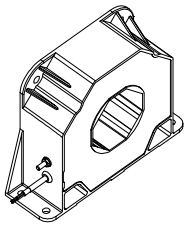
Current Transducer LF 2005-S/SP9

For the electronic measurement of currents: DC, AC, pulsed..., with galvanic separation between the primary circuit and the secondary circuit.

I_{PN} = **1000 A**



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Electrical data

I_{PN}	Primary nominal RMS current			1000		A
I_{PM}	Primary current, measuring range @ ±24 V			0 ... ±2000		A
$\hat{I}_{P\,max}$	Primary withstand peak current (maximum)			50		kA
R_M	Measuring resistance		T_A = 70 °C		T_A = 85 °C	
			$R_{M\,min}$	$R_{M\,max}$	$R_{M\,min}$	$R_{M\,max}$	
	with ±15 V	@ ±1000 A $_{max}$	0	27	0	26	Ω
		@ ±1700 A $_{max}$	0	2	0	1	Ω
	with ±24 V	@ ±1000 A $_{max}$	0	69	3	68	Ω
		@ ±2000 A $_{max}$	0	18	3	17	Ω
I_{SN}	Secondary nominal RMS current			200		mA
N_P/N_S	Turns ratio			1 : 5000		
U_C	Supply voltage (±10 %)			±15 ... 24		V
I_C	Current consumption			33 (@ ±24 V) + I_S		mA

Accuracy - Dynamic performance data

ε_L	Linearity error	< 0.1	%
$t_{D\,90}$	Delay time to 90 % of the final output value for I_{PN} step [1]	< 1	µs
BW	Frequency bandwidth (−1 dB)	DC ... 100	kHz

Test circuit

N_T	Number of turns (test winding)	1000	
R_T	Resistance of test winding @ T_A = 85	16	Ω
I_T	Test current	0.1 [2]	A

Remarks:

- Use a current generator for the test winding (high impedance)
- Otherwise a minimum resistance in series with the test winding is needed:
  - 30 Ω @ T_A = −25 ... +85 °C
  - 50 Ω @ T_A = −40 ... +85 °C

General data

T_A	Ambient operating temperature	−40 ... +85	°C
$T_{A\,st}$	Ambient storage temperature	−40 ... +85	°C
R_S	Resistance of secondary winding @ T_A = 70 °C	33	Ω
	@ T_A = 85 °C	34	Ω
m	Mass	1.4	kg
	Standards	EN 50155: 2021 [3]	
		EN 50121-3-2: 2016	

Notes: [1] For a di/dt = 100 A/µs

[2] Maximum 1 A during 10 seconds 6 times per hour

[3] Additional information available on request.

Features

- Closed loop (compensated) current transducer using the Hall effect
- Insulating plastic case recognized according to UL 94-V0.

Special features

- I_{PN} = 1000 A
- I_{PM} = 0 ... ±2000 A
- U_C = ±15 ... 24 (±10 %) V
- U_d = 12 kV
- N_T = 1000 turns
- T_A = −40 °C ... 85 °C
- Secondary connection on shielded cable 5 × 0.5 mm².

Advantages

- Excellent accuracy
- Very good linearity
- Low temperature drift
- Optimized response time
- Wide frequency bandwidth
- No insertion losses
- High immunity to external interference
- Current overload capability.

Applications

- Single or three phase inverter
- Propulsion and braking chopper
- Propulsion converter
- Auxiliary converter
- Battery charger.

Application Domain

- Railway (fixed installations and onboard).

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Insulation coordination			
U_d	RMS voltage for AC insulation test, 50 Hz, 1 min	12 [1] 500 [2]	kV V
U_t	Partial discharge RMS test voltage (q_m < 10 pC)	≥ 4.1 [3] Min	kV
d_{Cp}	Creepage distance	51.5	mm
d_{Cl}	Clearance	51.5	mm
CTI	Comparative tracking index (group I)	600	

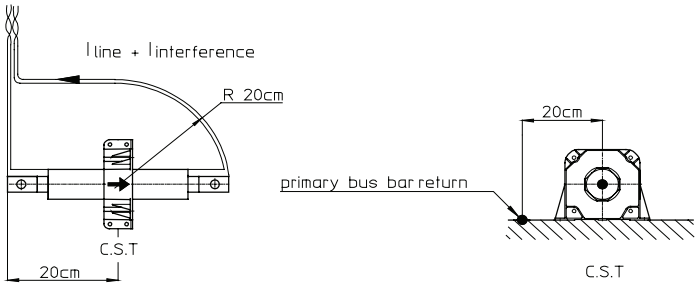
Notes: [1] Between primary and secondary + test
[2] Between shield and secondary + test
[3] Test performed with a non-insulated bus bar (dimension 290 × 50 × 10 mm) centered in the aperture.

