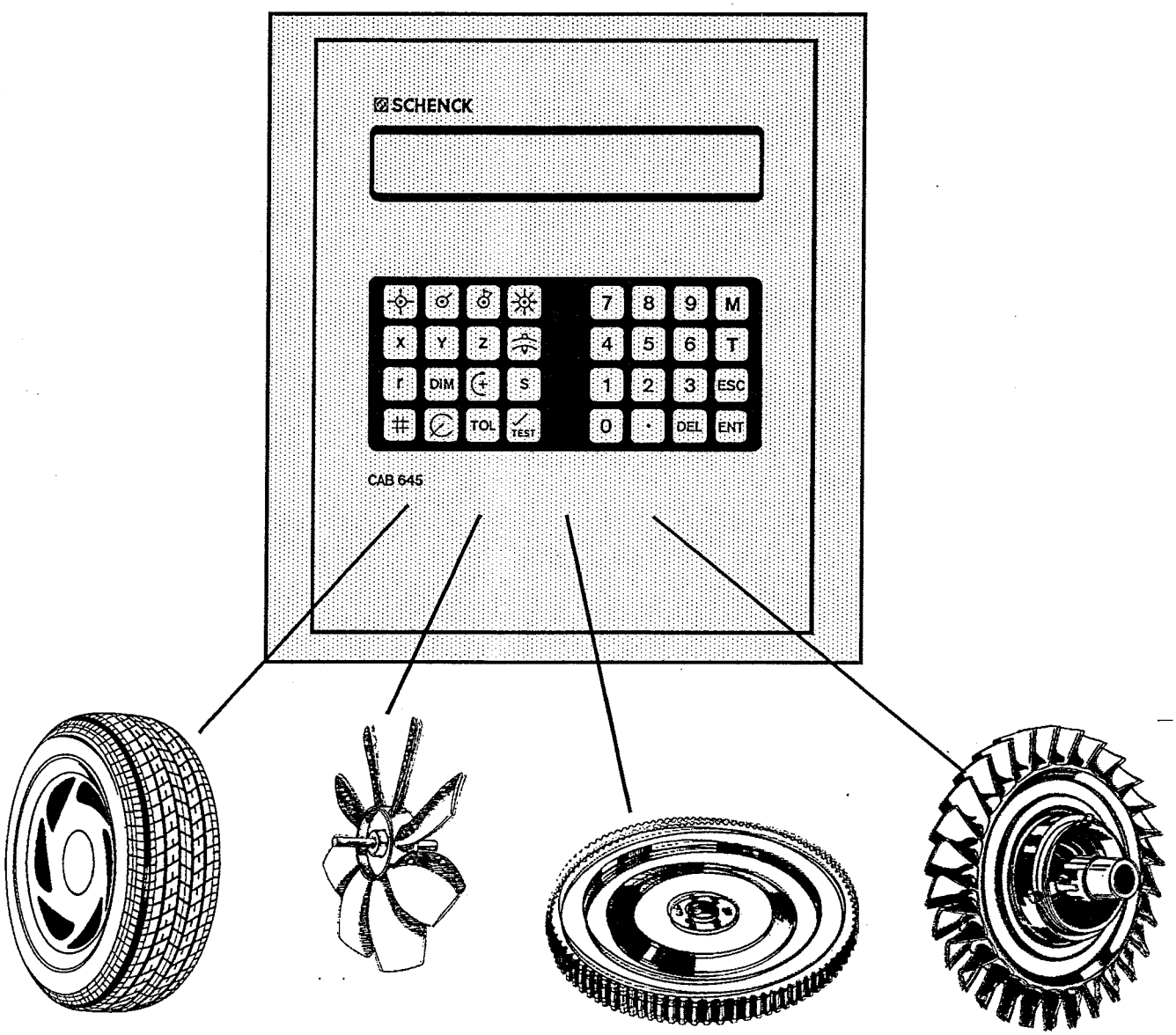
SCHENCK

OPERATING MANUAL

MICROPROCESSOR-

MEASURING INSTRUMENTATION

CAB 645



F 3971 c 20.000 06.90 HA

DTP: 645ATIE_.CHP

C 21 168

SCHENCK

Measuring instrumentation CAB 645 for static non-rotating balancing machines

Operating instructions

Table of contents

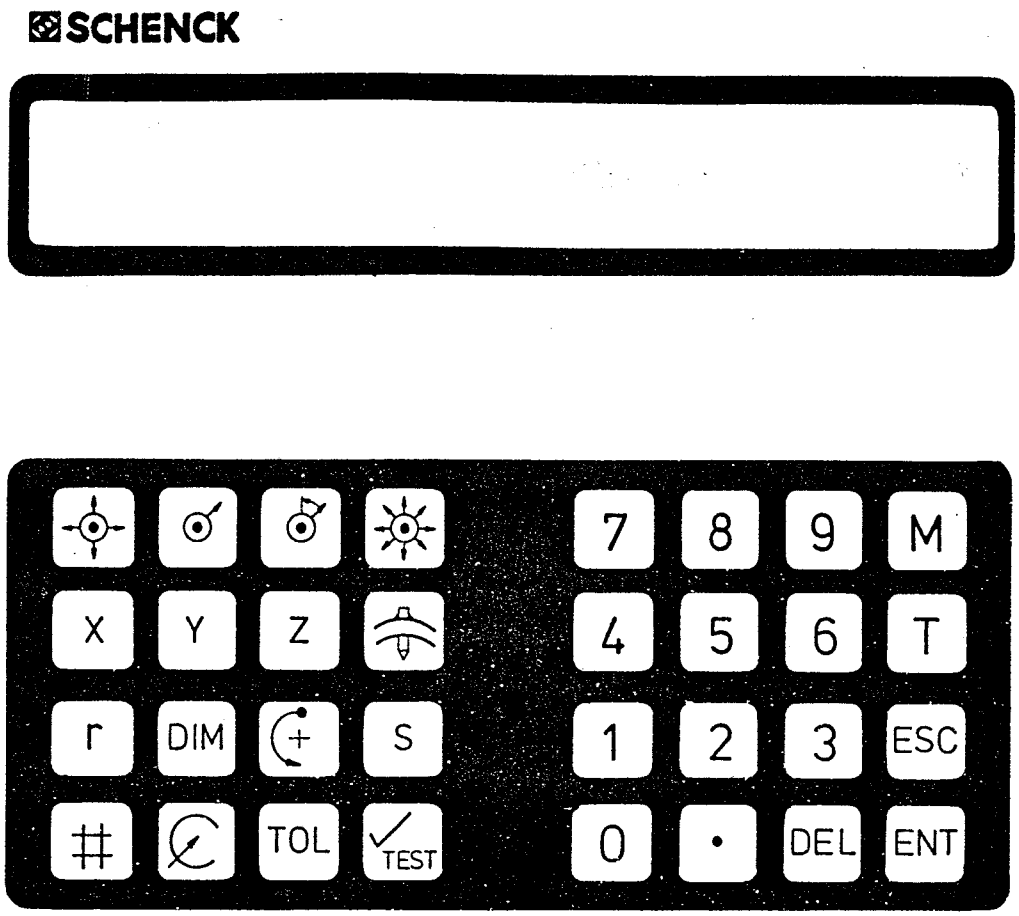
Measuring instrumentation CAB 645 for static non-rotating balancing machines

Operating instructions

Table of contents (continued) Page

The table of contents below will only be valid for those additional functions which are actually built in. If they are present provision must be made for the appropriate hardware and software.

16 digit indication



CAB 645

Left keypad:

Input of functions and definitions

(see the following two pages)

Right keypad:

Input of numbers and decimal point

M (=MEASURE) Starting a measuring procedure

T (=TARE) Taring of the empty balance

ESC (=ESCAPE) Break off a started calibration procedure / Ending a measuring procedure during calibration

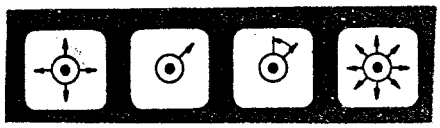
ENT (=ENTER) Completion of an input and command to continue

DEL (=DELETE) Deletion of the characters in the indication

F 3850 c 100.000 11.86 WIE

Left keypad

Function or definition

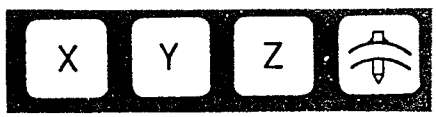


n-location display for equally spaced component systems. Number of locations can be 3 ... 99 (or 3 ... 36)

key is inoperative

Polar indication of unbalance as angle and amount.

Direct selection of 4 location display (subfunction of the n-location display) in 90° components. Number display shows component (0 = 0°, 1 = 90°, 2 = 180°, 3 = 270°).



Selection of display for material removal or addition. SUB (Subtraction) = display of heavy spot. ADD (Addition) = display of light spot.

Input of a key word to deactivate (or reactivate) the keyboard. Continuation only possible in previously input functional mode.

Rounding function for amount readout (type dependent)

Special indications (On/Off switch), dependent on machine design.
Either: No special readout possible,
or Circular arc milling,
or Graded amount readout
(unbalance classification).

Left keypad	Function or definition
	
	Service function (configuration facility)
	Calibration of the indexing bias. i.e. electrical compensation of an unbalance indication which is the result of eccentric mounting of part to be balanced.
	Valid only for type 0! Selection of the dimension for the unbalance indication G*MM. G*IN. OZ*IN. After radius value input display in G or OZ.
	Valid only for type 0! Radius input in MM or IN corresponding to the previously selected unbalance indication unit selected by key DIM.
	
	Selection of the test function
	Input of the tolerance limit. Always accepted by the instrumentation as polar unbalance value. even at component indication (in the calibrated dimension).
	Selection of the calibration functions
	Input of the number of the desired rotor type to be balanced

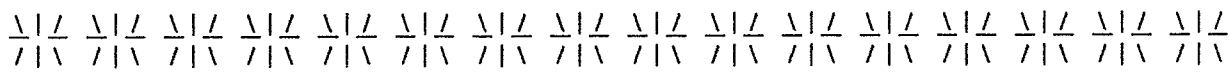
1. Start up

Make sure that all built-up unbalance correction units are in their home position in any possible direction of motion.
If yes:

Set main disconnect switch to ON
(Switch control voltage on)

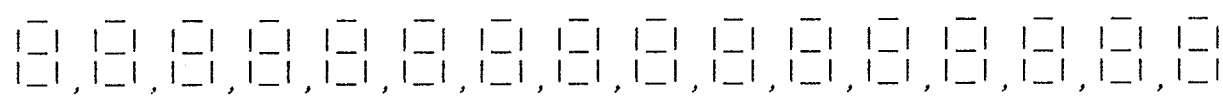
Within the instrumentation:
Power-up test runs off.

For 1 second "stars" are displayed

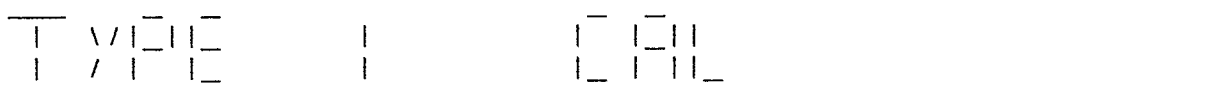


(If during the self-test any error has been detected:
Indication of an error message, see section 17.)

In normal cases, if there have been no errors detected:
For 30 seconds "eights" are displayed

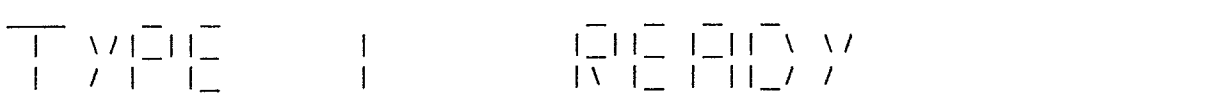


After that the following readouts are possible:



This type has to be calibrated prior to any balancing operation. Please continue with section 10.

Or



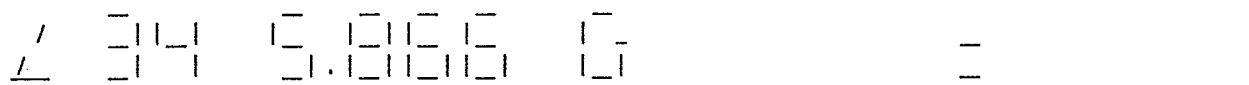
This type can be balanced from now on. For this type the function "Calibration of unbalance indication" CAL 1 already has been performed.

Start measuring procedure: Press key M.

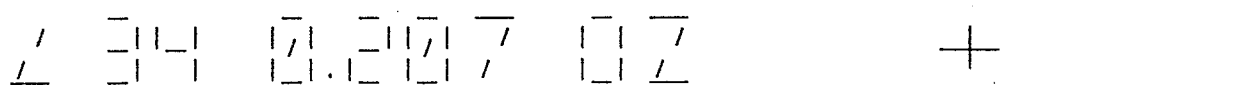
If "Taring" is to be performed:
Press the key T after completion of a measuring procedure.
Taring will be performed automatically.
Wait for the taring indication. Then continue to work with the instrumentation as before.

2. Unbalance readouts

Polar, with angle ∠ and amount



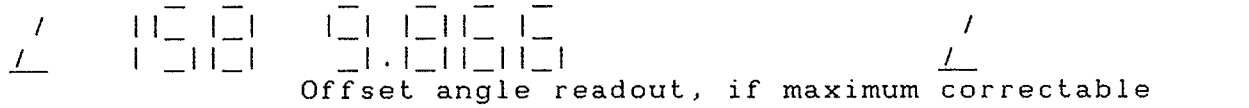
Readout for type 0 [= means "Measurement finished". Good for all types]



Readout for type 0 [+ means "Overrange". Good for all types]

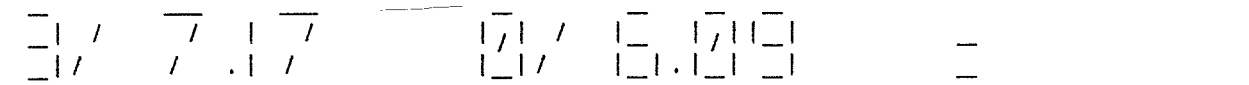
Readout for types 1.. 21 [= means "Measurement finished". Good for all types]

Additional readout for any type, provided that the appropriate calibration has been performed:



Offset angle readout, if maximum correctable amount of unbalance exceeded.

90°-components (4-location correction)



All types [= means "Measurement finished".]

Any equally spaced component system (N-location correction)

All types [= means "Measurement finished".]

Additional indication to all readout modes provided that the appropriate calibration has been performed:

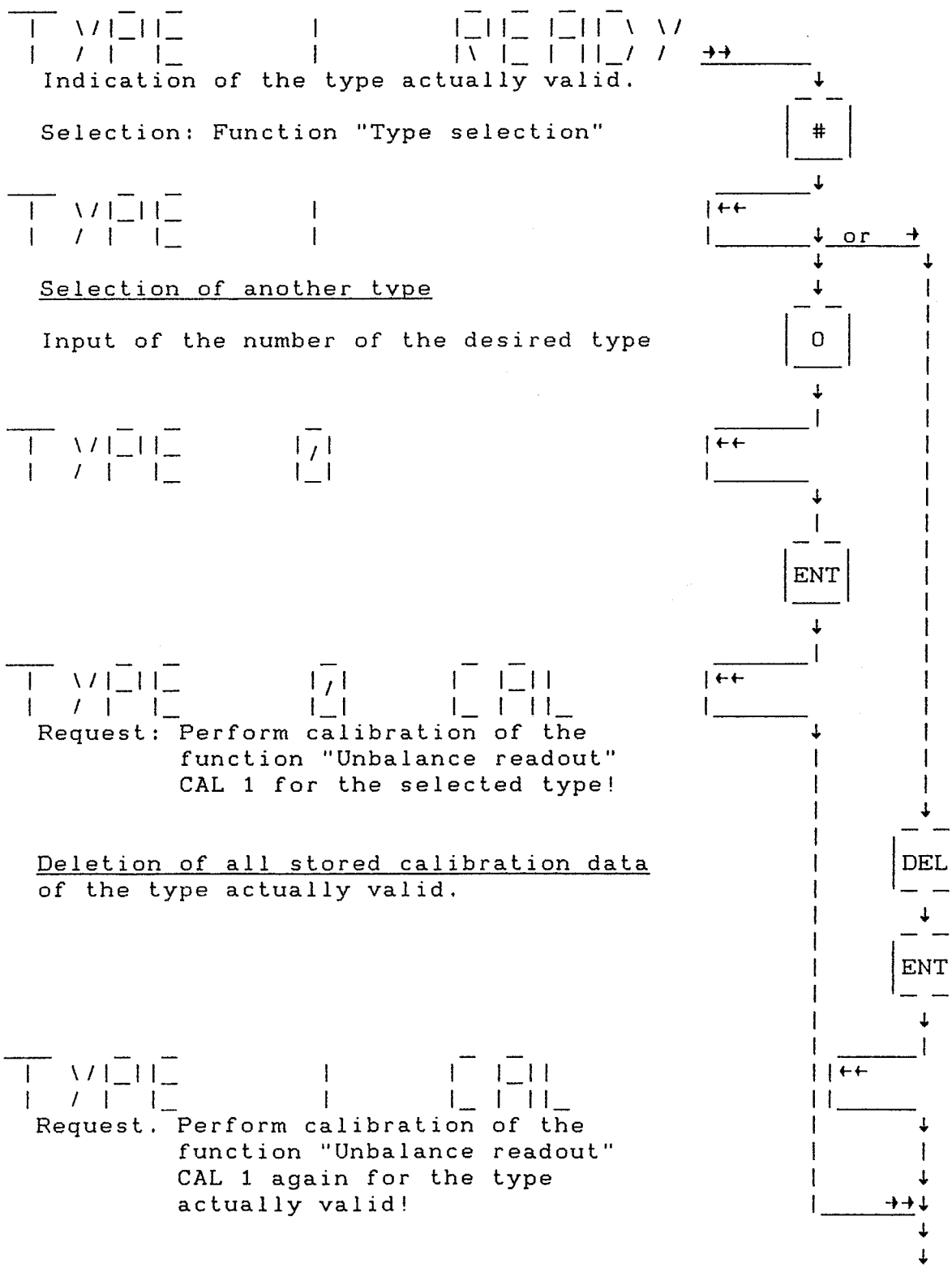
In Tolerance (characterized by *)

3. Type selection

The type numbers used below serve as examples only.

