

CP AL1

User Manual

FFT VOLTMETER FOR STEP AND TOUCH
VOLTAGE MEASUREMENTS



Manual Version: ENU 1128 05 01

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The product information, specifications, and technical data embodied in this manual represent the technical status at the time of writing and are subject to change without prior notice.

We have done our best to ensure that the information given in this manual is useful, accurate and entirely reliable. However, OMICRON does not assume responsibility for any inaccuracies which may be present.

The user is responsible for every application that makes use of an OMICRON product.

OMICRON translates this manual from the source language English into a number of other languages. Any translation of this manual is done for local requirements, and in the event of a dispute between the English and a non-English version, the English version of this manual shall govern.

Contents

1	Introduction	5
1.1	Delivery	5
1.2	Warnings	5
1.3	Connectors	6
1.4	Battery Replacement	7
1.5	CE Declaration of Conformity	8
1.6	Test & Calibration Certificates	8
1.7	International Warranty	9
2	Operation	11
2.1	Menu Bar	12
2.2	Measurement Functions	13
2.2.1	FFT Analysis	13
2.2.2	RMS/THD Measurement	17
2.3	Input Filters	19
2.4	Setup Screen	19
2.5	Memory Menu	21
2.6	Battery State Indication	25
3	Technical Data	27
	Contact Information / Technical Support	29
	Index	31

1 Introduction

Congratulations and thank you for buying NTI's FFT voltmeter *CP AL1*, a product which is primarily designed for professional acoustical test applications. For step and touch voltage measurements, the *CP AL1* is delivered with an OMICRON electronics software which allows measuring the frequency selective voltage level by using a real-time Zoom FFT. This User Manual describes in detail the OMICRON electronics software specific *CP AL1* functions and measurements. The *CP AL1* makes understanding and handling the step and touch voltage measurements simple. However, fundamental working knowledge of the step and touch voltage measurement techniques is a prerequisite for using the *CP AL1*.

1.1 Delivery

The *CP AL1* delivery includes:

- FFT voltmeter *CP AL1*
- Adapter ML 1 –20 dB (1:10)
- Adapter XLR to BNC with 1 k Ω
- 3 × 1.5 V LR6/AA battery
- *CP AL1* User Manual

1.2 Warnings

For a proper operation of the *CP AL1*, observe the following rules:

- Read this manual thoroughly before putting the *CP AL1* into operation.
- Use the *CP AL1* for the intended purpose only.
- Never connect the *CP AL1* to a high-voltage output such as a power amplifier, mains power plug, etc.
- Do not disassemble the *CP AL1*.
- Never use the *CP AL1* in a damp environment.
- Remove the batteries as soon as they are flat or if the *CP AL1* is not intended to be used for a longer period of time.

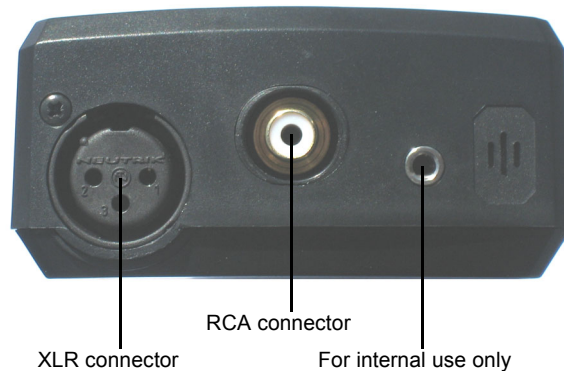
1.3 Connectors

The *CP AL1* provides the following connectors on the rear:

- XLR input for feeding a signal to the *CP AL1*
- RCA input for feeding a signal to the *CP AL1*
- 3.5 mm (1/18") jack designed for internal use only
Never connect any electrical signal to this connector.

Note: Never connect electrical signals simultaneously to both the XLR and the RCA connector.

Figure 1-1:
Connectors



1.4 Battery Replacement

To insert or replace batteries, remove the rear cover, and then insert three 1.5 V alkaline batteries, type AA/LR6 into the *CP AL1* battery compartment as shown below. The typical life-time for a set of alkaline batteries is 16 hours.

