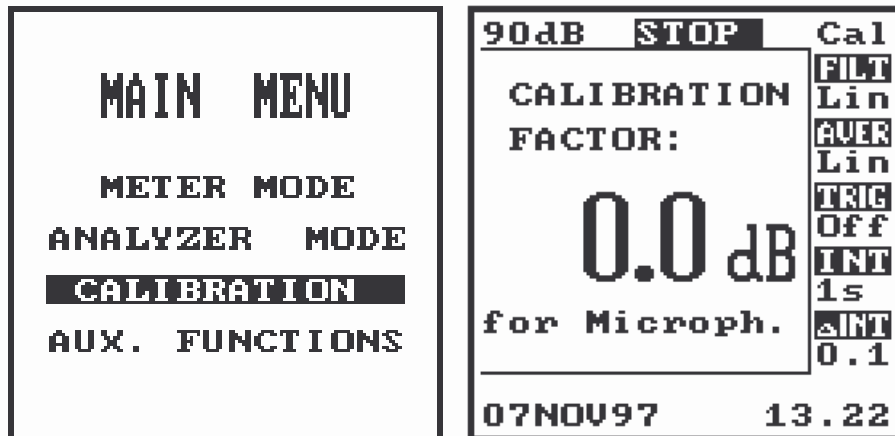


6. CALIBRATION

In this mode the calibration of the sound & vibration measurement channel is possible. The user can store calibration factors for the different microphones or accelerometer transducers. They are stored together with the SETUP files. The assignment of the new value to the stored calibration factor (the default value is 0.0 dB) can be made in two ways:

- by the calibration measurement (the calibration factor is calculated in the relation to the reference level),
- by the introduction of the transducer's sensitivity (in mV/Pa , pC/ms^{-2} or mV/ms^{-2}).

The user has to select in the **MAIN MENU** the **CALIBRATION** text using the $\langle \blacktriangle \rangle$, $\langle \blacktriangledown \rangle$ push-buttons and press the $\langle \text{ENTER} \rangle$ one in order to get into the **CALIBRATION** mode. The organisation of this mode is similar to the **METER MODE**, but a few new control windows are added.

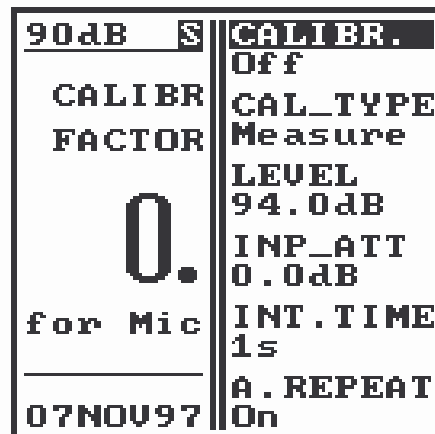


The view of the display in the **MAIN MENU** and after entering the **CALIBRATION** mode

The **FUNC** window

This window consists of several sub-windows, which enable the user to introduce the parameters essential for the calibration procedures. These sub-windows are as follows: **CALIBR.**, **CAL_TYPE**, **LEVEL** or **SENSIT.**, **INP_ATT**, **INT.TIME** and **A.REPEAT**.

CALIBR. sub-window



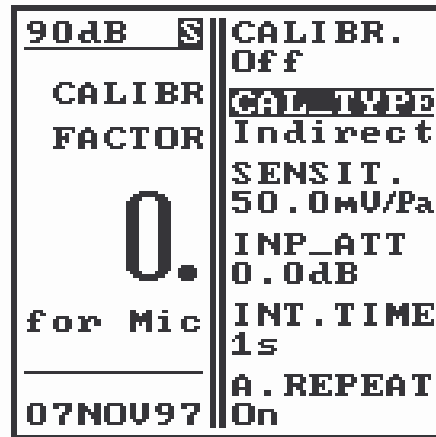
The display's view in the **CALIBRATION MODE** - the **FUNC** window, setting the **CALIBR.** sub-window

This sub-window enables one to switch on (**On**) or off (**Off**) the process of taking into account the calibration factor. The **On** state is signalled in the **METER MODE** by the text **CAL.**, which is displayed under the main result of the measurement.