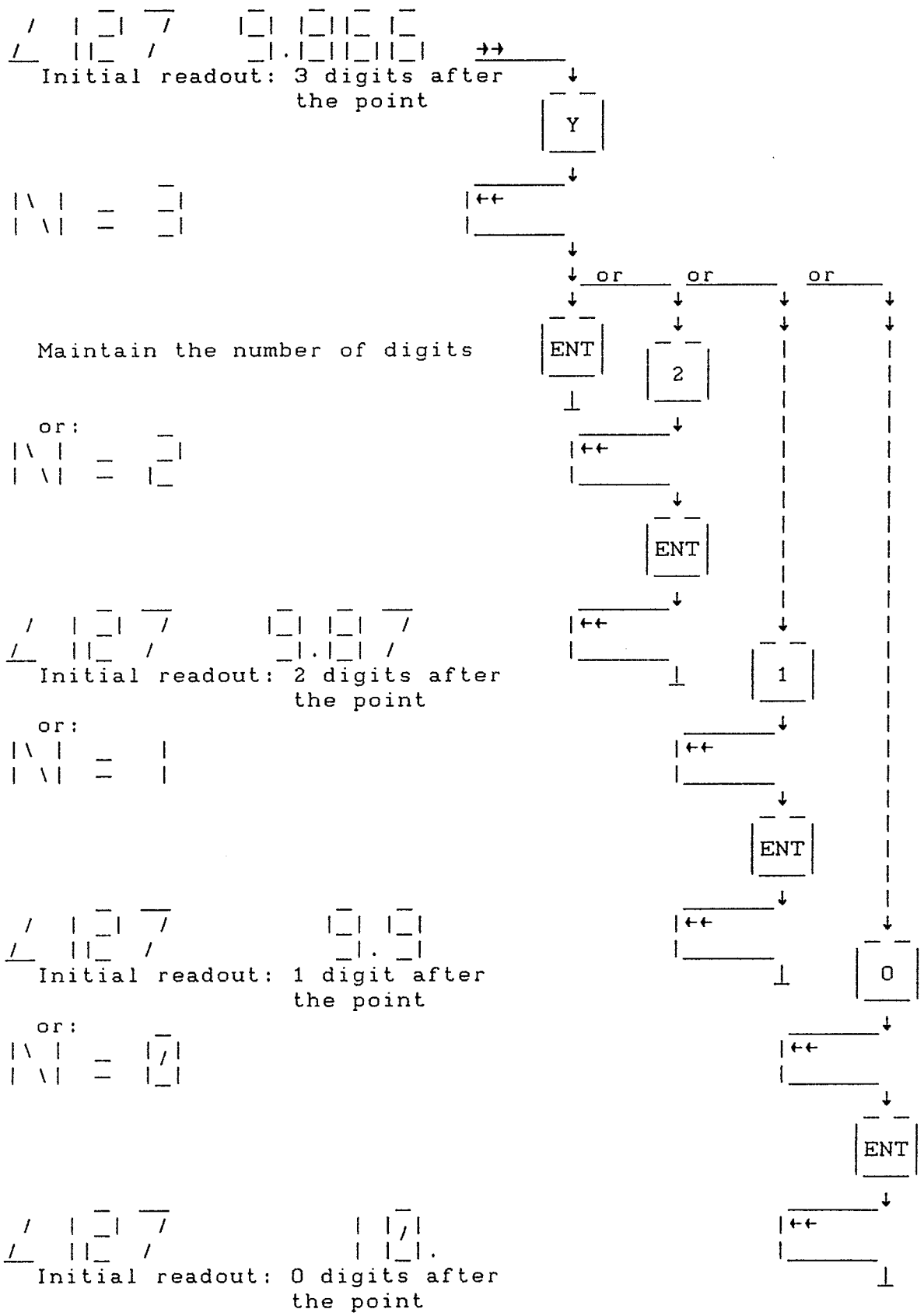
Type numbers 0 to 21 (→→ 22 types, hereof type 0 with permanent calibration)
Type numbers 1 to 21 (no type 0)

Generally it is possible to change from one type to another one. But, care should be taken, because on some types the workpiece adapter must also be changed.



4. Y Determination of the number of digits after the decimal point in the amount readout (rounding function)

Initial readout: any
Sequence in change between N = 3, 2, 1, 0 : any



F 3850 c 100.000 11.86 WIE

5. Installation and initial set-up of the balancer

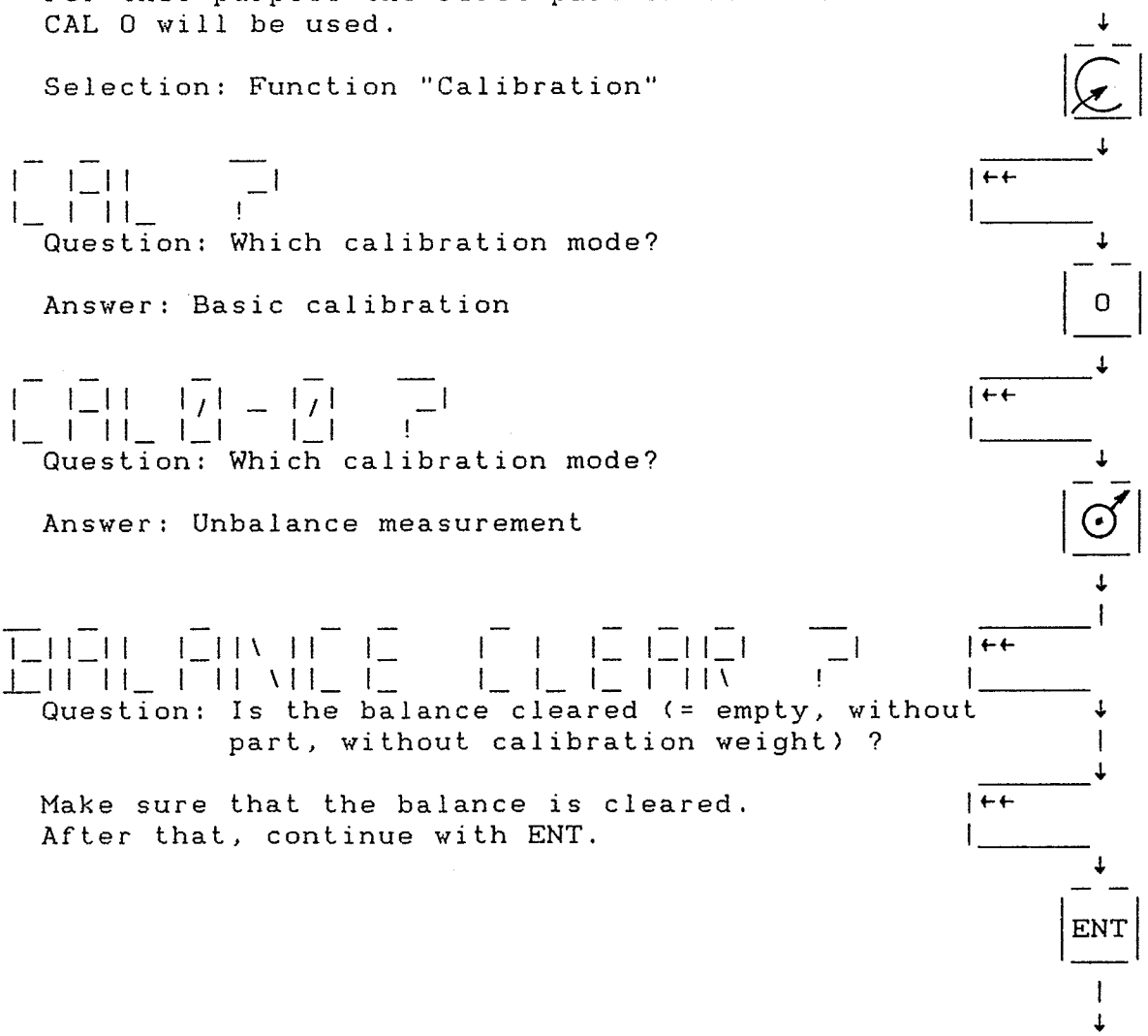
Install the machine according to the installation layout

5.1 Adjustment of mechanical and electrical zero

5.1.1 Release transport safeties securing the pendulum body. For this: remove the red painted screw completely and store it. Before moving the machine to any other place: The screw must be re-inserted securing the pendulum body !

5.1.2 Remove workpiece adapter and the centering ring (if any). Put a machine spirit level of high accuracy (light weight, short length) centrically onto the upper, machined surface of the pendulum body. Level the balancer in two directions perpendicular to each other using the leveling screws close to the foundation bolts in the lower part of the housing. After the machine (pendulum body) is leveled in both directions, then tighten the nuts of the foundation bolts.

5.1.3 Set the MAIN DISCONNECT to ON (left side of machine housing). Now the zero of the measuring voltages is to be adjusted. That means: after the mechanical zero has been adjusted, now the output voltages of the two pickups (LVDT's) are to be brought as near as possible to zero.
For this purpose the first part of the basic calibration CAL 0 will be used.



The instrumentation starts to locate its zero.

```
 _       _            _   _        _   _   __   _
|/|  -  |/|  -+-  |  _|  _| |_|  --  |_| |_    /  |_|
|_|     |_|    |  | |_   _|.   |    _| |_|./    |_|
```

During measurement: Changing readout !
[Any figures !]

At this point the <u>error message E29 is to be provoked !</u>
For this: Wait until the above readout has changed at least two times.
Then depress the upper end of the pendulum body by hand while changing the point of application of this load alternatingly.
Keep the deflection until E29 is indicated.
This error message is output because the instrumentation has perceived that it will be impossible to locate the electrical zero.

The instrumentation now permanently will read the voltage in digits, which is output by the two pickups (LVDT's).

```
 _   _   _        _   _        _   _   __   _
|_   _|| _|  -+-  |  _|  _| |_|  --  |_  |_     /  |_|
|_  |_   _|   |   | |_ .  _|   |     _|.|_|  /    |_|

          \_______________  _______________/
                          \/
                     [Any figures]
```

The numerical values appearing to the right of E29 represent the values of the measuring components reduced to one fifth (0.2 * M). Overrange will occur when exceeding a numerical value of 400.

<u>Adjustment of electrical zero</u>
The numerical values, now, are to be brought as near as possible to zero by means of mechanical adjustment of the pickups (LVDT's).
For this adjustment use the two big knurled screws which may be accessed in the lower compartment of the housing. Please, turn slowly in intervals to allow the values to stabilize.
When approaching the zero point, the sign of the reading might change upon continuation of turning. That does not matter.
Only the absolute numerical value of the two components will count.

<u>Adjustment of the limit stops for deflection</u>
First, the limit stops in the four components are to be adjusted. Place a weight successively in each component which should produce a reading of more than 300 digits. Adjust the limit stops in a way that in each component no mor than 270 digits will be read. These 270 digits equal 0.2 mm measured in the plane of the pickups.

If a further improvement of the values is no longer possible, then break from the adjustment mode by ESC (escape), and pass into the actual calibration. (CAL 0).

5.2 CAL 0 Basic calibration of the balancer, to be performed during initial set-up [*]

If the basic calibration CAL 0 has not yet been performed, the function "Calibration" can be selected immediately.

If the calibration data of CAL 0 has been lost, or, if the calibration dialog CAL 0 has been interrupted by the main disconnect (with subsequent error message E14 GRD, which requires input of ENT), display will be:

Request: Perform CAL 0!

Selection: Function "Calibration"

Question: Which calibration mode?

Answer: Basic calibration

Question: Which calibration mode?

Answer: Unbalance measurement

Question: Is the balance cleared (= empty, without part, without calibration weight) ?

Make sure that the balance is cleared.
After that, continue with ENT.

The instrumentation starts to locate its zero.

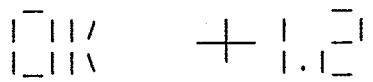
During measurement: Changing readout!
[Any figures!]

■■■ Do not press any key !!!

[*] - after the error message E30 → E29 the basic calibration CAL 0 is to be performed too, but only partially, i. e. up to the first OK (on top of the following page).

F 3850 c 100.000 12.87 MIE

When the instrumentation has located its zero:



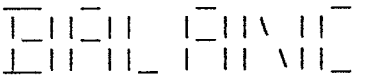
After measurement: Steady readout!
[numerical values < 80]

The zero point of the readout now has been defined, [or, after the error message E30 re-defined].

Only when re-adjusting the zero points after and because of the error message E30 → E29 the dialog may be left at this point !

Press key ESC !

ESC



Confirmation: The zero point for the indication is re-defined.

This provides that the relationship between the deflection of the balance and the digital readout has been established previously !

During initial set-up of the balancer this relationship has to be established at first !
Therefore now:
Establish the relationship between the deflection of the balance and the digital readout.

After display has reached OK, then press ENT, to start the calibration measurement procedure.

ENT

[If, instead of ENT the ESC key will be depressed here, the error message E14 GRD will be displayed, which means to restart with CAL 0 on top of the preceding page !]

Then the instrumentation requests:

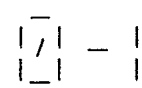
Apply the adjustment weight to +V (0°) by screwing it into the tapped hole in the +V (0°) component on the top of the pendulum body. This weight will lead to an unbalance readout of more than 400 digits.
After that, unscrew said weight and screw it into the tapped hole in the +H (90°) component.
The readout again will amount to more than 400 digits.

F 3850 c 100.000 12.87 WIE

Table of adjustment weights
[the adjustment weight is not identically with the calibration weight being used later on for the calibration of the unbalance readout (CAL 1) of each individual rotor type]

Type of the balancer	Adjustment weight [g]	Pitch circle of tapped holes [mm]
BWC	40	140
BWD	120	140
BWE	400	220
BWF	1300	220
BWG	2700	337
BWH	4000	337

The adjustment weight determined above will be supplied with each balancer. It produces the desired readout of more than 400 digits, provided the weight has been screwed in on the radius determined above.



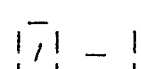
Request: Screw the adjustment weight into the tapped hole in the +V component. The readout will amount to more than 400 digits.

This request will be visible only a few seconds.
Then transition to readout of measured values.

Screw the adjustment weight into the tapped hole in the + V (0°) component on top of the pendulum body.
Regard the direction of the component !

Readout of measured values for component V

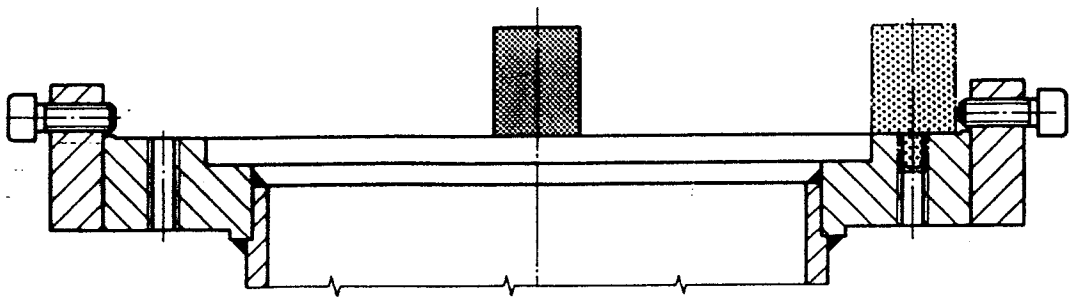
Readout of measured values for component H

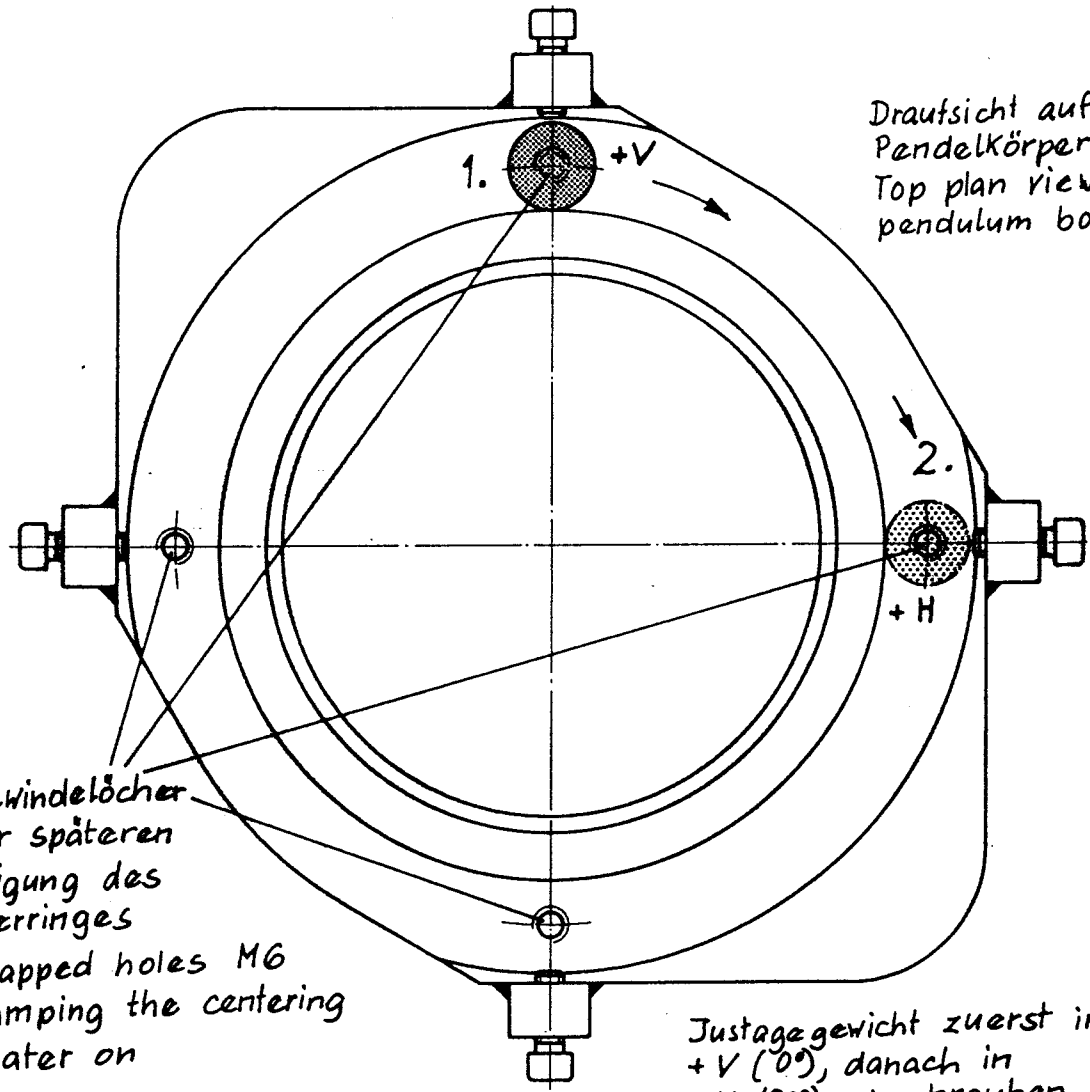


During measurement: Changing readout!]
[Numerical value left to be more than 400]
When the change of readout becomes negligible:
End calibration measurement procedure in the +V component by pressing ESC!
Now the measurement in the H component is started.

