

# Safety Evaluation within a Magnetic Field Environment

## Exposure Level Tester ELT-400



- Direct evaluation of field exposure in comparison to major standards
- Automatic exposure evaluation for various waveforms
- Eliminates the overestimation occurring occasionally with FFT-based evaluation
- Ultra wide frequency range (1 Hz to 400 kHz)
- Wide measurement range (up to 80 mT, type-dependent)
- Isotropic 100 cm<sup>2</sup>-probe (complies with standards)
- Three-channel scope output



### APPLICATIONS

The ELT-400 is an innovative exposure level meter for measuring magnetic fields in the workplace and in public spaces. The model is designed for health and safety professionals in industry, the insurance business and the service industry. The instrument can handle practically any level measurement requested in the low- and medium-frequency range, simply and precisely. It is comparable to the sound level meters that are commonly used in the assessment of noise at the workplace.



#### Production Area

The ELT-400 is useful with diverse machinery used in manufacturing. This includes induction heating, melting and hardening equipment. Also – thanks to the extremely low frequency limit and high power capability – most magnetic stirrers can be measured.

Special demands often occur with machinery in production areas where non-sinusoidal signals are common, e.g. in industrial applications that use resistance welding machinery (pulse waveform, phase angle control) with traditional 50/60 Hz systems as well as in newer medium-frequency switching units.



#### General Environment

In public spaces, complex fields occur with several kinds of electronic article surveillance systems. Most of the electromagnetic and acustomagnetic gates are operated in the frequency range of the ELT-400.



## EMC Test House

Magnetic fields generated by household appliances or other electrical devices are receiving increased attention. Some new standards such as prEN 50366 describe how to investigate such products. The ELT-400 is the ideal measuring device when it comes to compliance with these standards. Benefits include the perfectly matched frequency range and implementation of the specified transfer function.

The aim of this new generation ELT-400 is to greatly simplify the assessment process. With the EXPOSURE STD (Shaped Time Domain) mode, the instrument achieves a new standard in simple but reliable measurement of magnetic fields, whether straightforward or in very complex field environments. Time-consuming and easily misinterpreted measurements with a spectrum analyzer or a scope are rendered obsolete. Detailed knowledge about the evaluation procedure or the field waveform or frequency is no longer needed. The results are reliable, and speed and ease of use are significantly improved over all traditional methods.

## BASIC OPERATION

The ELT-400 covers the wide frequency range of 1 Hz to 400 kHz. The measurement range of the ELT-400 is far beyond the reference limits of common guidelines. The instrument has an external isotropic magnetic field probe with a 100 cm<sup>2</sup> cross-sectional area. This is suitable for standards-compliant measurement even in inhomogeneous fields.

The ELT-400 has a rugged housing and is easy to operate using only six buttons. The measurement result and the instrument settings are clearly displayed on a backlit LCD display.

An optional probe extension cable is especially designed for low influence on the frequency response and sensitivity of the instrument. The cable is a good choice in cases where the probe and instrument must be handled separately.

Variants of the ELT-400 are available with different combination of the operating modes, e.g. "Exposure STD" or "Field Strength". Please refer to the Ordering Information section for details.

## EXPOSURE STD (SHAPED TIME DOMAIN) MODE

### Signal-Shape-Independent Field Evaluation

In EXPOSURE STD mode, the level of the magnetic (B-) field is directly displayed as a "Percent of Standard" regardless of the signal shape and frequency. The numeric result clearly reflects the current situation and the remaining safety margin.

The implemented method can be compared to sound level meters that are commonly used to determine noise in the workplace.

A standard's variation with frequency is normalized by means of an appropriate filter. The user no longer needs any knowledge about the frequency or the frequency-dependent limits. The standard is easily selected with a single key-press. Signals with one or more frequencies are no problem.

Newer safety standards and guidelines also specify waveform-specific evaluation procedures. For example, stationary sinusoidal and pulsed fields are differentiated. With the ELT-400 the waveform is automatically taken into account. The user no longer needs any knowledge about the waveform or the duty cycle.

Pulse signal measurements are also possible. Different evaluation patterns are occasionally specified in the standard for some selected pulse waveforms. These patterns (valid for all imaginable waveforms) are directly handled by EXPOSURE STD mode. This completely eliminates the need to analyze the waveform in the time domain using a scope.

