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## **HUMAN-RESPONSE VIBRATION METER TYPE 2512**

Applicable to instruments from serial number 927661

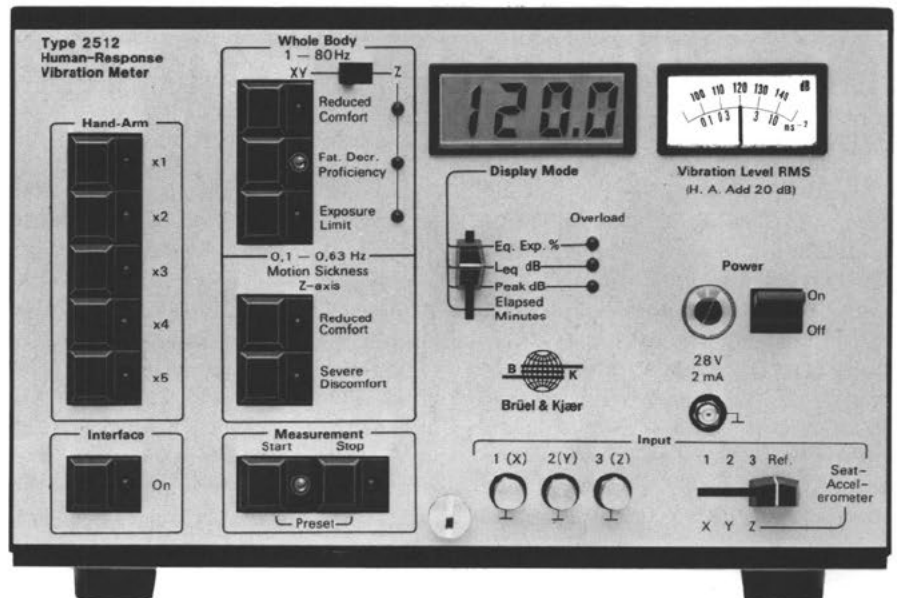
April 1981

types 2512 and 4322

## Human-Response Vibration Meter and Triaxial Seat-Accelerometer

### USES:

- Measurement of vibratory motion based on standardised human response criteria
- Measurements in the design, development and inspection of passenger vehicles, tractors, earth-moving equipment etc., and powered hand-tools for increased comfort and reduced fatigue
- Monitoring human exposure to vibratory environments
- Frequency analysis of vibration together with external filters



### FEATURES (2512):

- Whole-Body, Hand-Arm and Motion Sickness measurements, weighted in accordance with standards and recommendations, with a single portable instrument
- Digital readout of percentage of permitted exposure dose, equivalent RMS exposure level ( $L_{eq}$ ), peak acceleration level (giving crest factor) and elapsed time
- X-Y-Z inputs and appropriate weighting
- Analogue meter aids signal monitoring and  $m/s^2$  to dB conversion
- Built-in battery or external DC power supply
- Provision for connecting external filters
- Analogue (AC and DC) output for tape and graphical recorder or level analyzer

- Digital data output via IEC 625 compatible interface bus for automatic readout of full data to alphanumeric printer, calculator etc.

### FEATURES (4322):

- Detects vibration in three mutually perpendicular directions
- Built into a flexible rubber pad for comfortable seating
- Integral robust cable



The emergence of standards and recommendations specifying boundaries for human exposure to mechanical vibration has prompted the development of the **Human-Response Vibration Meter Type 2512**, a single easily operated instrument designed specially for making measurements in accordance with these standards. The 2512 includes comprehensive measurement facilities enabling the evaluation of "human" vibration as covered by current standardisation, Hand-Arm and Whole-Body including Motion Sickness. The complex compu-

tation of level, frequency and time factors is automatically carried out by the 2512 which displays either the exposure dose, the equivalent continuous vibration level, or the max. peak vibration level.

Its small size and built-in battery power supply make the 2512 ideal for both field and laboratory use. Several vibration pick-ups are available including Triaxial Seat-Accelerometer Type 4322 which is specially designed for whole-body measurements.

## Standards and Recommendations

**Human-Response Vibration Meter Type 2512** is designed to make frequency- and time-weighted vibration measurements in accordance with (1) International Standard ISO 2631-1978, "Guide to the evaluation of human exposure to whole-body vibration", (2) Draft Amendment to ISO 2631 DAM 1 submitted 14-2-80 (3)

Revised draft addendum to ISO 2631 DAD 2 (16-9-80), "Evaluation of exposure to whole-body z-axis vertical vibration in the frequency range 0,1 to 0,63 Hz. (4) Draft International Standard ISO/DIS 5349, Submitted 18-1-1979, "Principles for the measurement and the evaluation of human exposure to vibration transmitted to the hand".

Numerous national standards can be expected to appear which will be based on these international documents. Current status of both national and international standards should be requested from the relevant national standards institute.

**Triaxial Seat-Accelerometer Type 4322** is dimensioned in accordance with the requirements of SAE Recommended Practice J 1013 (1973).

# Human-Response Vibration Meter Type 2512

## Introduction

Human-Response Vibration Meter Type 2512 is a dedicated, battery operated instrument for measuring vibratory motion with respect to its ability to cause discomfort or damage to the human body. The instrument is conditioned to measure vibration in accordance with criteria laid down in several national and international standards and recommendations. Three categories are covered: (1) "Whole-Body" vibration relative to the "Reduced Comfort", "Fatigue Decreased Proficiency" and "Exposure Limit" boundaries (2) "Hand-Arm" Vibration covering vibration from tools and appliances held in the hand, and including correction factors for interrupted use, and (3) "Whole-Body Vibration" at very low frequencies which causes "Motion Sickness" (dealt with in an addendum to the "Whole-Body standard"\*).

