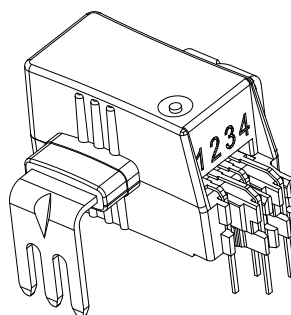


Current Transducer HLSR-P/SP10 series $I_{PN} = 80 \dots 120 \text{ A}$

Ref: HLSR 80-P/SP10, HLSR 100-P/SP10, HLSR 120-P/SP10

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



Features

- Open loop multi-range current transducer
- Voltage output
- Single supply +5 V
- Galvanic separation between primary and secondary
- Low power consumption
- Compact design for through-hole PCB mounting
- Factory calibrated
- High bandwidth, very low loss magnetic core.

Special feature

- Silicon Iron Core.

Advantages

- Extremely low profile: $h = 12 \text{ mm}$
- Low foot-print
- Low offset drift
- Over-drivable U_{ref}

Applications

- AC variable speed and servo motor drives
- Static converters for DC motor drives
- Battery supplied applications
- Uninterruptible Power Supplies (UPS)
- Switched Mode Power Supplies (SMPS)
- Power supplies for welding applications
- Combiner box
- MPPT.

Standards

- IEC 61800-3: 2017
- IEC 61800-5-1: 2007
- IEC 61326-1: 2012
- IEC 62109-1: 2010
- UL 508: 2010.

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/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.

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.

Although LEM applies utmost care to facilitate compliance of end products with applicable regulations during LEM product design, use of this part may need additional measures on the application side for compliance with regulations regarding EMC and protection against electric shock. Therefore LEM cannot be held liable for any potential hazards, damages, injuries or loss of life resulting from the use of this product.



Underwriters Laboratory Inc. recognized component

Absolute maximum ratings

Parameter	Symbol	Unit	Value
Maximum supply voltage (not destructive)	U_C	V	8
Maximum supply voltage (not entering non standard modes)	U_C	V	6.5
Maximum primary conductor temperature	T_B	°C	120
Electrostatic discharge voltage (HBM - Human Body Model)	$U_{ESD\ HBM}$	kV	2

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

UL 508: Ratings and assumptions of certification

File # E189713 Volume: 2 Section: 5

Standards

- UL 508 and CSA C22.2 NO. 14 18 STANDARD FOR INDUSTRIAL CONTROL EQUIPMENT

Ratings

Parameter	Symbol	Unit	Value
Primary involved potential		V AC/DC	600
Max surrounding air temperature	T_A	°C	105
Primary current	I_P	A	According to series primary current
Secondary supply voltage	U_C	V DC	5
Output voltage	U_{out}	V	0 to 5

Conditions of acceptability

- 1 - These devices have been evaluated for overvoltage category III and for use in pollution degree 2 environment.
- 2 - A suitable enclosure shall be provided in the end-use application.
- 3 - The terminals have not been evaluated for field wiring.
- 4 - These devices are intended to be mounted on a printed wiring board of end use equipment. The suitability of the connections (including spacings) shall be determined in the end-use application.
- 5 - Primary terminals shall not be straightened since assembly of housing case depends upon bending of the terminals.
- 6 - Any surface of polymeric housing have not been evaluated as insulating barrier.
- 7 - Low voltage control circuit shall be supplied by an isolating source (such as a transformer, optical isolator, limiting impedance or electro-mechanical relay).

Marking

Only those products bearing the UR Mark should be considered to be Listed or Recognized and covered under UL's Follow-Up Service. Always look for the Mark on the product.

Insulation coordination

Parameter	Symbol	Unit	Value	Comment
RMS voltage for AC insulation test 50/60 Hz/1 min	U_d	kV	4.3	
Impulse withstand voltage 1.2/50 μ s	U_{Ni}	kV	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
Clearance (pri. - sec.)	-	mm	8	When mounted on PCB with recommended layout
Case material	-	-	V0	According to UL 94
Comparative tracking index	CTI		600	
Application example	-	V	600	Reinforced insulation according to IEC 61010 CAT III, PD2
Application example	-	V	1000	Basic insulation according to IEC 61010 CAT III, PD2
Application example	-	V	600	According to UL 508, CAT III, PD2

