SYL 802 - Indicator and Measuring Probe

EN

Sylvac Calibration Standard – SYL 802 – Indicators and Measuring Probes

This standard is based on ISO 13102

1. REFERENCE CONDITIONS

1.1. Standards

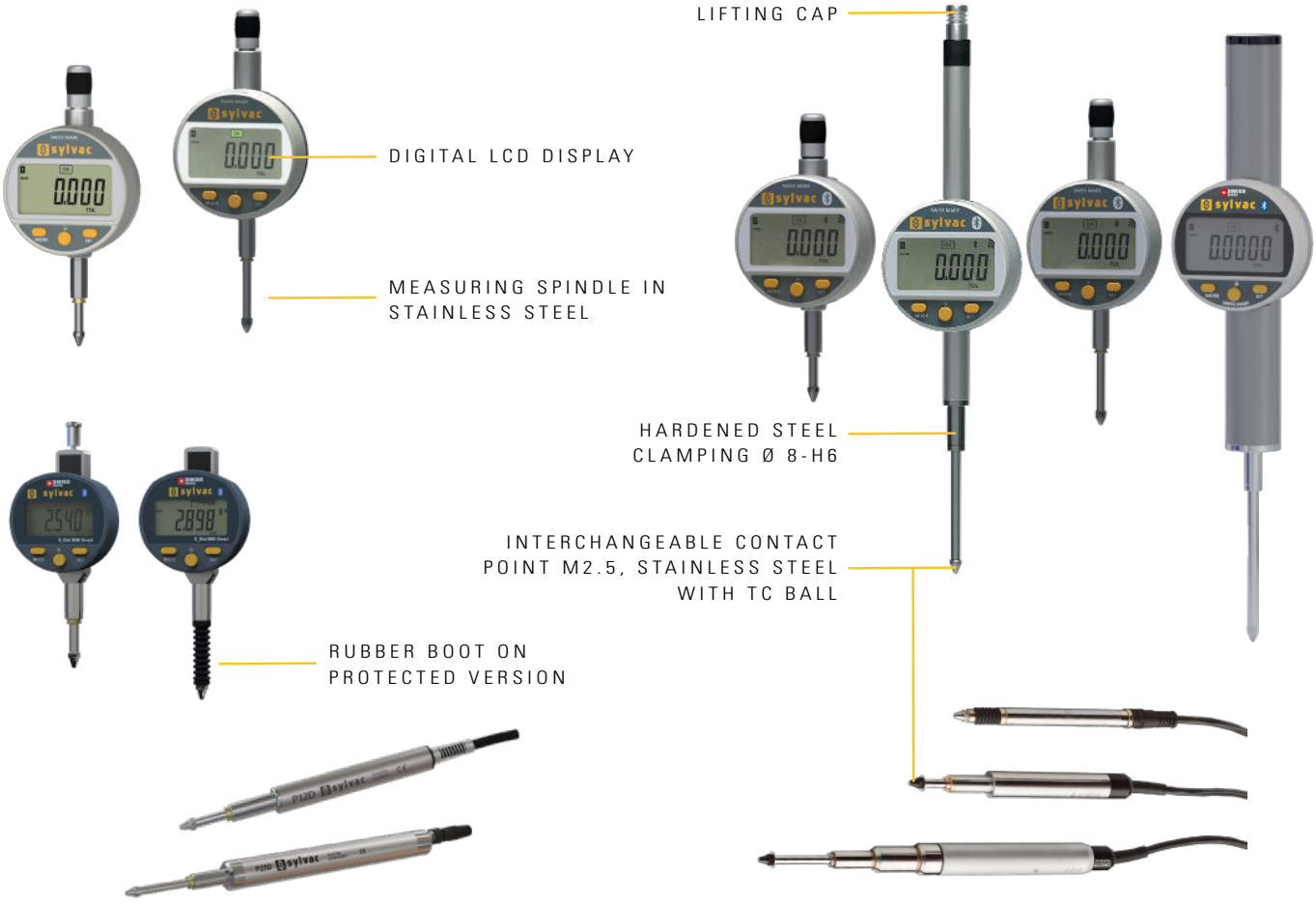
- A high-precision vertical calibration bench (Sylvac M3) or a vertical LASER calibration bench.
- Computer equipment with calibration software (Sycopro).
- A reference display unit (for all probes except the P12D and P25D series).
- A set of gauge blocks.
- A vertical measuring stand with a granite or ceramic table.
- A force probe (or a precision balance).

