

# Fusion

## Smart Sound & Vibration Analyser



Acoem's Fusion is the most versatile Class 1 sound level meter on the market, designed for acoustic consultants, experts, and technicians alike. From handheld measurements and building acoustics to environmental noise monitoring and long-term studies, Fusion adapts to any challenge with precision and accuracy.

Discover the Fusion difference:

**Unrivalled versatility** **Intuitive** operation for simple and advanced tasks **Seamless** integration with Cadence cloud platform

Explore the datasheet to learn how Fusion can revolutionize your acoustic workflow.

## Fusion

Certified to the highest standards (IEC 61672), FUSION delivers unparalleled versatility and performance in a single, easy-to-use instrument. Capture acoustic, vibration, and audio data simultaneously, even with wireless sensors. Boost your productivity with seamless remote control and powerful processing software.

## General Overview

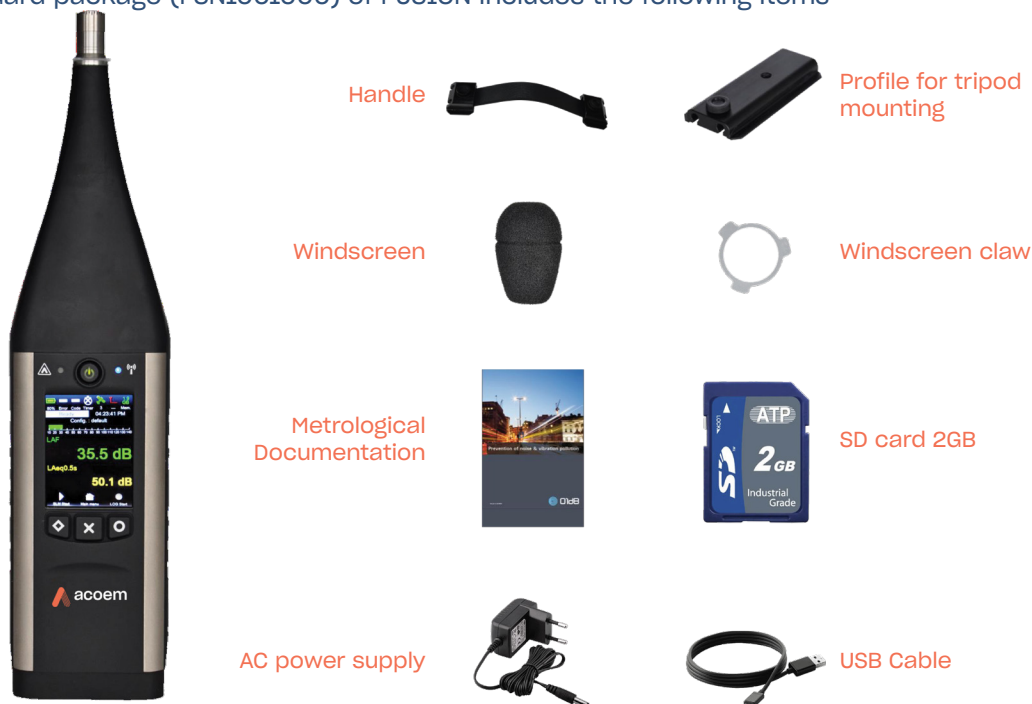


1. Class 1 microphone
2. Integrated preamplifier
3. Colour display
4. Keyboard
5. Windscreen
6. Removable hand grip
7. Rail fastening
8. Mini HDMI
9. DC 8-28V power supply input

10. RJ45 Network
11. External microphone preamplifier input & analogue output
12. Mini USB
13. SIM card slot
14. RS232 input
15. TTL input/output
16. SD card slot

## Deliverable & Accessories

The standard package (FSN1001000) of FUSION includes the following items



## Cadence & Fusion

Fusion is versatile and can be used as dedicated noise monitoring system designed for seamless integration into your existing setup. To further streamline your monitoring projects and reduce

operational costs, Acoem offers Cadence, a suite of web services that simplifies deployment, management, and maintenance.

## Cadence

User-friendly platform puts the power of acoustic monitoring in everyone's hands.

### Data Security and Control

Cadence secures your acoustic data and provides real-time information on sound levels, system alerts, and triggers.

### Integrated Artificial Intelligence

Automatically identify problematic noise sources with Cadence's pre-trained AI. Save time and simplify acoustic analysis without specific expertise.

