

ATO series

Ref: ATO-10-B225-D10/SP3

ATO series is a split core current transformer for the electronic measurement of AC waveform current with galvanic separation between the primary circuit (power) and the secondary circuit (measurement).

ATO series is an ideal current transformer for new Smart-Grid applications, in which ratio error and phase displacement are fully tested with IEC 61869 standards accordance.



Features

- Split-core current transformer
- Rated primary current: 10 A
- Application up to 600 V CAT III PD2, basic insulation
- Accuracy class 1 (IEC 61869-2)
- Voltage output, 225 mV at I_{Pr}
- \varnothing 10 mm sensing aperture
- 1 m output cable
- Ambient temperature $-10\text{ }^{\circ}\text{C} \dots +55\text{ }^{\circ}\text{C}$
- Very low cost solution
- Slot for attaching the C.T. on the primary with plastic tie
- DIN rail adapter (optional).

Special feature

- BOSCH XDK 110 compatible.

Advantages

- No interruption of electricity during installation on insulated conductors
- Quick, non-intrusive and easy setup
- Provide a calibrate output.

Applications

- Hybrid inverter (Home Energy Storage)
- Power metering: current measurement for active power calculation
- Building sub-metering: energy efficiency monitoring, consumption analysis and cost allocation
- Power quality monitoring: electrical loads and distribution system equipment
- Distributed measurement systems
- Condition monitoring (e.g. Motor loads such as conveyers, pumps).

Standards

- IEC 61010-1: 2010
- IEC 61010-031 ed1.1: 2012
- IEC 61869-1 ed1.0: 2007
- IEC 61869-2: ed1.0: 2012
- IEC 61869-6: draft 2016
- IEC 61869-10: draft 2016.

Application Domain

- Industrial.

Safety



Caution

If the device is used in a way that is not specified by the manufacturer, the protection provided by the device may be compromised. Always inspect the electronics unit and connecting cable before using this product and do not use it if damaged. Mounting assembly shall guarantee the maximum primary conductor temperature, fulfill clearance and creepage distance, minimize electric and magnetic coupling, and unless otherwise specified can be mounted in any orientation.



Caution, risk of electrical shock

This transducer must be used in limited-energy secondary circuits SELV according to IEC 61010-1, in electric/electronic equipment with respect to applicable standards and safety requirements in accordance with the manufacturer's operating specifications.

Use caution during installation and use of this product; certain parts of the module can carry hazardous voltages and high currents (e.g. power supply, primary conductor).

Ignoring this warning can lead to injury and or/or cause serious damage.

De-energize all circuits and hazardous live parts before installing the product.

All installations, maintenance, servicing operations and use must be carried out by trained and qualified personnel practicing applicable safety precautions.

This transducer is a build-in device, whose hazardous live parts must be inaccessible after installation.

This transducer must be mounted in a suitable end-enclosure.

Besides make sure to have a distance of minimum 30 mm between the primary terminals of the transducer and other neighboring components.

Main supply must be able to be disconnected.

Always inspect the flexible probe for damage before using this product.

Never connect or disconnect the external power supply while the primary circuit is connected to live parts.

Never connect the output to any equipment with a common mode voltage to earth greater than 30 V.

Always wear protective clothing and gloves if hazardous live parts are present in the installation where the measurement is carried out.

This transducer is a built-in device, not intended to be cleaned with any product. Nevertheless if the user must implement cleaning or washing process, validation of the cleaning program has to be done by himself.

When defining soldering process, please use no cleaning process only.



ESD susceptibility

The product is susceptible to be damaged from an ESD event and the personnel should be grounded when handling it.

Do not dispose of this product as unsorted municipal waste. Contact a qualified recycler for disposal.

Absolute maximum ratings

Parameter	Symbol	Unit	Value
Maximum primary conductor temperature	$T_{B\max}$	°C	100

Stresses above these ratings may cause permanent damage.
Exposure to absolute maximum ratings for extended periods may degrade reliability.

