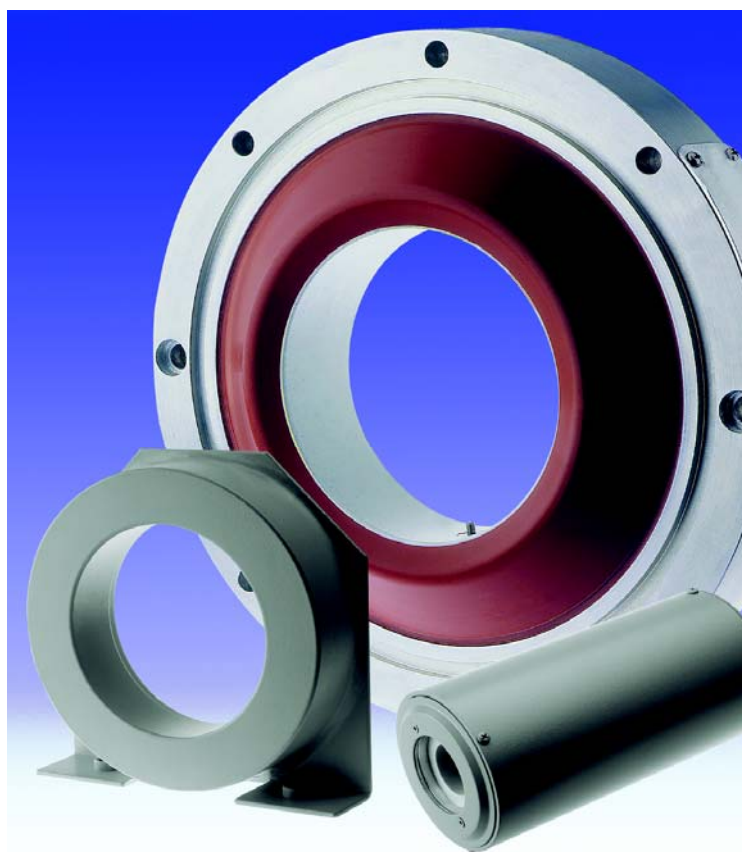


# LOPO®

## Low Power Instrument Transformers

### For Medium Voltage Switchgear



**TRENCH**

# LOPO<sup>®</sup>

## Low Power Instrument Transformers For Medium Voltage Switchgear

The modern digital technology has modified the requirements for instrument transformers used for measurement and protection applications.

The modern secondary equipment does not need the high power output of the instrument transformers (ITs) as this was necessary for electromechanical relays.

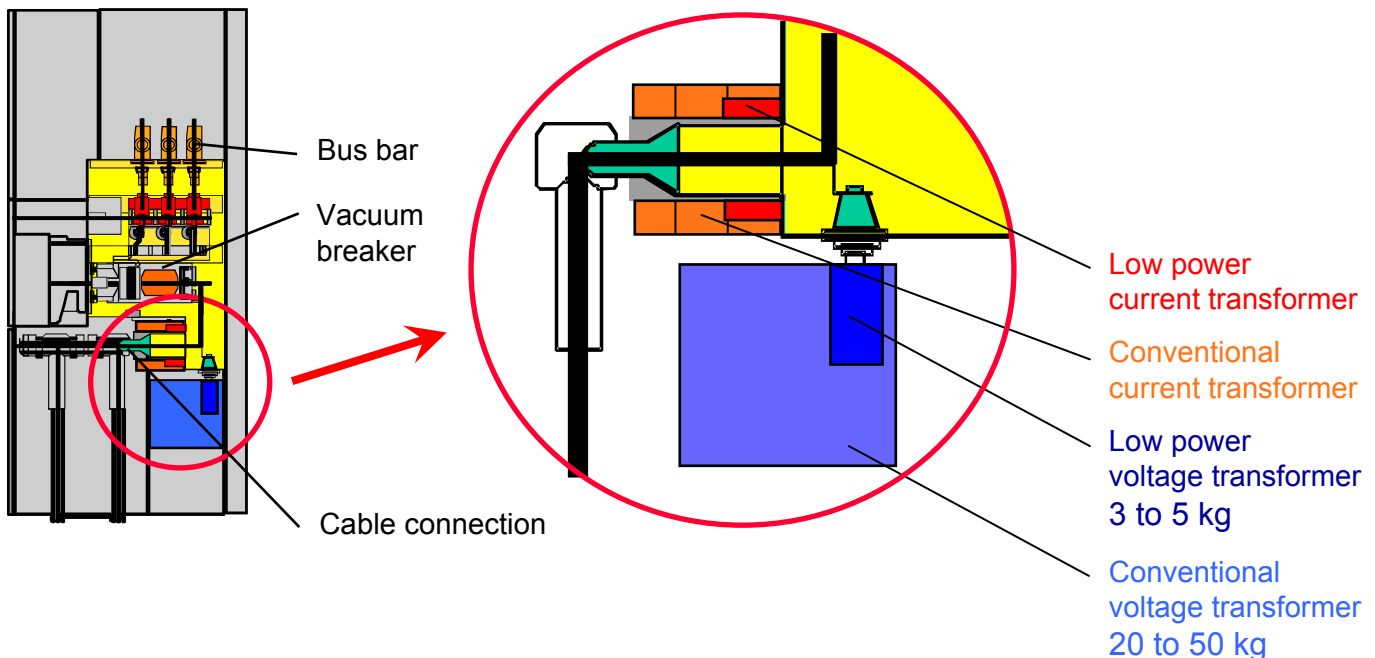
For this reason Trench developed the LOPO<sup>®</sup>- Instrument Transformers series, a range of voltage and current transformers which are compatible with the modern microprocessor controlled relays and other secondary equipment with high input impedance.

LOPO<sup>®</sup>- ITs fit into existing as well as future designs of switchgear and fulfill the requirements of IEC standards 60044-7 and 60044-8.

The output signal for the LOPO<sup>®</sup>- Voltage Transformer is volts rather than conventional hundreds of volts; the output of the LOPO<sup>®</sup>- Current Transformer is millivolts rather than conventional amperes.

Please refer to the separate leaflet for an updated list of available relays.

Example of integration in a medium voltage switchgear and indication of size comparison



LOPO<sup>®</sup> is a registered trademark of Trench

## Features and Advantages

- Designed for low power digital protection and measuring in accordance with:

- IEC 60044-7, Electronic Voltage Transformers
- IEC 60044-8, Electronic Current Transformers

- Cost effective

- With one LOPO® both measuring and protection requirements can be met. Just one single instrument transformer for measurement and protection purposes
- Reduced size and weight: easy to handle, less space required
- Opportunity to optimize medium voltage switchgear for size, manufacture, logistics and operation.

- The LOPO® instrument transformers are supplied with standardised cables and connectors:

- Double screened twisted pair cable with ODU Mini Snap connector



or

- Twisted pair cable, CAT5 with modular plug 8P8C „RJ45“



- Protection against polarity reversal

- Standard length of the cables is 6,5 m

- EMC immunity.

- Operator safety with earthed metal encapsulated housing.

- No secondary circuit problem: LOPO® voltage and current transformers can have their secondary open or short circuited. Important safety feature.

- High reliability and availability.

- Environmentally friendly, less raw material required.

- **Medium voltage applications up to 52 kV**
- **Rated primary current up to 5000 A**
- **Rated short circuit current withstand up to 63 kA / 3 s**
- **Type tested to IEC standards**
- **Meets IEC 60044-7 and 60044-8 requirements**
- **Few models to cover the whole range of application**
- **Compact, light and easy to connect**
- **Quality Assurance in accordance with ISO 9001**

# LOPO<sup>®</sup> Voltage Transformers

Trench LOPO<sup>®</sup> voltage transformers are passive devices based on a compensated resistive divider, designed for medium voltage protection and measuring systems in accordance with IEC 60044-7.

These transformers provide a secondary voltage proportional to the primary voltage, without saturation.

LOPO<sup>®</sup> transformers are available in different designs up to a system voltage of 52 kV.

The components mainly are cast in resin. Against electromagnetic fields the components (active part) can be encapsulated in a metallic housing or shielded with an electrode or screen.

