narda Safety Test Solutions®
an L3 Communications Company

EXPOSURE LEVEL TESTER

ELT-400

Conforms to EMF Directive 2013/35/EU

Safety Evaluation Within a Magnetic Field Environment

Exposure Level Tester ELT-400

- **Direct evaluation of field exposure in comparison with major standards and regulations such as Directive 2013/35/EU for workplaces**
- **Automatic exposure evaluation for various waveforms in compliance with Weighted RMS and Weighted Peak methods**
- **Eliminates the overestimation that occasionally occurs with FFT-based evaluation**
- **Ultra wide frequency range (1 Hz to 400 kHz)**
- **Wide measurement range up to 80 mT (dependent on type)**
- **IEC/EN 62311 and 62233 standard compliant including isotropic 100 cm² and 3 cm² probe**
- **Three-axis analog output for time signal analysis with oscilloscope / analyzer**

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 service industries.

The instrument can simply and precisely handle practically any level measurement required in the low and medium-frequency range. It is comparable to the sound level meters that are commonly used in the assessment of noise at the workplace.

Industrial melting furnace

Production Areas

The ELT-400 is useful for checking fields caused by various manufacturing plant, including induction heating, melting and hardening equipment. Thanks to its extremely low frequency limit and high power capability, it can also be used to check most magnetic stirrers.

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.

Resistance welding machinery in operation

General Environment

The different types of electronic article surveillance systems generate complex fields in public spaces. Most electromagnetic and magneto acoustic gates operate within the frequency range of the ELT-400.

EMC Test House

The magnetic fields generated by household appliances or other electrical devices have become the focus of increased attention. Some new standards such as IEC/EN 62233 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 ELT-400 allows to greatly simplify the assessment process. With EXPOSURE STD (Shaped Time Domain) mode, the instrument achieves a new standard in simple but reliable measurement of magnetic fields, whether in straightforward or in very complex field environments.

Magneto acoustic gate used for product surveillance

The easily misinterpreted time-consuming measurements with a spectrum analyzer or 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 better than 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 wider than the reference limits of common guidelines. The instrument has an external isotropic magnetic field probe with a 100 cm^2 cross-sectional area. This is suitable for standards-compliant measurement even in non-homogeneous 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 panel.

The optional probe extension cable is specially 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 operating mode combinations, e.g. “Exposure STD” or “Field Strength”. Please refer to the Ordering Information section for details.

Compliance testing of household appliances

EXPOSURE STD (SHAPED TIME DOMAIN) MODE

Signal-Shaped-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 method employed can be compared to sound level meters that are commonly used to determine noise in the workplace.

The variation with frequency specified in the standard is normalized by means of an appropriate filter. Users no longer need to know the frequency or the frequency-dependent limits. The standard is easily selected by pressing just one button. Multi-frequency signals are just as easy to measure as single frequencies.

Coupling factors can be determined in compliance with IEC/EN 62233 by use of the optional 3 cm^2 probe

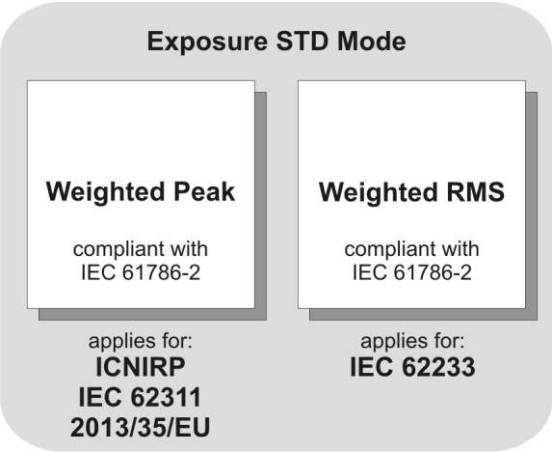
The newer safety standards and guidelines also specify waveform-specific evaluation procedures. For example, stationary sinusoidal and pulsed fields are differentiated. With the ELT-400 the waveform is automatically taken into account. Users no longer need any knowledge about the waveform or the duty cycle. Measurements on pulsed signals are also possible. Different evaluation patterns are occasionally specified in the standard for certain 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 (***Weighted RMS*** and ***Weighted Peak***), 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 other problems may occur. For example, FFT spectrum analysis tends to overestimate results for the ICNIRP standard. The ELT-400 continuously monitors the field, and the results are constantly updated. Any change in the field, e.g. due to a power reduction, can be evaluated immediately.
Proper evaluation in a personal safety context is achieved quickly and reliably using the STD technique.