ESC

Justagegewicht zur Anzeige < 400 in CAL 0
Adjustment weight for readout





Draufsicht auf Pendelkörper
Top plan view of pendulum body

Vier Gewindelöcher M6 zur späteren Befestigung des Zentrierringes
Four tapped holes M6 for clamping the centering ring later on

Justagegewicht zuerst in +V (0°), danach in +H (90°) einschrauben
Adjustment weight to be screwed in at first in +V (0°), then in +H (90°)

Zchg. Nr. Auftraggeber

Gruppen-Zchg. Nr.

Allgemeintoleranzen mittel DIN 7168/1 B DIN 8570 II A DIN 2310 GT ... DIN ...

Oberfläche DIN ISO 1302 DIN 4768

Maßstab im Original

Gewicht kg

Stoff-Nr.

Werkstoff

Sachkenn-Schl.

Fert.-Schl.

	Datum	Name
Bearb.		
Gepr.		
Norm		
Verwendung		

Format A Dia 2

Benennung (2. Zeile für Fremdsprache)

CAL 0
0 - V - ≤ 400

SCHENCK
CARL SCHENCK AG
Postfach 40 10 · D-6100 Darmstadt 1

Zeichnung Nr.

Blatt

Bl.

Zust.	Änderung	Datum	Name

Ursprung

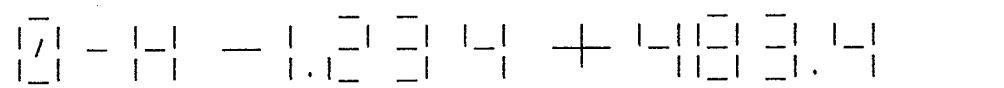
Ers. für

Ers. durch

■ Unscrew the adjustment weight in the + V
■ component and screw it into the tapped hole
■ in the + H (90°) component on top of the pendulum
■ body. Regard the direction of the component !
■ The weight must be applied exactly in the stated
components (otherwise error message E08).

Readout of measured values for component V

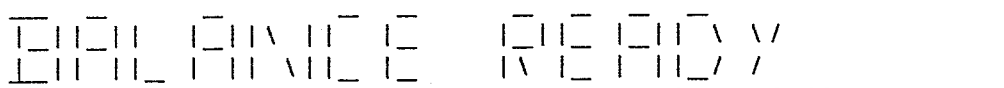
Readout of measured values for component H



During measurement: Changing readout!]

When the change of readout becomes negligible:
End calibration measurement procedure in the H component by pressing ESC!

ESC



Confirmation: The basic calibration of the balance has been completed successfully.

■■■ Remove the adjustment weight and store it well !

Before any measurement can be started, a rotor type is to be selected, and, for this type the calibration CAL 1 is to be performed !
Selection: Function "Type selection"

#

Recommendation: For this first calibration of an unbalance readout select type 0 !!
Input of the number "0" of the desired type.
Readout:

0

Depress ENT !

ENT

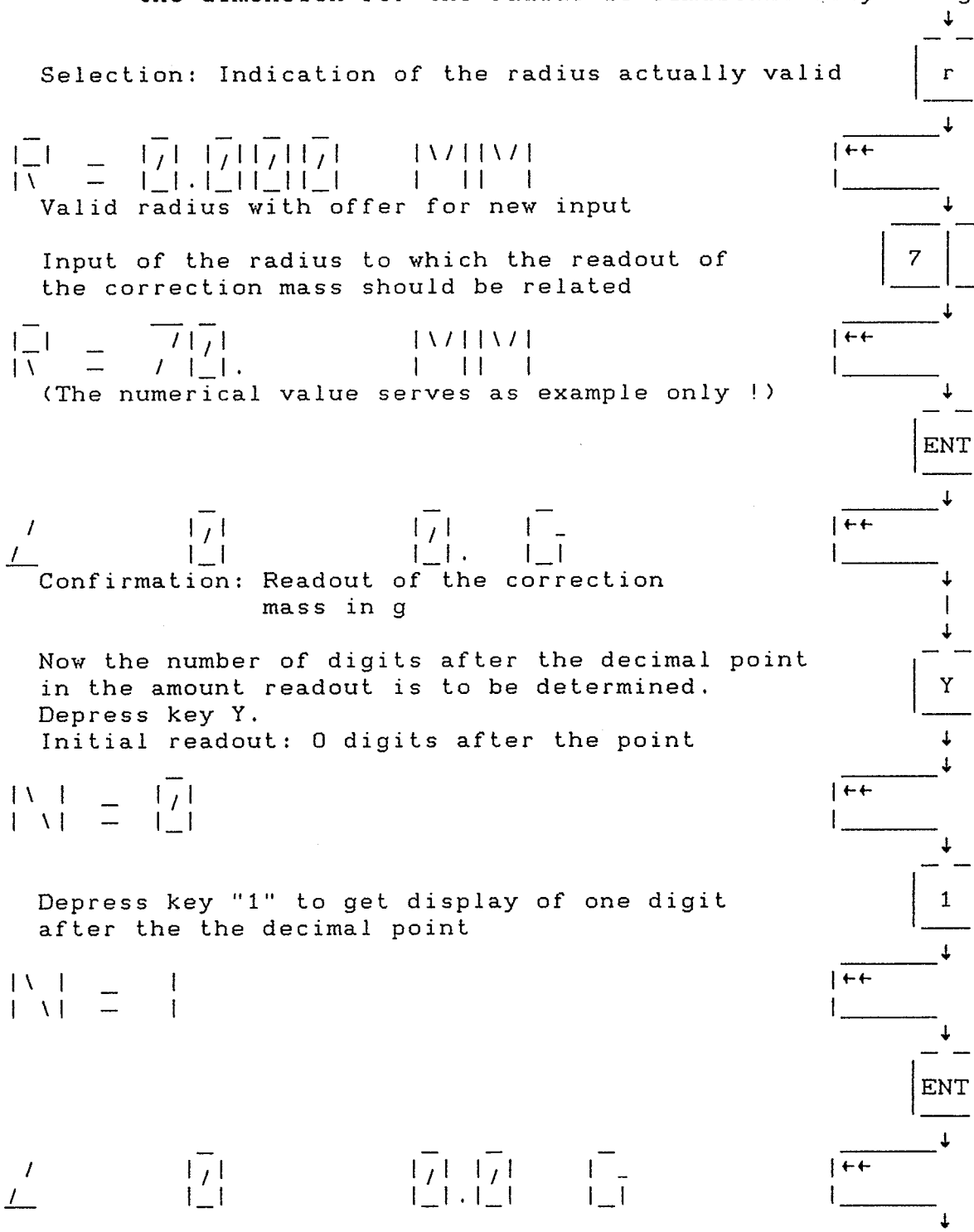
Request: Perform calibration of the function "Unbalance readout" CAL 1 for type 0 !

Calibration of the unbalance readout (CAL 1) is not possible until the input of the basic data has been carried out.

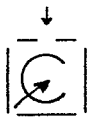
Basic data for type 0 :

1. Radius, on which mass is applied or removed.
2. Dimension of unbalance readout (gmm, oz.in., g.in.)

Without definite selection of another dimension the instrumentation uses the dimension gmm, which, in turn, means the dimension mm for the radius.
If another dimension is selected for the unbalance readout the dimension for the radius is simultaneously changed.

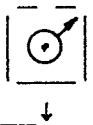


Selection. Function "Calibration"

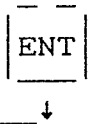


Question: Which calibration mode?

Answer: Unbalance readout!



Request: Start a calibration measurement procedure without calibration weight by pressing ENT !

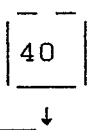


During measurement. Changing readout!
[Any figures!]

When the change of readout becomes negligible: End calibration measurement procedure with the empty balance by pressing ESC!

(If dimension G*MM has been selected:)

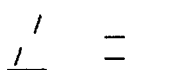
Request: Enter the amount of the weight to be used for calibration!



Request: Enter the angle on which the above defined weight shall be applied.

The weight shall be applied on 0°.

0



Press ENT

ENT

Request: Apply the weight determined above on the top of the pendulum body at the determined angle and on the radius entered before !
Start calibration measurement procedure by pressing ENT !

ENT

During measurement. Changing readout!
[Any figures!]

When the change of readout becomes negligible:
End calibration measurement procedure with calibration weight being applied by pressing ESC !

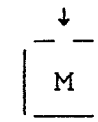
ESC

Confirmation: Calibration of unbalance readout performed successfully.
From now on also the other calibration functions may be performed.

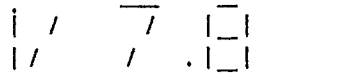
Remove the calibration weight.

On the measuring instrumentation:
Select four-location-readout, fitting to the four lateral set screws.

Start the measuring procedure by pressing key M on keypad !



After the end of measurement



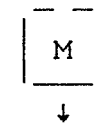
Unbalance readout. Record the values !
Component direction defined by the preceding number (0 = 0°, 1 = 90°, 2 = 180°, 3 = 270°).
The heavy spot of the part is indicated !

There are two possibilities for the further sequence of operation:

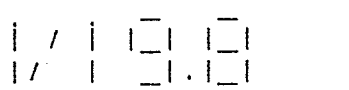
1. The workpiece adapter is clamped directly on the pendulum body,
2. A centering ring is fitted between workpiece adapter and pendulum body.

If a centering ring is used:
Screw the centering ring with its plain surface onto the workpiece adapter. Place the assembly onto the pendulum body. Turn the screws which clamp the centering ring on the pendulum body only slightly as to allow the assembly to be shifted easily by the four lateral set screws.

In both cases:
Start the measuring procedure by pressing key M on keypad !



After the end of measurement



Unbalance readout.
Component direction defined by the preceding number (0 = 0°, 1 = 90°, 2 = 180°, 3 = 270°).
The heavy spot of the part is indicated !

The unbalance readout has changed with respect to the readout without workpiece adapter.
That means that the center of gravity of the adapter does not coincide with that one of the pendulum body.
That may be corrected using the four lateral set screws which press onto the centering ring. These screws are located in the component directions V and H. This is also the reason for selecting the readout mode of component representation of the unbalance.

Using these four screws
the assembly consisting of centering ring
and adapter
or the workpiece adapter alone
is to be shifted until the original readout
has been reached again.
Please note: The readout gained by this shifting
operation may change when subsequently tightening
the clamping screws. This is unavoidable.

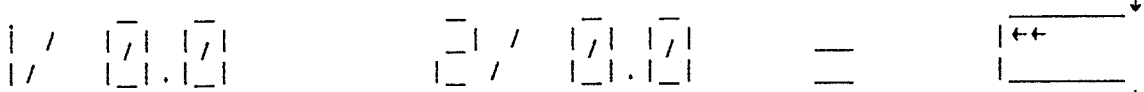
For the observation of the change of the readout
due to the shifting a permanent readout is required.
Since the heavy spot is indicated, the assembly is to
be shifted in opposite direction of readout.

Start the measuring procedure by pressing
key M on keypad !

Shift the assembly using the appropriate set
screws while permanently observing the readout.

Upon reaching the original readout: Tighten the
clamping screws of the centering ring on the
pendulum body !

Tare the empty workpiece adapter by pressing
key T on keypad !
Please note: The taring procedure will only be
accepted after a preceding measuring procedure !
If this measuring procedure has not yet been
concluded, i.e. if the "=" sign to the right of the
unbalance readout is still missing, the Tare key T
is to be depressed two times !
Readout (example only!):



The calibration of unbalance readout for
type 0 herewith is concluded.
The non-rotationg balancer has been tared
for the adapter being used for type 0.

A possible error due to an eccentricity
of the centering pilot is not taken into
account by the above calibration.
For this purpose the calibration function
CAL 2 for the eccentricity bias has to be
performed (please continue with section 10).

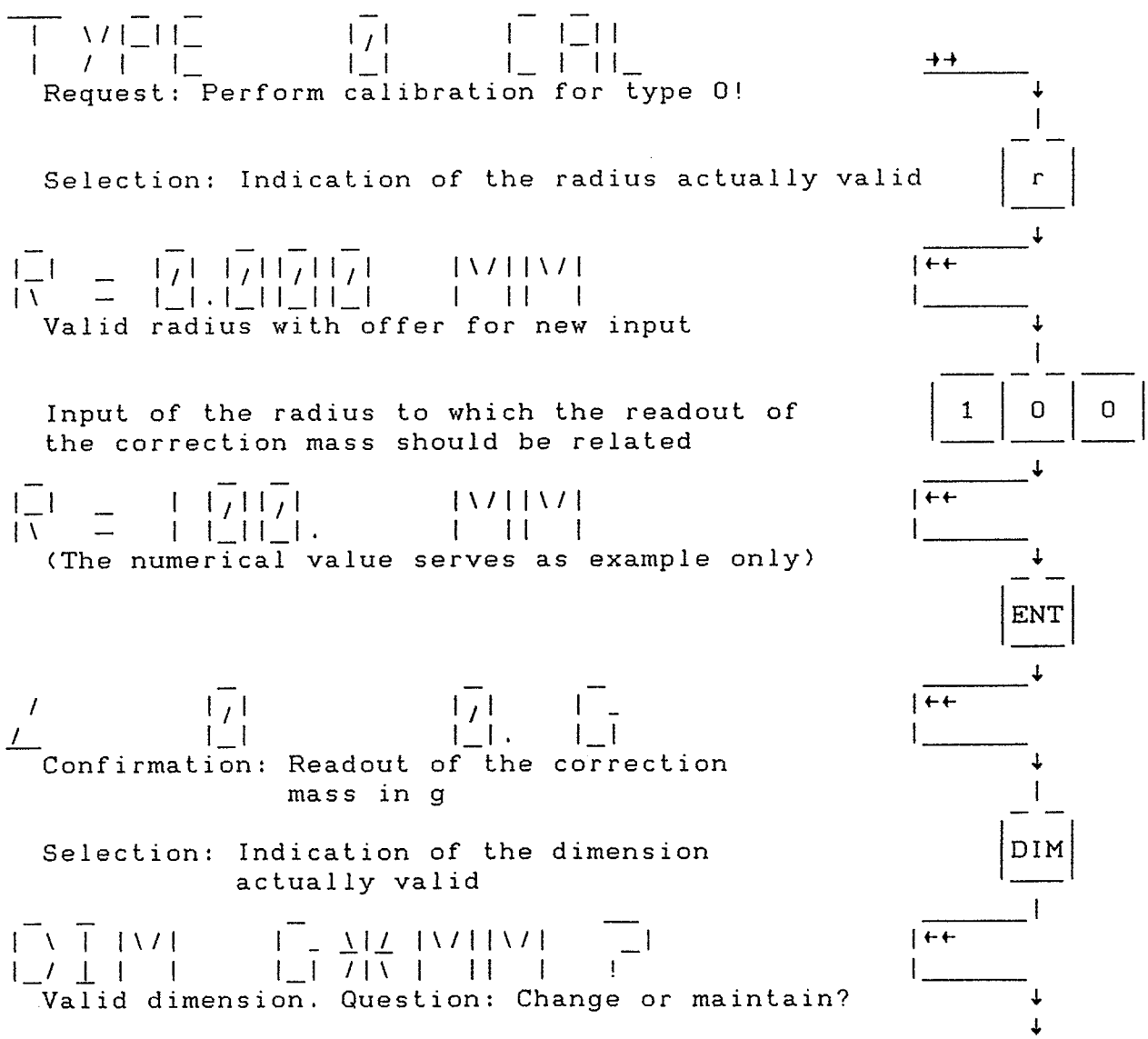
6. Re-calibration of unbalance readout CAL 1 for type 0 if calibration data has been lost or deleted

