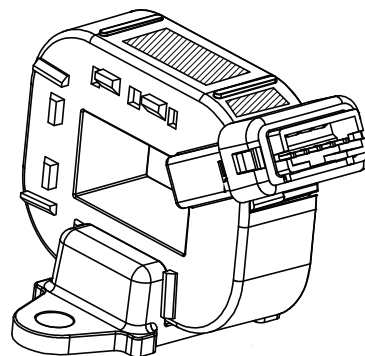


## Current Transducer HO-S/SP33 series

$I_{PN} = 50, 100, 150, 200, 250 \text{ A}$

Ref: HO 50-S/SP33, HO 100-S/SP33, HO 150-S/SP33, HO 200-S/SP33, HO 250-S/SP33

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
- Over-current detect  $2.92 \times I_{PN}$  (peak value)
- Galvanic separation between primary and secondary circuit
- Low power consumption
- Compact design for panel mounting
- Aperture:  $15 \times 8 \text{ mm}$
- Factory calibrated
- Connection mating with JST:
  - housing PHR-5
  - contact SPH-00xT.
- **Dedicated parameter settings available on request (see page 11).**

### Special feature

- Single power supply  $+3.3 \text{ V}$ .

### Advantages

- Low offset drift
- Over-drivable  $V_{ref}$
- 8 mm creepage /clearance
- Fast response
- Low profile 2 mm pitch connector for 24 to 32 AWG wire.

### 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

- EN 50178: 1997
- IEC 61010-1: 2010
- IEC 61326-1: 2012
- UL 508: 2010.

### Application Domain

- Industrial.

## Absolute maximum ratings

Parameter	Symbol	Unit	Value
Supply voltage (not destructive)	$U_C$	V	8
Supply voltage (not entering non standard modes)	$U_C$	V	6.5
Primary conductor temperature	$T_B$	°C	120
ESD rating, Human Body Model (HBM)	$U_{ESD}$	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

- CSA C22.2 NO. 14-10 INDUSTRIAL CONTROL EQUIPMENT - Edition 11 - Revision Date 2011/08/01
- UL 508 STANDARD FOR INDUSTRIAL CONTROL EQUIPMENT - Edition 17 - Revision Date 2010/04/15

### 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	$V_{out}$	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.
- 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 $\mu$ s	$\hat{U}_W$	kV	8	
Partial discharge extinction rms voltage @ 10 pC	$U_e$	V	> 1200	Busbar / Secondary
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	-	-	600 V CAT III PD2	Reinforced insulation, non uniform field according to EN 50178, EN 61010
Application example	-	-	1000 V CAT III PD2	Based insulation, non uniform field according to EN 50178, EN 61010
Application example	-	-	600 V CAT III PD2	Simple insulation, non uniform field according to UL 508

## Environmental and mechanical characteristics

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Ambient operating temperature	$T_A$	°C	-40		105	
Ambient storage temperature	$T_s$	°C	-40		105	
Mass	$m$	g		32		

**Electrical data HO 50-S/SP33-1106**

At  $T_A = 25\text{ °C}$ ,  $U_C = +3.3\text{ V}$ ,  $R_L = 10\text{ k}\Omega$  unless otherwise noted (see Min, Max, typ. definition paragraph in page 12).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal rms current	$I_{PN}$	A		50		
Primary current, measuring range	$I_{PM}$	A	-125		125	
Number of primary turns	$N_P$	-		1		See application information
Supply voltage	$U_C$	V	3.14	3.3	3.46	
Current consumption	$I_C$	mA		19	25	
Reference voltage (output)	$V_{ref}$	V	1.63	1.65	1.67	Internal reference
Reference voltage (input)	$V_{ref}$	V	0.5		1.7	External reference
Output voltage range @ $I_{PM}$	$V_{out} - V_{ref}$	V	-1.15		1.15	Over operating temperature range
$V_{ref}$ output resistance	$R_{ref}$	$\Omega$	130	200	300	Series
$V_{out}$ output resistance	$R_{out}$	$\Omega$		2	5	Series
Allowed capacitive load	$C_L$	nF	0		6	
OCD output: On resistance	$R_{on}$	$\Omega$	70	95	150	Open drain, active low Over operating temperature range
OCD output: Hold time	$t_{hold}$	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	$V_{out}$	mV	0		50	$V_{out}$ forced to GND when EEPROM in an error state <sup>1)</sup>
Electrical offset voltage @ $I_P = 0\text{ A}$	$V_{OE}$	mV	-5		5	$V_{out} - V_{ref}$ @ $V_{ref} = 1.65\text{ V}$
Electrical offset current Referred to primary	$I_{OE}$	A	-0.5435		0.5435	
Temperature coefficient of $V_{ref}$	$TCV_{ref}$	ppm/K	-170		170	-40 °C ... 105 °C
Temperature coefficient of $V_{OE}$	$TCV_{OE}$	mV/K	-0.075		0.075	-40 °C ... 105 °C
Offset drift referred to primary @ $I_P = 0\text{ A}$	$TCI_{OE}$	mA/K	-8.15		8.15	-40 °C ... 105 °C
Theoretical sensitivity	$G_{th}$	mV/A		9.2		460 mV @ $I_{PN}$
Sensitivity error @ $I_{PN}$	$\varepsilon$	%	-0.5		0.5	Factory adjustment (straight bus-bar)
Temperature coefficient of G	$TCG$	ppm/K	-350		350	-40 °C ... 105 °C
Linearity error 0 ... $I_{PN}$	$\varepsilon_L$	% of $I_{PN}$	-0.75		0.75	
Linearity error 0 ... $I_{PM}$	$\varepsilon_L$	% of $I_{PM}$	-0.5		0.5	
Magnetic offset current (@ $10 \times I_{PN}$ ) referred to primary	$I_{OM}$	A	-0.92		0.92	One turn
Reaction time @ 10 % of $I_{PN}$	$t_{ra}$	$\mu\text{s}$			2.5	@ 50 A/ $\mu\text{s}$
Response time @ 90 % of $I_{PN}$	$t_r$	$\mu\text{s}$			3.5	@ 50 A/ $\mu\text{s}$
Frequency bandwidth (-3 dB)	$BW$	kHz		100		Small signals
Output rms voltage noise (spectral density) (100 Hz ... 100 kHz)	$e_{no}$	$\mu\text{V}/\sqrt{\text{Hz}}$			8.8	
Output voltage noise (DC ... 10 kHz) (DC ... 100 kHz) (DC ... 1 MHz)	$V_{no}$	mVpp		4.1 8.1 18.5		
Over-current detect		A	$2.63 \times I_{PN}$	$2.92 \times I_{PN}$	$3.21 \times I_{PN}$	Peak value $\pm 10\%$
Accuracy @ $I_{PN}$	X	% of $I_{PN}$	-1.25		1.25	
Accuracy @ $I_{PN}$ @ $T_A = +105\text{ °C}$	X	% of $I_{PN}$	-5.35		5.35	See formula note <sup>2)</sup>
Accuracy @ $I_{PN}$ @ $T_A = +85\text{ °C}$	X	% of $I_{PN}$	-4.33		4.33	See formula note <sup>2)</sup>

