sylvac

D100S

INSTRUCTIONS FOR USE

Program version V1.4
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SWISS MADE

sylvac

1. D100S DISPLAY UNIT

1.1 GENERAL DESCRIPTION

The **D100S** unit displays the absolute displacement of the long-travel Sylvac probes 2, 5, 10, 25 et 50 mm (**P2**, **P5**, **P10**, **P25** et **P50**). Highest resolution is **0.1 μm**. It also allows for OptoRS simplex or duplex instruments to be seen. Numerous integrated functions will resolve most metrological problems, be they in the workshop or laboratory.
The 8200 points backlit graphic read out provides tremendous flexibility and ease of use Similarly, it allows the unit to be used simply and in a choice of 3 languages. All readings entered are protected from erasure if the unit is switched off (when switched back on, the unit returns exactly to the point where it was switched off, and the probe's position is retained). The numerous inputs/outputs of the unit, as well as its modest dimensions and ability to function from batteries allow it to be incorporated in a great variety of industrial locations.

A 230 V, 120 V or 100 V charging block is supplied with the unit.

By means of complementary multichannel units it is possible to connect from **2 à 64** probes to just one **D100S** unit and/or **2** to **48 Sylvac Opto-RS232 instruments** (**max 64 channels**). Each probe connected can be individually selected, as well as automatic scanning with comparison of tolerances.

The pneumatic unit **D110** (vacuum unit = **D110V**)enables from 1 to 16 probes to be lifted. The maximum lifting capacity will be 64 probes using 3 additional units **D111** (**D111V** for vacuum system).

1.2 FRONT OF UNIT

On/Off switch

LCD display, CCFL back-light

Function keys
(sound acknowledgement)
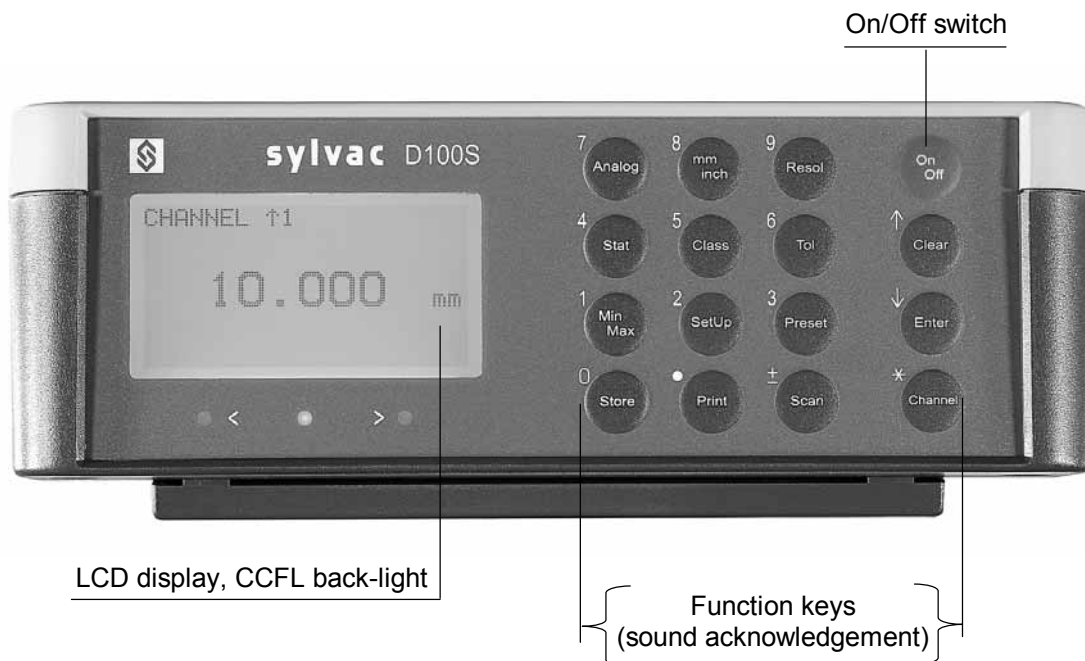
1.3 FUNCTION KEYS

1.3.1 Summary of functions

7 Analog : displays or removes analog scale.

8 mm inch : direct conversion mm/in.   **On Off** + **8 mm inch** : lock/unlock the mm/inch conversion.

9 Resol : choice of the resolution :

0.1-0.01-0.001-0.0001 mm
ou 0.01- 0.001-0.0001-0.00001 in

4 Stat : displays statistical results of stored values. There are two choices :

2 SetUp + **4 Stat** : There are two choices :
- display classical statistics and, if tolerance mode is activated, will display capabilities and bar chart..
- display $\overline{X}$/R control chart..

Print : Print out by pressing the **Print** key. Press the **Print** key more then >2 sec.

5 Class : display or remove the classes < 1 2 .... >

2 SetUp + **5 Class** : choose the number of classes, (2 to 6), and setup of limits for each class.

6 Tol : display or remove tolerances < = >

2 SetUp + **6 Tol** : enter nominal value and tolerances limits.

1 Min Max : display or remove the MAX, MIN, Delta or Mean first chosen by pressing SET UP and then Min/Max

2 SetUp + **1 Min Max** : choose mode to be displayed first by pressing Min/Max.

Enter : in Min/Max mode : display successively Min, Max, Delta, Mean.

Clear : in Min/Max mode : clear the MIN/MAX memory to the current value.

SetUp (2)	: introduction of parameters or functions for the following keys. *Stat*, *Class*, *Tol*, *Clear* or *Enter*, *Min/Max*, *Setup*, *Preset*, *Store*, *Print*, *Scan* and *Channel*. All The parameters will be stored after unit has been switched off.	**SetUp** (2) + **SetUp** (2)	: introduction of general parameters: function of the external contact, language, keyboard lock, sound inhibition, date/time input and save configurations (up to 12).

Preset (3)	: display the Preset value (zero or any value).	**SetUp** (2) + **Preset** (3)	: introduction of a Preset value for the selected channel. (for Preset zero, enter 0).

Store (0)	: 2 functions are available : - hold display - store value	**SetUp** (2) + **Store** (0)	: program the *Store* key for hold or store. Enter the number of channels to be stored, display or delete values in memory.

Print	: printout of the following : measure, values after scanning, statistics, memorized values on RS232 and Centronics outputs.	**SetUp** (2) + **Print**	: choice of RS232 transmission parameters and RS232/Centronics output format.
		On Off + **Print**	: display the program version (firmware)

Scan (±)	: scan a preprogrammed number of channels and display part OK, rework or reject, according to the tolerances introduced for each channel.	**SetUp** (2) + **Scan** (±)	: define the first and last channel of the scan ; possibility to stop on one or several channels.
		On Off + **Scan** (±)	: active/deactivate the step by step scan (stop on each channel).

Channel (*)	: choice of one channel, a channel combination A+/-B or A+/-B+/-C, the measuring direction or a multiplication factor.	**SetUp** (2) + **Channel** (*)	: allocate a probe to a specific channel, specify an Opto-RS simplex or duplex channel.

Enter	: either proceed to preceding channel, adjust contrast or pneumatic descent. When entering parameters : confirm numerical entry or proceed to following menu.	**SetUp** + **Enter** : choice of Enter/Clear function : change channel, contrast adjustment or pneumatic descent. **On Off** + **Enter** :unlock the keyboard if inhibited.
Clear	: either proceed to following channel, adjust contrast or pneumatic raise. Leave a menu without modification.	**SetUp** + **Clear** : choice of Enter/Clear function : change channel, contrast adjustment or pneumatic descent. **On Off** + **Clear** : main reset of the unit (complete reinitialization of parameters)
On Off	: switch unit ON / OFF. All parameters will be stored after unit has been switched off.	

Sw 1

Sw 2

: can be programmed for:

1. data transmission to Centronics / RS232 outputs

2. hold/store.

3. new min/max

4. preset

5. change channels

6. pneumatic lifting

7. scanning

: different combination of the above functions are also possible. (up to 2x30 possible combinations)

1.3.2   General method

All functions are directly accessible, e.g. by pressing the *Tol* key, tolerance indicators will be displayed. Pressing it again causes the indicators to disappear. The numbers on the function keys are used to select a menu or to enter numeric values. The *Setup* key allows the input of parameters required for the various functions of the unit.

When a menu is displayed, the previously stored selection is indicated by black rectangle :   ■■

1.3.3   Entering numbers :

Numbers are entered as follows:

The old numerical value will be displayed first..

Should the *Clear* key be pressed before any other key has been activated, the program cycle will be set back without correcting the old value.

Pressing the *Enter* key validates the input value and the next menu is displayed.

All values to be input are selected in the same way as for a calculator. Plus and minus can be changed at any time by pressing the +/- key.
The number of digits on the left hand side of the decimal point is max. 4 for mm and max. 2 for inch. The number of digits after the decimal point depends on the resolution.
An input value can be started directly with the decimal point.
If an incorrect value is selected, press the *Clear* key and start again.

1.4 OPERATION

1/ Depending on the operating location, the independent base may be screwed onto the bottom of the unit, so that the display is presented « face-on » to the operator.

2/ Connect the charger (*Section 1.8.5*). If the accumulators are completely flat, wait approx. 10 minutes before use.

3/ Connect one probe **P2, P5, P10, P25** or **P50** (*Section. 1.8.8*) or several probes if operating with one or more **D102/D108** units (*Section 2.3*).

4/ If there is need, connect one **Opto-RS** instrument to instrument input of D100S unit. To connect more than one Opto-RS instrument, use **D104** (max. 4).

5/ Switch on unit. *On/Off*

When operating autonomously (without charger) the symbol   appearing at the top right of the screen indicates the need to recharge the battery.
<u>Duration of charge</u> : min 15 hours.

6/ Select language by pressing **2** then **2** then **3** and then 1,2 or 3 (*see chap.. 1.6.11*).
   This selection is memorized permanently by the unit (along with all other data).

7/ Where necessary, convert from metric to imperial measurement by pressing ***mm/inch*** key.

8/ Specify the readout resolution by pressing ***Resol*** key and then 1,2,3 or 4 (*Section 1.6.4*).

9/ If required (*refer to Section. 1.6.3*) :
   Reverse direction of probe measurement. (*Channel + (+/-)*)
   Select diameter mode (* 2)or any other multiplication factor. (*Channel + Channel*)
   Select measuring channel if several probes (or channels) are used, and A +/- B or A+/-B+/-C mode if necessary.
   Change probe – channel allocation or allocate a channel to an Opto-RS232 instrument.

10/ If required, connect the foot pedal or other external contact (*section 1.8.6*) and assign its function(*refer to section 1.6.11*). It is also possible to connect a printer to the Centronics output (*section 1.8.1*) and set up transmission parameters (*section. 1.6.14*). It is equally possible to connect an analog printer to the analog output (*section 1.8.3*) and command devices (*e.g. electro-valve*) on sort outputs (*section 1.8.3*). It is possible to use a D110 vacuum pneumatic lifting unit (*section 5*) and configure the external contact (*section 1.6.11*) in order to lift/lower probes.

11/ Reset display to zero or to any probe reference value by pressing ***Preset*** key. The stored preset value may be entered with ***Setup*** key then ***Preset*** key (*section. 1.6.10*).

12/ The displayed measurement can be accompanied by :

   the analog scale (*section 1.6.6*)
   tolerances (*section 1.6.7*) or classification (*section 1.6.8*) indicators.
   min/max mode (*section 1.6.12*)
   store mode for statistics (*section 1.6.15 and 1.6.9*)
   scanning mode if one or more **D102/D108/D104** units are used. (*section 1.6.13*).

13/ Once the unit has been set up, the keyboard can be locked. The external contact and ***Print*** key remain active. The mm/inch function can also be locked.

1.5 EXAMPLES OF OPERATIONS

1.5.1 Simple measurements :
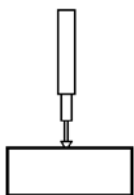
Choose the required channel + channel number + ENTER or

if this channel was combined
(A+/-B or A+/-B+/-C)

Channel + Scan

Reverse measuring direction

1.5.2 Combined measurements A +/-B (using D102 or D108) :
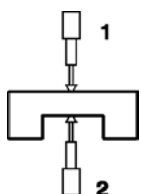
Channel + Scan

Choose the measuring direction of channel 1

Channel + Min Max + Scan + SetUp + Enter
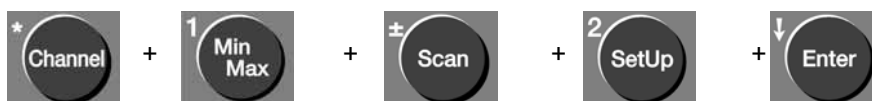
Choose combination 1 + 2 or 1 - 2

once = +
twice = -

1.5.3 Combined measurements A +/- B +/- C :
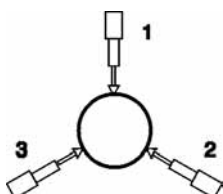
Scan + Preset + Enter

Proceed in the same way as for 2 channels. *Scan, Preset, Enter*

1.5.4 Multiplication factor: (also available for A+/-B et A+/-B+/-C combinations)

Channel + Channel

Channel + Channel then multiplication factor (e.g. 0.33333)

1.5.5 Measurements and checking tolerance limits :

SetUp + Tol

Enter nominal value, the upper and the lower tolerances :

Tol

Activates or deactivates the tolerance indicators.

1.5.6 Measurements with classification (2 to 6 classes)

< 1 2 3 4 5 >

SetUp (2) + **Class** (5)
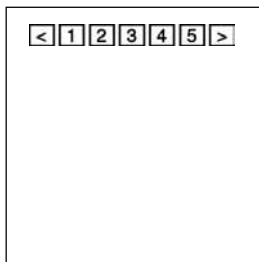
Enter number of classes and then limits of classes using **Setup** key and **Class** key.

Class (5)

Activates or deactivates the indicators.

1.5.7 Statistics

LLT   ULT
50%
40%
30%
20%
10%
0%
N=93   width=0.2

SetUp (2) + **Store** (0) + **Class** (5)
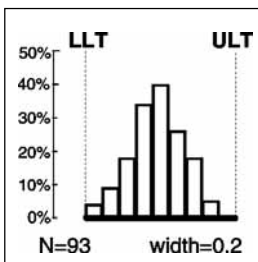
Store = mémorizing: **Setup, Store, Class** keys then number of Store channels.

Stat (4)   **SetUp** (2) + **Stat** (4)

Display statistics with **Stat** key,   choose statistics type by pressing **Setup, Stat**

Enter

Display next tables (only available if tolerances have been activated) by pressing **Enter** key.

1.5.8 Combined measurements with scanning

1   2   3

SetUp (2) + **Scan** (±)
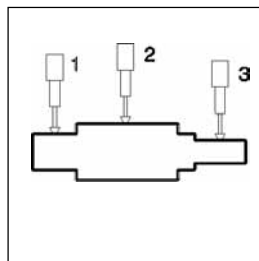
Enter number of channels to be scanned by pressing **Setup** key then **Scan** key.

SetUp (2) + **Tol** (6)

Enter tolerance limits for each channel by **Setup** key then **Tol** key.

PART 24:

REJECT GOOD REWORK

1 9.000 E < = >
2 0.002 E < = >
3 26.074 E < = >

SetUp (2) + **Preset** (3)
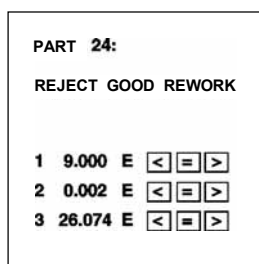
Preset each channel using your master **Setup** then **Preset** +preset values for each channel.
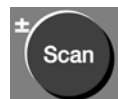
Scan (±)

Start scanning = **Scan** (or external contact if configured for this purpose)

Print

Print out the results = **Print** key, press>2sec.

Preset (3)

New calibration (without introducing new preset values) : **Preset** key

1.6   FUNCTION KEYS

1.6.1 CLEAR KEY

Operating in normal measuring mode	:	move to following channel, adjust contrast or control lifting of probes with **D110** or **D110V** (choose between three functions by pressing **Setup** the **Enter** : (refer to next page).
Operating in Min/Max mode	:	clears the Min/Max memory before taking a new measurement.
Operating in Set Up mode	:	cancels an input value or cancels a chosen menu without alteration.
Operating in Scanning mode	:	with the display of first measurement values picture, the Scan-mode is cancelled. Otherwise the display will be regressed successively until it reaches the first one.
Operating in Stat mode	:	returns to normal display.
Operating in the Store mode	:	erases last value (s), starting from last one.

1.6.2 ENTER KEY

Operating in normal measuring model: move directly to preceding channel, adjust contrast or controls descent of probe with D110 or D110V.

Choose between following three functions :

 + or

1/ press **Setup** key 2/ Then press **Enter** key or **Clear** key.

The following menu will appear :

```
Enter/Clear =

1: Channel
2: Contrast
3: D110
```
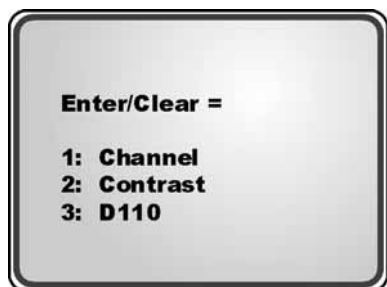
Choice 1 allows you to move directly to the preceding channel by pressing the **Enter** key, or to the following channel by pressing the **Clear** key. Constant pressing is possible.

Choice 2 allocates the **Enter** and **Clear** keys for contrast to be adjusted by means of the Enter and Clear keys according to working conditions (temperature, angle of view).

Choice 3 allocates the **Enter** and **Clear** keys respectively to lower or lift probes in service by using the **D110** pneumatic command unit or the **D110V** vacuum unit.

It is also possible to configure the external contact (pedal) to lift/lower the probes.
(*refer to section. 1.6.11*).

Operating in Min/Max mode : changes the displayed value : maximum, then minimum, then max-min, then mean (max + min)/2, then maximum again….

Operating in Set Up mode   :Confirms an input value or cancels a menu without alteration.

Operating in Scanning mode: when the last measurement values are displayed, Scan mode will be cancelled. Otherwise, the display will move successively forwards until it reaches the last values.

Operating in Stat mode   : displays next values.

Operating in Store mode   : reactivates the values erased by **Clear** key.

1.6.3 CHANNEL KEY

The **D100S** unit can command up to **64** channels. The use of **D108** or **102** units makes it possible to connect up to **64 P2, P5, P10, P2**5 or **P50**. Use of the **D104** (for connecting RS232 instruments) is possible for up to **48** Opto-RS Sylvac instruments.

All the following functions are available for each channel independently :

any Preset value.
specific tolerance limit.
normal mode, maximum mode, minimum mode, delta mode (max-min), or mean mode (max + min) / 2
storage of values.
measuring direction.
combination A+/-B or A+/-B+/-C
any multiplication factor including diameter mode.
classification on 2 to 6 classes.
probes **P2, P5, P10, P25, P50** or **Opto RS simplex or duplex instruments.**

Note: When using the display unit only one probe (without additional accessory unit D102/D108/D104), the same probe can be used for **64** channels and thus manage up to **64** measurements.

Probe 1 is allocated to channel 1, probe 2 to channel 2 etc.. This allocation can be modified, and therefore several channels may be allocated to a single probe. For example, channel 3 can be allocated to probe 1.

In the case of A+/-B or A+/-B+/-C, channel combinations, the active tolerances, preset, multiplication factor, measuring direction and so on will be those on channel A, i.e. the first channel.

