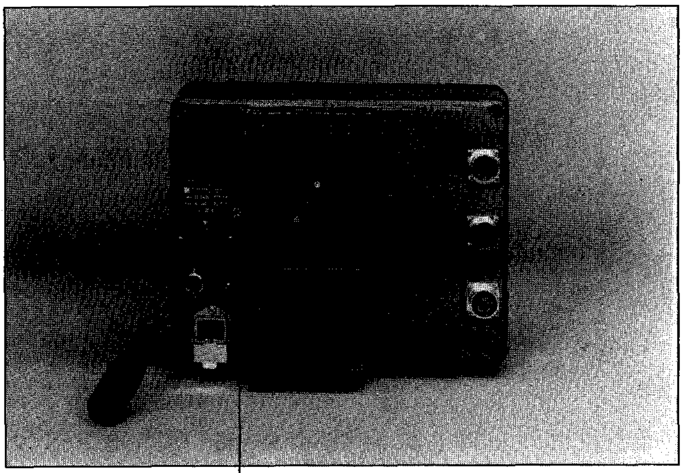
3.3
Selection of mains voltage

The counters are set to 220 V~ when supplied, and can be converted to 100, 120, 140, 200 or 240 V~:

After removing mains fuse holder, set voltage selector to desired voltage by using a coin; replace mains fuse holder with fuse:
T 0.2 A for 200–240 V
T 0.4 A for 100–140 V

The appropriate replacement fuse is provided in a compartment adjacent to voltage selector. Remove cover by using a Phillips screw-driver.





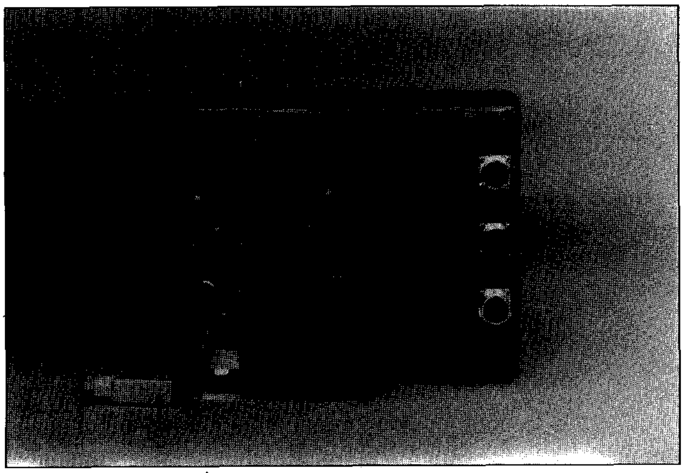
Replacement fuse

Instructions to be observed prior to activation of unit

1. Check that rated voltage on the unit corresponds to mains voltage.
2. In the case that this unit is to be operated via an autotransformer from higher mains voltage it must be ensured that the low end of the transformer is connected to the earth conductor of the mains supply.

3.4
Mains connection

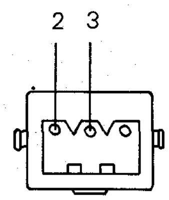
Wire mains cable to enclosed mains coupling (compl. mains cable available as accessory) and insert mains coupling into mains socket of counter. Push down safety clamp.



Wiring of Mains Coupling

CAUTION

Mains connection to contacts



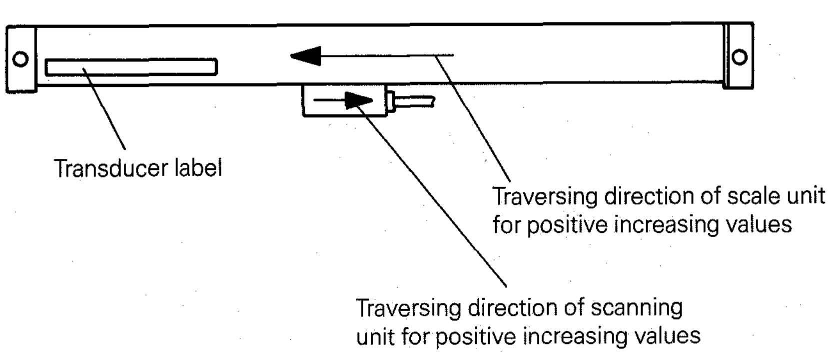
Protective earth to ⏚

Note:
The mains connector must be inserted into a socket with earthing contact.
The protection must not be interrupted by an extension cable without earth conductor.

Caution!
Any interruption of the earth conductor either inside or outside of the housing or loosening of the earth conductor connection may render the unit unsafe. Deliberate interruption is not permissible.

3.5
Counting direction

The transducers are supplied as follows:

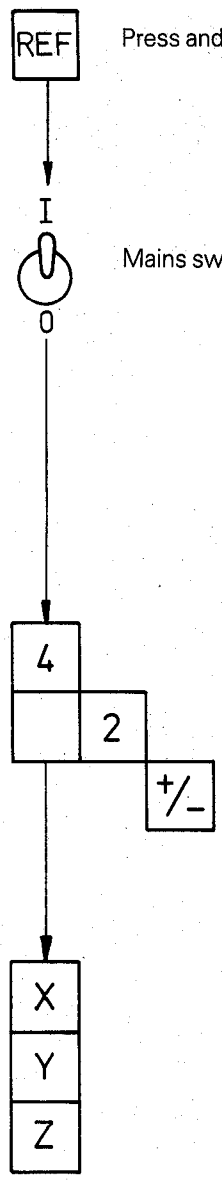


Counting direction

3.6 Setting of pulse evaluation and counting direction

Counter versions VRZ 714 B and 754 B, permit programming of pulse evaluation and counting direction. This information is entered into a non-volatile store after programming. Both settings are indicated for each axis.