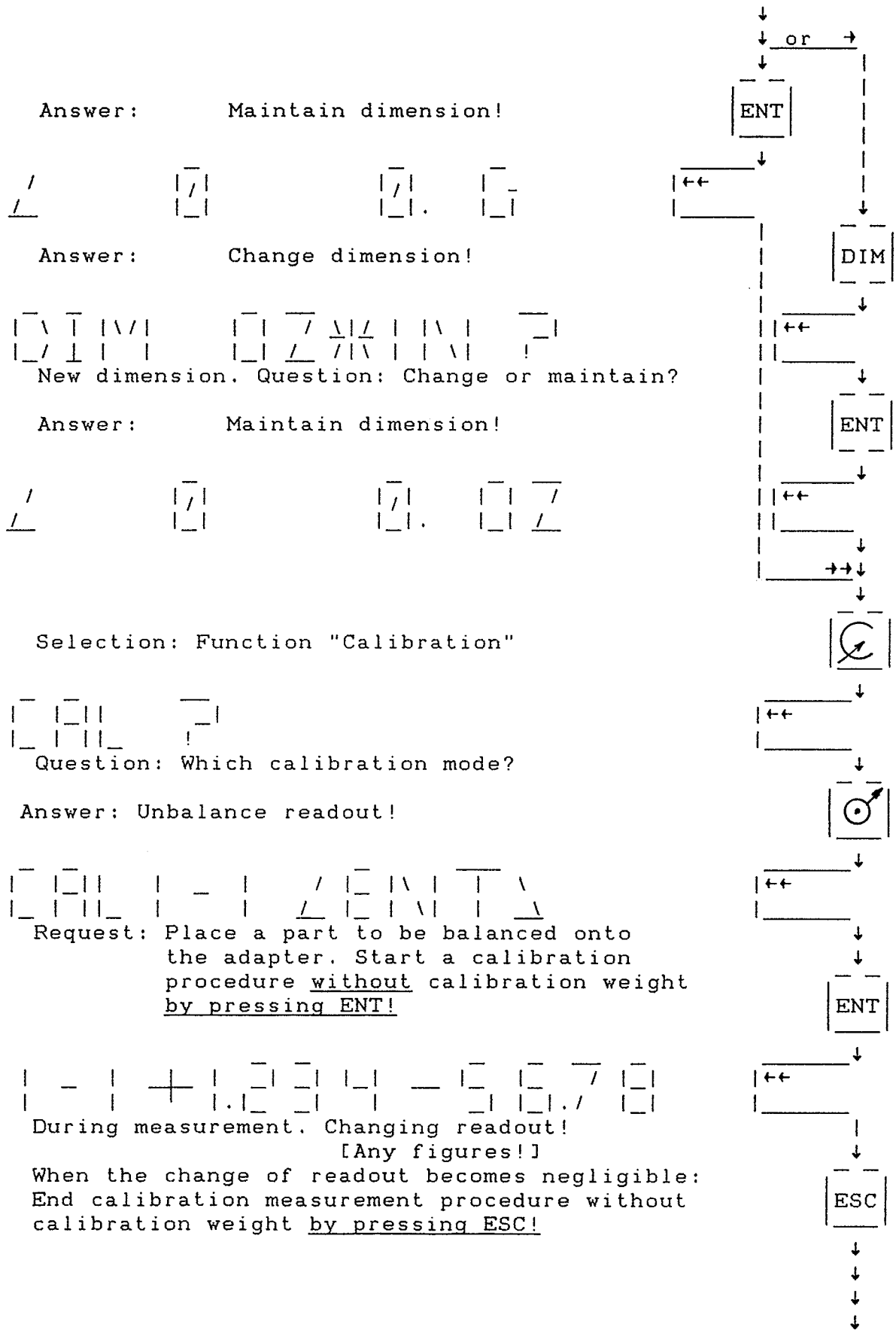
<u>General information, independent on the basic calibration CAL 0 of the balancer, being explained in item 5.2</u>

Calibration of the unbalance readout (CAL 1) for type 0 is not possible until the input of the basic data has been carried out.

Basic data:
1. Radius, on which mass is applied or removed.
2. Dimension of unbalance readout (gmm, oz.in., g.in.)

Without definite selection of another dimension the instrumentation uses the dimension gmm, which, in turn, means the dimension mm for the radius.
If another dimension is selected for the unbalance readout the dimension for the radius is simultaneously changed.





(If dimension KG*MM has been selected:)

Request: Enter the amount of the weight to be used for calibration!

50

ENT

Request: Enter the angle on which the above defined weight shall be applied.

0

ENT

Request: Apply the weight determined above on the workpiece (or on the adapter) at the determined angle and on the radius entered previously! Start calibration measurement procedure by pressing ENT!

ENT

During measurement. Changing readout!
[Any figures!]

When the change of readout becomes negligible: End calibration measurement procedure with calibration weight being applied by pressing ESC!

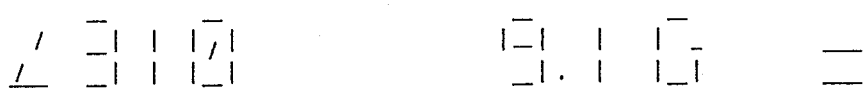
ESC

Confirmation: Calibration of unbalance readout performed successfully.
From now on, the other calibration functions may be performed.

Remove the calibration weight

Leave the part on the adapter.
Start the measuring procedure by pressing key M on keypad !

After the end of measurement



Unbalance readout

Remove the part from the adapter.

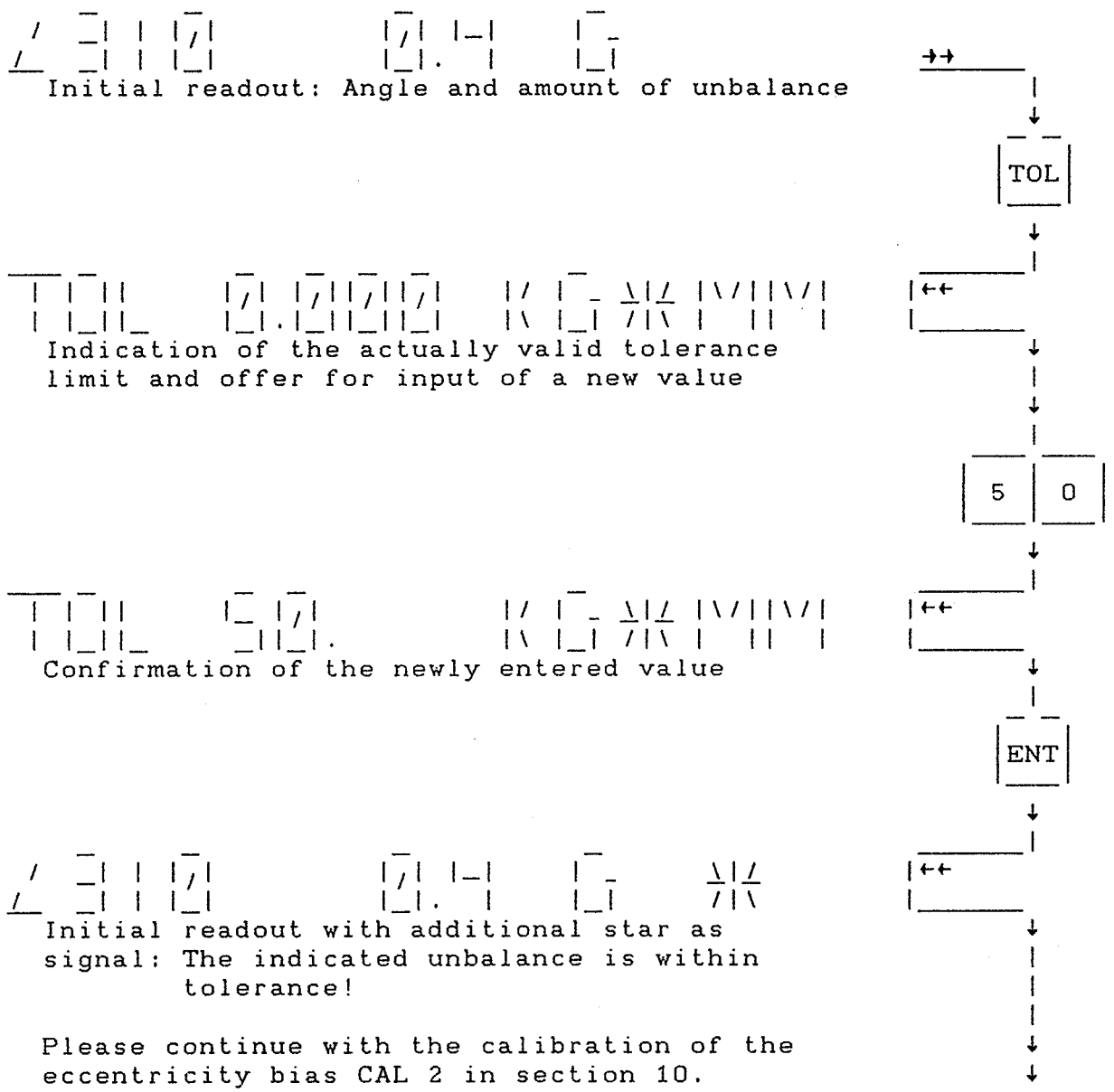
Tare the empty workpiece adapter by pressing key T on keypad !
Please note: The taring procedure will only be accepted after a preceding measuring procedure !
If this measuring procedure has not yet been concluded, i.e. if the "=" sign to the right of the unbalance readout is still missing, the Tare key T is to be depressed two times !

Readout:

The calibration of unbalance readout for type 0 herewith is concluded.
The non-rotationg balancer has been tared for this type.

A possible error due to an eccentricity of the centering pilot is not taken into account by the above calibration.
For this purpose the calibration function CAL 2 for the eccentricity bias has to be performed (please continue with section 10).

7. TOL Input of the limit for the "In Tolerance" indication (*) for type 0



Please continue with the calibration of the eccentricity bias CAL 2 in section 10.

Please note:
For type 0 the "In Tolerance" information which is displayed during unbalance measurement as '*' always is related to the dimension of unbalance having been determined by the DIM key, i. e. g*mm, oz*in, g*in !

The tolerance limit remains unchanged, if another radius will be entered!

8. CAL 1 Calibration of unbalance readout for types 1 ... 21

Selection: Function "Calibration"

Question: Which calibration mode?

Answer: Unbalance readout

Request: Place a part to be balanced onto the adapter. Start a calibration procedure without calibration weight by pressing ENT!

ENT

During measurement. Changing readout!
[Any figures!]
When the change of readout becomes negligible:
End calibration measurement procedure with the empty balance by pressing ESC!

ESC

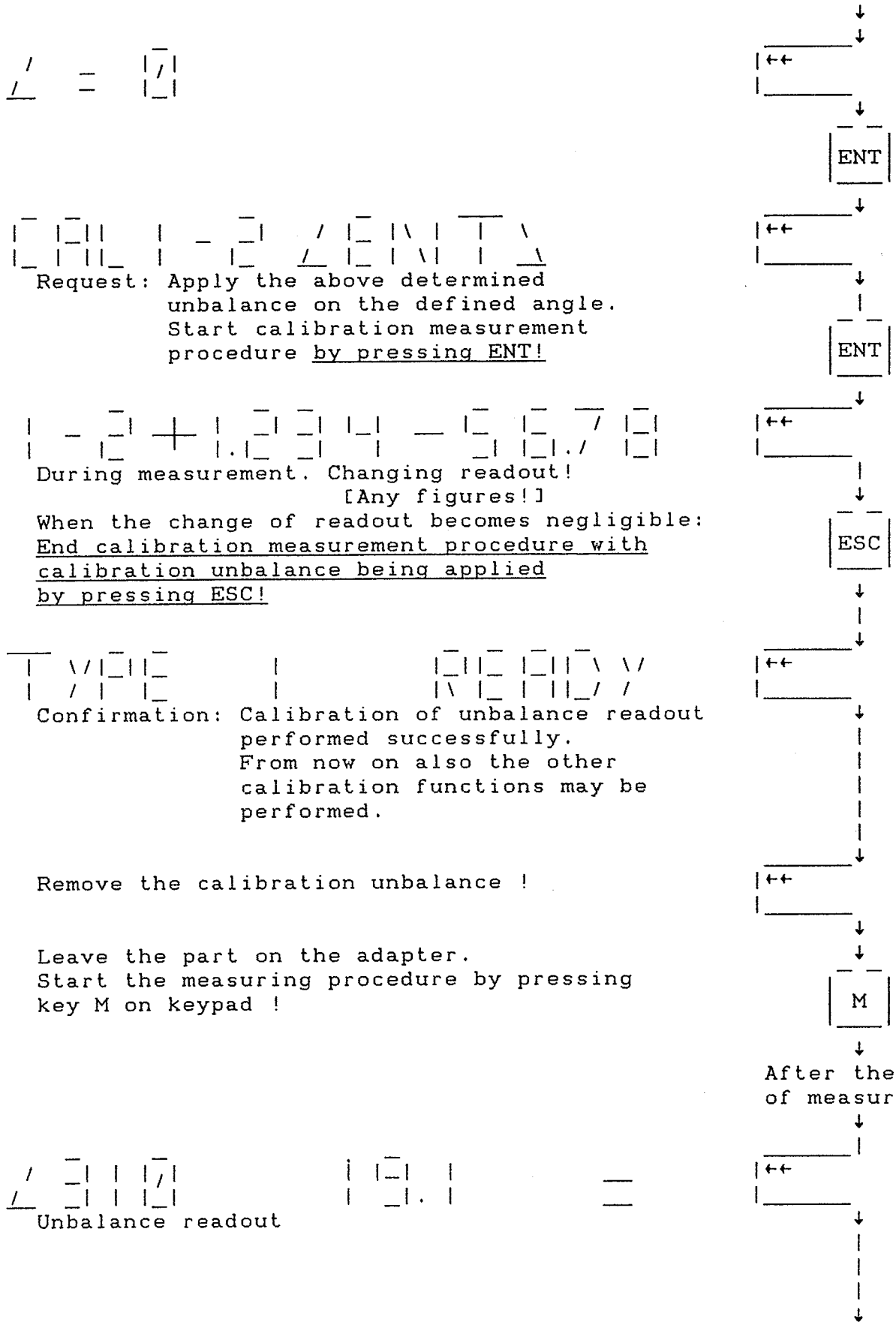
Request: Enter the amount of unbalance to be used for calibration!

1 5 0

ENT

Request: Enter the angle on which the above defined unbalance shall be applied!

0



Request: Apply the above determined unbalance on the defined angle. Start calibration measurement procedure by pressing ENT!

ENT

During measurement. Changing readout! [Any figures!]

When the change of readout becomes negligible: End calibration measurement procedure with calibration unbalance being applied by pressing ESC!

ESC

Confirmation: Calibration of unbalance readout performed successfully. From now on also the other calibration functions may be performed.

Remove the calibration unbalance !

Leave the part on the adapter. Start the measuring procedure by pressing key M on keypad !

M

After the end of measurement

Unbalance readout

Remove the part from the adapter.

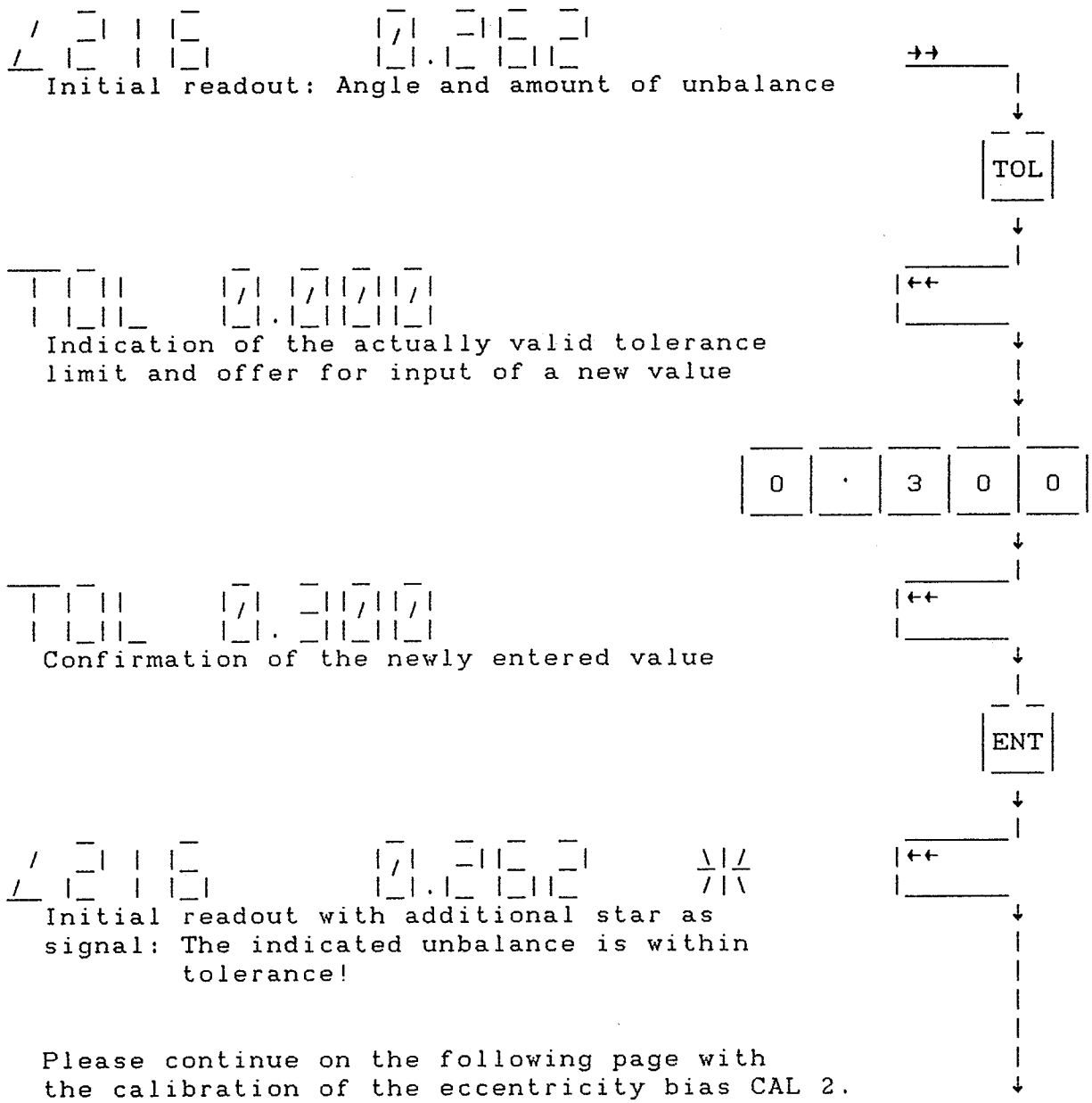
Tare the empty workpiece adapter by pressing key T on keypad !
Please note: The taring procedure will only be accepted after a preceding measuring procedure !
If this measuring procedure has not yet been concluded, i.e. if the "=" sign to the right of the unbalance readout is still missing, the Tare key T is to be depressed two times !