Notes: <sup>1)</sup> EEPROM in an error state makes the transducer behave like a reverse current saturation. Use of the OCD may help to differentiate the two cases.

$$^2) \text{ Accuracy @ } X_{TA} (\% \text{ of } I_{PN}) = X + \left( \frac{TCG}{10000} \times (T_A - 25) + \frac{TCI_{OE}}{1000 \times I_P} \times 100 \times (T_A - 25) \right).$$

# Electrical data HO 100-S/SP33-1106

At  $T_A = 25\text{ }^{\circ}\text{C}$ ,  $U_C = +3.3\text{ V}$ ,  $R_L = 10\text{ k}\Omega$  unless otherwise noted (see Min, Max, typ. definition paragraph in page 12).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal rms current	$I_{PN}$	A		100		
Primary current, measuring range	$I_{PM}$	A	-250		250	
Number of primary turns	$N_P$	-		1		See application information
Supply voltage	$U_C$	V	3.14	3.3	3.46	
Current consumption	$I_C$	mA		19	25	
Reference voltage (output)	$V_{ref}$	V	1.63	1.65	1.67	Internal reference
Reference voltage (input)	$V_{ref}$	V	0.5		1.7	External reference
Output voltage range @ $I_{PM}$	$V_{out} - V_{ref}$	V	-1.15		1.15	Over operating temperature range
$V_{ref}$ output resistance	$R_{ref}$	$\Omega$	130	200	300	Series
$V_{out}$ output resistance	$R_{out}$	$\Omega$		2	5	Series
Allowed capacitive load	$C_L$	nF	0		6	
OCD output: On resistance	$R_{on}$	$\Omega$	70	95	150	Open drain, active low Over operating temperature range
OCD output: Hold time	$t_{hold}$	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	$V_{out}$	mV	0		50	$V_{out}$ forced to GND when EEPROM in an error state <sup>1)</sup>
Electrical offset voltage @ $I_P = 0\text{ A}$	$V_{OE}$	mV	-5		5	$V_{out} - V_{ref}$ @ $V_{ref} = 1.65\text{ V}$
Electrical offset current Referred to primary	$I_{OE}$	A	-1.0870		1.0870	
Temperature coefficient of $V_{ref}$	$TCV_{ref}$	ppm/K	-170		170	-40 °C ... 105 °C
Temperature coefficient of $V_{OE}$	$TCV_{OE}$	mV/K	-0.075		0.075	-40 °C ... 105 °C
Offset drift referred to primary @ $I_P = 0\text{ A}$	$TCI_{OE}$	mA/K	-16.30		16.30	-40 °C ... 105 °C
Theoretical sensitivity	$G_{th}$	mV/A		4.6		460 mV @ $I_{PN}$
Sensitivity error @ $I_{PN}$	$\varepsilon$	%	-0.5		0.5	Factory adjustment (straight bus bar)
Temperature coefficient of $G$	$TCG$	ppm/K	-350		350	-40 °C ... 105 °C
Linearity error 0 ... $I_{PN}$	$\varepsilon_L$	% of $I_{PN}$	-0.5		0.5	
Linearity error 0 ... $I_{PM}$	$\varepsilon_L$	% of $I_{PM}$	-0.5		0.5	
Magnetic offset current (@ $10 \times I_{PN}$ ) referred to primary	$I_{OM}$	A	-0.92		0.92	One turn
Reaction time @ 10 % of $I_{PN}$	$t_{ra}$	$\mu\text{s}$			2.5	@ 50 A/ $\mu\text{s}$
Response time @ 90 % of $I_{PN}$	$t_r$	$\mu\text{s}$			3.5	@ 50 A/ $\mu\text{s}$
Frequency bandwidth (-3 dB)	$BW$	kHz		100		Small signals
Output rms voltage noise (spectral density) (100 Hz ... 100 kHz)	$e_{no}$	$\mu\text{V}/\sqrt{\text{Hz}}$			4.0	
Output voltage noise (DC ... 10 kHz) (DC ... 100 kHz) (DC ... 1 MHz)	$V_{no}$	mVpp		2.9 5.7 11.5		
Over-current detect		A	$2.63 \times I_{PN}$	$2.92 \times I_{PN}$	$3.21 \times I_{PN}$	Peak value $\pm 10\%$
Accuracy @ $I_{PN}$	$X$	% of $I_{PN}$	-1		1	
Accuracy @ $I_{PN}$ @ $T_A = +105\text{ }^{\circ}\text{C}$	$X$	% of $I_{PN}$	-5.10		5.10	See formula note <sup>2)</sup>
Accuracy @ $I_{PN}$ @ $T_A = +85\text{ }^{\circ}\text{C}$	$X$	% of $I_{PN}$	-4.08		4.08	See formula note <sup>2)</sup>

Notes: <sup>1)</sup> EEPROM in an error state makes the transducer behave like a reverse current saturation. Use of the OCD may help to differentiate the two cases.