1.6.3.1 selection of measuring channel :

1/ press l**channel** key , **CHANNEL** appears as negative on the screen.

2/ select number of required channel.

3/ confirm by pressing **Enter** key, CHANNEL this time appears as positive on the screen —> end of input.

1.6.3.2 selection of channel immediately following :

1/ press **Clear** key, if it is configured for the channel selection.

It is also possible to configure the external contacts (foot pedal) for the channel selection.
(*refer to section 1.6.11*).

1.6.3.3 selection of the directly preceding channel :

1/ press **Enter** key, if it is configured for the channel selection.

1.6.3.4 reversing the measuring direction :

The measuring direction is indicated by the arrow preceding the channel number. An up arrow indicates that the measurement value increases when the probe moves against inside (so when it is vertical will indicate a positive measurement direction).

1/ press **Channel key** 2/ then **Scan** key.

The arrow preceding the channel number changes its direction.

To reverse the direction, repeat the sequence.

1.6.3.5 radius/diameter mode, multiplication factor or measure on V base :

Allows the introduction of any multiplication factor for one probe or for combination A+/-B or A+/-B+/-C (e.g. calibration of each channel and its probe).

1/ press **channel key** 2/ then **channel** key (* represents multiplication factor)

Special cases :   factor   = 1 —> normal mode, no coefficient.
                          factor   = 2 —> diameter mode, (read value will be twice the measured value).

                          factor   = 0 —> the factor will calculated automatically (for measurements on a V base with
                                          any angle), or calibration of one channel according to gauge block.

The calibration on V or on pad should be made as follows :

1/ choose option 0.
2/ put a calibrated rod on V base or a gauge block and enter its value using keyboard
   or set probe to reference 1.
3/ put a second calibrated rod on the V base or a gauge block and enter its value, or
   place probe on reference pad and enter its value.
4/ The unit will calculate the multiplication factor or scale correction factor automatically
   (this factor can be displayed pressing Channel twice). You can start with either the smaller
   or the bigger gauge.
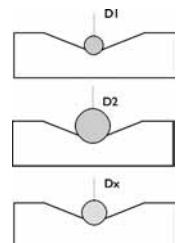
As soon as a multiplication factor has been introduced, a * will be shown on the display (just before the arrow) In diameter mode, the diameter sign will be shown (ø).
When in diameter mode, a channel cannot work in +/- B or A+/-B+/-C. A P50 mm (P50) probe in diameter mode cannot work with a resolution greater than **1 μm**.

1.6.3.6 A +/- B or A+/-B+/-C measuring mode (any 2 or 3 channels may be combined)

1/ press **Channel** key.
2/ select channel number A (1-64)

3/ press **Scan** key   Once for A + B
                               Twice for A - B
                               and once again if you wish to return to A + B, etc..

4/ select channel number B (1 to 64).

5/ Press *Enter* key to confirm the input or for A+/-B+/-C, press *Scan* key once for +C or twice for –C.

6/ select channel number C (1-64).

7/ Press *Enter* key to confirm input.

Tolerances, classification, preset, multiplication factor or store function will be those stored on channel A. Diameter mode is not available for combined channel. The Min/Max can be used in A +/- B mode. (*refer to section. 1.6.12*).

Return to normal mode (non-combined channel) :

1/ press *Channel* key.
2/ enter the channel number A

3/ press *Clear* key.

1.6.3.7 Change channel allocation or allocate an RS232 instrument to a channel.

It is possible with this function to change the allocation of a specified channel (from 1 to 64) to another specified probe (from 1 to 64), using the multi-channel units D102 or D108. One probe can be used for more than one channel with different tolerances, preset, classifications or storing. This function can also be used to display the min/max/delta and mean values on different channels (with only one probe). This function is also with A +/- B and A+/-B+/-C mode, with one probe used in more than one combination.

Any channel can be allocated to a Sylvac OptoRS simplex or duplex instrument. The channel displays the value of the instrument connected to instrument input or via the *D104* multiplexer.

1/ press *Setup* key 2/ then *Channel* key.

The following will be displayed :
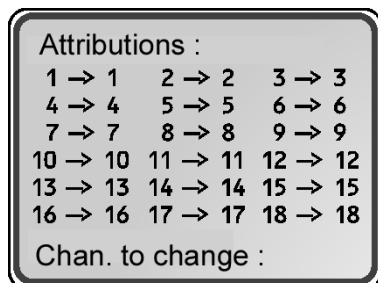
To exit this mode, press *Clear* key. Pressing the **Enter** key allows the user to move from channel 19 to 36, 37 to 54 and finally 55 to 64.

First enter the channel number (from 1 to 18) for which the probe allocation is. To be changed. To correct an input error press *Clear* key.

3/ Confirm input number with *Enter* key.

Following display will appear :

```
Attributions :
  1 → 1    2 → 2    3 → 3
  4 → 4    5 → 5    6 → 6
  7 → 7    8 → 8    9 → 9
 10 → 10  11 → 11  12 → 12
 13 → 13  14 → 14  15 → 15
 16 → 16  17 → 17  18 → 18
 = Input  :   2
```
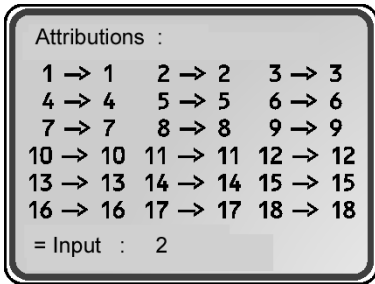
The channel selected by default in 3/ will appear. A number from 1 to 64 can be entered.

4/ confirm input number with *Enter* key.

Following display will appear :

```
Input 2

1 ▫ P5-P10-P25-P50
2 : OptoRS Simplex
3 : OptoRS Duplex
```
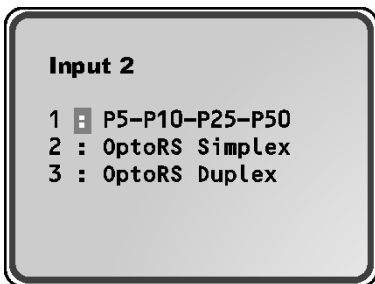
press 1 for analog probes.
press 2 for Opto-RS instruments used with simplex cable (no adapter required)
press 3 for Opto-RS instruments used with duplex cable (no adapter required).
The value of the RS232 instrument (indicator, caliper , Microcal…will be displayed continuously on the D100S. The calculation functions or the unit are available : TOL, CLASS, PRESET, STORE, STAT….

Using one or more D104 units, 48 RS232 channels can be connected to D100S unit.

5/ The first display will then appear and a new allocation can be started, or exit with *Clear* key.

Example : using one D102 and 2 P10 probes for internal bore measurements. The first probe measures 3 kinds of bores with corresponding presets and classifications, and the second measures 4 types of bore with corresponding presets and tolerances. An independent measurement is required on the last channel with a Microcal micrometer used with a simplex cable.

Channels 1,2 and 3 are thus allocated to probe n° 1 : 1 —> 1   2 —> 1   3 —> 1

Channels 4,5,6 and 7 are allocated to probe n°2 : 4 —> 2   5 —> 2   6 —> 2   7 —> 2

Channel 8 is allocated to input 8 of the RS232 simplex : 8 —> 8 RS

1.6.4 RESOL KEY

Allows choice of resolution displayed and printed :

1/ press **Resol** key.

The following will be displayed :

```
1 ░ 0.000  1mm
2 : 0.001
3 : 0.01
4 : 0.1
```
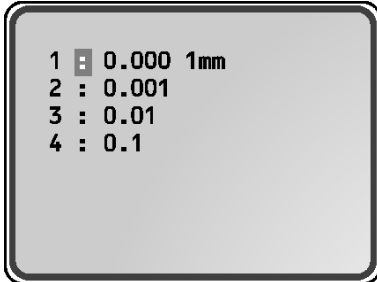
2/ to obtain the correct resolution, select the corresponding number on the keyboard (1 to 4).

Input values (e.g. Preset or Tolerances) will be automatically input according to the resolution. Resolution is identical for all channels.

The selected resolution also defines the graduation of the analog output (one dot of the analog scale corresponds to one least significant digit of measured value).

The lower the resolution on the D100S , the faster the unit operates. Scanning, for example, is faster with a 0.001 mm resolution than a 0.0001 mm resolution (refer to section. 1.12 : technical specifications).

1.6.5 mm/In KEY

Alternates between metric (millimeter) and English (inch) display.

Locking mm/in conversion :

1/ Switch off unit **ON/OFF** key   2/ Press **mm/inch** key.

3/ Hold **mm/inch** key down, when switch **ON** unit.

Unlocking conversion : repeat above operation.

1.6.6 ANALOG KEY

Display or remove the analog scale. The analog scale features an indicating range of 100 points, each one states one least significant digit of the measured value (digit at the most right of the display). Thus the range covered by analog scale is given by the working resolution :

<u>Example</u> : Selected resolution : 0.001 mm . One graduation is equal to 0.001 mm and the inclusive range is therefore 0.1 mm.

Example in normal mode :

In tolerance mode, the scale changes and two fixed vertical lines represent the tolerances limits :

The user can then judge centering of measure with tolerances at a glance.

In min/max mode, the line opens out to indicate searching lap back :

In scanning mode, each channel is accompanied by a scale of 40 points indicating centering with tolerances :

PIECE 1 :

1 12.864
2   5.970
3 16.004
4 10.990
3   7.887
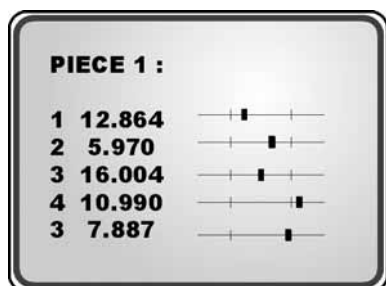
1.6.7 TOL KEY

Displays or removes tolerance indicators :

 indicates a measured value smaller than the nominal dimension + negative tolerance on the external measurement or smaller than the nominal + positive tolerance on the internal measurement.

 indicates a measured value inside the limits of tolerances.

 indicates a measured value larger than the nominal dimension + positive tolerance on the external measurement or larger than the nominal dimension + negative tolerance on internal measurement.

This indication is also transmitted to the corresponding opto-coupler for external command purposes. (*refer to section 1.8.3*).

Each channel has its own tolerances.

Input of nominal dimension and tolerances :

1/ select the channel.

2/ press **Setup** key.

3/ then **Tol** key.

The following will be displayed (the current nominal dimension is displayed) :

```
CHANNEL ↑ 1
Enter nominal size  :
      8.45 IN
```
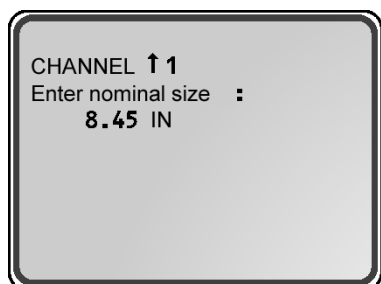

The **Clear** key allows you to quit the tolerances input.

 4/ input nominal dimension.
    Wrong value entered can be cancelled by pressing **Clear** key.

The value is entered as described in section 1.3.3. (input of values).

5/ confirm by pressing **Enter** key.

The following will be displayed :

```
CHANNEL ↑ 1
Enter nominal size  :
      8.45 IN
Tol.  + :
      0.02 IN
```
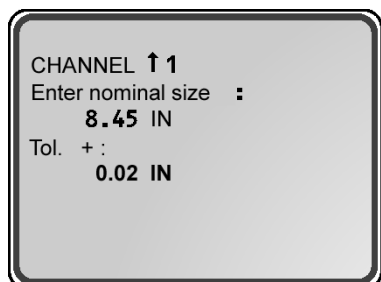
6/ input of upper tolerance. If negative, must always be greater than the lower limit.

7/ confirm by pressing *Enter* key.

The following will be displayed :

```
CHANNEL ↑ 1
Enter nominal size  :
        8.45 IN
Tol.  + :
         0.02 IN
Tol.  - :
         -0.004 IN
```
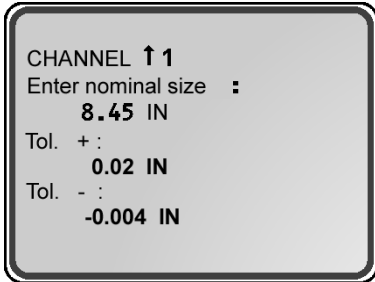
8/ enter the lower tolerance with its sign.

9/ confirm by pressing *Enter* key.

The following will be displayed :

```
1 : External meas.
2 : Internal    "
```
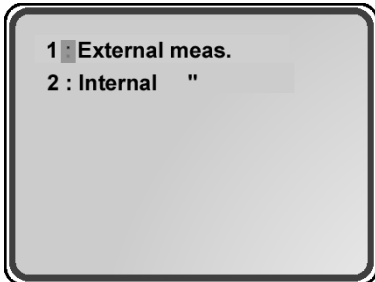
10/ select number 1 or 2 according to the measurements to be taken : internal or external. This input is important for identification of " reject ", " good " or "rework" in scanning mode.

External measurement : measured value too big   —> Rework (yellow)
                                         measured value too small —> Reject (red)
Internal measurement : measured value too small —> Rework
                                         measured value too big   —> Reject

11/ if the current channel number is smaller than the scanning number (*refer to section. 1.6.13*).
The following will be displayed :

```
Next channel  ?

No   -> CLEAR
Yes  -> ENTER
```
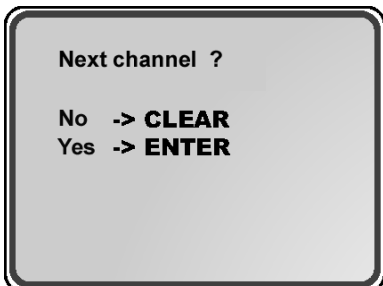

Pressing *Enter* key allows you to enter the nominal dimension and tolerances for the next channel, up to the last one.

Pressing *Clear* key return to measuring mode.

Once back in measuring mode, tolerance indicator < = or > corresponding to à measured value is displayed.

By pressing *Tol* key, the tolerance indicators are erased.

Pressing *Tol* key again recalls the lights.

When tolerance mode is activated with scanning mode, a tolerance indicator is displayed for each channel and the values displayed are the difference between the measurement value and the nominal size.

The second and third displays in statistical bar chart mode only appear if the tolerance mode is active.

1.6.8 CLASS KEY

Displays or removes the classification of measured values.

< Indicates measured value under the 1st class limit.
3 Indicates measured value inside class 3 (n = 2 to 6)
> Indicates measured value over the last class limit.

This information is also sent to the corresponding opto-coupleur for external command purposes.
(*refer to section. 1.8.3*).

Input of classes :

1/ press *Setup* key   2/ then *Class* key.

The following will be displayed :

```
CHANNEL ↑ 1

   Enter number of
   classes (2 to 6) :
```
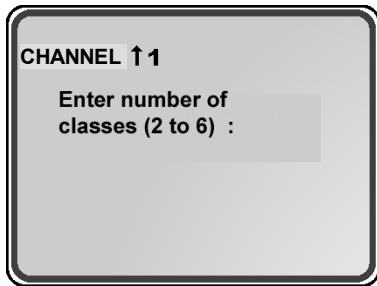
3/ enter the required number of classes, minimum 2 and maximum 6
   (1 class is equivalent to tolerance mode).
4/ the enter the lower limit of class 1, e.g. 12.4 mm. Numerical values are
   entered as described in section 1.3.3.

5/ then enter the upper limit of class 1, e.g. 12.6 mm.

6/ then enter the upper limit of class 2, e.g. 12.8 mm.
7/ and so on, up to the selected number of classes.

Once this has been done, the unit reverts back to measuring mode. The measured value and the class graphics will be displayed. The measured value is displayed in reverse video on the corresponding class symbol.

In the above example, the limit of the 1 st class is from 12.4 mm to 12.6 mm, the 2nd is 12.6 mm to 12.8 mm, etc. The measured values under the lower limit, e.g. 12.4 mm will be shown by the symbol < , measured values over the upper limit, e.g. 12.8 mm, by the symbol >.

By pressing *Class* key the graphic symbols will be cancelled.

Pressing *Class* key again displays them again, with the parameters *Setup* and *Class* previously entered.

1.6.9 STAT KEY
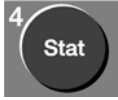
Allows two types of statistical results to be displayed :

Choice of display :

1/ Press **Setup** key 2/ then **Stat** key, appears :

Enter the choice :

1 : Histogram
2 : X/R - chart
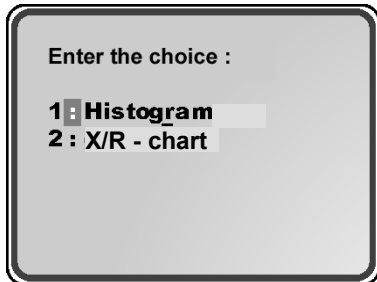
1 = display of classical statistics and bar chart.
2 = display of $\overline{X}$/R control charts.
These are the measured values, stored in memory using the **Store** key
(*refer to section. 1.6.15*) which are used. Each channel (1 to 64) can have
an independent statistic.
The statistical results can also be given on the Centronics and RS232 links
in order to be printed or dealt with by computer.
The bar chart may be printed in 80 or 40 columns, while the $\overline{X}$/R cards may
be printed in 80 columns. (*refer to section 1.6.14*).

1.6.9.1 1First choice : bar chart.

1/ Press **Stat** key. Following display will appear :

CHANNEL ↑ 1
N = 112
Xmax = 10.007
Xmin = 9.990
R = 0.017
X̄ = 10.000
σ = 0.0020
S = 0.0020
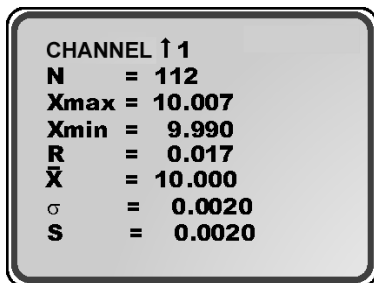
N = number of stored values = used for statistical analysis.
Xmax = maximum stored value.
Xmin = minimum stored value.
R = Range = Xmax - Xmin

$\overline{X}$ = mean value $\dfrac{\sum\limits_{i=1}^{N} x_i}{N}$

σ = (sigma) = standard deviation = $\sqrt{\dfrac{\sum\limits_{i=1}^{N} (x_i - \overline{X})^2}{N}}$

s = standard deviation= standard deviation of population based on a sample.

$$\sqrt{\dfrac{\sum\limits_{i=1}^{N} (x_i - \overline{X})^2}{N - 1}}$$

The **Print** key allows statistical results to be printed via the Centronics or RS 232 according to the selected format. It
is also possible to press the **Print** key in the following displays.

Statistical results may also be requested in scanning mode. The unit will first request the channel on which statistics
are required, and at the end request the next channel (if 0 is chosen as channel number, the statistics of all channels
will be printed).

2/ if the unit is in tolerance display mode, the next display can be requested with the **Enter** key.

Exit statistics mode with **Clear** key or **Stat** key.

Following display :

```
- 3 σ  =   9.994
+3 σ   = 10.006
-NG    = 1
+NG    = 0
%DEF = 0.893
Cp     = 1.3311
Cpk    = 1.3102
Cm     = 1.3252
Cmk    = 1.3068
```

-3s = $\overline{X}$ - 3 σ = lower regulation or intervention limit.

+3s = $\overline{X}$ + 3 σ = upper regulation or intervention limit.

-NG = number of stored values smaller than lower tolerance.

+NG = number of stored values greater than upper tolerance.

