PRODUCT DATA

Exhaust Noise Inspector — Types 3638 A and 3638 B

Exhaust Noise Inspector is a complete all-in-one system, designed for automatic measurement of exterior exhaust sound levels from road vehicles under stationary conditions, simultaneously with RPM detection. The noise level and engine RPM are measured with the same microphone.

A large display, showing all the necessary information, and an optional tachometer allow extremely simple and quick measurements, in accordance with the standards.

Local authorities and police inspectors will appreciate the ergonomics of the system, allowing measurements to be performed by one single operator.

USES

- Measurement of exterior exhaust sound level from motorbikes, cars, trucks and mopeds under stationary conditions (engine sweep test)

FEATURES

- IEC and ANSI Type 1 Sound Level Meter Type 2238
- Non-contact measurements of engine RPM by computing the engine speed from the acoustic signal of the exhaust noise
- Allows totally non-invasive tests of vehicles – the engine bonnet or compartment cover does not need to be opened
- Acoustic detection of engine RPM for 2- and 4-stroke engines, gasoline and diesel, from 1 to 12 cylinders
- Suitable for use by a single operator – a dedicated computer manages the complete measurement sequence
- All in one suitcase. It can be carried easily on a motorcycle, for use by motorcycle police
- Battery operated
- Intuitive setup menu for measurement configuration and engine type, via 4 keys
- Remote control of the SLM, for setup, autorange and measurements
- Simultaneous measurement and display of sound level and engine RPM
- Red and green lights indicator for throttle control setup
- Automatic trigger of the measurement when the correct RPM is reached
- Automatic procedure according to 70/157/EEC and ISO 5130
- Integrated printer for measurement reports
- Optional electromagnetic external tachometer
- Print out of results for instantaneous report

Introduction

The Directive on Motor Vehicles 70/157/EEC: “Permissible Sound level and the exhaust system of motor vehicles” and its amendments describe a measurement procedure to facilitate subsequent checks on vehicles in use. In addition, ISO – 5130 (under revision) specifies a test procedure, environment and instrumentation for measuring the exterior exhaust sound levels from road vehicles under stationary conditions, providing a continuous measure of exhaust system sound level over a range of engine speeds (engine sweep test).

Exhaust Noise Inspector is a Sound Level Meter (SLM) especially designed for automatically performing the complete measurement procedure mentioned above.

Automatic Calibration

Fig. 1
Automatic calibration

The system assists the operator in calibrating the SLM. Once the calibration menu has been selected, you only have to insert the microphone into Type 4231 Sound Level Calibrator and activate calibration. The results can be printed for official reports.