$$^2) \text{ Accuracy @ } X_{TA} (\% \text{ of } I_{PN}) = X + \left( \frac{TCG}{10000} \times (T_A - 25) + \frac{TCI_{OE}}{1000 \times I_P} \times 100 \times (T_A - 25) \right).$$

### Electrical data HO 150-S/SP33-1106

At  $T_A = 25^\circ\text{C}$ ,  $U_C = +3.3\text{ V}$ ,  $R_L = 10\text{ k}\Omega$  unless otherwise noted (see Min, Max, typ. definition paragraph in page 12).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal rms current	$I_{PN}$	A		150		
Primary current, measuring range	$I_{PM}$	A	-375		375	
Number of primary turns	$N_P$	-		1		See application information
Supply voltage	$U_C$	V	3.14	3.3	3.46	
Current consumption	$I_C$	mA		19	25	
Reference voltage (output)	$V_{ref}$	V	1.63	1.65	1.67	Internal reference
Reference voltage (input)	$V_{ref}$	V	0.5		1.7	External reference
Output voltage range @ $I_{PM}$	$V_{out} - V_{ref}$	V	-1.15		1.15	Over operating temperature range
$V_{ref}$ output resistance	$R_{ref}$	$\Omega$	130	200	300	Series
$V_{out}$ output resistance	$R_{out}$	$\Omega$		2	5	Series
Allowed capacitive load	$C_L$	nF	0		6	
OCD output: On resistance	$R_{on}$	$\Omega$	70	95	150	Open drain, active low Over operating temperature range
OCD output: Hold time	$t_{hold}$	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	$V_{out}$	mV	0		50	$V_{out}$ forced to GND when EEPROM in an error state <sup>1)</sup>
Electrical offset voltage @ $I_P = 0\text{ A}$	$V_{OE}$	mV	-5		5	$V_{out} - V_{ref}$ @ $V_{ref} = 1.65\text{ V}$
Electrical offset current Referred to primary	$I_{OE}$	A	-1.6304		1.6304	
Temperature coefficient of $V_{ref}$	$TCV_{ref}$	ppm/K	-170		170	-40 °C ... 105 °C
Temperature coefficient of $V_{OE}$	$TCV_{OE}$	mV/K	-0.075		0.075	-40 °C ... 105 °C
Offset drift referred to primary @ $I_P = 0\text{ A}$	$TCI_{OE}$	mA/K	-24.46		24.46	-40 °C ... 105 °C
Theoretical sensitivity	$G_{th}$	mV/A		3.067		460 mV @ $I_{PN}$
Sensitivity error @ $I_{PN}$	$\varepsilon$	%	-0.5		0.5	Factory adjustment (straight bus-bar)
Temperature coefficient of $G$	$TCG$	ppm/K	-350		350	-40 °C ... 105 °C
Linearity error 0 ... $I_{PN}$	$\varepsilon_L$	% of $I_{PN}$	-0.5		0.5	
Linearity error 0 ... $I_{PM}$	$\varepsilon_L$	% of $I_{PM}$	-0.5		0.5	
Magnetic offset current (@ $10 \times I_{PN}$ ) referred to primary	$I_{OM}$	A	-0.92		0.92	One turn
Reaction time @ 10 % of $I_{PN}$	$t_{ra}$	$\mu\text{s}$			2.5	@ 50 A/ $\mu\text{s}$
Response time @ 90 % of $I_{PN}$	$t_r$	$\mu\text{s}$			3.5	@ 50 A/ $\mu\text{s}$
Frequency bandwidth (-3 dB)	$BW$	kHz		100		Small signals
Output rms voltage noise (spectral density) (100 Hz ... 100 kHz)	$e_{no}$	$\mu\text{V}/\sqrt{\text{Hz}}$			3.3	
Output voltage noise (DC ... 10 kHz) (DC ... 100 kHz) (DC ... 1 MHz)	$V_{no}$	mVpp		2.8 5 8.9		
Over-current detect		A	$2.63 \times I_{PN}$	$2.92 \times I_{PN}$	$3.21 \times I_{PN}$	Peak value $\pm 10\%$
Accuracy @ $I_{PN}$	$X$	% of $I_{PN}$	-1		1	
Accuracy @ $I_{PN}$ @ $T_A = +105^\circ\text{C}$	$X$	% of $I_{PN}$	-5.10		5.10	See formula note <sup>2)</sup>
Accuracy @ $I_{PN}$ @ $T_A = +85^\circ\text{C}$	$X$	% of $I_{PN}$	-4.08		4.08	See formula note <sup>2)</sup>

Notes: <sup>1)</sup> EEPROM in an error state makes the transducer behave like a reverse current saturation. Use of the OCD may help to differentiate the two cases

$$^2) \text{ Accuracy @ } X_{TA} (\% \text{ of } I_{PN}) = X + \left( \frac{TCG}{10000} \times (T_A - 25) + \frac{TCI_{OE}}{1000 \times I_P} \times 100 \times (T_A - 25) \right).$$

# Electrical data HO 200-S/SP33-1106

At  $T_A = 25\text{ °C}$ ,  $U_C = +3.3\text{ V}$ ,  $R_L = 10\text{ k}\Omega$  unless otherwise noted (see Min, Max, typ. definition paragraph in page 12).