Readout:

The calibration of unbalance readout for type 1 herewith is concluded.
The non-rotationg balancer has been tared for this type.

A possible error due to an eccentricity of the centering pilot is not taken into account by the above calibration.
For this purpose the calibration function CAL 2 for the eccentricity bias has to be performed (please continue with section 10).

9. TOL Input of the limit for the "In Tolerance" indication (*) for types 1 ... 21



Please continue on the following page with the calibration of the eccentricity bias CAL 2.

10. CAL 2 Calibration of the eccentricity bias (all types)

If 180° indexing is possible (corresponding to even number of centering holes or unspecified) enter N = 2.
If 120°/240° indexing is possible (corresponding to three centering holes) enter N = 3.
If 72°/144°/216° indexing is possible (corresponding to five centering holes) enter N = 5.

The workpiece adaptor is <u>empty</u>

Selection: "Calibration" function

Insert workpiece

Selection: Function "Calibration"

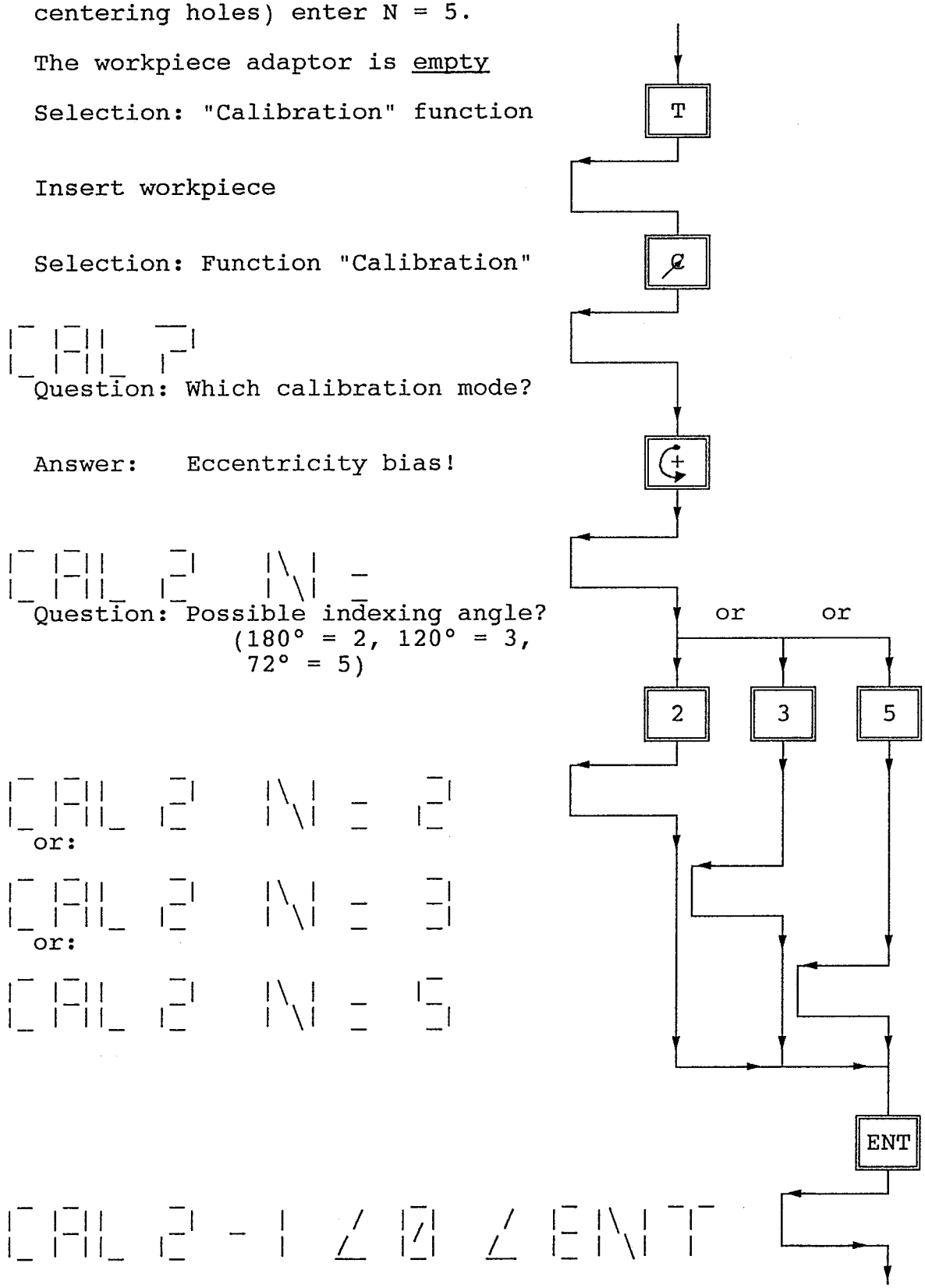
Question: Which calibration mode?

Answer: Eccentricity bias!

Question: Possible indexing angle?
(180° = 2, 120° = 3,
72° = 5)

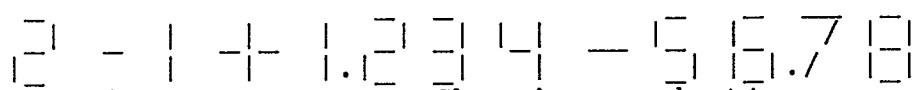
or:

or:



F 3971 c 20.000 11.91 HÄ

Request: Start measuring procedure with
a part placed on the adapter
in zero angle position!



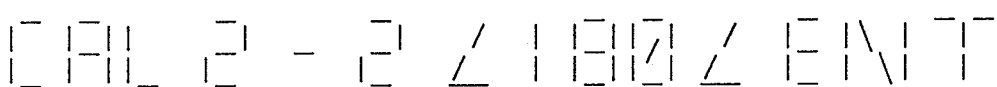
During measurement: Changing readout!
[Any figures!]
When the change of readout becomes negligible:
End calibration measurement procedure with
part being placed in zero angle position
by pressing ESC!

ENT

ESC

New readout
dependent on
input for N

■■■ If N = 2 :

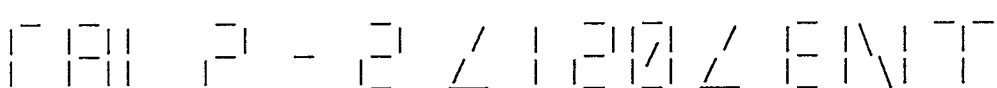


Request: Rotate part by 180° with respect to
the adapter.
Start measurement procedure!

ENT

Continue at
readout of
measured values

■■■ If N = 3 :

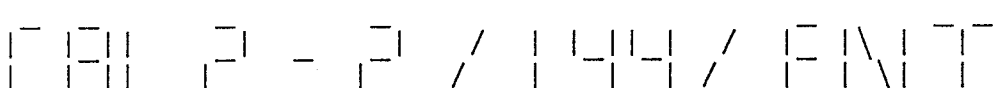


Request: Rotate part by 120° with respect to
the adapter.
Start measurement procedure!

ENT

Continue at
readout of
measured values

■■■ If N = 5 :

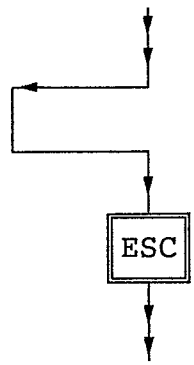


Request: Rotate part by 144° with respect to
the adapter.
Start measurement procedure!

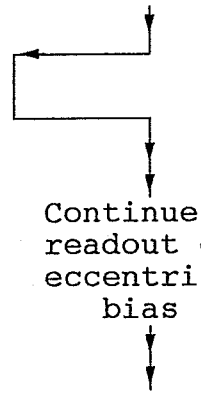
ENT

■■■ Readout of measured values after indexing once:

During measurement: Changing readout!
[Any figures!]
When the change of readout becomes negligible:
End calibration measurement procedure with part having been rotated by 180° / 120° / 144°
by pressing ESC!

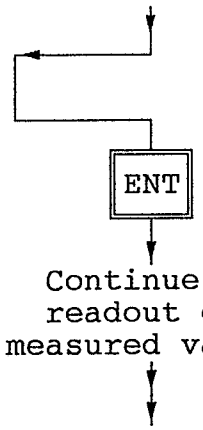


■■■ If N = 2 :
Calibration of the eccentricity bias completed.
Continue at readout of the values determined as eccentricity bias.



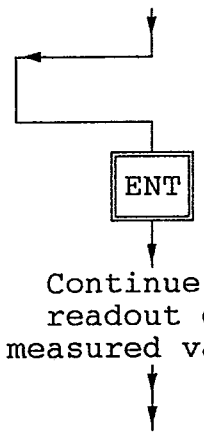
■■■ If N = 3 :

Request: Rotate part once more by 120° (i.e. by a total of 240°) with respect to the adapter.
Start measurement procedure!



■■■ If N = 5 :

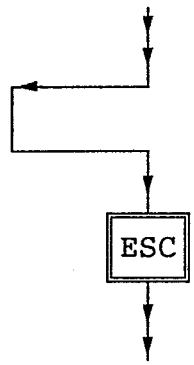
Request: Rotate part once more by 72° (i.e. by a total of 216°) with respect to the adapter.
Start measurement procedure!



F 3971 c 20.000 11.91 HÄ

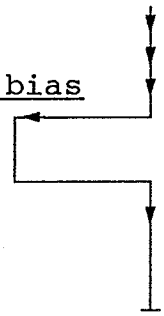
■■■ Readout of measured values after indexing twice:

During measurement: Changing readout!
[Any figures!]
When the change of readout becomes negligible:
End calibration measurement procedure with part having been rotated by 240° / 216°
by pressing ESC!



■■■ Readout of the values determined as eccentricity bias

Confirmation: Calibration of the
eccentricity bias has
been performed successfully.



Prior to starting production, the tare key "T" must be pressed while the adaptor must be empty!!!

During production, the tare key "T" must be pressed at intervals of approx. 15 minutes while the adaptor is empty!!!

F 3971 c 20.000 11.91 HÄ

11. CAL 5 Offset angle readout
(here for polar unbalance readout)

Selection: Function "Calibration"

Question: Which calibration mode

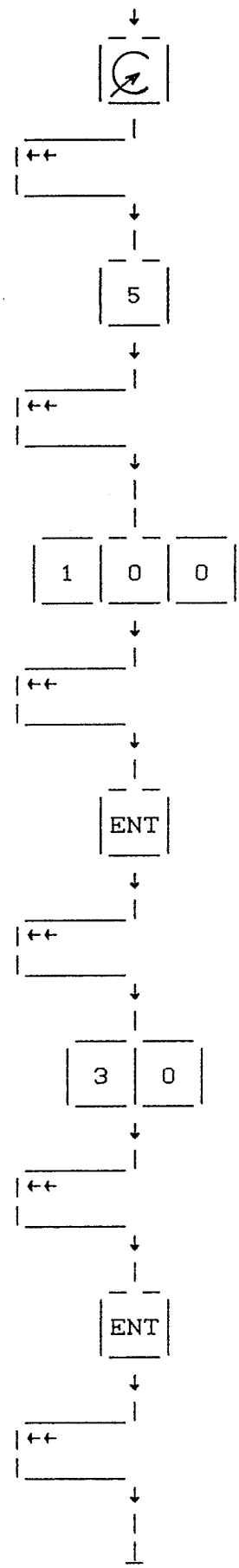
Answer : Offset angle readout

Requirement: Enter the amount of unbalance from which on the unbalance angle shall be read offset.
Enter the unbalance amount in the same dimension as used for calibration CAL 1 of unbalance readout.

Requirement: Enter offset angle. Admissible range is 272 ... 0 ... 89°

Completion of input of the calibration data for "Offset angle readout" CAL 5

Unbalance readout if the amount of measured unbalance exceeds the limit UM defined above with additional information / regarding the angular offset.



F 3850 c 100.000 11.86 WIE

12. Selection of addition/removal of material (+/-)

Initial readout: Heavy spot

+/- key

Readout mode actually valid: Heavy spot,
unbalance correction by removal of material.
Furthermore, offer for change of readout mode.

Maintain readout mode!

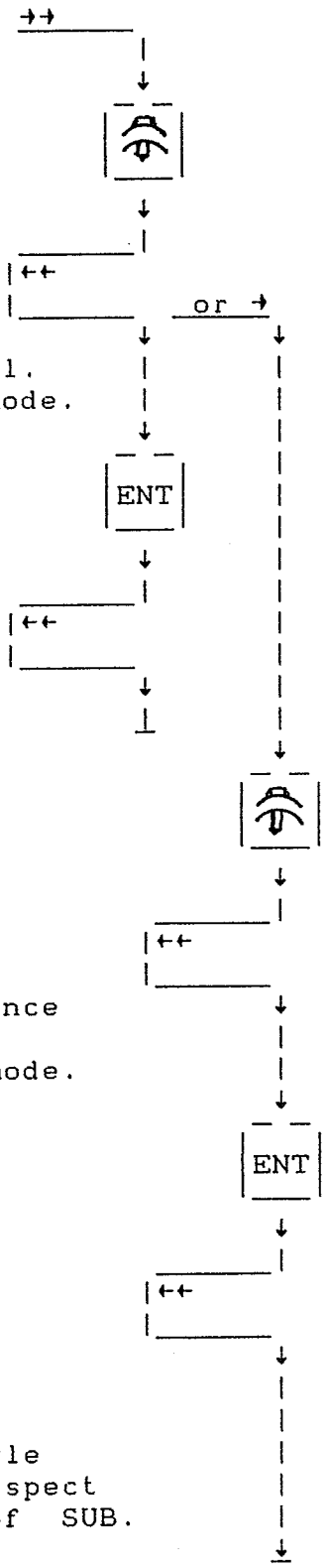
Change readout mode!

Change of readout mode: Light spot, unbalance
correction by addition of material.
Furthermore, offer for change of readout mode.

Acceptance of this readout mode

New readout mode: Light spot, unbalance
correction by addition of material

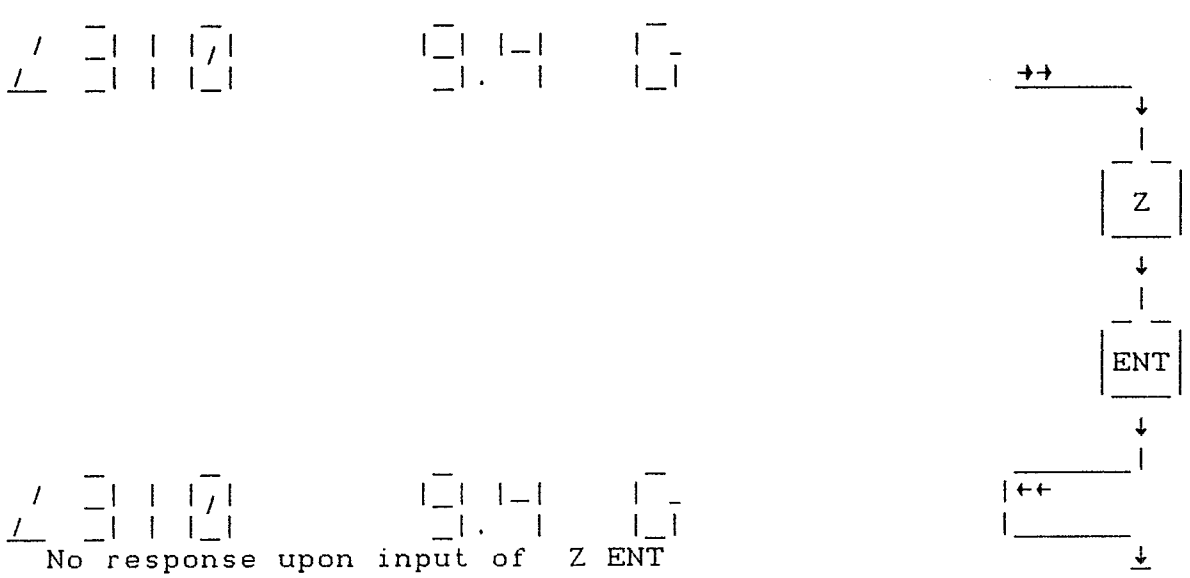
After selection of ADD the unbalance angle
will be indicated with 180° offset with respect
to the position indicated upon selection of SUB.