Procedure



Press and hold

Mains switch on, release REF

REF-light diode flashes

Counter	Linear transducer	Key sequence for entry: Pulse evaluation – Direct display	Pulse evaluation – Diameter display	Reversed counting direction +/– *	Axis
VRZ 714 B	LS 303, 603	2 or 2	4	+/– +/–	X Y
VRZ 754 B	LS 303, 603	2 or 2 2	4	+/– +/– +/–	X Y Z
VRZ 714 B/ VRZ 754 B	LIDA 190/40	4		+/–	X or Y or Z

* Only press +/– for reversal of counting direction.

REF After entry of the values in all axes the REF light diode ceases flashing.

The counter is now operational.

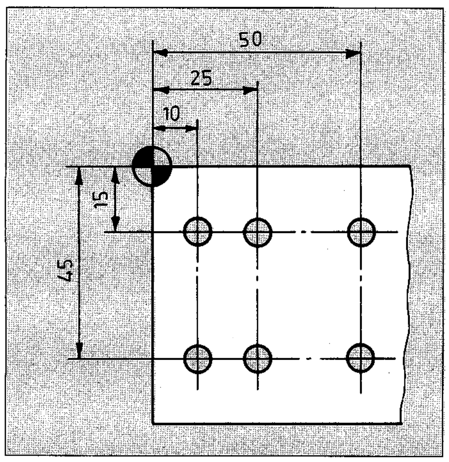
Note:
Even if only one parameter is to be changed, all settings for X, Y and Z must be reentered.

II. Working with VRZ 714 B, 754 B

By deciding upon counter VRZ 714 B, 754 B, you have purchased a unit which, due to the practical design, makes positioning easier, quicker and more economical. This counter offers the possibility of setting several datum points. Furthermore, it is possible to position with "target" counting whereby the tool radius can be simultaneously taken into account. Re-establishing the correlation between datum points and reference marks of the LS system is "automated". Traversing over the reference marks once is sufficient to calibrate the counter in all axes. (Previous determination of the position value for the datum point is not required; a buffer battery back-up in case of power failures etc. is not necessary.) In addition to these advantages, the counters are provided with keyboard entry (keyboard display), selectable display step, mm/inch converter, direction switch and dimmer.
When reading the following explanations, it is recommended to refer to the illustration of the operating panel on page 20. The encircled figures (①, ②, ③ . . .) of a 3 axes counter are explained in this illustration.

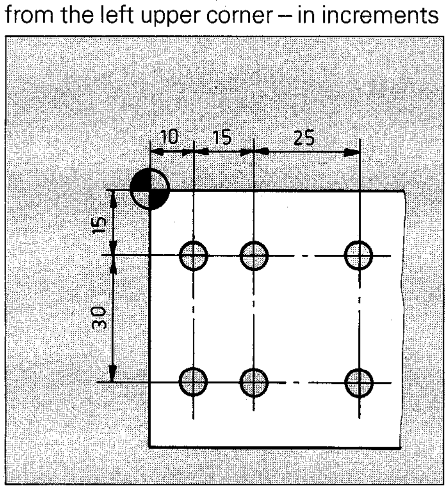
1.1
Absolute mode and incremental mode
In the absolute mode all measurements refer to the "absolute" datum point, whilst in incremental mode each immediately preceding position serves as datum point.

Absolute mode
Example:
The left upper corner is the "absolute datum point" for the measurements



The machine is to be positioned **to** a certain dimension.

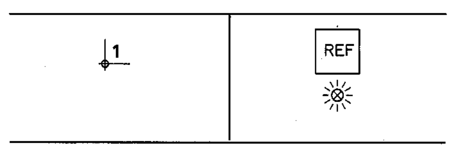
Incremental mode
Example:
Measurements are carried out – starting from the left upper corner – in increments



The machine is to be traversed **by** a certain distance.

1.2
Instructions for key-in of position values or dimensions
Entry errors can be cleared by means of the [CE] button.
Values are entered in "mm" or "inch", whereby key-in of trailing zeroes is not required.
An entered value remains within the keyboard memory until it is overwritten by a new value or cleared by the [CE] button.
The finest decade of the keyboard display is rounded off to digital step 0.005 mm in operating mode "metric", and to 0.0002 inch in "Imperial" operating mode.
An entry value can be preset into the position displays ⑯ or can be repeated any number of times as an incremental dimension – in any axis and with changing sign (see item 2.2).
Only negative sign "–" is displayed. Each actuation of the sign change key [+/–] will change the sign of the value in the keyboard memory. For entry of negative values, the following is applicable: **first** enter **value, then** negative **sign.**
If the entered value in the keyboard display is too large (> 19999,995 mm or 787,402 inches), then each numeral in the keyboard display will illuminate with decimal point.