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal rms current	$I_{PN}$	A		200		
Primary current, measuring range	$I_{PM}$	A	-500		500	
Number of primary turns	$N_P$	-		1		See application information
Supply voltage	$U_C$	V	3.14	3.3	3.46	
Current consumption	$I_C$	mA		19	25	
Reference voltage (output)	$V_{ref}$	V	1.63	1.65	1.67	Internal reference
Reference voltage (input)	$V_{ref}$	V	0.5		1.7	External reference
Output voltage range @ $I_{PM}$	$V_{out} - V_{ref}$	V	-1.15		1.15	Over operating temperature range
$V_{ref}$ output resistance	$R_{ref}$	$\Omega$	130	200	300	Series
$V_{out}$ output resistance	$R_{out}$	$\Omega$		2	5	Series
Allowed capacitive load	$C_L$	nF	0		6	
OCD output: On resistance	$R_{on}$	$\Omega$	70	95	150	Open drain, active low Over operating temperature range
OCD output: Hold time	$t_{hold}$	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	$V_{out}$	mV	0		50	$V_{out}$ forced to GND when EEPROM in an error state <sup>1)</sup>
Electrical offset voltage @ $I_P = 0\text{ A}$	$V_{OE}$	mV	-5		5	$V_{out} - V_{ref}$ @ $V_{ref} = 1.65\text{ V}$
Electrical offset current Referred to primary	$I_{OE}$	A	-2.1739		2.1739	
Temperature coefficient of $V_{ref}$	$TCV_{ref}$	ppm/K	-170		170	-40 °C ... 105 °C
Temperature coefficient of $V_{OE}$	$TCV_{OE}$	mV/K	-0.075		0.075	-40 °C ... 105 °C
Offset drift referred to primary @ $I_P = 0\text{ A}$	$TCI_{OE}$	mA/K	-32.61		32.61	-40 °C ... 105 °C
Theoretical sensitivity	$G_{th}$	mV/A		2.3		460 mV @ $I_{PN}$
Sensitivity error @ $I_{PN}$	$\varepsilon$	%	-0.5		0.5	Factory adjustment (straight bus-bar)
Temperature coefficient of G	$TCG$	ppm/K	-350		350	-40 °C ... 105 °C
Linearity error 0 ... $I_{PN}$	$\varepsilon_L$	% of $I_{PN}$	-0.5		0.5	
Linearity error 0 ... $I_{PM}$	$\varepsilon_L$	% of $I_{PM}$	-0.5		0.5	
Magnetic offset current (@ $10 \times I_{PN}$ ) referred to primary	$I_{OM}$	A	-0.92		0.92	One turn
Reaction time @ 10 % of $I_{PN}$	$t_{ra}$	$\mu\text{s}$			2.5	@ 50 A/ $\mu\text{s}$
Response time @ 90 % of $I_{PN}$	$t_r$	$\mu\text{s}$			3.5	@ 50 A/ $\mu\text{s}$
Frequency bandwidth (-3 dB)	$BW$	kHz		100		Small signals
Output rms voltage noise (spectral density) (100 Hz ... 100 kHz)	$e_{no}$	$\mu\text{V}/\sqrt{\text{Hz}}$			3.1	
Output voltage noise (DC ... 10 kHz) (DC ... 100 kHz) (DC ... 1 MHz)	$V_{no}$	mVpp		2.7 4.8 8.5		
Over-current detect		A	$2.63 \times I_{PN}$	$2.92 \times I_{PN}$	$3.21 \times I_{PN}$	Peak value $\pm 10\%$
Accuracy @ $I_{PN}$	X	% of $I_{PN}$	-1		1	
Accuracy @ $I_{PN}$ @ $T_A = +105\text{ °C}$	X	% of $I_{PN}$	-5.10		5.10	See formula note <sup>2)</sup>
Accuracy @ $I_{PN}$ @ $T_A = +85\text{ °C}$	X	% of $I_{PN}$	-4.08		4.08	See formula note <sup>2)</sup>

Notes: <sup>1)</sup> EEPROM in an error state makes the transducer behave like a reverse current saturation. Use of the OCD may help to differentiate the two cases

$$^2) \text{ Accuracy @ } X_{TA} (\% \text{ of } I_{PN}) = X + \left( \frac{TCG}{10000} \times (T_A - 25) + \frac{TCI_{OE}}{1000 \times I_P} \times 100 \times (T_A - 25) \right).$$

# Electrical data HO 250-S/SP33-1106

At  $T_A = 25\text{ }^{\circ}\text{C}$ ,  $U_C = +3.3\text{ V}$ ,  $R_L = 10\text{ k}\Omega$  unless otherwise noted (see Min, Max, typ. definition paragraph in page 12).