Environmental and mechanical characteristics

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Ambient operating temperature	T_A	°C	-40		105	
Ambient storage temperature	$T_{A\text{st}}$	°C	-40		105	
Mass	m	g			8	

Electrical data HLSR 80-P/SP10

At $T_A = 25\text{ °C}$, $U_C = +5\text{ V}$, $R_L = 10\text{ k}\Omega$ unless otherwise noted (see Min, Max, typ. definition paragraph in [page 8](#)).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		80		
Primary current, measuring range	I_{PM}	A	-200		200	For $U_C > 4.6\text{ V}$
Number of primary turns	N_P	-		1		
Resistance of primary jumper @ $T_A = 25\text{ °C}$	R_P	m Ω		0.21		
Resistance of primary jumper @ $T_A = 105\text{ °C}$	R_P	m Ω		0.29		$T_{\text{jumper}} = 120\text{ °C}$
Supply voltage ¹⁾	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		19	25	
Reference voltage (output)	U_{ref}	V	2.48	2.5	2.52	Internal reference
Reference voltage (input)	U_{ref}	V	0.5		2.65	External reference
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	-2		2	Over operating temperature range
Internal series resistance of reference voltage	R_{ref}	Ω	130	200	300	series
Output internal resistance	R_{out}	Ω		2	5	series
Load capacitance	C_L	nF	0		6	
Electrical offset voltage referred to primary @ $I_P = 0$	U_{OE}	mV	-5		5	$U_{out} - U_{ref} @ U_{ref} = 2.5\text{ V}$
Electrical offset current referred to primary	I_{OE}	mA	-500		500	
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	-200		200	-40 °C ... 105 °C
Temperature coefficient of U_{OE} referred to primary	TCU_{OE}	mV/K	-0.075		0.075	-40 °C ... 105 °C
Temperature coefficient of I_{OE} referred to primary	TCI_{OE}	mA/K	-7.5		7.5	-40 °C ... 105 °C
Nominal sensitivity	S_N	mV/A		10		800 mV @ I_{PN}
Sensitivity error	ε_S	%	-0.5		0.5	Factory adjustment
Temperature coefficient of S	TCS	ppm/K	-250		250	-40 °C ... 105 °C
Linearity error 0 ... I_{PN}	ε_L	% of I_{PN}	-0.5		0.5	
Linearity error 0 ... I_{PM}	ε_L	% of I_{PM}	-0.5		0.5	
Magnetic offset current (@ $10 \times I_{PN}$) referred to primary	I_{OM}	A	-0.4		0.4	
Delay time to 10 % of the final output value for I_{PN} step	t_{D10}	μs			2	@ 50 A/ μs
Delay time to 90 % of the final output value for I_{PN} step	t_{D90}	μs			2.5	@ 50 A/ μs
Frequency bandwidth (-3 dB)	BW	kHz		90		
Noise voltage spectral density referred to primary 100 Hz ... 100 kHz	u_{no}	$\mu\text{V}/\sqrt{\text{Hz}}$			5.6	
RMS noise voltage referred to primary DC ... 10 kHz DC ... 100 kHz DC ... 1 MHz	U_{no}	mVpp		4.3 8.8 13.3		
Sum of sensitivity and linearity @ I_{PN}	ε_{SL}	% of I_{PN}	-1		1	
Sum of sensitivity and linearity @ I_{PN} @ $T_A = +85\text{ °C}$	$\varepsilon_{SL 85\text{ °C}}$	% of I_{PN}	-3.1		3.1	See formula note ²⁾
Sum of sensitivity and linearity @ I_{PN} @ $T_A = +105\text{ °C}$	$\varepsilon_{SL 105\text{ °C}}$	% of I_{PN}	-3.8		3.8	See formula note ²⁾

Notes: ¹⁾ 3.3 V SP version available

$$\varepsilon_{SL}(T_A) = \varepsilon_{SL 25} + \left(TCS + \frac{TCI_{OE}}{I_{PN}} \right) \times |T_A - 25|$$

