

User Manual

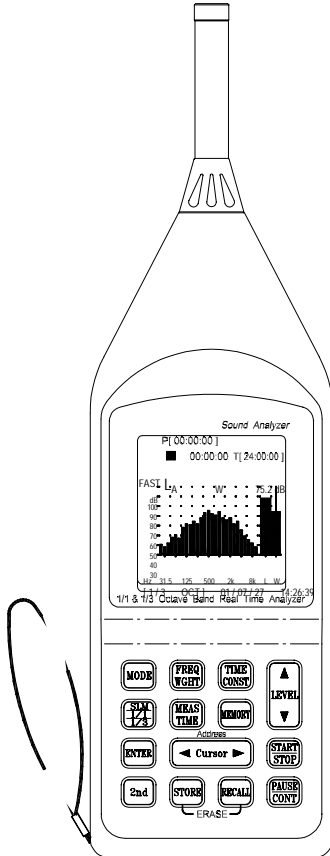
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INSTRUMENTS

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Real Time Octave Band Analyzer

Model 407790



Introduction

Congratulations on your purchase of the Extech 407790 Real Time Octave Band Analyzer. This auto ranging Type 2 integrating sound level meter features 1/1 and 1/3 Octave Band real-time noise analysis. The 407790 offers five measurement parameters: SPL (Sound Pressure Level), Leq (Equivalent Continuous Sound Pressure Level), Le (Sound Exposure Level), Lmax (Maximum Sound Pressure Level), and Lmin (Minimum Sound Pressure Level). The built-in memory stores 12,280 data records in sound level mode and 1024 records in Octave mode. The stored data can be easily transferred to a PC with the supplied software and RS-232 cable. This meter permits choice of 'A', 'C', or 'Flat' weighting and 'Slow' / 'Fast' response times. AC and DC analog output signals are available for chart recorders and other external recording devices. Careful use of this device will provide years of reliable service.

Specifications

Applicable Standards: IEC 60651 type2, 60804 type 2, ANSI S1.4 type2, IEC 1260 (1995)

Display: Backlit LCD (160×160 dot matrix)

Sound level meter mode:

Numeric display: 4 digits; Update rate: 0.5 seconds; Resolution: 0.1 dB

Bar graph display: 100dB range; Update rate: 0.125S; Resolution: 1dB

Frequency analysis mode:

Numeric display: 4 digits; Update rate 0.5 seconds; Resolution: 0.1dB

Bar graph display: 70dB range; Update rate: 0.125S; Resolution: 1 dB

Accuracy: ±1.5dB (ref 94dB @1kHz)

Measurement Frequency range: 25Hz to 10 kHz

Dynamic range: 100dB (Sound level meter mode); 70dB (Frequency analysis mode)

Measurement range: 30dB to 130dB

Sound Pressure Level range: SLM mode: 100dB (30 to 130dB); Frequency analysis mode:
70dB (20 to 90dB, 30 to 100dB, 40 to 110dB, 50
to 120dB, 60 to 130dB)

Frequency weighting: 'A', 'C', 'P' (Flat)

Time weighting (Response Time): Fast and Slow

Microphone: 1/2 inch electret condenser type

Display warning indicators:

OVER indicator (Input signal exceeds the upper limit)

UNDER indicator (Input signal under the lower limit)

Memory capacity: See Table below (Manual/Auto storage blocks are separate)

Mode \ Storage type	Manual	Auto
Sound level meter	1024 data sets	10000 data sets
1/1-octave analysis	1024 data sets	6140 data sets
1/3-octave analysis	1024 data sets	3070 data sets

AC output: 2 Vrms at FS (full scale); Output impedance approx. 600Ω

DC output: 10mV/dB; Output impedance approx. 100Ω

Power: Four (4) C size 1.5V alkaline batteries

External DC power supply: 6 Vdc, 1A

Battery life: Approx. 2hours

Operating Temperature/Humidity: 32 to 104°F (0 to 40°C); 10 to 90%RH

Storage Temperature/Humidity: 14 to 140°F (-10 to 60°C); 10 to 90%RH

Environment conditions: Altitude up to 2000 meters

Safety symbol



Complies with EMC

Dimensions & Weight: 13.6 (H) x 4.0 (W) x 2.4 (D)" (34.5 × 10 × 6cm); Approx.33.5 oz. (950g) including batteries