Insulation coordination

Parameter	Symbol	Unit	Value	Comment
RMS voltage for AC insulation test, 50 Hz, 1 min	U_d	kV	4.3	Between primary (completely filling the hole) and secondary
Impulse withstand voltage 1.2/50 μ s	U_{Ni}	kV	7.8	
Partial discharge RMS test voltage ($q_m < 10$ pC)	U_t	kV	1.8	
Clearance (pri. - sec.)	d_{Cl}	mm	8	Shortest distance through air
Creepage distance (pri. - sec.)	d_{Cp}	mm	8	Shortest path along device body
Case material flammability	-	--	V0	According to UL 94
Application example	-	V	600	Reinforced insulation according to EN 50178 CAT III PD2
Application example	-	V	300	Reinforced insulation according to EN 61010-1 CAT III PD2
Application example	-	V	600	Basic insulation according to EN 61010-1 CAT IV PD2
Application example	-	V	1000	Basic insulation according to EN 61010-1 CAT III PD2
Application example	-			According to UL 508

Environmental and mechanical characteristics

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Ambient operating temperature	T_A	°C	-10	25	55	
Ambient storage temperature	$T_{A\text{st}}$	°C	-30		90	
Relative humidity (non-condensing)	RH	%	0		85	
Altitude above sea level		m			2000	
Surrounding temperature according to UL		°C			70	
Mass	m	g		86		

Electrical data

 At $T_A = 25\text{ °C}$, $R_{br} > 1\text{ M}\Omega$, unless otherwise noted.

Parameter	Symbol	Unit	Min	Value	Max	Comment
Reference voltage	U_{ref}	V		2.5		The reference voltage will be apply in application side.
Rated primary current	I_{Pr}	A		10		
Rated extended primary current	I_{ePr}	A		12		120 % of I_{Pr}
Rated short-time thermal current	I_{th}	kA			0.6	¹⁾ at 50 Hz; $60 \times I_{Pr}$ (1 s)
Rated dynamic current	I_{dyn}	kA			1.5	at 50 Hz; $2.5 \times I_{th}$
Rated transformation ratio	k_r	A/V		44.44		
Rated secondary voltage	U_{Sr}	mV		225		⁴⁾
Output voltage @ pin S1	U_{out}	V	0		U_{ref}	
Output voltage @ pin S2	U_{out}	V	0		U_{ref}	
Rated frequency	f_r	Hz		50/60		

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Frequency bandwidth (-3 dB)	BW	kHz	1.5			²⁾ Short circuit condition (no load).
Phase displacement	$\Delta\varphi$	°	-1		1	³⁾ -10 °C ... 55 °C
Temperature coefficient of I_{out}	TCI_{out}	ppm/k			80	
Ratio error	ε	%	-1		1	³⁾ -10 °C ... 55 °C
Linearity error	ε_L	%	-0.1		0.1	
Error due to magnetic field of external conductor current	$\varepsilon_{I_{ext}}$	%		0.3		

- Notes:**
- ¹⁾ No test conducted given that is the worst case (load = 100 kΩ i.e short circuit on the output) the peak dissipated power remains low.
 - ²⁾ Frequency bandwidth and phase shift modeling schematic can be provided on request.
 - ³⁾ Considering a primary conductor of at least $\varnothing 9\text{ mm}$ perpendicular to the current transformer. All our **LEMcity** transducers class I are tested at 5 %, 20 % 100 % and 120 % of I_{Pr} to be according to IEC61869-2 table 201.
 - ⁴⁾ Rated signal output equal to the differential output of the Pin S1 and S2.

Performance parameters definition

Rated transformation ratio K_r

Ratio of K_r to the actual secondary voltage or current.

Ratio error ε

The current ratio error, expressed in per cent, is given by the formula:

$$\varepsilon = \frac{k_r I_s - I_p}{I_p} \times 100 \%$$

Where:

- K_r : is the rated transformation ratio
- I_p : is the actual primary current
- I_s : is the actual secondary current when I_p is flowing, under the conditions of measurement

Phase displacement $\Delta\varphi$

The $\Delta\varphi$ is the difference in phase between the primary voltage or current and the secondary voltage or current phasors. The direction of the phasors being so chosen that the angle is zero for an ideal transformer.

The phase displacement is said to be positive when the secondary voltage or current phasors leads the primary voltage or current phasors.

Linearity error ε_L

The linearity error ε_L is the maximum positive or negative difference between the measured points and a corresponding linear regression line, expressed in % of I_{Pr} .