Electrical data HLSR 100-P/SP10

At $T_A = 25\text{ °C}$, $U_C = +5\text{ V}$, $R_L = 10\text{ k}\Omega$ unless otherwise noted (see Min, Max, typ. definition paragraph in [page 8](#)).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		100		
Primary current, measuring range	I_{PM}	A	-250		250	For $U_C > 4.6\text{ V}$
Number of primary turns	N_P	-		1		
Resistance of primary jumper @ $T_A = 25\text{ °C}$	R_P	m Ω		0.21		
Resistance of primary jumper @ $T_A = 105\text{ °C}$	R_P	m Ω		0.29		$T_{\text{jumper}} = 120\text{ °C}$
Supply voltage ¹⁾	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		19	25	
Reference voltage (output)	U_{ref}	V	2.48	2.5	2.52	Internal reference
Reference voltage (input)	U_{ref}	V	0.5		2.65	External reference
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	-2		2	Over operating temperature range
Internal series resistance of reference voltage	R_{ref}	Ω	130	200	300	series
Output internal resistance	R_{out}	Ω		2	5	series
Load capacitance	C_L	nF	0		6	
Electrical offset voltage referred to primary @ $I_P = 0$	U_{OE}	mV	-5		5	$U_{out} - U_{ref} @ U_{ref} = 2.5\text{ V}$
Electrical offset current referred to primary	I_{OE}	mA	-625		625	
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	-200		200	-40 °C ... 105 °C
Temperature coefficient of U_{OE} referred to primary	TCU_{OE}	mV/K	-0.075		0.075	-40 °C ... 105 °C
Temperature coefficient of I_{OE} referred to primary	TCI_{OE}	mA/K	-9.4		9.4	-40 °C ... 105 °C
Nominal sensitivity	S_N	mV/A		8		800 mV @ I_{PN}
Sensitivity error	ε_S	%	-0.5		0.5	Factory adjustment
Temperature coefficient of S	TCS	ppm/K	-250		250	-40 °C ... 105 °C
Linearity error 0 ... I_{PN}	ε_L	% of I_{PN}	-0.5		0.5	
Linearity error 0 ... I_{PM}	ε_L	% of I_{PM}	-0.5		0.5	
Magnetic offset current (@ $10 \times I_{PN}$) referred to primary	I_{OM}	A	-0.4		0.4	
Delay time to 10 % of the final output value for I_{PN} step	t_{D10}	μs			2	@ 50 A/ μs
Delay time to 90 % of the final output value for I_{PN} step	t_{D90}	μs			2.5	@ 50 A/ μs
Frequency bandwidth (-3 dB)	BW	kHz		90		
Noise voltage spectral density referred to primary 100 Hz ... 100 kHz	u_{no}	$\mu\text{V}/\sqrt{\text{Hz}}$			5.6	
RMS noise voltage referred to primary DC ... 10 kHz DC ... 100 kHz DC ... 1 MHz	U_{no}	mVpp		4.3 8.8 13.3		
Sum of sensitivity and linearity @ I_{PN}	ε_{SL}	% of I_{PN}	-1		1	
Sum of sensitivity and linearity @ I_{PN} @ $T_A = +85\text{ °C}$	$\varepsilon_{SL85\text{ °C}}$	% of I_{PN}	-3.1		3.1	See formula note ²⁾
Sum of sensitivity and linearity @ I_{PN} @ $T_A = +105\text{ °C}$	$\varepsilon_{SL105\text{ °C}}$	% of I_{PN}	-3.8		3.8	See formula note ²⁾

Notes: ¹⁾ 3.3 V SP version available

$$\varepsilon_{SL}(T_A) = \varepsilon_{SL25} + \left(TCS + \frac{TCI_{OE}}{I_{PN}} \right) \times |T_A - 25|$$