1.3
Traversing over reference marks when first setting up
After initial connection of transducers, all REF-memories of the counter must be "activated".



press REF key ⑮:
reference mark indicators ⑰ in the position displays illuminate.
Traverse over reference marks in all axes; reference mark indicators are extinguished.

1.4
Failure signal
Failure of a transducer, cable defects etc. are indicated by flashing of the appropriate position display ⑯.
Switch off counter, remedy the fault and re-active counter. Alternatively, the failure signal can be cancelled by pressing the REF key (repeat, if reqd.).

1.5
Operating condition each time counter is switched on

	Keyboard display Position display	⑱ . . . "0" ⑯ . . . Displayed position values indicate correlation between established datum point 1 and reference mark.
REF ⊗	**REF key**	⑮ . . . "OFF"
mm ⊗ ⊗ inch	**mm/inch button**	⑭ . . . metric or Imperial (depending on last mode chosen) Random switch-over from "mm" to "inch" and vice-versa during measuring procedure, whereby the displayed values and all stored values are simultaneously converted.
0,005 mm 0,0002 inch ⊗ ⊗ 0,01 mm 0.0005 inch	**Display step**	. . . With the display step button ⑬ either 0.005 mm or 0.0002 inch | or 0.01 mm or 0.0005 inch can be selected as display step for the position display.
DIM	**Display brightness**	. . . maximum brightness dimmer switch ⑫ for two brightness settings

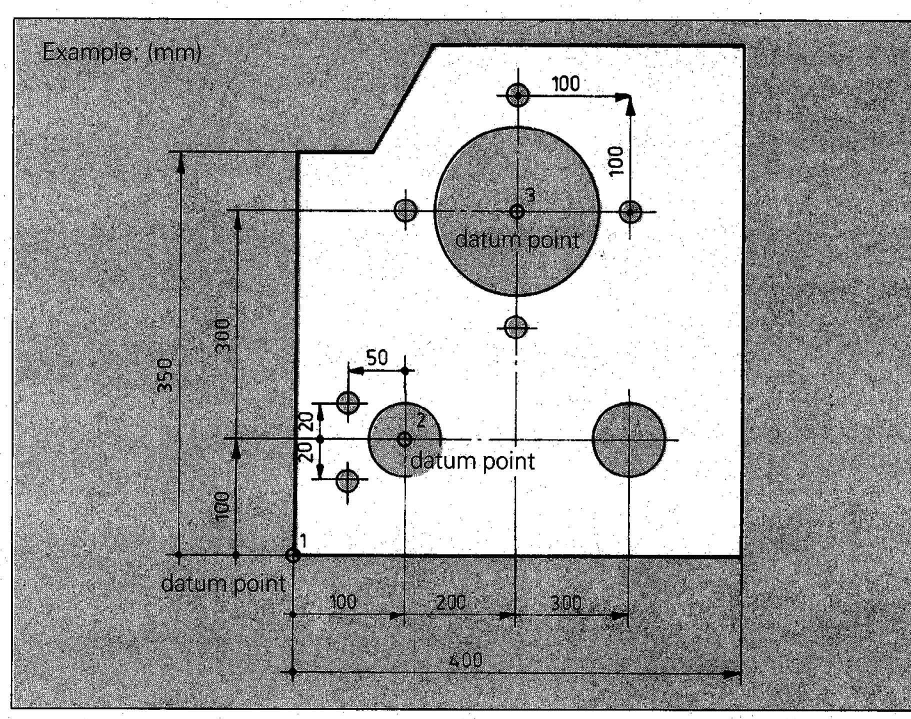
2. Establishing datum point

2.1 Selection of datum point

The counter permits establishing four floating datum points for the position displays. The dimensioning of a workpiece may be referenced to different datum points, i.e. in the following example datum point 1 can be referenced to the workpiece edge as starting point, and the other datum points can be referenced to the centering points of the bore holes for positioning of the incremental dimensions:

Prior to setting a datum point, one of the datum point keys ⑥ 1 to 4 is to be pressed – the corresponding indicator lamp ⑤ illuminates.

Switch-over between datum points is possible at any time.



2.2
Preset

Presetting assigns fixed display values to all positions.
Zero is often selected as datum point:

datum point 1. . . 4	CE or 0	press clear button ④ or zero	keyboard display ⑱ shows "0"
	X Y Z	press axis keys ①	"0" appears in position display ⑯

The counter can be preset to any datum values as follows:

datum point 1. . . 4	0 . . . 9	position value for workpiece datum point (= reference value) entered: ②	datum value appears in keyboard display ⑱
	X Y Z	press appropriate axis key ①	datum value appears in position display ⑯

If machine axes are now traversed, then VRZ 714 B, 754 B always indicates the actual position with reference to the selected datum point. For presetting a determined absolute position value (absolute nominal position), traverse individual machine axes such that the pre-determined position value appears in the position displays ⑯.

For incremental dimensions two procedures are possible: either traverse to required dimension by assigning value zero to the starting position, or preset the nominal value and position with "countdown" to zero.