### Advanced Connectivity

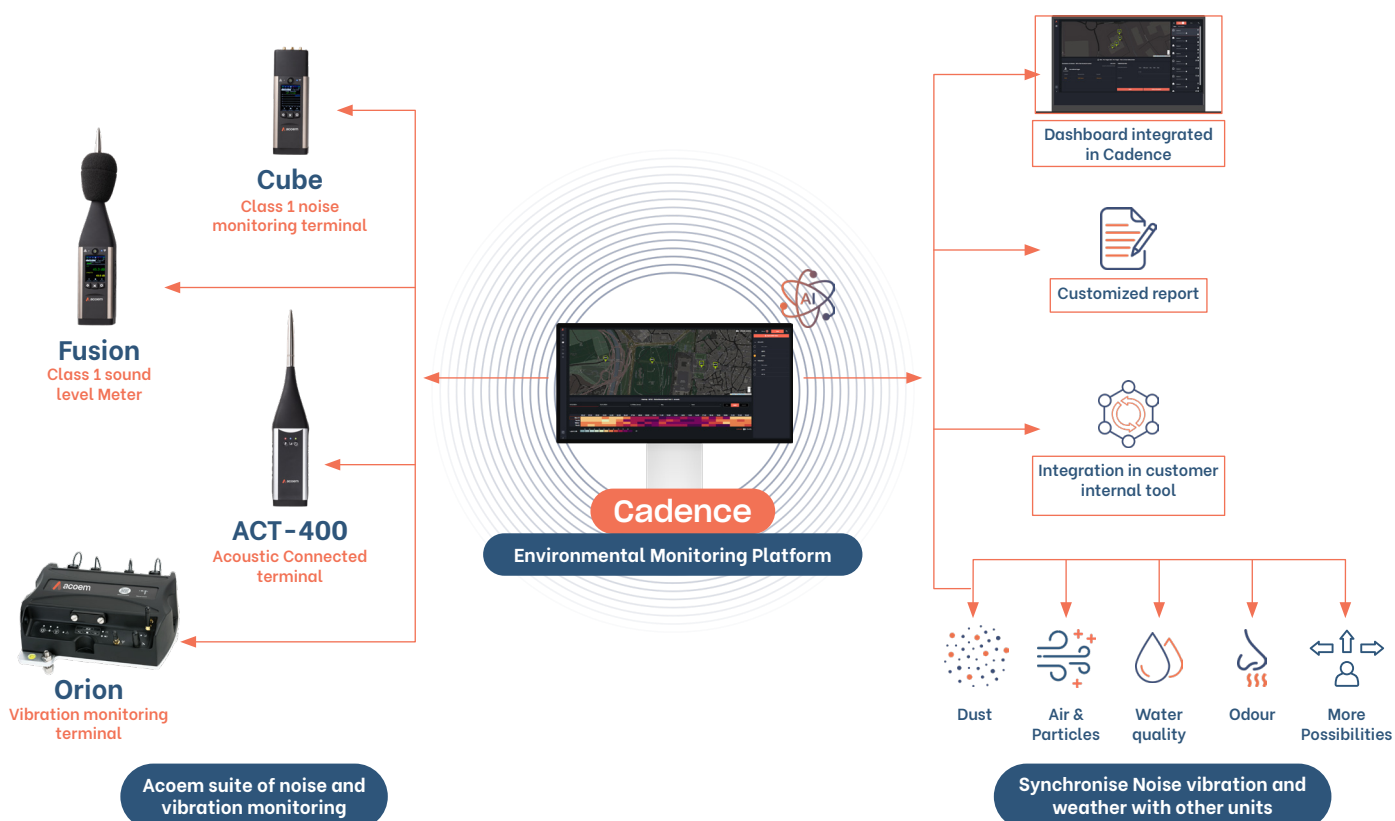
Transform your sound level meters into connected objects. Remotely manage your Acoem devices: configuration, updates, metrological monitoring, and scheduling.

### Optimized Communication

Accelerate decision-making by sharing relevant information with the right people. Create public consultation sites and configure real-time alerts.

### Seamless Integration

Integrate Cadence with your existing systems via documented APIs. Exchange real-time and aggregated data with your other tools for optimized monitoring.



## Technical Specifications (serial number > 14000)

### IEC class

IEC 61672-1 ed. 2.0 (2013) (0° & 90° reference direction)

IEC 61620 (1995) NF EN 61260/A1 (2002)

Sound Level Meter, Integrating Sound Level Meter with storage, group X.