%Def = percentage of defective stored values = $\dfrac{(-NG) + (+NG)}{N} \times 100$

Cp = process capability = $\dfrac{T\ sup - T\ inf}{6\ \sigma}$

Cm = machine = capability $\dfrac{T\ sup - T\ inf}{6\ s}$ **s** given for a sample at time t.

A high **Cp** will indicate a small dispersion of measured values inside the tolerances :

High **Cp** :

Low **Cp** :
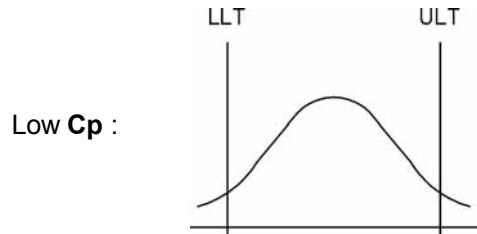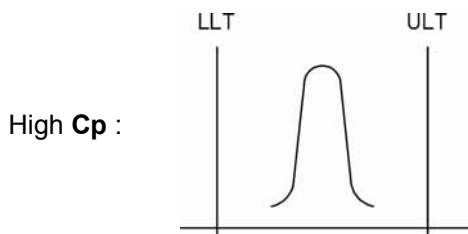
Cmk = center capability= the smaller value of the 2 formulas

$\dfrac{T\ sup - \overline{X}}{3\ s}$ or $\dfrac{\overline{X} - T\ inf}{3\ s}$

Cpk = process capability in relation to spec
mean = the small value of

$\dfrac{T\ sup - \overline{X}}{3\ \sigma}$ or $\dfrac{\overline{X} - T\ inf}{3\ \sigma}$

Cmk/Cpk will formulate capability in a manner that indicates shifts (skewing) in the mean of distribution away from the midpoint :

Good **Cmk/Cpk**

Poor **Cmk/Cpk** :
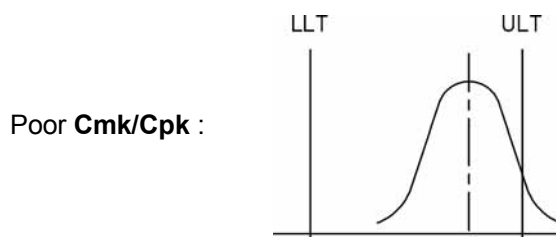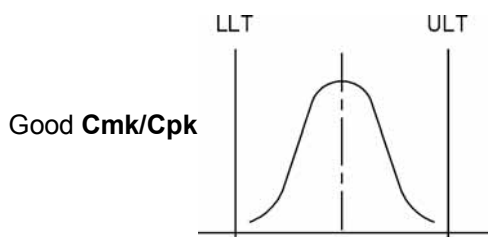
Cp >= **1.33** corresponds to a **capable** process.

Note: some users require a **Cp** > = 1.66 which corresponds to 10σ.

These indices of capability are certainly an efficient way of taking decisions but their importance must not be exaggerated. Without process analysis, i.e. without knowing the dispersion, random factors and system influences, the indices are only of limited value and may lead to erroneous decisions being taken.

3/ Press *Enter* ,the histogram of stored values will be displayed :
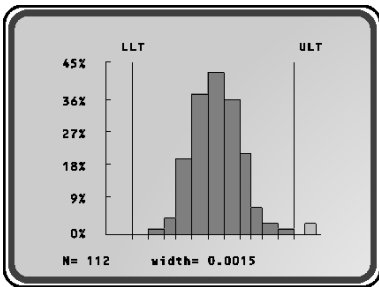
The number of cells is determined with the formula : $n = \sqrt{N}$

but at least 5 cells and maximum 11 cells, n being always odd. The Y axis represents % number of stored values for each cell.

The lower tolerance limit is indicated by **LLT** (lower limit of tolerance) and the upper limit by **ULT** (upper limit of tolerance). Values outside tolerances limits are displayed with a grey cell beside each tolerances.

N = total number of stored values. **width** = cell width of histogram.
Histogram printing is available in 80 or 40 columns output formats.

1.6.9.2 2nd choice : $\overline{X}$/R control charts.

The value stored in memory are divided into sub-groups of five measures. **m** represents the number of sub-groups and **n** the number of measures memorized in the last sub-group. The date and time are stored with the sub-group.

1/ Press *Stat* key $\overline{X}$ chart appears :
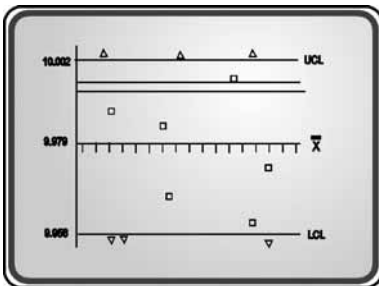
▲ Value greater than upper control limit.
▼ Value less than lower control limit.
UCL : Upper control limit = $\overline{\overline{X}} + A_2\,\overline{R}$, with A2 = 0.577 for n = 5
LCL : Lower control limit = $\overline{\overline{X}} - A_2\,\overline{R}$, with A2 = 0.577 for n = 5
= = = : Target value

2/ Press *Enter* key (*Clear* key exit from charts display)

The R chart reappears :
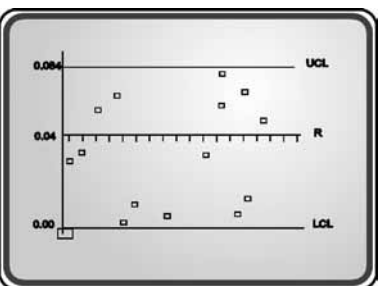
UCL = Upper control limit = $D_4\,\overline{R}$, with D4 = 2.114 for n = 5
LCL = Lower control limit = $D_3\,\overline{R}$, with D3 = 0 for n = 5

To print press *Print* key (only in 80 columns format)

To return to $\overline{X}$ card, press *Clear* key.

To exit, press *Enter* key.

1.6.10 PRESET KEY

Displays stored preset value.

The external contact (e.g. foot pedal) can also be configured to preset the displayed value.

Any preset value may be input, **also 0.000** for zeroing the display.
Each channel (from 1 to 64) has its own preset value.

Input of a preset value :

1/ press *Setup* key 2/ then *Preset* key. Following will be displayed :

```
CHANNEL ↑ 1

Enter preset value :

 0.000 mm

Scan = Auto
```

3/ the old preset value is displayed. Enter preset value according to general principle described in section *1.3.3*.

To enter a preset of 0.000, simply press *Enter* key.
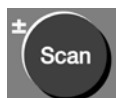
The *Scan* key automatically introduces the stored preset value for the number of channels defined for scanning mode.

4/ if the current channel number is smaller than scanning number, the following will be displayed :

```
Next channel  ?

No  -> CLEAR
Yes -> ENTER
```
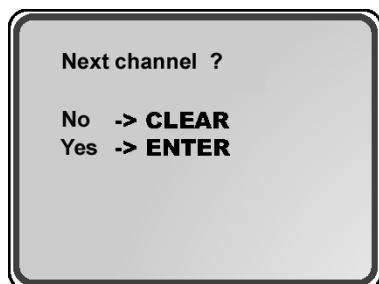

exit preset input mode.

input preset value for the next channel.

To calibrate the input unit with a master, the different presets are introduced with the master and probes in the measuring position.

A new calibration can be made as follows :

In normal mode : press *Setup* key, then *Preset* key, then *Scan* key.
In scanning mode : simply press *Preset* key.

Once the preset value has been entered, the unit reverts to measuring mode and displays the preset value. Had more preset values been entered, each channel would be affected by its respective value.
If one channel is in A +/- B or A+/-B+/-C mode, the measurement preset is stored on channel A the value of the channel B preset remaining unchanged.

After a general reset (*Clear* + *ON/OFF* keys),the preset values of all channels will be reset to zero.

1.6.11 SETUP KEY

Allows input of parameters for the following functions : Stat, Class, Tol, Clear or Enter, Min/Max, SetUp, Preset, Store, Print, Scan et Channel. The input of parameters is explained with each corresponding function key.

Input of general parameters of unit :

1/ Press *Setup* key .2/ then *Setup* key. Following will be displayed :

1: Foot sw. 1
2: Foot sw. 2
3: Language -
   Sprache - Langue
4: Keyboard lock
5: Sound off
6: Set date/time
7: Configuration
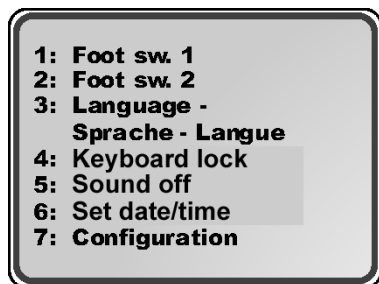
To exit this menu or the followings without changes, press *Clear* key or *Enter* key.

1.6.11.1 External contact 1 function :
menu 1 allows you to define the external contact function (in general the foot pedal supplied with the unit). When the unit is ready for measurements, it is thus possible to inhibit the keyboard and use only the foot-pedal.

1/: Transmission of values through the Centronics or RS-232-C output according to the parameters specified for the Print function. Each time the foot pedal is pressed, the measurement value is transmitted.

This choice may be combined with the following other functions :

2 : display hold/store. The display is held as long as the foot pedal is pressed, when foot pedal is released, the measured value is sent. The function 5 (change channels),6 (D110 command), 7 (scanning) can be combined as well.

3 : Min/Max initializationMin/Max. The display is held as long as the foot pedal is pressed, when foot pedal is released, the measured value is sent. The functions 2 (hold/store), 5 (change channels) can be combined as well.

4 : display preset. Alternately, pressing the pedal presets the display, pressing it again sends the measured value.

5 : change channel. The same action on the foot pedal sends the measured value and then changes to the next channel.

6 : control the lifting of probes with *D110* unit. The probes are lifted as long as foot pedal is pressed. When foot pedal is released, the probes will go down and the measured value is sent. A delay can be introduced between descent and transmission of value (value 1 to 36000 = 1 sec to 10 hours). Function 7 (start scanning) can be combined as well. The first time the pedal is pressed the probes will be lifted, the second time they will go down, scanning starts (after the delay, if any) the value is sent.

7 : scanning starting. Scanning is carried out first, followed by data transmission. A delay between the release of the foot pedal and the scanning can be entered.

If a combination of the second or 3rd function is not required, simply press *Enter* key.

2/: Display hold or store. According to the **Store** key function (**Setup** then **Store**),the external contact enables :

display hold : as long as the foot pedal is pressed, the display value is frozen.

store : each time the foot pedal is pressed, a measured value will be stored.

As for the Print function of the external contact, the hold/store function of the external contact can be combined with :

3 : Min/Max initialization. The first depression initializes the min/max, the second stores/holds the value. Function 5 (channel change) can be combined as well.

4 : alternately with display preset.

5 : togeher with channel change.

6 : alternately with probe lifting control using D110. Start scanning can also be combined as a third function.

7 : start scanning.

3/ in Min/Max mode : reinitialize maximum and minimum registers.

(same function as **Min/Max** key in Min/Max mode). Function 5 (channel change) can be combined.

4 : Preset of display at each external contact. Can be combined alternately with start scanning.

5 : Change channel, each external contact provokes a jump to the next channel. When the number of channels introduced for the scanning mode is reached (with **Set Up** then **Scan** : refer to this function), the unit automatically returns to channel 1. When the number of channels for the scanning mode is 0 or 1, the channel change will be from 1 to 64 and then back to 1.

6 : Command for pneumatic unit D110. Pressing the foot pedal lifts the probes connected to D100. Releasing the foot pedal let them go down. This function can be combined with start scanning.

A delay (in seconds) can be introduced between the descent of the probes and start scanning.

7 : Start scanning : each time the external contact is released, the channels are scanned. When the foot pedal is pressed a **S** negative appears on the display. If this option is selected, a delay can be introduced between the external contact and start scanning. This delay can be from zero (0 sec. = no delay) to 36000 sec (10 hours) in multiples of 1 second. It is generally used when pneumatic lifters have been installed on the probes. The time required for lowering probes and for stabilization of measurements must be determined before the start scanning sequence, printing or storing.

1.6.11.2 External contact 2 function :
all functions explained in Section 1.6.11.1 are applicable for a second external contact input. Allows for use of e.g. a pedal to change channel and another for sending data (Print).

1.6.11.3 Choice of language :
menu 3 allows the choice of three languages, English, German or French for all text shown on the display or transmitted to the Centronics or RS232 ports.

1.6.11.4 Inhibit keyboard :
choice 4 in Setup menu allows you to lock the keyboard. All functions keys are inhibited, except for :

On/Off key
two pedals
Print key
And, if required, anyone function key on the keyboard (Exception).

To recall keyboard operation, choose one of the following options :

1/ press any key for at least 5 seconds

2/ switch on unit with *Enter* key pressed.

1.6.11.5 Activate/deactivate sound :
   Activate/deactivate sound release of keyboard and exceed tolerance limit function.

1.6.11.6 Date/time input :
   adjusting permanent clock : Year – Month – Day – Hour and Minutes.
   Used for printing results, control chart and unit calibration.

1.6.11.7 Configuration
   All unit configuration parameters (tolerances, presets, setups…) can be stored or recalled :

Give backup file number, then *Enter*

 Insert name of file, in letters and numbers, max. six characters (allows for more efficient file management).

The *Channel* key switches from numerical to alphabetic input and back.

Up to 12 complete configurations may be stored.

To restore a configuration, simply select the file name, then *Enter* . The unit will appear exactly as it was stored.

<u>NB</u> :   the Store memory is not saved.

          to delete an element stored : select 1 : save, then number of file to be
          deleted then *Enter* then *Clear*

The **MEM?** and **MEMR** remote command allow for the same operation a PC using link RS232.

Program D100SRS allows backup files to be managed on a PC.

1.6.12 MIN/MAX KEY

Allows the choice of displaying minimum, maximum, difference Max – min, or mean (max + min)/2 instead of normal measurement. Entering this mode will automatically set minimum and maximum registers to measuring position. Min/Max measurements therefore start from this point.

If the channel is configured for an Opto-RS duplex instrument, this mode is automatically linked by remote command to the instrument.

In this mode, the preset will be given on the displayed value, i.e. on the maximum, the minimum, the difference or the mean value.
Choice of the displayed function :

1/ press **Setup** 2/ then **Min/Max**

The following will be displayed :
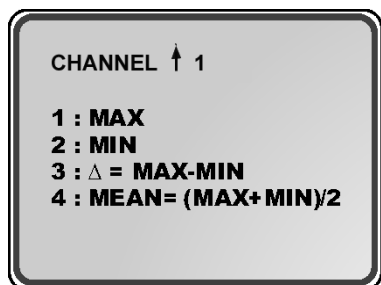
Select required displayed value (min, max, etc.).

If the current channel number is smaller than the scanning number, the unit asks if you wish to move to the next channel to enter the Min/Max choice :

    return to normal mode :

    return to choice above :

If min, max, delta and mean are to be stored or classified (TOL or CLASS), and this for the same probe, simply allocate this probe to different channels, each one with a different function (min, max, etc.).

Example   : Channel 1 = probe 1 (standard) in the MIN mode, with its own TOL.
             Channel 2 = probe 1 (SET UP – CHANNEL) in the MAX mode, with its own TOL.

When working in MIN/MAX mode, the **Enter** and **Clear** keys have a special function :

Set MIN/MAX registers to the current measuring value. All new Min/Max values start from this point.

Change the displayed value : Maximum → Minimum → Difference → Mean → Maximum.

Example : The probe is used for measuring a camshaft. The unit displays the maximum value. The camshaft is rotated and the displayed value is frozen on the maximum value recorded. The preset value is entered, for example 10,000 mm.

Min/Max registers are initialized by pressing **Clear** key.

A new measurement of the camshaft will now display value of 10.000 mm.

It is possible to combine A +/- B mode with Min/Max mode (*refer to section 1.6.3*) Channel A or channel B both channels can be set in one of the Min/Max modes described above. If channel A is in Min/Max mode, both measurements cannot be taken simultaneously, but only one after the other. The channel A measurements is taken first, then by pressing ENTER Key, the channel B measurement will follow (the channel in use is indicated on the display in reverse video). If only channel B is in Min/Max mode, the unit switches from A to B automatically.

The **Clear** key reinitializes Min/Max registers in case of error either in channel A or B (switching from channel A to B or the opposite will automatically initialize Min/Max registers for the new active channel).

The scanning mode (refer to section 1.6.13) is also compatible with A +/- B mode combined with Min/Max mode. In this case, scanning stops on the channel in Min/Max mode and waits for measurement. The measured value is then displayed. Scanning may be continued by pressing the ENTER key or the foot pedal (depending on what function has been assigned to it).

1.6.13 SCAN KEY

Starts scanning of 1 to n channels (n being defined as indicated below), compares each measurement with its assigned tolerance and displays the results with a global indication : part OK (green light), rework (yellow light), or reject (red light). This information is also transmitted to the opto-coupler (refer to section 1.8.3).

It is also possible to configure the external contact (foot pedal) for scanning.

Scanning mode requires the connection of one or more multi-channel units **D102** or **D108** (for probes) or **D104** (for RS232 instruments (refer to sections 2.3 and 3.3).

How to use the scanning mode :

1/ connect the **D100S** unit with one or more **D102/108/D104**. If required, connect a foot pedal or another external contact to start scanning. A pneumatic unit D110 or D110V vacuum can also be used for lifting the probes.

2/ Press **Setup** key 3/ then **Scan** key

4/ Enter the number of the first channel to be scanned (1 to 63).

5/ Enter the number of the last channel to be scanned (1 to 64).

6/ If necessary, enter the channel number on which to stop (e.g. opportunity to move the workpiece). Pressing Enter or foot pedal (whatever its function) will continue the scanning. If no stop is required, just press ENTER (stop channel = last channel).

7/ If required, assign the function of the external to start the scanning, combined as required with data transmission or store and/or with probe lifting, then enter delay time between external contact and start scanning (explained with Set Up function in section 1.6.11)

8/ If the data is to be stored, the number of channels to be stored must be entered in **Setup** – **Store** then 5 (*refer to section 1.6.15*).

9/ If required, enter Min/Max mode for any channels. Scanning automatically stops when a given channel is in Min/Max mode and waits for measurement. To continue scanning, simply press the **Enter** key or **foot pedal**.

10/ Enter the channels working in the A +/- B or A+/- function (do not forget the correct direction sign) the diameter or any multiplication factor function, allocation of a probe to several channels (*refer to section 1.6.3*)

   Example :   channel 1 - 6
                    channel 2 - 7
                    channel 3 + 8
                    channel 4 minimum measurement
                    channel 5 diameter measurement

5 channels have to be scanned, of which 3 in A +/- B.

11/Choose the resolution of the display. The lower the resolution, the faster the scanning will be :
   using 0.0001 mm / 0.00001 in :   approx. 2 measurements / sec.
   using 0.001 mm / 0.0001 in :   approx. 4 measurements / sec.
   using 0.01 mm / 0.001 in :   approx. 5 measurements / sec.
   using 0.1 mm / 0.01 in :   approx. 6 measurements / sec.

12/ Select scanning start channel (in order to start all preset and tolerance inputs from this channel).

13/ Enter nominal size and tolerances for all channels to be scanned (refer to section 1.6.7).

14/ Put a block gauge (master) under the probes and be ready to calibrate the channels.

15/ Enter the preset values according to the master for all required channels. For a new calibration in scanning mode, just press **Preset** when the master is in place.

16/ The system is now ready. Position the work piece to be measured and when the probes are in the measuring position, press the **Scan** key.