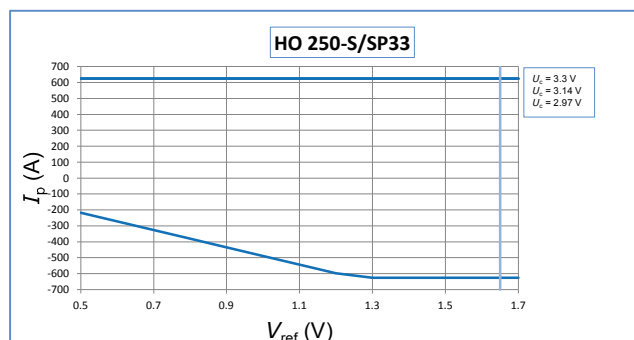
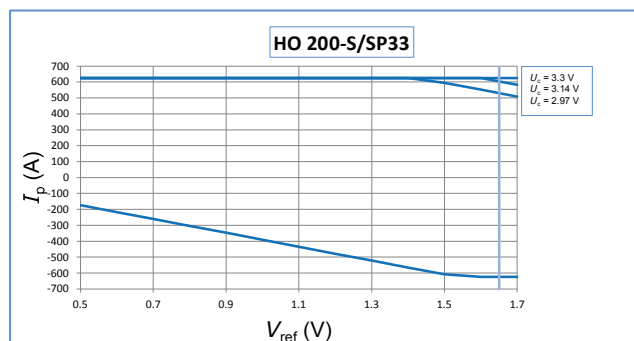
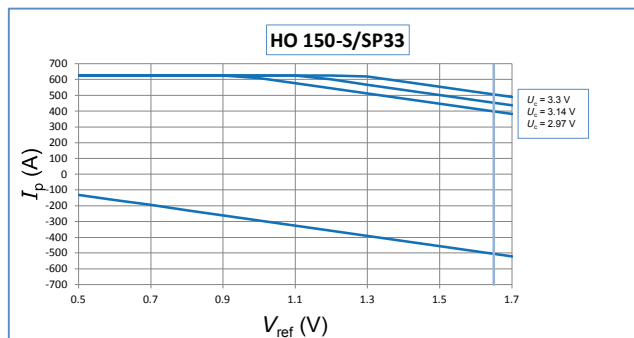
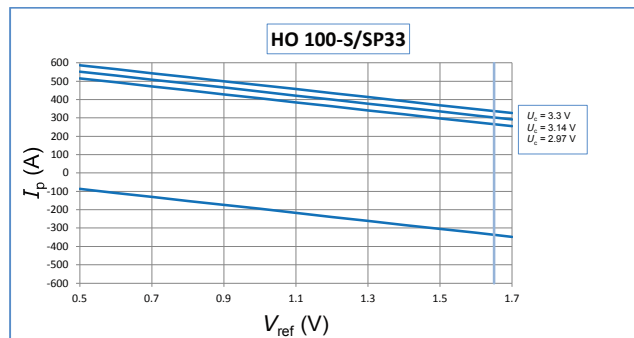
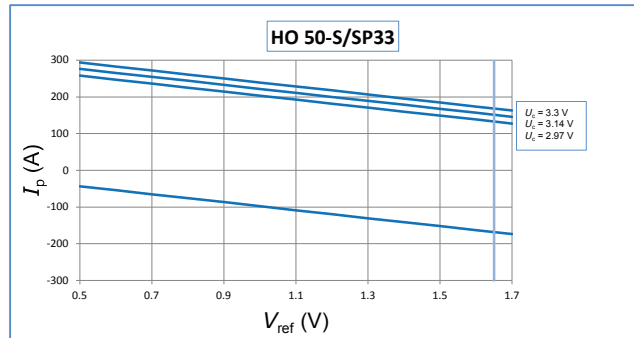
Parameter	Symbol	Unit	Min	Typ	Max	Comment
Primary nominal rms current	$I_{PN}$	A		250		
Primary current, measuring range	$I_{PM}$	A	-625		625	
Number of primary turns	$N_P$	-		1		See application information
Supply voltage	$U_C$	V	3.14	3.3	3.46	
Current consumption	$I_C$	mA		19	25	
Reference voltage (output)	$V_{ref}$	V	1.63	1.65	1.67	Internal reference
Reference voltage (input)	$V_{ref}$	V	0.5		1.7	External reference
Output voltage range @ $I_{PM}$	$V_{out} - V_{ref}$	V	-1.15		1.15	Over operating temperature range
$V_{ref}$ output resistance	$R_{ref}$	$\Omega$	130	200	300	Series
$V_{out}$ output resistance	$R_{out}$	$\Omega$		2	5	Series
Allowed capacitive load	$C_L$	nF	0		6	
OCD output: On resistance	$R_{on}$	$\Omega$	70	95	150	Open drain, active low Over operating temperature range
OCD output: Hold time	$t_{hold}$	ms	0.7	1	1.4	Additional time after threshold has released
EEPROM control	$V_{out}$	mV	0		50	$V_{out}$ forced to GND when EEPROM in an error state <sup>1)</sup>
Electrical offset voltage @ $I_P = 0\text{ A}$	$V_{OE}$	mV	-5		5	$V_{out} - V_{ref}$ @ $V_{ref} = 1.65\text{ V}$
Electrical offset current Referred to primary	$I_{OE}$	A	-2.7174		2.7174	
Temperature coefficient of $V_{ref}$	$TCV_{ref}$	ppm/K	-170		170	-40 $^{\circ}\text{C}$ ... 105 $^{\circ}\text{C}$
Temperature coefficient of $V_{OE}$	$TCV_{OE}$	mV/K	-0.075		0.075	-40 $^{\circ}\text{C}$ ... 105 $^{\circ}\text{C}$
Offset drift referred to primary @ $I_P = 0\text{ A}$	$TCI_{OE}$	mA/K	-40.76		40.76	-40 $^{\circ}\text{C}$ ... 105 $^{\circ}\text{C}$
Theoretical sensitivity	$G_{th}$	mV/A		1.84		460 mV @ $I_{PN}$
Sensitivity error @ $I_{PN}$	$\varepsilon$	%	-0.5		0.5	Factory adjustment (straight bus-bar)
Temperature coefficient of G	$TCG$	ppm/K	-350		350	-40 $^{\circ}\text{C}$ ... 105 $^{\circ}\text{C}$
Linearity error 0 ... $I_{PN}$	$\varepsilon_L$	% of $I_{PN}$	-0.5		0.5	
Linearity error 0 ... $I_{PM}$	$\varepsilon_L$	% of $I_{PM}$	-0.5		0.5	
Magnetic offset current (@ $10 \times I_{PN}$ ) referred to primary	$I_{OM}$	A	-0.92		0.92	One turn
Reaction time @ 10 % of $I_{PN}$	$t_{ra}$	$\mu\text{s}$			2.5	@ 50 A/ $\mu\text{s}$
Response time @ 90 % of $I_{PN}$	$t_r$	$\mu\text{s}$			3.5	@ 50 A/ $\mu\text{s}$
Frequency bandwidth (-3 dB)	$BW$	kHz		100		Small signals
Output rms voltage noise (spectral density) (100 Hz ... 100 kHz)	$e_{no}$	$\mu\text{V}/\sqrt{\text{Hz}}$			2.9	
Output voltage noise (DC ... 10 kHz) (DC ... 100 kHz) (DC ... 1 MHz)	$V_{no}$	mVpp		2.6 4.7 8.2		
Over-current detect		A	$2.63 \times I_{PN}$	$2.92 \times I_{PN}$	$3.21 \times I_{PN}$	Peak value $\pm 10\%$
Accuracy @ $I_{PN}$	X	% of $I_{PN}$	-1		1	
Accuracy @ $I_{PN}$ @ $T_A = +105\text{ }^{\circ}\text{C}$	X	% of $I_{PN}$	-5.10		5.10	See formula note <sup>2)</sup>
Accuracy @ $I_{PN}$ @ $T_A = +85\text{ }^{\circ}\text{C}$	X	% of $I_{PN}$	-4.08		4.08	See formula note <sup>2)</sup>

**Notes:** <sup>1)</sup> EEPROM in an error state makes the transducer behave like a reverse current saturation. Use of the OCD may help to differentiate the two cases

$$^2) \text{ Accuracy @ } X_{TA} (\% \text{ of } I_{PN}) = X + \left( \frac{TCG}{10000} \times (T_A - 25) + \frac{TCI_{OE}}{1000 \times I_P} \times 100 \times (T_A - 25) \right).$$