13. Keypad blockage
(only present if configured by the SERVICE function)

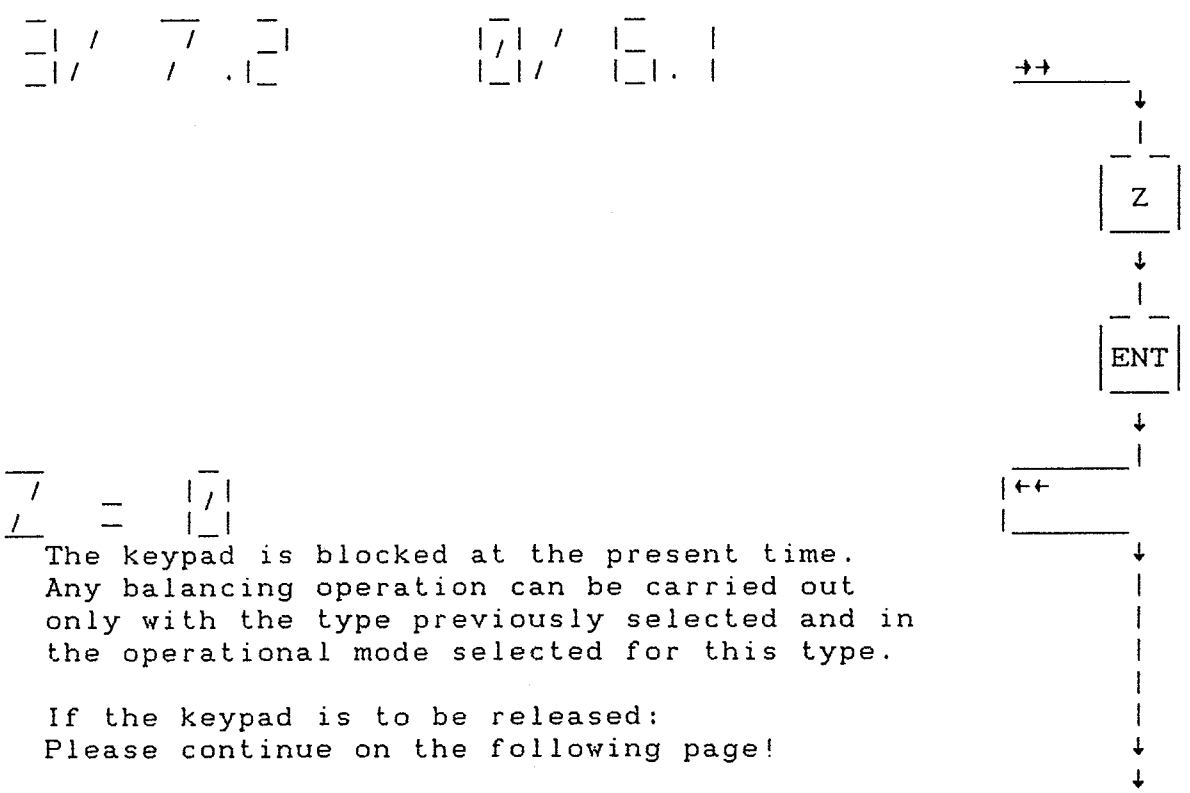
When entering Z ENT the measuring instrumentation informs by its response whether the keypad blockage is activated or not.

13.1 Keypad blockage not activated



No response upon input of Z ENT

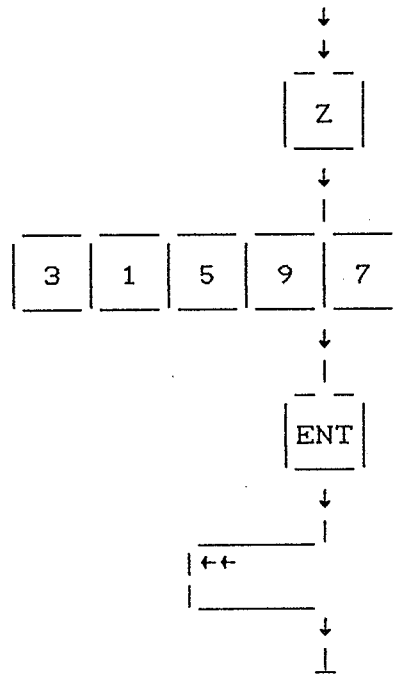
13.2 Keypad blockage activated



The keypad is blocked at the present time.
Any balancing operation can be carried out only with the type previously selected and in the operational mode selected for this type.

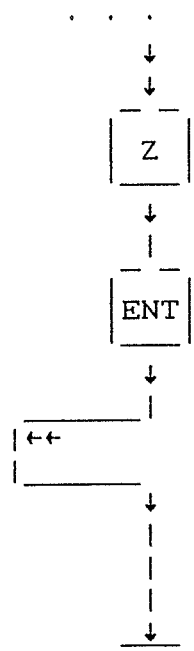
If the keypad is to be released:
Please continue on the following page!

Release of the keypad by input of
the following combination:



The keypad is released.
All inputs are possible.

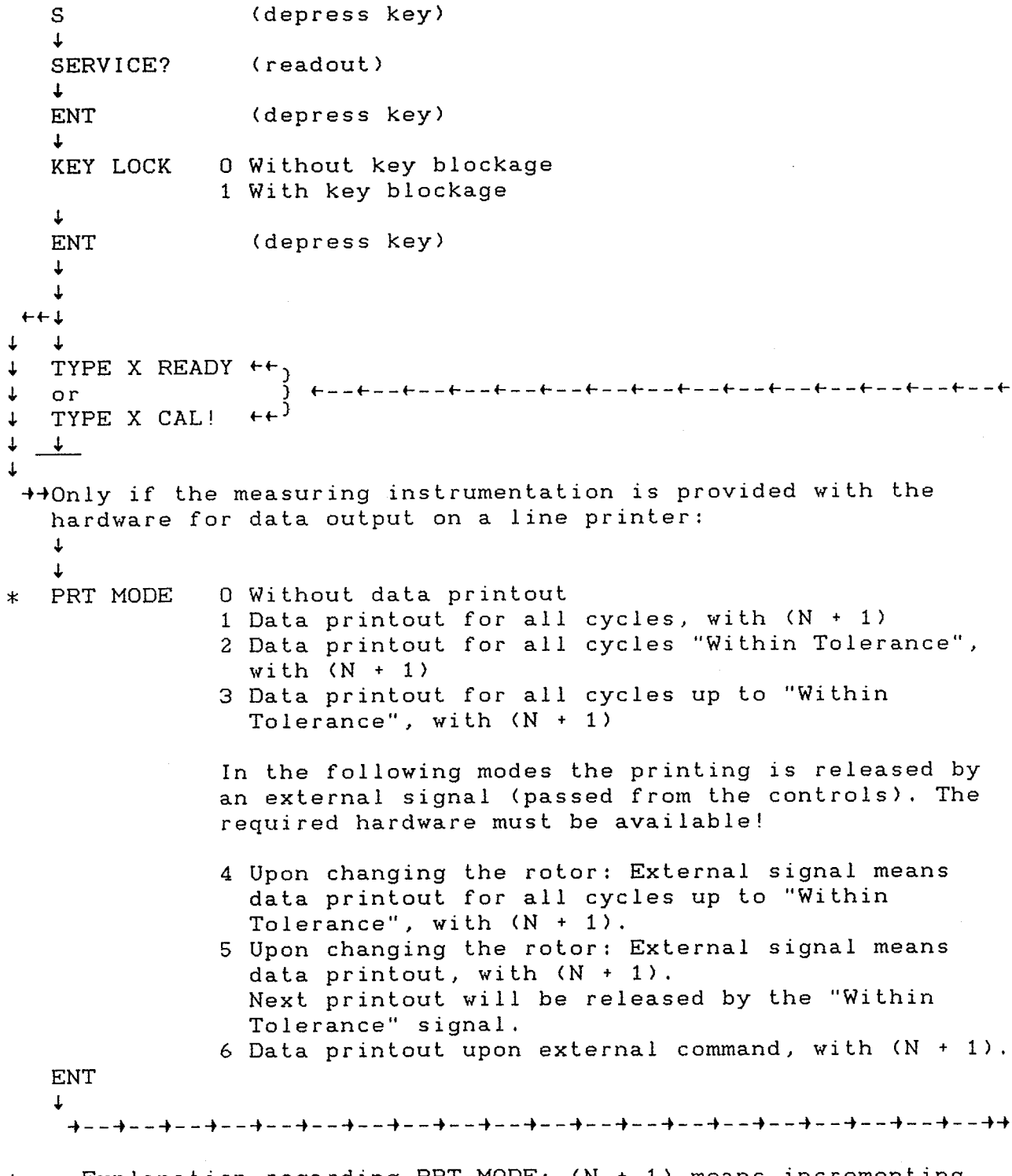
If the keypad shall be blocked again:



The keypad is blocked again.
Any balancing operation can be carried out
only with the type previously selected and in
the operational mode selected for this type.

14. Configuration facilities, for the user of the machine

The functions below are released for modification after actuating the service key S and the ENT key.



* Explanation regarding PRT MODE: (N + 1) means incrementing the number of cycles by 1.

15. Output of measured data on a line printer
(only possible if the appropriate hardware is built-in!)

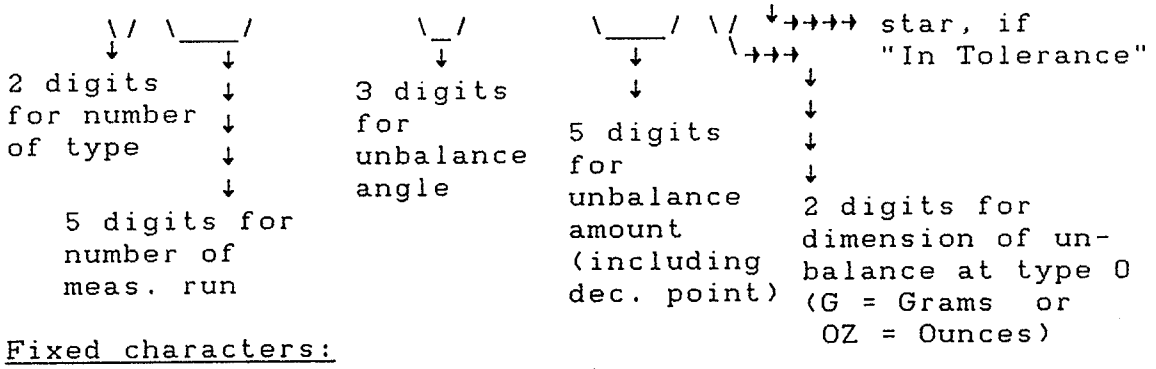
In the hardware included:
The control cabinet of the machine is provided with a socket for a line printer as well as with a socket for power supply of this printer.
The printer which will be used has to match the following requirements:

Interface	RS 232 C (V 24)
Transmission rate	300 Bd
8 data bit	
2 stop bit	
without parity control	

There is no printer control by the measuring instrumentation. I. e. the printer has to be able to keep following the data flow also during carriage return (data buffer required).

Printing format (40 characters, @ = blank):

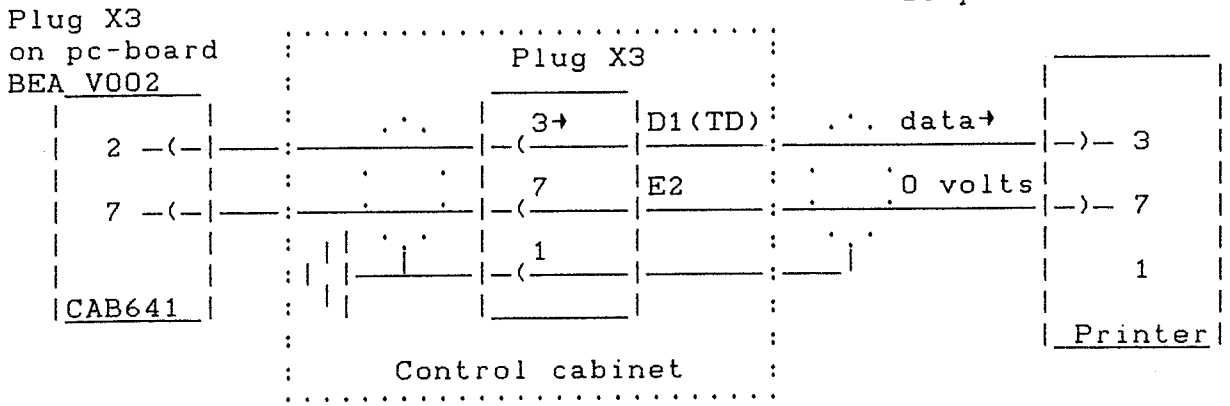
TYPE@XX@XXXXX@@PHI@=@XXX@@U@=@XXXXX@XX@*



Fixed characters:

TYPE	→→	Number of the current type
PHI	→→	Angle
U	→→	Amount of unbalance

Printer connection Connector: HD 20-plug
25 poles (female part)

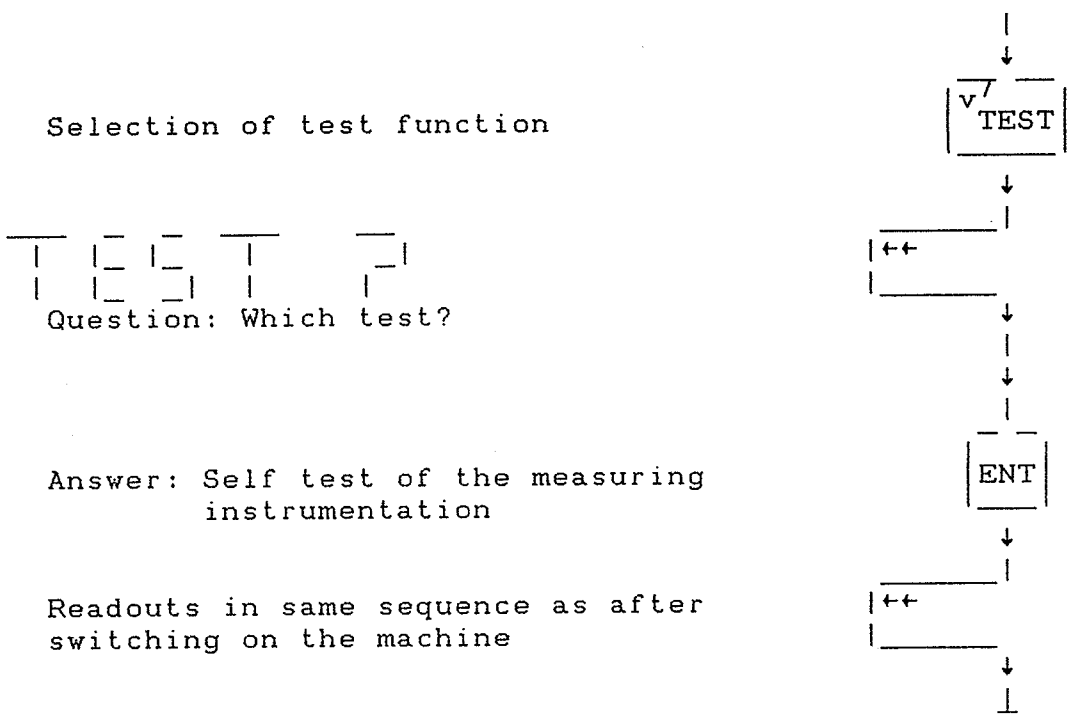


The length of the connection cable must not exceed 5 m !

16. Test function $v/TEST$

Individual selection: Self test of the measuring instrumentation

Selection of test function



Question: Which test?

Answer: Self test of the measuring instrumentation

Readouts in same sequence as after switching on the machine

17. Error messages

RETURN DRILL! (only during self test or after selection of the test function and input of ENT)

Return correction unit (e.g. drill press) up to the positive stop into its **home position and keep it there**. After completion, new readout:

DRILL OK WAIT

Wait until readout jumps into "TYPE . READY" or "TYPE . CAL!" or error message. (During this readout the measuring instrumentation continues its self test.

E 01 'Type not calibrated' or 'Fault in analog section':

Calibrate unbalance readout (CAL 1).

E 02 For type 0: Missing input of radius:

Depress key "r", enter radius. After that: Calibrate unbalance readout (CAL 1).

E 03 Number of components not admissible:

In normal case:
Enter a number between 3 and 99 upon the question N = ..

If for the present type a certain special readout has been provided:
Enter a number between 3 and 9 upon the question N = ..

E 06 Radius out of range 50 ... 500 mm
or 2 ... 20 in) (only type 0 concerned)

Enter a radius which is within the allowable limits.

E 08 Excessive difference between the measured values of the two components during basic calibration CAL 0, i. e. difference in amount more than +/- 10 %, or deviation from the 90 degree intersection angle of the two components more than +/- 10°.

Possible reasons: different adjustment weights used in the two components and/or adjustment weight applied on different radii.

Re-perform the basic calibration (CAL 0).
If the same error message does occur again:
Re-adjust mechanically the pick-ups for displacement of the balance pendulum.

E 10 Eccentricity bias too large

Reduce the error due to eccentricity by shifting the adaptor toward the direction which corrects the unbalance.

Note: The measuring instrumentation indicates the heavy spot of the workpiece adaptor. Readout of the unbalance amount is in same dimension as used for calibration CAL 1.

The following complete procedure (step by step) has to be done after the error E10 has occurred.

- Shifting the adaptor toward the direction which corrects the unbalance.
- Measuring (without workpiece)
  Now the indicated unbalance on the display is the unbalance of the adaptor (without workpiece).
- Reduce roughly the unbalance by adding or removing mass to the adaptor.
- Thereafter the rest the unbalance of the adaptor will be cleared by using the Tara key.
  Now the display must indicate 0° and 0 g unbalance.
- At last the procedure 2) "calibration of the eccentricity bias (with workpiece) - CAL 2" has to be done again.

E 12 Signature error EPROM *

E 13 RAM error *

E 14 Data error in EEPROM

upon E 14 GEN: * > Informations for service personnel

upon E 14 TYPE: Depress key ENT;
After the end of the test:
Re-calibrate that type.

* Working with the system not possible.

E 15 Error of zero in analog section or in A/D-converter **

Depress key ENT

** Record error number and digital values and pass them to the SCHENCK Service

E 16 Deviation from test value too large **

Depress key ENT

** Reccord error number and digital values and pass them to the SCHENCK-Service

E 17 ANA DEF Fault in analog section *

F 3971 c 100.000 11.91 HÄ

E 14 CON Configuration of the measuring instrumentation still missing! (This error message will nearly not occur in practical operation. It may occur immediately after connecting a new measuring instrumentation to the electric controls of the machine, if, e.g., someone tried to start a measuring of calibration procedure.)

E 14 GRD Basic calibration CAL 0 required !
Reason for this error message: Calibration dialog CAL 0 has been interrupted by the main disconnect.

E 18 'Illegal selection of type 0' or 'Allowed only for type 0':

Only types 1 ... 21 can be selected. The keys "r" and "DIM" can not be used.

E 19 'Drill depth indication not provided' or (for type 0) 'illegal selection of drill depth indication'

Drill depth indication can not be calibrated.

E 20 Drill depth indication not calibrated:

Calibrate drill depth indication (CAL 4)

E 21 Incorrect adaptation of drill feed:

Enter correct values upon the questions CAL 4-V = ..., CAL 4-K = ..., CAL 4 - P = ..., CAL 4 - W ...