Electrical data HLSR 120-P/SP10

At $T_A = 25\text{ °C}$, $U_C = +5\text{ V}$, $R_L = 10\text{ k}\Omega$ unless otherwise noted (see Min, Max, typ. definition paragraph in [page 8](#)).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal RMS current	I_{PN}	A		120		
Primary current, measuring range	I_{PM}	A	-300		300	For $U_C > 4.6\text{ V}$
Number of primary turns	N_P	-		1		
Resistance of primary jumper @ $T_A = 25\text{ °C}$	R_P	m Ω		0.21		
Resistance of primary jumper @ $T_A = 105\text{ °C}$	R_P	m Ω		0.29		$T_{\text{jumper}} = 120\text{ °C}$
Supply voltage ¹⁾	U_C	V	4.5	5	5.5	
Current consumption	I_C	mA		19	25	
Reference voltage (output)	U_{ref}	V	2.48	2.5	2.52	Internal reference
Reference voltage (input)	U_{ref}	V	0.5		2.65	External reference
Output voltage range @ I_{PM}	$U_{out} - U_{ref}$	V	-2		2	Over operating temperature range
Internal series resistance of reference voltage	R_{ref}	Ω	130	200	300	series
Output internal resistance	R_{out}	Ω		2	5	series
Load capacitance	C_L	nF	0		6	
Electrical offset voltage referred to primary @ $I_P = 0$	U_{OE}	mV	-5		5	$U_{out} - U_{ref}$ @ $U_{ref} = 2.5\text{ V}$
Electrical offset current referred to primary	I_{OE}	mA	-750		750	
Temperature coefficient of U_{ref}	TCU_{ref}	ppm/K	-200		200	-40 °C ... 105 °C
Temperature coefficient of U_{OE} referred to primary	TCU_{OE}	mV/K	-0.075		0.075	-40 °C ... 105 °C
Temperature coefficient of I_{OE} referred to primary	TCI_{OE}	mA/K	-11.25		11.25	-40 °C ... 105 °C
Nominal sensitivity	S_N	mV/A		6.67		800 mV @ I_{PN}
Sensitivity error	ε_S	%	-0.5		0.5	Factory adjustment
Temperature coefficient of S	TCS	ppm/K	-250		250	-40 °C ... 105 °C
Linearity error 0 ... I_{PN}	ε_L	% of I_{PN}	-0.5		0.5	
Linearity error 0 ... I_{PM}	ε_L	% of I_{PM}	-0.5		0.5	
Magnetic offset current (@ $10 \times I_{PN}$) referred to primary	I_{OM}	A	-0.4		0.4	
Delay time to 10 % of the final output value for I_{PN} step	t_{D10}	μs			2	@ 50 A/ μs
Delay time to 90 % of the final output value for I_{PN} step	t_{D90}	μs			2.5	@ 50 A/ μs
Frequency bandwidth (-3 dB)	BW	kHz		90		
Noise voltage spectral density referred to primary 100 Hz ... 100 kHz	u_{no}	$\mu\text{V}/\sqrt{\text{Hz}}$			5.6	
RMS noise voltage referred to primary DC ... 10 kHz DC ... 100 kHz DC ... 1 MHz	U_{no}	mVpp		4.3 8.8 13.3		
Sum of sensitivity and linearity @ I_{PN}	ε_{SL}	% of I_{PN}	-1		1	
Sum of sensitivity and linearity @ I_{PN} @ $T_A = +85\text{ °C}$	$\varepsilon_{SL85\text{ °C}}$	% of I_{PN}	-3.1		3.1	See formula note ²⁾
Sum of sensitivity and linearity @ I_{PN} @ $T_A = +105\text{ °C}$	$\varepsilon_{SL105\text{ °C}}$	% of I_{PN}	-3.8		3.8	See formula note ²⁾

Notes: ¹⁾ 3.3 V SP version available

$$\varepsilon_{SL}(T_A) = \varepsilon_{SL25} + \left(TCS + \frac{TCI_{OE}}{I_{PN}} \right) \times |T_A - 25|$$

Definition of typical, minimum and maximum values

Minimum and maximum values for specified limiting and safety conditions have to be understood as such as well as values shown in “typical” graphs.

On the other hand, measured values are part of a statistical distribution that can be specified by an interval with upper and lower limits and a probability for measured values to lie within this interval.

Unless otherwise stated (e.g. “100 % tested”), the LEM definition for such intervals designated with “min” and “max” is that the probability for values of samples to lie in this interval is 99.73 %.