Making a Complete Measurement

Measurement Setup

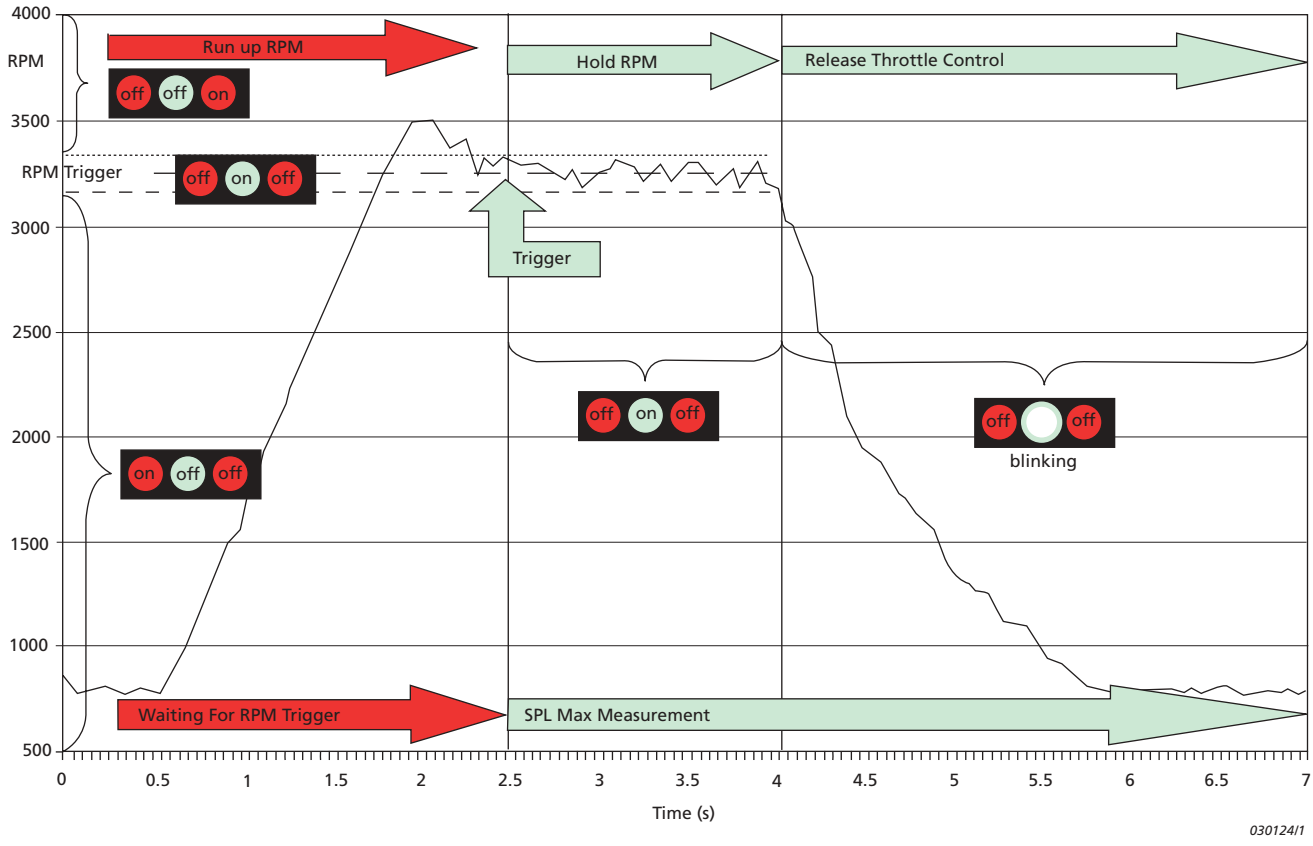
Before starting a measurement, you have to enter the different parameters via the setup menu:

- RPM trigger value: set at three-quarters or half of the engine’s rated maximum net power, as stated by the manufacturer.
- Type of engine (2 or 4 stroke)
- Number of cylinders

Measurement Sequence

The sequence, (see Fig. 2), is started by operating the throttle so that the engine speed gradually increases from idle to the engine speed corresponding to the trigger RPM value, with help from the RPM Indicator, (see Fig. 3). Then the speed should be held constant for 1 to 2 s. Finally, the throttle should be released rapidly and the engine speed allowed to return to idle. The SLM will measure from the time the RPM trigger occurs, until the engine has returned to idling position. This sequence is generally repeated 3 times, but can be modified, if required.

Fig. 2 *Complete measurement sequence*



Instrument Display Features

RPM Indicator

Fig. 3
RPM indicator

The RPM Indicator consists of three LEDs. During a measurement, the red LED on the left lights up while the engine RPM is under the RPM trigger. The central green LED lights up when the RPM trigger level is reached, (and while the RPM is between the upper and lower RPM trigger limits), and the red LED on the right lights up when the engine RPM is too high. When the green LED blinks, the throttle should be rapidly released so the engine can return to idle speed. If only the red LEDs are on, this signifies that the measurement phase has been completed and the engine is now returning to idle ready for the next measurement.

Display

Fig. 4
4-line display

During a measurement, the 4-line display shows sound level in real-time of the current measurement, and displays the previous measurements. See Fig. 4.

Results

Fig. 5
Printout

The results are available on a printed report which includes the following information:

- Engine RPM trigger
- Number of cylinders
- Type of engine
- Date/time
- Measurement values
- Criteria level
- L_{max} or $L_{average}$
- Pass/Fail criteria
- SLM serial number

External Tachometer (Optional)

Fig. 6
External tacho setup (boot closed)

In some cases where the exhaust noise level is low compared to other sources, such as cars with noisy rear engines, or motorbikes with noisy engines, the normal acoustic detection of engine RPM is not suitable. An external tachometer is recommended in order to be able to perform measurements on these types of vehicles, see Fig. 6 and Fig. 7.

Fig. 7
External tacho placed next to the engine

The tachometer is recognised by the system when you connect it. Open the bonnet and place the tachometer close to the ignition system. Its display and indicator allow monitoring of the correct signal capture. Then close the bonnet while performing the test. The measurement sequences are then performed in the same way as acoustic detection, with the inspector displaying engine RPM (in real-time), measured now by the tachometer.