In Exposure STD mode the result is displayed directly as a percentage of the permitted limit



Exposure STD automatically sets the prescribed detector applicable for the selected standard

FIELD STRENGTH MODE

Broadband Field Strength Measurements
If the field under test is essentially a single frequency component, broadband mode is also a good choice.

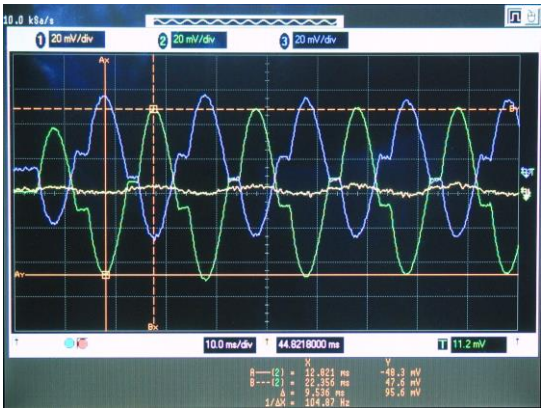
The ELT-400 provides an ultra wideband, flat frequency response. The measurement range can handle extremely high field strength levels. Both detectors, RMS and Peak, are available for broadband measurement. The field strength result is displayed in “Tesla”.

Broadband measurement in “mT” with RMS detector

ACTIVE FIELD PROBE

Three-Axis Analog Signal Output
For scientific studies or advanced signal-shape / frequency analysis, a scope or an FFT analyzer can 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 for simple operation.



The oscilloscope display shows the welding current when using the analog signal output of ELT-400

SPECIFICATIONS [a]

ELT – 400 with 100 cm² probe						
Frequency range (-3 dB), selectable	1 Hz to 400 kHz, 10 Hz to 400 kHz, 30 Hz to 400 kHz					
Probe type	Magnetic (B-) field					
Sensor	Isotropic coil 100 cm²					
Damage level – RMS	160 mT	The damage level reduces linearly with increasing frequency above 77.5 Hz (1/f)				
Damage level – Peak	226 mT	The damage level reduces linearly with increasing frequency above 620 Hz (1/f). The damage level (peak) applies for pulse duration ≤15.6 ms and duty cycle ≤ 1/64.				
Measurement uncertainty [d]	±4 % (50 Hz to 120 kHz)					
E-Field response	< 20 nT @ f < 2 kHz, 100 V/m < 300 nT@ f = 50 Hz, 50 kV/m					
Mounting thread	1/4-20UNC-2B (standard thread)					
EXPOSURE STD MODE						
Exposure evaluation	Comparison with standard (see Ordering Information)					
MODE [b]	2013/35/EU, EMFV 2016 ICNIRP / IEC 62311		BGV B11		IEC/EN 62233	
RANGE	LOW	HIGH	LOW	HIGH	LOW	HIGH
Overload limit	160 %	1 600 %	160 %	1 600 %	160 %	1 600 %
Noise level, typical [c]	1 %	5 %	0.4 %	2 %	0.4 %	2 %
Resolution	0.001 % (RANGE: LOW)					
Detection, selectable	Automatic according to selected standard, or RMS (averaging time 1 s), or Peak Value					
Display mode, selectable	Instantaneous or Max Hold					
FIELD STRENGTH MODE						
Frequency response	Flat					
MODE [b]	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
Noise level, typical [e]	60 nT	320 nT	1 µT	8 µT	10 µT	80 µT
Resolution	1 nT (RANGE: LOW)					
Detection, selectable	RMS (averaging time 1 s), or Peak Value					
Display mode, selectable	Instantaneous or Max Hold					
OUTPUT						
Analog scope output	Three channel (X-Y-Z)					
Analog output level	The open-circuit analog output voltage is 800 mV when the field strength value corresponds to the overload limit (sensitivity = 800 mV/ overload limit). Load impedance ≥ 10 kΩ					
Interface (remote control and readout)	RS-232 (19200 baud, 8n1, XON/XOFF), 3-wire, 2.5 mm stereo jack					
GENERAL SPECIFICATIONS						
Operating temperature range	-10 °C to +50 °C					
Operating humidity range	< 95 % (30 °C) or < 29 g/m³, non-condensing					
Weight	910 g (with probe)					
Dimensions	180 mm x 100 mm x 55 mm (basic unit) / 290 mm x 125 mm Ø (probe)					
Display	LCD with backlight; refresh rate 4 times per second					
Battery	NiMH batteries (4 x Mignon, AA), exchangeable					
Operating life, typical	12 h					
Charger unit	100 to 240 V AC / 47 to 63 Hz, fits all AC line connectors					
Charging time, typical	2 h					
Recommended calibration interval	24 months					
Country of origin	Germany					