## Benefits:

- One resistive divider for all metering and protection requirements, e.g. class 0.2 or 0.5 and 3P.
- Ferro-resonance free
- No disconnection of the voltage transformer is required during cable and switchgear voltage testing. The voltage transformers are able to withstand the on-line switchgear and cable voltage testing:
- Connecting cable (double shielded twisted pair) and connector are parts of the voltage transformer.
- Very low voltage amplitude error and phase displacement.

Applied voltage	Frequency	Duration
$2 * U_m / \sqrt{3}$	50 / 60 Hz	60 min
$3 * U_m / \sqrt{3}$	0.1 Hz	50 min
$4 * U_m / \sqrt{3}$	DC	15..30 min

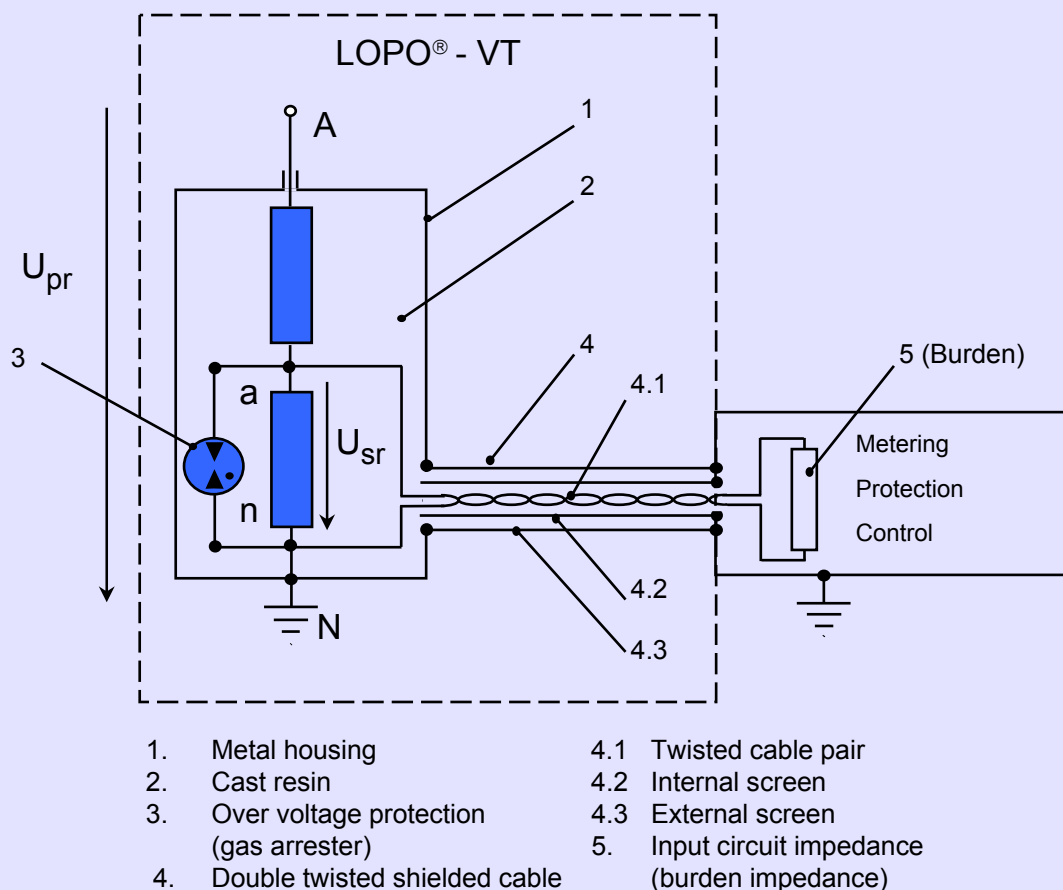
## Electrical data

Type (for x see letter at designs)	Designs  See on p. 6 to 8					Highest voltage for equipment  $U_m$ *) [ kV ]	Rated primary voltage  $U_{pr}$ *) [ kV ]	Rated power frequency test voltage  $U_d$ *) [ kV ]	BIL  $U_p$ *) [ kV ]	Rated secondary voltage  $U_{sr}$ *) [ V ]	
LPVT-x 7,2	A	I	G	P	F	S	7.2	$6/\sqrt{3}$	20	60	3.25 $/\sqrt{3}$
LPVT-x 12							12	$10/\sqrt{3}$	28	75	
LPVT-x 15							15.5	$15/\sqrt{3}$	35	95	
LPVT-x 24							24	$20/\sqrt{3}$	50	125	
LPVT-x 36							36	$30/\sqrt{3}$	70	170	
LPVT-x 38							38	$34.5/\sqrt{3}$	95	200	
LPVT-x 40							40.5	$36/\sqrt{3}$	95	200	
LPVT-x 52							52	$45/\sqrt{3}$	95	250	

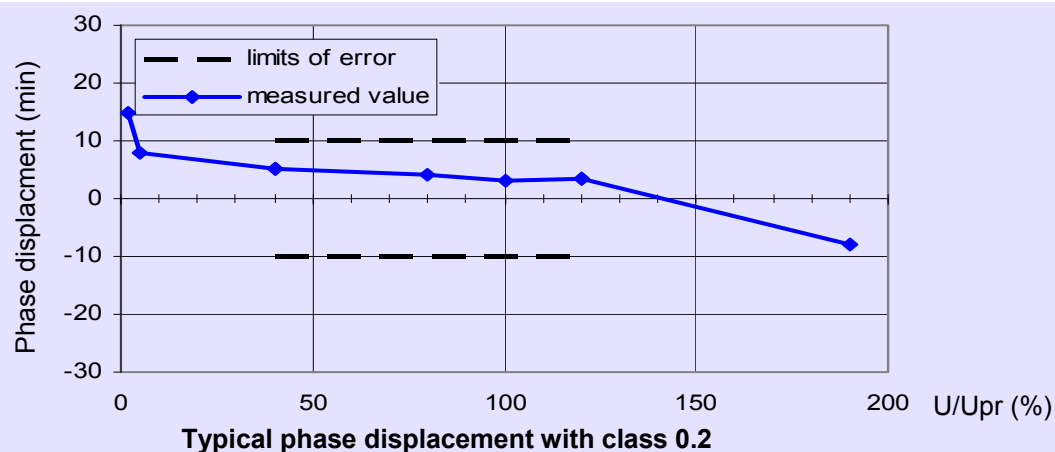
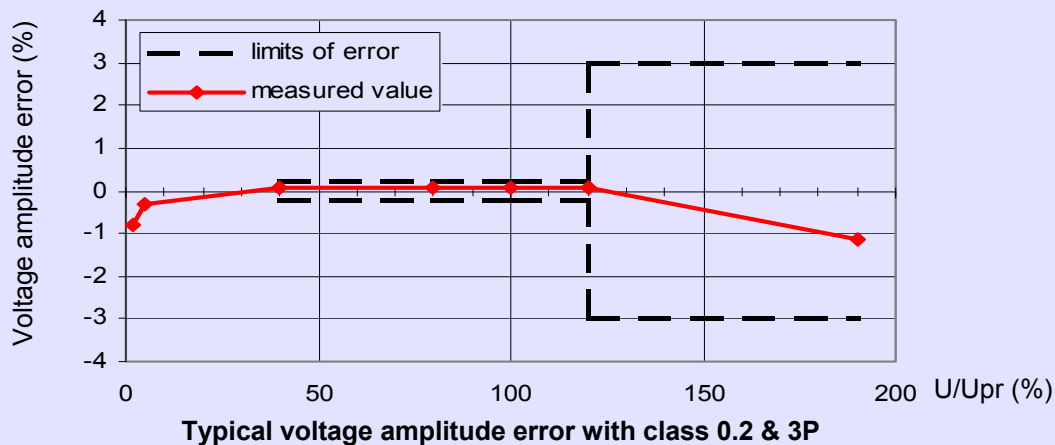
\*) : other values and designs on request

- System frequency: 16 2/3, 50, 60 Hz
- Accuracy: Class 0.2 or 0.5 & 3P  
the accuracy of the voltage transformer is guaranteed between 40% and 120% of the rated voltage
- Rated voltage factor: 1.2/continuous; 1.9/8 hours
- Type tests: In accordance with IEC 60044-7, including immunity tests and measurement of transmission overvoltage factor