According to the particular channel allocation specified in point 10, scanning will stop at channel 4 and the following will be displayed :

```
CHANNEL ↑4
IN MODE MIN

    12.402

follow --> ENTER
or external contact
```

Take a minimum measurement on channel 4 and then press **Enter** key or foot pedal.

In case of a wrong measurement, the **Clear** key will allow a new measurement to be taken.

17/ When scanning is completed, the following will be displayed (numerical value are given as examples) :

```
PIECE 1 :          ↓

1 + 5   12.864 E    < = >
2 - 6    5.970 E    < = >
3       16.004 E    < = >
4       18.997 E    < = >
5       12.103 E    < = >
```
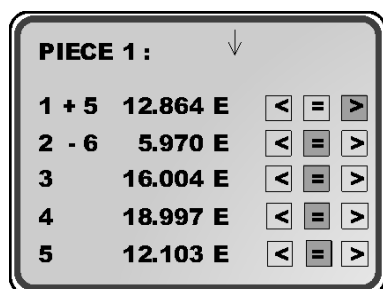
Sequential work-pieces numbered : from 1 to max 65 000.
General indication for the measured work piece from indicators lights.
This criteria takes into account the internal or external measurement for each channel. (*refer to tolerances in section 1.6.7*)

Display of channel number, measuring mode if channel is in A +/- B mode, And measured value or, if tolerances are active, of the difference between nominal size and measured value and graphical display <, = or >.

The following keys are active in Scan mode :

Starts a new scan. Work piece numbering is done automatically (from 1 to n pieces). For 40 or 80 Columns printing format, it is also possible to enter an alpha-numerical identification of each scanned work piece (*refer to section. 1.6.14* : **Print** key).

Displays or removes the tolerance indicators for each channel.
Tol not activated : measured value is displayed.
Tol activated : difference between nominal and measured value is displayed, followed by **E** for an external measurement or **I** for an internal measurement, and finally by tolerance indicators **<,=** or **>**.

The first displayed values show a maximum of 5 channels. Any following channels will be shown by Pressing this key. When the last table is reached (the arrow ↓ disappears from the upper-right-hand Side of the display), you can exit scanning mode by pressing this key again.

This key allows display of the preceding table. When the first table is reached (the arrow↑ disappears) pressing the key again allows you to exit scanning mode.

Print — Prints measured values of channels 1 to n through the RS 232 and Centronics outputs, according to The selected Print format (*refer to section 1.6.14*).

Store — Stores the measured value for each channel (from 1 to n), if **Store** key has been configured to memorize. (*refer to section 1.6.15*).

Stat — Displays statistical results if the **Store** key is used for memorizing. Firstly, the channel number to display the statistics is required (simply press Enter, channel 1 appears by default). If choice is 0: Print results of all channel scanned). Once the statistics of this channel have been read, the next Channel can follow by pressing **Enter** —> yes or **Clear** → no. Statistical results may be printed by pressing the **Print** key.

Resol — Same as normal mode :select the resolution.

SetUp — Unit configuration : refer to Section 1.6.11. **Setup** then **Store** : asks for channel number for stored Values (Choice 0 —>print all channels).

Preset — Automatic Preset of channels to scan —> new pre-setting with a master piece.

Analog — Display individual analog scale (40 points) for each channel. Indicates centering of each measure to tolerances.

Min Max — Allows overall scanning results to be displayed :max, Scan value and corresponding channel number, channel min. value and number, average of values scanned and difference between min. and max :

```
PIECE 3 :

Xmax = 2.347 (6)
Xmin = 1.203 (2)
X̄    = 1.995
Δ    = 1.144
```
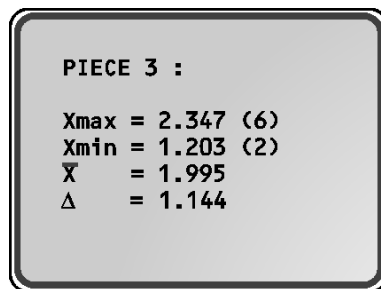
Return to normal display : **Min Max**

On Off — After unit is stopped, it will return to scanning mode and the measured values are redisplayed. The part counter remains unchanged.

When controlling the unit from a PC, scanning mode can work continuously, sending the measured values automatically to the RS232 output (no display on the unit). To activate this function, use the ASCII character OUT1, and OUT2 to stop this function. The transmission speed for each channel will be as follows :

- resolution 0.0001 mm : 2 RS232 outputs per sec.
- resolution 0.001 mm : 4 RS232 outputs per sec.
- résolution 0.01   mm : 5 RS232 outputs per sec.
- résolution 0.1   mm : 5 RS232 outputs per sec.

Step by step scanning is possible (stop on each channel). **Enter** or **foot pedal** will have to be pressed to start again.

On Off   **Scan**

1/ Switch off unit **ON/OFF** 2/ Switch on unit with **Scan** pressed.

To disable this function, repeat operation.

1.6.14 PRINT KEY

Printing of values through :

Centronics output, identical to parallel port of PC (LPT1 or 2). This output does not need to be set up and allows connection of practically all printers on market. Different printing formats are generated by unit **D100S** : 80, 40 or 15 columns.

Output RS-232-C, in accordance with transmission parameters selected for this function.

A **P** in reverse video is displayed on the top right corner of display during RS 232-C / Centronics transmission. If the channel has no installed probe (NO PROBE on display), 999.9 is transmitted.

It is also possible to configure the external contact (foot pedal) for the RS-232-C/Centronics output (refer to section 1.6.11)
Setting RS 232 transmission parameters and Centronics/RS-232-C output format :

1/ press *Setup* key 2/ then *Print* key the following will be displayed :

> Enter the choice :
>
> 1 : RS232 config.
> 2 : Peripheral
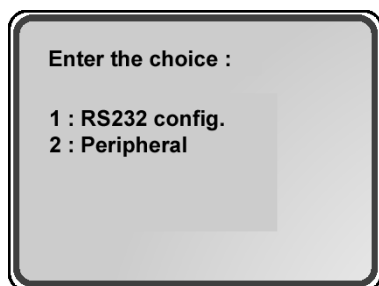
The 1st menu sets RS 232 C transmission parameters.

The 2nd menu select the Centronics/RS-232-C output format according to which peripheral is being used.

1.6.14.1 RS232 input/output parameters :

Default parameters (after a reset) : **4800 bps, 7 bits, even parity, CR**.

2.1.1/ transmission speed : 300, 600, 1200, 2400, 4800, 9600 et 19200 bauds/sec.

By pressing the *Clear* key the preceding menu will be displayed.

By pressing the *Enter* key the next menu will be displayed (without changing previous choice).

2.1.2/ word length : on **7** or **8** bits.
2.1.3/ parity control : **No** parity, **even** or **odd**.
2.1.4/ end characters : **CR** (Carriage Return) or CR + LF (Carriage Return + Line Feed) or LF only. A printer with auto LF mode needs only CR. If CR + LF is sent in this case, a supplementary empty line is printed at each carriage return. With a connection to an PC or compatible select CR only.

1.6.14.2 Peripheral choice, the following menu will appear :
The following will be displayed :

```
Enter the choice :

1 : Computer
2 : 80 col. Printer
3 : 40    "      "
4 : 15    "      "
```
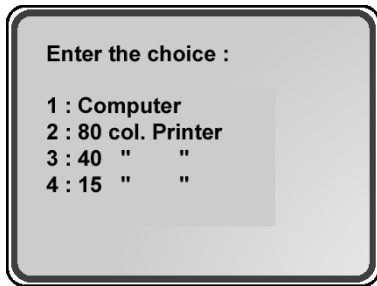
These different choices modify the output format for the Centronics/RS232 outputs.
Remote command of the unit will not be modified.
80 and 40 column formats allow the header to be printed following the user's parameters.

2.2.1/ Connection to a computer. This is the most simple transmission format allowing easy processing of values.

The measurement is transmitted as it appears on the display :

a/ In mm :

$$\text{SIGN} \quad 10^2 \quad 10^1 \quad 10^0 \quad \text{DP} \quad 10^{-1} \quad 10^{-2} \quad 10^{-3} \quad 10^{-4} \quad \text{CR} \quad \text{LF}$$
or 10^3

SIGN = space if positive sign   DP = decimal point   LF only if requested

10^2 et 10^1 = space3 if zero 10^{-4}, 10^{-3} and 10^{-2} only with resp. resolutions 0.1 µm, 1 µm et 10 µm.

The sign always immediately precedes the 1st digit.

b/ In inch :

$$\text{SIGN} \quad 10^1 \quad 10^0 \quad \text{DP} \quad 10^{-1} \quad 10^{-2} \quad 10^{-3} \quad 10^{-4} \quad 10^{-5} \quad \text{CR} \quad \text{LF}$$

10^1 = space if zero 10^{-5}, 10^{-4} et 10^{-3} only with resp. resolutions 0.00001, 0.0001et 0.001 in

c/ In scanning mode the values are transmitted as follows :

```
  5. <          = number of measured work piece  followed by< (reject), = (good) or > (rework) if TOL active.
 10.002         = measured value of channel 1
 20.002
 12.003
  7.999         to channel n..
```
+ **CR** (+**LF**) extra to indicate end of transmission of measurements.

d/ **Stored values** are transmitted from first to last. Between each measurement, a **CR** (+ **LF**) is transmitted.

e/ Statistical values are transmitted as follows :

```
CANAL  1          = Channel No. for which statistics are transmitted.
N  28              the statistical values are transmitted in the same order as they appear on the screen
Xmax 10.004      (refer to section 1.6.9 ). The histogram is not transmitted.
Xmin   9.998
R        0.006
Xbar  10.000
Sigma  0.0017
s        0.0017
- 3 S    9.995    This value and the following are only transmitted if tolerances are activated.
+3 S   10.005
- NG    7
+ NG    6
%Def  46.428
Cp      0.2986
Cpk    0.2450
Cm      0.2932
Cmk    0.2290
```

for A4 printers, i.e. *Centronics* (standard PC link cable).
Check on WEB www.sylvac.ch, last updates : infotec printer compatibility.
If a header is required, the unit will ask for company name and will then switch to alpha-numerical input mode, as shown below :

Factory name
?
  AB CD EF
  GH IJ KL
  MN OP QR
  ST UVW XYZ **ALPHA**
                NUM
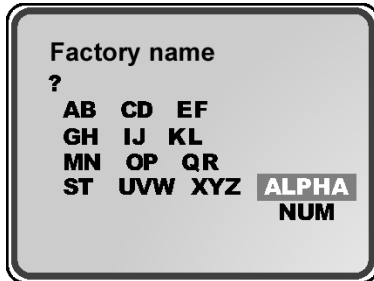
Press *Clear* key if no company name has to be printed.

Otherwise an alpha-numerical name may be entered (using figures & letters up to 20 characters.

The table opposite shows the alphabetic input display. The 12 left-hand keys of the keyboard each now represent 2 or 3 letters. The position of letters on the display correspond : to the position on the keyboard. Pressing once on a key selects the first letter of 2 or 3, pressing a second time on the same key selects the second letter, pressing again selects the first letter again (or the third letter for the last 2 keys) and so on. Another couple of letters may also be selected, until confirmed with the *Enter* key.

Clear

In case of an error, press *Clear* key and restart.

Channel

The *Channel* key allows you to switch from alphabetic to numerical input and back :

Factory name
?
  7 8 9
  4 5 6
  1 2 3
  0 . space **ALPHA**
                NUM
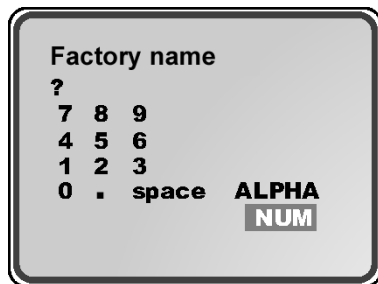
The keys are also represented graphically. It is possible to insert a blank space (...).

Enter

Continue inserting different letters and numbers and confirm the word by *Enter* key.

Example : in alpha mode, 1st depression of key 7 —> selects A, 2nd depression selects —> letter B, 3rd depression —> return to letter A, and so on…Confirm letter with *Enter* key.

When company name is entered, the unit asks for :

drawing number
work station
work-piece identification :   at heading.
                                         At each printing. This allows each measured work-piece to be identified,
                                         Either in normal measuring mode, or in scanning mode.
                                         Insertion of date and time (real time clock))

If one item of a header is not entered (question mark instead of word), this will not be printed.

Following pages show printing examples in 80 column format. If tolerances mode is not activated, only the channel number (with A+/-B mode or min/max indication) and measurement are printed. In tolerance mode, we have the nominal value, upper and lower tolerances, dispersion i.e. difference between nominal value and measurement, out of tolerance value (if there is one), External (**E**) or Internal (**I**) measurement indication, and finally if the measurement is within tolerances (**=**), under (**<**) or over (**>**).

a/printing in normal measurement mode (not scanning) with header and tolerance mode not activated :

<div align="center">SYLVAC SA</div>

Piece ident.   : COUVERCLE
Drawing nbr   : PM230.010.412
Work station : L 201

Date : 12/11/1998   Time : 14:37

CHANNEL	MEAS. VALUE
1	8.383
1	8.354
1	8.382
1	8.381
1	8.375
1	8.371

b/ printing in scanning mode with header and tolerances enabled :

<div align="center">SYLVAC SA</div>

Piece ident. : COUVERCLE
Drawing nbr : PM230.010.412
Work station : L 201

Date : 12/11/1998   Time : 14:37

CHANNEL	MEAS.VALUE	NOM.SIZE	UPPER TOL	LOWER TOL	DEVIATION	OUT OF TOL	<=>
PIECE 1 : REJECT							
1	8.379	8.350	0.020	-0.010	0.029	0.009	E >
2	5.092	5.100	0.000	-0.010	-0.008		E =
3	12.284	12.220	0.050	0.000	0.064	0.014	I >
4	7.004	7.000	0.050	-0.050	0.004		E =

c/ Printing of statistical values with tolerances active (printing therefore of 2nd statistical and histogram) and with complete header. After printing, the unit ask if you wish to print stored values, as in the examples below. If the stored values are printed, the unit will then request whether they should be kept (→ press **Enter**) or if they should be erased from memory of the channel in operation (—> press **Clear**) :

<div align="center">SYLVAC SA</div>

Piece ident. : COUVERCLE
Drawing nbr. : PM230.010.412
Work station : L 201

Date : 12/11/1998   Time : 14:41

CHANNEL   1

N	30	Xmax	8.361	Xmin	8.338	R	0.023	Xbar	8.352

Sigma   0.0063   s   0.0064   -3 S   8.333   +3 S   8.371

- NG   1   + NG   0   %Def   3.333

Cp   0.7933   Cpk   0.6433   Cm   0.7800   Cmk   0.6325

```
                                                                    0 + NG

  ULT  ----------------------------------------------------------------------  8.3700
                                                                          0
                                                                       8.3640
             #####################################################  7
                                                                       8.3580
          ###########################################################  9
                                                                       8.3520
          ###########################################################  9
                                                                       8.3460
                       #############################  4
                                                                       8.3400
  LLT  ----------------------------------------------------------------------  8.3400

                                                              *******  1  - NG
```

1	8.342	2	8.342	3	8.350	4	8.359	5	8.359
6	8.358	7	8.342	8	8.344	9	8.354	10	8.348
11	8.356	12	8.360	13	8.360	14	8.357	15	8.353
16	8.351	17	8.348	18	8.350	19	8.353	20	8.349
21	8.349	22	8.349	23	8.350	24	8.354	25	8.353
26	8.338	27	8.361	28	8.361	29	8.361	30	8.354

d/ printing example of X̄/R control chart

SYLVAC SA

Piece ident.   : COUVERCLE
Drawing nbr.   : PM230.010.412
Work station   : L 201

Date : 12/11/1998   Time : 14:43

CHANNEL   1

n = 5   Cp   0.9560   Cpk   0.7647   S   0.0052

```
          1       3       5       7       9      11      13      15      17      19      21

        |
8.359|  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   UCL
        |
        |         #
        |= == == == == == == == == == == == == == == == == == == == == == == == == =
        |                   #
        |                                                                              =
8.352|  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   X
        |              #
        |#        #
        |      #
        |
        |
8.345|  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   LCL
        |
```
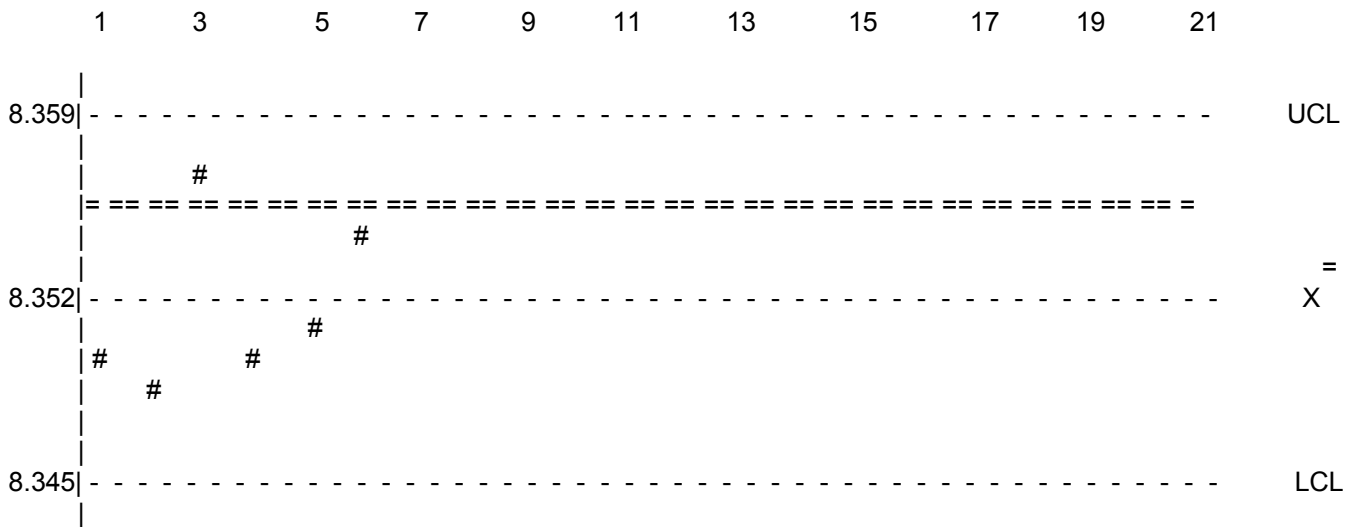
   Time   17 17 17 17 17 17
   Min.   39 39 39 40 40 40
   Day   21
   Month   2

```
        |
0.026|  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   UCL
        |
        |                   #
        |#
        |      #
        |
                                                                                      _
0.012|  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   R
        |
        |
        |        #   #   #
        |
        |
0    |  - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -   LCL

          1       3       5       7       9      11      13      15      17      19      21
```
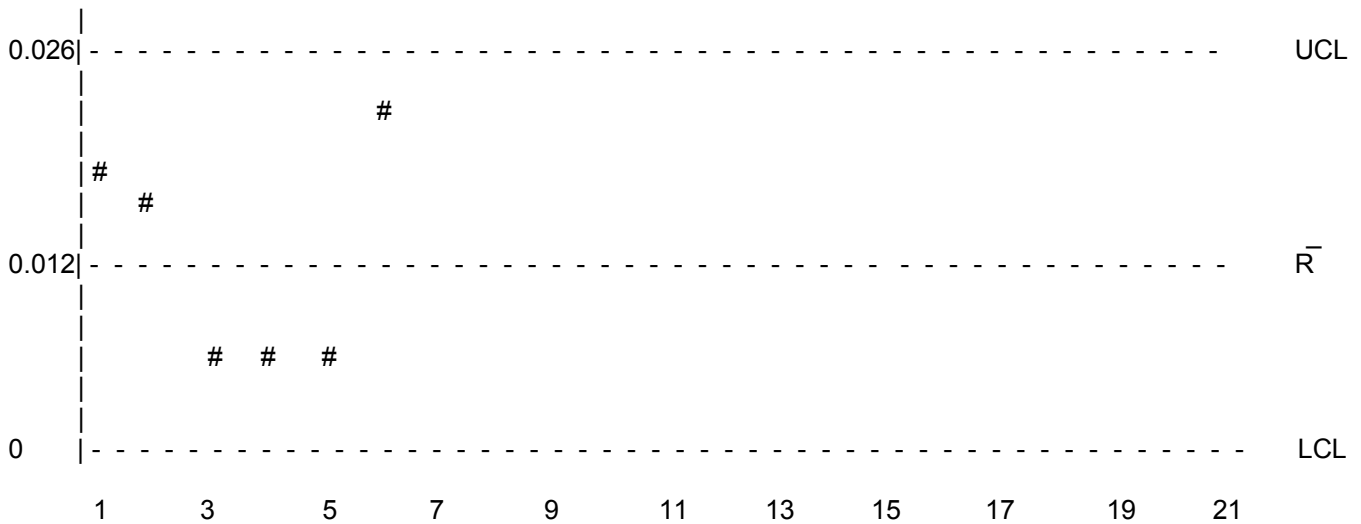
1.6.14.4 *Output format for 40 columns printer*

For small printers with a paper width of approx. 80 to 120 mm.

