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## D100S DISPLAY UNIT

### 1.1 GENERAL DESCRIPTION

The DIOOS unit displays the absolute displacement of the long-travel Sylvac probes P5, P10, P25, P50. Highest resolution is $0.1 \mu \mathrm{~m}$. 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 $230 \mathrm{~V}, 120 \mathrm{~V}$ or 100 V charging block is supplied with the unit.
By means of complementary multichannel units it is possible to connect from 2 to 64 probes to just one DIOOS unit and/or 2 to 16 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 D1 10 (vacuum unit D11OV) enables from 1 to 16 probes to be liffed. The maximum liffing capacity will be 64 probes using 3 additional units D 11 (D11lV for vacuum system).

### 1.2 FRONT OF UNIT




### 1.3 FUNCTION KEYS

### 1.3.1 Summary of functions:

: displays or removes analog scale.
: direct conversion mm/inch.
 : lock/unlock the mm/inch conversion.
: choice of the resolution:
0.1-0.01-0.001-0.0001mm or . $01-.001-.0001-.00001$ inch.
: displays statistical results of stored values. There are two choices: then


- displays classical statistics and, If tolerance mode is activated, pressing ENTER key will display capabilities and bar chart.
- display $\bar{X} / R$ control chart.

Press

: display or remove the classes <12 ...>

## Setup) then ${ }^{5}$ Class ) : choose the number of classes (2 to 6 ) and setup of limits for each class.

display or remove tolerances < = >

: display or remove the MIN, MAX, DELTA, MEAN first chosen by pressing SET UP and then Min/Max.


[^0]
: introduction of parameters or functions for the following keys: Start, Class, Tol, Clear or Enter, Min/Max, Setup, Preset, Store, Print, Scan and Channel. All these parameters will be stored affer unit has been switched off.

Seitup then ${ }^{2}$ Seitup : introduction of general parameters: function of the external contact, langurations (up to 12).
: display the Preset value (zero or any value)
${ }^{2}$ Setup then ${ }^{3}$ Preset $\begin{aligned} & \text { : introduction of a Preset value for the selected channel (for Preset zero, } \\ & \text { enter 0). }\end{aligned}$
: 2 functions are available: - hold display

- store value
 : program the store key for hold or store. Enter the number of channels to be stored, display or delete values in memory.
printout of the following: measure, values after scanning, statistics, memorized values on RS232 and Centronics outputs.

scan a preprogrammed number of channels and display part OK, rework or reject, according to the tolerances introduced for each channel.

Setup then ${ }^{ \pm}$Scan | : define the first and last channel of the scan; possibility to stop on one |
| :--- |
| or several channels |
| Onf | and $^{ \pm}$: activate/deactivate the step by step scan (stop on each channel).

: choice of one channel, a channel combination (A+/-B or A+/-B+/-C), the measuring direction
or a multiplication factor.

[^1]
: either proceed to preceding channel, adjust contrast or pneumatic descent When entering parameters: confirm numerical entry or proceed to following menu.

## Enter

: choice of Enter/Clear function: change channel, contrast adjustment or pneumatic descent


## Enter

 : unlock the keyboard if inhibited: either proceed to following channel, adjust contrast or pneumatic raise. Leave a menu without modification

## Setup then <br> Clear <br> choice of Enter/Clear function: change channel, contrast adjustment or pneumatic descent



## Clear

 : main reset of the unit (complete reinitialization of parameters): switch unit ON/OFF. All parameters will be stored after unit has been switched off.
: can be programmed for: - data transmission to Centronics/RS232 outputs

- hold/store
- new min/max
- preset
- change channels
- pneumatic lifting
- scanning
different combination of the above functions are also possible (up to $2 \times 30$ 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 Set Up 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 a black rectangle:

### 1.3.3 Entering numbers:

Numbers are entered as follows:

- The old numerical value will be displayed first.
- Should the key
be pressed before any other key has been activated, the program cycle will be set back without correcting the old value.
- Pressing the 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 signs 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


### 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. 1 minute before use.
3/ Connect one probe - 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 OptoRS instrument, use D104 unit (max 4).

5/ Switch on unit


When operating autonomously (without charger) the symbol cates the need to recharge the battery.
 appearing at the top right of the screen indiDuration of charge: minimum 15 hours.

This selection is memorized permanently by the unit(along with all other datas).
7/ Where necessary, convert from metric to imperial measurement by pressing


8/ Specify the readout resolution by pressing

9/ If required (refer to Section 1.6.3):

- reverse direction of probe measurement
- select diameter mode (*2) or any other multiplication factor
- 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 (refer to Section 1.8), or a computer or any other peripheral device to the RS-232-C input/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. electrovalve) on sort outputs (Section 1.8.3). It is possible to use a D1 10 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 with Set Up then Preset (Section 1.6.10).


The stored preset value may be entered

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 $\mathrm{mm} / \mathrm{inch}$ function can also be locked.

### 1.5. EXAMPLES OF OPERATIONS

## 1/ Simple measurements:



2/ Combined measurements A+/-B (using D102 or D108)


## 3/ Combined measurements $A+/-B+/-C$



4/ Multiplication factor (also available for $\mathrm{A}+/-\mathrm{B}$ and $\mathrm{A}+/-\mathrm{B}+/-\mathrm{C}$ combinations)

* Channe) then * Channes then multiplication factor (e.g. 0.33333)


## 5/ Measurements and checking tolerance limits

- Enter nominal value, the upper and the lower tolerances:

- Tol activates or deactivates the tolerance indicators.


## 6/ Measurements with classification (2 to 6 classes)



- Enter number of classes and then limits of classes using:


Class activates or deactivates the indicators.

## 7/ Statistics



## 8/ Combined measurements with scanning



### 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 D1 10 or D110V (choose between three functions by pressing Setup then Enter: refer to next page).
- Operating in Min/Max mode:
- Operating in Set Up input mode:
- Operating in Scanning mode:
- Operating in Stat mode:
- Operating in the Store mode:
clears the Min/Max memory before taking a new measurement. cancels an input value or cancels a chosen menu without alteration.
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.
returns to normal display.
erases last value(s), starting from last one.


### 1.6.2 ENTER KEY

- Operating in normal measuring mode: moves directly to preceding channel, adjust contrast or controls descent of probe with D1 10 or D110V.

Choose between following three functions:

The following menu will appear:


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.

Choise 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 D1 10 pneumatic command unit or the D1 10V 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:
- Operating in Scanning mode:
- Operating in Stat mode:
- Operating in Store mode:
confirms an input value or cancels a menu without alteration.
when the last measured values are displayed, Scan mode will be cancelled. Otherwise, the display will move successively forwards until it reaches the last values.
displays next values.
reactivates the values erased by Clear.


### 1.6.3 CHANNEL KEY

The DIOOS unit can command up to 64 channels. The use of D102/D108 units makes it possible to connect up to 64 P5, P10, P25 or P50 probes. Use of the D104 (for connecting RS232 instruments) is possible for up to 16 Opto-RS Sylvac instruments.

All the following functions are available for each channel independently:

- any Preset value
- specific tolerance limits
- normal mode, maximum mode, minimum mode, delta mode (max - min) or mean mode (max+min)/2
- storage of values
- measuring direction
- combination $\mathrm{A}+/-\mathrm{B}$ or $\mathrm{A}+/-\mathrm{B}+/-\mathrm{C}$
- any multiplication factor including diameter mode
- classification on 2 to 6 classes

Note: when using the display unit with only one probe (without additional accessory units D102/D108/D104), the same probe can be used for the 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 $\mathrm{A}+/-\mathrm{B}$ or $\mathrm{A}+/-\mathrm{B}+/-\mathrm{C}$ channel combinations, the active tolerances, preset, multiplication factor, measuring direction and so on will be those on channel $A$, i.e. the first channel.
a) selection of the measuring channel:

1/ press * Channel key CANAL appears as negative on the screen

2/ select number of required channel

3/ confirm by pressing
CHANNEL this time appears as positive on the screen $\longrightarrow$ end of input.
b) selection of channel immediately following:

1/ press
key, if it is configurated 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).
c) selection of the directly preceding channel:

1/ press Enter
key, if it is configurated for the channel selection

## d) 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, the arrow will indicate a positive measurement direction).

1/ press 2/ then

The arrow preceding the channel number changes its direction.
To reverse the direction, repeat the sequence.
e) radius/diameter mode, multiplication factor or measure on V base:

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


Special cases: factor $=1 \longrightarrow$ normal mode, no coefficient
factor $2 \longrightarrow$ diameter mode (read value will be twice the measured value)
factor $0 \longrightarrow$ the factor will be 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.
When in diameter mode, a channel cannot work in A+/-B or A+/-B+/-C mode. A P50 (50 mm) probe in diameter mode cannot work with a resolution greater than $0.1 \mu \mathrm{~m}$.
f) $(A+/-B)(A+/-B+/-C)$ measuring mode (any 2 or 3 channels may be combined):

1/ press


2/ select channel number $A(1-64)$

3/ presskey once for $A+B$, twice for $A-B$, and once again if you wish to return to $A+B$, etc.