We guarantee that our standards are recorded and managed in accordance with our ISO 9001 quality management system. The calibration chain is ensured, and its traceability is recognized by the Federal Institute of Metrology (METAS).

1.2. Ambient Conditions for Calibration

- The reference temperature is 20°C.
- The maximum temperature variation in the room (Δ max) is 1°C over a 6-hour period.

2. FUNCTIONAL DIAGRAM



3. INSTRUMENT CHECKS

3.1. Preparation and Cleaning

- Basic check: instrument integrity, value display, spindle movement, condition and tightness of the measuring tip. If out of service, repair or recycle as appropriate.
- Clean the exterior with a soft cloth. Usable solvents: mild detergent, isopropyl alcohol (except on the display screen), light petroleum. For intensive use, lubricate the spindle with a drop of petroleum or fine watchmaker's oil.
- Verify the suitability and validity of the calibration standard.
- Store the instrument under calibration ambient conditions for at least 5 hours prior to measurement (thermal stabilization).

3.2. Visual Inspection

- Check that the instrument shows no impact marks, corrosion, or excessive wear.
- Verify that the identification and/or serial number is clearly visible.
- For dial indicators, check the display, number of digits, measurement range, and counting direction.
- For probes, the probe cable must be free from defects (cuts, etc.).

3.3. Functional Check

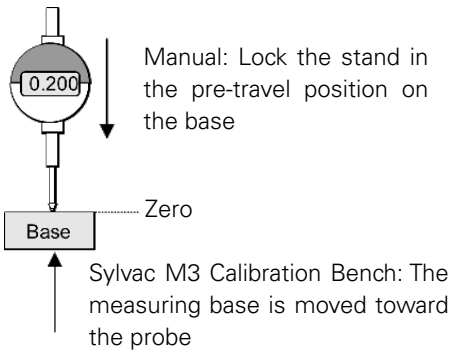
- Check smooth movement of the dial indicator spindle over the entire range (no sticking points).
- Verify the operation of the electronic buttons (on/off, zero, mode).
- Check display stability. Maximum deviation of 1 digit over 10 seconds.
- Verify data output by connecting the instrument to a PC or a Sylvac display.

3.4. Pre-Travel Before Zero Setting

Pre-travel sets the starting position for measurements. Instrument fixed on its stand.
Manual method: Move the spindle to the pre-travel value by lowering the instrument onto the measuring base.
Automated method: The driven measuring base contacts the instrument tip (as soon as the instrument display moves) and advances by the defined pre-travel distance.

Zero Setting in Pre-Travel Position: Press SET on the instrument and the standard, or use the calibration software.

Instrument	Pre-race
Indicator	0.2mm
Digital probe: P12D – P25D	0.2mm
Capacitive probe: P5 – P10 – P25	0.5mm



4. CALIBRATION SPECIFICATIONS

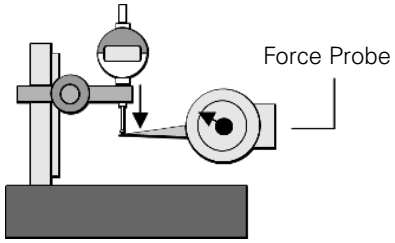
4.1 Measuring Force

The measuring force is a design specification and is not checked during calibration. If verification is required, it can be performed as follows:

- Mount the instrument vertically on a stand.
- Allow the measuring spindle to lower onto the force probe, with the spindle pointing downward.
- Perform this measurement at the beginning and at the end of the effective measuring range.