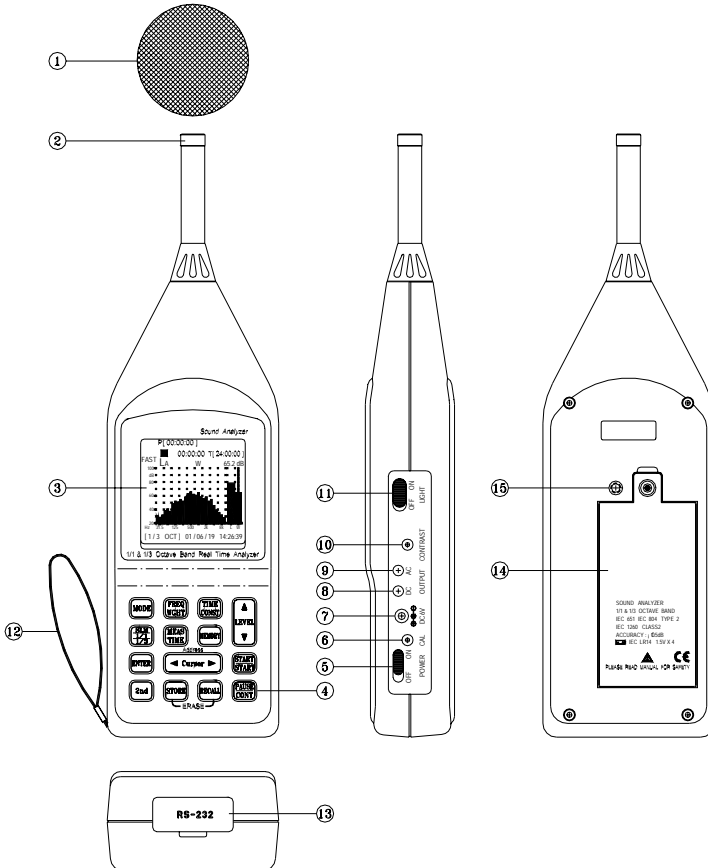
Accessories: Four (4) C 1.5V batteries, hard-shell carrying case, CD-ROM Windows™ software, RS-232 cable, 9 pin to 25 pin adapter, adjustment screw driver, Windscreen, 3.5mm plug, and AC adaptor

Optional accessories: Microphone extension cable (5m or 10m), Sound level calibrator

Meter Description

Refer to the diagram below for the following descriptions.

1. Windscreen
2. Microphone
3. Display
4. Operation keys
5. Power switch
6. Calibration adjust knob
7. 6VDC adapter jack
8. DC analog output jack
9. AC analog output jack
10. LCD contrast adjust knob
11. LCD backlight on/off switch
12. Hand strap
13. RS-232 interface connector
14. Battery compartment
15. Tripod mounting screw



Operation Buttons

Refer to the diagram on the next page for the following button descriptions.

MODE button

Press to display the following: Sound pressure level (L), equivalent continuous sound pressure level (Leq), Sound exposure level (LE), maximum sound pressure level (Lmax), and minimum sound pressure level (Lmin).

FREQ WGHT button

Selects the frequency weighting. "A" weighting (A), "C" weighting (C), and flat frequency response (P).

TIME CONST button

Selects the response time "FAST" and "SLOW".

▲ LEVEL ▼

Press to select the sound pressure level ranges in 1/1 and 1/3 octave band frequency analysis mode. (20~90dB, 30~100dB, 40~110dB, 50~120dB and 60~130dB)

SLM/ 1/1/ 1/3 button

Press to select the operation mode: Sound level meter (SLM), 1/1-octave frequency analysis (1/1), and 1/3-octave frequency analysis (1/3).

MEAS TIME button

- ① Sets the Leq, LE, Lmax and Lmin measurement time :
24h→1s→3s→10s→30s→1m→5m→8m→10m→15m→
30m→1h→8h
- ② [2nd] + [MEAS TIME] : Enter to setting the date and time mode.