### Type approval (extract)

France: N° LNE-29639 rév. 3 du 07 juin 2021

Switzerland: METAS: CH-A3-2111 0-00

Germany: PTB: DE-16-M-PTB-0008, Revision 2

Portugal: NESMC-11

Spain: CEM: 210491003/M2

### Dynamic range

21-139 dB (A, B), 26-139 dB (C), 31-137 dB (Z),

One single range for a rated sensitivity of 40 mV/Pa

### Linear operating range for A weighting (5 frequencies)

31,5 Hz : 26-98 dB

1 kHz : 23-138 dB

4 kHz : 23-138 dB

8 kHz : 23-134 dB

12,5 kHz : 23-130 dB

### Dynamic range Peak

60-140 dBC, 1 single range

### Time weightings

Slow, Fast, Impulse, Peak

### Frequency weightings

X=A, B, C, Z; Y=S, F, I for LXeq & LXY X=A; Y=S, F, I for LXYTd

X=C, Z for LXpk

### Instantaneous broadband values stored

	LXY				LXYeq				LXYTd				LXYMinMax			
	A	B	C	Z	A	B	C	Z	A	A	B	C	Z			
F	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pk			✓	✓												

LnsT (sliding Ln) | LAeqsT (sliding LAeq)

LAexPT (exposure level)

### Instantaneous weather data stored

Fe[kHz]	48	32	16	8
Possible bit rate [kbps]	32	32	8	8
	96	96	32	32
	192	192	96	96

Wind speed [m/s] Wind direction [°] Rain intensity [mm/h]

Barometric pressure [hPa] Air temperature [°C] Humidity [%HR]

### Noise logging period T

Mini 20ms - maxi 3600s, 5 ms steps

Short logging period: mini 20ms - max standard T, 5 ms

steps. Short logging period applicable during events Short logging period must be a divisor of T

### Weather logging period

Weather logging period is a multiple of T with a minimum of 1 second

### Spectral analysis

Parallel measurement & storage of Leq & LY (Y=F, S, I)

### Filters

1/1 (8Hz-16kHz) et 1/3 (6.3Hz-20kHz)

### Statistics

7 selectable Ln in parallel from L1 to L99, 1 dB class Samples for calculation: T if Leq or 20 ms if LXY, 0.1 dB resolution.

### Back erase

0, 5s or 10s, SLM mode only

### Input high pass filter

0,3 Hz / 10 Hz

### Reference directions

0° on internal input

0° & 90°, selectable built-in correction on external input (with a DMK01 external microphone)

### Reference point for microphone

Centre of the protection grid (with or without nose cone).

### Calibration

Reference level: 94 dB

Acoustic calibration detection

### Starting point for linearity tests

Reference level, i.e. 94 dB.

### Data storage modes

SLM (hand-held sound level meter) & LOG (logging sound level meter)

### Signals recording

Audio signal type

allows selecting either RAW (uncompressed data for dBTrait post-processing) or MP3 (format MPEG-1/2 Audio Layer 3 compressed data). allows selecting audio signal sampling frequency; Possible choices:

For RAW : 51.2kHz, 25.6kHz, 12.8kHz, 6.4kHz, 3.2kHz, 1.6kHz

For MP3 : 48kHz, 32kHz, 16kHz, 8kHz.

MP3 bit rate [kbps] allows selecting MP3 bit rate ; possible

### Triggers (5 different per event)

Settings for pre-trigger, post-trigger, minimum time, end time

Types: on instant acoustic and weather values (except wind direction), instant spectral values, TTL input.

### Manual markers

On the instrument: 1 code "code 1"

On web interface: 5 codes: "codes 1 to 5"

### Timers

Immediate, differed, daily periodic Audio: periodic

### Typical background noise

Microphone (thermal noise): 14.5 dBA, 15.0 dBC, 15.3 dBZ

	[dB]	LA	LC	LZ
Acoustic	Typical	16,1	16,8	20,2
	Maximum	20,0	21,0	24,0
Electric	Typical	11,0	12,5	18,5
	Maximum	16,0	16,0	21,0

### Vibration

Signal: Metrological,  $F_s = 12,800$  Hz

Pre-trigger = 0 sec

1 (Z) or 3-axis(X, Y & Z)

### Audio recording triggers

Simultaneously with events & manual  
(using FUSION integrated key & web interface  
for remote control)

### Events (automatic coding)

5 user-definable event: codes 6 to 10 24

user-definable time periods

### Preamplifier

Integrated, not removable

External type PRE22 (included in DMK01) on external input  
(standard 10 m lemo extension cable)