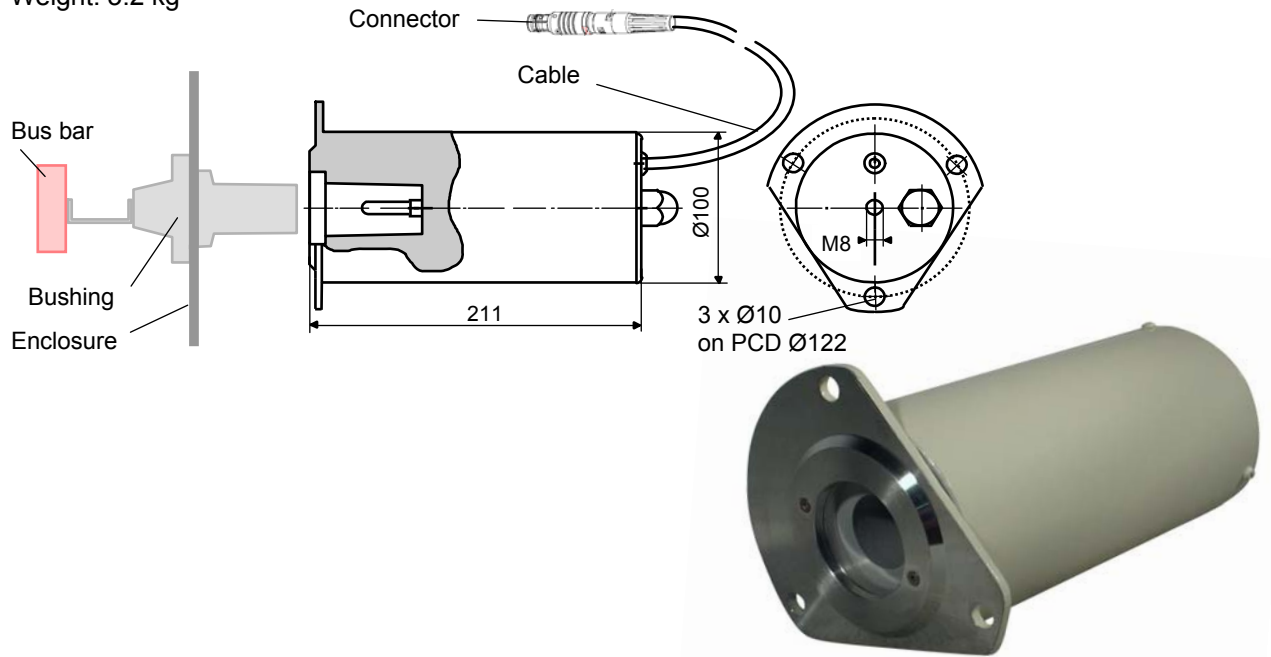
## Principle scheme



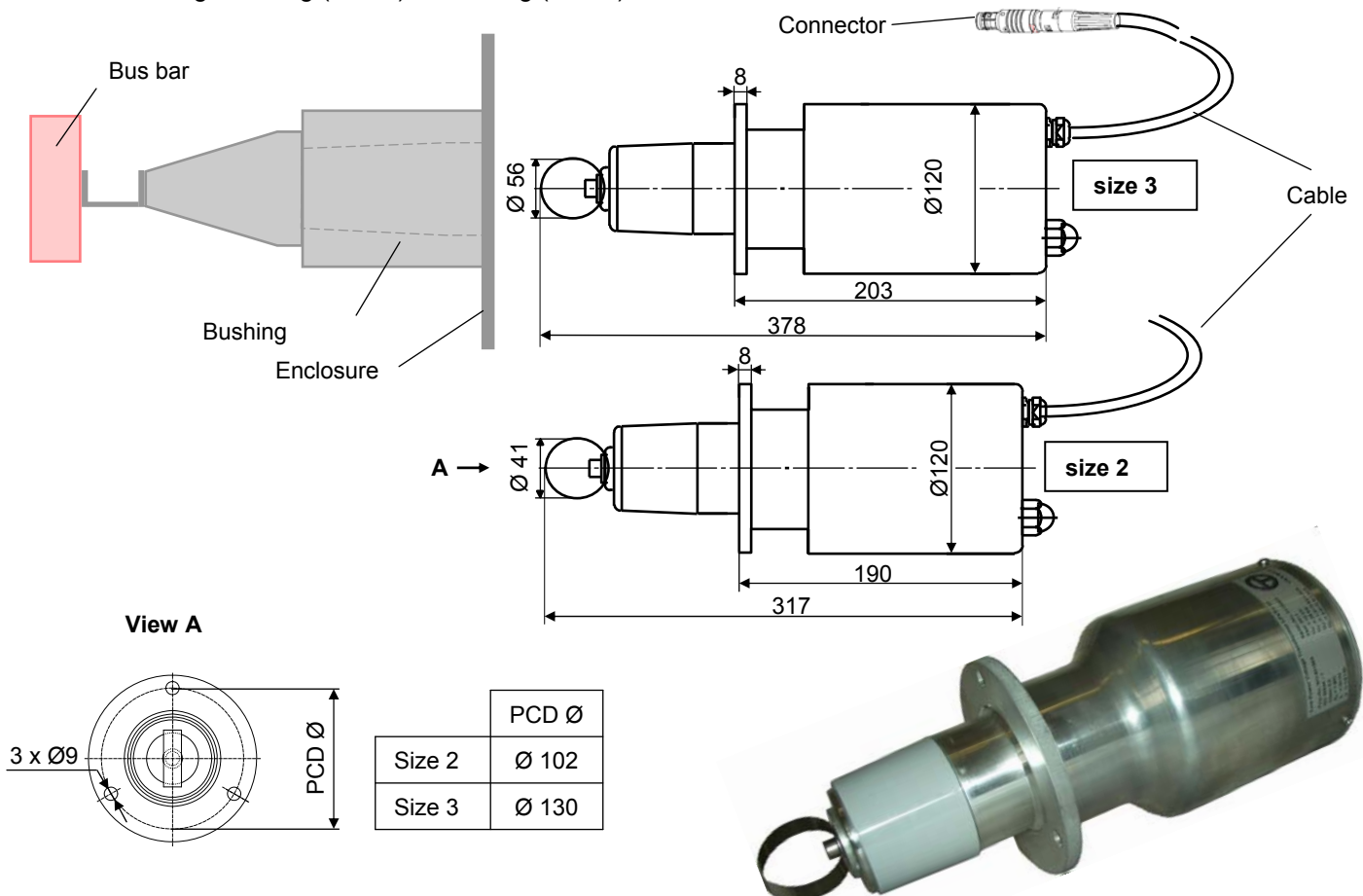
## Example of accuracy performance



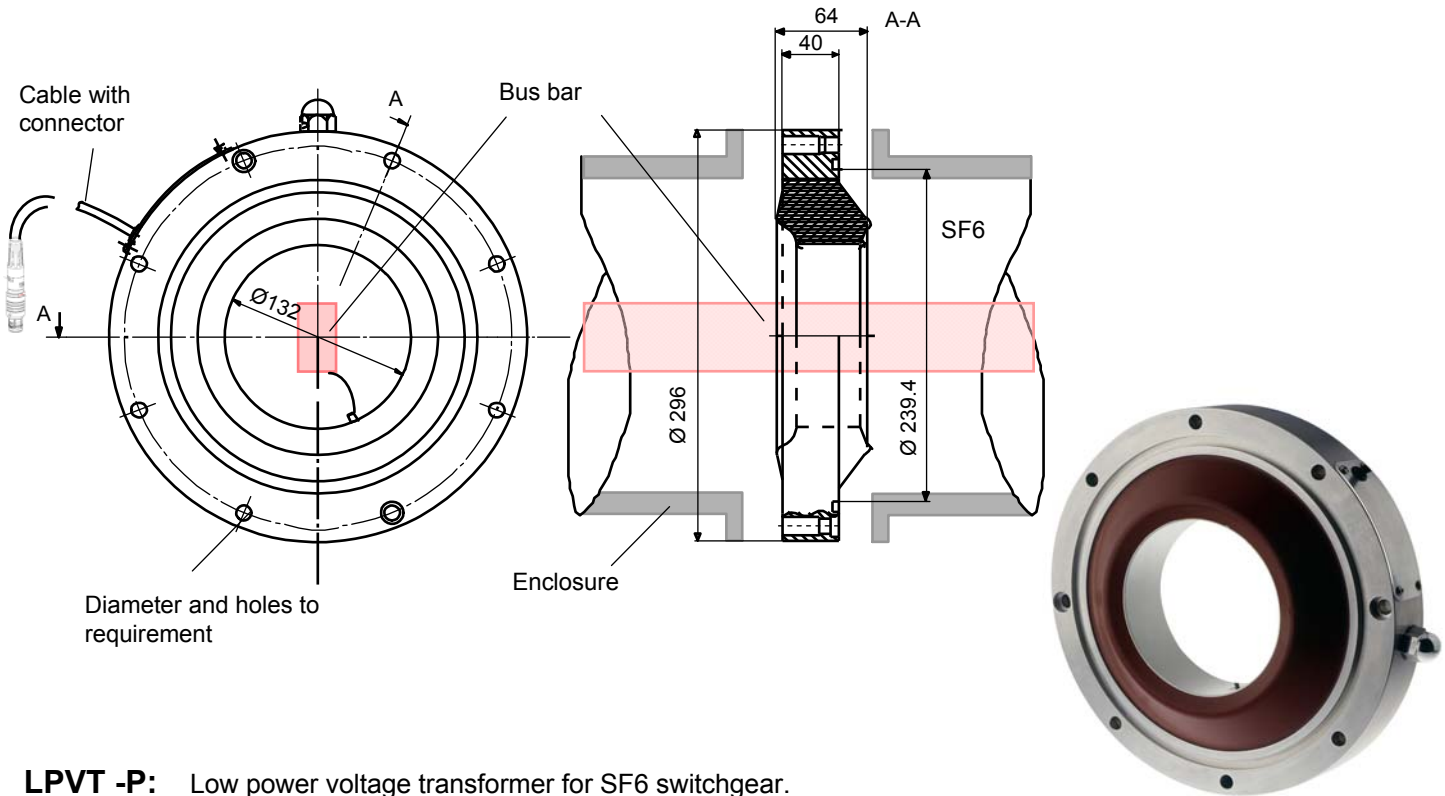
**LPVT -A:** Low power voltage transformer (outer cone type)  
 Available up to  $U_m$  24 kV  
 Same dimensions for all voltages.  
 Primary connector according to EN 50181 (DIN 47636), type 24 kV, 250 A.  
 Outline drawing: 16300000  
 Weight: 3.2 kg



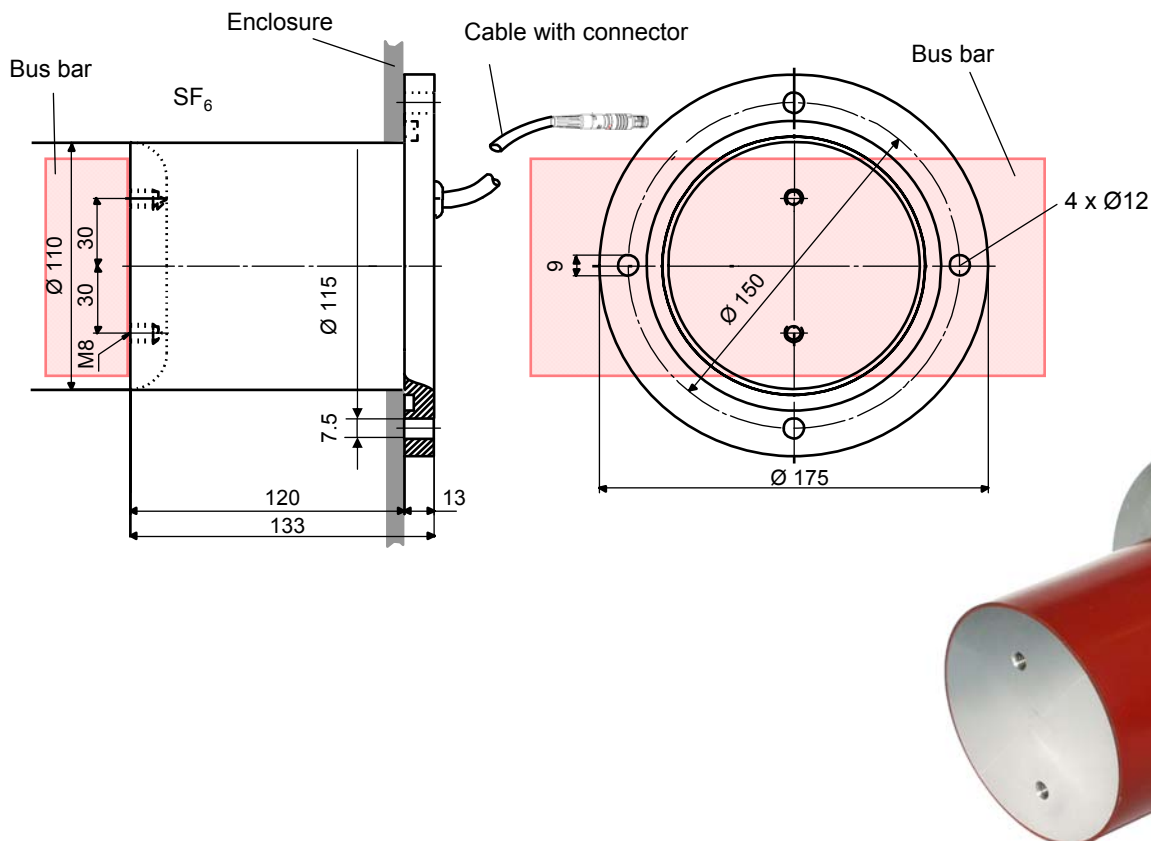
**LPVT -I:** Low power voltage transformer (inner cone type)  
 Available up to  $U_m$  36 kV.  