Table 4.1.1 Force tolerance: ±20%

	Standard	Low	High	Protected
MINI 12.5	0.5 – 0.9 N	0.35 – 0.5 N	1.8 – 2.3 N	0.6 – 1.3 N
12.5	0.65 – 0.9 N	0.4 – 0.55 N	1.0 – 1.6 N	0.7 – 1.4 N
25	0.65 – 1.15 N	0.45 – 0.9 N	0.9 – 1.8 N	0.65 – 1.8 N
50	1.1 – 2.6 N	-	-	0.9 -2.8 N
100	1.8 – 3.8 N	-	-	-
150	2.6 – 5.7 N	-	-	-
PRO 25	0.75 – 1.0 N	0.3 N	-	-
PRO 50	0.85 – 1.2 N	0.4 N	-	-
PRO 100	0.9 – 1.3 N	-	-	-
P12D HR	0.2-0.3 N	0.08 N	-	-
P12D	0.4-0.8 N	0.2-0.3 N	-	-
P25D	0.7-1.3 N	0.15 N	-	-
P5	0.5 – 0.9 N	0.3 – 0.65 N	0.80 – 1.40 N	-
P10	0.60 – 0.80 N	0.20 – 0.25 N	0.70 - 1.50 N	0.70 - 1.25 N
P25	0.60 - 1.0 N	0.20 – 0.30 N	0.70 – 1.60 N	0.65 – 1.40 N



4.2 Maximum Permissible Indication Error (Full and Partial)

On a Sylvac M3 vertical calibration bench, the instrument and the standard are mounted opposite each other, in contact with the two faces of a movable parallel base (gauge block).

4.2.1. The maximum permissible indication error consists mainly of a full measurement error (total error over the entire effective measuring range of the instrument) and a partial (according to ISO 13102) or local measurement error (over 1 mm).

The maximum permissible error is the largest deviation among the measurement errors (Δ max), including the first point considered as the zero error. If necessary, the full and partial errors may be checked separately.

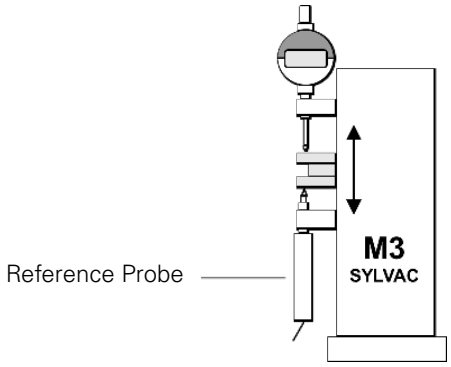
4.2.2. Verification of the full maximum permissible indication error (MPE E) on a calibration bench (Sylvac M3 type).

The goal is to measure distances that are not exact multiples of 1 mm, distributed across the effective range:

- Mount the instrument and set the pre-travel (see 3.4).
- Perform zero setting on both the instrument and the standard (SET).
- Carry out "upward travel" measurements, range, and measurement steps according to Table 4.2.2.1.
- Calculate the maximum deviation between measurement errors (Δ max).
- Tolerances according to Table 4.6.

Table 4.2.2.1

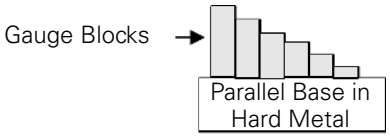
Race	Measurements on a calibration bench
5mm	0 to 5 mm, in 0.5 mm increments
10mm	0 to 10 mm, in 1.0 mm increments
12.5mm	0 to 12.7 mm, in 1.27 mm increments
25mm	0 to 25.4 mm, in 2.54 mm increments
50mm	0 to 50.8 mm, in 5.08 mm increments
100mm	0 to 101.6 mm, in 10.16 mm increments
150mm	0 to 152.4 mm, in 15.24 mm increments



4.2.3. Verification of the Full Maximum Permissible Indication Error (MPE E) Using Gauge Blocks

If a vertical measuring bench is not available, the verification is performed using gauge blocks:

- The instrument to be calibrated is mounted vertically on a measuring stand with a marble or ceramic table.
- If possible, place the gauge blocks on a precision parallel base made of tungsten carbide. Handling the gauge blocks increases measurement uncertainty — use cotton gloves.
- Ensure the cleanliness of the gauge block surfaces and the measuring tip.
- Set the pre-travel (see 3.4).
- Perform zero setting of the instrument (SET).
- Carry out measurements using gauge blocks.
- Calculate the maximum deviation between measurement errors (Δ max).
- Tolerances according to Table 4.6.