4/ select channel number $B$ (1-64)

5/ press.

once for +C or twice for -C

6/ select channel number C (1-64)

7/ press

to confirm input

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


2/ enter the channel number A


## g) 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 multichannel 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 helpful 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.


The following will be displayed:

```
Attributions :
    1->1 2 
    4->4 5 5 5 6 > 6
```



```
10->10 11 -> 11 12 -> 12
13->13 14 -> 14 15 -> 15
16 -> 16 17 -> 17 18 -> 18
Chan. to change:
```


## Attributions :

```
\[
\begin{aligned}
& 1 \rightarrow 1 \quad 2 \rightarrow 2 \quad 3 \rightarrow 3 \\
& 4 \rightarrow 4 \quad 5 \rightarrow 5 \quad 6 \rightarrow 6 \\
& 7 \rightarrow 7 \quad 8 \rightarrow 8 \quad 9 \rightarrow 9 \\
& \begin{array}{l}
10 \rightarrow 1011 \rightarrow 1112 \rightarrow 12 \\
13 \rightarrow 1314 \rightarrow 1415 \rightarrow 15
\end{array} \\
& 16 \rightarrow 1617 \rightarrow 1718 \rightarrow 18 \\
& \text { Chan. to change: }
\end{aligned}
\]
```

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.

Following display will appear:

```
Attributions :
    1->1 2 - 2 3 > 3
    4->4 5 6 5 6 6
    7->7 8 品 9 9 9
10->10 11 -> 11 12 -> 12
13 -> 13 14 -> 14 15 -> 15
16 -> 16 17-> 17 18 -> 18
= Input : 2
```

4/ confirm input number with

## Enter

Following display will appear


- press 1 for analog probes
- press 2 for OptoRS instruments used with simplex cable (no adapter required) - press 3 for OptoRS 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, 16 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.

Example: using one D102 with 2 P10 probes for internal bore measurements. The first probe measures 3 kinds of bore 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 No. 1:
- Channels 4,5,6 and 7 are allocated to probe No. 2:

| $1 \longrightarrow 1$ | $2 \longrightarrow 1$ | $3 \longrightarrow 1$ |  |
| :--- | :--- | :--- | :--- |
| $4 \longrightarrow 2$ | $5 \longrightarrow 2$ | $6 \longrightarrow 2$ | $7 \longrightarrow 2$ |

- Channel 8 is allocated to input 8 of the RS232 simplex:
$8 — 8 R S$


### 1.6.4 RESOL KEY

Allows choice of resolution displayed and printed:


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).

Example: Resolution $=0.001 \mathrm{~mm} \longrightarrow 1$ dot of the analog scale $=0.001 \mathrm{~mm}$. As the analog scale features 100 points, a display of 0.1 mm can be achieved (analog scale also features auto ranging).

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

### 1.6.5 mm/Inch KEY

Alternates between metric (millimeter) and English (inch) display.
Locking mm/in conversion:


3/ Hold

switch down and switch


Unlocking conversion: repeat above operation.

### 1.6.6 ANALOG KEY

Displays or removes 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:

Example: 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 tolerance 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 :
112.864
25.970
316.004
$4 \quad 10.990$
$5 \quad 7.887$


### 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 dimension + 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 optocoupler output 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 ${ }^{2}$ selup
3 / then


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


The key
Clear allows you to quit the tolerances input.

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


The value is entered as described in Section 1.3.3. (Input of values).

5/ confirm by pressing


The following will be displayed:

CHANNEL $\uparrow 1$
Enter nominal size :
12.6 IN

Tol. + :
0.02 IN

6/ input of upper tolerance. If negative, must always be greater than the lower limit.

7/ confirm by pressing

The following will be displayed:


8/ enter the lower tolerance with its sign

9/ confirm by pressing

The following will be displayed:


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 "rectify" in scanning mode.

External measurement: measured value too big $\quad \rightarrow$ Rework measured value too small $\longrightarrow$ Reject
Internal measurement : measured value too small $\longrightarrow$ Rework measured value too big $\longrightarrow$ Reject
$11 /$ if the current channel number is smaller than the scanning number (refer to Section 1.6.13), the unit will display:


- Pressing Enter allows you to enter the nominal dimension and tolerances for the next channel, up to the last one.
- Pressing (clear return to measuring mode.

Once back in measuring mode, tolerance indicators corresponding to measured value is displayed. the tolerance indicators are erased. Pressing it 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 measured 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 ( $\mathrm{n}=2$ to 6 ).
$>$ Indicates measured value over the last class limit.
This information is also sent to the corresponding optocoupler for external command purposes (refer to Section 1.8.3)

- Input of classes:


The following will be displayed:


3 enter the required number of classes, minimum 2 and maximum 6 ( 1 class is equivalent to tolerance mode).

4/ then enter the lower limit of class 1, e.g. 12.4 mm . Numerical values are entered as described in Section 1.3.3.
$5 /$ enter the upper limit of class $1, ~ e . g . ~ 12.6 \mathrm{~mm}$.
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 to 12.6 mm , the 2 nd class is from 12.6 to 12.8 mm , etc. Measured values under the lower limit, e.g. 12.4 will be shown by the symbol $<$, measured values over the upper limit, e.g. 12.8, by the symbol $>$.

By pressing
Class the graphic symbols will be cancelled.

Pressing
 again displays them again, with the parameters and

### 1.6.9 STAT KEY

Allows two types of statistical results to be displayed:
Choice of display:

$1=$ display of classical statistics and bar chart
2 = display of $\bar{X} / R$ control charts

These are the measured values, stored in memory using the Store key (refer to Store key in 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 $\bar{X} / R$ cards may be printed in 80 columns (refer to Print key in Section 1.6.14).

## First choice: bar chart

1/ Press key Stat. Following display will appear:

$\mathrm{N}=$ number of stored values $=$ used for statistical analysis
Xmax = maximum stored value
$X \min =$ minimum stored value
$\mathrm{R}=$ Range $=$ Xmax -Xmin
$\bar{X}=$ mean value $=\frac{\sum_{i=1}^{N} x_{i}}{N}$
$\sigma($ sigma $)=$ standard deviation $=\sqrt{\frac{\sum_{i=1}^{N}\left(x_{i}-\bar{x}\right)^{2}}{N}}$
$s=$ standard deviation $=$ standard deviation of population based on a sample $\sqrt{\frac{\sum_{i=1}^{N}\left(x_{i}-\bar{x}\right)^{2}}{N-1}}$ key allows statistical results to be printed via the Centronics or RS232 according to the selected format. It is also possible to press Print 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


Exit statistics mode with


Following display:

| $-3 \sigma$ | $=9.994$ |
| :--- | :--- |
| $+3 \sigma$ | $=10.006$ |
| $-N G$ | $=1$ |
| $+N G$ | $=0$ |
| $\% D E F$ | $=0.893$ |
| Cp | $=1.3311$ |
| Cpk | $=1.3102$ |
| Cm | $=1.3252$ |
| Cmk | $=1.3068$ |