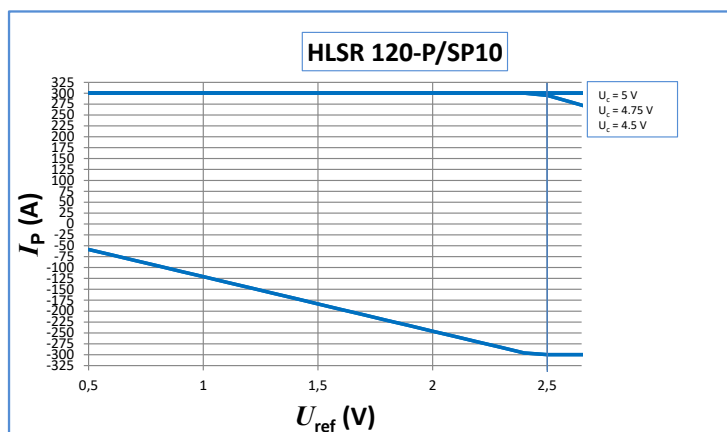
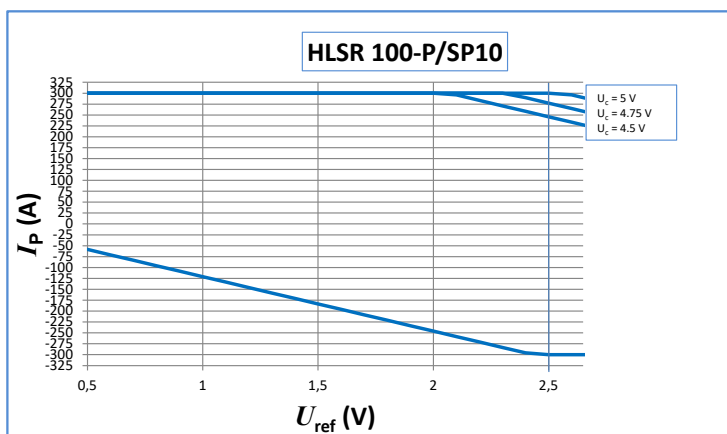
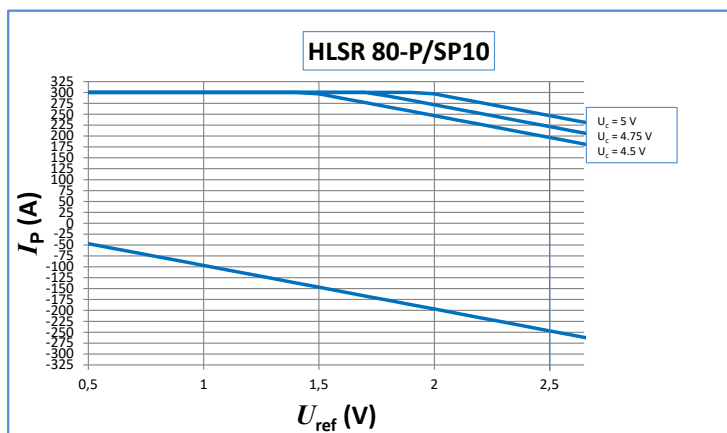
For a normal (Gaussian) distribution, this corresponds to an interval between -3σ and $+3\sigma$. If “typical” values are not obviously mean or average values, those values are defined to delimit intervals with a probability of 68.27 %, corresponding to an interval between $-\sigma$ and $+\sigma$ for a normal distribution.

Typical, minimum and maximum values are determined during the initial characterization of the product.

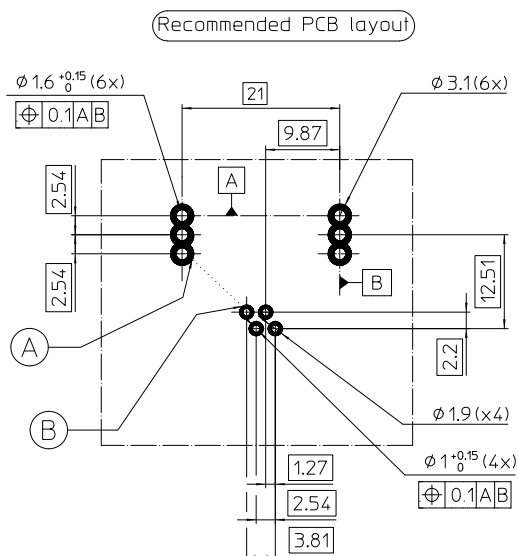
Maximum continuous DC current

Whatever the usage and/or application, the transducer jumper temperature shall not go above the maximum ratings of 120 °C as stated in page 2 of this datasheet.