Even when faced with pulses that include DC fields, the EXPOSURE STD method provides valuable results. The ELT-400 covers all the signal components down to 1 Hz that are relevant in assessing such a situation.



Occasionally both the RMS value and the peak value are critical for assessing exposure in the low-frequency range. Both detector types are provided, and are simultaneously activated in the default setting. Depending on the incoming signal and standard selected, the most suitable detector is automatically employed at all times. The necessary weighting factors are also taken into account. The detectors may also be selected independently for further interpretation of the signal.

Detailed knowledge of the field, the test equipment and other auxiliary conditions is necessary to obtain insight into the degree of exposure when using traditional analysis instruments. The exposure level is derived through extensive calculation. Results can be easily misinterpreted or can have problems. For example – with ICNIRP standard – FFT spectrum analysis tends to overestimate results. The ELT-400 continuously monitors the field, and the results are permanently updated. Any change in the field, e.g. due to a power reduction, may be immediately evaluated.

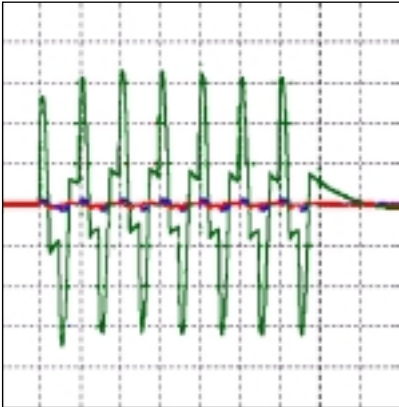
Proper evaluation in a personal safety context is achieved quickly and reliably using the STD technique.

## **FIELD STRENGTH MODE**

### **Broadband Field Strength Measurements**

If the field under test has essentially a single frequency component, the broadband mode is also a good choice.

The ELT-400 provides a ultra wideband, flat frequency response. The measurement range can handle extremely high field strength levels. Both detectors, RMS and Peak, are available for broadband measurement. The field strength result is displayed in “Tesla”.



## **ACTIVE FIELD PROBE**

### **Three-Axis Analogue Signal Output**

In scientific studies or advanced signal-shape / frequency analysis, a scope or an FFT analyzer may be connected to the analog output. The output signal ensures proper phase within the three axes and covers the full bandwidth of the instrument.

The buffered output provides an adequate voltage swing to allow simple operation.

## SPECIFICATIONS (preliminary) <sup>a</sup>

		<b>Magnetic (B-) FIELD</b>				
Sensor System	Coil (100 cm <sup>2</sup> )					
Measurement Axis	Tri-Axial (Isotropic)					
<b>EXPOSURE STD MODE</b>						
Frequency Range (-3dB), selectable	1 Hz to 400 kHz, 10 Hz to 400 kHz, 30 Hz to 400 kHz					
Exposure Evaluation	Compared to Standard (see Table 1)					
MODE <sup>b</sup>	ICNIRP		BGV B11			
RANGE	LOW	HIGH	LOW	HIGH		
Overload Limit	160 %	1600 %	160 %	1600 %		
Nominal Range	10 %	100 %	10 %	100 %		
Noise Level <sup>c</sup> , approximate	1.3 %	6 %	0.4 %	1.6 %		
Damage Level RMS (Peak) <sup>d</sup>	160 mT (226 mT)					
Resolution (RANGE: LOW)	0.001 %					
Detection, selectable	Automatic according to Selected Standard or RMS (averaging time 1 sec.) or Peak Value					
Display Mode, selectable	Instantaneous or Max Hold					
<b>FIELDSTRENGTH MODE</b>						
Frequency Range (-3dB), selectable	1 Hz to 400 kHz, 10 Hz to 400 kHz, 30 Hz to 400 kHz					
Frequency Response	Flat					
MODE <sup>b</sup>	320 μT		8 mT		80 mT	
RANGE	LOW	HIGH	LOW	HIGH	LOW	HIGH
Overload Limit	32 μT	320 μT	800 μT	8 mT	8 mT	80 mT
Nominal Range	2 μT	20 μT	50 μT	500 μT	500 μT	5 mT
Noise Level, approximate	70 nT	320 nT	1.8 μT	8 μT	18 μT	80 μT
Damage Level RMS (Peak) <sup>d</sup>	160 mT (226 mT)					
Resolution (RANGE: LOW)	1 nT					
Overall Uncertainty <sup>e</sup>	±4 % (50 Hz to 120 kHz)					
Detection, selectable	RMS (averaging time 1 sec.) or Peak Value					
Display Mode, selectable	Instantaneous or Max Hold					
<b>OUTPUT</b>						
Analog Scope Output	Three Channel (X-Y-Z)					
Output Level (Nominal Range)	0.05 V rms (output: 50 Ohm, nominal)					
Interface (Remote Control and Readout)	RS-232 (19200 baud, 8n1, XON/XOFF), 3-Wire, Stereo Jack 2.5mm					
<b>GENERAL SPECIFICATION</b>						
Display	LCD with Backlight					
Result Update Rate	4 / sec					
Operating Temperature Range	-10 °C to +50 °C					
Operating Humidity Range	<95 % (30° C) or <29 g/m <sup>3</sup> , non-condensing					
Operation Period, approximate	12 Hours					
Battery	NiMH Batteries (4 x AA-cell), exchangeable					
Charger Unit	100 to 240 V AC / 47 to 63 Hz, all plugs					
Charging Time, approximate	2 Hours					
Calibration Interval, recommended	24 Months					
Mounting Thread (body bottom side)	1/4-20UNC-2B (standard thread)					
Dimensions, approximate	180 x 100 x 55 mm (w/o probe) 300 x 125 Ø mm (probe only)					
Weight, approximate	770 g (with probe)					