Printing time per line may be entered, as small printers often have a limited input buffer.

As for the 80 col. Printer, a header can be added at the start of the printing process. This is carried out as Described in the previous section. A new printout of the header can be activated by pressing the ***Print*** key for two seconds.

a/printing example in normal measurement mode with tolerances activated and complete header :

SYLVAC SA

Piece ident.   : COUVERCLE
Drawing nbr.   : PM230.010.412
Work station   : L 201

Date : 12/11/2003   Time : 14:45

CHANNEL MEAS.VALUE DEVIATION OUT OF TOL

CHANNEL	MEAS.VALUE	DEVIATION	OUT OF TOL
1+ 2	13.421	5.071	5.051 E>
1+ 2	13.369	5.019	4.999 E>
1+ 2	13.405	5.055	5.035 E>
1+ 2	13.393	5.043	5.023 E>

b/ Printing example in scanning mode with activated tolerances (incomplete header) :

SYLVAC SA

Piece ident. : COUVERCLE

Date : 12/11/1998   Time : 14:49

CHANNEL MEAS.VALUE DEVIATION OUT OF TOL

PIECE   1 : WORK

1	8.385	0.035	0.015	E>
2	5.098	-0.002		E=
3	12.235	0.015		I =
4	7.010	0.010		E=

c/printing example of statistical analysis and stored values (tolerances activated) :
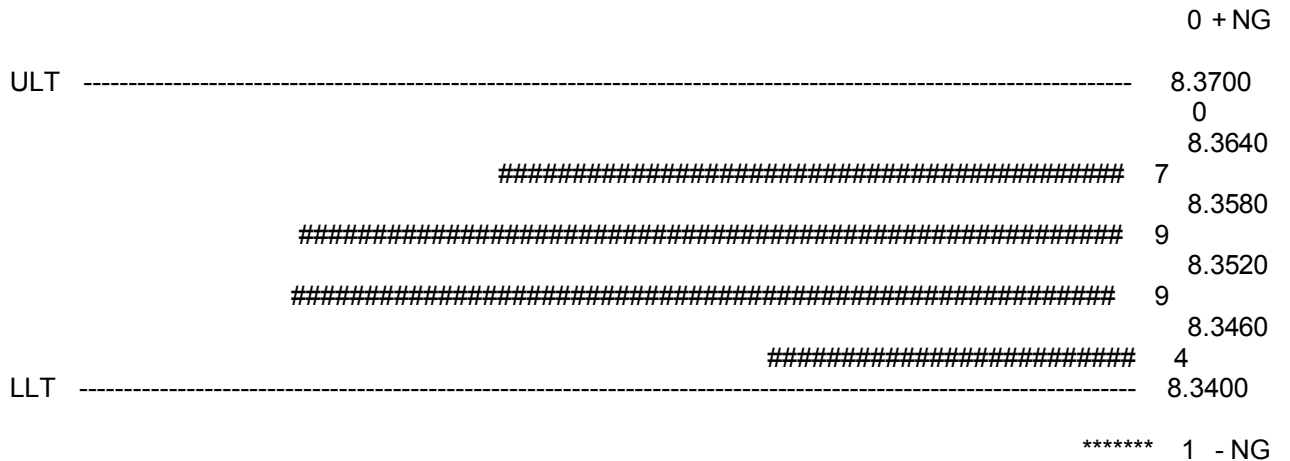

SYLVAC SA

Piece ident. : COUVERCLE
Drawing nbr. : PM230.010.412
Work station : L 201

Date : 12/11/1998   Time : 14 :46

CHANNEL   1+ 2

N	30		
Xmax	8.361	Xmin	8.338
R	0.023	Xbar	8.352
Sigma	0.0063	s	0.0064
-3 S	8.333	+3 S	8.371
- NG	1	+ NG	0
%Def	3.333	Cp	0.7933
Cpk	0.6433	Cm	0.7800
Cmk	0.6325		

```
                                                    0  + NG

ULT ---------------------------------------------------    8.3700
                                                     0
                                                       8.3640
                         ############# 7
                                                       8.3580
                     #################### 9
                                                       8.3520
                     #################### 9
                                                       8.3460
                          ######### 4
LLT--------------------------------------------------------    8.3400

                                          ***  1  - NG
```
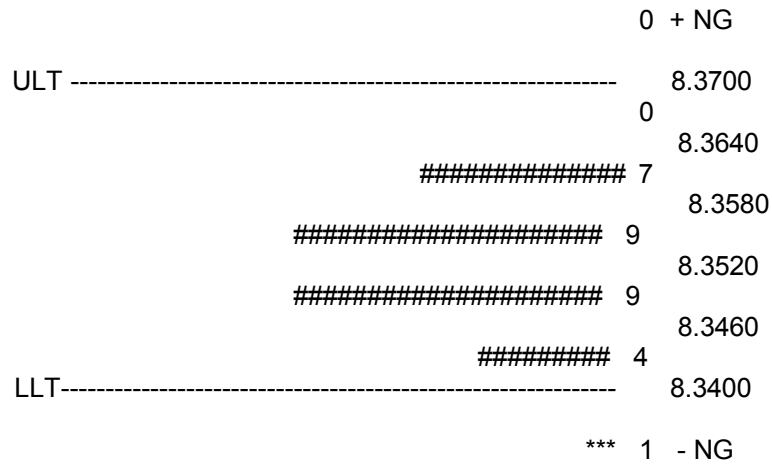
1	8.342	2	8.342
3	8.350	4	8.359
5	8.359	6	8.358
7	8.342	8	8.344
9	8.354	10	8.348
11	8.356	12	8.360
13	8.360	14	8.357
15	8.353	16	8.351
17	8.348	18	8.350
19	8.353	20	8.349
21	8.349	22	8.349
23	8.350	24	8.354
25	8.353	26	8.338
27	8.361	28	8.361
29	8.361	30	8.354

1.6.14.5 Format for 15 columns printer
For small printers, battery or accumulator powered (e.g. EDP5000 or SP1).

As previously, the unit requests the time needed to print one line. A header cannot be entered here.

a/ in normal mode, the measurements are printed as in computer format, but are preceded by the channel number. In tolerance mode, the difference between the nominal dimension ant the measurement is printed :

```
1          9.716
2+3       15.434
```

b/ in scanning mode, the following is printed (in tolerance mode, the difference between the nominal dimension and the measurement is printed) :

```
WORKPIECE  4 <
1          9.716
2         12.54
3          2.008
```

c/ printing of statistical values : as per computer format but with the possible addition of stored values :

d/ printing of stored values : they are preceded by the store number (figure from 1 to N) :

```
1          9.999
2          9.998
3         10.002
4         10.000
```

1.6.14.6 Remote command of D100S unit :
Practically all functions of the D100S unit are remote controllable from a computer through input RS232, according to the following general method :

The first 3 letters of functions are used for remote command. For example, if a measured value is required from the computer, the first 3 letters of Print are transmitted, i.e. **PRI**.

Any number of spaces can be inserted anywhere, except inside numbers.

Command characters may be in upper or lower case (the latter are ASCII coded).

On/Off functions like analog scale or tolerances indicators are activated with the first 3 letters of the function, followed by ON or 1. They are disabled with OFF or 0 (= zero and not the letter O).

For example : TOL ON displays tolerances indicators, as does TOL 1.

There should be no delay between characters in remote command word.

Words used for remote commands :

CHA+ (CHANNEL)	= selects positive measuring direction of the indicated channel.
CHA-	= selects negative measuring direction of the indicated channel.
CHA3	= selects channel 3.
CHA-2	= selects channel 2, in negative measuring direction.
CHA+1-2+	= selects channel 1 minus channel 2, both channels with positive measuring direction.
CHA*2	= establishes diameter function of the selected channel. (X*2)
CHA*1	= establishes radius function (normal) of the selected channel. (X*1)
CHA*1.5	= 1,5 multiplication factor.
CHA? or CHA PRI	= identifies the direction of measurement (+/-) followed by the active channel number.
CHA2=1	= channel 2 assigned to probe 1.
CHA1=1RS	= channel 1 assigned to RS232 instrument (simplex cable)
CHA1=1RSD	= channel 1 assigned to RS232 instruments (duplex cable)
CHA1=1	= channel 1 assigned to analog instruments (P5,P10…)

CLA 0 (CLASSIFICATION)	= no display of class indicators.
CLA 1	= display class indicators.
CLA 3 12.1 12.2 12.3 12.4	= input of 3 classes, lower limit of class 1 is 1.21, upper limit of class 1 is 12.2, upper limit of class 2 is 12.3 and upper limit of class 3 is 12.4 (according to current unit).
CLA?	= output of memorized class values.
DIS .... (DISPLAY)	= displays a 20 characters max message on the first line of the D100S display. The end of message is given is given by CR (Carriage Return). This message is cleared by pressing any key on D100S unit or by sending the NOR remote command.
EXT 0 (EXTERNAL CONTACT)	= allocates data transmission function to external contact (foot pedal). (*refer to section 1.6.11*).
EXT 1	= display hold or store.
EXT 2	= reset Min/Max registers.
EXT 3	= preset display.
EXT 4	= change channel.
EXT 5	= D110 command.
EXT 6	= start scanning.
EXT 7	= status transmitted automatically.
EXT 8	= status transmitted on request.
EXT 9	= transmission of values + display hold or store.
EXT 10	= new Min/Max the transmission of values.
EXT 11	= preset then transmission of values.
EXT 12	= transmission of values + change channel.
EXT 13	= D110 command then transmission of values.
EXT 14	= start scanning then transmission of values.
EXT 15	= D110 command then start scanning and transmission of values.
EXT 16	= D110 command then start scanning.
EXT 17	= new Min/Max then store or hold.
EXT 18	= preset then store or hold.
EXT 19	= store + change channel.
EXT 20	= D110 command then store or hold.
EXT 21	= start scanning the store.
EXT 22	= D110 command then start scanning then store.
EXT 23	= start scanning then transmission of values then store/hold.
EXT 24	= new Min/Max (if necessary) then store/hold and change channel.
EXT 25	= new Min/Max then Print + change channel.
EXT 26	= new Min/Max then change channel.
EXT 27	= print + store + change channel.
EXT 28	= D110 command then print and store.
EXT 29	= preset then scanning.
EXT 30	= D110 command then scanning then print + store/hold.
EXT?	= request status of external contact (corresponding to EXT 8) the unit transmits 0 (zero) if no external contact. The unit transmits 1 if an external contact has occurred (status is automatically reset To 0).
FS1	= actives the function of the external contact 1
FS2	= actives the function of the external contact 2 (*refer to section 1.6.11*).
IDE ou **ID?** (IDENTIFICATION)	= identification of instrument—> the unit responds «SYLVAC D100S date V1.4» V1.4 = firmware version

KEY 0 (KEYBOARD)	= keyboard locked.
KEY 1	= keyboard unlocked.
MAX (MAXIMUM)	= selects max function.
MIN (MINIMUM)	= selects min function.
DEL (DELTA)	= selects delta function (max-min)
MEA (MEAN)	= selects mean function (max + min/2)
CLE (CLEAR)	= re-initializes min/max registers when inut is in max, min, delta or mean modes.
ENT (ENTER)	= displays in succession Max - Min - Delta - Mean ... in Min/Max mode.
NOR (NORMAL)	= re-establishes normal measuring function.
MOD? (MODE)	= the unit sends its measuring mode : NOR, MAX, MIN, DEL or MEAN.
MEM? (MEMORY)	= request memory configuration of unit. All 6000 parameters are transmitted in one block, without Xon/Xoff protocol, at 9600 bps, 8 bits, no parity.
MEMR	= restores memory configuration of unit, same transmission parameters as above.
MM (MILLIMETER)	= selects metric unit.
IN (INCH)	= select inch unit.
OUT 1 (OUTPUT MODE)	= actives : automatic output of values :

OUT 1 (OUTPUT MODE) = actives : automatic output of values :
in normal measurement mode : each displayed value is also transmitted to RS 232
output. In this case, the transmission speed at 9600 bauds is :

in 0.000 1 mm / 0.000 01 IN = 3 trans. per sec.
in 0.001   mm / 0.000 1   IN = 7 trans. per sec.
in 0.01   mm / 0.001   IN = 12 trans. per sec.
in 0.1   mm / 0.01   IN = 13 trans. per sec.

In scanning mode display is inhibited, (OUTPUT MODE is displayed). Scanning
Is continuous and the values are automatically transmitted as well as the status of
The external contact at the end of transmission, for EXT 8 mode.

in 0.000 1 mm / 0.000 01 IN = 2 trans. per sec.
in 0.001   mm / 0.000 1   IN = 3 trans. per sec.
in 0.01   mm / 0.001   IN = 4 trans. per sec.
in 0.1   mm / 0.01   IN = 4 trans. per sec.

OUT 0	= disables this mode.
PRE (PRESET)	= displays the stored preset value.
PRE 123.4567	= memorize and display preset value 123.4567.
PRE ?	= unit sends memorized preset value.
PRI or **?** or **P** (PRINT)	= print out of the displayed value. In scanning mode : output of scanned values.
RES1 (RESOLUTION)	= selects resolution of 0.000 1 mm or 0.000 01 IN
RES2	= selects resolution of 0.001 mm or 0.000 1 IN
RES3	= selects resolution of 0.01 mm or 0.001 IN
RES4	= selects resolution of 0.1 mm or 0.01 IN
RST (RESET)	= general reset of the unit (return to initial status)
SAV+no	= save the configuration to the file nbr (1 to 12)
REC+no	= load the configuration from the file nbr (1 to 12)

SCA (SCANNING)	= initiates scanning.
SCA 21	= sets number of channels to be scanned, here 21.
SCA2 6	= initializes scanning from channel 2 to channel 6 and starts scanning.
SCA ?	= the unit returns the stored number of channel to scan.
ENT	= has the same function as the Enter key in scanning mode (D100S display next table or quit scanning mode).
CLE	= has the same function than Clear key in scanning mode (D100S displays preceding table or quit scanning mode).

SET ? (SETUP) = the unit transmits general parameters :

	MM	RES1	ANA0	TOL 0	CLA 0	STO 0	KEY 0
or	IN	2	1	1	1	1	1
or	UM	3					
or	MI	4					

<u>Note</u> : ST00/1indicates if hold function is active or not.

STA ? (STATISTICS)	= the unit outputs statistical analysis of current channel.
STA2 ?	= outputs statistical analysis of channel 2.

STO (STORE) = when receiving this command, the unit will store the measured value of the current channel. Maximum of 6000 measurements can be stored, shared between the channels defined for storage. For example if STO = 4, we have 6000/4 = 1500 values that can be stored per channel.

STO4 = gives the number of channels for storage, starting with channel 1. Here, 4 channels are reserved for storage → 1500 measurements per channel. Reinitializes the Store memory.

STO0	= Removes Hold from the display..
STO ?	= the unit outputs stored values for current channel, from 1st stored value to the last.

STO 1 ?	= outputs stored values of channel 1
STO RST	= reset complete store memory.
STO 3 RST	= reset store memory of channel 3.

TOL0 (TOLERANCES)	= no display of tolerances indicators.
TOL1	= displays tolerances indicators.
TOL 10.2 0.1 -.05 I	= input of nominal size 10.2, upper tolerance 0.1, lower tolerance –0.05 and internal measurement (= I).

TOL ? = output of memorized values : for example 10.000 0.005 –0.003

UP	= retraction of probes using D110/D110V.
DOW (DOWN)	= return motion of probes using D110/D110V.

<u>Errors codes transmitted by the D100S unit :</u>

ERR 1	= parity error of received message
ERR 2	= syntax error of received message
ERR 3	= content of RAM memory lost.

1.6.14.7 Programming on a PC

An application diskette for communication with PC can be obtained from a Sylvac agent. This diskette includes a Demonstration program written in Pascal for data acquisition and remote command of **D100S** unit.

Basic (QBASIC), supplied with all PCs, is the most simple language to use. Below are 2 examples written in this language found on the diskette.

a/ acquisition of one measured value :

10 CLS	Clear screen
20 OPEN "COM1:4800,E,7,1,CS,DS,CD" AS#1	Selects communication port 1 or computer and the following transmission parameters : 4800 bauds, even paryty, 7 bits /car. 1 stop bit.**CS** inibits time-out control of **CTS** (Clear To Send), **DS** for **DSR** line (Data Set Ready) and **CD** for **CD line** (Carrier Detect).
30 IF INKEY\$ <> "" THEN 80	Programs stops if any key is pressed.
40 IF LOC(1) = 0 THEN 30	Wait if RS232 input buffer is empty.
50 LINE INPUT#1, A\$	Inputs one complete line up to CR.
60 PRINT A\$	Displays value transmitted by **D100S**
70 GOTO 30	Ready for new entry.
80 END	

b/ remote command of D100S unit :

10 CLS	
20 OPEN "COM1:4800,E,7,1,CS,DS,CD" AS#1	
30 PRINT "Donner le mot de commande"	
40 INPUT B\$	Enters word for remote command of **D100S** (e.g. PRI for transmitting a value).
50 PRINT#1, B\$	Outputs command word through RS232 port.
60 IF LOC(1) > 1 THEN 100	Wait for any response from **D100S** unit.
70 K\$ = INKEY\$	
80 IF K\$ = CHR\$(13) THEN 130	Program stopped by pressing by pressing **Enter** key.
90 IF K\$ = " " THEN 60 ELSE 30	Pressing another key allows output of a new command word
100 LINE INPUT#1,A\$	
110 PRINT A\$	Displays eventual response from **D100S**
120 GOTO 70	Ready for new input.
130 END	

For transmission of a long characters strings, e.g. for the transmission of memorized values (Store function), the Computer can use the Xon/Xoff protocol to control transmission. If the RS 232 buffer of the computer exceeds a Given stated limit, e.g. 200 bytes (capacity is 255 bytes), the computer stops transmission by sending Xoff (=ASCII Code 19 = CHR\$(19)). When the computer is ready for a new input, it will transmit Xon (=ASCII code 17=CHR\$(17))

Pinout of RS232 and Centronics connectors : *refer to Sections 1.8.1 et 1.8.4*

Various RS232 connection cables or D100S Centronics printer cable are available from Sylvac.
(*refer to section. 1.14*).