CAL_TYPE sub-window

This sub-window enables one to choose the way in which the calibration can be done:

- Measure** by the calibration measurement (the calibration factor is calculated in the relation to the reference level).
- Indirect** by giving the value of the transducer's sensitivity (in mV/Pa , pC/ms^{-2} or mV/ms^{-2}).



The view of the display in the CALIBRATION MODE - the FUNC window, setting CAL_TYPE:indirect

LEVEL sub-window

The Level sub-window enables one to introduce the reference level in the assessment of the calibration factor in the measurement way. This sub-window is active only in the case of the direct calibration performed by the measurement.

SENSIT. sub-window

The Sensitivity sub-window enables one to introduce the value of the transducer's sensitivity (taken from the calibration card of the used transducer). This sub-window is active only in the case of the indirect calibration, not performed by the measurement.

INP_ATT sub-window

The Input Attenuation sub-window enables the user to define an additional "input factor", independent from the calibration one (e.g. in order to correct the external attenuation of the signal's level).

INT.TIME sub-window

The Integration Time sub-window enables the user to choose the averaging (integration) time of the measured calibration signal from the series: **1 m** (min), **5 m** (min), **15 m** (min), **1 h**, **8 h**, **16 h** (the direction of the selection to the left) or **1 s**, **2 s**, ..., **59 s**, **1 m** (min), **2 m** (min), ..., **59 m** (min), **1 h**, ..., **16 h** (the direction of the selection to the right).

A.REPEAT sub-window

The Auto Repeat sub-window enables one to repeat the calibration measurement.

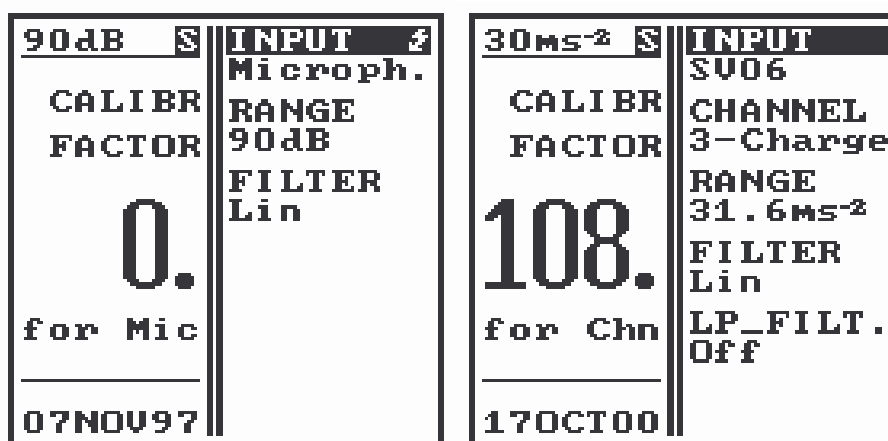
The **INPUT** window

This window consists of several sub-windows, which appear on the screen depending on the selected input. For one channel calibration these sub-windows are as follows: **INPUT**, **RANGE**, **FILTER**. For four-channel calibration appear **CHANNEL** and **LP_FILT.** sub-windows additionally.

INPUT sub-window

This sub-window enables the user to select the measurement input: **Microphone**, **Direct**, **Charge**, **Accelerometer**, **SV06** or **SV08**.

- Microph.** the microphone input (the signal from the external microphone preamplifier, e.g. the SV 01A),
- Direct** the direct input,
- Charge** the input of the charge piezoelectric transducer,
- Acceler.** the input from the IEPE transducer with the built-in charge preamplifier,
- SV06** the input from four channel module for vibration measurements,
- SV08** the input from four channel module for sound and vibration measurements.