2.3
Reference mark evaluation "REF"

In the case of switch-off of VRZ 714/754, 756/757 or power failures the established correlation between positions and display values is lost.
If the momentary position is known (e.g. from the drawing), then the position values can be directly re-entered in accordance with item 2.2.
If this is not the case, then the datum points which were established last can be reproduced by means of the REF key.
Immediately upon counter switch-on, all digits of the position displays will show zero; the position displays ⑯ will then jump to those position values which had been assigned to the transducer reference marks by establishing the datum point 1 prior to the operational interruption.
When switching to 2, 3 or 4, the reference mark position values with regard to these datum points will be displayed.
In order to reproduce the datum point, simply press the REF key and traverse over reference marks in all axes – displays are activated and show the position values with reference to the selected datum point 1, 2, 3 or 4.
This procedure is explained in detail as follows:

2.3.1
Calibration = retrieval of datum points
(after operational interruption or power failure)

a) selected counting mode prior to interruption: mm

	REF ⊗ — mm ☼	X + 0000000	⊗	display immediately after counter switch on
☼ 1	REF ⊗ — mm ☼	X + 67.070	⊗	display value approx. 1.5 sec. after switch on of counter dimension 67.07 = position value of X-reference mark for datum point 1
	REF ☼ — mm ☼	X + 67.070	☼	if REF key is pressed, the REF indicators in the position display illuminate – counting function ceases
	REF ☼ — mm ☼	X + 67.070 + 67.075 + 67.080 . .	⊗	machine traverse over reference mark of X-transducer. REF indicator is extinguished and counting is resumed. The displayed position value corresponds to the X-machine position for the selected datum point 1 : counter is calibrated in X-axis

b) selected counting mode prior to interruption: inch

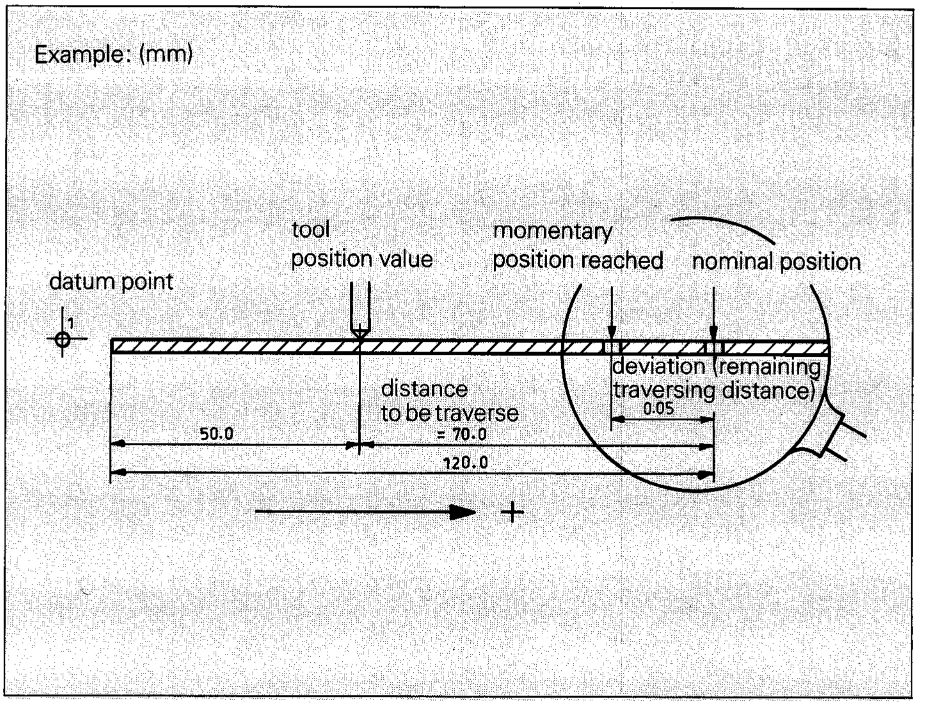
	REF ⊗ — mm ☼	X + 0000000	⊗	display immediately after counter switch on
☼ 1	REF ⊗ — inch ☼	X + 2.6406	⊗	display value approx. 1.5 sec. after counter switch on dimension 2.6406″ = position value X-reference mark for datum point 1
	REF ☼ — inch ☼	X + 2.6406	☼	if REF key is pressed, the REF indicators in the position displays illuminate – counting function ceases
	REF ☼ — inch ☼	X + 2.6406 + 2.6408 + 2.6410 . .	⊗	machine traverse over reference mark of X-transducer. REF indicator is extinguished and counting is resumed. The displayed position value corresponds to the X-machine position for the selected datum point 1 : the counter is calibrated in X-axis

REF remains activated; illumination of the REF lamp indicates that the REF values (position values relative to the reference mark) are automatically stored when a datum point is established and thus are available for re-establishing this datum point after power interruptions. If the reference marks are inaccessible (e.g. workpiece and milling tool are clamped and reference mark cannot be traversed over) REF should be switched off.

3. Positioning with "target" counting

In conjunction with the △-key ⑪, absolute dimensions can be positioned with "target" counting.
This mode of positioning is more convenient and safer than "traversing to a nominal value". Even with inexact positioning (value other than zero in the position display), errors in this operating mode will not be accumulative as the deviation is automatically taken into account with the next positioning step in this axis.

When entering the nominal dimension, e.g. 120 mm, the position display shows the deviation from the nominal value "−70 mm": in order to position the nominal value, machine must be traversed in "+" direction.