4.2.4. Verification of Local and/or Partial Maximum Permissible Indication Error (MPE P) on a Vertical Calibration Bench (Sylvac M3 type)

The same method as for the full maximum permissible indication error (MPE E) according to 4.2.2 is applied. Calculate the maximum error minus the minimum error (Δ max of errors, first measurement point = 0). Tolerances according to Table 4.6:

4.2.4.1. Verification of Local Indication Error (over 1 sensor step)

Measure every 0.1 mm over a 1 mm distance, at the start of the travel or around the highest error. Perform 11 measurements (including the starting point).

4.2.4.2. Verification of Partial Indication Error, According to ISO 13102 (MPE P)

11 measurements distributed over a range of 50× the resolution; range 0.5 mm for 0.01 mm resolution; range 0.05 mm for 0.001 mm resolution or according to specifications, at the start of the travel or around the highest error.

As standard, we measure the local error, which provides a more representative error of actual conditions.

4.3. Repeatability (MPE R) :

Repeatability is a design specification and is not checked during calibration. If verification is required, it can be performed as follows:

- Take 5 successive measurements on a gauge block (similar to 4.2.3) or on a Sylvac M3 calibration bench (similar to 4.2.2). Ensure that each measurement is repeated identically, in the direction of increasing travel.
- Calculate the range of the measurement results.
- Tolerances according to Table 4.6.

4.4 Indication Error Hysteresis (MPE H):

Hysteresis is the difference in measurement of the same height in upward and downward travel on a measuring bench (Sylvac M3 type).

The measuring scale of Sylvac probes and dial indicators is fixed on the spindle, and the electronic sensor measures the displacement of the measuring rod directly. Therefore, the hysteresis error is equal to the repeatability error.

Hysteresis verification can be performed as follows:

- Calibrate according to method 4.2.2, performing both upward and downward travels.
- For each identical measurement point, calculate the difference between the upward and downward readings.
- Tolerances according to Table 4.6.

Note: Positioning errors of the measurement point may introduce a rounding error related to the display resolution.

4.5 Pairing a Capacitive Probe P5, P10, or P25 with a Display Unit

- To reduce the measurement error of a capacitive probe, it can be paired with its display unit. This process consists of defining a correction curve in the unit with a maximum of 25 points distributed over the full travel of the probe and specifying a correction for each point.
- Points can be entered via software or manually, depending on the display unit's characteristics (see the display unit manual).
- To issue a calibration certificate after pairing, increase the zero pre-travel to verify measurements outside the corrected points.

IMPORTANT :

- Never use the probe outside its corrected range (below the starting point or above the last correction point) as errors may be significant.
- Do not connect any probe other than the one paired with the display unit.

4.6 Calibration Tolerances

Table 4.6.1 Metrological specifications for sylvac retractable-stylus indicators with digital display