a Unless otherwise stated, these specifications apply for the reference condition: ambient temperature 23±3 °C, relative air humidity 40 % to 60 %, continuous wave signal (CW) and RMS detection
b Depends on type; see Ordering Information
c Detection: Automatic according to selected standard, for IEC/EN 62233 based on ICNIRP limit values
d Includes flatness, isotropy, absolute and linearity variations (frequency range: 1 Hz to 400 kHz or 10 Hz to 400 kHz). The uncertainty increases at the frequency band limits to ±1 dB based on the nominal frequency response.
e For Frequency Range 10 Hz to 400 kHz and 30 Hz to 400 kHz only.

ELT – 400 with 3 cm² probe						
Frequency range (-3 dB), selectable	1 Hz to 400 kHz, 10 Hz to 400 kHz, 30 Hz to 400 kHz					
Probe type	Magnetic (B) field					
Sensor	Isotropic coil 3 cm²					
Damage level – RMS	1 500 mT	The damage level reduces linearly with increasing frequency above 30 Hz (1/f).				
Damage level – Peak	2 121 mT	The damage level reduces linearly with increasing frequency above 240 Hz (1/f). The damage level (peak) applies for pulse duration ≤ 15.6 ms and duty cycle ≤ 1/64.				
Measurement uncertainty [d]	±6 % (50 Hz to 120 kHz)					
E-Field response	< 187.5 nT @ f < 2 kHz, 100 V/m < 2.8mT @ f = 50 Hz, 50 kV/m					
Mounting thread	1/4-20UNC-2B (standard thread)					
EXPOSURE STD MODE						
Exposure evaluation	Comparison with standard (see Ordering Information)					
MODE [b]	2013/35/EU, EMFV 2016 ICNIRP / IEC 62311		BGV B11		IEC/EN 62233	
RANGE	LOW	HIGH	LOW	HIGH	LOW	HIGH
Overload limit	1 500 %	15 000 %	1 500 %	15 000 %	1 500 %	15 000 %
Noise level, typical [c]	10 %	50 %	4 %	20 %	4 %	20 %
Resolution	0.001 % (RANGE: LOW)					
Detection, selectable	Automatic according to selected standard, or RMS (averaging time 1 s), or Peak Value					
Display mode, selectable	Instantaneous or Max Hold					
FIELD STRENGTH MODE						
Frequency range	Flat					
MODE [b]	320 µT		8 mT		80 mT	
RANGE	LOW	HIGH	LOW	HIGH	LOW	HIGH
Overload limit [f]	300 µT	3 mT	7.5 mT	75 mT	75 mT	750 mT
Noise level, typical [e]	600 nT	3.2 µT	10 µT	80 µT	100 µT	800 µT
Resolution	1 nT (RANGE: LOW)					
Detection, selectable	RMS (averaging time 1 s) or Peak Value					
Display mode, selectable	Instantaneous or Max Hold					
OUTPUT						
Analog scope output	Three channel (X-Y-Z)					
Analog output level	The open-circuit analog output voltage is 800 mV when the field strength value corresponds to the overload limit (sensitivity = 800 mV/ overload limit). Load impedance ≥ 10 kΩ					
Interface (remote control and readout)	RS-232 (19200 baud, 8n1, XON/XOFF), 3-wire, 2.5 mm stereo jack					
GENERAL SPECIFICATIONS						
Operating temperature range	-10 °C to +50 °C					
Operating humidity range	< 95 % (30 °C) or < 29 g/m³, non-condensing					
Weight	840 g (with probe)					
Dimensions	180 mm x 100 mm x 55 mm (basic unit) / 250 mm x 32 mm Ø (probe)					
Display	LCD with backlight; refresh rate 4 times per second					
Battery	NiMH batteries (4 x Mignon, AA), exchangeable					
Operating life, typical	12 h					
Charger unit	100 to 240 V AC / 47 to 63 Hz, fits all AC line connectors					
Charging time, typical	2 h					
Recommended calibration interval	24 months					
Country of origin	Germany					