1.6.15 STORE KEY

This key may have 2 functions :

1/ Display hold. A reverse video **H** appears at the top right-hand side of the screen. This is cancelled by pressing key again to reactivate the display.

All functions remain active during Hold mode. Frozen measurements may therefore be : converted from mm to inch, preset, printed, etc. Min/Max, scanning and channel functions automatically disable the hold function.

The hold function is selected by choosing 0 for the number of channel for Store (see below) : this will not reinitialise the Store memory.

2/ Storing of measurements. The measured value is stored each time the Store key is pressed. These stored values are used for the unit's statistical function /refer to section 1.6.9). Stored values may also be output to the RS232/Centronics ports. Up to 6000 values can be stored. These 6000 values are divided by the number of channels allocated for storage (Set up then Store then 5) For example, if 3 channels are used for storage, a total of 6000/3 = 2000 values can be stored for channels 1 to 3. If only one channel is allocated, 6000 can be stored on channel 1.

Before storing it is necessary to choose the required number of channels with Set Up then Store then menu 5. Changing this number will reset the store memory.

Storing mode is represented by an **n** at the bottom of the display, followed by the number of stored values for the displayed channel. When in control chart mode, sub-group **m** is displayed, following by number **n** of stored elements in last sub-group.

If the number of stored values reaches the maximum (6000/number of channels), each new stored value will be recorded but will erase the first entered value. Thus, stored value No 1 is lost, No 2 becomes No 1, and so on.
It is also possible to configure the external contact (foot pedal) to HOLD the display or STORE the measured value.

The memory storage capacity is represented by a barograph $E\boxed{}F$ on the bottom of the display.

Choice of **Store** key function :

1/ Press **setup** key 2/ then **store** key, following will be displayed :
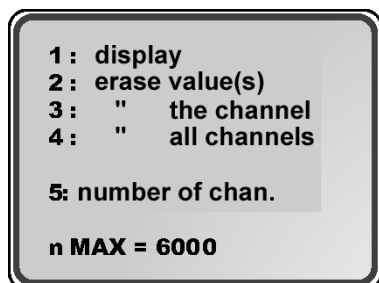
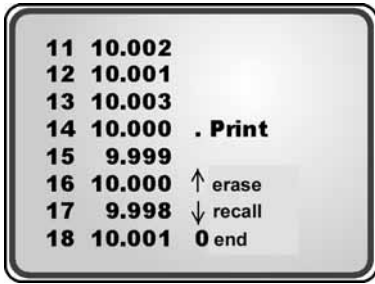1 : 1st choice will display the last 8 stored values, preceded by their store number (from 1 to N).

2 : 2nd choice erases one or more values defined by their number. If, for example, 102 values are stored and you wish to erase the 88th value, this is automatically replaced by the 89th, the 90th takes the place of the 89th, etc. and as a result there will be a total of only 101 stored values. If there are several corrections to make, it is advisable to start from the highest value and work downwards.

3 : 3rd choice erases stored values for the current channel.

4 : 4th choice erase stored values for all channels.

5 : 5th choice specifies the number of channels for the store function.
N=0 :Hold function is active.

```
1 : display
2 : erase value(s)
3 :    "    the channel
4 :    "    all channels

5: number of chan.

n MAX = 6000
```

The following will appear if the 1st choice is selected :

```
11  10.002
12  10.001
13  10.003
14  10.000   . Print
15   9.999
16  10.000  ↑ erase
17   9.998  ↓ recall
18  10.001  0 end
```


Pressing the *clear* key erases the last stored value.

The *enter* key will recover erased value(s). When the last stored value is displayed, this key will quit the stored values display.

The *store* key saves correction (s) and quits the table.

The *print* key outputs stored values to the RS232/Centronics ports, from first to last, according to the selected Print format (*refer to section 1.6.14 : Print* key).

Once all data have been transmitted, the unit asks if you wish to :
- keep stored values → press **Enter** key.
- erase stored values for current channel → press **Clear** key

Printing of stored values may also be requested from the computer (refer to remote command). The Xon/Xoff protocol can be used by the computer for transmission control.

In Scanning mode, Setup + Store asks you which channel you wish to work on. If you reply with 0, the stored values of all channels are printed.

1.7 CALIBRATION OF THE UNIT

1.7.1 General calibration

The D100S units are calibrated at the factory. However if a re-calibration is required, proceed as follows :

1/ Fix a **P2, P5, P10, P25** or **P50** probe to a vertical support.

2/ Select a resolution of 0.0001 mm or 0.00001 in.

3/ With the probe in its fully extended contact-free position, reset display to zero (*Preset* key).

4/ Mechanically position probe under reference base so that readout indicates a measurement :

for   **P2** between 0.2 and 0.3 mm
     P5 between 0.7 and 0.8 mm
     P10 between 0.4 and 0.5 mm
     P25 between 0.8 and 0.9 mm
     P50 between 1.0 and 1.2 mm

5/ Switch off unit, then switch on by pressing *channel* key for four seconds. The following display will appear :

The date of the last calibration is shown.

Last calibration date
12/10/98
Ref. 0 ?

0.000 mmm
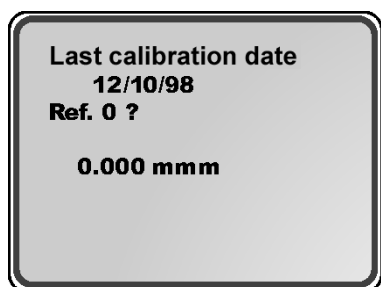
6/ Place probe on reference base (value 0). Press *enter* **Enter** key.
7/ Insert 2 mm test block for the **P2**, 5 mm for a the **P5**, a 10 mm
 for the **P10**, 25 mm for a **P25** or 50 mm for a **P50**.

8/Enter exact value of pad on keyboard : 2, 5, 10, 25 or 50 mm, then
 press *Enter* key.

The calibration value is automatically stored and can only be deleted by a new calibration (changing lithium module Or accumulator does not effect the calibration).
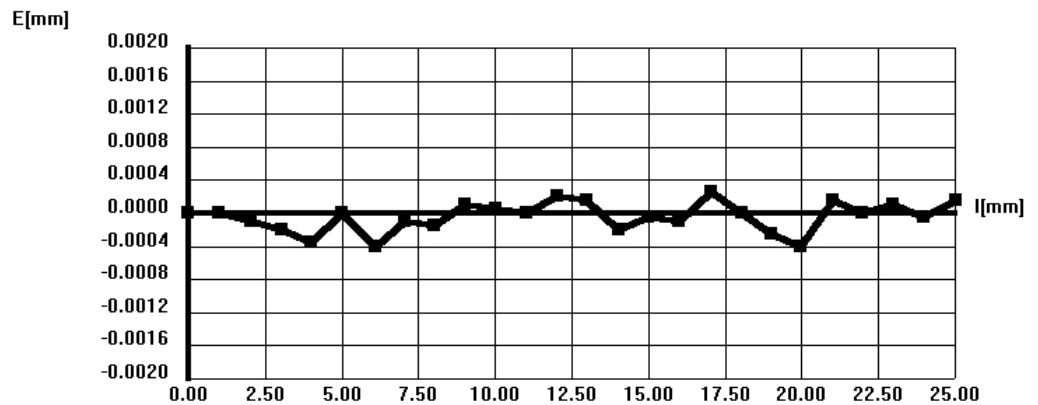
1.7.2 Coupling probe to unit

The user can couple the probe-unit couple and correct from 2 to 25 points linearly.

Example of correction :
1/ Probe P25 with D100S without correction —> max error 1.4 um :
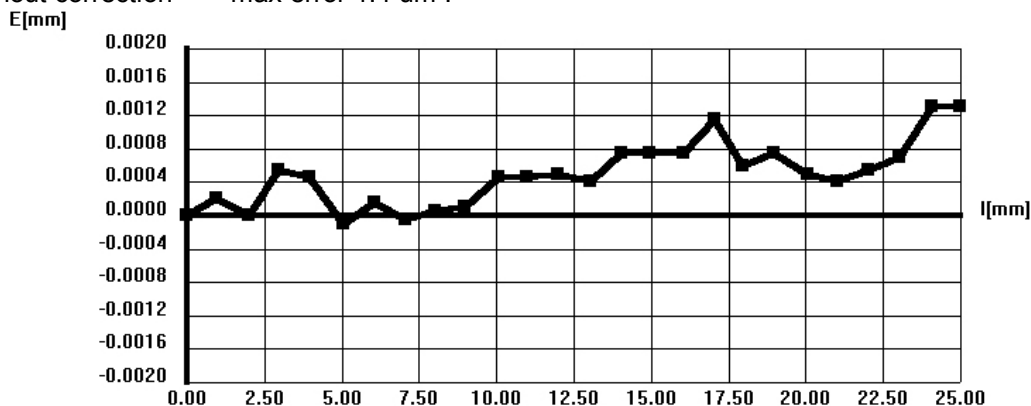
2/ Same instruments, but with correction of 10 points (every 2.5 mm—> max. error 0.7 um :

Introduction of correction : probe out to probe in.

1/ Switch off unit D100S

2/ Switch on unit while pressing *Store* key for at least 5 seconds.

3/ If there is room, the date of old correction is displayed.

4/ Insert value of first reference in keyboard, normally 0. In theory, this is the probe travel stroke, approx. 0.8 mm for a **P25** probe. Confirm by pressing **Enter** key.

5/ Then enter correction points. Gauge block may be used, whose exact value is know. With probe in opposition on the pad, insert its exact value on keyboard and confirm by pressing *Enter* key.

6/ Continue in same way for all correction points, with 1 point min. and 25 points max.

7/ When the final correction point is reached e.g. 5, press the *Clear* key and this will exit correction mode (otherwise you will move to the next point.

Correction is indicated by an E on the display (E for Extended accuracy)
This value cannot be deleted, even if you restart the unit (Reset)

If you wish to delete the effect of the multiple correction, briefly press *Store* key when switching the unit on.

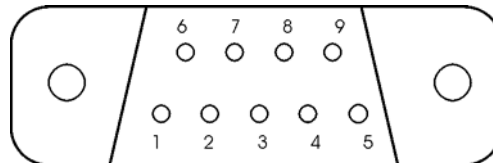To reconfirm this correction, repeat the same sequence as above.
Correction is the same for all channels of the D100S. Multiplexing units D102 and D108 for multiple probe use are invalid.

1.8 REAR PANEL
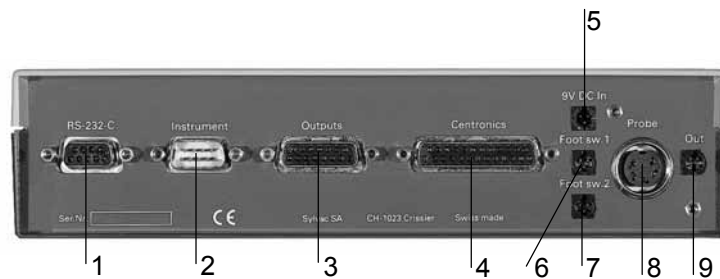
1.8.1 RS-232-C Input/output

9 pin D-sub female connector (external view) :

Pin 1 :   Charger output **8.5 V / 300 mA** non-regulated (current limit protection). Output only with charger connected.

Pin 2 :   **RXD** = RS-232-C output when *Print* key or foot pedal (if configured) is pressed, or by remote command.

Pin 3 :   **TXD** = RS-232-C input for remote command from computer.

Pin 4 :   **DTR** (Data Terminal Ready) :not used.
Pin 5 :   **SG** (Signal Ground) =Signal ground.
Pin 6 :   **DSR** (Data Set Ready) =not used.
Pin 7,8 :   Unconnected.
Pin 9 :   **6 à 7 V / 150 mA** accumulator output, non-regulated (current limitation).

To configure the RS-232-C transmission parameters, press *Setup* key then *Print* key.
(refer to *Print* key section *1.6.14*).

1.8.2 RS-232-C input instrument (Opto-RS simplex or duplex)

9 pin D-sub male connector (external view) :
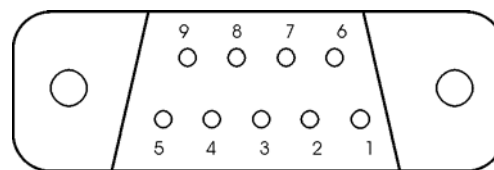

Pin 1 :   Charger output **8.5 V / 300 mA**
Pin 2 :   **TXD** = RS-232-C input from connected OptoRS instrument.
Pin 3 :   **RXD** = RS-232-C output for Opto-RS duplex instrument : data request or min/max. mode selection.

Pin 4 :   **DSR** : output for data request for OptoRS simplex instrument or positive supply for OptoRS duplex.

Pin 5 :   **SG** = Signal ground.

Pin 6 :   not connected.
Pin 7 :   **CTS** = (Clear to Send) = positive supply for OptoRS simplex instruments or negative for duplex.
Pin 8 :   not connected.
Pin 9 :   **6 à 7 V / 150 mA** accumulator output.

1.8.3 Outputs

15-pin D-sub female connector (external view) :
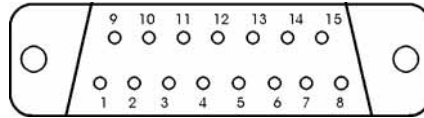
Pin 1 :   Common (digital ground).
Pin 2 :   **0** to **5 V** or **-2.5 V** to**+2.5 V** analog output according to pin 3
                     Each time the Preset key is pressed, this output is set to mid-range, i.e.: to **2.5 V** if the voltage
                     ranges from 0 to 5V or to **0 V** if the voltage ranges from **-2.5 V** to **+2.5 V.**

1 least significant digit on the display (the digit furthest to the right) represents **20 mV** on the analog output
(19.5 mV precisely, i.e. 5 V / 256).The effective range on the analog output therefore depends on the selected
resolution :

for 0.0001 mm   : range from +/- 0.0127 mm   with a speed of :   3 measurements/sec.
for 0.001 mm   : range from +/- 0.127 mm   "   5   "
for 0.01 mm   : range from +/- 1.27 mm   "   12   "
for 0.1 mm   : range from +/- 12.7 mm   "   15   "

for 0.00001 in   : range from +/- 0.00127   in speed same as   0.000 1 mm
for 0.0001 in   : range from +/- 0.0127 in   0.001 mm
for 0.001 in   : range from +/- 0.127 in   0.01 mm
for 0.01 in   : range from +/- 1.27 in   0.1 mm

the analog output has a maximum error of **+/- 4 %**. 0 position accuracy is : **+/- 100 mV** max.
With the above measuring speeds, the analog output can only be used to record **slow measurements.**

Pin 3 :   Select range of analog output :
If unconnected =   range from **-2.5 V** to **+2.5 V**
If connected to 1 (ground) = range from **0 V** à **+5 V.**

Pin 9 :   absolute analog output. Between 6 and 10 V for a **P10**, between 0 and 10 V for a **P25** or **P50**.

Pin 4,5,6,7 and
12,13,14,15   : opto-coupled outputs for sort or pneumatic lifting commands (D110).
                    Depending on which mode is active, the outputs have the following functions :

Mode :	Tolerance	Classification	Scanning	D110 (pneumatic lifting)
Pin 4	<	<	REJECT	
Pin 5	=	Class 1 good	GOOD	
Pin 6	not used	Class 2 good	not used	
Pin 7	not used	Class 3 good	not used	lowering command
	not used	Class 4 good	not used	lifting command
	not used	Class 5 good	not used	lowering command
	not used	Class 6 good	RECTIFY	lifting command
	>	>		

Notes :

if pneumatic unit is activated, classification is only possible for 2 classes.

Pin 8 : Common for 8 opto-coupler outputs.
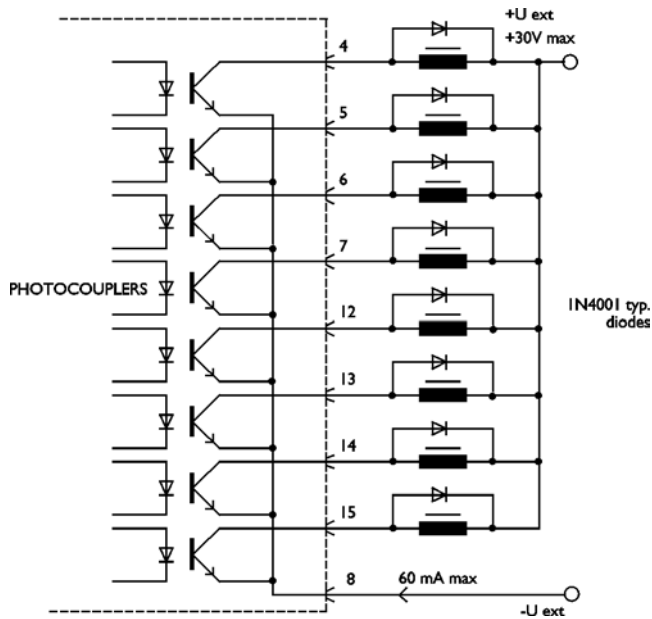
Max voltage = **30 V**, max. current = **60 mA** per output.

The opto-coupler outputs must be supplied externally
With negative voltage to the common emitters (pin 8)

The protection diode is necessary in the event of
Inductive charge (électrovalve), relay, solenoid, etc..)

Pin 10 : **8.5 V / 300 mA** output, non-regulated (protected), only if charger is fitted).

Pin 11 : **6** to **7 V / 150 mA** output, non-regalated (protected)

1.8.4 Centronics Output : parallel printer link

25-pin D-sub female connector (external view) :
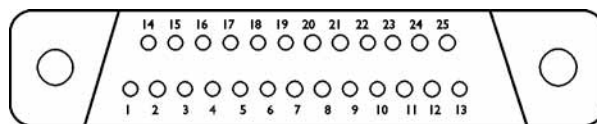
Pin 1 :   Strobe = output signal which validates data D1 to D8.

Pin 2 to 9 :   data outputs D1 to D8.

Pin 11 :   Busy = input signal indicating if printer is ready to receive data.

Pin 18 to 25 :   signal ground.

Pin 10 and 12 to 17 :   not connected.

Link cable :   standard PC - printer.

1.8.5 Socket for mains charger

May be inserted in either 5, 6 or 7.
Before insertion : ensure socket polarization is at 12 o'clock.

### 1.8.6 Socket for external contact 1, e.g. foot pedal

May be inserted in either 6 or 5.
The external contact may be configured for different functions, refer to section 1.6.11.

1.8.7 Socket for external contact 2, e.g. second pedal

This second may have all functions of contact 1. One pedal can be used to transmit data and the second for changing channel.

Allocation of pins for 4, 6 and 7 (external view) :
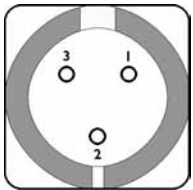
1 : Ground
2 : Power input/charger + 8.5 V
 3 : External contact input 1 or 2 (signal = 0 V)

1.8.8 Probe input

Probe input or for linking cable for multi-channel unit **D102** or **D108**.
For best connection, screw the plug into the socket.

1.8.9 Command output

Socket for command cable used with multi-channel unit **D102, D108** or **D104**.