Indicator	Maximum indication error (MPE E)[1] based on resolution			Local error max. 1 mm[2]	Partial error max. (MPE P)[3]	Repeatability (MPE R) & Hysteresis (MPE H)
	0.01	0.001	0.0001			
S_Dial MINI 12.5mm	14 µm	4 µm	-	0.01 : 10 µm 0.001 : 3.2 µm	0.01 : 10 µm 0.001 : 1.8 µm	0.01 : 5 µm 0.001: 2 µm
S_Dial Work BASIC / PLC 12.5mm	14 µm	4 µm	-	0.01 : 10 µm 0.001 : 3.2 µm	0.01 : 10 µm 0.001 :1.8 µm	0.01 : 5 µm 0.001: 1.4 µm
S_Dial Work BASIC / PLC 25 mm	14 µm	5 µm	-	0.01 : 10 µm 0.001 : 3.2 µm	0.01 : 10 µm 0.001 :1.8 µm	0.01 : 5 µm 0.001: 1.4 µm
S_Dial Work BASIC 50 mm	24 µm	7 µm	-	0.01 : 10 µm 0.001 : 3.2 µm	0.01 : 10 µm 0.001 :1.8 µm	0.01 : 5 µm 0.001: 2 µm
S_Dial WORK ADVANCED / SMART / ANALOG / CBG 12.5mm	14 µm	3 µm	3 µm	0.01 : 10 µm 0.001 : 2.2 µm 0.0001 : 2.2 µm	0.01 : 10 µm 0.001 :1.6 µm 0.0001 : 1.0 µm	0.01 : 5 µm 0.001: 1.4 µm 0.0001 : 0.8 µm
S_Dial WORK ADVANCED / SMART / ANALOG / CBG 25mm	14 µm	4 µm	4 µm	0.01 : 10 µm 0.001 : 2.2 µm 0.0001 : 2.2 µm	0.01 : 10 µm 0.001 :1.6 µm 0.0001 : 1.0 µm	0.01 : 5 µm 0.001: 1.4 µm 0.0001 : 0.8 µm
S_Dial WORK ADVANCED / SMART 50mm	24 µm	5 µm	-	0.01 : 10 µm 0.001 : 3 µm	0.01 : 10 µm 0.001 :1.6 µm	0.01 : 5 µm 0.001: 2 µm
S_Dial WORK ADVANCED / SMART 100mm	24 µm	6 µm	-	0.01 : 10 µm 0.001 : 3.4 µm	0.01 : 10 µm 0.001 :1.8 µm	0.01 : 5 µm 0.001: 2 µm
S_Dial WORK ADVANCED 150mm	24 µm	10 µm	-	0.01 : 10 µm 0.001 : 4 µm	0.01 : 10 µm 0.001 :2.0 µm	0.01 : 5 µm 0.001: 2 µm
S_Dial Work NANO 12.5 mm	-	-	1.2 µm	0.6 µm	0.34 µm	0.3 µm
S_Dial Work NANO 25 mm	-	-	1.6 µm	0.6 µm	0.34 µm	0.3 µm
S_Dial PRO 25 mm	-	-	1.0 µm	0.5 µm	0.30 µm	0.2 µm
S_Dial PRO 50 mm	-	-	1.2 µm	0.5 µm	0.30 µm	0.2 µm
S_Dial PRO 100 mm	-	-	1.8 µm	0.6 µm	0.34 µm	0.2 µm

Table 4.6.2 Metrological specifications for Sylvac digital absolute probes with retractable rod

Probe	Maximum display error (MPE E)[1]		Local error on a specific range	Partial error max. (MPE P) Range 0.025 mm	Repeatability (MPE R) & Hysteresis (MPE H)
	0.000 1	0.000 01			
P12D HR	-	0.6 µm	0.38 µm by 0.125 mm	0.24 µm	0.08 µm
P12D Standard	1 µm	-	0.55 µm by 0.52 mm	0.30 µm	0.20 µm
P12D WORK	1.6 µm	-	0.65 µm by 0.36 mm	0.34 µm	0.20 µm
P25D	-	0.8 µm	0.34 µm by 0.095 mm	0.24 µm	0.08 µm
P25D HR	-	0.6 µm	0.28 µm by 0.095 mm	0.20 µm	0.08 µm

Tableau 4.6.3 Metrological specifications for Sylvac retractable-probe capacitive sensors

Probe	Maximum indication error (MPE E)	Max. factory error when connected to the reference display unit[4]	Max. error (with display unit and paired probe)
P2B	1.5 µm	0.8 µm	0.5 µm
P5 / P5B	1.6 µm	1.0 µm	0.6 µm
P10 / P10S	1.6 µm	1.0 µm	0.6 µm
P25 / P25S	1.9 µm	1.2 µm	0.8 µm

[1]Maximum indication error (MPE E) is the maximum deviation of the measurement error between the lowest and highest points of the error curve (Δ max of errors).

[2]The maximum local error corresponds to the error of a single sensor step (measured every 0.1 mm over 1 mm). Calculated as maximum error minus minimum error (Δ max of errors).

[3]The maximum partial error (MPE P) corresponds to the maximum error of 11 measurements spread over a range of 50 times the resolution; range 0.5 mm for 0.01 mm resolution; range 0.05 mm for 0.001 mm resolution; range of 0.025 mm for a resolution of <0.001 mm. First measurement point = error 0. Calculated as maximum error minus minimum error (Δ max of errors).

[4]The "calibration" display unit is specifically selected for the factory calibration of Sylvac capacitive probes.

5. RESULT AND DECISION

- Issue a calibration certificate.
- If the measurement conditions are not met, the instrument will either be repaired and recalibrated, or decommissioned or recycled; in the event of repair, an incident is logged.
- Note that for an instrument with 1/100 resolution, in the case of random positioning of the retracting rod, the rounding error can add 4.5 µm of error to the measurement.