MEMORY button

- ① Enter to memory mode.
- ② [2nd] + [MEMORY] : Enter to data record interval time setting : 0 (no record)
→1s→3s→10s→30s→1m→5m→8m→10m→15m→30m→1h→62.5ms

ENTER button

Stores the new date and time (also starts the real-time calendar clock)

◀ Cursor ▶ button

- ① Press to move the octave frequency band marker during frequency analysis.
- ② 2nd+ [◀ Cursor ▶] : Use in recall mode to select the memory address in which to store the measurement data.

START/STOP button

Press to start or stop the Leq, LE, Lmax and Lmin sound pressure level measurement.

PAUSE/CONT button

Press to temporarily pause (■ ■ display) or resume (▶ display)

[2nd] button: Press to change the buttons to their secondary functions.

STORE button

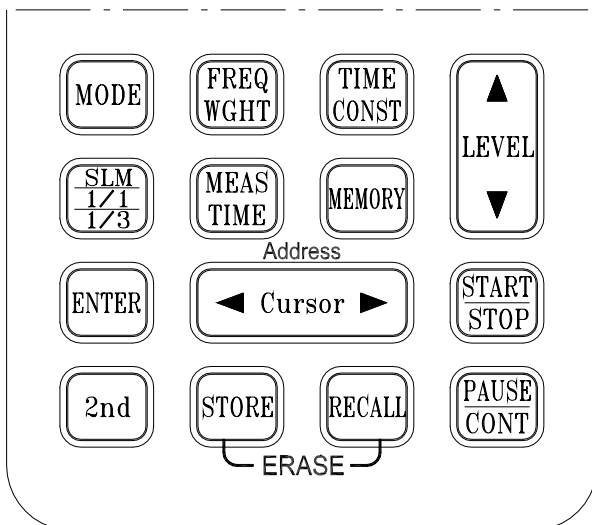
In manual dataloggin mode, press to store the measurement data.

RECALL button

In manual memory mode, press to recall the stored memory data.

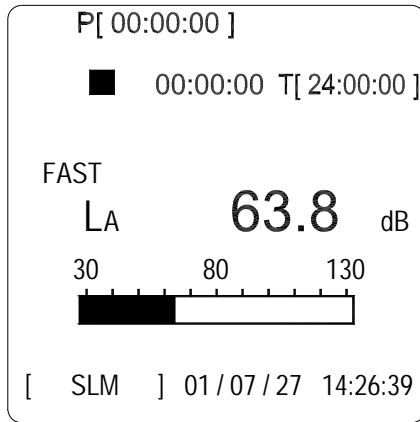
STORE + **RECALL** key (Erase memory data)

Turn off the meter, press and hold the STORE and RECALL buttons and then turn on the meter. Release buttons when the LCD displays "All memory erased".