1.9 IN CASE OF DIFFICULTY

1.9.1 No display on screen when unit is switched on.

The accumulators may be flat. If this is the case, you should reconnect the mains charger to the unit and wait for approx. 1 min for the display to appear. The accumulators have a working life of approximately 4 years. After this period, the autonomy will progressively be reduced.

Check for correct contrast : *Setup* then *Clear* or *Enter* the press a long lime on *Clear*

1.9.2 Complete reset of unit.

In case of problems, or if the operator so wishes, it is possible to completely reset the unit (will not work if keyboard is locked) :

1/ switch off the unit *On/Off*   2/ press *Clear*

3/ while holding the *Clear* key down , switch on the unit *On/Off*

This operation erases everything entered as a parameter or function and re-initializes the unit in the following manner :
- selects channel 1, a resolution of 0.001 mm and mm measuring unit.
- resets all channels (1 to 64) to positive measuring direction with probe tip returning, no A +/- B (+/-C) or
  diameter mode.
- resets all tolerances, class and resets values to zero, plus Store memory.
- the number of channels for scan and store modes is set to 1.
- configure Store key Hold, and external contacts 1 and 2 for printing.
- selects communication with a computer and the following transmission parameters : **4800** bauds, **7** bits/car.,
  even parity and **1** stop bit, **CR** at the end of the message.

Reset may also be remote controlled by sending the characters "**RST**" to the RS232 input.

Memory for twelve configuration saves is not deleted.

1.9.3 Loss of memory content.

If the following message appears on the screen when the unit is switched on :
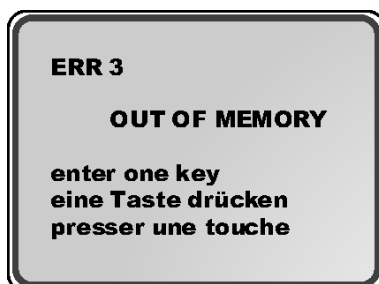
This means that the data back-up lithium module is flat (average life 10 Years). It is therefore necessary to change this module as per the Instructions in Section 1.10.

1.9.4 Software version

The software version may be displayed as follows ::

1/ switch the unit **On/Off** 2/ press **Print** key.

3/ keep it pressed when switching ON

Then any key will return you to normal measuring mode.

1.9.5 Special symbols

Meaning of symbols that may appear on the screen :

K Indicates locked keyboard (to unlock : Enter + On/Off or a long pressure (5 sec.) on any key).

P Indicates RS232/Centronics output in progress.

S Indicates Scanning mode.

↑ Indicates pneumatic lifting or possibility of moving to previous table in Scanning mode..

↓ Indicates pneumatic lowering or possibility of moving to next table in Scanning mode.

? Indicates a non authorized action on keyboard.

Indicates a need to recharge accumulators. Approx. 20 min. autonomy remaining.

1.10 REPLACING THE LITHIUM MODULE

If the following message appears on the screen when the unit is switched on :

ERR 3

OUT OF MEMORY

enter one key
eine Taste drücken
presser une touche
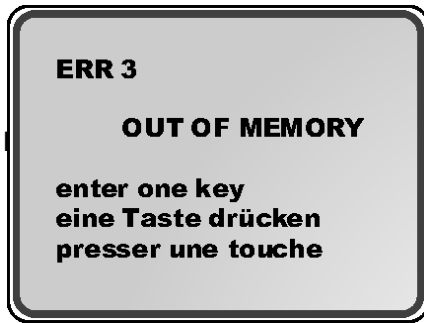
This means that the data back-up lithium module is flat (**average life 10 years**)

Note : It is possible to use **D100S** unit with a "flat" lithium module, but all parameters and functions entered by the operator will be lost each time the unit is switched off.

The module is replaced as follows :

After obtaining a new lithium module from Sylvac representative,

Place the unit on a table and remove the 4 retaining screws of the cover..

Touch a water pipe or other object connected to ground to release any static build-up (the inside of the unit is Sensitive to electrostatic discharges).

Remove yellow cover.

Remove lithium module with a screwdriver :

Insert new lithium module, replace cover and replace the 4 cover retaining screws.

When the unit is switched on again, the memory contents lost message will appear once more.

1.11 REPLACING ACCUMULATORS

When the autonomy of the D100S unit is no longer satisfactory it is necessary to replace the accumulators inside the unit (their life span is approx. 4 years.

Replacement of accumulators can be carried out either by a Sylvac representative or as follows :

Obtain a new battery pack for the **D100S**from your Sylvac agent..

Open the unit as described in section 1.10.

Remove the old accumulator connector by pulling it back :
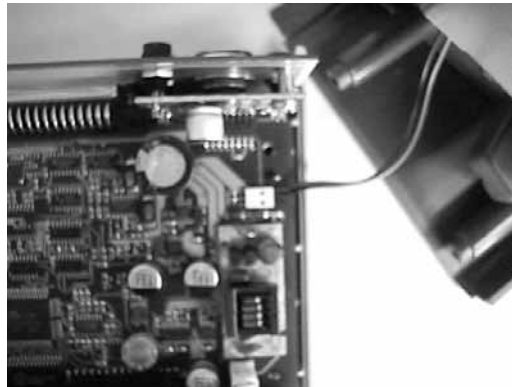
Loosen two fixing screws on the battery pack bracket.

Install the new accumulator as shown in the illustration :
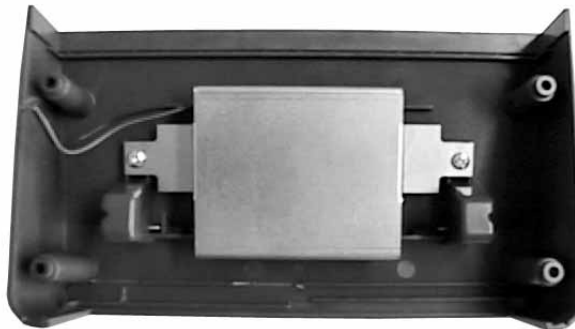
Replace the two fixing screws on the bracket. Plug in the battery pack connector.

Replace the lower half of the housing, ensuring that the front and back panels are correctly positioned in the Specially designed grooves.

Replace the 4 cover screws.

Plug the mains charger into the unit and charge the accumulators for at least 15 hours.

1.12 TECHNICAL SPECIFICATIONS

Enclosure :

in terblend plastic (= ASA + polycarbonate) :
resistant to alcohol, glycols, most oils and greases, diluted acids
and water.
Non-resistant to aromatic hydrocarbons, esters, ketones, concentrated
Mineral acids, ammonia gas and its dilutions.

Front panel :   Polyester.

Rear panel :   Aluminium varnish.

Keyboard :   Flat with metal dome tactile response.

Dimensions :   Width 227 mm, depth 132 mm height 77 mm without (87mm
with stand).

The stand is adjustable :   vertical or inclined at 13°

                                  A complementary base (supplied with the unit) allows an inclination of 35°.

Degree of IP protection :   IP40 (according to IEC 529).

Weight of unit   :   1.3 kg (2.9 lb).

Accuracy of measurement for D100S + interchangebility of probes and unit guaranteed as follows :
probes :

Probe type	D100S error	Probe error	Mean error
P2	1.5 µm	0.8 µm	1.0 µm
P5	1.0 µm	1.5 µm	1.8 µm
P10	1.2 µm	1.0 µm	1.6 µm
P25	1.5 µm	1.2 µm	1.9 µm
P50	3 µm	2.5 µm	3.9 µm

Repeatability (+/- 2s) :

P2 :   0.3 µm
P5   : 0.3 µm
P10 : 0.2 µm
P25 : 0.2 µm
P50 : 0.4 µm

Operating temperature :   Between +5° and +40 °C
Storage temperature :   Between -20° and +45 °C

Measuring frequency :

	Probe in	Probe out	
P2 :		between 170	and 205 measurements per sec.
P5 :		between 170	and 205 measurements per sec.
P10 :		between 170	and 205 measurements per sec.
P25/P50 :		between 130	and 205 measurements per sec.

The value measured is filtered digitally for the display, according to the resolution :

0.0001 mm or 0.00001 in :   approx. 3 readouts per sec.
                              (=3 analog outputs per sec.)
0.001 mm or 0.0001   in :   approx. 5 readouts per sec.
0.01   mm or 0.001   in   :   approx.12 readouts per sec.
0.1   mm or 0.01   in   :   approx.15 readouts per sec.
in min/max mode   :   no filtering, 60 readouts per sec.
                              for 0.1, 0.01 et 0.001 mm

Display: LCD , STN type (Super Twisted Nematics), graphics 128 x 64dots.
Viewing area 66 x 33 mm. CCFL. back-lighting.

Outputs:	analog 0 to 5 V or -2.5 V to +2.5 V, output current : max 10 mA. Voltage error: +/- 4 % max. 0 position : +/- 100mV max.
	absolute analog 6 to 10 V with a P10, 0 to 10 V with a P25 / P50.
	optocoupled output signals for sort and pneumatic unit D110 command.
	Centronics port for link with printer.
	RS-232-C port for linking to computer to computer or printer.
	Command for optional multichannel unit D102, D104 ou D108.
Inputs :	2 external contacts, e.g. supplied foot pedal. RS-232-Cport for remote command from computer.
Charger :	country specific, supplied in one of the following 4 types : European standard plug 230 V +/- 10 % 50-60Hz US standard plug 120 V +/- 10 % 50-60Hz Japan standard plug 100 V +/- 10 % 50-60Hz UK standard plug 240 V +/- 10 % 50-60Hz For all 4 models : output 8.5 V / 700 mA or 1100 mA.
Data back-up :	Lithium module 3V 175 mAh Renata type 175-OB. Lifetime approx. 10 ans.
Autonomy :	approx. 8 hrs. Autonomy is reduced at higher working temperatures. At 40° autonomy is reduced by 70 % compared to 25 °C.
Charge :	15 hrs minimum. The charger can be connected permanently without damaging the accumulators.
Self discharge of accumulators :	loos of 30 % of accumulator capacity per month. Do not leave accumulators completely uncharged.
Lifetime of accumulators :	approx.4 to 5 years

1.13 DELIVERY

Packaging in synthetic material :

		Order No
1 D100S unit (with accumulator)		804.1101
1 charger	European 230V	904.4010
	UK 240V	904.4011
	US 120V	904.4012
	Japan100V	904.4013
1 foot pedal for external contact		904.4101

1 base (to increase incline)

1 instructions manual

1.14 ACCESSORIES

Connecting cables for : parallel printer (Centronics)   925.5630

                     PC AT computer (Dsub 9p cable socket), 3 m length   925.5609

                     Converter (RS232/USB), 2 m) length   925.1142

Adapters :   9M/25M adapter for computer with 25 pins female connector   925.5626

                     9M/9M adapter for computer with 9 pins female connector   925.5627

Battery pack (accumulators) :   331.010

Lithium module :   331.005

2. MULTICHANNEL UNITS : « CHANNELS (D102) ET 8 CHANNELS (D108)

2.1 GENERAL DESCRIPTION

The **D102** et **D108** multichannel units are designed to work with the **D100S**, **D80** or old **D100/D101** display units. They can be mounted on the display unit by inserting the 4 plastic legs. The multichannel unit equally be positioned separately away from the display unit, close to the probes.

The **D102** unit allows connection of 2 probes on a **D100S** (usually for differential measurement A +/- B).

The **D108** unit allows connection of up to 8 probes on a **D100S** unit.

Additional **D102** and **D108**units may be connected to accommodate up to a maximum of 64 probes.

Choice of channel, its function mode (A, -A, A +/- B, A + / -B + /-C, radius / diameter), its preset and tolerance indicators are made from the **D100S** display unit.

2.2 REAR PANEL (D108 unit)
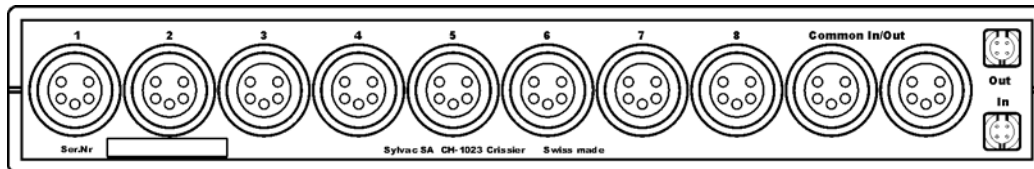
2.3 OPERATION

1/ Connect **D100S** 'Out ' socket to the 'In' socket on the **D102** or **D108** unit, using the short connecting cable provided with the multichannel unit.

2/ Connect the probe input socket marked 'Probe' on the **D100S** unit to one of the two sockets marked 'Common In/Out' of the **D102** or **D108** units using the connecting cable provided.

3/ Plug one or more probes into the sockets marked '1' or '2' for the **D102** unit and '1' to '8' for the **D108** unit. Ideally it is better to connect probes beginning at channel 1 and continue upwards without leaving a space between the channels in use. Input 1 corresponds to channel 1 of **D100S**, input 2 to channel 2, etc.

4/ If several D102 / D108 units are being, they are connected in the same way.

   - The 'Out' socket of the lower unit is connected to the 'In' socket of the upper unit.
   - One of the two 'Common In/Out' sockets on the lower unit is connected to one of the two 'Common In/Out' sockets on the upper unit.

The numerical order of the channels starts from the first **D102/D108** unit connected to the display unit. For example if there are 3 **D108** units connected to 1 **D100S** unit : the **D108** unit connected to the **D100S** corresponds to channel 1 to 8, the next unit corresponds to channel 9 to 16, and third unit to channels 17 to 24.

5/ Presets, tolerances, direction of measurement, radius/diameter or A +/- B modes may then be entered on the D100S unit. Once this is done, it is possible to select the channel to be displayed manually or with the external contact, or to use scanning function. These functions are explained in detail in Section 1.6

2.4 TECHNICAL SPECIFICATIONS OF D102 AND D108 UNITS

D102/D108 units:	Housing in Terblend plastic (= ASA+Polycarbonate :refer to characteristics described in Section 1.12)
Clip-on legs:	Polyurethane clip-on legs.
Front and rear panels :	Aluminium and polycarbonate sheet front and rear panels.
Degree of IP protection :	IP50 (according to IEC 529)
Weight of unit :	D102 0.450 kg D108 0.500 kg
Possible measuring error :	max 1 µm (this error can be reduced by re-calibrating the D100S unit).
Operating temperature :	between +5 and +40 °C
Storage temperature :	between -20 and +60 °C
Power supply :	via D100S display unit.

Packaging in synthetic material includes :

	Order No
- 1 D102 unit (2 channels)	904.1102
- or 1 D108 unit (8 channels)	904.1108
- 1 command connecting cable	925.5601
- 1 probe connecting cable	925.5603

2.5 ACCESSORIES

|	Order No
- Command connection cable 2.5 m length	925.5602
- Probe connection cable 2.5 m length	925.5604

3 D104 4-CHANNEL RS232 SWITCHING UNIT

3.1 GENERAL DESCRIPTION

The D104 switching unit is designed to link up to four OptoRS simplex or duplex instruments to be connected to unit **D100S** , or, by connecting several **D104** units in parallel, up to 16 instruments. The **D100S** unit automatically reads the values measured by the Sylvac RS 232 instrument and processes them in the same way as a value measured by a probe.

The **D104** unit may be fixed to the **D100S** by inserting four plastic legs. It may also be installed separately, close to OptoRS instruments (maximum RS232 connection distance is 15 meters).

3.2 CONNECTION OF 2 D104 UNITS AND 1 D108 UNIT ON D100S UNIT
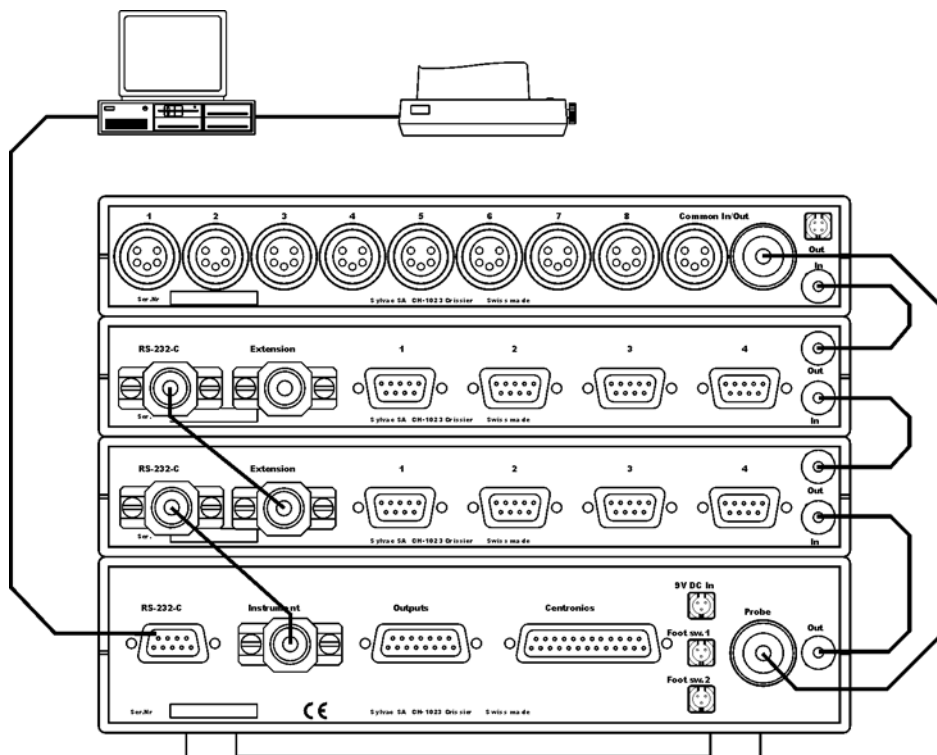
3.3 OPERATION

The OptoRS simplex or duplex instruments are connected to inputs 1 to 4 of the D104 unit and correspond to channels 1 to 4 on the display.

If a second **D104** unit is used, the inputs marked 1 to 4 on this unit correspond to channels 5 to 8 on the display. This second unit will be connected in the same way as above : the 'Extension' input/ouput of the first **D104** unit is connected to the 'RS232' input/ouput of the second **D104** by means of the 9p. male cable supplied. It is also necessary to connect the output of the first **D104** to the 'In' input od the second **D104**.

Configure the OptoRS channels by pressing Setup then channel, then type in the OptoRS channel number followed by Enter, then Enter if the channel is allocated to the OptoRS instrument connected to this channel number, then 2 for OptoRS simplex instruments or 3 for duplex.

It is now possible on the **D100S** display unit to enter presets, tolerances, choose the direction of measurement and the radius/diameter mode for each channel. Once this has been done, it is possible to select manually the channel to be displayed, and to change channels by means of the external contact (foot pedal) if this has been configured to do so. These functions are explained in detail in Section 1.6.

3.4 TECHNICAL SPECIFICATIONS

D104 unit :   Housing in Terblend plastic (= ASA + Polycarbonate :refer to characteristics
                                described in Section 1.12)

Clip-on legs :   Polyurethane legs with clip-on attachment.

Front panel: Aluminium and polycarbonate sheet.

Rear panel :   Aluminium varnished.