The view of the display in the CALIBRATION MODE - the INPUT window

RANGE sub-window

This sub-window enables the user to select the measurement input range (the input gain or attenuation). There are four measurement ranges (in 20 dB steps), which are defined as below.

- For sound measurements: **70 dB**, **90 dB**, **110 dB** and **130 dB** (the value in **dB** related to **20 μPa** calibrated for the microphone with the sensitivity of **50 mV/Pa**).
- For voltage measurements: **70 dB**, **90 dB**, **110 dB** and **130 dB** (the value in **dB** related to **1 μV**).
- For vibration acceleration measurements: **316 mms⁻²**, **3.16 ms⁻²**, **31.6 ms⁻²** and **316 ms⁻²** for the transducer with the sensitivity of **10 mV/ms⁻²** or **10 pC/ms⁻²**.

FILTER sub-window

This sub-window enables the user the selection of the weighting filter for the given measurement input (cf the description of this sub-window in chapter 4).



Notice: In the case of the sound calibration measurement it is recommended to use the **A** filter when the standard 94 dB / 1000 Hz calibrator is used and the **C** filter in the case of the pistonphone. In the case of the vibration calibration measurement it is recommended to use the **Lin** filter

CHANNEL sub-window

This sub-window is used to select the number of the calibrated channel in the case of four-channel calibration measurements with the SV 06A and SV 08A modules.

LP_FILT. sub-window

This sub-window enables the user to set on or off the hardware low-pass filter used for the measurements with the charged transducers.

*The **DISPLAY** window*

This window is not active in the calibration mode.

6.1. Calibration procedures of the instrument

The calibration for the sound or vibration measurements can be done in two ways:

1. by the calibration measurement (using a **calibrator**) after the reference level declaration (in the **LEVEL** sub-window). The calibration of the measurement channel consists of the measurement of the difference between the input value and the declared reference level set in the **LEVEL** sub-window (which results from the type of the used calibrator).
2. indirectly by the declaration of the transducer's sensitivity (due to the calibration card) in the **SENSIT.** sub-window.

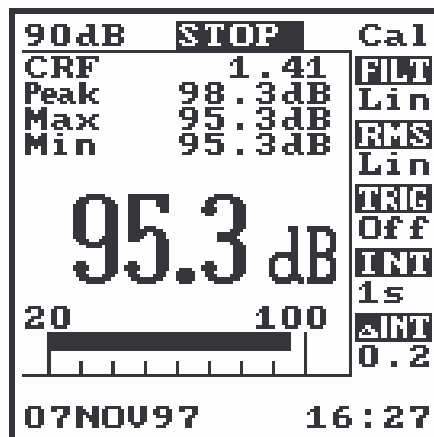


Notice: It is not recommended to use the indirect method of the calibration (the introduction of the sensitivity from the calibration card) in the case of sound measurements performed with the condensed microphones (with 200 V polarisation voltage).

The calibration measurement

In this case the user has to perform the following steps:

- set the proper input (**Microph.**, **Direct**, **Charge**, **Acceler.**, **SV06** or **SV08**) in the **INPUT** sub-window,
- set the calibration type to **Measure** in the **FUNC / CAL_TYPE** sub-window,
- set the value of the reference level in the **FUNC / LEVEL** sub-window,
- set the time of the measurement in the **FUNC / INT.TIME** sub-window,
- start the calibration measurement pressing the **<START/STOP>** push-button.