<sup>a</sup> Unless noted otherwise specifications apply at reference condition: ambient temperature 23±3 °C, relative air humidity 40 % to 60 %, continuous wave signal (CW), RMS detection (frequency range: 30 Hz to 400 kHz)

<sup>b</sup> Type-dependending, see Table 1

<sup>c</sup> Detection: automatic according to selected standard

<sup>d</sup> The damage limit decreases linearly with increasing frequency above 77.5 Hz (620 Hz). Damage level (Peak) limit applies at pulse duration ≤ 15.6 ms and duty cycle ≤ 1/64

<sup>e</sup> Includes flatness, isotropy, absolute and linearity variation (frequency range: 1 Hz to 400 kHz or 10 Hz to 400 kHz). At the frequency band limits (10 Hz, 30 Hz, 400 kHz) uncertainty increases to ±1 dB based on the nominal frequency response.

## ORDERING INFORMATION

### ELT-400 Set

Calibrated Basic Unit and B-Field Probe 100 cm<sup>2</sup>, Certificate of Calibration, Charger (all plugs), Operating / Programming Manual, Rechargeable Batteries

MODE (included in instrument)	Ordering Number
<ul style="list-style-type: none"><li>EXPOSURE STD: ICNIRP gen. pub.</li><li>EXPOSURE STD: ICNIRP occ.</li></ul>	<ul style="list-style-type: none"><li>FIELDSTRENGTH: 320 µT</li><li>FIELDSTRENGTH: 80 mT</li></ul> <b>2304/101</b>
<ul style="list-style-type: none"><li>EXPOSURE STD: BGV B11 EXP2</li><li>EXPOSURE STD: BGV B11 EXP1</li></ul>	<ul style="list-style-type: none"><li>EXPOSURE STD: BGV B11 2H/D</li><li>FIELDSTRENGTH: 8 mT</li></ul> <b>2304/102</b>
<ul style="list-style-type: none"><li>EXPOSURE STD: prEN 50366</li><li>EXPOSURE STD: ICNIRP occ.</li></ul>	<ul style="list-style-type: none"><li>FIELDSTRENGTH: 320 µT</li><li>FIELDSTRENGTH: 80 mT</li></ul> <b>2304/103</b>

**Table 1: Ordering Information**

#### Optional Accessory:

Probe Extension Cable (length 1 m)	<b>2300/90.30</b>
Serial Interface Cable (length 2 m) – Stereo Jack / DB9	<b>2260/90.51</b>
Interface Cable Analogue (D-SUB15 / 3xBNC)	<b>2260/90.80</b>
Tripod, non-conductive (height 1.65 m)	<b>2244/90.31</b>
Tripod Extension, non-conductive (height 0.5 m)	<b>2244/90.45</b>