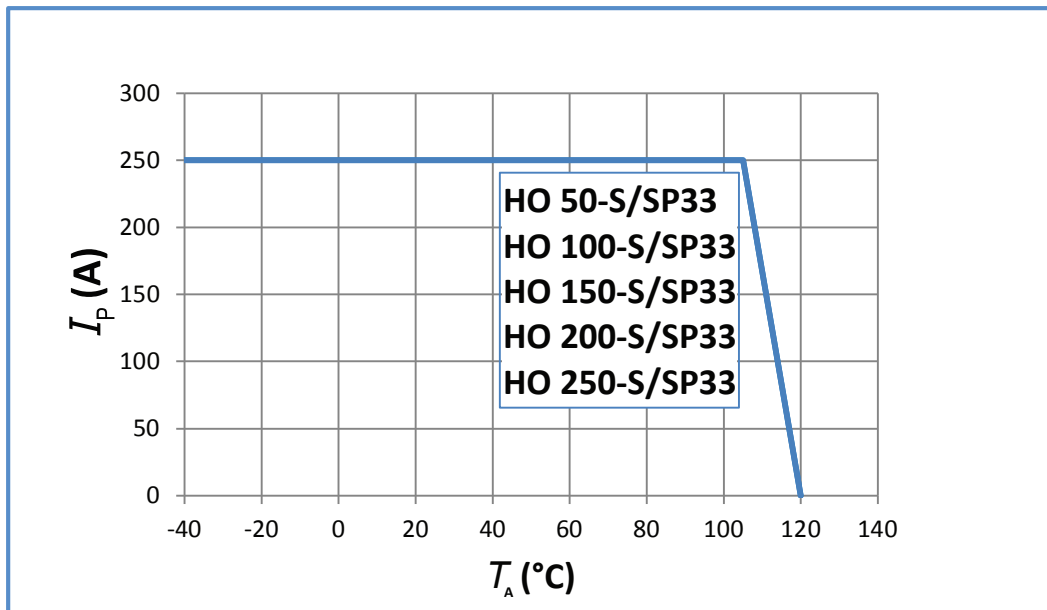


# HO-S/SP33 series, measuring range versus internal / external reference voltage



## Maximum continuous DC current

For all ranges:



Important notice: whatever the usage and/or application, the transducer primary bar temperature shall not go above the maximum rating of 120 °C as stated in page 2 of this datasheet.

## HO-S/SP33 series: name and codification

HO family products may be ordered **on request** <sup>1)</sup> with a dedicated setting of the parameters as described below (standards products are delivered with the setting 1106 according to the table).

### HO-S/SP33-xxxx

#### Internal reference <sup>2)</sup>

0	not used
1	1.65 V
2	1.5 V
3	0.5 V
4	External $V_{ref}$ only

#### Response time

0	4 $\mu$ s
1	3.5 $\mu$ s
2	6 $\mu$ s

#### EEPROM Control

0	YES
1	NO

#### Over current detection ( $\times I_{PN}$ ) <sup>3)</sup>

0	5.10	A	1.18
1	6.24	B	1.62
2	6.94	C	2.04
3	8.30	D	2.51
4	9.03	E	2.78
5	10.02	F	3.32
6	2.92	G	3.62
7	4.09	H	4.01

Standards products are:

- HO 50-S/SP33-1106
- HO 100-S/SP33-1106
- HO 150-S/SP33-1106
- HO 200-S/SP33-1106
- HO 250-S/SP33-1106

**Notes:** <sup>1)</sup> For dedicated settings, minimum quantities apply, please contact your local LEM support

<sup>2)</sup>  $V_{ref}$  electrical data

$V_{ref}$ parameter	$V_{ref}$ (V)			$TCV_{ref}$ (ppm/K)	
	min	typ	max	min	max
0	-	-	-	-	-
1	1.63	1.65	1.67	-170	170
2	1.48	1.5	1.52	-170	170
3	0.49	0.5	0.51	-250	250

<sup>3)</sup> OCD ( $\times I_{PN}$ ) correction table versus range and temperature  
All other values or empty cells: no change.

HO-S/SP33-110x			
OCD Parameter	$I_{PN}$ (A) all temperatures		
	150	200	250
0			6.90
1		8.11	-
2		-	-
3	10.69	-	-
4	-	-	-
5	-	-	-

Tolerance on OCD value	
$\pm 20$ %	
$\pm 10$ %	No change
-	Do not use

## Application information

- HOxx-S series is designed to use a bus-bar or a cable <sup>1)</sup> to carry the current through out the aperture with a maximum cross section of 8 × 15 mm
- Use of bare conductor is not recommended for panel mounting horizontal or vertical, insulation distance might not be respected between busbar and fixation screw head.

**Note:** <sup>1)</sup> The maximum magnetic offset referred to primary is inversely proportional to the number of turns, thus is divided by 2 with 2 turns.

## Insulation distance (nominal values):

	$d_{cp}$	$d_{cl}$
Between primary busbar and secondary pin	14.6 mm	-
Between primary busbar and core	-	11.34 mm
Between core and secondary terminal	-	1.18 mm

## 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 -3 sigma 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.

## Remark

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: [Products/Product Documentation](#)

## 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 (e.g. primary bus bar, power supply). Ignoring this warning can lead to injury and/or cause serious damage.