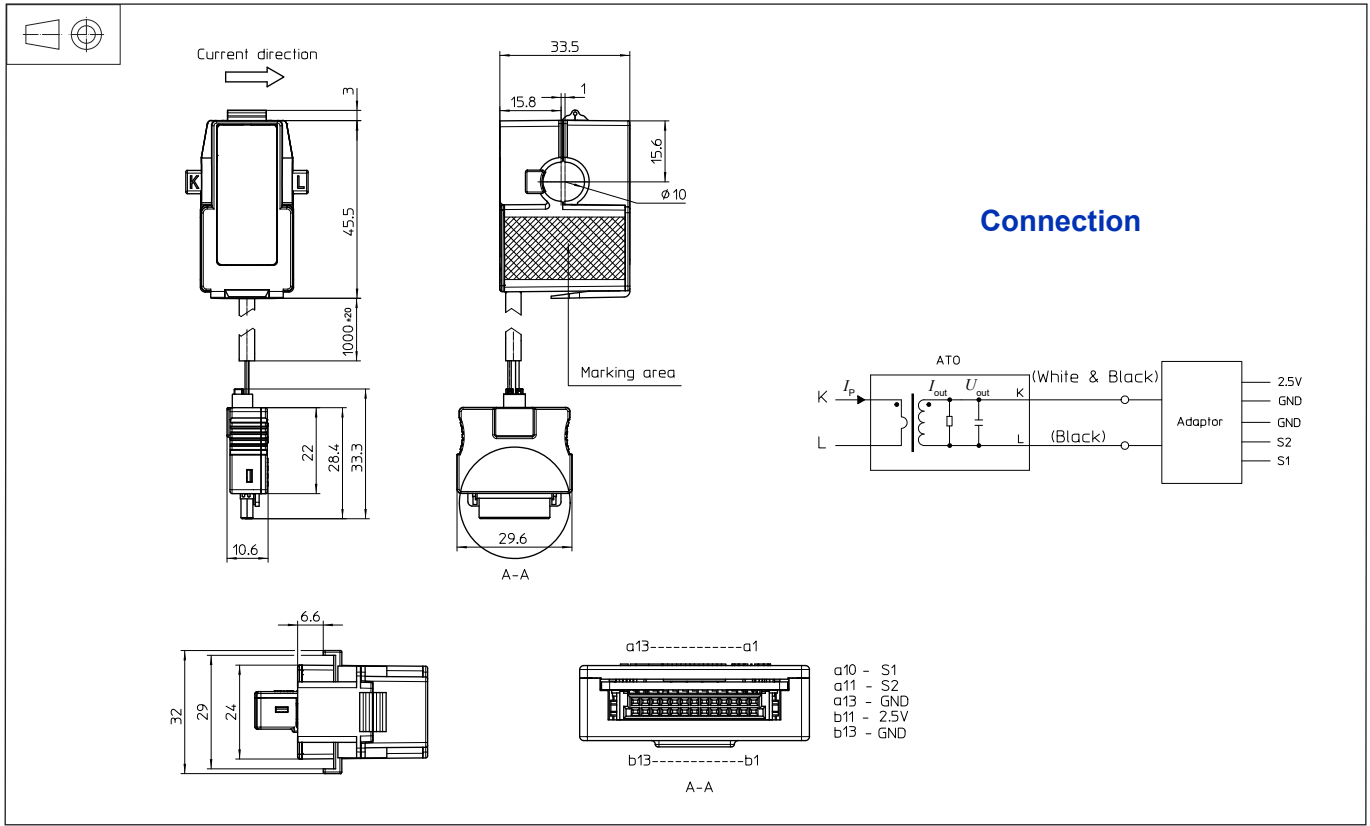
Rated short-time thermal current I_{th}

Maximum value of the primary current which a transformer will withstand for a specified short time without suffering harmful effects, the secondary winding being short-circuited.

Rated dynamic current I_{dyn}

Maximum peak value of the primary current which a transformer will withstand, without being damaged electrically or mechanically by the resulting electromagnetic forces, the secondary winding being short-circuited.