$-3 \sigma=\bar{X}-3 \sigma=$ lower regulation or intervention limit
$+3 \sigma=\bar{X}+3 \sigma=$ 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 $=\frac{(-\mathrm{NG})+(+\mathrm{NG})}{\mathrm{N}} \times 100$
$\mathrm{Cp}=$ process capability $=\frac{\mathrm{T} \text { sup }-\mathrm{T} \text { inf }}{6 \sigma}$
$\mathrm{Cm}=$ machine capability $=\frac{\mathrm{T} \text { sup }-\mathrm{T} \text { inf }}{6 \mathrm{~s}}$ 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 $\frac{T \text { sup }-\bar{X}}{3 \mathrm{~s}}$ and $\frac{\bar{X}-T \text { inf }}{3 \mathrm{~s}}$

Cpk $=$ process capability in relation to spec mean $=$ the smaller value of $\frac{\mathrm{T} \text { sup }-\overline{\mathrm{X}}}{3 \sigma}$ and $\frac{\overline{\mathrm{X}}-\mathrm{T} \text { inf }}{3 \sigma}$
Cmk/Cpk will formulate capability in a manner that indicates shifts (skewing) in the mean of the distribution away from the midpoint:

Good Cmk/Cpk:


Poor Cmk/Cpk:


Cp >= 1.33 corresponds to a capable process
Note: some users require a $\mathrm{Cp}>=1.66$ which corresponds to 10 .
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 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 tolerance limit) and the upper limit by ULT (upper tolerance limit).
Values outside tolerances limits are displayed with a grey cell beside each tolerance.
$\mathrm{N}=$ total number of stored values. $\quad$ width $=$ cell width of histogram.
Histogram printing is available in 40 or 80 column output formats.

## 2nd choice: $\bar{X} / R$ 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 The $\bar{X}$ chart appears:


A Value greater than upper control limit.
V Value less than lower control limit UCL: Upper control limit $=\overline{\bar{X}}+A 2 \bar{R}$, with $A 2=0.577$ for $n=5$
LCL: Lower control limit $=\overline{\bar{X}}-A 2 \bar{R}$, with $A 2=0.577$ for $n=5$ $===$ : Target value

2/ Press
 exit from charts display)

The R chart reappears


UCL: Upper limit $=D 4 \bar{R}$, with $D 4=2.114$ for $n=5$
LCL: Lower limit $=D 3 \bar{R}$, with $D 3=0$ for $n=5$

To print, press

(only in 80 column format)

To return to $\bar{X}$ card, press

To exit, press


### 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:


CHANNEL $\uparrow 1$
Enter preset value :
0.000 IN

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 0 then


The

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:
Yes $\rightarrow$ ENTER

```
    No ->> CLEAR
```

```
    No ->> CLEAR
```


exit preset input mode.

Enter 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
 then


In scanning mode: simply press


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 ( ${ }^{\uparrow}$ Clear $\left.+\begin{array}{c}\text { On } \\ \text { Off }\end{array}\right)$ ), 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, Set Up, Preset, Store, Print, Scan and Channel. The input of parameters is explained with each corresponding function key. Input of general parameters of unit:


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
```

3.1/ 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.
3.1.1/ Transmission of values through the RS 232C and Centronics outputs according to the parameters specified for the Print function. Each time the foot pedal is pressed, the measured 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 functions 5 (change channels), 6 (D1 10 command), 7 (scanning) can be combined as well.

3: Min/Max initialization. Alternately, pressing the foot pedal initializes Min and Max registers and pressing it again sends the measured value. 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 D1 10 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 $36000=1 \mathrm{sec}$ to 10 hours). Function 7 (start scanning) can be combined as well. The first time the pedal is pressed the probes will be liffed, the second time they will go down, scanning starts (after the delay, if any) and 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
3.1.2/ Display hold or store. According to the store key function (Set Up 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: together with channel change.
6: alternately with probe lifting control using D1 10 unit. Start scanning can also be combined as a third function.
7: start scanning
3.1.3/ In Min/Max mode: reinitialize maximum and minimum registers, same function as key mode. Function 5 (channel change) can be combined.
in min/max
3.1.4/ Preset of display at each external contact. Can be combined alternately with start scanning.
3.1.5/ 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 .
3.1.6/ Command for pneumatic unit D110. Pressing the foot pedal liffs the probes connected to D 110 . 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.
3.1.7/ 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 ( $0 \mathrm{sec}=$ 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.
3.2/ External contact 2 function: all functions explained in Section 3.1 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).
3.3/ 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.
3.4/ 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
3.5/ Activate/deactivate sound release of keyboard and exceed tolerance limit function.
3.6/ Date/time input: adjusting permanent clock: Year - Month - Day - Hour and Minutes.

Used for printing results, control chart and unit calibration.
3.7/ Configuration: All unit configuration parameters (tolerances, presets, setups...) can be stored or recalled:

Give backup file number, then

Insert name of file, in letters and numbers, max. six characters (allows for more efficient file management).
The Channel key switches form numerical to alphabetic input and back.

Up to 12 complete configurations may be stored.

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

NB:- - the Store memory is not saved.

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

then
- the MEM? And MEMR remote command allow for the same operation a PC using link RS232.

Program DIOOSRS 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 OptoRS 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:


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: $\quad$ 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
 et Clear keys have a special function:
(clear $=$ Set Min/Max registers to the current measuring value. All new Min/Max values start from this point.

$$
(\text { Enter })=\text { Change the displayed value: Maximum --> Minimum --> Difference --> Mean --> Maximum... }
$$

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

A new measurement of the camshaft will now display a maximum value of $10,000 \mathrm{~mm}$.
It is possible to combine A +/- B mode with Min/Max mode (refer to Section 1.6.3). Channel A or channel B or 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 measurement is taken first, then by pressing ENTER, 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 optocouplers (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 multichannel units D102/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 units. If required, connect a foot pedal or another external contact to start scanning. A pneumatic unit D1 10 or D110V vacuum can also be used for liffing the probes.


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 the 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 contact 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 (SET UP - STORE - 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 the foot pedal.
10/ Enter the channels working in the $A+/-B, A+/-B+/-C$ 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 $A+/-B$ mode.
11/ Choose the resolution of the display. The lower the resolution, the faster the scanning will be.
Using $0.0001 \mathrm{~mm} / 0.00001^{1 ": ~ a p p r o x . ~} 2$ measurements/sec.
Using $0.001 \mathrm{~mm} / 0.0001^{1 ": ~ a p p r o x . ~} 3$ measurements/sec.
Using $0.01 \mathrm{~mm} / 0.001 \mathrm{l}: \quad$ approx. 5 measurements/sec.
Using $0.1 \mathrm{~mm} / 0.01^{\prime \prime}: \quad$ 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 workpiece to be measured and when the probes are in the measuring posi-


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

12.402
follow $\rightarrow$ ENTER
or external contact

Take a minimum measurement on channel 4 and then press foot pedal. In the case of a wrong measurement, the surement to be taken.

key or

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