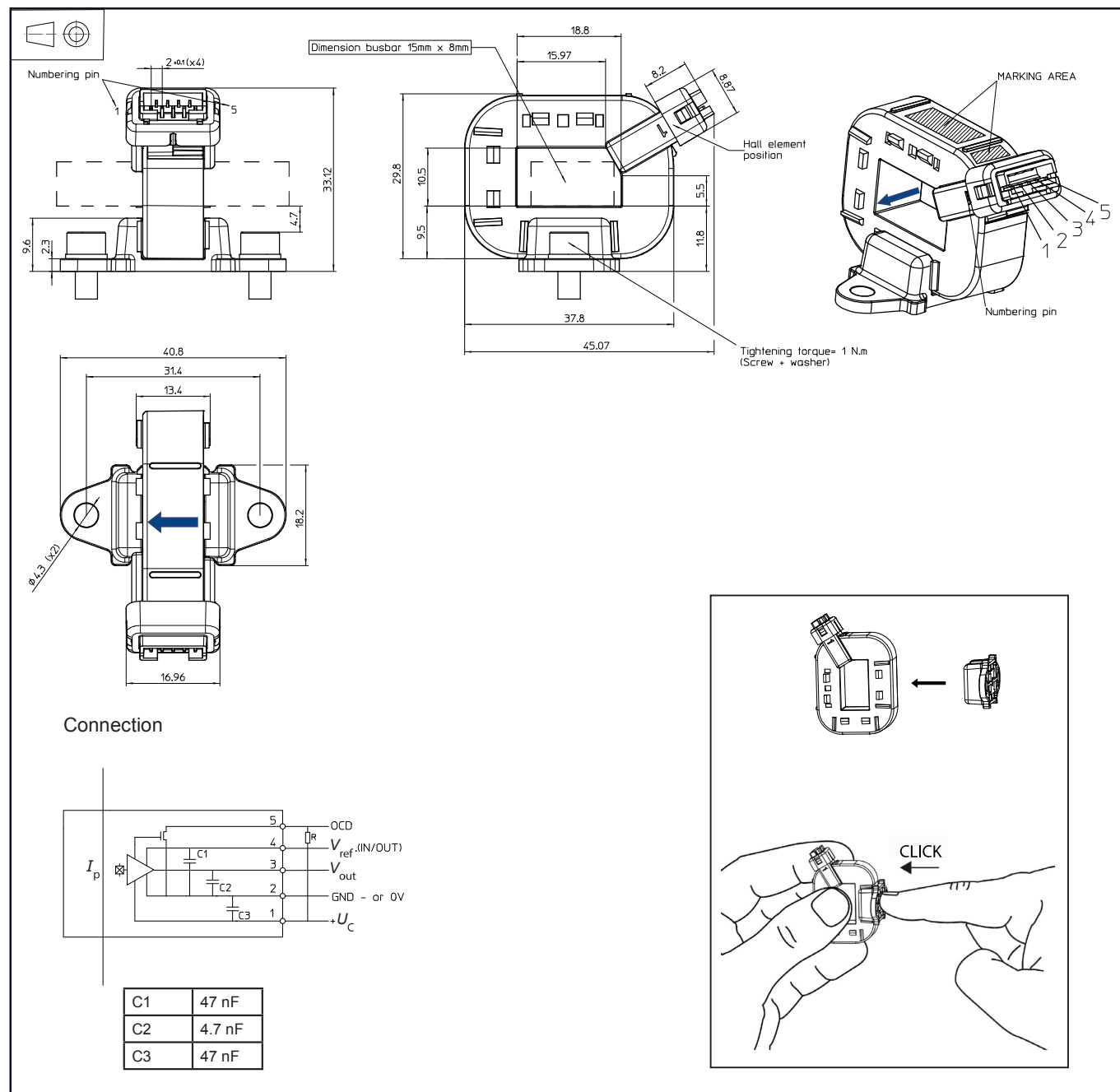
This transducer is a build-in device, whose conducting parts must be inaccessible after installation.

A protective housing or additional shield could be used.

Main supply must be able to be disconnected.