Figure 1-2:
Inserting batteries



When replacing the batteries:

- Do not use rechargeable NiCd or NiMH batteries.
- Do not use batteries of different types.
- Observe the correct battery polarity.
- Remove the batteries as soon as they are flat and replace all batteries at the same time.

1.5 CE Declaration of Conformity

We, the manufacturer

NTI AG

Im alten Riet 102

9494 Schaan

Liechtenstein, Europe

hereby declare that the product Acoustilyzer *CP AL1*, released in 2004, conforms to the following standards or other normative documents:

EMC-Directives: 89/336, 92/31, 93/68

Harmonized Standards: EN 61326-1

This declaration becomes void in case of any changes on the product without written authorization by NTI.

Date: 1. September 2004

Signature:



Position of signatory: Technical Director

1.6 Test & Calibration Certificates

This is to certify the Acoustilyzer *CP AL1* is fully tested to the manufacturer's specifications. NTI recommends to calibrate this test instrument one (1) year after purchase. Thereafter the calibration and adjustment interval is subsequently one (1) year.

1.7 International Warranty

NTI guarantees the functionality of the Acoustilyzer *CP AL 1* against defects in material or workmanship for a period of one year from the date of original purchase, and agrees to repair or to replace at its discretion any defective unit at no cost for either parts or labor during this period.

Restrictions

This warranty does not cover damages caused through accidents, misuse, lack of care, the attachment or installation of any components that were not provided with the product, loss of parts, connecting the instrument to a power supply, input signal voltage or connector type other than specified or wrongly polarized batteries. In particular, no responsibility is granted for special, incidental or consequential damages.

This warranty becomes void if servicing or repairs of the product are performed by any party other than an authorized NTI service center or if the instrument has been opened in a manner other than specified in this manual.

No other warranty, written or verbal, is authorized by NTI. Except as otherwise stated in this warranty, NTI makes no representation or warranty of any kind, expressed or implied in law or in fact, including, without limitation, merchandising or fitting for any particular purpose and assumes no liability, either in tort, strict liability, contract or warranty for products.

2 Operation

In spite of the wide range of available measurement functions and optional setups, the operation of the *CP AL1* is almost self-explanatory.

Figure 2-1:
Operating controls



To switch the *CP AL1* on/off, press the power on/off button for at least 2 sec.

The LCD displays the menu bar on the top and the measurement results beneath. The cursor keys and the ESC button allow straightforward navigation through the current screen displaying:

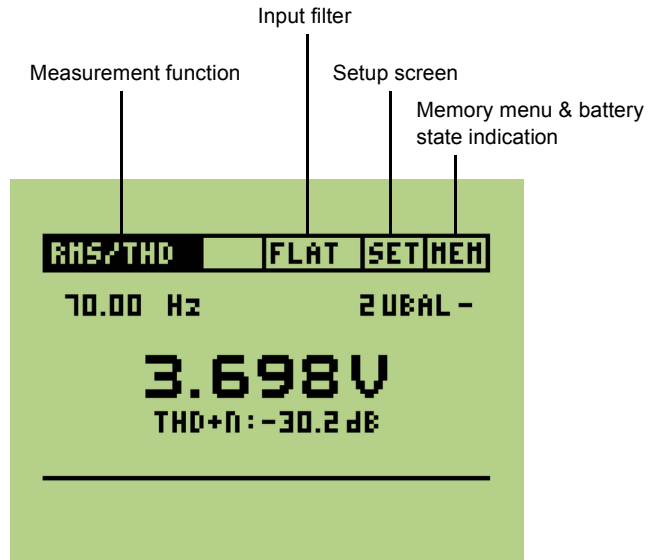
- Measurement settings (measurement function, filters)
- Measurement results (numerical or graphical display)

The base element is the cursor (inverted area) which may be navigated through the various functions by using the cursor keys. All selectable settings may be simply set by pressing the ENTER key. Alternatively, at longer selection lists the selected field is flashing. In this case select the value you want to enter using the cursor keys, and then confirm the setting by pressing the ENTER key again.