Measuring range versus external reference voltage



PCB footprint

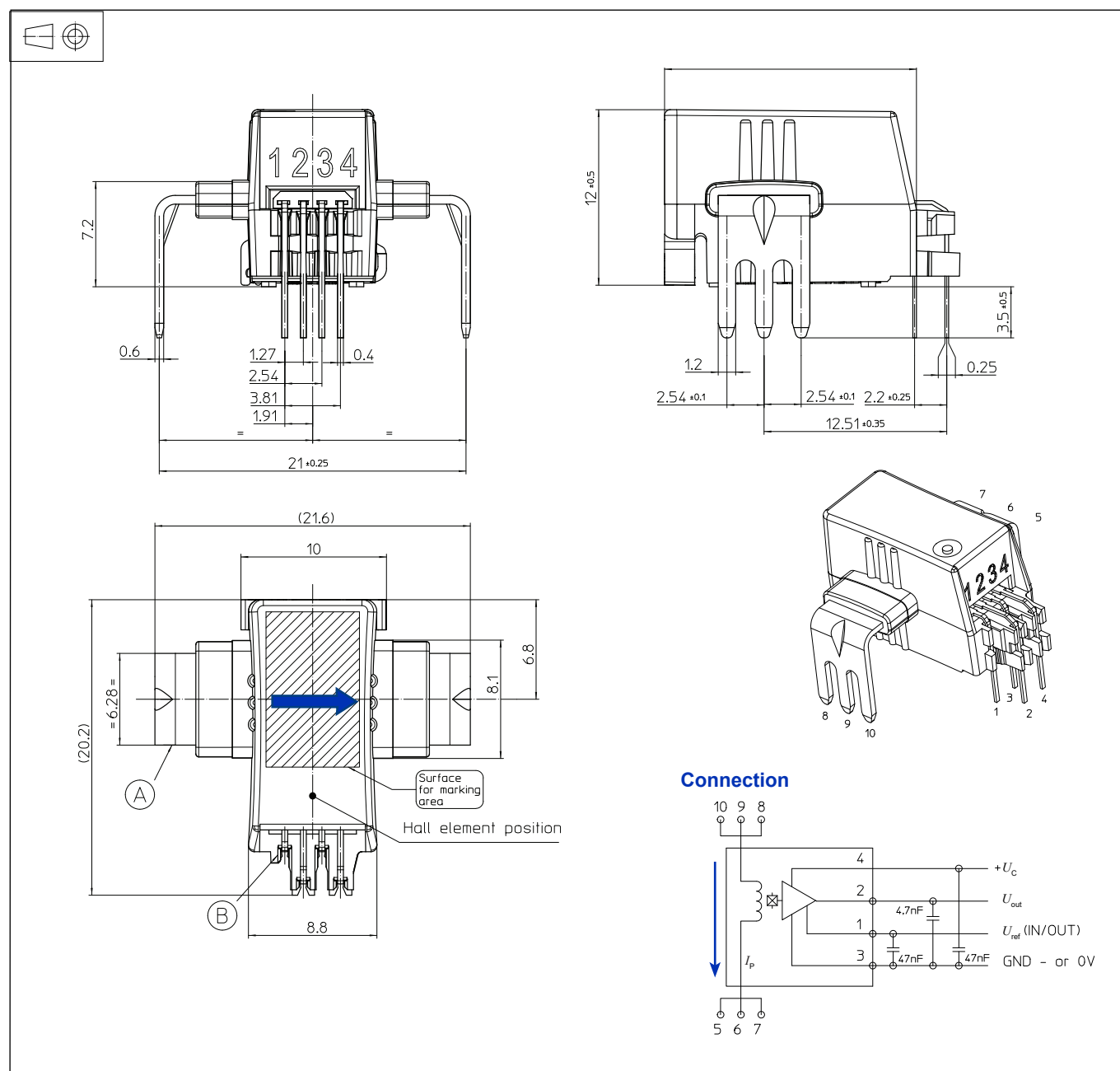


	d_{Cl} (mm)	d_{Cp} (mm)
A-B	9.42	9.42

Assembly on PCB

- Recommended PCB hole diameter
 - 1.6 mm for primary pins
 - 1 mm for secondary pins
- Maximum PCB thickness
 - 2.4 mm
- Wave soldering profile
 - maximum 260 °C for 10 s
 - No clean process only.

Dimensions (in mm.)



Mechanical characteristic

- General tolerance ± 0.2 mm

Remarks

- U_{out} is positive with respect to U_{ref} when positive I_p flows in direction of the arrow shown on the drawing above
- 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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