```
PIECE 1 :
```



Sequential workpieces numbered: from 1 to max 65000.
General indication for the measured workpiece from indicator 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 $\mathrm{A}+/-\mathrm{B}$ 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. Workpiece numbering is done automatically (from 1 to n pieces). For 40 or 80 column printing format, it is also possible to enter an alpha-numerical identification of each scanned workpiece (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 value 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 $\downarrow$ 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 $\uparrow$ disappears), pressing the key again allows you to exit scanning mode.

Prints measured values of channels 1 to $n$ through the RS232 and Centronics outputs, according to the selected Print format (refer to Section 1.6.14).

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).

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 channels scanned). Once the statistics of this channel have been read, the next channel can follow by pressing Enter $\longrightarrow$ yes or Clear $\longrightarrow$ no. Statistical results may be printed by pressing the Print key.

Same as normal mode: selects the resolution.
Unit configuration: refer to Section 1.6.11. Setup then Store: asks for channel number for stored values (Choice $0 \longrightarrow$ print all channels).

Automatic Preset of channels to scan $\longrightarrow>$ new presetting with a master piece.
Display individual analog scale (40 points) for each channel. Indicates centering of each measure to tolerances.

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:


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 ASCll character OUT1, and OUT2 to stop this function. The transmission speed for each channel will be as follows:

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

Step by step scanning is possible (stop on each channel). ENTER or the footpedal will have to be pressed to start again. To activate this function:

1/Switch off unit On $_{\text {Oif }}$ 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.
$\mathbf{P}$ 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 RS232 transmission parameters and Centronics/RS-232-C output format:


The following will be displayed:


The 1st menu sets RS-232-C transmission parameters.

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

## 2.1/ 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 and 19200 bps.

By pressing the
 key the preceding menu will be displayed.

By pressing the
 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 IBM PC or compatible select CR only.

## 2.2/ Peripheral choice, the following menu will appear:



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:

| SIGN | $10^{2}$ | $10^{1}$ | $10^{0}$ | DP | $10^{-1}$ | $10^{-2}$ | $10^{-3}$ | $10^{-4}$ | CR | LF |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| or $10^{3}$ |  |  |  |  |  |  |  |  |  |  |

$=$ space if positive sign $\quad \mathrm{DP}=$ decimal point

$$
10^{2} \text { et } 10^{1}=\text { space if zero }
$$

The sign always immediately precedes the 1 st digit.

## b/ In inch:

$$
\begin{array}{llllllllll}
\text { SIGN } 10^{1} & 10^{0} & \text { DP } & 10^{-1} & 10^{-2} & 10^{-3} \quad 10^{-4} \quad 10^{-5} \quad \mathrm{CR} \quad \text { LF } \\
10^{1} \text { = space if zero }
\end{array}
$$

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

5. < = number of measured workpiece followed by < (reject), = (good) or > (rework) if TOL active.
$10.002=$ measured value of channel 1
20.002
12.003
7.999 to channel $n$.
$+C R(+L F)$ 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:

| CHANNEL 1 |  |
| :--- | :---: |
| N 28 |  |
| Xmax | 10.004 |
| Xmin | 9.998 |
| R | 0.006 |
| Xbar | 10.000 |
| Sigma | 0.0017 |
| S | 0.0017 |
| -3S | 9.995 |
| $+3 S$ | 10.005 |

$=$ Channel No. for which statistics are transmitted
the statistical values are transmitted in the same order as they appear on the screen
(refer to Section 1.6.9). The histogram is not transmitted

| －NG | 7 |
| :--- | ---: |
| ＋NG | 6 |
| \％DEF | 46.428 |
| Cp | 0.2986 |
| Cpk | 0.2450 |
| Cm | 0.2932 |
| Cmk | 0.2290 |

2．2．2／Format for 80 column printer：for A4 printers，i．e．Centronics（standard PC link cable）．
If a header is required，the unit will ask for company name and will then switch to alpha－numerical input mode，as shown below：


Press ${ }^{\uparrow}$ Clear 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 dis－ play 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 Continue to input letters and figures and confirm the word thus entered with

In the case of an error，press $\square$ and restart．

The $\square$ key allows you to switch from alphabetic to numerical input and back：


The keys are also represented graphically．It is possible to insert a blank space （．．．）．

Continue inserting different letters and numbers and confirm the word entered by


Example：in alpha mode， 1 st depression of key $7 \longrightarrow$ selects letter $A, 2$ nd depression $\longrightarrow$ selects lefter B，3rd depres－ sion $\longrightarrow$ return to letter A，and so on．．．Confirm letter with Enter key．

When company name is entered，the unit asks for：
－drawing number
－workstation
－workpiece identification：－at heading
－at each printing．This allows each measured workpiece 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．

To print header again: press

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:

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

c/ printing of statistical values with tolerances active (printing therefore of 2nd statistical display and histogram) and with complete header. After printing, the unit will ask if you wish to print stored values, as in the example below. If the stored values are printed, the unit will then request whether they should be kept ( $\longrightarrow$ press ENTER) or if they should be erased from memory of the channel in operation ( $->$ press CLEAR):

SYLVAC SA

| Piece ident. | SHAFT |
| :--- | :--- | :--- |
| Drawing nbr | $:$ PM230.010.412 |
| Work station | $:$ L 201 |$\quad$|  |  |
| :--- | :--- |
| 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 |


|  |  | 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 |

d/ printing example of $\bar{X} / R$ control chart

SYLVAC SA

| Piece ident. : SHAFT |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Drawing nbr : PM230.010.412 |  |  |  |  |
| Work station : L 201 |  |  |  |  |
| Date : 12/11/1998 |  |  | Time | 14:43 |

CHANNEL 1
Cp 0.9560
Cpk
0.7647
S
0.0052

| 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |




| 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

2.2.3/ Output format for 40 column printer: for small printers with a paper width of approx. 80 to 120 mm .

Printing time per line may be entered, as small printers offen 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:

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

| SYLVAC SA |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Piece ident. : SHAFT |  |  |  |  |
| 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 |  | $\mathrm{I}=$ |
| 4 | 7.010 | 0.010 |  | $\mathrm{E}=$ |

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

| SYLVAC SA |  |
| :--- | :--- |
| Piece ident. $:$ SHAFT |  |
| Drawing nbr $: \quad$ PM230.010.412 |  |
| Work station $: \quad$ L 201 |  |
| Date : 12/11/1998 $\quad$ 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 |  |  |


2.2.4/ Format for 15 column printer: for small portable printers, battery or accumulator powered (e.g. EDP5000 or SPI).
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 and the measurement is printed:
$1 \quad 9.716$
$2+3 \quad 15.434$
$\mathrm{b} /$ in scanning mode, the following is printed (in tolerance mode, the difference between the nominal dimension and the measurement is printed):
WORKPIECE 4 <

1. $\quad 9.716$
2. 12.54
3. 2.008
c/ printing of statistical values: as per computer format but with the possible addition of stored values.
$\mathrm{d} /$ printing of stored values: they are preceded by the store number (figure from 1 to N ):
4. 9.999
5. 9.998
6. 10.002
7. 10.000

3/ Remote command of DIOOS unit: practically all the functions of he DIOOS unit are remote controllable from a computer through input RS232, according to the following general method:

- the first 3 lefters of functions are used for the 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 0 ).

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:

- PRI or ? or P (PRINT) = print out of the displayed value. In scanning mode: output of scanned values.
- CHA+ (CHANNEL) = selects positive measuring direction of the indicated channel.