2.1 Menu Bar

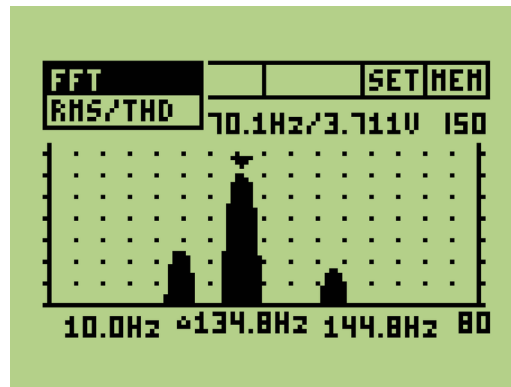
The menu bar allows configuring the *CP AL1* for the measurement.

Figure 2-2:
Menu bar



2.2 Measurement Functions

Figure 2-3:
Measurement function
menu



The *CP AL1* features two major measurement functions accessible via the menu bar:

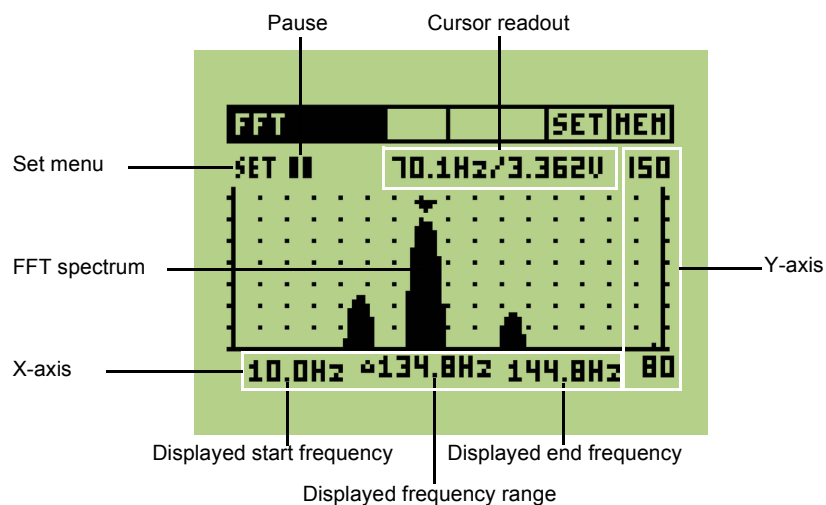
- FFT: real-time Zoom FFT
- RMS/THD: level and distortion measurements

To set the measurement function, select **FFT** or **RMS/THD** on the measurement function menu.

2.2.1 FFT Analysis

The *CP AL1* implements an extremely fast, real-time Zoom FFT analysis with resolutions up to 0.7 Hz over the entire frequency range. The FFT analysis results are displayed by 93 bins.

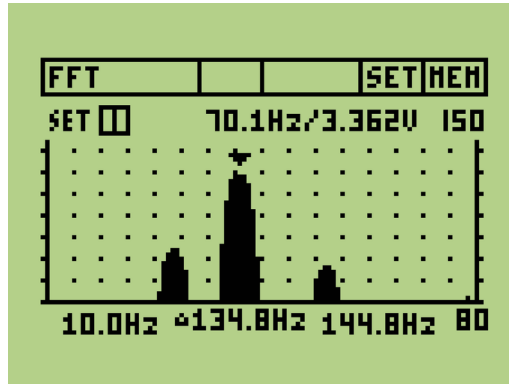
Figure 2-4:
FFT analysis display



The screen elements in the FFT measurement mode are described below.

