PQA 8000

Accessories MANUAL

V1.0

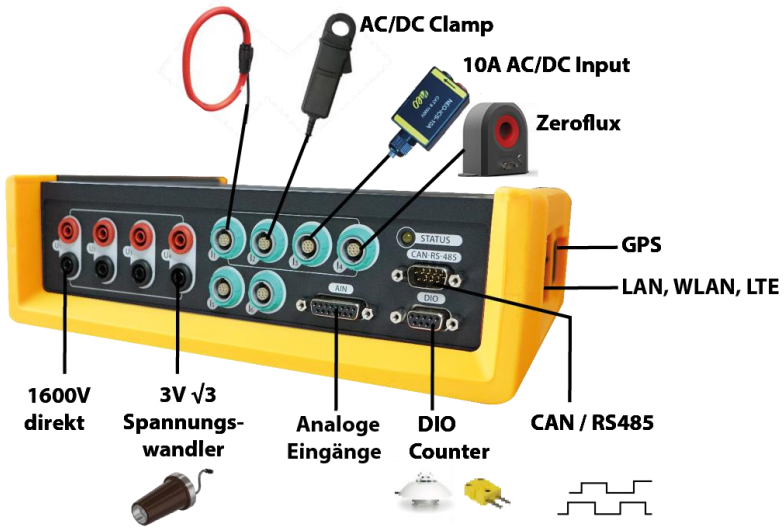

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Table of Contents

Thank you!

Thank you very much for your investment in our unique instrument. These are top-quality instruments which are designed to provide you years of reliable service. This guide has been prepared to help you get the most from your investment, starting from the day you take it out of the box, and extending for years into the future.

Support

When you are working with our products, we want to provide you with the greatest possible benefits. If you need any support, we are her to assist you.

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1 Introduction

Welcome to this manual, that provides a detailed exploration of essential electrical measurement tools: Iron Core Clamps, Rogowski Coils, Hall Sensors, and Zero-Flux Current Transformers. Within these pages, you will find not only technical specifications but also explanations of their operating principles and distinct characteristics.

In today's rapidly evolving technological landscape, a solid understanding of these specialized instruments is crucial for accurate electrical measurements. This manual offers insights into each device's design, advantages, and applications. From the non-intrusive accuracy of Iron Core Clamps to the innovative methodology of Zero-Flux Current Transformers, you'll gain knowledge that will help you make informed decisions when utilizing these tools in various contexts.

Whether you're an engineering professional or an eager learner, this manual equips you with the necessary information to navigate the intricacies of Iron Core Clamps, Rogowski Coils, Hall Sensors, and Zero-Flux Current Transformers effectively.

2 AC Iron Clamps

2.1 Technology (short) description

This section describes the principles behind current sensor operation. You should choose a current sensor to suit the application in which you plan to use it, based on an understanding of the differences among the various methods of measuring currents, including the Hall element method, the Rogowski method, and the zero-flux method.

A common form of AC measurement is the transformer principle. The measured alternating current (AC) will induce a magnetic flux (Φ) in the magnetic core. As a reaction to this primary flux a secondary magnetic flux is induced in the secondary coil in an effort to cancel it out. Through a shunt resistor on the secondary side this voltage difference will be the output. This voltage is proportional to the current flow on the primary side. The characteristics of AC current clamps are:

- Only AC currents
- Cheap
- Low Bandwidth (<20kHz)
- No power supply needed

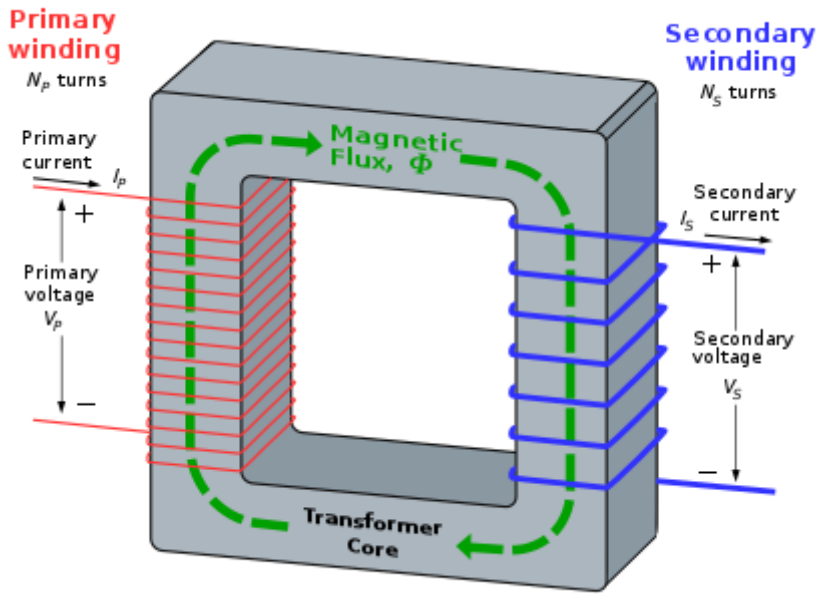

Figure 1: Working principle of Transformers

2.2 Detailed specifications

All AC current clamps will be delivered with calibration certificate as well as with our connector.

Other cable lengths on request.

	CLAMP-5AC	CLAMP-20AC	CLAMP-200AC	CLAMP-1000AC
Type	**Iron Core**	**Iron Core**	**Iron Core**	**Iron Core**
Range	5 A AC rms	20 A AC rms	200 A AC rms	1000 A AC rms
Bandwidth	20 Hz to 20 kHz [-3dB]	40 Hz to 20 kHz[1)] [-3dB]	40 Hz to 10 kHz [-3dB]	30 Hz to 10 kHz [-3dB]
Accuracy [+25° C]	**10 mA - 0,1 A** ± 3 % of reading + 60µV **0,1 A - 0,4 A** ± 1,5 % of reading **0,4 A - 6 A** ± 1 % of reading	**100 mA - 0,5 A** ± 2 % of reading **0,5 A - 1 A** ± 1 % of reading **1 A - 20 A** ± 1 % of reading	**0,5 A - 10 A** ≤ 3,5 % of reading + 5 mV **10 A - 40 A** ≤ 2,5 % of reading + 5 mV **40 A - 100 A** ≤ 2 % of reading + 5 mV **100 A - 240 A** ≤ 1 % of reading + 5 mV	**1 mA - 100 mA** ≤ 3 % of reading + 5 µV **0,1 A - 1 A** ≤ 2 % of reading + 3 µV **1 A - 10 A** ≤ 1 % of reading **10 A - 10 A** ≤ 0,5 % of reading **100 A - 1200 A** ≤ 0,3 % of reading
Phase Error [50Hz]	**10 mA - 0,1 A** not specified **0,1 A - 0,4 A** ± 1,5 ° **0,4 A - 6 A** ± 1 °	**100 mA - 0,5 A** not specified **0,5 A - 1 A** ± 2 ° **1 A - 20 A** ± 2 °	**0,5 A - 10 A** not specified **10 A - 40 A** ≤ 5 ° **40 A - 100 A** ≤ 3 ° **100 A - 240 A** ≤ 2,5 °	**< 1 A** not specified **1 A - 10 A** ≤ 2 ° **10 A - 10 A** ≤ 1 ° **100 A - 1200 A** ≤ 0,7 °
Sensitivity [mV/A]	60	10	10	1
Temperature Coefficient	± 0,015 % of reading per °C	± 0,015 % of reading per °C	± 0,015 % of reading per °C	± 0,02 % of reading per °C
GENERAL				
Dimension [mm]	135 x 51 x30	102 x 34 x 24	135 x 51 x30	216 x 111 x 45
Conductor Diameter [mm]	20	15	20	52
Cable length [m]	1,5	2	1,5	1,5
Weight [g]	180	190	180	550
Operating Temperature	-10 °C to +55 °C	-10 °C to +55 °C	-10 °C to +55 °C	-10 °C to +50 °C
Operating Humidity	15% to 85% (not condensing)			
Plug and measure (TEDS)	Yes			
STANDARDS / SAFETY				
Safety Standards	EN61010-1 / EN61010-2-032:2012			
Safety category	CAT III 600V / CAT IV 300V			
EMC Standards	EN61326-2-2			