DC offset [At]

Maximum range of measured current				
Temperature range	−100 ... +100 A	−500 ... +500 A	−1000 ... +1000 A	−2000 ... +2000 A
−25 °C ... +85 °C	±3.6	±3.8	±4.0	±4.8
−40 °C ... +85 °C	±5.1	±5.3	±5.5	±6.3

Maximum DC offset for different ranges of temperature and measured current.

Wiring plan for DC component measuring



Accuracy for the measurement of a single frequency signal

Frequency	20 ... 200 Hz		200 ... 3000 Hz	
Amplitude	Amplitude Error [%]	Phase Error [%]	Amplitude Error [%]	Phase Error [%]
0.1 ... 0.5 A	±55	−15.0	±55	22
0.5 ... 1 A	±17	−14.0	±48	22
1 ... 2 A	±7.0	−7.4	±32	14
2 ... 10 A	±6.6	−1.6	±17	6.2
10 ... 20 A	±3.7	< −1.0	±6.8	−1.4
20 ... 50 A	±2.8	< −1.0	±3.6	< −1.0

Amplitude error: in % of the measured signal.
Phase error: in degrees with respect to the measured signal.
Maximum amplitude and phase errors for single frequency signals.
High error values are due to zero-crossing distortion.

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Accuracy for the measurement of a signals added to a DC current ≥ 10 A

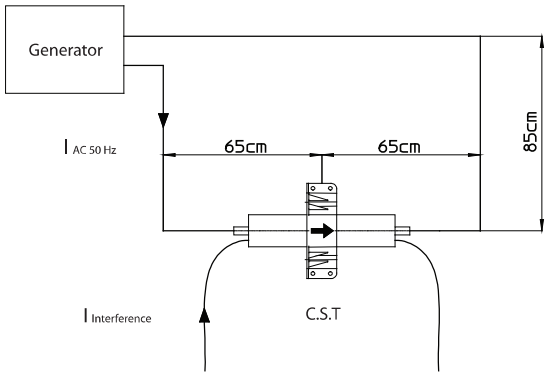
Frequency	20 ... 200 Hz		200 ... 3000 Hz	
Amplitude	Amplitude Error [%]	Phase Error [%]	Amplitude Error [%]	Phase Error [%]
0.1 ... 0.5 A	±2.2	−1.6	±4.4	1.4
0.5 ... 1 A	±2.5	−1.6	±4.1	< −1.0
1 ... 2 A	±2.5	−1.6	±4.1	< −1.0
2 ... 10 A	±6.1	−1.1	±7.0	< −1.0
10 ... 20 A	±6.1	< −1.0	±8.8	< −1.0
20 ... 50 A	±6.0	< −1.0	±7.5	< −1.0

Amplitude error: in % of the measured signal.
Phase error: in degrees with respect to the measured signal.
Maximum amplitude and phase errors for signals added to a DC fundamental.

Accuracy for the measurement of a signals added to an AC (fundamental) current (15 Hz < f < 100 Hz), ≥ 10 A RMS

Frequency	20 ... 200 Hz		200 ... 3000 Hz	
Amplitude	Amplitude Error [%]	Phase Error [%]	Amplitude Error [%]	Phase Error [%]
0.1 ... 0.5 A	±1.6	< −1.0	±2.3	< −1.0
0.5 ... 1 A	±1.2	< −1.0	±1.9	< −1.0
1 ... 2 A	±0.9	< −1.0	±1.3	< −1.0
2 ... 10 A	±0.6	< −1.0	±0.8	< −1.0
10 ... 20 A	±0.6	< −1.0	±0.7	< −1.0
20 ... 50 A	±1.0	< −1.0	±1.0	< −1.0

Amplitude error: in % of the measured signal.
Phase error: in degrees with respect to the measured signal.
Maximum amplitude and phase errors for signals added to an AC fundamental.

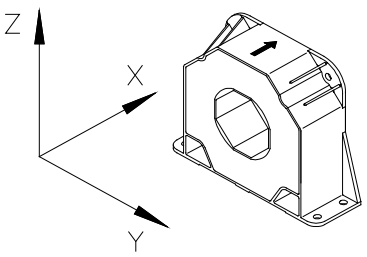


Wiring plan for measurements with an AC component.

Influence regarding external magnetic fields

Frequency Direction	0 ... 5 Hz Max error [mAt $_{RMS}$ per A/m]	0 ... 5 Hz Max error [mAt $_{RMS}$ per A/m]
X-axis	0.16	0.18
Y-axis	3.3	5.3
Z-axis	0.04	0.08

Error in the measurement of the primary current [mA $_{RMS}$] due to external magnetic fields at the specified frequencies for the three axes of the transducer



Orientation of transducer during magnetic field sensitivity testing.