Pause

Figure 2-5:
Pause

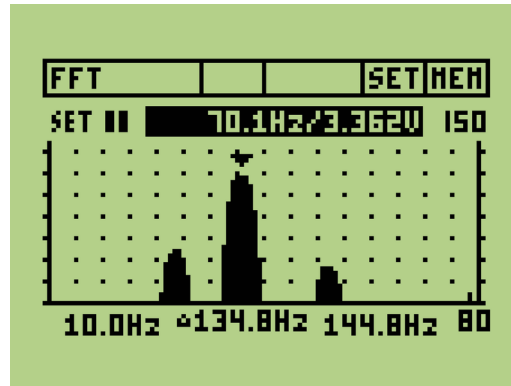


The **[]** command stops measurements temporarily. To pause a measurement:

1. Select the **[]** symbol, and then press the ENTER key.
The **[]** symbol is flashing.
2. Select the **[]** symbol, and then press the ENTER key to continue the measurement.

Cursor Readout

Figure 2-6:
Cursor readout

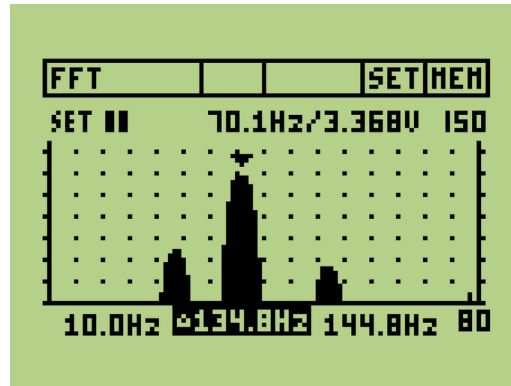


The cursor readout displays the frequency and level of the bin marked by the cursor. Initially, the cursor automatically marks the bin with the highest level. To control the cursor readout:

1. Select the cursor readout field, and then press the ENTER key.
A frame around the field is flashing.
2. Move the cursor using the left/right arrow keys.
The cursor readout field displays the measurement values corresponding to the bin marked by the cursor.

X-Axis

Figure 2-7:
X-axis

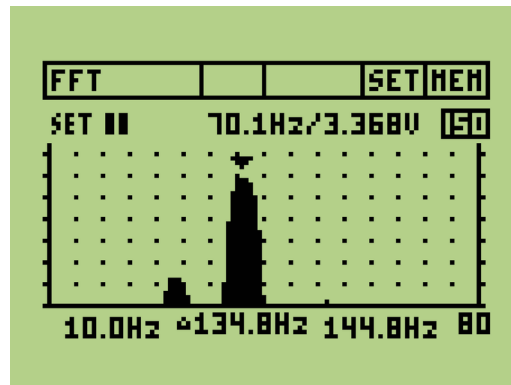


The X-axis displays from left to right the start frequency, the frequency range and the stop frequency. To set the displayed frequency range:

1. Select the frequency range field, and then press the ENTER key.
2. Set the displayed frequency range using the up/down arrow keys.
3. Move the displayed frequency range using the left/right arrow keys.

Y-Axis

Figure 2-8:
Y-axis



The Y-axis displays the signal level in dB. The signal level in volts is given by

$$U = 10^{\frac{x - 134}{20}} \quad (\text{Eq. 2-1})$$

where

U ...signal level in volts

x ...signal level in dB

By the default setting, the Y-axis range is 80...150 dB. This corresponds to the following range in volts:

$x = 80\text{dB} :$

$$U = 10^{\frac{80-134}{20}} \approx 2 \cdot 10^{-3} = 0.002\text{V} \quad (\text{Eq. 2-2})$$

$x = 150\text{dB} :$

$$U = 10^{\frac{150-134}{20}} = 10^{0.8} = 6.3\text{V} \quad (\text{Eq. 2-3})$$

Note: The signal level is displayed in logarithmic scale.