 Same dimensions for all voltages between 7.2 kV and 36 kV (size 2) and between 36 kV and 52 kV (size 3)  
 Primary connector according to EN 50181 (DIN 47637), type 36 kV, size 2 and 3.  
 Outline drawing: 16320000 (size 2) and 16320010 (size 3)  
 Weight: 4.0 kg (size 2) and 5.0 kg (size 3)



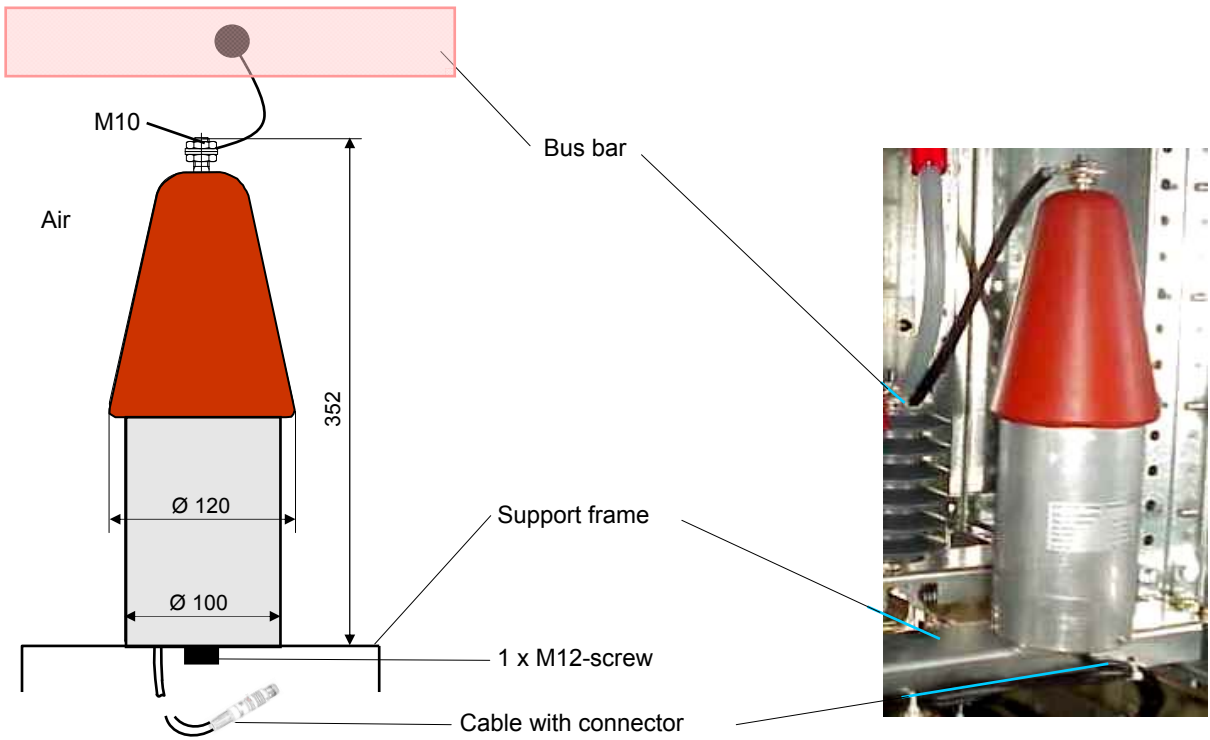
**LPVT -G:** Low power voltage transformer for SF6 switchgear.  
 Available up to Um 36 kV with the same dimensions.  
 The LPVT-G model is suitable for single phase encapsulated SF6 switchgear.  
 Outline drawing: 16340000.  
 Weight: 5.5 kg.