### Integrated keys

4 silent keys: on/stand-by/off & 3 multi-functions keys

### Status indicators

LED red (overload)

LED blue (Wi-Fi connection)

LED green (power ON, blinking on on-going  
measurement, charge ON)

### Display

High contrast colour screen 38\*50mm resolution 320\*240  
pixels 3 sets of colours (day, contrast, night) Display rate:  
0.1s, Display resolution: 0.1dB

### USB connection

Type 2.0; mass storage mode, charge on USB

### Ethernet connection

Connector RJ45, Speed: 100 MB/s DHCP(automatic) and  
Manual modes available

### Wi-Fi Connection: (Antennas included)

IEEE 801.11b, g

Point-to-point connection & infrastructure mode

### Cellular network connection (Antennas included)

Embedded modem 3.5G compatible with 4-band GSM/GPRS/  
EDGE & 3-band UMTS/HSDPA

### Data connectivity

Integrated Network protected http server for web interface

Integrated FTP server for data access

### SMS alarms

On event:

SMS text with CUBE serial #, location, date and time, user  
defined text, IP address:http port

On low battery (10%):

SMS text with CUBE serial #, location, date and time, %  
remaining battery

On movement:

SMS text with CUBE serial #, location, date and time,  
GPS coordinates, distance from previous location,  
IP address:http port (the alarm trigs if CUBE has moved  
more than the user defined distance)

### Automatic SMS actions

Sending "IP" by SMS to instrument makes it reply by sending  
an SMS with instrument serial #, location, date & time,  
IP:port address & automatically sends a new SMS at every  
new IP address in case of floating IP

### Actions on SMS sent to the instrument

On SMS sent "IP", the instrument replies by sending an SMS  
with the instrument serial #, location, date & time, IP:port  
address On SMS sent "stop", the instrument stops replying  
new SMS if IP has changed On SMS "reboot", the instrument  
reboots to establish a new connection & replies with an  
SMS with instrument serial #, location, date & time, IP :port  
address

### Web interface refresh rate webpages

Standard: twice per second Mobile: once per second

### Analogue output

Audio output A, B, C or Z (+/-10Vpp R=2000hms)

Adjustable gain: 0, 10, 20, 30, 40, 50 dB

### Electrical check

Programmable periodicity: 1, 2 or 4 times per day (0h,0h-  
12h, 0h, 6h, 12h, 18h)

3 pre-set frequencies (1000 Hz, 2000 Hz, & 4000 Hz) & 2  
user-defined frequencies (between 10 Hz & 20 kHz)

2 user-defined excitation levels, maximum level 5 V (100%)

### External microphone input

For DMK01, PRE22 (R = 560kOms / 22Vpp (+/- 11V)

### TTL output

R = 100 Ohms / 0 / 5V

### TTL input

R = 100 kOhms / 0...1V = «0» 1.8...5V =>



### Typical power consumption

Without communication (screen switch off): < 1200 mW  
+ Wi-Fi & screen switch on: < 1800 mW  
+ Modem: <3800 mW

### Operating lifetime

20 hours with Wi-Fi connection (during 10% of measurement time) (for temperatures ranging from 10°C to 50°C, in LOG mode with IT = 1 s, fine IT 100 ms, 1/3 octave & audio recording on threshold during 10% of the measurement time)

### External power supply

DC 8 to 28 V on charge input  
DC 5 V on USB input (slow charge)

### Memory

SD, SDHC or SDXC card, 2 GB or higher (2GB standard delivery) for measured data & signals. Minimum recommended requirement: ≥ class 10. Please note only SD cards provided by Acoem should be used. Acoem cannot be held responsible for data loss if the SD card used is not delivered by Acoem.

Measured data stored on the SD card every 10 seconds.  
Non-volatile memory for configurations, system log (500), calibration data (500) & electrical checks (500)TTL input  
 $R = 100 \text{ k}\Omega / 0 \dots 1 \text{ V} = \llcorner 0 \gg 1.8 \dots 5 \text{ V} = \gg 1 \gg$

### Battery

Type lithium polymer Voltage 3.7V Capacity 6750 mAh  
Non-removable, charging time approximately 3 hours

### Clock

GPS PPS, error < 50 milliseconds Internal clock, error < 0.5 s/24 hours

### Localization

Automatic with integrated GPS  
Information stored with measurement campaigns

### Warm-up time

From power off: < 25 seconds

### Operating temperature:

-10°C to +50°C

### Humidity

IEC 60068-2-78: damp heat: 90% HR  
(non condensing at 40°C).