Dimensions (in mm)



Mechanical characteristics

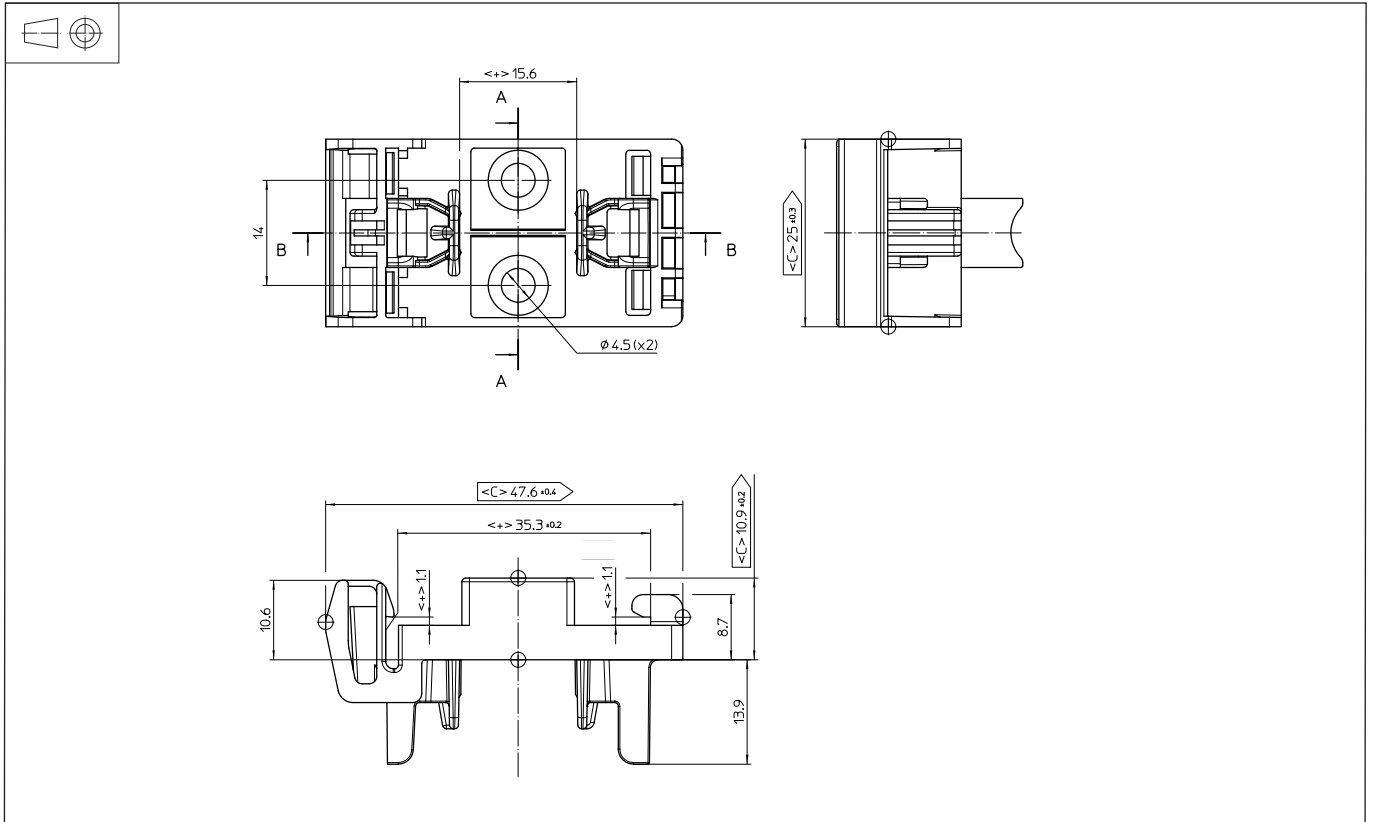
- General tolerance ± 0.5 mm
- Primary aperture $\varnothing 10$ mm
- Fastening Cable tie
- Output cable length 1 m

Remarks

- Attention: contact areas (air gap) must be kept clean (particle free) to ensure proper performance
- Installation of the transducer must be done unless otherwise specified on the datasheet, according to LEM Transducer Generic Mounting Rules. Please refer to LEM document N°ANE120504 available on our Web site:

<https://www.lem.com/en/file/3137/download/>.

DIN RAIL ADAPTOR (additional part option) dimensions (in mm)



LEM Reference:70.C6.98.001.0

Mechanical characteristics

- General tolerance ± 0.4 mm
- Fastening 1.5 N·m

Remarks

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- Installation of the transducer must be done unless otherwise specified on the datasheet, according to LEM Transducer Generic Mounting Rules. Please refer to LEM document N°ANE120504 available on our Web site: <https://www.lem.com/en/file/3137/download/>.

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