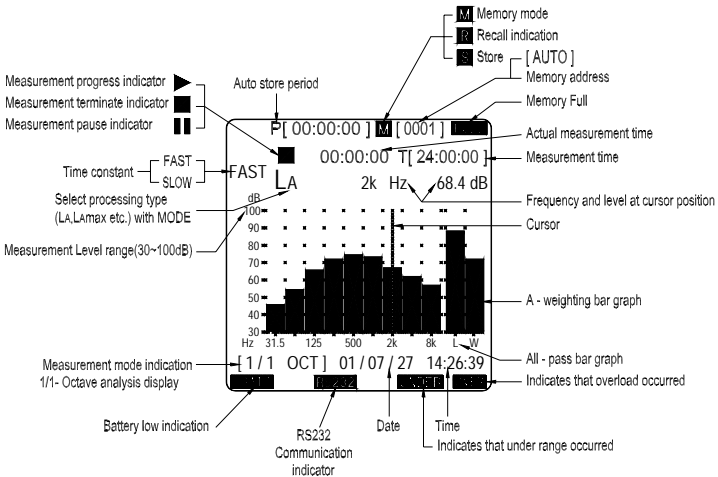
Measurement Screens

1. Sound pressure level measurement screen



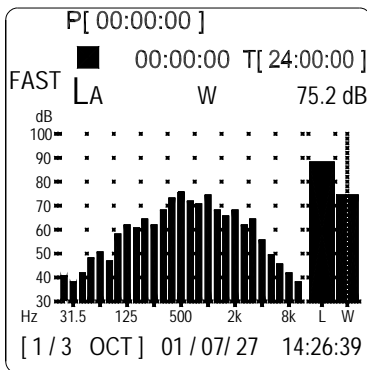
2. 1/1-octave analysis screen

The staircase shape on the display represents the 1/1-octave analysis result. From left, the bars correspond to 31.5, 63, 125, 250, 500, 1k, 2k, 4k, 8kHz. To read the levels at these frequencies, use the **◀ Cursor ▶** key to move the cursor to the desired point. The frequency and level are then shown on the upper of the screen.



3. 1/3-octave analysis screen

The staircase shape on the display represents the 1/3-octave analysis result. From left, the bars correspond to 25, 31.5, 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1k, 1.25k, 1.6k, 2k, 2.5k, 3.15k, 4k, 5k, 6.3k, 8k, 10kHz. To read the levels at these frequencies, use the **◀ Cursor ▶** key to move the cursor to the desired point. The frequency and level are then shown on the upper of the screen.



Calibration

Use a standard acoustic calibrator such as the Extech 407744 or 407766. Acoustic calibration is often performed on a daily basis to compensate for any possible changes in microphone sensitivity.

1. Configure the following switch settings.

Display: SLM (L_A)

Time weighting: FAST

2. Insert the microphone carefully into the insertion hole of the calibrator.
3. Turn on the calibrator and adjust its CAL potentiometer so that the display matches the calibrator output.
4. Note that the 407790 is fully calibrated before shipment.
5. Recommended full recalibration cycle: 1 year.



Measurement Preparation

1. **Battery loading:** Remove the rear battery cover and insert four 1.5V 'C' size batteries. Take care to observe battery polarity.
2. **Battery replacement:** When the battery voltage drops below operating voltage,
3. **LBATT** flashes on the display.
4. **AC adaptor connection:** Insert the adaptor in the DC 6V jack on the side panel.

Setting the Calendar Clock

Date and time information is stored with each record saved. Set the date and time as follows:

1. Press the 2nd button once and then press the MEAS TIME button to enter the date and time mode. The display screen in the second function location will flicker.
2. Press the ▲ LEVEL ▼ button to increment/decrement the values.
3. Use the ◀ Cursor ▶ button to scroll through year/month/day/hour/minute/second setting locations (location will flash when it is ready to be programmed).
4. Press the ▲ LEVEL ▼ button to set the value.
5. When the settings are correct, press the ENTER button to exit this mode. The calendar clock will start running.

Note: When no changes are made to the date and time or the ENTER button is not pressed within one minute, the date and time settings will not change and the unit returns to normal operating mode automatically.

Sound Pressure Level

Technical notes

1. The decibel (dB)
The range over which the human ear responds to sound pressure (noise) is extremely large; in Pascals (Pa) it is 20 μ Pa (the threshold of hearing) to 100 Pa (the threshold of pain). The measurement of sound pressure has been made more convenient by the use of the decibel, which is logarithmic. However, decibels are non-linear and therefore cannot be added together. A simple rule is that doubling the amplitude of the noise under test causes the level to rise by 3dB.

2. SLM-sound level meter: Instantaneous sound pressure level (SPL) is used for spot checks to establish instantaneous noise levels. SPL is defined by the logarithmic equation:

$$\text{SPL (in dB): } 20 \log_{10} \frac{P}{P_0}$$

Where P = rms measured sound pressure level

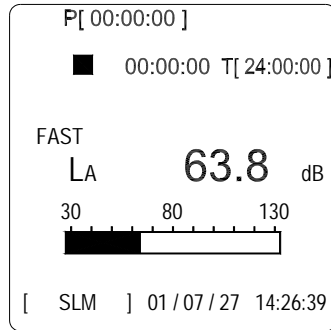
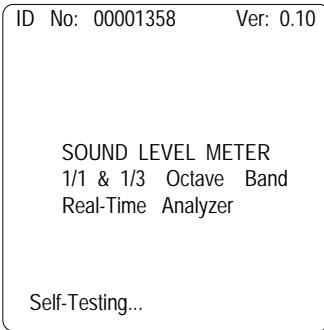
P_0 = rms reference sound pressure level (20 μ Pa)