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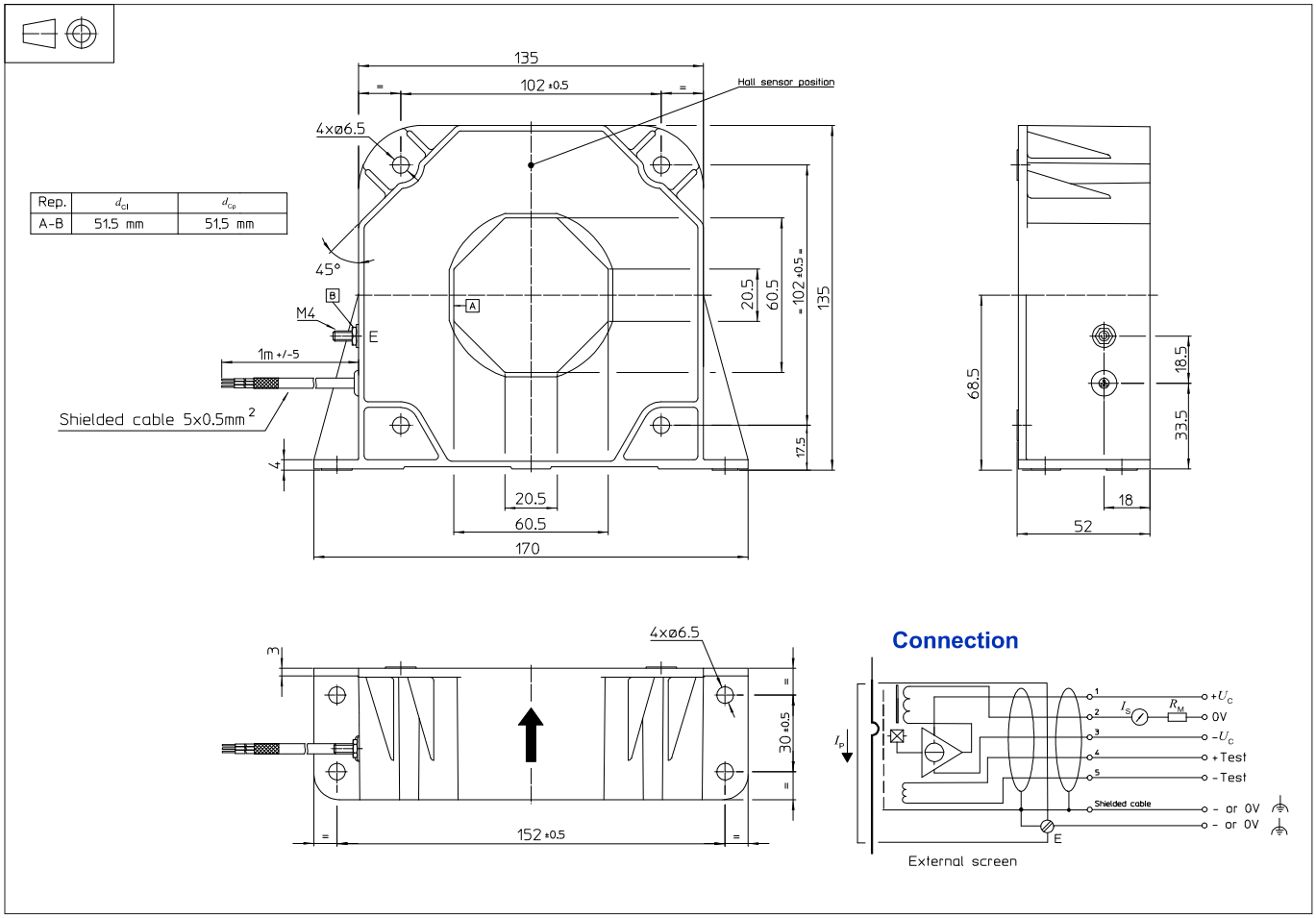
Dimensions LF 2005-S/SP9 (in mm)



Mechanical characteristics

• General tolerance	±1 mm
• Transducer fastening	
Vertical or flat position	4 holes ⌀ 6.5 mm
	4 M6 steel screws
Recommended fastening torque	5.5 Nm
• Primary through-hole	60.5 × 20.5
Or	⌀ 56 mm max
• Connection of secondary	shielded cable
	5 x 0.5 mm²
• Connection shields	M4 threaded stud
Recommended fastening torque	1.2 Nm

Remarks

- I_S is positive when I_P flows in the direction of the arrow.
- Temperature of the primary conductor should not exceed 100 °C.
- Dynamic performances (di/dt and delay time) are best with a single bar completely filling the primary hole.

Safety

This transducer must be used in limited-energy secondary circuits according to IEC 61010-1.

This transducer must be used in electric/electronic equipment with respect to applicable standards and safety requirements in accordance with the manufacturer's operating instructions.

Caution, risk of electrical shock

When operating the transducer, certain parts of the module can carry hazardous voltage (eg. primary busbar, power supply).
Ignoring this warning can lead to injury and/or cause serious damage.
This transducer is a build-in device, whose conducting parts must be inaccessible after installation.
A protective housing or additional shield could be used.
Main supply must be able to be disconnected.

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