To scale the Y-axis:

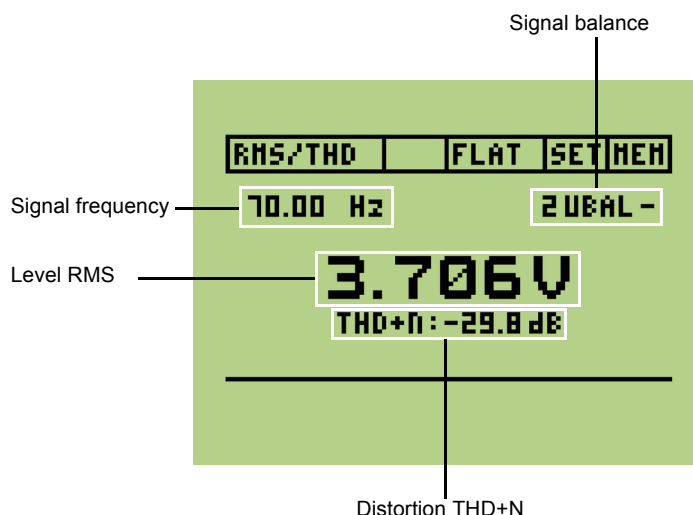
1. Select the Y-axis maximum value field, and then press the ENTER key.
2. Move the displayed Y-axis range using the up/down arrow keys.
3. Set the Y-axis resolution using the left/right arrow keys.

2.2.2 RMS/THD Measurement

In the RMS/THD mode, the *CP AL1* implements the following measurement functions:

- Level RMS: level of the measured signal
- THD+N: total harmonic distortion plus noise

Figure 2-9:
RMS/THD
measurement display



Level RMS

The units dB μ , dBV, dB SPL and V are selectable.

Distortion THD+N

The distortion measurement is carried out within the bandwidth 10 Hz...20 kHz. The results are given in dB or in %.

Signal Balance

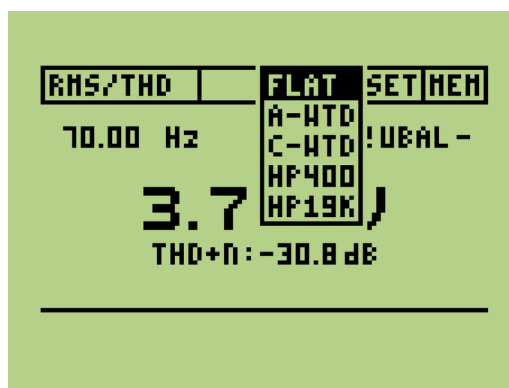
The signal balance field shows the matching deviation of the incoming signal between pin 2 and pin 3 in %. The signal balance field indicates the following:

- Arrow in center: the input signal is balanced.
- Arrow out of center: linear indication of a balancing problem.
E.g. the arrow shifted to the left shows the signal level on pin 2 is higher than on pin 3.
- Arrow at the left or right end: the signal balance error is 33% or higher.
33% corresponds to a difference of the signal level of 6 dB.
- 2UBAL-: indicates a signal only on pin 2 of the symmetrical XLR cable, no signal at pin 3.
- -UBAL3: indicates a signal only on pin 3 of the symmetrical XLR cable, no signal at pin 2.

Note: Use the adapter –20 dB for balanced input levels higher than 3.8 V (unbalanced).

2.3 Input Filters

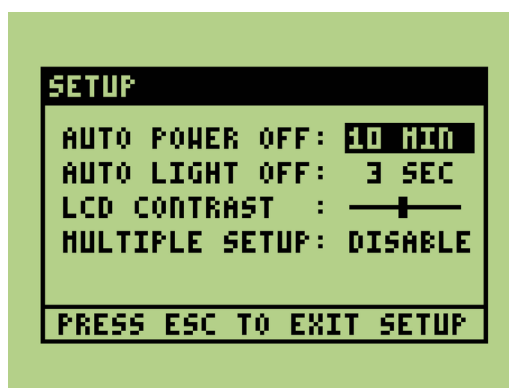
Figure 2-10:
Input filter menu



In the RMS/THD measurement mode, filters are available on the input filter menu. For the filter characteristics and applications, see Table 3-2: "Input filters" on page 27.

2.4 Setup Screen

Figure 2-11:
Setup screen



The setup screen allows customizing the *CP AL1* basic settings. To customize the settings:

1. Select the setup screen menu (**SET**) on the menu bar.
The setup screen opens.
2. Move the cursor to the entry field corresponding to the setting you want to change, and then press the ENTER key.
3. Select the required value by using the arrow keys.
4. Press the ENTER key.