		Position display	Keyboard display	
⌖1		X +50.00	0.00	e.g. 50.0 in position display = actual position referenced to datum point ⌖1
	△	X + 0.00	0.00	by pressing the △-key ⑪ the value in the position display is set to "0"
⌖1 △ ☼	1 2 0	X + 0.00	120.0	key- in of nominal value X + 120.0
	X	X −70.00	120.0	by pressing the axis key, the deviation from the nominal value appears in the position display
		X − 0.05	120.0	position machine with "target" counting; "0" is not exactly reached (difference of 0.05 mm with regard to nominal value)
⌖1 △ ⊗	△	X 119.95	120.0	when △-key is switched off, then the absolute dimension referenced to datum point ⌖1 will appear in position display

4. Tool offset ⑦

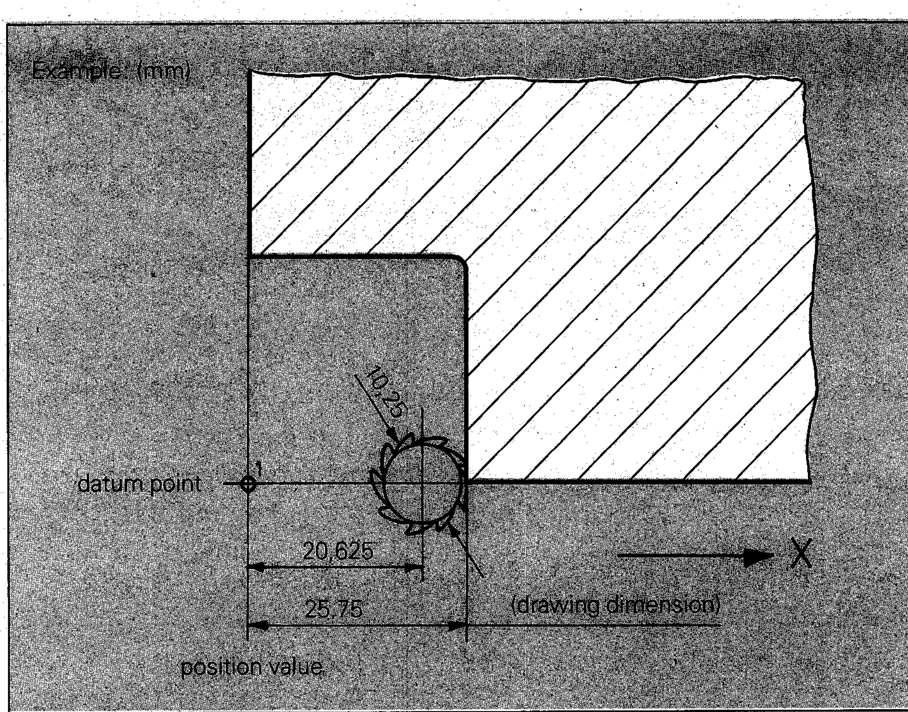
With the three $\frac{D}{2}$-keys, the tool radius can be taken into account without calculations during positioning.
For example, key-in milling cutter **diameter:** by pressing the $\rightarrow\frac{D}{2}$-key ⑩ the milling cutter **radius** is stored.

The value remains in memory until a new diameter is entered (even after switch-off of the counter).
If working only with one milling cutter in an operation, it is recommended to store the milling cutter radius prior to starting.

0 . . . 9	enter diameter value ②	diameter value appears in keyboard display ⑱
$\rightarrow\frac{D}{2}$	$\rightarrow\frac{D}{2}$-key pressed ⑩	milling cutter radius is stored and appears in keyboard display ⑱

When working with several milling cutters, the appropriate radius is to be entered after each tool change.
After pressing the $+\frac{D}{2}$-key ⑨ the milling cutter radius is added to the value in the keyboard display ⑱, or subtracted by pressing $-\frac{D}{2}$-key ⑧.

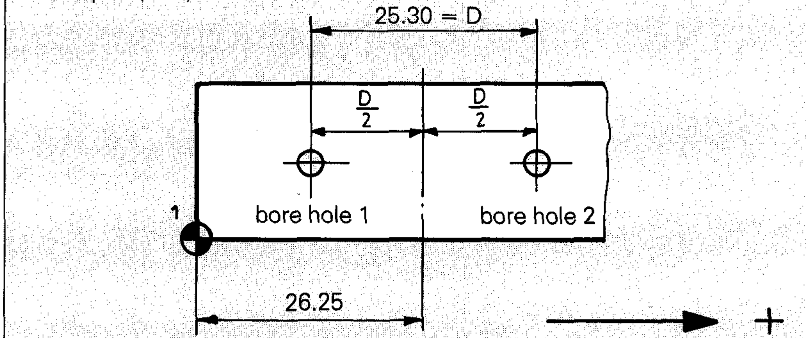
Pressing twice will result in addition or subtraction of the total diameter.
After compensation the value is transferred or preset by pressing the appropriate axis key as usually.
In conjunction with the △-key, positioning is simply carried out with "target" counting to zero (also see example on page 17)!