3. Leq-level equivalent (continuous): Leq is used to assess the rms average noise level over a preset period of time, often the starting point of a noise assessment. To take a Leq measurement the period of time over which it is to be made must be selected. The longer the period of measurement time, the more accurate the Leq reading will be, a typical period is 8 hours (the length of a working day).
4. LE – Sound exposure level
LE measurements are almost identical to Leq measurements but normalised or compressed to 1 second. This allows the total sound energy of an event, such as train passing a platform, to be evaluated. Another event, such as the next train, which lasts for a different amount of time, can be measured in the same way. The two readings can be compared to assess how much total noise the passengers standing at the platform were exposed to by each train. To make an LE measurement either a preset time period must be selected on the instrument, or the PAUST/CONT key must be used to stop and start the measurement of a specific event.

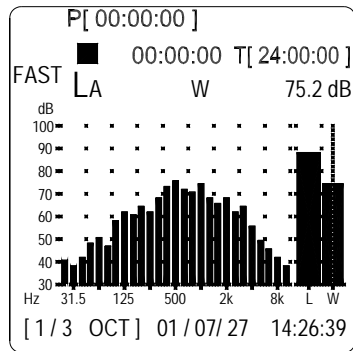
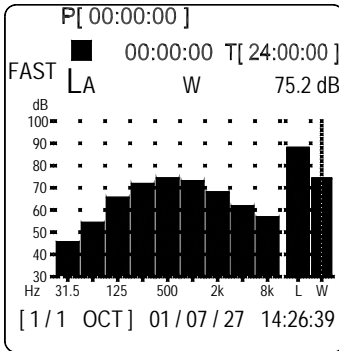
Instantaneous sound pressure level measurement (L_A , L_C , L_P)

To perform a measurement, carry out the following steps.

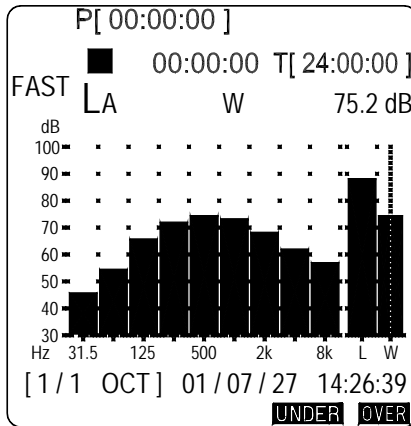
1. Set the power switch to ON and wait until the measurement screen appears.



2. Press the **SLM/ 1/1/ 1/3** button to select the desired SLM, 1/1 or 1/3 octave band sound pressure level measurement screen.



3. Use the **FREQ WGHT** button to select the desired L_A , L_C or L_P frequency weighting setting.
4. Use the **TIME CONST** button to select the desired FAST or SLOW time constant setting. Normally, the "FAST" setting should be used.
5. Use the **▲LEVEL▼** button to select the range. Choose a setting in which the "OVER" and "UNDER" indications do not appear. In SLM mode, the dynamic range is 30~130dB so the **▲LEVEL▼** button is not used.



L_{eq} and L_E measurement

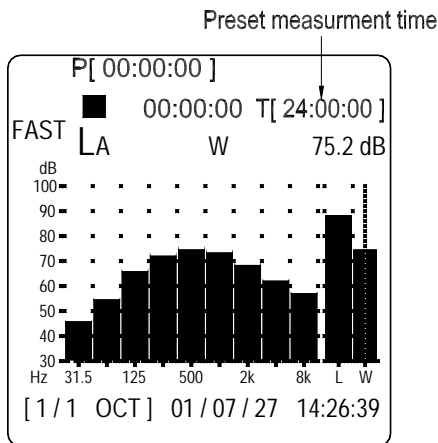
To perform a measurement, carry out the following steps.

1. Set the power switch to ON and wait until the measurement screen appears.
2. Press the **MEAS TIME** button to set the preset measurement time (known as the integral time) after which measurement automatically stops.

There are 13 preset time settings available:

- 1s
- 3s
- 10s
- 30s
- 1min
- 5min
- 8min
- 10min
- 15min
- 30min
- 1h
- 8h
- 24h

Note: The setting will wrap around from 24h to 1s.