- CHA- = selects reverse video measuring direction of the indicated channel.
- CHA3
- CHA-2
- CHA $+1-2+$
- CHA*2
- СНА* ${ }^{1}$
- CHA* 1.5
- CHA? or CHA PRI
- CHA2 $=1$
- CHAl=1RS
- PRE (PRESET)
- PRE 123.4567
- PRE ? or PRE PRI


## = selects channel 3 .

$=$ selects channel 2 , reverse video measuring direction.
$=$ selects channel 1 minus channel 2 , both channels with positive measuring direction.
= establishes diameter function of the selected channel.
$=$ establishes radius function (normal) of the selected channel.
$=1.5$ multiplication factor
$=$ identifies the direction of measurement ( $+/$-) followed by the active channel.
$=$ channel 2 assigned to probe 1
$=$ channel 1 assigned to RS232 on input 1
$=$ displays the stored preset value.
$=$ memorize and display preset value.
$=$ unit sends memorized preset value.

- MM = selects metric unit.
- IN
- RES $1 \quad=$ selects resolution of 0.0001 mm or 0.00001 IN .
- RES2 $\quad=$ selects resolution of 0.001 mm or 0.0001 IN .
- RES3 $\quad=$ selects resolution of 0.01 mm or 0.001 IN .
- RES4 $\quad=$ selects resolution of 0.1 mm or 0.01 IN .
- ANAO or ANA OFF
- ANAI or ANA ON
- TOLO
- TOL1
- TOL 10.20 .1 -. 05 I
- TOL? $\quad=$ output of memorized tolerances values: for example $10.0000 .005-0.003 \mathrm{E}$.
- CLAO = no display of class indicators.
- CLA1 = displays class indicators.
- CLA3 $12.112 .212 .312 .4=$ input of 3 classes, lower limit of class 1 is 12.1 , 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?
- MAX
- MIN
- DEL
- MEA
- CLE
- ENT
- NOR
- MOD?
- STO
- STO4
- STOO
- STO?
- STOI?
- STO RST
- STO 3 RST
- STA?
- STA2?
- SCA
- SCA 21
- SCA2 6
- SCA?
- ENT
- CLE
$=$ output of memorized class values.
$=$ selects max function.
= selects min function.
$=$ selects delta function (max $-\min$ ).
$=$ selects mean function ( $\max +\min / 2$ ).
= re-initializes min/max registers when unit is in max, min, delta or mean modes.
= displays in succession Max - Min - Delta - Mean... in Min/Max mode.
= re-establishes normal measuring function.
= the unit sends its measuring mode: NOR, MAX, MIN, DEL or MEA.
$=$ 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.
$=$ gives the number of channels for storage, starting with channel 1 . Here, 4 channels are reserved for storage $\longrightarrow 1500$ measurements per channel. Reinitializes the Store memory.
= Removes Hold from the display.
$=$ the unit outputs stored values for current channel, from 1 st stored value to the last.
= outputs stored values of channel 1 .
$=$ reset complete store memory.
$=$ reset store memory of channel 3 .
= the unit outputs statistical analysis of current channel.
$=$ outputs statistical analysis of channel 2.
= initiates scanning.
$=$ sets number of channels to be scanned, here 21.
= initializes scanning from channel 2 to channel 6 and starts scanning.
$=$ the unit returns the stored number of channels to scan.
= has the same function as the Enter key in scanning mode (D100S displays next table or quit scanning mode).
= has the same function than Clear key in scanning mode (D100S displays preceding table or quit scanning mode).
- KEYO
- KEYI
- RST = general reset of the unit (return to initial status).
- SET? = the unit transmits general parameters:

Note: STOO/1 indicates if hold function is active or not.

- MEMR
- DIS BLA...BLA...
- EXT 0
- EXT 1
- EXT 2
- EXT 3
- EXT 4
- EXT 5
- EXT 6
- EXT 7
- EXT 8
- EXT 9
- EXT 10
- EXT 11
- EXT 12
- EXT 13
- EXT 14
- EXT 15
- EXT 16
- EXT 17
- EXT 18
- EXT 19
- EXT 20
- EXT 21
- EXT 22
- EXT 23
- EXT 24
- EXT 25
- EXT 26
- EXT 27
- EXT 28
- EXT 29
- EXT ?

|  | MM | RES 1 | ANA 0 | TOL 0 | CLA O | STO 0 | KEY O |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| or | IN | 2 | 1 | 1 | 1 | 1 | 1 |

- MEM? $\quad=$ requests memory configuration of unit. All 5000 parameters are transmitted in one block, without Xon/Xoff protocol, at 9600 bps, 8 bits, no parity.
= keyboard locked.
$=$ keyboard unlocked.
= restores memory configuration of unit, same transmission parameters as above.
$=$ displays a 20 characters max message on the first line of the DIOOS display. The end of message is given by CR (Carriage Return). This message is cleared by pressing any key on DIOOS unit or by sending DIS only followed by CR.
= allocates data transmission function to external contact (foot pedal). Refer to Section 1.6.11.
= display hold or store.
$=$ reset Min/Max registers.
$=$ preset display.
= change of channels.
= D1 10 command.
= start scanning.
= status transmitted automatically.
= status transmitted on request.
$=$ transmission of values + display hold or store.
= new Min/Max then transmission of values.
$=$ preset then transmission of values.
$=$ transmission of values + change channels.
= D1 10 command then transmission of values.
= start scanning then transmission of values.
= D1 10 command then start scanning and transmission of values.
$=$ D1 10 command then start scanning.
= new Min/Max then store or hold.
$=$ preset then store or hold.
$=$ store + change channels.
= D1 10 command then store or hold.
= start scanning then store.
= D1 10 command then start scanning then store.
$=$ store/hold + print + scanning.
= new Min/Max (if necessary) then store/hold and change channel.
= new Min/Max then print + change channel.
= new Min/Max then change channel.
$=$ print + store + change channel.
= D1 10 command then print and store.
$=$ preset then scanning.
$=$ 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 ).
$=$ retraction of probes using $\mathrm{D} 110 / \mathrm{D} 110 \mathrm{~V}$.
- DOW
$=$ return motion of probes using $\mathrm{D} 110 / \mathrm{D} 110 \mathrm{~V}$.
- OUT 1
= activates automatic output of values:
- in normal measurement mode:
each displayed value is also transmitted to RS232 output.
In this case, the transmission speed at 9600 bauds is:
in $0.0001 \mathrm{~mm} / 0.00001 \quad \mathrm{~N}=3$ trans. per sec.
in $0.001 \mathrm{~mm} / 0.000 \quad 1 \quad \quad \mathrm{~N}=7$ trans. per sec.
in $0.01 \mathrm{~mm} / 0.001 \quad \mathbb{N}=12$ trans. per sec.
in $0.1 \mathrm{~mm} / 0.01 \quad \mathbb{N}=13$ 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 $0.0001 \mathrm{~mm} / 0.00001 \quad \mathrm{IN}=2$ trans. per sec.
in $0.001 \mathrm{~mm} / 0.0001 \quad \mathrm{~N}=3$ trans. per sec.
in $0.01 \mathrm{~mm} / 0.001 \quad \mathrm{IN}=4$ trans. per sec.
in $0.1 \mathrm{~mm} / 0.01 \quad \mathrm{IN}=4$ trans. per sec.
- OUT 0
- IDE or ID?
= disables this mode.
= identification of instrument --> the unit responds "SYLVAC DIOOS date V1.0" (V1.0 = firmware version)

Errors codes transmitted by the D100S unit:

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

4/ Programming on an IBM PC or compatible computer
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 DIOOS unit.

Basic (QBASIC), supplied with all PCs, is the most simple language to use. Below are 2 examples of programs 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 of computer and the following transmission parameters: 4800 bauds, even parity, 7 bits/car., 1 stop bit. CS inhibits time-out control of CTS line (Clear to Send), DS for DSR line (Data Set Ready) and CD for CD line (Carrier Detect).
30 IF INKEY\$ <> "" THEN 80
program stops if any key is pressed
40 IF LOC(1) $=0$ THEN 30
50 LINE INPUT\#1, A\$
wait if RS232 input buffer is empty
inputs one complete line up to $C R$
60 PRINT A\$
displays value transmitted by DIOOS
70 GOTO 30
80 END
ready for new entry
b/ remote command of D100S unit:

10 CLS
20 OPEN"COM 1: 4800, E,7, 1, CS, DS, CD" AS\#1
30 PRINT" Input command word"

40 INPUT B\$

50 PRINT\#1, B\$
60 IF LOC(1) > 1 THEN 100
70 K\$ = INKEY\$
80 IF K\$ = CHR\$(13) THEN 130
90 IK K\$ = "" THEN 60 ELSE 30
100 LINE INPUT\#1, A\$
110 PRINT AS displays eventual response from D100S
120 GOTO 70
130 END
enters word for remote command of D100S (e.g. PRI for transmitting a value)
outputs command word through RS232 port waits for any response from D100S unit
program stopped by pressing Enter key pressing another key allows output of a new command word
ready for new input

For transmission of 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 RS232 buffer of the computer exceeds a given stated limit, e.g. 200 bytes (capacity is 255 bytes), the computer stops transmission by sending Xoff ( $=$ ASCll code $19=$ CHRS(19)). When the computer is ready for a new input, it will transmit Xon (= ASClI codel7 = CHR\$(17)).

Pinout of RS232 and Centronics connectors: refer to Sections 1.8.1. and 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 the 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 functions (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, followed 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.
Choice of Store key function:


Following will be displayed:

```
1 : display
2 : erase value(s)
3: " the channel
4 : " all channels
5: number of chan.
n MAX = 6000
```

1: 1 st 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.
$\mathrm{N}=\mathrm{O}$ : Hold function is active.

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


Pressing the ${ }^{\uparrow}$ 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/Centroics 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 $\rightarrow$ press Enter
- erase stored values for current channel $\longrightarrow$ press Clear

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 DIOOS units are calibrated at the factory. However if a recalibration is required, proceed as follows:

1/ Attach a P5, P10, P25 or P50 probe to a vertical support.
2/ Select a resolution of $0.0001 \mathrm{~mm} / 0.00001 \mathrm{in}$.
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 P5, between 0.7 \& 0.8 mm
- for P10, between $0.4 \& 0.5 \mathrm{~mm}$
- for P25, between $0.8 \& 0.9 \mathrm{~mm}$
- for P50, between $1.0 \& 1.2 \mathrm{~mm}$

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


The date of the last calibration is shown.
6/ Place probe on reference base (value 0). Press
7/ Insert 5 mm test block for the P5, a 10 mm for the P10, a 25 mm for the P25 and a 50 mm for the P50.

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

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 $1.4 \mu \mathrm{~m}$ :


2/ Same instruments, but with correction of 10 points (every 2.5 mm ) max. error $0.7 \mu \mathrm{~m}$ :


Introduction of correction: probe out to probe in.
1/ Switch off unit DIOOS.
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 point is the probe travel stroke, approx. 0.8 mm for a P25. Confirm by pressing

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

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
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 $8.5 \mathrm{~V} / 300 \mathrm{~mA}$ non-regulated (current limit protection). Output only with charger connected.
Pin 2: $\quad$ RXD $=$ RS-232-C output when Print key or foot pedal (if configured) is pressed, or by remote command.
Pin 3: $\quad$ TXD $=$ RS-232-C input for remote command from computer.
Pin 4: DTR (Data Terminal Ready): not used.
Pin 5: $\quad \mathbf{S G}=$ Signal ground .
Pin 6: $\quad$ DSR (Data Set Ready) $=$ not used.
Pin 7.8: Unconnected.
Pin 9: $\quad 6$ to $7 \mathrm{~V} / 150 \mathrm{~mA}$ accumulator output, non-regulated (current limitation).
To configure the RS-232-C transmission parameters, press ${ }^{2}$ (setup) then (rint (refer to "PRINT key" Section 1.6.14).

### 1.8.2 RS232 input instrument (OptoRS simplex or duplex)

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


Pin 1: Charger output $8.5 \mathrm{~V} / 300 \mathrm{~mA}$.
Pin 2: $\quad$ TXD $=$ RS-232-C input from connected OptoRS instrument.
Pin 3: RXD = RS-232-C output for OptoRS 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: $\quad \mathbf{S G}=$ Signal ground.
Pin 6: not connected.
Pin 7: $\quad$ CTS (Clear to Send) $=$ positive supply for OptoRS simplex instruments or negative for duplex.
Pin 8: not connected
Pin 9: $\quad 6$ to $7 \mathrm{~V} / 150 \mathrm{~mA}$ 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

key is pressed, this output is set to mid-range, i.e.: to 2.5 V if the voltage ranges from 0 to 5 V or to OV 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 $\mathbf{2 0 ~ m V}$ on the analog output ( 19.5 mV precisely, i.e. $5 \mathrm{~V} / 256$ ). The effective range on the analog output therefore depends on the selected resolution:

| for 0.0001 mm | range from $+/-0.0127 \mathrm{~mm}$ with a speed of: | 3 measurements/sec. |
| :---: | :---: | :---: |
| for 0.001 mm | : range from + - 0.127 m |  |
| for 0.01 mm | : range from $+/-1.27 \mathrm{~mm}$ | 12 |
| for 0.1 mm | : range from + /- 12.7 mm | 15 |
| for 0.00001 in | : range from +/- 0.00127 in , speed same as | 0.0001 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 $+/-100 \mathrm{mV}$. 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 to +2.5 V
- if connected to 1 (ground) $=$ range from 0 to +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 Pins $4,5,6,7$ and $12,13,14,15$ : optocoupled outputs for sort or pneumatic lifting commands (D1 10). Depending on which mode is active, the outputs have the following functions:

| Mode: | Tolerance | Classification | Scanning | D110 (pneumatic lifiting) |
| :--- | :--- | :--- | :--- | :--- |
| Pin4 | $<$ | $<$ | 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 |
| Pin 12 | not used | class 4 good | not used | lifting command |
| Pin 13 | not used | class 5 good | not used | lowering command |
| Pin 14 | not used | class 6 good | not used | lifting command |
| Pin 15 | $>$ | $>$ | RECTIFY |  |

Notes:

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

Pin 8: Common for 8 optocoupler outputs.


Max voltage $=30 \mathrm{~V}$, max current $=60 \mathrm{~mA}$ per output.
The optocoupler 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 (electrovalve, relay, solenoid, etc...).

Pin 10: 8.5V/300 mA output, non-regulated (protected), only if charger is fitted.
Pin 11: 6 to 7V/150 mA output, non-regulated (protected).

### 1.8.4 Centronics Output: parallel printer link

25-pin D-sub female connector (external view)


Pin 1: $\quad$ Strobe = output signal which validates data D1 to D8
Pins 2 to 9: $\quad$ data outputs D 1 to D8
Pin 11:
Pins 18 to 25:
Busy $=$ input signal indicating if printer is ready to receive data.
signal ground
Pins 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 contact 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):


### 1.8.8 Probe input

Probe input or for linking cable for multichannel Unit D102 or D108.
For best connection, screw the plug into the socket.

### 1.8.9 Command output

Socket for command cable used with multichannel unit D102, D104 or D108.

### 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.



### 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):


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 baud, 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:

```
ERR 3
```

    OUT OF MEMORY
    enter one key
eine Taste drücken
presser une touche

### 1.9.4 Software version

The software version may be displayed as follows:

1/ switch the unit off


2/ press 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.
$\uparrow \quad$ Indicates pneumatic lifting or possibility of moving to previous table in Scanning mode.
$\downarrow \quad$ 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 mins. autonomy remaining.

### 1.10 REPLACING THE LITHIUM MODULE

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 possible to use unit DIOOS 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 your 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 lifespan is approx. 4 years).

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

- Obłain 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:

Dimensions:

The stand is adjustable:

Degree of IP protection:
Weight of unit:
in terblend plastic (= ASA + polycarbonate):

- resistant to alcohol, glycols, most oils and greases, diluted acids and water.
- non-resistant to aromatic hydrocarbons, esters, ethers, ketones, concentrated mineral acids, ammonia gas and its dilutions.

Polyester front panel.
Aluminum varnish rear panel.
Flat keyboard with metal dome tactile response.
Width 227 mm , depth 132 mm , height 77 mm without stand (87 mm with stand).
vertical or inclined at $13^{\circ}$.
A complementary base (supplied with the unit) allows an inclination of $35^{\circ}$.

IP50 (according to IEC 529)
$1.3 \mathrm{~kg}(2.9 \mathrm{lb})$

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

| Probe type | D100S error | Probe error | Mean error |
| :--- | :--- | :--- | :--- |
| P5 | $1.0 \mu \mathrm{~m}$ | $2.0 \mu \mathrm{~m}$ | $2.2 \mu \mathrm{~m}$ |
| P10 | $1.2 \mu \mathrm{~m}$ | $1.0 \mu \mathrm{~m}$ | $1.6 \mu \mathrm{~m}$ |
| P25 | $1.5 \mu \mathrm{~m}$ | $1.5 \mu \mathrm{~m}$ | $2.1 \mu \mathrm{~m}$ |
| P50 | $3 \mu \mathrm{~m}$ | $4 \mu \mathrm{~m}$ | $5 \mu \mathrm{~m}$ |

Repeatability (+/- 2s):

Operating temperature:
Storage temperature:
Measuring frequency:

- for P5: $0.3 \mu \mathrm{~m}$
- for P10: $0.2 \mu \mathrm{~m}$
- for P25: $0.2 \mu \mathrm{~m}$
- for P50: $0.4 \mu \mathrm{~m}$
between $+5^{\circ}$ and $+40^{\circ} \mathrm{C}$
between $-20^{\circ}$ and $+45^{\circ} \mathrm{C}$
probe in
- for P10 between 170 and 205 measurements per sec.
- for 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 $0.00001 \mathrm{in}: \quad$ 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 there is no filtering and thus maximum conversion speed is obtained.

Display:
LCD, STN type (Super Twisted Nematics) graphics $128 \times 64$ dots.Viewing area $66 \times 33 \mathrm{~mm}$. CCFL backlighting.

Outputs:

Inputs:

Charger:

Data back-up:
Autonomy:

Charge:

Self discharge of accumulators:

Lifetime of accumulators:

### 1.13 DELIVERY

Packaging in synthetic material

- D100S unit (with accumulator)
- 1 charger
- 1 foot pedal for external contact
- 1 base (to increase incline)
- 1 instruction manual
- analog 0 to 5 V or -2.5 to +2.5 V , output current: max 10 mA . Voltage error: +/- 4 \% max. 0 position: +/- 100 mV .
- absolute analog 6 to 10 V with a P10, 0 to 10 V with a P25/P50
- optocoupled output signals for sort and for pneumatic unit D1 10 command.
- Centronics port for link with printer.
- RS-232-C port for linking to computer or printer.
- command for optional multichannel unit D102/D104/D108
- 2 external contacts, e.g. supplied foot pedal
- RS-232-C port for remote command from a computer
- country specific, supplied in one of the following 4 types:
- European standard plug $230 \mathrm{~V}+/-10 \% 50-60 \mathrm{~Hz}$
- US standard plug 120V +/- $10 \% 50-60 \mathrm{~Hz}$ or for Japan: $100 \mathrm{~V}+/-10 \%$ $50-60 \mathrm{~Hz}$
- UK standard plug 240V +/- $10 \% 50-60 \mathrm{~Hz}$

For all 4 models: output $8.5 \mathrm{~V} / 700 \mathrm{~mA}$

Lithium module 3 V 175 mAh Renata type 175-OB. Lifetime approx. 10 years. approx. 8 hrs NB. Autonomy is reduced at higher working temperatures. At $40^{\circ}$ autonomy is reduced by $70 \%$ compared to $25^{\circ} \mathrm{C}$.

15 hrs. minimum. The charger can be connected permanently without damaging the accumulators.
loss of $30 \%$ of accumulator capacity per month. Do not leave accumulators completely uncharged.
approx. 4-5 years.
$\begin{array}{ll}\text { European } 230 \mathrm{~V} & 904.4010 \\ \text { UK } 240 \mathrm{~V} & 904.4011 \\ \text { US 120 V } & 904.4012 \\ \text { Japanese 100 V } & 904.4013\end{array}$
904.4101

### 1.14 ACCESSORIES

|  | Order No |
| :---: | :---: |
| - Sylvac SP1 printer | 926.1807 |
| - Connecting cables for: - parallel printer (Centronics) | 925.5630 |
| - PC AT computer (Dsub 9p cable socket), 3m length | 925.5609 |
| - same as above but length 2 m | 925.5608 |
| Adapters $\quad-9 \mathrm{M} / 25 \mathrm{M}$ adapter for computers with 25 pin female connector | 925.5626 |
| - 9M/9M adapter for computer with 9 pin female connector | 925.5627 |
| - Battery pack (accumulators): | 331.010 |
| - Lithium module | 331.005 |

## 2 MULTICHANNEL UNITS: 2 CHANNELS (D102) \& 8 CHANNELS (D108)

### 2.1 GENERAL DESCRIPTION

The D102 and 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 can equally be positioned separately away from the display unit, close to the probes.

- the D102 unit allows connection of 2 probes on a D100S unit (usually for differential measurement).
- 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 indications 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/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 ' and ' 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 the D100S, input 2 to channel 2 , etc.

4/ If several D102/D108 units are being used, 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 channels 1 to 8 , the next unit corresponds to channels 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 the scanning function. These functions are explained in detail in Section 1.6.

### 2.4 TECHNICAL SPECIFICATIONS

| D102/D108 units: | Housing in Terblend plastic (= ASA + Polycarbonate: refer to characteristics <br> described in Section 1.12). <br> Polyurethane clip-on legs. <br> Aluminum and polycarbonate sheet front and rear panels. |
| :--- | :--- |
| Degree of IP protection: | IP 50 (according to IEC 529) |
| Weight of unit: | D102 0.45 kg |
|  | D108 0.5 kg |
| Possible measuring error: | max $1 \mu \mathrm{~m}$ (this error can be reduced by recalibrating the D100S unit) |
| Operating temperature: | between $+5^{\circ}$ and $+40^{\circ} \mathrm{C}$ |
| Storage temperature: | between $-20^{\circ}$ and $+60^{\circ} \mathrm{C}$ |
| 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 DIOOS, or, by connecting several D104 units in parallel, up to 16 instruments. The D100S unit automatically reads the values measured by the Sylvac RS232 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 TO 1 DIOOS 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/output of the first D104 unit is connected to the 'RS232' input/output of the second D104 by means of the 9p. male cable supplied. It is also necessary to connect the 'Out' output of the first D104 to the 'In' input of 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 DIOOS 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

Terblend plastic housing (= ASA+Polycarbonate: refer to characteristics in Section 1.12).

Polyurethane legs with clip-on attachment.
Aluminum and polycarbonate film front panel, varnished aluminum rear panel.
IP degree of protection:

## Weight of unit:

Operating temperature:
Storage temperature:
Power supply: IP50 (according to IEC 529)
$0.5 \mathrm{~kg}(1.1 \mathrm{lb})$
between $+5^{\circ}$ and $+40^{\circ} \mathrm{C}$
between $-20^{\circ}$ and $+60^{\circ} \mathrm{C}$
via D100S unit

Synthetic material packaging includes:

- 1 D104 unit

Order number
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 ACCESSORIES

Order number

- RS232 9M-9M connecting cable length 2 m 50
- Connection control cable length $2 m 50$
925.5602


## 4 SYLVAC PROBES 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.
P5 (L) : probe with effective measuring range of 5 mm . L indicates right-angled output cable.