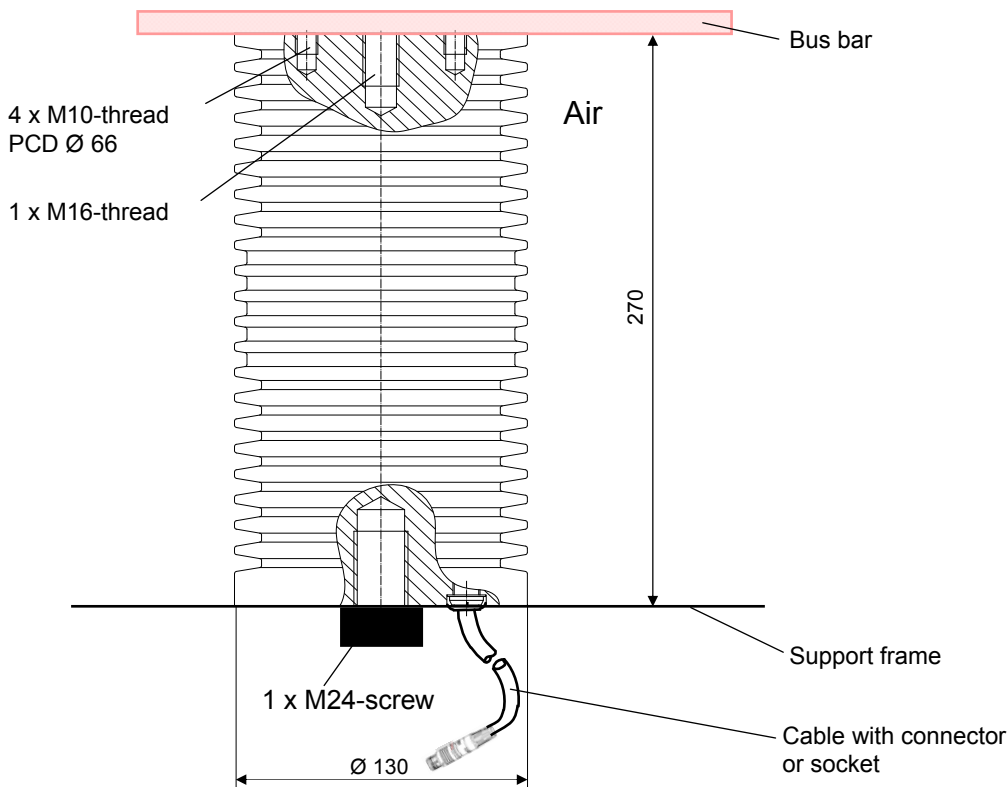
**LPVT -P:** Low power voltage transformer for SF6 switchgear.  
 Available up to Um 36 kV with the same dimensions.  
 The LPVT-P series is suitable for encapsulated SF6 switchgear.  
 Outline drawing: 16360000.  
 Weight: 4.0 kg.



**LPVT -F:** Low power voltage transformer for AIS switchgear.  
 Available up to Um 24 kV with the same dimensions.  
 The LPVT-F series is suitable for air insulated switchgear.  
 Outline drawing: 16380000  
 Weight: 4.8 kg.



**LPVT -S:** Low power voltage transformer for AIS switchgear.  
 Available up to Um 36 kV with the same dimensions.  
 The LPVT-S series is suitable for air insulated switchgear.  
 Outline drawing: 16380101.  
 Weight: 5.0 kg.





# LOPO<sup>®</sup> Current Transformers

Trench LOPO<sup>®</sup> current transformers are passive devices, based on the principle of a ring core transformer with an integrated precision shunt,

designed for medium voltage protection and measuring systems in accordance with IEC 60044-8. The LOPO<sup>®</sup> current transformer provides a voltage output proportional to the

primary current. It replaces conventional current transformers with significant space and weight advantages.

## Benefits:

- Only one core required for all measurement and protection requirements, e.g. class 0.2 or 0.5 and 5P, with the transient performances of TPY cores in accordance with IEC 60044-6.
- Reduced inventory: one LOPO<sup>®</sup> current transformer covers currents from 50 A to 5000 A.
- Linear and saturation free up to short time current.
- Insensitive to burden: accurate for a total burden  $\geq 20 \text{ k}\Omega$ , making it possible for several relays and meters to be connected in parallel to the LOPO<sup>®</sup> current transformer without affecting accuracy.
- Connecting cable (double shielded twisted pair) and connector are parts of the LOPO<sup>®</sup> CT
- Very low voltage amplitude error and phase displacement (ideal for earthfault protection).

## Technical data

- Measuring range
- Rated primary current
- Secondary voltage\*
- System frequency:
- Rated short time thermal current:
- Accuracy\*:
- Burden:
- For distance protection