The standards and recommendations define frequency dependent vibration amplitude limits for various periods of exposure and for various degrees of discomfort or danger. As the limits are both frequency and time dependent, both factors need to be included in any calculation to obtain the degree of discomfort or danger. Human-Response Vibration Meter Type 2512 is equipped with the appropriate frequency weighting filters and time weighting functions to enable a single figure measure of the severity of the motion to be obtained.

\* Additionally included in 2512 is a "reduced comfort" mode in the motion sickness category of whole-body vibration, this is valuable for research-oriented measurements.

Measured values are computed and displayed in three different modes; (1) the equivalent exposure, expressed as a percentage of the vibration dose allowed for the measured time; (2) the equivalent RMS vibration level ( $L_{eq}$ ) over a chosen measurement period; and (3) the maximum peak vibration level which has occurred during the chosen measurement period. Automatic hard-copy print-out of the measured levels can be obtained from an Alphanumeric Printer Type 2312 or any printer equipped with an IEC compatible interface bus.

### Basic Operating Procedure

One of the three possible input signals is chosen by means of the "Input" selector switch. As security against losing previously accumulated data both "Measurement"

"Start" and "Stop" pushbuttons must be depressed simultaneously before the vibration category i.e. "Whole-Body" "Hand-Arm", or "Motion Sickness", together with the relevant discomfort or danger criterion, may be selected. The measurement period is commenced by depressing "Start". At any time during measurement the "Display Mode" switch may be moved at will to display the accumulated exposure dose ("Eq. Exp."), the equivalent continuous level (" $L_{eq}$ "), the maximum peak level, or the elapsed time from the start of the measurement period. Depressing "Stop" interrupts measurement but the measurement may be restarted by depressing "Start" without losing data already accumulated. Pressing "Start" and "Stop" simultaneously clears all accumulated data.

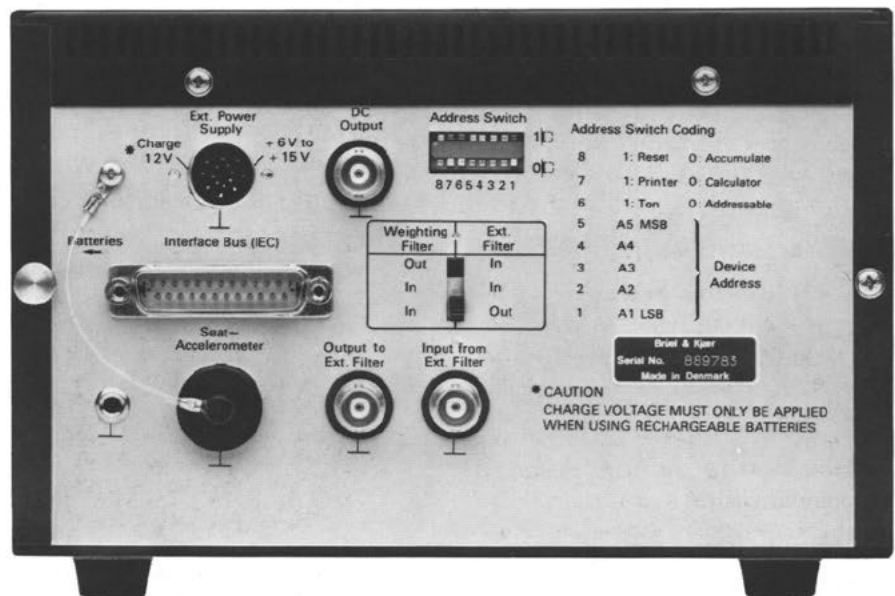
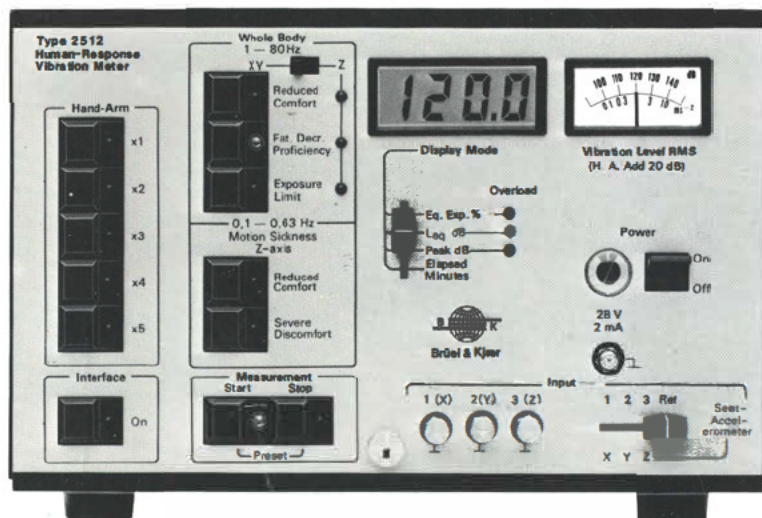


Fig. 1. Rear panel view of the Human-Response Vibration Meter Type 2512

2512

# Instruction Manual

## Human-Response Vibration Meter Type 2512



The 2512 is a single, easy to operate instrument designed for the evaluation of the effects of vibration on the human body in agreement with current standards for Hand-Arm and Whole-Body (Including Motion Sickness) measurement. The complex relationship between level, frequency, and time, is automatically taken into account in the computation of equivalent continuous vibration level and exposure dose. Either of these parameters, the maximum peak vibration level, or the elapsed time, can be displayed at any time. Powered from internal batteries for both field and laboratory use, it is designed for use with Uni-Gain® Accelerometers, including the Tri-axial Seat-Accelerometer Type 4322 for measurements with seated persons.