The available settings are described below.

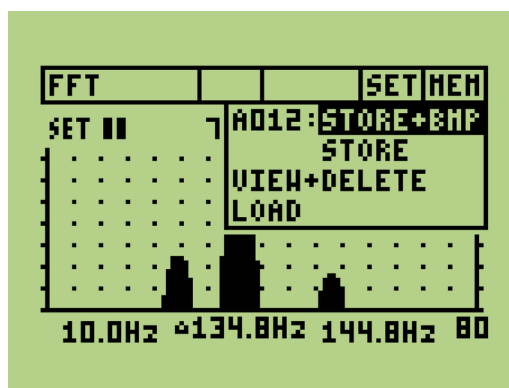
Table 2-1:
Setup screen settings

Setting	Description
AUTO POWER OFF	Defines the time the <i>CP AL1</i> is switched off automatically after the last key press. The available values are: 3 MIN, 10 MIN, 30 MIN, 60 MIN and DISABLE. If DISABLE is selected, the <i>CP AL1</i> is turned on until it is switched off by pressing the power on/off button.
AUTO LIGHT OFF	Defines how long the backlight stays on after any key press. The available values are: 3 SEC, 10 SEC, 60 SEC and DISABLE. If DISABLE is selected, the backlight stay on until the <i>CP AL1</i> is switched off. Note: Lighting of the backlight shortens the battery life.
LCD CONTRAST	Adjusts the contrast of the display. Note: Alternatively, you can adjust the contrast if a measurement result is displayed by holding the ESC button down and pressing the up/down arrow key.
MULTIPLE SETUP	Allows storing up to four individual settings. To enable the MULTIPLE SETUP mode, set the corresponding value to ENABLE. The next time the <i>CP AL1</i> is switched on, select the setting ID (1, 2, 3 or 4) on the start screen. After the <i>CP AL1</i> is switched off, the setting values are stored under this ID.

Note: To load the default settings after switching the *CP AL1* off, press and hold the ESC button, and then press the power on/off key for at least 2 sec.

2.5 Memory Menu

Figure 2-12:
Memory menu



All measurement results can be stored in the *CP AL1* internal memory, viewed and processed. Each memory record is saved with a file name beginning with the capital A followed by a number between 000...999 and the measurement mode, e.g. "A000_FFT" or "A001_RMS_THD". The number increases by 1 and continues with 000 after 999.

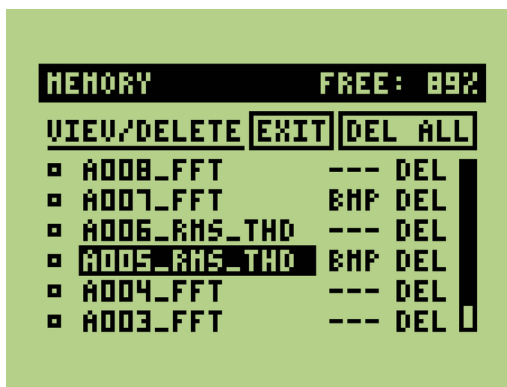
The available memory menu entries are described below.

Table 2-2:
Memory menu entries

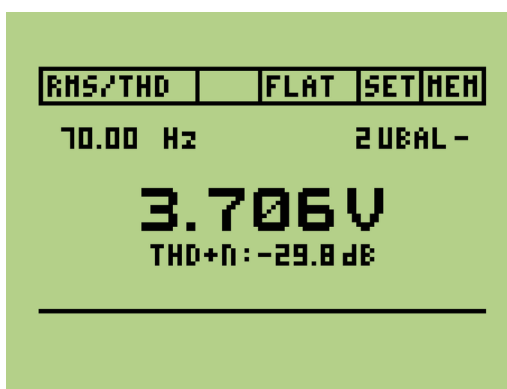
Memory Menu Entry	Description
STORE+BMP	Saves the numeric measurement results including the graphical display.
STORE	Not supported by the current software version.
VIEW+DELETE	Lists the memory records in ascending order. The free memory space is displayed in the right upper corner of the screen.
LOAD	Loads the stored measurement data from the <i>CP AL1</i> internal memory for further processing. Supported in the FFT measurement mode only. Note: Any ongoing measurement continues during loading and processing the stored measurement data.
LIVE MODE	Switches the display from loaded measurement data to the current measurement.