key	position display ⑯	keyboard display ⑱	
1 0 · 2 5	X 0.00	10.25	enter milling cutter diameter
→ D/2	X 0.00	5.125	milling cutter radius is stored
⌊1 △	X 0.00	5.125	datum point ⌊1 addressed press △-key
2 5 · 7 5	X 0.00	25.75	key-in drawing dimension into keyboard display
− D/2	X 0.00	20.625	subtract milling cutter radius
X	X −20.625	20.625	transfer dimension to be traversed into position display
	X 0.00	20.625	traverse to target "0"
△	X +20.625	20.625	when switching off the △-key, the absolute dimension referenced to datum point ⌊1 appears in the position display ⑯

5. Setting lines of symmetry

The three $\frac{D}{2}$-keys can also be utilized for axially symmetrical hole arrangements



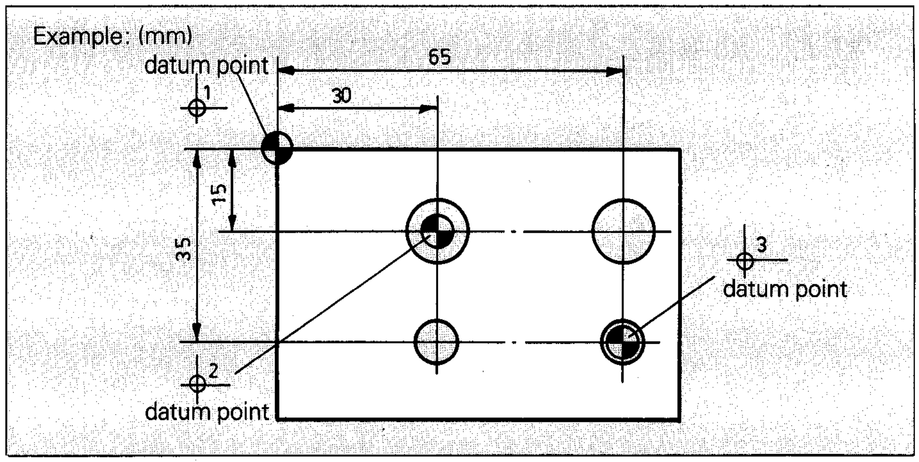
1	2 5 · 3	store symmetry dimension 25.30 by means of $\frac{D}{2}$ key	12.650 = symmetry dimension appears in keyboard display: 2
	X	press △-key and axis key	0 appears in position display
△ 1	2 6 · 2 5 $-\frac{D}{2}$ X	enter 26.25 and then press $-\frac{D}{2}$ and axis key	13.600 appears in keyboard display X = 13.600 appears in position display
	position machine by "target" counting for borehole 1 and drill hole		
	$+\frac{D}{2}$ X	press $+\frac{D}{2}$ twice press axis key	25.30 (= deviation from nominal value) appears in keyboard display – this dimension is preset into position display.
	position machine by "target" counting for borehole 2 and drill second hole		

6. Operating examples

6.1

1st Example

Working with several datum points. Several identical workpieces are to be machined with 4 boreholes. If the appropriate values are referenced to the datum points during machining of the first workpiece, then a "program" has been stored, i.e. all further identical parts can be positioned by calling up the individual datum points (without re-entering of dimensions or re-checking drawing).