**Dimensions HO-S/SP33 series** (mm, general linear tolerance  $\pm 0.3$  mm)

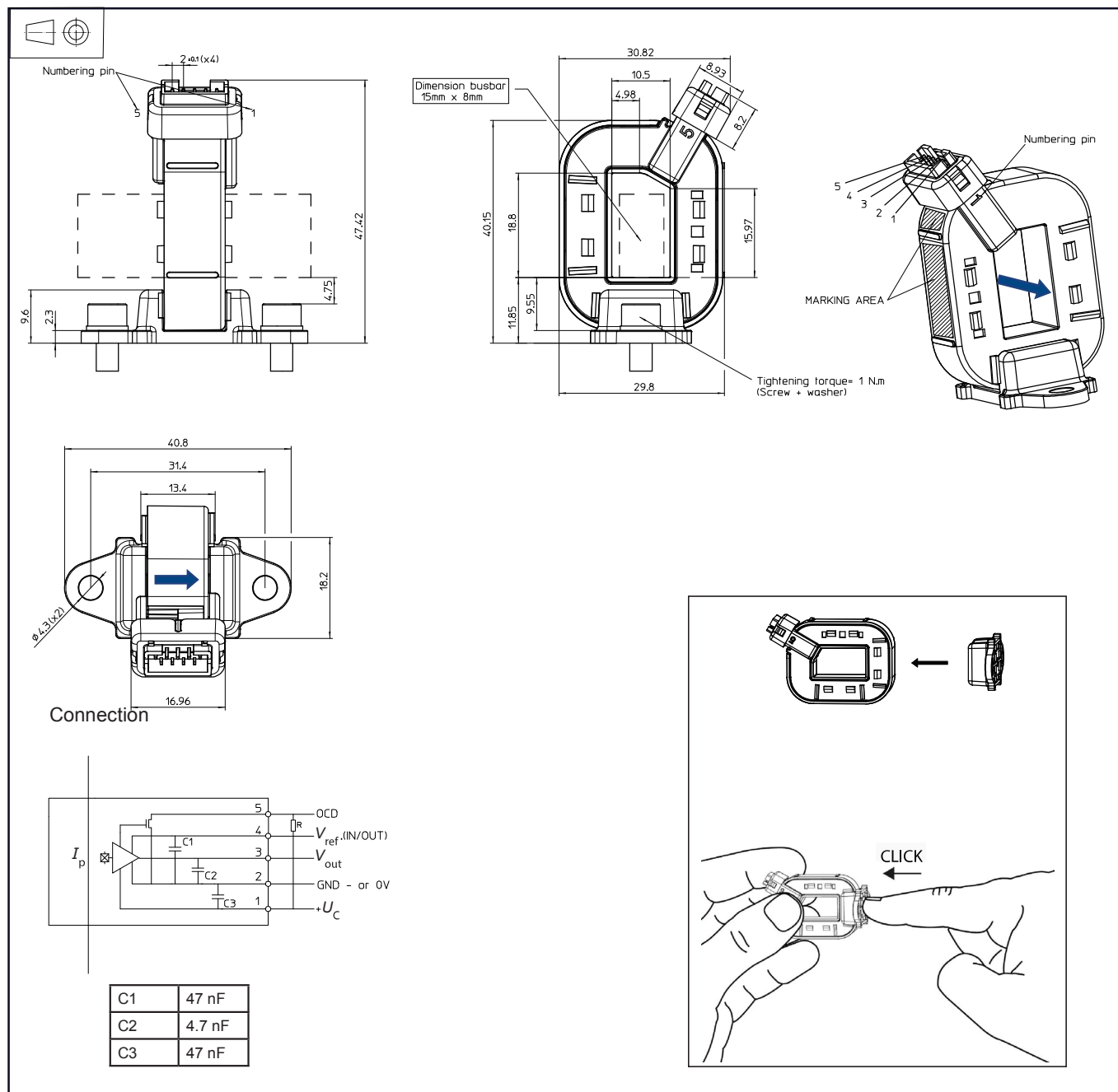
Mounting example: horizontal


**Remarks:**

- $V_{OUT}$  is positive with respect to  $V_{ref}$  when positive  $I_P$  flows in direction of the arrow shown on the drawing above.
- Connection system: equivalent to JST B5B-PH type.

### Dimensions HO-S/SP33 series (mm, general linear tolerance $\pm 0.3$ mm)

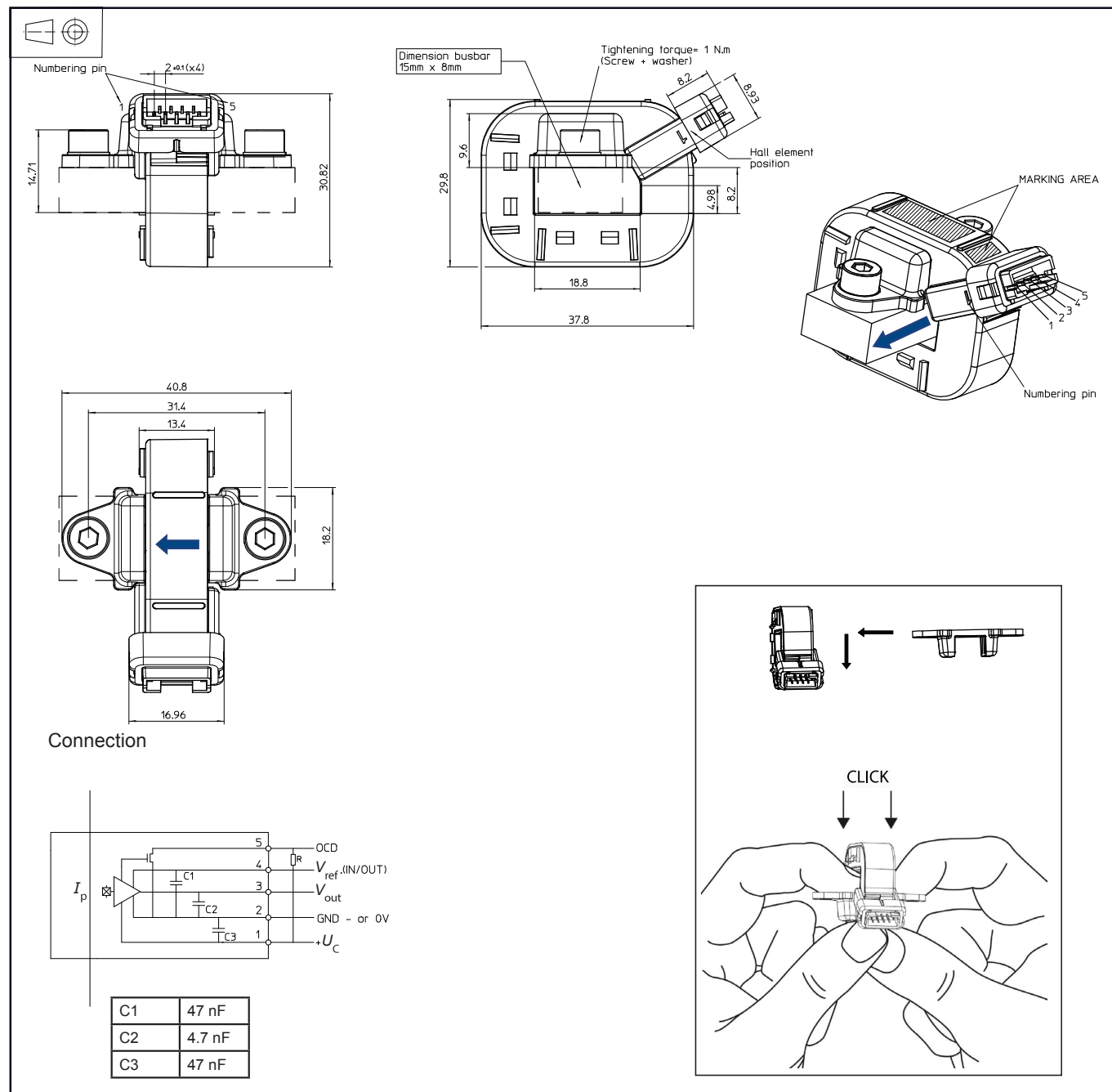
### Mounting example: vertical

**Remarks:**

- $V_{OUT}$  is positive with respect to  $V_{ref}$  when positive  $I_p$  flows in direction of the arrow shown on the drawing above.
- Connection system: equivalent to JST B5B-PH type.

**Dimensions HO-S/SP33 series** (mm, general linear tolerance  $\pm 0.3$  mm)

Mounting example: busbar


**Remarks:**

- $V_{OUT}$  is positive with respect to  $V_{ref}$  when positive  $I_P$  flows in direction of the arrow shown on the drawing above.
- Connection system: equivalent to JST B5B-PH type.