To view stored measurement results:

1. Select **VIEW+DELETE** on the memory menu.
2. Select the memory record you want to view using the cursor keys.



3. Press and hold the ENTER key.
The stored measurement results are displayed on the CP AL1 screen.



Note: The last selected record is marked by the full square in the front. You can display the marked record at any time later by holding down the ESC button and pressing the ENTER key.

To delete stored measurement data individually:

1. Select **VIEW+DELETE** on the memory menu.
2. Select the record you want to delete using the cursor keys.
3. Select the corresponding **DEL** field.
4. Press the ENTER key, and then select **OK** in the dialog box.



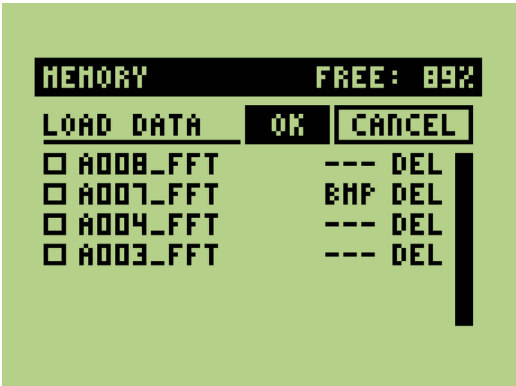
To delete all stored measurement data:

1. Select **VIEW+DELETE** on the memory menu.
2. Select the **DEL ALL** field.
3. Press the ENTER key, and then select **OK** in the dialog box.

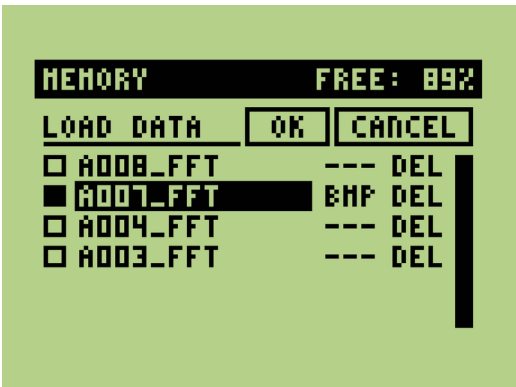


To load stored measurement data:

- 1. Select **LOAD** on the memory menu.
The display lists the memory records available for loading.

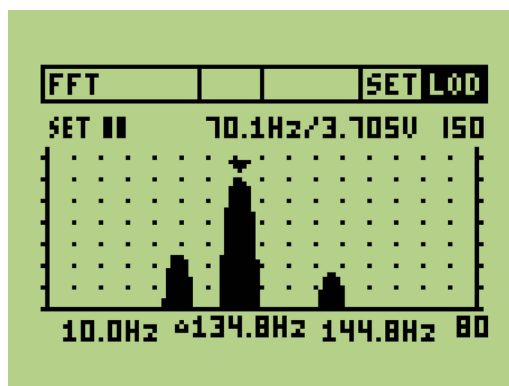


- 2. Select the memory record you want to load.

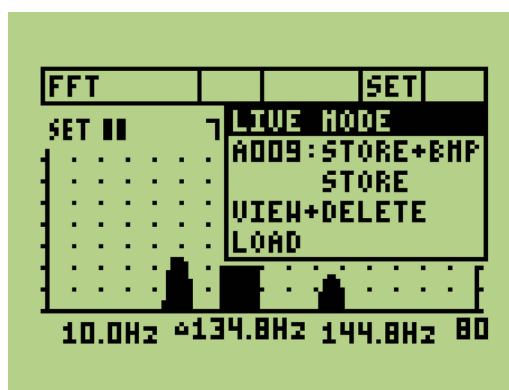


- 3. Press the ENTER key.