### Electromagnetic compatibility

According to Directive 2004/108/EC  
NF EN 61000-6-1 NF EN 61000-6-2 NF EN 61000-6-3  
NF EN 61000-6-4 (2001)  
ETSI EN 300 328 V1.5.1 (2004)

### Protection

IP40 in standard use  
IP42 if the instrument is used in vertical position without connectors cover  
IP55 if the instrument is used in vertical position with connectors cover

### Influence of vibration

Use with no outdoor microphone:

For mechanical vibration of an acceleration level of 1 m/s<sup>2</sup> perpendicular to the microphone diaphragm, at frequencies 31.5 Hz, 63 Hz, 125

Hz, 250 Hz, 500 Hz, 630 Hz, 800 Hz & 1000 Hz:  
the lower limit of the linear operating domain for A-weighting becomes 80 dB.

For mechanical vibration of an acceleration level of 1 m/s<sup>2</sup> parallel to the microphone diaphragm, at frequencies 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 630 Hz, 800 Hz & 1000 Hz: the lower limit of the linear operating domain for A-weighting becomes 60 dB.

Use with outdoor microphone unit DMK01:

For mechanical vibration of an acceleration level of 1 m/s<sup>2</sup> perpendicular to the microphone diaphragm, at frequencies 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 630 Hz, 800 Hz & 1000 Hz:  
the lower limit of the linear operating domain for A-weighting becomes 75 dB.

### Weight & dimensions

775 g

H x L x P: 300 x70 x 52 mm

### Building Acoustics Module (Opt.FSN2009000)

#### CALCULATION OF REVERBERATION TIMES

Fine IT 20 ms for decay analysis Simultaneous calculation of T20 & T30

Automatic detection of interrupted or pulsed noise sources  
Schroeder integration for pulsed sources Estimate by least squares approximation

### Calculation of quality indicators (Iso 3382)

Name	Quality indicator	Description, default values
N	Background noise level too high*	Low dynamic range (between 41 & 45 dB for T30; between 31 & 35 dB for T20)
D	Calculation impossible*	Insufficient dynamic range (< 41 dB for T30; < 31 dB for T20)
<	Reverberation time too low*	$T_r < 0.24$ seconds (scaled by logging period = 20 ms)
ξξ	Non-linearity*	Non-linearity parameter >1%
C	Curvature*	$C > 10\%$ or $C < 0$ ; see [1] appendix B.3 Difference
L	Linearity of the sound source linearity	Difference between adjacent 1/1 or 1/3 octave bands > 6 dB

### Frequency-based analysis

1/1 or 1/3 octave, 50 to 5000 Hz

#### Levels L1, L2, Li (Emission, Reception, Impact Noise)

Calculation of the mean spectrum L<sub>Ze</sub> over the specific coding duration, detected automatically (source on duration).

#### Background Noise Level (Db)

Calculation of the mean spectrum over the entire Measurement duration

#### ISO 3382-2 standard indicator

Invalid indicators displayed on the Tr spectrum & stated on decay

#### Audio Comments

Used to store a voice comment, with the same sampling frequency as for the measurement

#### Pc Software

dB Inside

#### Integration Times (It)

1 second; 20 milliseconds

#### Maximum Averaging Time For Spectra L1, L2, Lb & Li

120 seconds

#### Maximum Measurement Time For Equipment Noise

600 seconds

#### Simultaneous Audio Recording

Sampling frequency: 51.2 kHz, 25.6 kHz, 12.8 kHz, 6.4 kHz, 3.2 kHz, 1.6 kHz

#### Equipment Noise Levels

Selection of the maximum level for one of the following parameters: LX<sub>Y</sub>Max where X = A, C or Z & Y = F, S or I

#### Optional Accessories

Weather Station and anemometer:

	WXT532	ANEMO	WXT536
Wind speed	✓	✓	✓
Wind direction	✓	✓	✓
Air temperature		✓	✓
Relative humidity			✓
Rain intensity			✓
Barometric pressure			✓

Wireless vibration sensor 3-axis (X, Y, Z) 80g, Weight 373 g, Dimension Ø42 x H116 mm, 8h battery life.

Weatherproof external charger IP67 (10m cable)

Connecting these accessories has no Influence on measurements.



DMK01  
(External Microphone)



Kit weatherproof -  
(Standalone)



CAL31 Class1 Calibrator



DSC01 Outdoor case



TM01 Tapping Machine



Omnidirectional Sources  
- LS01 LS02 LS03 LS04



Anemometer



WXT Weather Station