What the System Includes

Fig. 8
Complete suitcase including SLM, calibrator and optional tachometer

Type 3638 A is the complete system, with specially designed suitcase containing Type 2238 Sound Level Meter and Type 4231 Sound Level Calibrator, see Fig. 8. The suitcase contains all the equipment you need to perform exhaust noise testing. See the Specifications for a complete list of accessories.

Type 3638 B is the suitcase excluding Type 2238 Sound Level Meter and Type 4231 Sound Level Calibrator, for customers who already have a calibrator and Sound Level Meter Type 2238 or 2239.

Optional Accessories

Fig. 9
Optional tachometer

The Tachometer Type 2979, (pictured in Fig. 9 being used on a motorcycle), has to be purchased separately, see the Specifications for details.

Contact your local Brüel & Kjær representative for further information.

Compliance with Standards

CE, C-Tick	CE-mark indicates compliance with: EMC Directive and Low Voltage Directive. C-Tick mark indicates compliance with the EMC requirements of Australia and New Zealand
Safety	EN 61010–1 and IEC 61010–1: Safety requirements for electrical equipment for measurement, control and laboratory use. UL 3111–1: Standard for Safety – Electrical measuring and test equipment
EMC Emission	EN/IEC 61000–6–3: Generic emission standard for residential, commercial and light industrial environments. EN/IEC 61000–6–4: Generic emission standard for industrial environments. CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits. FCC Rules, Part 15: Complies with the limits for a Class B digital device.
EMC Immunity	EN/IEC 61000–6–1: Generic standards – Immunity for residential, commercial and light industrial environments. EN/IEC 61000–6–2: Generic standards – Immunity for industrial environments. EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements. **Note:** The above is only guaranteed using accessories listed in this Product Data sheet.
Temperature	IEC 60068–2–1 & IEC 60068–2–2: Environmental Testing. Cold and Dry Heat. Operating Temperature: –10 to +50 °C (14 to 122 °F) Storage Temperature: –25 to +70 °C (–13 to +158 °F) Effect of Temperature: < 0.5 dB (–10 to +50 °C)
Humidity	IEC 60068–2–78: Damp Heat: <0.5 dB for 30% < RH < 90% (non-condensing at 40 °C, 1 kHz)

Specifications – Exhaust Noise Inspector, Types 3638 A and 3638 B

The following specifications apply to both types of Exhaust Noise Inspector used with a Type 2238 Sound Level Meter, fitted with the supplied microphone, preamplifier and extension cable.

Note: Specifications that apply only to the SLM are shown in italics in the following specification.

STANDARDS
Conforms with the following:
- *IEC/EN 61672–1:2002 Class 1*
- *IEC 60651 Type 1, 1979 & Amendment 1 1993 & Amendment 2 2000*
- *EN 60651 Type 1*
- *EN 60804 Type 1*
- *ANSI S1.4 – 1983 Type S1*
- *ANSI S1.43 – 1997 Type 1*
- Measurements of exhaust sound levels emitted by stationary road vehicles according to ISO 5130 and 70/157/EEC: Standards:
- ISO – 5130:1982 (under revision)
- SAE J1492: 1998–05, Measurement of Light Vehicle Stationary Exhaust System Sound Level Engine Sweep Method
- SAE J1297: 1998–07, Measurement of Exhaust Sound Levels of Stationary Motorcycles

NATIONAL LEGISLATION
Germany: DIN ISO 5130 Methode für die Messung des Standgeräusches von Straßenfahrzeugen; 70/157EWG, 2/97/EWG, 96/20/EG, ECE-R 63, 78/1015/EWG, 97/24/EG, 1999/101/EC
France: Arrêté du 18 juillet 1985 relatif au contrôle au point fixe du niveau sonore des véhicules; 70/157/EEC

SUPPLIED MICROPHONE
Type 4188 Prepolarized Free-field 1/2" Condenser Microphone
Nominal Sensitivity: *–30 dB re 1 V/Pa or 31.6 mV/Pa*
Frequency Range: *8 Hz to 16 kHz ± 2 dB*
Capacitance: *12 pF*

MICROPHONE PREAMPLIFIER
ZC 0030

EXTENSION CABLE
5 m in length

MEASUREMENT RANGES
Dynamic Range – automatic setup of the measurement range by the inspector:
- *Type 2238: 80 dB, adjustable to give full-scale readings from 0 to 140 dB in 10 dB steps*