4. Press the **ESC** button, and then press the ENTER key.
The loaded measurement data is displayed and LOD is flashing in the menu bar.



5. Select **LIVE MODE** on the memory menu to switch to the current measurement.



2.6 Battery State Indication

The battery state is indicated by the memory menu field in the menu bar as follows:

Table 2-3:
Battery state indication

Memory Menu Field	Battery State
MEM	Batteries are high enough.
	Batteries are low.

3 Technical Data

Table 3-1:
Measurement functions

Measurement Functions	Specifications
Zoom FFT	Real-time Zoom FFT with 50% overlapping, 93 bins
	Frequency range: 10 Hz...20 kHz
	Resolution: 0.73 Hz...187.5 Hz
Level RMS	Units: Vrms (dBμ, dBV)
	Resolution: 4 digits (V scale), 3 digits (dB scale)
	Accuracy: ±1%
	Bandwidth: 20 Hz...20 kHz
Distortion THD+N	Bandwidth: 10 Hz...20 kHz
	Resolution: 4 digits (% scale), 3 digits (dB scale)
	Residual THD+N
	Balanced: < -85 dB @ -10 dBμ...+20 dBμ Unbalanced: < -74 dB @ 0 dBμ...+14 dBμ
Frequency	Range: 10 Hz...20 kHz
	Resolution: 4 digits
	Accuracy: ±1%

Table 3-2:
Input filters

Filter	Characteristic	Application
FLAT	Flat frequency response (no filtering)	Default measurement setting
A-WTD	A-weighting filter	Measuring residual noise of the unit under test according to IEC 61672
C-WTD	C-weighting filter according to IEC 61672	Special applications
HP400	High-pass filter 400 Hz according to DIN 45045, -120dB/dec	Removes mains frequency (50/60 Hz) components of the measurement signal.

Filter	Characteristic	Application
HP19k	High-pass filter 19 kHz	Removes low-frequency components of the measurement signal, e.g. for measuring the 20 kHz pilot tone level of critical public announcements systems.

Table 3-3:
Technical specifications

Characteristic	Specifications
Input level RMS (upper measurement limit)	3.8 Vrms (unbalanced) for input levels > 3.8 Vrms (unbalanced) the adapter ML 1 –20 dB has to be used
Max. DC input	±50 V DC
Input impedance	Balanced: 40 kΩ Unbalanced: 20 kΩ
Input connectors	Balanced: XLR Unbalanced: RCA
Display	Graphical LCD 64×100 pixel with backlight
Batteries	3 × 1.5 V alkaline battery type LR6/AA typical battery lifetime > 16 hrs

Table 3-4:
Environmental
requirements

Characteristic	Rating
Temperature	0...+45°C/+32...+113°F
Relative humidity	< 90%, non-condensing

Table 3-5:
Mechanical data

Characteristic	Rating
Dimensions (l × w × h)	163 × 86 × 42 mm/6.4" × 3.38" × 1.63"
Weight	300 g/10.6 oz. incl.batteries

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Index

A

address
 manufacturer 29

B

battery 5, 28
 replacement 7
 state indication 25
 button
 ESC 11
 power on/off 11

C

connector
 RCA 6, 28
 XLR 6, 28
 cursor keys 11
 cursor readout 15

D

deleting measurement data
 all 23
 individually 23
 distortion THD+N 18

E

ESC button 11

F

FFT analysis 13

H

hotline 29

I

input filter 19, 27

L

level RMS 18
 loading measurement data 24

M

manufacturer address 29
 measurement function
 FFT 13
 RMS/THD 13, 17
 menu
 input filter 19
 measurement function 13
 memory 21
 setup screen 19
 menu bar 11, 12

O

OMICRON address 29

P

pause	14
power on/off button	11

R

RCA connector	6, 28
---------------------	-------

S

Service	
OMICRON address	29
signal balance	18
support	29

T

technical support	29
-------------------------	----

V

viewing measurement data	22
--------------------------------	----

X

X-axis	16
XLR connector	6, 28

Y

Y-axis	16
--------------	----