**LOPO<sup>®</sup>-CT covers a wide measuring range (e.g. LPCT-A: from 50 up to 5000 A)**

$I_{pr}$ : 50 A up to 5000 A  
 $U_{sr}$ : 22.5 mV up to 2.25 V

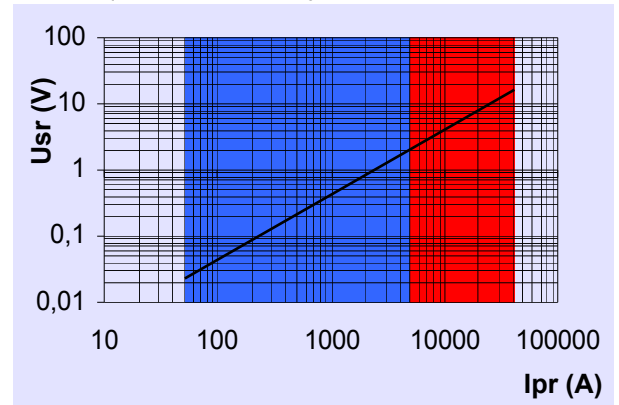
16 2/3, 50, 60 Hz

up to 63 kA / 3 s

Class 0.2, 0.5 or 1.0 and simultaneously class 5P up to 63 kA

$\geq 20 \text{ k}\Omega$

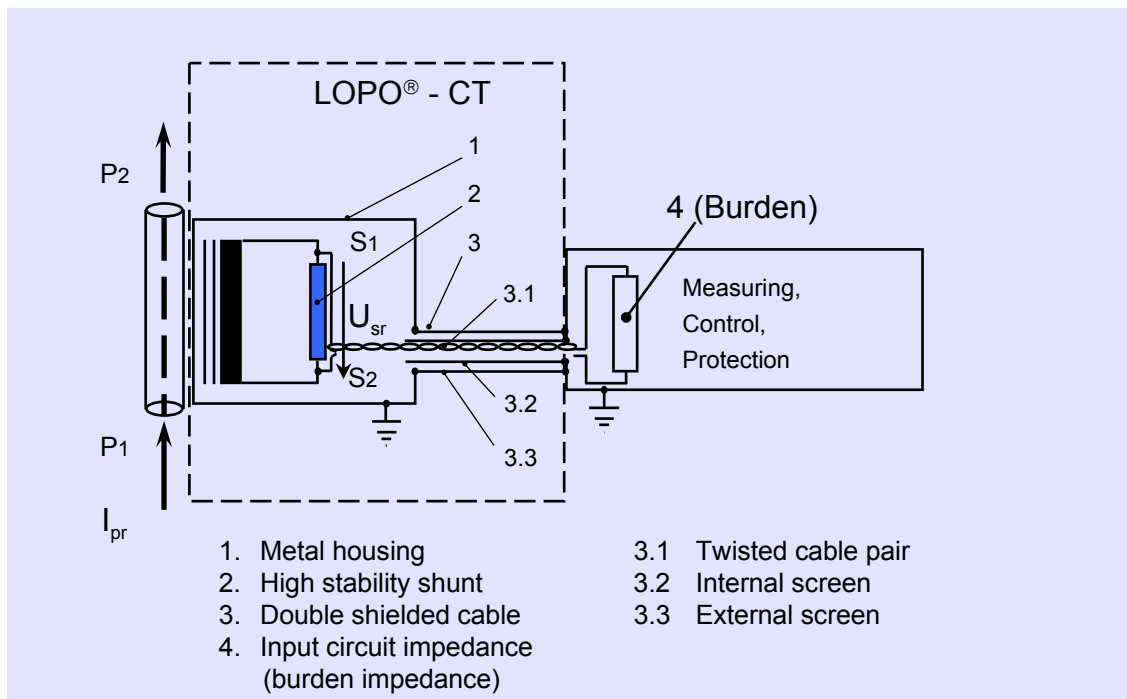
e.g.  $I_{pr} = 1000 \text{ A} \Rightarrow U_{sr} = 0.450 \text{ V}$   
 $I_{th} = 10 \text{ kA} \Rightarrow U_{sr} = 4.50 \text{ V}$



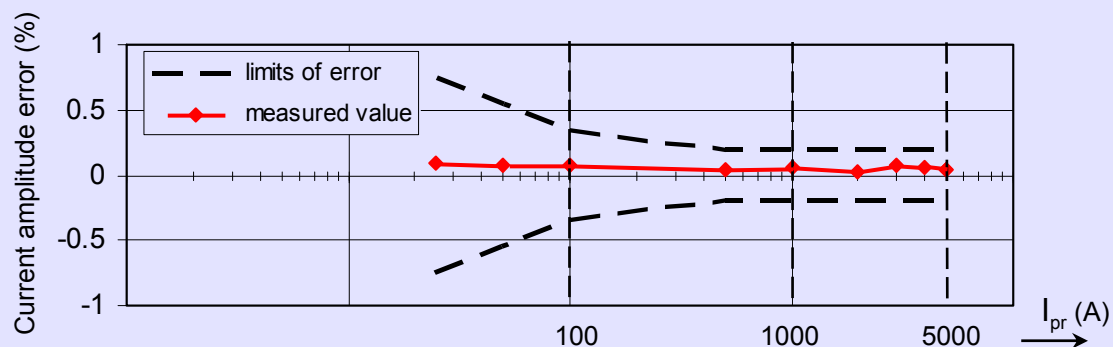
- Type tests: In accordance with IEC 60044-8, including immunity tests and measurement of the overvoltage transmission factor

\*: other values and designs on request

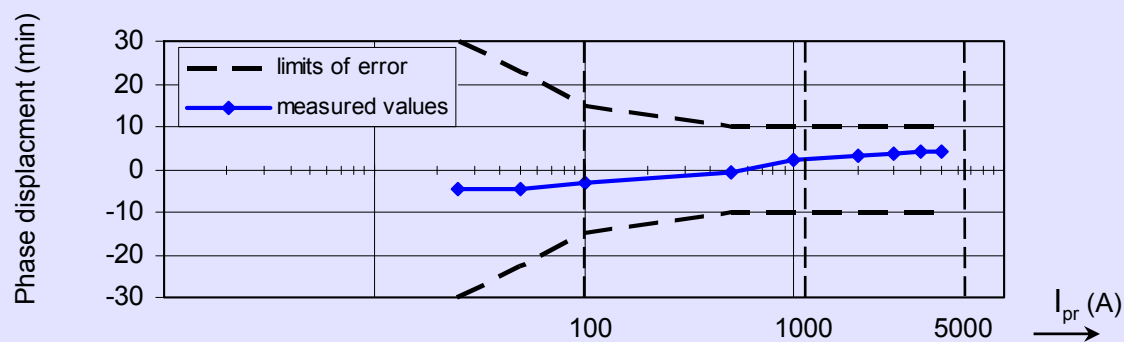
## Principle scheme



## Example of accuracy performance

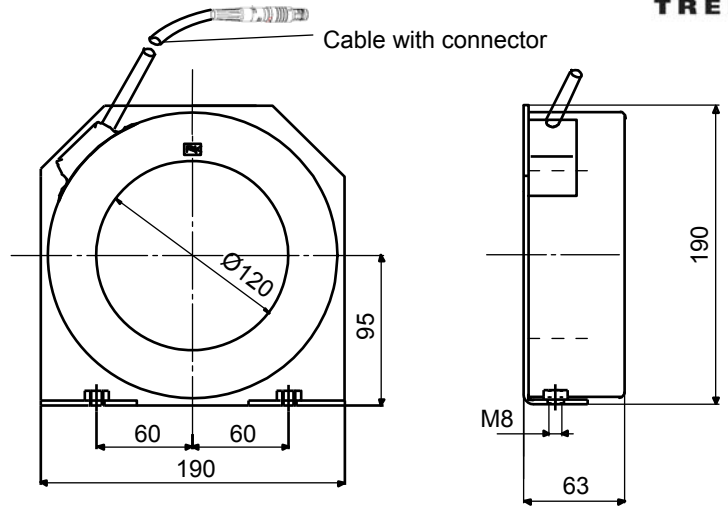


Typical current amplitude error with class 0.2

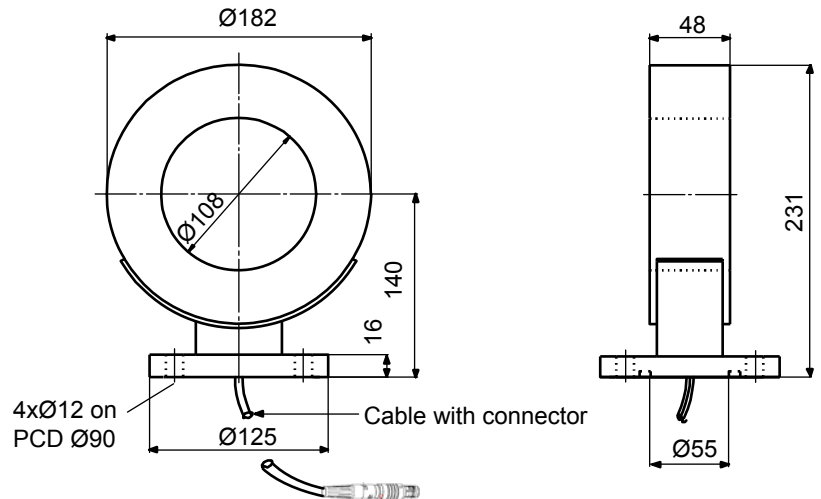


Typical phase displacement with class 0.2

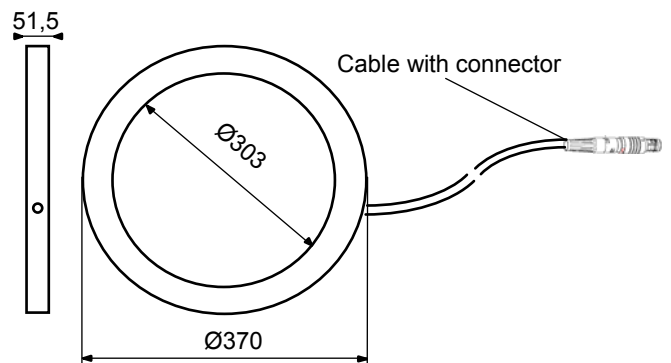
**LPCT 25-A:** Low power current transformer  
 Available for rated current up to 5000 A.  
 Outline drawing number: 16100000.  
 Weight: 4.0 kg