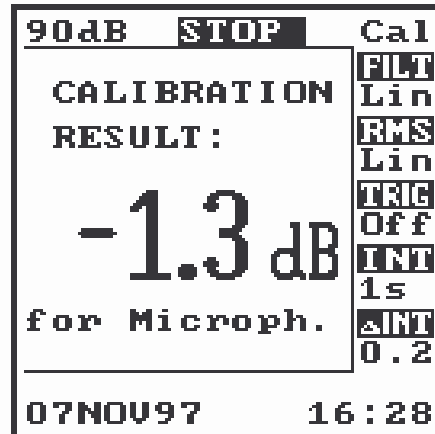


The view of the display during the calibration after performing the measurement of the reference level

After the end of the measurement the result is displayed (cf. next Fig. above)

- press the **<ENTER>** push-button in order to calculate the calibration factor.

After pressing the **<ENTER>** push-button the calibration factor is calculated and displayed (cf. Fig. below).



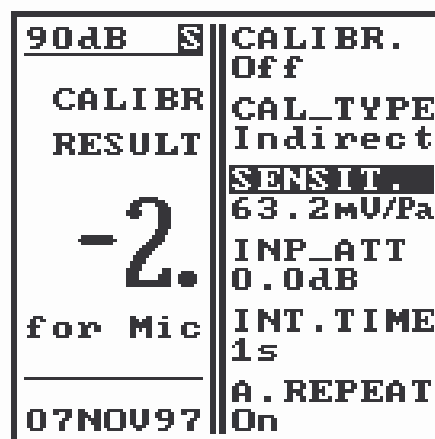
The view of the display with the value of the calibration factor

Indirect calibration

In this case the user has to perform the following steps:

- set the proper input (**Microph.**, **Direct**, **Charge**, **Acceler.**, **SV06** or **SV08**) in the **INPUT** sub-window,
- set the **Indirect** type of calibration in the **FUNC / CAL_TYPE** sub-window,
- set the value of the transducer's sensitivity in the **FUNC / SENSIT.** sub-window:
 for the microphone in the range from **0.1 mV/Pa** to **100 mV/Pa**, it is possible to set the sensitivity with the step equal to **0.1 mV/Pa**;
 for the vibration piezoelectric transducer in the range from **0.01 pC/ms⁻²** to **1500 pC/ms⁻²** - with the step equal to **1 %** (the values chosen in this window make the series conforming to the change of the sensitivity of **0.1 dB**);
 for the sensor with the built-in charge preamplifier in the range from **0.1 mV/ms⁻²** to **1 V/ms⁻²**. It is possible to set the transducer's sensitivity with the step equal to **0.1 mV/ms⁻²**.
- press the **<ENTER>** push-button.

After pressing the **<ENTER>** push-button the value of the calibration factor is calculated and displayed.



The view of the display during the calibration by the declaration of the transducer's sensitivity

90dB	S	CALIBR.
		On
CALIBR		CAL_TYPE
RESULT		Indirect
-2.		SENSIT.
		63.2mV/Pa
for Mic		INP_ATT
		0.0dB
		INT.TIME
		1s
		A.REPEAT
07NOV97		On

The view of the display after the introduction to the measurements the value of the calibration factor



Notice: The values of the calibration factors are rewritten without the ambiguity to the related measurement input. It means that it is possible to make several calibration measurements for different microphones and transducers and use the calibration factors in the performed measurements.

The **Save SETUP** operation should be performed after finishing the calibration measurements in order to save the calibration factor and use it in the future measurements.

In one **SETUP FILE** the calibration factors for each channel are stored independently (for one-channel sound measurements, for one-channel vibration measurements and for four-channel measurements). In the case of different transducers and microphones the user has to save the calibration factors in different **SETUP FILES**.



Notice: In order to take into account during the measurements the value of the calibration factor the **FUNC / CALIBR.** sub-window should be set on (**On**).



Notice: It has to be remembered that the value of the input factor set in the **INPUT_ATT** window is also added to the calibration factors for the microphone channel as well as the vibration one (it should be reset to zero after the measurement in which it was used).



Notice: The calibration procedure should be repeated for each channel independently in the case of four-channel measurements with the **SV 06A** and **SV 08A** modules.