RPM MEASUREMENTS RANGE
- 2 or 4 stroke
- Number of cylinders: 1, 2, 3, 4, 5, 6, 8, 10, 12
- 200< RPM measurement capabilities< 13000 for 1, 2, 3, 4 cylinders
- 200< RPM measurement capabilities< 7000 for 5, 6, 8, 10, 12 cylinders
- Accuracy: better than 2 %

SLM REMOTE CONTROL
The inspector manages the Sound Level Meter Type 2238 or 2239 setup, autorange, measurements and measured values according to the above standards, automatically, via the RS–232 interface

TACHOMETER CONNECTION
'Plug and play'

DISPLAY
Digital Display:
4 lines back-lit LCD, which shows:
- Display of RPM & SPL (SLM display value) during measurement
- SPL_{max} of the previous measurements
- Remaining measurement time
- Warning for overload
- Warning for low battery power
- Menus for displaying and editing setup and advanced setup
- All relevant indications during calibration procedure

Colour lights display:
RED/GREEN/RED lights for indication of UNDER/OK/ABOVE RPM values for throttle control

CALIBRATION
Automatic, using Sound Level Calibrator Type 4231, via the SLM menu

PRINTER
Measurement data are automatically printed, (in the chosen language), or manually selected via the main menu. The data consists of the following:

- Engine RPM trigger
- Number of cylinders
- Type of engine
- Date/time
- Measurement values
- Criteria level
- L_{max} or $L_{average}$
- Pass/Fail criteria
- SLM serial number

TACHOMETER INTERFACE AND CABLING
Tachometer cable (length 4 m) connected to the system on the front plate

SETTLING TIME
From power-on: <20 s

BATTERY
Dry lead battery 6 V/7.2 Ah

Lifetime (at room temperature): typically >12 h
Power supply for SLM and external tachometer

LANGUAGE
Each instrument is loaded with English, German, French, Italian and Spanish text. You can select one of these languages at any time, via the advanced setup

EXTERNAL DC BATTERY CHARGER
Voltage: Regulated 7 to 15 V
Power: Approximately 150 mA at 7 V
Standard plug connected on the front plate

PHYSICAL CHARACTERISTICS
Size (L×W×H): 426.7 x 337.8 x 111.7 mm (16.8 x 13.3 x 4.4")
Weight: Type 3638 A – 6 kg (13 lb 2 oz.) (including SLM, calibrator, tachometer and all the accessories).

Ordering Information

TYPE 3638 A

Type 3638 A	Exhaust Noise Inspector (including Hard Case and inserts for SLM, calibrator, tachometer, controller, printer, additional paper roll for printer and accessories)
Includes the following accessories:	
Type 2238	Mediator™ Integrating Sound Level Meter
Type 4231	Calibrator
AO 0561-A	5 m Extension Cable for microphone
UA 1254	Microphone Holder
QH 0033	Tape Measure (for 50 cm measurement)
UA 0599	Cullman 2701 Mini-magic Tripod
ZG 0443	External DC Battery Charger
Optional Accessories	
Type 2979	Tachometer
AO 0604	4 m Cable for tachometer connection (with FRB-DIN connectors)
QP 0025	Set of 10 Paper Rolls
Service Products	
3638-A-REF	3638 A Repair, including conformance test with certificate
3638-A-CVF	Accredited Calibration of 2238 and 4231, followed by a Chain Verification of the measurements chain
3638-A-EW1	3638 A Extended Warranty, one year extension
3638-A-MS1	3638 A Software Upgrade, one year extension

TYPE 3638 B

Type 3638 B	Exhaust Noise Inspector (including Hard Case and inserts for SLM, calibrator, tachometer, controller, printer, additional paper roll for printer and accessories)
Includes the following accessories:	
AO 0561-A	5 m Extension Cable for microphone
UA 1254	Microphone Holder
QH 0033	Tape Measure (for 50 cm measurement)
UA 0599	Cullman 2701 Mini-magic Tripod
ZG 0443	External DC Battery Charger
Optional Accessories	
Type 2238	Mediator™ Integrating Sound Level Meter or
Type 2239	Integrating Sound Level Meter
Type 4231	Calibrator
Type 2979	Tachometer
AO 0604	4 m Cable for tachometer connection (with FRB-DIN connectors)
QP 0025	Set of 10 Paper Rolls
GM 0053	Modified Backplate for Type 2239 (used for external battery charger)

TRADEMARKS
Mediator is a trademark of Brüel & Kjær Sound & Vibration Measurement A/S

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