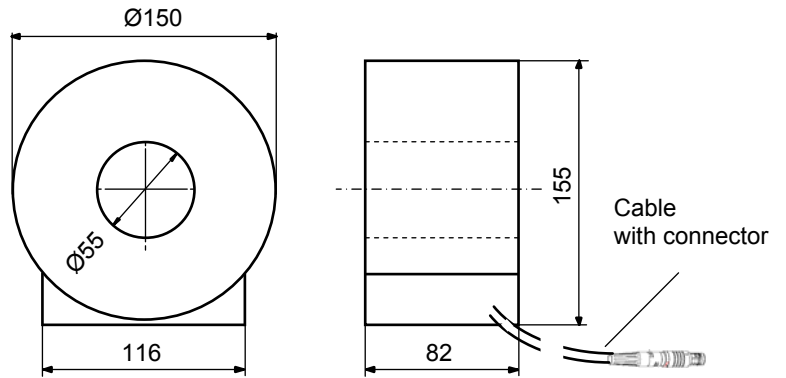
**LPCT 25-B:** Low power current transformer  
 Available for rated current up to 5000 A.  
 Outline drawing number: 16110000.  
 Weight: 4.2 kg



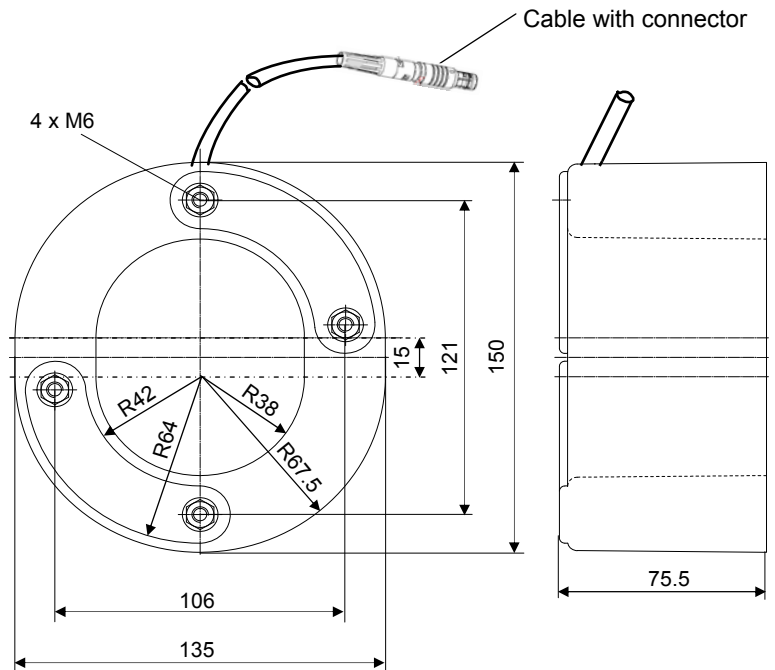
**LPCT 25-C:** Low power current transformer  
 Available for rated current up to 5000 A.  
 Outline drawing number: 16120000.  
 Weight: 7.4 kg



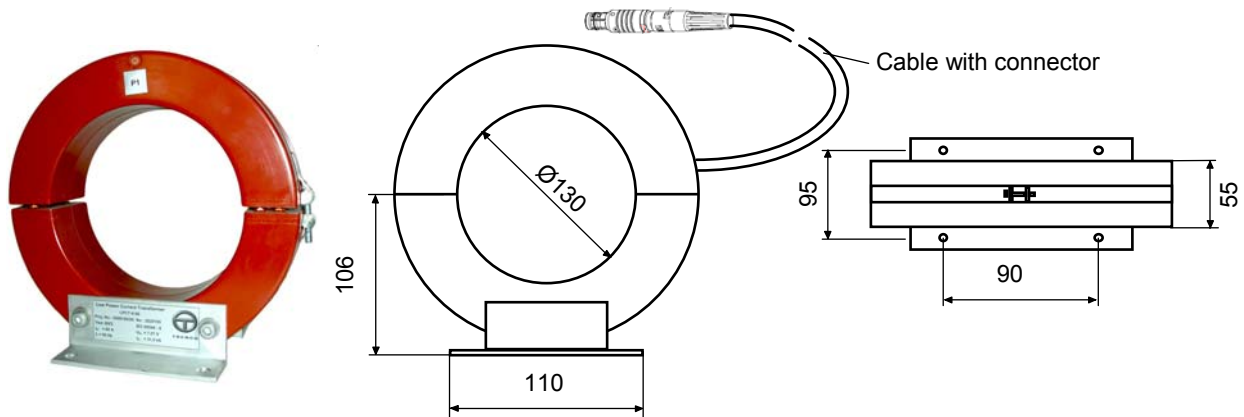
**LPCT 25-D:** Low power current transformer  
 Available for rated current up to 5000 A.  
 Outline drawing number: 16130000  
 Weight 5.7 kg



**LPCT 25-E:** Low power current transformer  
 Available for rated current up to 5000 A.  
 Outline drawing number: 16150003  
 Weight: 3.3 kg



**LPCT K-60:** Split core low power current transformer  
 Rated current 60 A (Available for rated current up to 100 A).  
 Outline drawing number: 16140000  
 Weight: 3.6 kg



**Principle:**

The LOPO® split core current transformer sums magnetically the three line currents (Fig. 1) to measure the zero sequence current of the three lines. This method provides a better result than obtaining the zero sequence by the summation of the output signals of three single current transformers.

The output signal of the LPCT K-60 is a voltage.

**Application:**

Measurement of zero sequence current in networks with isolated or compensated neutral point (arc suppression coil or Petersen coil) for detection and disconnection of faulty feeders in a substation (Fig. 2).

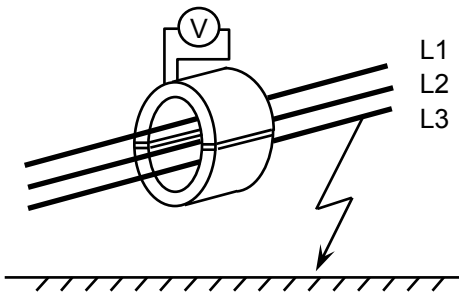


Fig. 1: Measurement of earthfault current

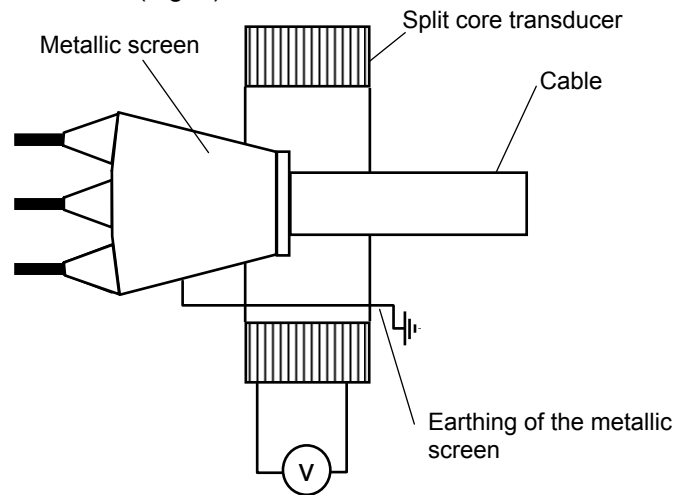


Fig. 2: Mounting of the split core transformer

- Secondary voltage at  $\Sigma I_{\text{primary}} = 60 \text{ A}$ :  $U_{\text{secondary}} = 7.07 \text{ V}_{\text{r.m.s.}}$
- Max. output voltage if  $\Sigma I_{\text{primary}} > 60 \text{ A}$ :  $28 \text{ V}_{\text{r.m.s.}}$  for 1 sec. and  $14 \text{ V}_{\text{r.m.s.}}$  continuous

Error of a LOPO® split core transformer type LPCT K with voltage output.