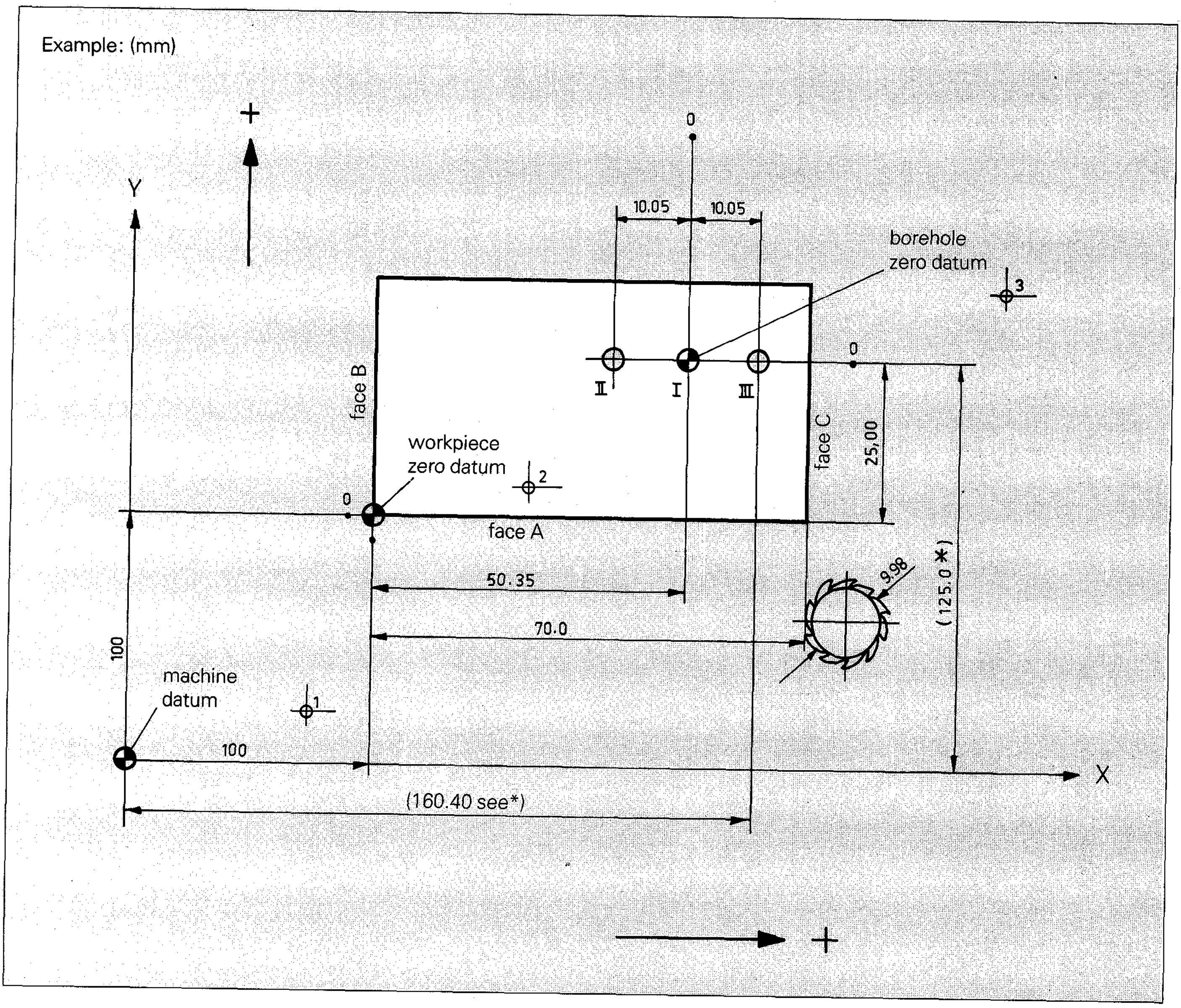
⌖1 [Δ] ☼	[CE] [X] [Y] [Δ]	press clear key and axes keys press delta key	preset datum point 1
	[3] [0] [X] [1] [5] [Y]	enter distance values to first borehole	X = −30 Y = −15 appears in position display
	position machine towards zero		
⌖2 [Δ] ☼	[CE] [X] [Y]	address datum point 2 press clear key and axis key	datum point 2 preset
⌖1 [Δ] ☼	[Δ] [6] [5] [X]	address datum point ⌖1 once again press Δ-key enter dimension X = 65 mm	boreholes are dimensioned from datum point ⌖1 deviation from nominal value = −35 mm appears in keyboard display
	position machine towards zero		
	[3] [5] [Y]	enter dimension Y = 35 mm	deviation from nominal value = −20 mm appears in keyboard display
	position machine towards zero		
⌖3	[CE] [X] [Y]	select reached position as datum point ⌖3 press clear key and axis keys	datum point ⌖3 preset
⌖1 [Δ] ☼	[Δ] [3] [0] [X]	address datum point ⌖1 once again press Δ-key enter dimension X = 30 mm	X = +35 mm appears in keyboard display
	position machine towards zero		
	[1] [5] [Y]	enter dimension X = 15 mm	Y = +20 mm appears in keyboard display
	position machine towards zero		
⌖1 or ⌖2	[Δ]	switch off Δ-key	drill is positioned on first borehole X = 30 Y = 15, i.e. deviation from datum point ⌖1 appears (for checking only) or X = 0 Y = 0 with datum point ⌖2

When the next workpiece is placed into the jig, then the 4 boreholes can be directly positioned by addressing the various datum points.

The same example is applicable to inner contour milling (with "target" counting – however, do not forget to take tool radius into account).