a Unless otherwise stated, these specifications apply for the reference condition: ambient temperature 23±3 °C, relative air humidity 40 % to 60 %, continuous wave signal (CW) and RMS detection
b Depends on type, see Ordering Information
c Detection: Automatic according to selected standard, for IEC 62233 based on ICNIRP limit values
d Includes flatness, isotropy, absolute and linearity variations (frequency range: 1 Hz to 400 kHz or 10 Hz to 400 kHz).
The uncertainty increases at the frequency band limits to ±1 dB based on the nominal frequency response.
e For frequency range 10 Hz to 400 kHz and 30 Hz to 400 kHz only.
f The overload limit is different from the value of the field strength mode, because the value of the mode is related to the 100 cm² probe.

ORDERING INFORMATION

ELT-400 Exposure Level Tester			Part number P/N
Sets include: Calibrated Basic Unit and B-field probe (100 cm²), with calibration certificate, charger unit (fits all AC line connectors), operating / programming manual and rechargeable batteries			
MODES (included in instrument)			
Set 1	• EXPOSURE STD: ICNIRP 1998 Gen. Pub. • EXPOSURE STD: ICNIRP 1998 Occup.	• FIELDSTRENGTH: 320 µT • FIELDSTRENGTH: 80 mT	**2304/101**
Set 2	• EXPOSURE STD: BGV B11 2001 Exp 2 • EXPOSURE STD: BGV B11 2001 Exp 1	• EXPOSURE STD: BGV B11 2001 2h/d • FIELDSTRENGTH: 8 mT	**2304/102**
Set 4	• EXPOSURE STD: IEC/EN 62233 • EXPOSURE STD: ICNIRP 1998 Occup.	• FIELDSTRENGTH: 320 µT • FIELDSTRENGTH: 80 mT	**2304/104**
Set 5	• EXPOSURE STD: IEC 62311 • EXPOSURE STD: ICNIRP 1998 Occup.	• FIELDSTRENGTH: 320 µT • FIELDSTRENGTH: 80 mT	**2304/105**
Set 6	• EXPOSURE STD: ICNIRP 2010 Gen. Pub. • EXPOSURE STD: ICNIRP 2010 Occup.	• FIELDSTRENGTH: 320 µT • FIELDSTRENGTH: 80 mT	**2304/106**
Set 7	• EXPOSURE STD: 2013/35/EU Low ALs • EXPOSURE STD: 2013/35/EU High ALs	• EXPOSURE STD: 2013/35/EU Limbs ALs • FIELDSTRENGTH: 80 mT	**2304/107**
Set 8	• EXPOSURE STD: EMFV 2016 Low ALs • EXPOSURE STD: EMFV 2016 High ALs	• EXPOSURE STD: EMFV 2016 Limbs ALs • FIELDSTRENGTH: 80 mT	**2304/108**
OPTIONAL ACCESSORIES			
Cable, Probe Extension, 1 m			**2300/90.30**
Cable, Serial Interface, Stereo Jack/DB9, 2 m			**2260/90.51**
Cable, Interface Analog, DSUB15/3xBNC, 3 m			**2260/90.80**
Tripod, Non-Conductive, 1.65 m with Carrying Bag			**2244/90.31**
Tripod Extension, 0.50 m, Non-Conductive			**2244/90.45**
Transport Soft Case for ELT-400			**2245/90.07**
B-Field Probe 3 cm² (Upgrade required for all ELT-400 with firmware version below 2.1 or serial number A-0001 till H-9999)			**2300/90.20**

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