$\Sigma I_{\text{primary}} \text{ (A}_{\text{r.m.s.}})$	0,6	6	12	20	30	60	96
Current % of $\Sigma I_{\text{primary}} \text{ (}\Sigma I_{\text{primary}} = 60 \text{ A)}$	1	10	20	33.3	50	100	160
Current amplitude error (%)	6	3	1,5	1,2	1	1	1
Phase error (°)	3	1,5	1	0,5	0,5	0,5	0,5

# LOPO<sup>®</sup> Combined Voltage and Current Transformers

The combined Trench LOPO<sup>®</sup> current and voltage transformers allow a space saving design of medium switchgear, designed for medium voltage systems in

accordance with IEC 60044-7 and IEC 60044-8. The dimensions are according DIN 42600, part 8 (narrow design).

The LOPO<sup>®</sup> combined voltage and current transformer provides two voltage output signals which are proportional to the primary voltage and to the primary current.

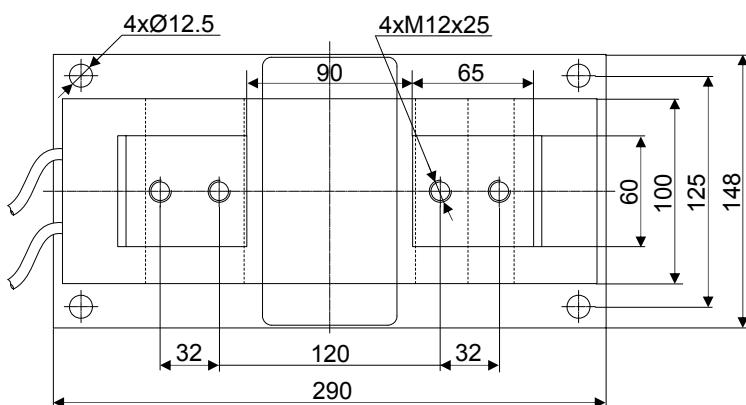
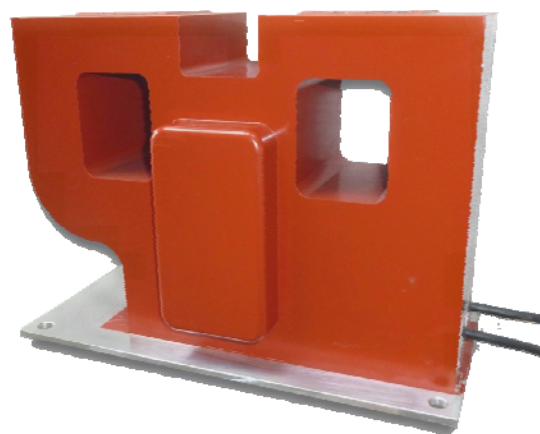
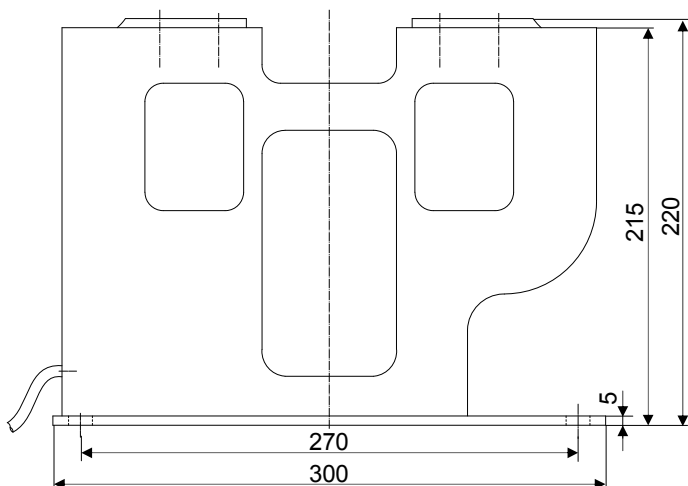
## Benefits:

- Optimized in weight and space.
- Dimensions according DIN 42600, part 8 (narrow design).
- Very low voltage amplitude error and phase displacement (CT signal ideal for earthfault protection).
- Only one combined LOPO<sup>®</sup> unit for all metering, measuring and protection requirements, e.g. for CT-part: class 0.2 or 0.5 and 5P, with the transient performances of TPY cores in accordance with IEC 60044-6.
- Reduced inventory: Only one LOPO<sup>®</sup> current transformer covers the current measurement over a wide range (e.g. from 50 A to 5000 A).
- The CT is linear and saturation free up to short time current and insensitive to a total burden  $\geq 20 \text{ k}\Omega$ , making it possible for several relays and meters to be connected in parallel to the LOPO<sup>®</sup> CT-output without affecting accuracy.
- Connecting cables and connectors are parts of the combined LOPO<sup>®</sup> unit.
- The VT is ferro-resonance free and no disconnection of the voltage transformer is required during cable and switchgear voltage testing. The voltage transformers are able to withstand the on-line switchgear and cable voltage testing:

Applied voltage	Frequency	Duration
$2 * U_m / \sqrt{3}$	50 / 60 Hz	60 min
$3 * U_m / \sqrt{3}$	0.1 Hz	50 min
$4 * U_m / \sqrt{3}$	DC	15..30 min

**LPVCT-12:** Combined LOPO<sup>®</sup> voltage and current transformer  
 Available for rated current up to 2500 A and highest voltage for equipment up to 24 kV.  
 Outline drawing number: 16400002 (12 kV / 1250 A)  
 Weight: 12.0 kg

Other types on request.





**TRENCH**

# Trench Facilities



**TRENCH**

## **Trench® Austria GmbH**

Paschinger Strasse 49  
Postfach 13  
A-4060 Linz-Leonding  
Austria  
Phone: 43-732-6793-0  
Fax: 43-732-671341

## **Trench® Brasil Ltda**

Via Expressa de Contagem, 2685  
Contagem, Minas Gerais  
CEP 32370-485  
Brazil  
Phone: 55-31-3391-5959  
Fax: 55-31-3391-1828

## **Trench® China**

MWB (Shanghai) Co., Ltd.  
No. 3658, Jiancheng Road  
Minhang, Shanghai  
Peoples Republic of China  
200245  
Phone: 86-21-54720088  
Fax: 86-21-54723118

## **Trench® Shenyang**

Trench High Voltage  
Products Ltd., Shenyang  
Dao Yi Economic Development Zone  
Shenyang 110136  
Peoples Republic of China  
Phone: 86-24-89725308  
Fax: 86-24-89737200

## **Trench® Limited**

Bushing Division  
432 Monarch Avenue  
Ajax, Ontario  
Canada L1S 2G7  
Phone: 905-426-2665  
Fax: 905-426-2671

## **Trench® Limited**

Coil Product Division  
71 Maybrook Drive  
Scarborough, Ontario  
Canada M1V 4B6  
Phone: 416-298-8108

## **Trench® Limited**

Instrument Transformer Division  
390 Midwest Road  
Scarborough, Ontario  
Canada M1P 3B5  
Phone: 416-751-8570  
Fax: 416-751-6952

## **Trench® Limited**

Power Line Carrier Division  
815 Middlefield Road, Unit 6A  
Scarborough, Ontario  
Canada M1V 2P9  
Phone: 416-291-8544  
Fax: 416-291-5581

## **Trench® France S.A.**

16, Rue du Général Cassagnou  
B.P. 70 F-68 302  
St. Louis, Cedex, France  
Phone: 33-3 89-70-2323  
Fax: 33-3 89-67-2663

## **Trench® Germany GmbH**

Nürnberg Strasse 199  
D-96050 Bamberg, Germany  
Phone: 49-951-1803-0  
Fax: 49-951-1803-224

## **Trench® Switzerland AG**

Lehenmattstrasse 353  
CH-4052  
Basel, Switzerland  
Phone: 41-61-315-51-11  
Fax: 41-61-315-59-00

## **Trench® (UK) Limited**

South Drive  
Hebburn, Tyne & Wear  
NE 31 1 UW  
Phone: 44-191-483-4711  
Fax: 44-191-430-0633

## **Trench® Italia**

Strada Curagnata  
37 Bragno-Cairo  
17014, Italy  
Phone: 39-019-5161-111  
Fax: 39-019-5161-401

[www.trenchgroup.com](http://www.trenchgroup.com)

## **E910**

Subject to change without notice (04.2011)  
Printed in Switzerland