E 22 Illegal selection of special readout (X) for type 0:

Switch over to a type between 1 and 21 for which the desired special readout is provided.

E 23 Special readout (X) not provided (on types 1 ... 21):

Calibration of any special readout not possible.

E 24 Special readout not calibrated:

Calibrate special readout (CAL X).

E 25 Illegal combination of standard and special readout:

Switch off special readout.

E 26 Entered data incompatible:

Enter calibration data (e.g. Number of holes and their angular spacing) in permissible combination.

E 29 Basic calibration of balance missing:
Perform basic calibration (CAL 0).
Additional information BALANCE CAL will be displayed, if CAL 0 will not be performed immediately.

F 3971 c 100.000 11.91 HÄ

E 29 after E 30 (taring error !):
Deviation from the correct zero by more than 80 digits in at least one component:

Repeat basic calibration of the balance (CAL 0), but, in this case: terminate calibration CAL 0 after the automatic determination of the new zero (readout "OK") using the ESC key.

E 30 Excessive deviation from the stored zero point during taring procedure.

Repeat basic calibration of the balance (CAL 0), see alo E29, but, upon E30: terminate calibration CAL 0 after the automatic determination of the new zero (readout "OK") using the ESC key.

Attention !
If during indication E 30 a measuring procedure it initiated, the error indication will jump to E 29. In this case the shortened basic calibration applies for E 29 too, as for E 30 !

Measuring instrumentation CAB 645 Operating manual

B. Additional functions

18. Graded readout of unbalance amount ("Classification")

Graded readout of unbalance amount is one of the special functions and is switched on or off by key "X".

This special readout not only serves for classification but, for instance, also may be used to display the required number of holes to be drilled, provided that in any case all holes from the drill pattern thus produced will in this case not be taken into account.

The unbalance class displayed may relate either to the polar unbalance readout, or to the two components displayed, depending or which type of readout has been selected.

Please note when calibrating this special readout:
The values to be entered for U0 and UN have the same dimension as the unbalance which has been used during CAL 1 for calibration of the unbalance readout.

F 3971 c 100.000 11.91 HÄ

18.1 CAL X Calibration of the function "Graded readout of unbalance amount (classification)"

Selection: Function "Calibration"

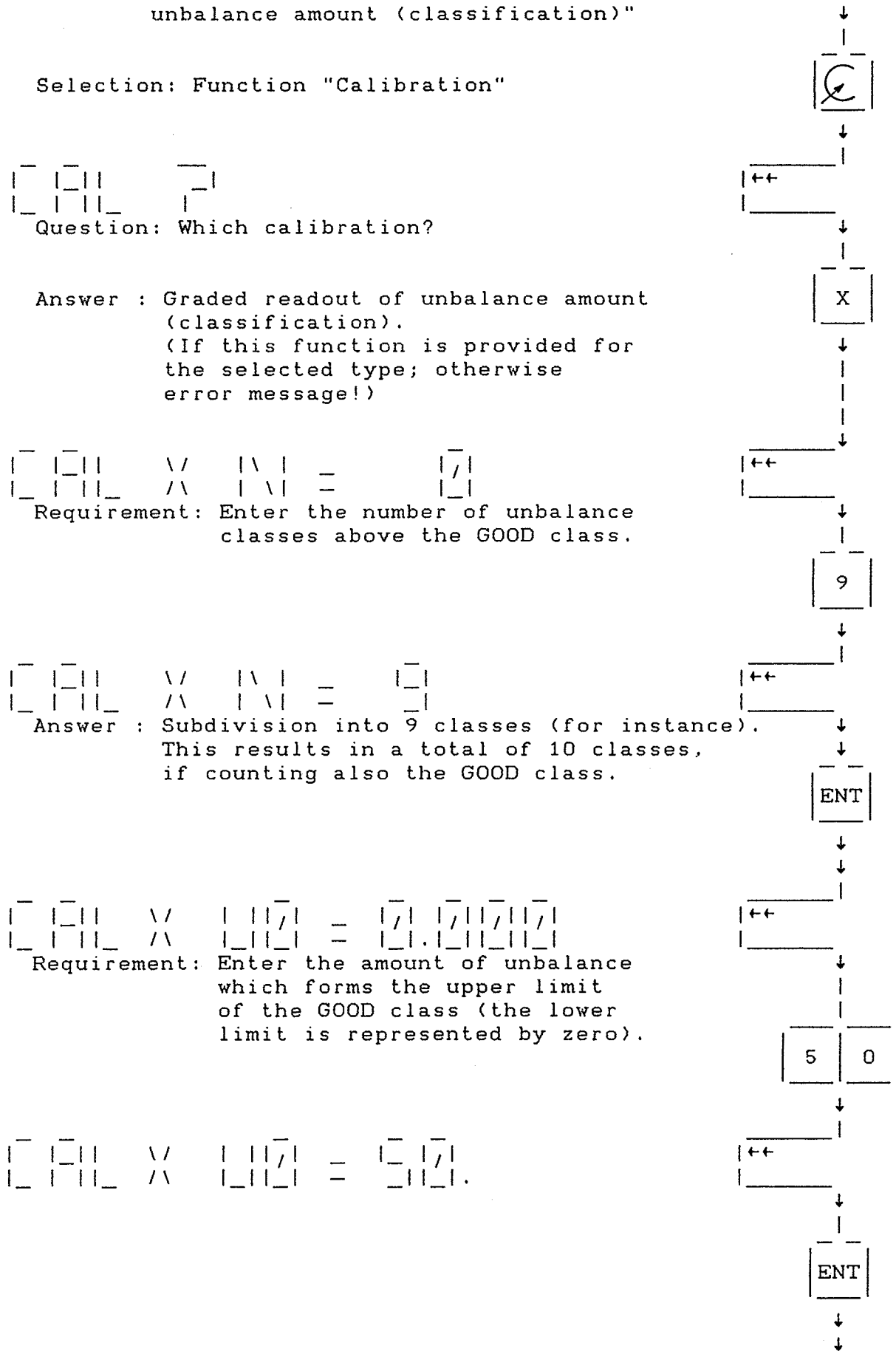
Question: Which calibration?

Answer : Graded readout of unbalance amount (classification).
(If this function is provided for the selected type; otherwise error message!)

Requirement: Enter the number of unbalance classes above the GOOD class.

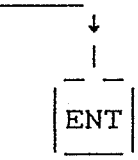
Answer : Subdivision into 9 classes (for instance).
This results in a total of 10 classes, if counting also the GOOD class.

Requirement: Enter the amount of unbalance which forms the upper limit of the GOOD class (the lower limit is represented by zero).



Requirement: Enter the class width of the unbalance classes which follow up to the GOOD class N times.

Answer : Class width 50 (gmm, g, oz)

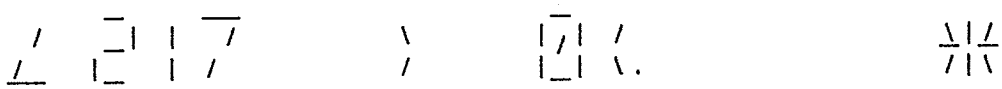


Confirmation: Input of calibration data for the function "Graded readout of unbalance amount (classification)" performed correctly.

F 3850 c 100.000 11.86 WIE

18.2 Readout variants in case of "Graded readout of unbalance amount (classification)"

Polar readout: Class 0 In tolerance



Unbalance as above, combined with indexing aid indication

Class 4 Out of tolererance

Maximum value of classification exceeded

Component readout:

Component 3/ Class 0 Component 0/ Class 4

Comp. 0/ Max. value exceeded Comp. 1/ Class 4

Component 0/ Class 3 Component 1/ Class 2

19. Drill functions

19.1 Drill depth indication for a single drilled hole

The drill depth indication can substitute the four digit field for the unbalance amount readout in the readout mode "polar" indication". If unbalance readout is in components the drill depth indication after a measuring run will be the same as upon polar readout, but related to the component selected by the switch 1-2 on the machine.

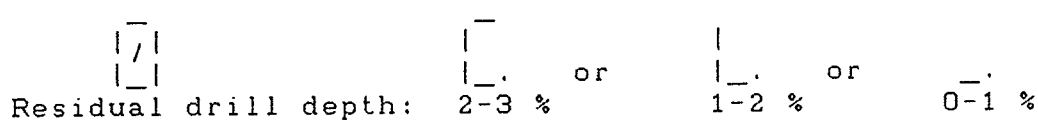
A drill depth transducer (potentiometer) must be mounted on the drill press as well as two contacts one of which switching when the correction tool leaves its home position while the second one switches when the tool contacts the workpiece (drill spindle contact). The second contact also may be substituted by a signal which is output when reaching a predetermined voltage value on the drill depth potentiometer.
The latter method provides that the drill depth transducer always travels the same distance up to the contact between drill point and workpiece surface. When the drill is worn or has been reground the point of contact is to be recalibrated.

As long as the contact for the home position has not been opened the unbalance is displayed in polar form or the indexing aid. When opening the home position contact the drill depth indication appears - provided it has been calibrated.

The count down of the drill depth indication from right to left starts when the drill contacts the workpiece. When the drill depth indication is completely cleared the end of the drill feed required for unbalance correction has been reached. The tool is to be returned into its home position.

When starting the drill feed an individual segment of the indication is cleared after 20 % of the required feed. From now on the individual segments are cleared faster and faster, at first in 10 %-, then in 5 %-, then in 2 %-jumps. Short before reaching the full required drill depth the segments are cleared in 1 %-jumps.

Therefore the recommendation for manual drill feed:
Stop feeding of drill when one of the following indications is reached:



20. CAL 4 Calibration of the function "Drill depth indication", related to a single drilled hole

Data known from the drawing for the unbalance correction of the present rotor:

D Drill diameter
W Maximum drill depth
r Correction radius

Dependent on these data is:

U The unbalance amount being compensated by a single drilled hole

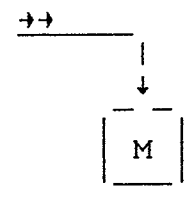
When drilling a hole for correction of unbalance the twist drill removes less material in the range of the tapered drill point as compared to the material removed subsequently by the cylindrical drill body. Thus, the linear relationship between compensated unbalance and drill feed is modified to a curved line, the so called drill curve (or milling curve etc.).
The measuring instrumentation provides the facility to adapt the drill depth indication to the curvature of the drill curve. This is performed by the input of digital values (also 0) for the following points of the curve (see also the examples on the following pages):

V Bias value (e.g. for the drill point)
K Breakpoint of curve (different input modes!)
(single hole) : at XXX gmm of compensated unbalance
P Shifting point for 2nd trace of curve (or for 1st one if V = 0) in XX % of max. drill depth W

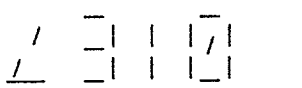
Determination of the amount of U

Place a workpiece of type 1 (or 2 - 21)

Start the measuring procedure by pressing key M on keypad !



After the end of measurement



Initial unbalance of part = initial readout!
Record amount readout!

Orient part as to bring the heavy spot under the drill press!

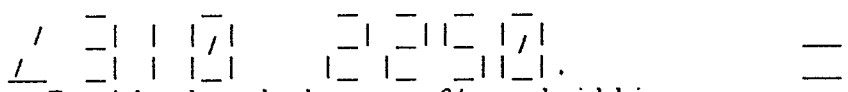
Either:

Determine drill curve:
Drill a hole in the indexed angular position millimeter by millimeter until max. drill depth is reached.
Perform a measuring run after each millimeter. Plot the unbalance measured at each millimeter into a diagram.
Determine the breakpoints of the curve in accordance to the examples on the two following pages. Enter the values thus determined later on when calibrating.

Or:

Drill a hole with maximum allowable depth in the indexed angular position!

Start the measuring procedure by pressing key M on keypad !

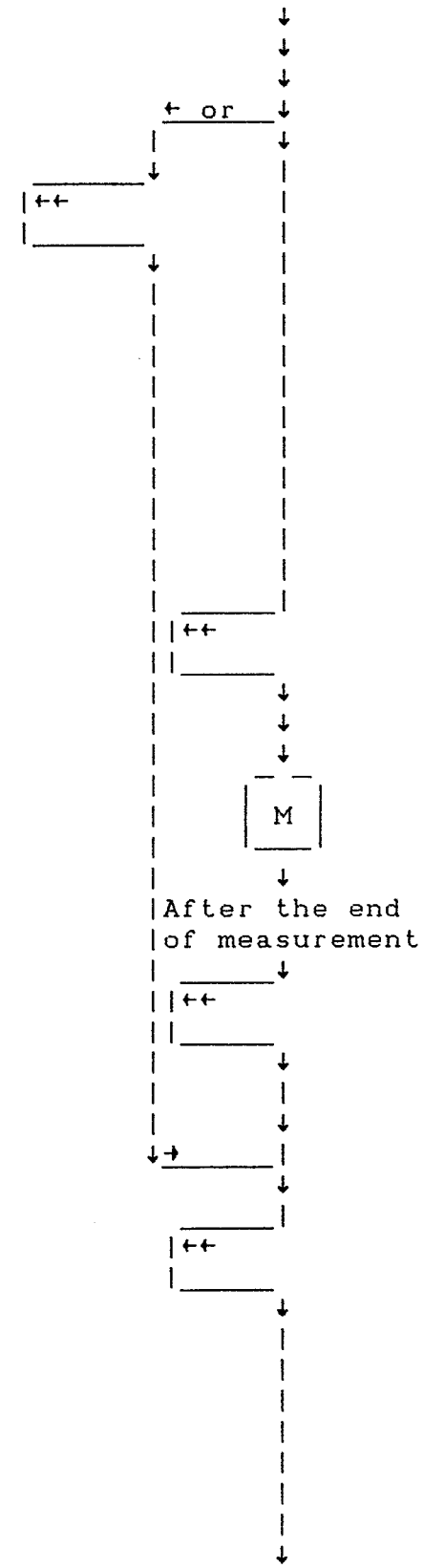


Residual unbalance after drilling
Record amount readout!

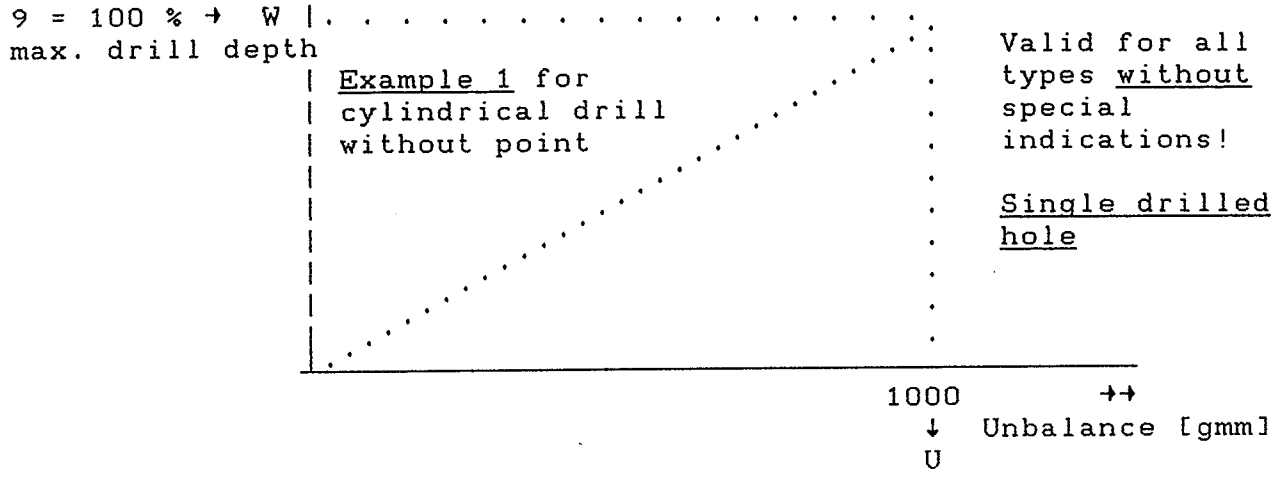
Record the amount readout and subtract it from the initial readout.

```
   3250
 - 2250
 ------
 = 1000   = U
 ==========
```

U is the amount of unbalance which has been compensated by that drilled hole.

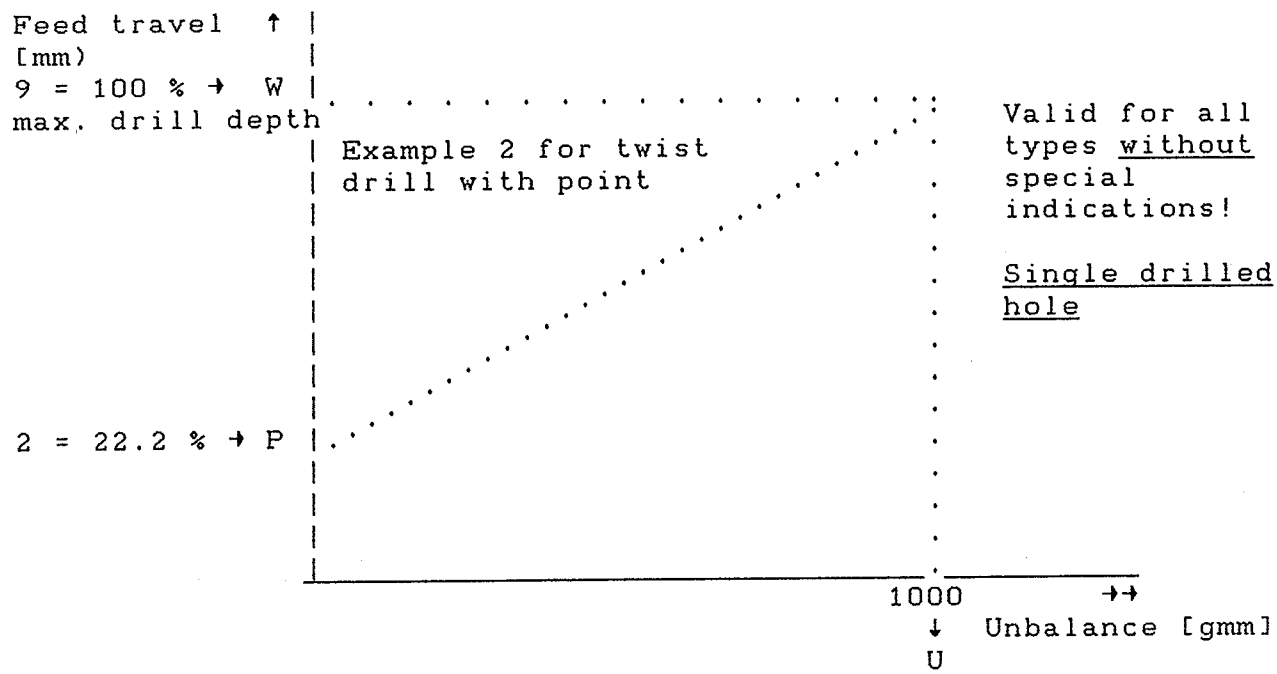


Definition of the values for adaptation of drill depth indication to the unbalance amounts being actually compensated with increasing feed




```
CAL 4 - U =  1000  → ENT
CAL 4 - V =  0     → ENT
CAL 4 - K =  0     → ENT
Cal 4 - P =  0     → ENT
CAL 4 - W =  9     → ENT
CAL 4   OK
```

1000 gmm → Unbalance compensated by a single hole drilled to full depth (= 100 %).