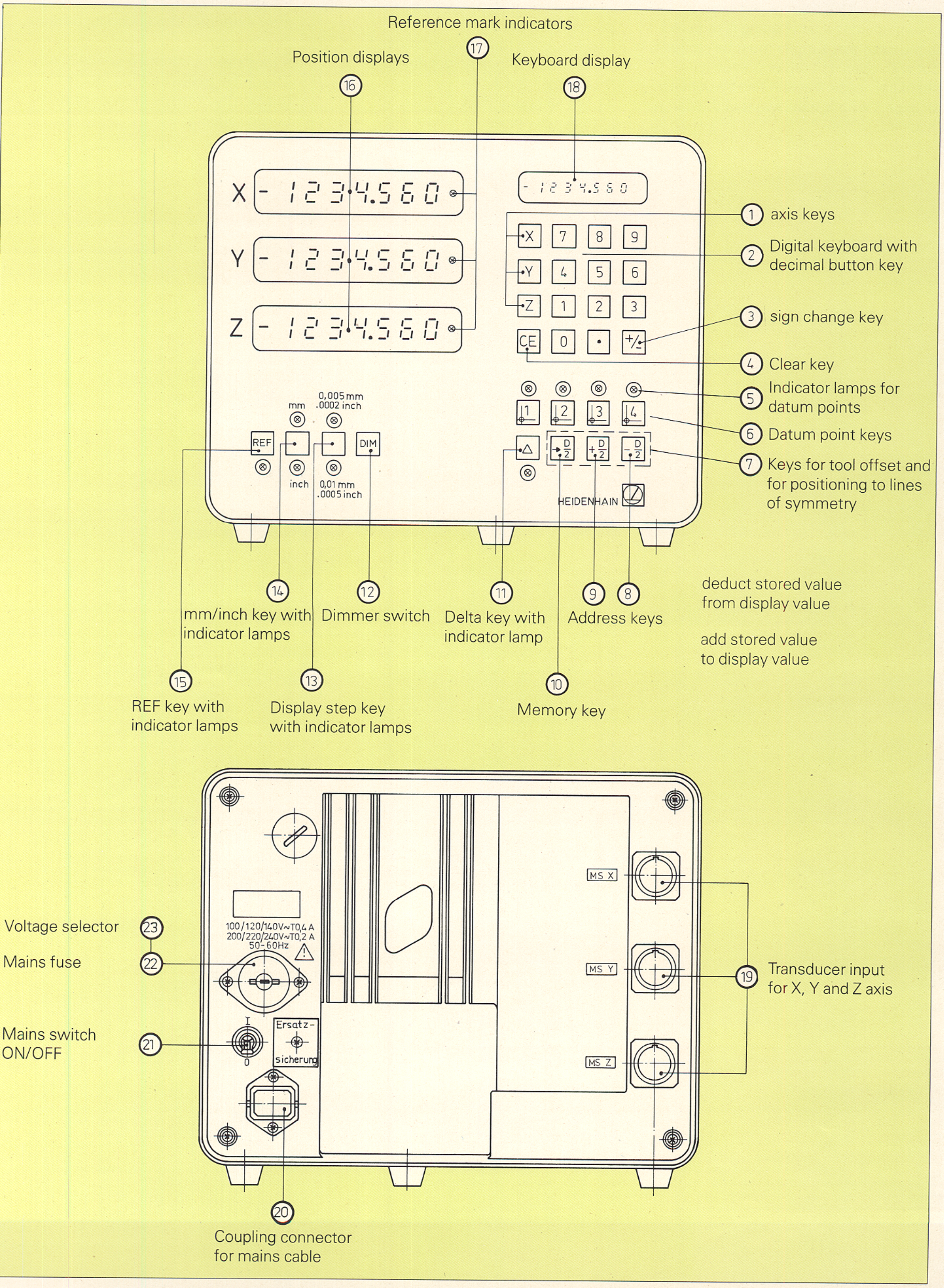
6.2
2nd Example

(for several datum points and tool offset)
Face C is to be milled and boreholes I, II, III drilled in main and auxiliary dimensioning on a workpiece:



	9 · 9 8	milling cutter diameter 9.98 entered
	→D/2	milling cutter radius stored (R = 4.99)
1	X Y	position datum point 1 = machine datum and preset in X and Y axis
	–	position machine X and Y axis, until X = 0 and Y = 0 appears in position display
2 △ ⊗	CE X Y	press datum point key 2 ! preset datum point 2 = 0 in X and Y axis
	△	press △-key
	7 0	enter value X = 70 mm
	+D/2 X	add milling cutter radius press X key. Deviation from nominal value = 74.99 appears in position display
	– – –	position machine by "target" counting mill face C remove milling tool and insert appropriate drill
	5 0 · 3 5	enter distance X = 50.35 for borehole I (△-key still functional)
	X	press X key. Deviation from nominal value +24.64 mm appears in position display
	2 5	enter distance value Y = 25.00 for borehole I (△-key still functional)
	Y	press Y key. Deviation from nominal position appears in position display
	– –	position machine in X and Y axis by "target" counting drill borehole I
3 △ ⊗	1 0 · 0 5	press datum point key 3 ! enter dimension for borehole II, X = −10.05 (△-key still functional)
	– –	position machine in X-axis by "target" counting drill borehole II
	1 0 · 0 5	enter dimension for borehole III (△-key still functional) X = +10.05 −20.1 mm appears in position display (deviation from nominal position)
	– –	position machine by "target" counting drill borehole III
3	△ ⊗	press △-key once again (indicator of △-key extinguished). the deviation from the datum point 3 appears in the position display = +10.05 mm (for checking purposes only)
1 or 2	*	by pressing the datum point key 1 or 2 the corresponding absolute dimension referenced to the datum points is displayed, e.g. for datum point 1 referenced to borehole III: X = +160.40 mm Y = +125.00 mm

7. Control panel



8. Instructions for operation and maintenance

Replacement of parts and repairs

Opening of covers or removal of parts, unless this can be done by hand, might expose live parts. Connection points might also be live.
Prior to repairs or replacement of parts, the unit must be disengaged from all power sources if an opening is required.
In the case that a repair must be carried out with open unit under power, it is absolutely essential that this be done by an expert who is well aware of the danger involved.

Note for repetitive test

The test voltage for a single repetitive test is limited to 1500 V/max. 2 s.

Replacement of fuses

It must be ensured that only fuses of the indicated type and rated voltage are used as replacement. The use of repaired fuses or short-circuiting of the fuse holder is not permissible.
The following fuses are to be used.

- Fuse in mains fuse holder (see para. 3.3) T 0.2 A or T 0.4 A
- Fuses on power pack 0.05 A slow-blow

Failures and extreme stress conditions

In the case that safe operation is no longer possible, the unit is to be disengaged and safeguarded against unintentional operation. Safe operation is no longer provided if

- the unit is obviously damaged
- the unit is no longer operational
- after extended storage under adverse conditions
- after extreme transport conditions.

The unit is to be returned for checking to the factory or to the nearest HEIDENHAIN service agency.

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