P5 (L) V: as above, but intended for vacuum lifting.
P10 : probe with effective measuring range of 10 mm
P10 L : as above but with output cable at a right angle
P25 : effective measuring range 25 mm
P50 : effective measuring range 50 mm
Different lifting methods are available for the various probes:

- by photocable
- by foot pedal and cable
- by pneumatic lifter: D1 10 unit
- by vacuum, P5 only: D1 10V 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 object to be measured. Ideally, a mechanical retracting liffer 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 outermost 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 P5 model: the cable is connected to the probe by means of a sealed connector.


### 4.5 TECHNICAL SPECIFICATIONS

| SPECIFICATIONS | CODE NUMBERS |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | P5(L) / P5(L) V | P10 / P10L | P25 | P50 |
| Construction | Plunger gage | Plunger gage | Plunger gage | Plunger gage |
| Type of bearing for measuring plunger | Friction bearing | Friction bearing | Friction bearing | Friction bearing |
| Moving mass ( without measuring contact ) | $3.2 \mathrm{~g} / 0.11 \mathrm{oz}$ | $3.2 \mathrm{~g} / 0.11 \mathrm{oz}$ | $8.7 \mathrm{~g} / 0.31 \mathrm{oz}$ | $14.6 \mathrm{~g} / 0.51 \mathrm{oz}$ |
| LINEAR MEASURING RANGE | $5 \mathrm{~mm} / 0.2^{\prime \prime}$ | $10 \mathrm{~mm} / 0.44^{\prime \prime}$ | $25 \mathrm{~mm} / 1^{\prime \prime}$ | $50 \mathrm{~mm} / 2^{\prime \prime}$ |
| Total range | $6.5 \mathrm{~mm} / 0.26^{\prime \prime}$ | 10.8 mm / 0.43' | 25.8 mm / 1.02' | $52 . .2$ mm / $2.06{ }^{\prime \prime}$ |
| Limit of travel |  |  |  |  |
| - upper stop <br> - lower stop | $\begin{aligned} & 5.7 \mathrm{~mm} / 0.22 \\ & 0.7-0.8 \mathrm{~mm} \end{aligned}$ | $0.4-0.5 \mathrm{~mm}$ | $\begin{aligned} & 25.8 \mathrm{~mm} / 1.0 \text { 1 } \\ & 0.8-0.9 \mathrm{~mm} \end{aligned}$ | $1.0-1.2 \mathrm{~mm}$ |
| Accuracy over the measuring range | $2 \mathrm{um} / 0.00008{ }^{\prime \prime}$ | $1 \mathrm{um} / 0.00004{ }^{\prime \prime}$ | 1.5 um / 0.00006' | $4 \mathrm{um} \mathrm{/} 0.00016$ |
| Measuring force | 0.45-0.65 N | 0.6-0.9 N | 0.6-1.2 N | 0.6-1.4 N |
| - without pressure | - | 0.1 N | 0.15 N | - |
| - low pressure | 0.3-0.5 N | 0.2-0.4 N | 0.2-0.4 N | - |
| - high pressure <br> (Tolerance +/- 15\%) | 0.75-1.05 N | 0.8-1.8 N | 0.8-1.8 N | - |
| Increase of measuring force | $0.04 \mathrm{~N} / \mathrm{mm}$ | $0.03 \mathrm{~N} / \mathrm{mm}$ | $0.024 \mathrm{~N} / \mathrm{mm}$ | $0.016 \mathrm{~N} / \mathrm{mm}$ |
| Permissible lateral force | 0.7 N | 0.6 N | 0.3 N | 0.25 N |
| Repetability | 0.3 um/0.000012' | $0.2 \mathrm{um} / 0.000008^{\prime \prime}$ | $0.2 \mathrm{um} / 0.000008^{\prime \prime}$ | 0.4 um/0.000016' |
| Zero drift | 0.01 um/deg. Cmm | 0.02 um/deg.Cmm | 0.01 um/deg.Cmm | 0.01 um/deg.Cmm |
| Protection according to IEC529 <br> - with rubber boot | IP64 | IP40 IP50 | IP40 IP50 | $\begin{aligned} & \text { IP40 } \\ & \text { IP50 } \end{aligned}$ |
| Lifting lever | Vacuum | Pneumatic lifter | Pneumatic lifter | Pneumatic lifter |
| Temperature range |  |  | $50 \mathrm{deg} . \mathrm{C}$ |  |
| Cable length |  |  | 50 / 59" |  |
| Extension cables |  |  | 0 $20 \mathrm{~m} / 787^{\prime \prime}$ |  |
| Direct cable special length |  |  | 0 $20 \mathrm{~m} / 787^{\prime \prime}$ |  |
| Interchangeable measuring contact |  |  |  |  |

Accuracy using extension cables:
These measuring errors are applicable only when using D100S or D101 units without recalibration:

| Normal cable | + extension up to 5 m | : additional error | $1.5 \mu \mathrm{~m}$ approx. |
| :--- | :--- | :--- | :--- |
| Normal cable | + extension up to 10 m | : additional error | $3 \mu \mathrm{~m}$ approx. |
| Normal cable | + extension up to 15 m | : additional error | $6 \mu \mathrm{~m}$ approx. |
| Normal cable | + extension up to 25 m | : additional error | $8 \mu \mathrm{~m}$ approx. |

Direct cable up to $5 \mathrm{~m} \quad$ : additional error $3 \mu \mathrm{~m}$ approx.

Direct cable up to 10 m : additional error $6 \mu \mathrm{~m}$ approx.
Direct cable up to 15 m : additional error $10 \mu \mathrm{~m}$ approx.
This is a progressive error margin and recalibration of D100S unit can considerably reduce the error.

### 4.6 ACCESSORIES

Standard measuring tip with 2 mm diameter ball (supplied with each probe)
Order No: 905.2204


Ordinary comparator tips, with standard M2.5 thread, may be attached to Sylvac probes.
Rubber boot set for P10 and P10L
Order No 901.2003
Rubber boot set for P25 (19 mm travel)
Order No 901. 2004

Lever with photocable, for P, P10 and P25 probes: Order No 901.2005
For P50 probe
Order No 901. 2006


Pneumatic lifting jack:

- for P10 and P25 probes, mounted on 12 mm diameter. Lifting stroke 30 mm

Order No 901.2010

- for P50 probes (dimensions in brackets). Lifting stroke 55 mm

Order No 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 AND D111 or VACUUM D110V and D111V

### 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 D 110 N and 3 D 111 N units can be connected to one D100S, allowing the pneumatic/vacuum command of a maximum of 64 probes.

The retraction and return motion of probes is commanded from the D100S unit, i.e. by the keys or by means of the foot pedal. Remote command from a computer for pneumatic

Clear and
 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 (D1 10 unit)



### 5.3 OPERATION OF DIIO UNIT

1/ Connect the D1 10 unit to the D100S unit ("Output" socket) by means of the 15 pin connecting cable.
2/ Connect from 1 to 16 lifters to the pneumatic outputs of the D1 10 unit. Use the semi-flexible black PUR tube with an outside diameter of 4 mm 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 bar.
4/ Configure the D100S unit for liffing:

- by means of the ${ }^{\uparrow}$ Clear and Enter keys: Set Up then Enter (refer to Section 1.6.2).
- using the foot pedal (external contact):
- 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 DIIIV UNIT

1/ Configure the 1st D110/D110V unit as shown in Section 5.3.
2/ Connect the air supply input marked 'In' on the D D 1 l (V) unit to the output marked 'Out' on the D 10 (V) unit or the D1 11 (V) using the air tube supplied with this unit.

3/ Connect from 1 to 16 lifters to the outputs of the D11 (V) unit. The unused sockets must have the red plastic cap filted.
4/ Adjust the speed of descent of the probes by means of the microflow restrictor on the D110 (V) unit.

The $\mathrm{D} 110(\mathrm{~V})$ and $\mathrm{D} 111(\mathrm{~V})$ units require no maintenance.

### 5.5 TECHNICAL SPECIFICATIONS

Dllo/Dו1 (V) units:
Terblend plastic housing (= ASA+Polycarbonate: refer to characteristics described in Section 1.12).

Polyurethane clip-on legs.
Polycarbonate front panel,
varnished aluminum rear panel.

Degree of IP protection: IP 50 (according to IEC 529)

Weight of unit:

- D110 $0.9 \mathrm{~kg}(2 \mathrm{lb})$
- D1 10V 0.8 kg (1.8 lb)
- D111 0.7 kg ( 1.5 lb )
- D111V 0.7 kg ( 1.5 lb )

Operating temperature: $\quad$ Between $+5^{\circ}$ and $+40^{\circ} \mathrm{C}$
Storage temperature: $\quad$ Between $-20^{\circ}$ and $+60^{\circ} \mathrm{C}$

Control: electrically by display unit DIOOS
Air supply:
filtered and dry, pressure 3 to 6 bar.

Packaging in synthetic material includes:

Order No

- 1 D1 10 unit ( 16 channels)
904.1110
- or 1 D1 10V unit (16 vacuum channels)
904.1112
with:
- 1 command connecting cable D100S - D110, length $2 m 50$
- 1 quick connector for connection to air supply
- 16 plastic obturating caps
- or 1 D1 11 unit ( 16 channels)
904.1111
- or 1 D1 11 V unit (16 vacuum channels)
904.1113
with:
- 1 D110-D1 11 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 4 mm , inside diameter 2 mm for 901.2010 connection, per meter
901.2012

Plastic pipe in black PUR outside diameter 6 mm , inside diameter 4mm for D1 10 connection, per meter 901.2013
Plastic pipe in black PUR couble $2 x$ diameter $4 / 2$
901.2014

Modifications reserved.


[^0]:    Enter : in MIN/MAX mode: display successively Min, Max, Delta, Mean.

[^1]:    SetUp then
    
    : allocate a probe to a specific channel, specify an OptoRS simplex or duplex channel.