3. Use the **[LM/ 1/1/ 1/3]** button to select the desired SLM, 1/1 or 1/3 octave band sound pressure level measurement screen.
4. Use the **[FREQ WGT]** button to select the desired L_A , L_C or L_F frequency weighting setting.
5. Use the **[TIME CONST]** button to select the desired FAST or SLOW time constant setting. Normally, the "FAST" setting should be used.
6. Use the **[▲ LEVEL ▼]** button to select the level range. Choose a setting in which the "OVER" and "UNDER" indications do not appear. In SLM mode, the dynamic range is 30~130dB, so the **[▲ LEVEL ▼]** key is not activated.
7. Press the **[START/STOP]** button. The "▶" mark appears on the display and the equivalent continuous sound pressure level measurement begins.
8. The following status displays are used in the mode "▶ measuring", "⊗ ⊗ pause" or "⊗ terminate". Use the **[MODE]** button to select any parameter L , L_{eq} , L_E , L_{max} or L_{min} .
9. When the measurement time set in step 2 has elapsed, the measurement terminates automatically.
10. Terminate the measurement earlier by pressing the **[PAUSE/CONT]** button, "⊗ ⊗" will appear on the display. Press **[PAUSE/CONT]** to resume measuring.
11. Press the **[START/STOP]** button to stop measuring, the "⊗" mark will appear on the display.
12. Press the **[MODE]** button to display the L_{Aeq} , L_{AE} or other parameter value.

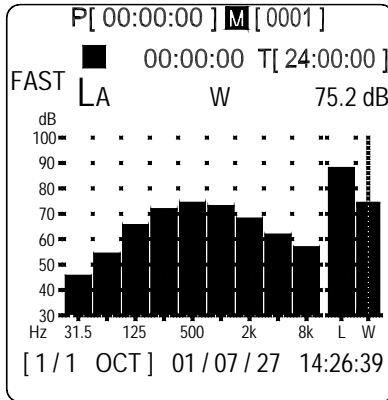
Note: In this measurement mode, the frequency weighting, time weighting and SLM/ 1/1/ 1/3 mode cannot be changed.

Datalogging

The 407790 has an automatic and a manual datalogging function. Stored measurement results can be displayed by pressing the **RECALL** button.

Manual Datalogging (1024 data sets)

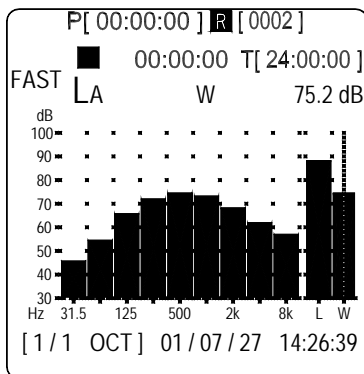
1. Set the power switch to ON.
2. Use the **SLM/ 1/1/ 1/3** button to select the desired SLM, 1/1 or 1/3 octave band sound pressure level measurement screen.
3. Press the **MEMORY** button to enter to memory mode; the display shows **M [0001]** which is the first data record address number.



4. Press the **STORE** button and one set of data will be stored in the [0001] memory address location. The address counter is incremented by one.
5. Repeat the above steps to store additional data.
6. Press the **MEMORY** button again to exit the memory mode.

Reading from memory

1. Press the **MEMORY** button to access the memory mode; the display will show **M** [***].
2. Press the **RECALL** button to recall data; the display will show **R** [****] which is the record number and the data value in memory. If there are no data records in memory the **RECALL** button will not be active.