IP degree of protection: IP50 (according to IEC 529)

Weight of unit :   0.5 kg (1.1 lb)

Operating temperature :   between +5 and +40 °C

Storage temperature :   between -20 and +60 °C

Power supply :   Via D100S unit

Synthetic material packaging includes :

	Order No
- 1 D104 unit	904.1104
- 1 RS232 9M-9M connecting cable (crossed)	926.5524
- 1 RS232 9M-9F connecting cable (straight)	925.5608
- 1 command connecting cable	925.5601

3.5 ACCESSOIRES

	Order No
- RS232 9M-9M connecting cable length 2m50	
- Connection control cable length 2m50	925.5602

4 SYLVAC PROBES P2, P5, P10, P25 AND P50

4.1 GENERAL DESCRIPTION

Sylvac long travel probes are of compact design and are distinctive by their stability and consistent measuring accuracy. In addition they are absolute, i.e. having been disconnected then connected again or after switching off the unit, they still display the same measuring value. They have no speed limit, so that they never lose their absolute value.

The built-in preamplifier allows the use of long cables without intermediate amplification. The probe is not affected by magnetic fields. (Up to 20 meters)

P2B	Measuring range of 2 mm (ball cage)	P5V	Same as P5 (vacuum lifting)
P2BL	Same as P2B (right-angled output cable (90°))	P5VL	Same as P5V (right-angled output cable (90°))
P2BV	Same as P2B (vacuum lifting)	P10	Measuring range of 10 mm
P2BVL	Same as P2BV(right-angled output cable (90°))	P10L	Same as P10 (right-angled output cable (90°))
P5	Measuring range of 5 mm	P25	Measuring range of 25 mm
P5L	Same as P5 (right-angled output cable (90°))	P25S	Same as P25 (with rubber boot)
		P50	Measuring range of 50 mm

Different lifting methods are available for various probes :
- by photo-cable
- by foot pedal and cable
- by pneumatic lifter : D110 unit
- by vacuum, only for P2 - P5 : D110V unit

4.2 PROBE DIMENSIONS
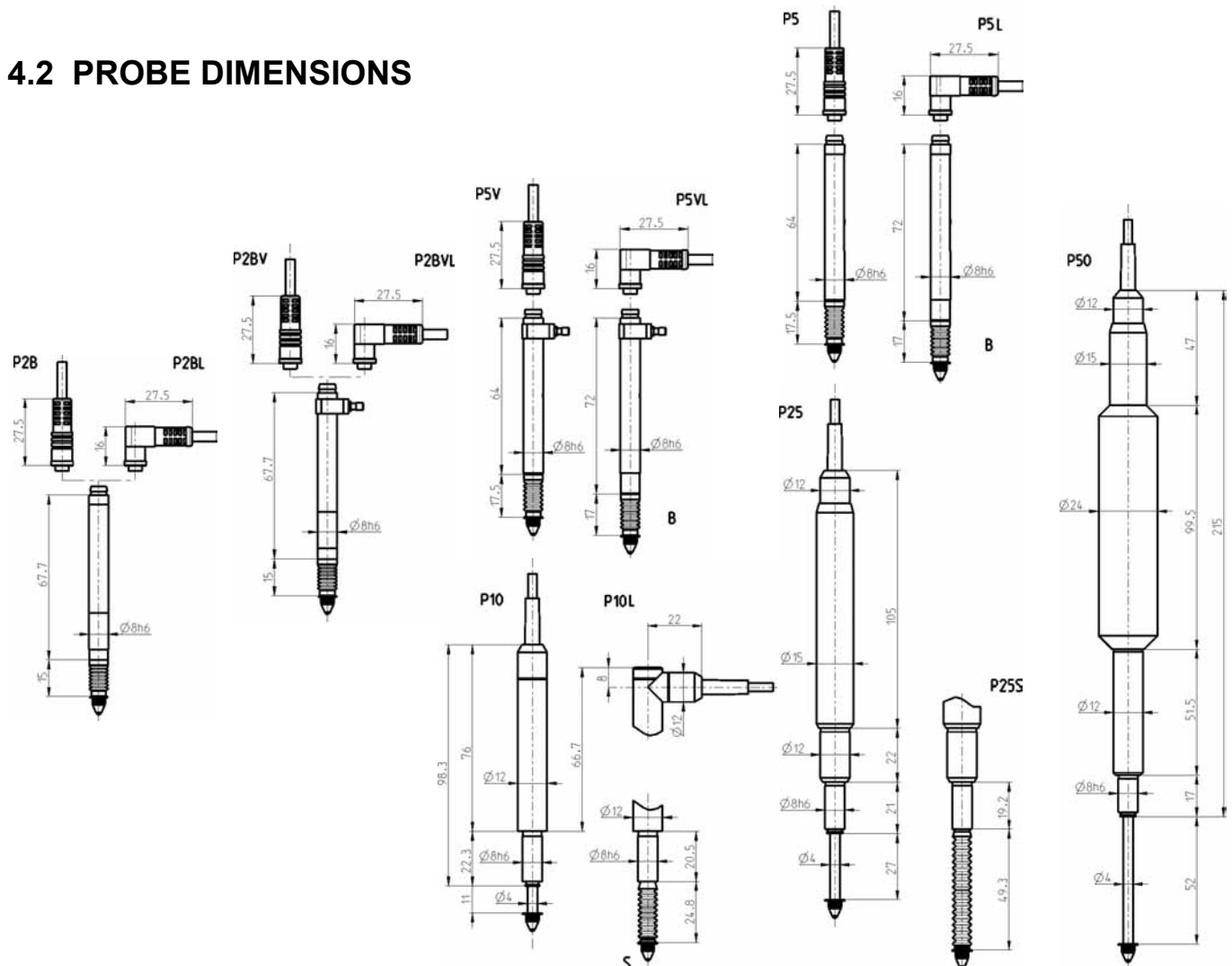
4.3 USE

4.3.1 Precautions

To ensure optimum measurement precision avoid all lateral pressure when presenting the probe contact to the objet to be measured. Ideally, a mechanical retracting lifter should be used.

Carefully clamp the fixing bearing of the probe in the holder. Fixing too tight can influence the measurement.

Avoid any impact on the probe spindle.

4.3.2 Changing the contact point

The probe spindle has an ISO M 2.5 thread in the end allowing replacement of the contact points. When changing the contact point, the probe spindle should be in the outmost position.

4.4 MAINTENANCE

This has been reduced to a simple operation. When the measuring spindle no longer slides with complete ease
And precision, clean it with a dust free cloth and lightly lubricate with a fine oil.

4.4.1 Replacing the connection cable, for P10, P25 and P50 :
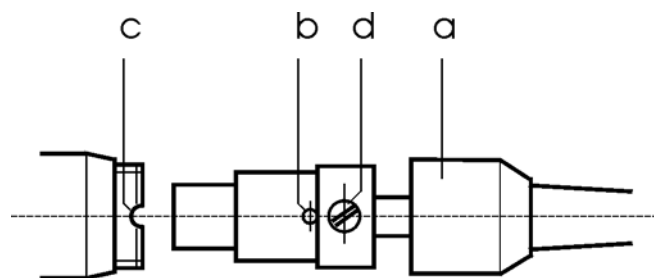
unscrew the cap (**a**)
pull out the cable
plug in the new cable, locate the pin (**b**) of the cable sleeve (**d**) in the slot (**c**).
Screw on the cap (**a**)

Notes :   use connection cable for the corresponding probe (**P10-P25-P50**).

                         For the **P2/P5** :the cable is connected to the probe by means of a sealed connector.

4.5 TECHNICAL SPECIFICATIONS

Construction	P2BL/P2B	P2BV/P2BVL	P5/P5L	P5B/P5BL	P5V/P5LV	P5BV/P5BVL	P10S/P10LS	P10/P10L	P25S	P25	P50
	Pluger gage	Pluger gage	Pluger gage	Pluger gage	Pluger gage	Pluger gage	Pluger gage	Pluger gage	Pluger gage	Pluger gage	Pluger gage
Type of bearing for meas. Plunger	ball bearing	ball bearing	Friction bearing	ball bearing	Friction bearing	ball bearing	Friction bearing	Friction bearing	Friction bearing	Friction bearing	Friction bearing
Moving mass (without contact)	3.4 g	3.4 g	3.7 g	3.7 g	3.7 g	3.7 g	4.1 g	4.1 g	9.6 g	9.6 g	15.3 g
Linear measuring range	2 mm /.078"	2 mm /.078"	5 mm /.19"	5 mm /.19"	5 mm /.19"	5 mm /.19"	10 mm /.39"	10 mm /.39"	25 mm /.98"	25 mm /.98"	50 mm / 1.96"
Total range	2.5 mm /.098"	2.5 mm /.098"	6.5 mm /.25"	6.5 mm /.25"	6.5 mm /.25"	6.5 mm /.25"	10.8 mm /.42"	10.8 mm /.42"	25.8 mm /1.01"	25.8 mm /1.01"	52.2 mm / 2.05"
Pre-travel	0.25 mm/.009"	0.25 mm/.009"	0.7 mm /.025"	0.7 mm /.025"	0.7 mm /.025"	0.7 mm /.025"	0.5 mm /.02"	0.5 mm /.02"	0.8 mm /.03"	0.8 mm /.03"	1 mm /.04"
Accuracy over the range	0.8 µm	0.8 µm	1 µm	1 µm	1 µm	1 µm	1 µm	1 µm	1.2 µm	1.2 µm	2.5 µm
Accuracy with D100S unit	1.5 µm	1.5 µm	1.6 µm	1.6 µm	1.6 µm	1.6 µm	1.6 µm	1.6 µm	1.9 µm	1.9 µm	3.9 µm
Accuracy with D100S unit (Coupled)	0.5 µm	0.5 µm	0.6 µm	0.6 µm	0.6 µm	0.6 µm	0.6 µm	0.6 µm	0.8 µm	0.8 µm	1.5 µm
Limit of travel upper stop	2.5 mm	2.5 mm	5.7 mm	5.7 mm	5.7 mm	5.7 mm	10.4 mm	10.4 mm	25.8 mm	25.8 mm	51 mm
Limit of travel lower stop	0.2 - 0.3 mm	0.2 - 0.3 mm	0.7 - 0.8 mm	0.7 - 0.8 mm	0.7 - 0.8 mm	0.7 - 0.8 mm	0.4 - 0.5 mm	0.4 - 0.5 mm	0.8 - 0.9 mm	0.8 - 0.9 mm	1.0 - 1.2 mm
Measuring force without pressure	0.60-0.75N		0.60 - 1.20 N	0.50 - 0.90 N			0.70 - 1.25 N	0.60 - 0.80 N	0.70 - 1.40 N	0.60 - 1.00 N	0.50 - 1.10 N
Measuring force low pressure								≤0.10N		≤0.15N	
Measuring force high pressure (Tolerance +/-20%)			0.20 - 0.25 N / 1.00 - 1.80 N					0.20 - 0.25 N / 0.70 - 1.50 N		0.20 - 0.30 N / 0.70 - 1.60 N	
Increase of measuring force	0.04 N/mm	0.04 N/mm	0.4 N/mm	0.04 N/mm	0.04 N/mm	0.04 N/mm	0.03 N/mm	0.03 N/mm	0.024 N/mm	0.024 N/mm	0.016 N/mm
Permissible lateral force	0.70N		0.70 N				0.60 N	0.60 N	0.30 N	0.30 N	0.25 N
Repeatability	0.2 µm	0.2 µm	0.2 µm	0.2 µm	0.2 µm	0.2 µm	0.2 µm	0.2 µm	0.2 µm	0.2 µm	0.2 µm
Zero drift	0.01µm/°C(/mm)	0.01µm/°C(/mm)	0.01µm/°C(/mm)	0.01µm/°C(/mm)	0.01µm/°C(/mm)	0.01µm/°C(/mm)	0.01µm/°C(/mm)	0.02µm/°C(/mm)	0.01µm/°C(/mm)	0.01µm/°C(/mm)	0.01µm/°C(/mm)
Protection according to IEC529	IP64	IP64	IP64	IP64	IP64	IP64	IP50	IP40	IP50	IP40	IP40
with rubber boot	*	Vaccum	*	*	Vaccum	Vaccum	Vaccum				
Lifting lever			Pneum.lifter	*	Pneum.lifter	Pneum.lifter	Pneum.lifter	Pneum.lifter	Pneum.lifter	Pneum.lifter	Pneum.lifter

Accuracy using extension cables :
These measuring errors are applicable only when using **D100S** unit without re-calibration :

Normal cable	+ extension up to 5 m:	additional error	1.5 µm approx.
	+ extension up to 10 m :	"	3 µm approx.
	+ extension up to 15 m :	"	6 µm approx.
	+ extension up to 20 m :	"	8 µm approx.
Direct cable	+ extension up to 5 m :	additional error	3 µm approx.
	+ extension up to 10 m :	"	6 µm approx.
	+ extension up to 15 m :	"	10 µm approx.

This in a progressive error margin and re-calibration of D100S unit can considerably reduce the error.
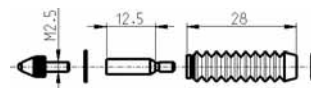
4.6 ACCESSORIES

Standard measuring tip with M2.5 thread, with 2 mm ball. (supplied with each probe).
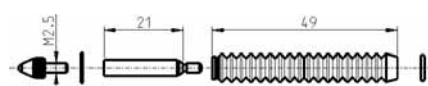
Order No : **905.2204**
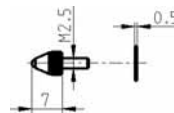
Rubber boot set for **P10** and **P10L** probes

Order No : **901.2003**

Rubber boot set for **P25** probe
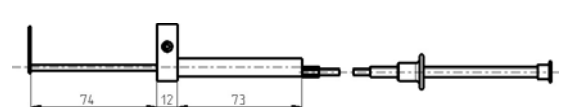
Order N°: **901.2004**

Lever with photo-cable, for **P10/P25** probes
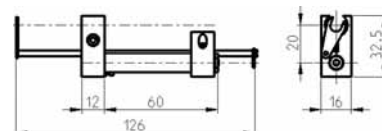
Order N°: **901.2005**

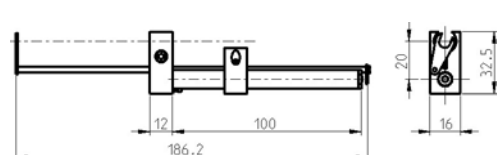Lever with photo-cable, for **P50** probe

Order N°: **901.2006**

Pneumatic lifting jack for **P10/P25** probes

Order N°: **901.2010**

Pneumatic lifting jack for **P50** probe

Order N°: **901.2011**

Input pressure is 2 to 3 bar (dry, filtered air). The jack does not affect the probe's measuring pressure.
The unit is fully sealed and requires no maintenance.

# 5 PNEUMATIC COMMAND UNITS D110(V) AND D111(V)

5.1 GENERAL DESCRIPTION

The pneumatic command units **D110/D111** or **D110V/D111V** (vacuum) are designed to work with the display units **D100S**. They can be mounted on the display unit by inserting the 4 plastic legs, or, for weight considerations, under the display unit. They can also be positioned separately away from the display unit, close to the probes.

- the **D110 / D110V** units allow the control of pneumatic/vacuum lifting of from 1 to 16 probes.

- the **D111 / D111V** pneumatic/vacuum extension units allows pneumatic/vacuum lifting of 16 additional probes.

A maximum of 1**D110 / V** and 3 **D111 / V** units can be connected to one **D100S**, allowing the pneumatic/vacuum command or a maximum of 64 probes.

The retraction and return motion of probes is commanded from D100S unit, i.e. by the **Clear** and **Enter** keys, or by means of the foot pedal. Remote command from a computer for pneumatic lifting is equally possible. Please note that all pneumatic lifters or vacuum probes are commanded simultaneously, so it is not possible to control each lifter separately.

5.2 REAR PANEL (D110 unit)
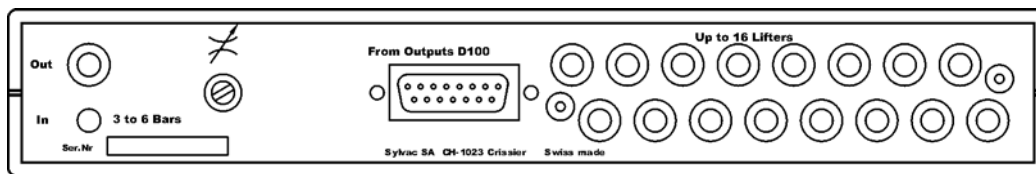
5.3 OPERATION OF D110 / D110V

1/ Connect the **D110** unit to the **D100S** unit ('Outputs' socket) by means of the 15 pin connecting cable.

2/ Connect from 1 to 16 lifters to the pneumatic outputs of the **D110**.Use the semi-flexible black PUR tube with an, outside diameter of 4mm and an inside diameter of 2.5 mm which is supplied with the pneumatic lifter. Unused sockets must have the red plastic plug which close the air outlet.

3/ Connect the air system at the point marked 'In' on the unit using the quick connector supplied and a tube with an outside diameter of 6 mm and an inside diameter of 4 mm. Filtered and dry air, 3 to 6 bars.

4/ Configure the **D100S**unit for lifting :
  - by means of the **Clear** and **Enter** keys : Set Up then Enter (refer to Section 1.6.2)

  -using the foot pedal (external contact) : **Clear** key then **Setup** key then 1 then 6 (*refer to Section 1.6.11*).

using the computer : this gives the UP order for lifting and DOW (DOWN) for the return motion (refer to Section 1.6.14 : remote command).

5/ Control the probe return speed by means of the microflow restrictor thumbscrew on the rear panel (can be locked by means of the locknut).

5.4 OPERATION OF D111 or D111V UNIT

1/ Configure the 1st **D110** / **D110V** unit as shown in section *5.3*.

2/ Connect the air supply Input market 'In' on the **D111 (V)** unit to the output marked 'Out' on the **D110 (V)** unit or the **D111** (V), using the air tube supplied with this unit.

3/ Connect from 1 to 16 lifters to the outputs of the **D111 (V**). The unused sockets must have the red plastic cap fitted.

4/ Adjust the speed of descent of the probes by means of the microflow restrictor on the **D110 (V)** unit.

The **D110 (V)** and **D111 (V)**units require no maintenance.

5.5 TECHNICAL SPECIFICATIONS

D110/D111 (V) units : :	Terblend plastic housing (= ASA+Polycarbonate : *refer to Section 1.12*)
Clip-on legs:	Polyurethane clip-on legs.
Front panel :	Polycarbonate front panel
Rear panel :	Varnished aluminium rear panel
Dregree of IP protection :	IP50 (according to IEC 529)
Weight of unit :	D110 900 g (2 lb)
	D110V 800 g (1.8 lb)
	D111 700 g (1.5 lb)
	D111V 700 g (1.5 lb)
Operating temperature :	beetween +5 and +40 °C
Storage temparature :	between -20 and +60 °C
Control:	electrically by display unit D100S
Air supply :	filtered and dry, pressure 3 to 6 bar.

Packaging in synthetic material includes :

1 D110 unit   (16 channels)   904.1110

or 1 D110V unit (16 vacuum channels)   904.1112

1 command connecting cable D100S - D110, length 2m50

1 quick connector for connection to air supply

16 plastic obturating caps

or 1 D111 unit (16 channels)   904.1111

or 1 D111V unit (16 vacuum channels)   904.1113

1 D110 - D111 linking air tube

16 plastic obturating caps

The air tube between the pneumatic unit – pneumatic lifters is supplied with pneumatic lifters.

5.6 ACCESSORIES

Order No

Plastic pipe in black PUR outside diameter 4mm,
Inside diameter 2 mm for 901.2010 connection, per meter   901.2012

Plastic pipe in black PUR outside diameter 6 mm,
inside diameter 4 mm for D110 connection, per meter   901.2013

Plastic pipe in black PUR couple 2x ø 4/2 mm   901.2014

Modifications reserved

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