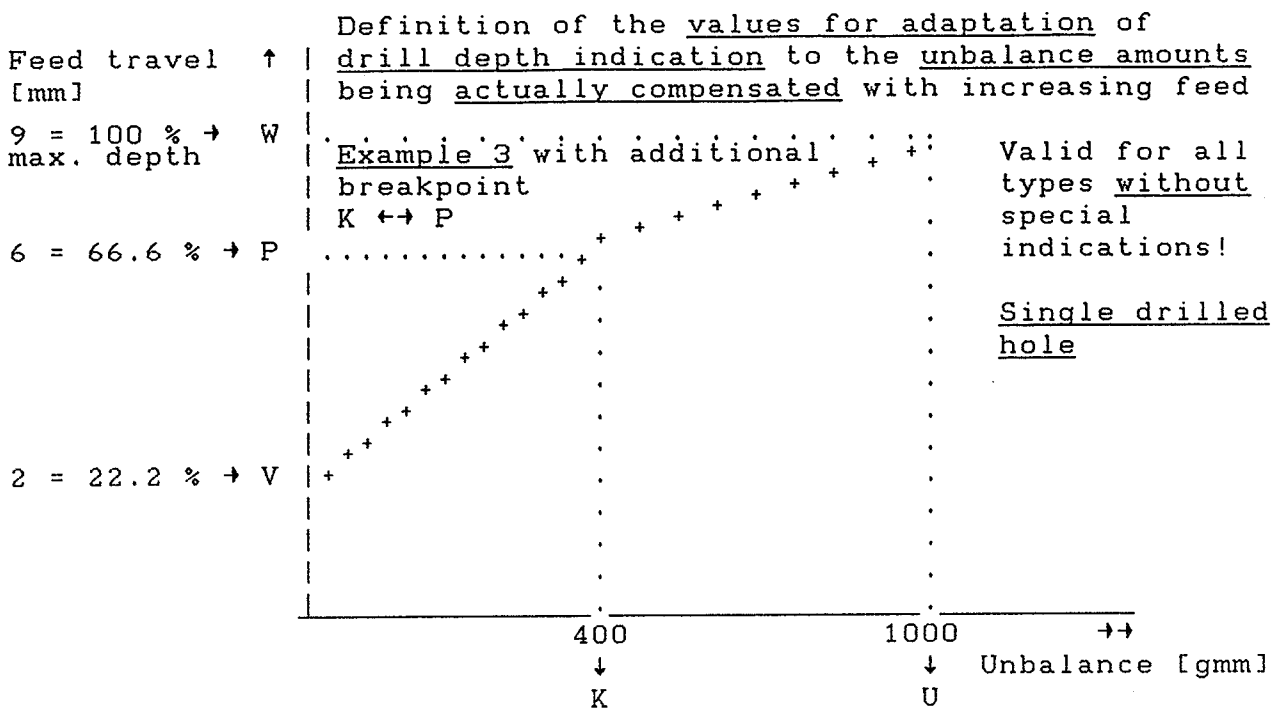



```
CAL 4 - U =  1000  → ENT
```

1000 gmm at 100 % drill depth

```
CAL 4 - V =  0     → ENT  )
CAL 4 - K =  0     → ENT  )
CAL 4 - P =  22.2  → ENT
CAL 4 - W =  9     → ENT
CAL 4   OK
```

Enter "0" at V and K if only one breakpoint by which the drill curve is shifted when entering a value for P.




```
CAL 4 - U =  1000  → ENT
CAL 4 - V =  22.2  → ENT
CAL 4 - K =  400   → ENT
Cal 4 - P =  66.6  → ENT
CAL 4 - W =  9     → ENT
CAL 4   OK
```

1000 gmm → Unbalance compensated by a single hole drilled to full depth (= 100 %).

Input of calibration data

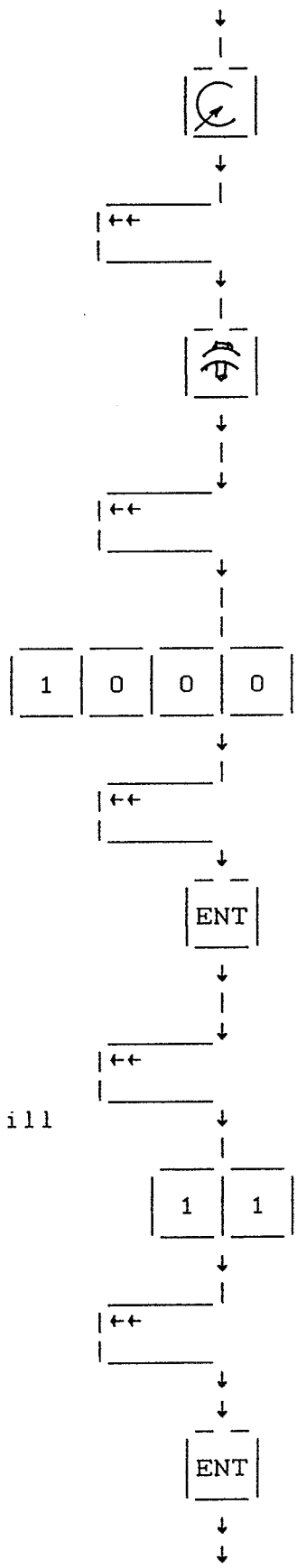
Selection: Function "Calibration"

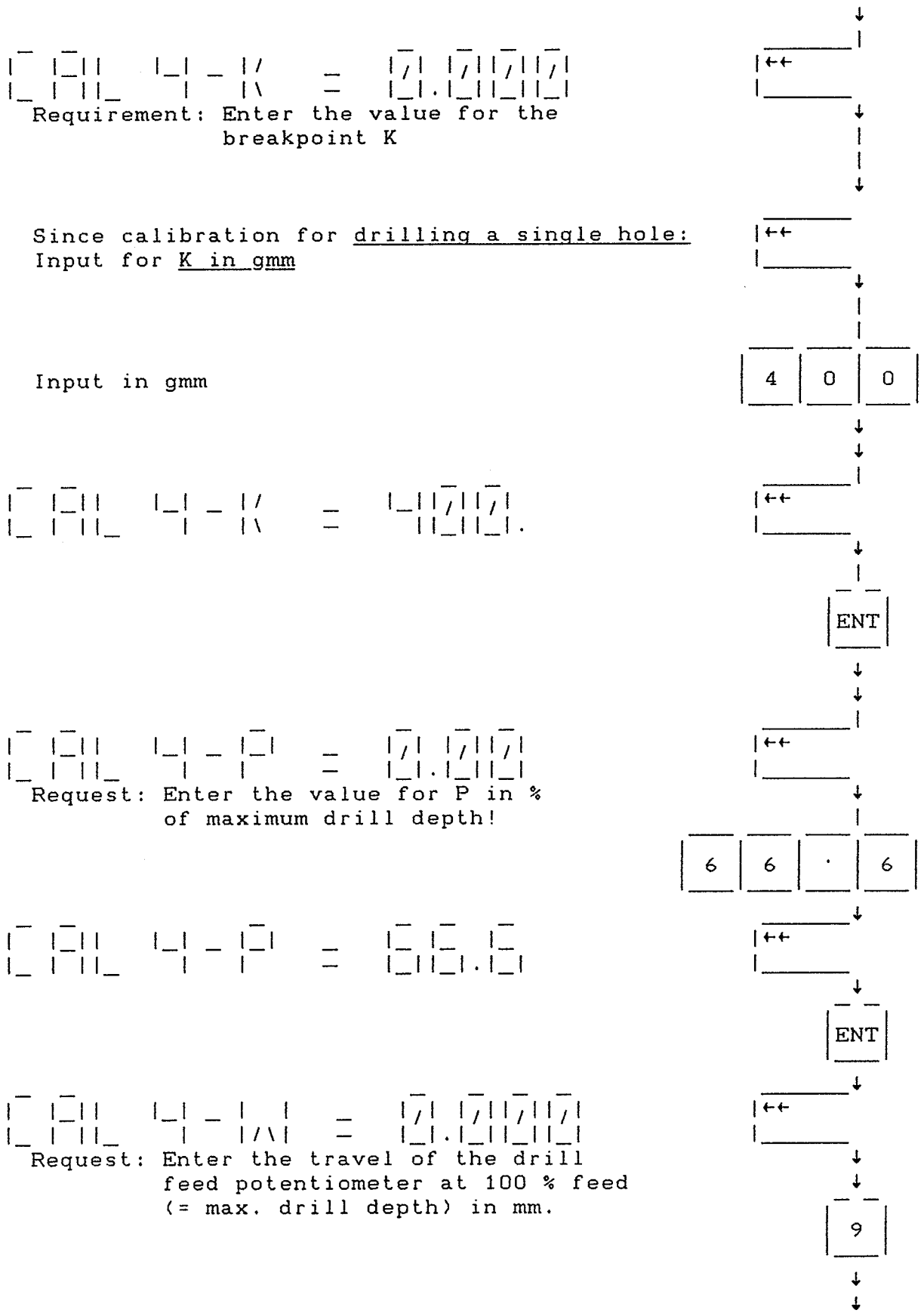
Question: Which calibration?

Answer: Drill depth indication

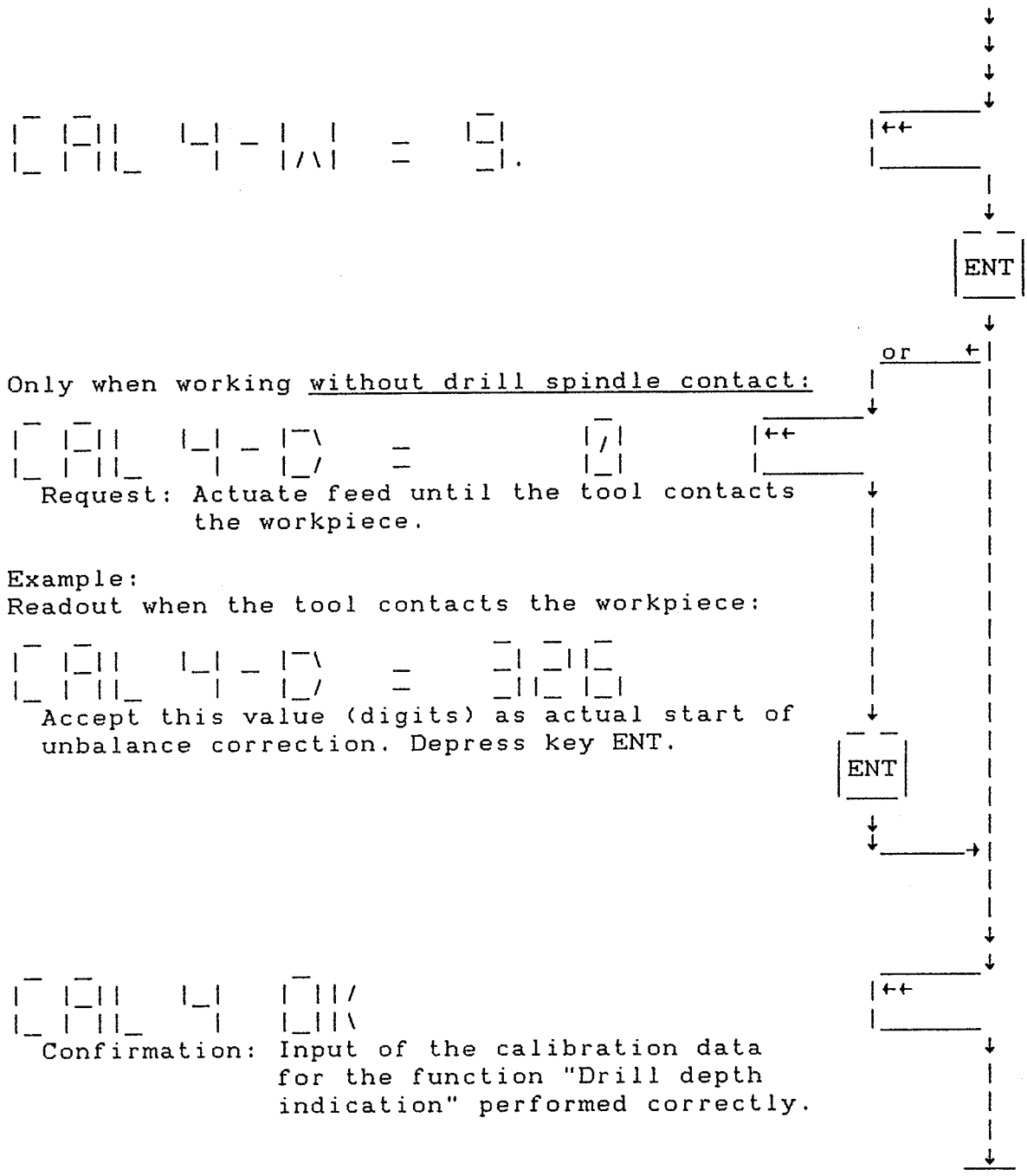
Requirement: Enter the amount of unbalance being compensated by drilling a single hole to max. depth.

Request: Enter the bias value for the drill point in %.





F 3850 c 100.000 11.86 WIE



Only when working without drill spindle contact:

Request: Actuate feed until the tool contacts the workpiece.

Example:
Readout when the tool contacts the workpiece:

Accept this value (digits) as actual start of unbalance correction. Depress key ENT.

Confirmation: Input of the calibration data for the function "Drill depth indication" performed correctly.

21. 2nd step for unbalance correction
(only for unbalance readout in components)

This function extends the facilities for unbalance correction. A precondition is that the workpiece still has free sections for a second unbalance correction. These sections must be located in a component system which corresponds to that one being used for the first unbalance correction. The component system of the second step may have an angular offset in relation to that one of the first step, but this is not a must.
For instance, a second step may also be carried out in the same component system, e. g. if a swivelling drill head is used which drills in the first step with two spindles while it drills in the second step with a single spindle just between the holes of the first step.
This would correspond to a zero offset angle.
The external signal for measuring in the component system of the 2nd step has to be entered before the measuring run is started. This results in the following possible sequence of operations:

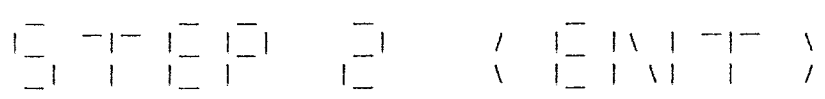
Measuring in 1st step.
Correction in 1st step.
Switch-over to second step.
Measuring in 2nd step for inspection of residual unbalance.

If required:
Correction in 2nd step.
Inspect run in 2nd step.

As far as an offset angle between the two component systems will be required it has to be entered through CAL 5.
The unbalance will be displayed in the component system of the 2nd step only due to an external signal. The numbering of the components is the same as in the 1st step. A special designation of the 2nd step in the display is not provided.

If the 2nd step shall be used in combination with the drill depth indication, the appropriate hardware and software should be present. The drill depth indication CAL 4 has in this case to be calibrated separately.
Upon selection of these calibration function the following display will appear:

Enter all data related to "Unbalance correction in 1st step".
. . . . . .



Enter all data related to "Unbalance correction in 2nd step".
also if they are the same as in the first step!
. . . . . .

F 3850 c 100.000 11.88 WIE

22. CAL 5 Offset angle readout (here for the angular offset for the component system of the 2nd step)

Selection: Function "Calibration"

Question: Which calibration?

Answer: Offset angle readout

Requirement: Enter the unbalance amount from which on the angle shall be read offset at polar unbalance readout).

→→→ But here: Component readout with external switch-over to 2nd step.

→→→ Therefore: Enter "0" !

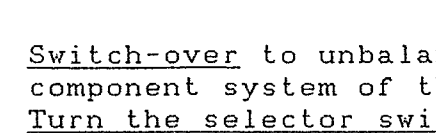
Requirement: Enter the angle by which the component system of the 2nd step is to be rotated with respect to that of the 1st step.

Completion of the input of the calibration data for the angular offset between the component systems of the 1st and the 2nd step on component readout of the unbalance.

Unbalance readout in the component system of the 1st step for 90° components

F 3850 c 100.000 11.88 WIE

Switch-over to unbalance readout in the component system of the 2nd step.
Turn the selector switch on the machine.



Unbalance readout in the component system of the 2nd step in 90° components and an offset angle of 30°.
Please note:
The unbalance of the workpiece is the same as in the readout for the 1st step on the preceding page.
The numbering of the components is the same as before.
The amount readout has changed.
Component 3: From 0 into 267
Component 0: From 534 into 466

(Since the offset angle amounts to 30°, in this example the change in the amount readout is proportional to the sine and cosine function of 30°.)