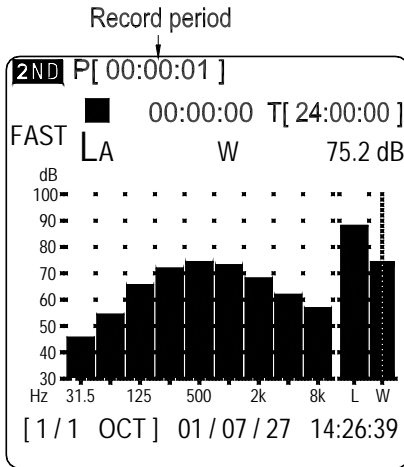


3. Press the **2nd** button, the **2ND** annunciator in the upper left of the screen will display.
4. Press the **◀ Cursor ▶** key to select the memory address of the data to be viewed.
5. In the 1/1 or 1/3 octave band screen, Press the **2nd** button to remove the **2nd** annunciator, then press the **◀ Cursor ▶** button; the frequency and level values for the desired data points will display.
6. Press the **2nd** button to remove the **2nd** annunciator.
7. Press the **RECALL** button to exit the recall mode.
8. Press the **MEMORY** button to exit the memory mode.

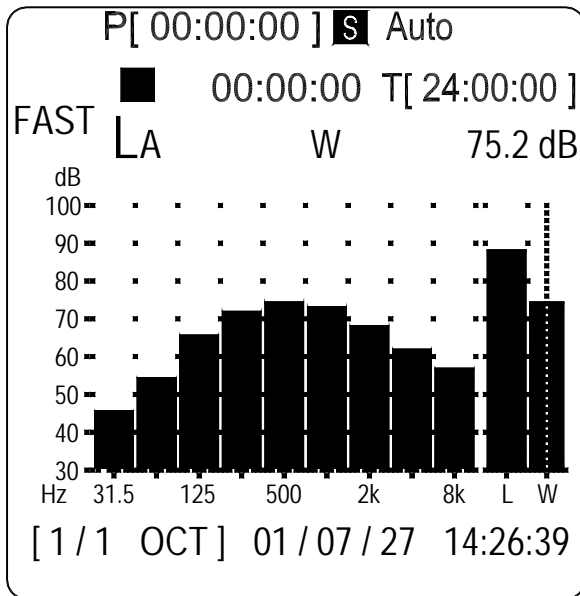
Automatic Datalogging

First set the datalogging sampling rate (how often a reading is stored). When in the auto datalogging mode, parameter editing is disabled.

1. Setting the sampling rate: The default value is "0" indicating that datalogging is disabled. Press the **2ND** button, then press the **MEMORY** button to select the sampling rate from the following list: 0sec (No recording) → 1sec → 3sec → 10sec → 30sec → 1min → 5min → 8min → 10min → 15min → 30min → 1hr → 8h → 62.5ms. For example: with the rate set to 1 second, the display will read: P [00:00:01].



2. Press the **2ND** button, the **2ND** annunciator will disappear from the screen.
3. Use the **SLM/ 1/1/ 1/3** button to select the desired SLM, 1/1 or 1/3 octave band sound pressure level measurement screen.
4. Set the preset measurement period (explained above in section X).
5. Press the **MEMORY** button to enter the memory mode; the upper portion of the LCD will display "**M** [****]".
6. Press the **START/STOP** button, automatic datalogging will begin. The upper portion of the screen will display "**S** Auto" and the "▶" annunciator.

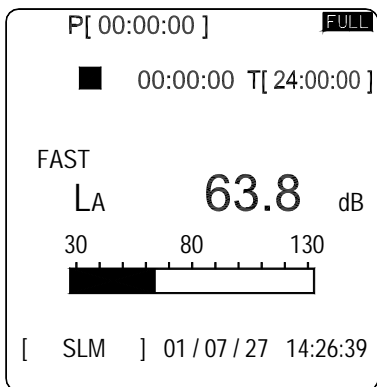


CAUTION: While automatic datalogging, parameter editing is disabled.

- When the preset measurement time has elapsed (or the internal memory fills up to maximum capacity) press the **PAUSE/CONT** button or press the **START/STOP** button, to end the auto datalogging session.
- To retrieve the stored data, use the PC interface utility.

Erase memory data

1. When the instrument memory is full, the **FULL** annunciator appears in the upper right hand corner of the screen.



ID No: 00001358 Ver: 0.10

ALL Memory are Erased !!
SOUND LEVEL METER
1/1 & 1/3 Octave Band
Real-Time Analyzer

Self-Testing.....OK!!

2. Turn off the meter, then press and hold down the **STORE** and the **RECALL** buttons together. Turn on the meter and when the display shows "ALL Memory Erased!" release the keys.