[1)] Additional error of 1% at 20kHz

2.3 Dimensions and Pictures

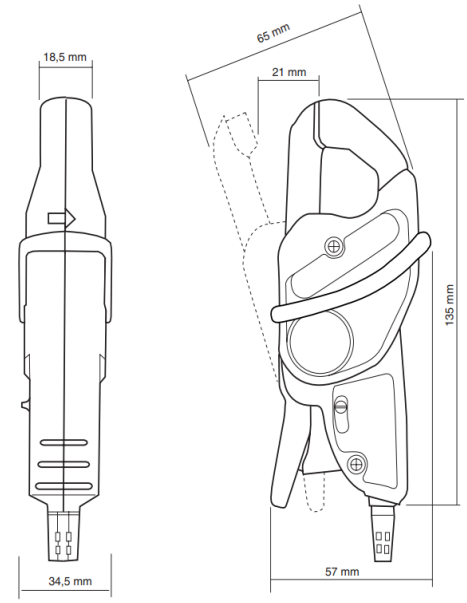

Figure 2: Dimensions (in mm) of CLAMP-5AC and CLAMP-200AC

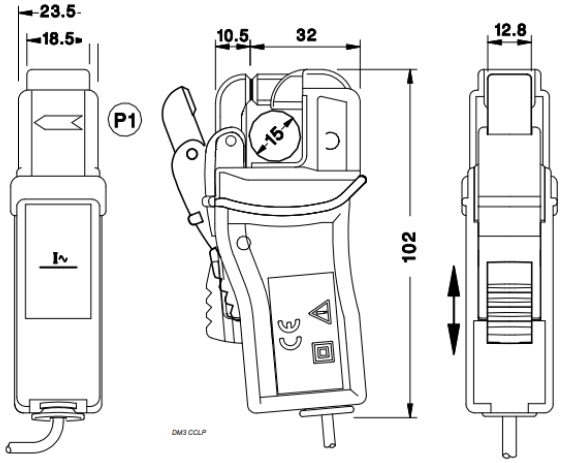

Figure 3: Dimension (in mm) of CLAMP-20AC

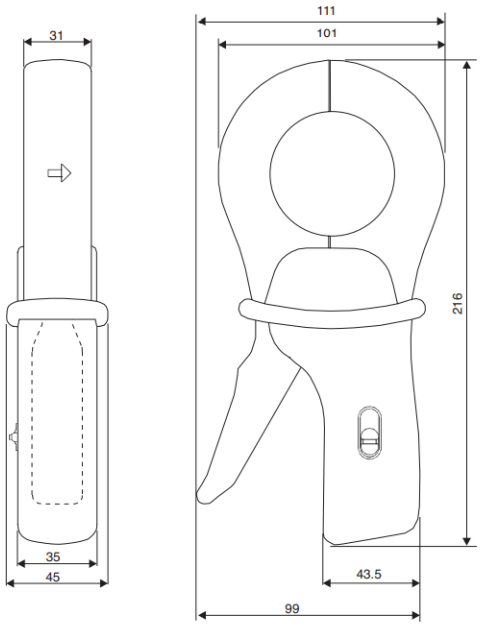

Figure 4: Dimension (in mm) of CLAMP-1000AC

3 AC Rogowski Coils

3.1 Technology (short) description

A Rogowski coil is an air-cored toroidal coil placed around the conductor. The alternating magnetic field produced by the current inside induces a voltage in the core. This induced voltage is then output as the time derivative (di/dt) of the measured current. Furthermore, the voltage in the core is proportional to the rate of change of current. To complete the transducer the voltage is integrated so that the output reproduces accurately the current waveform. The characteristics of Rogowski coils are:

- Useful for large currents (because of the air-core and therefore no magnetic saturation)
- Flexible
- Only AC currents can be measured
- Affordable
- High position error
- High susceptibility to noise

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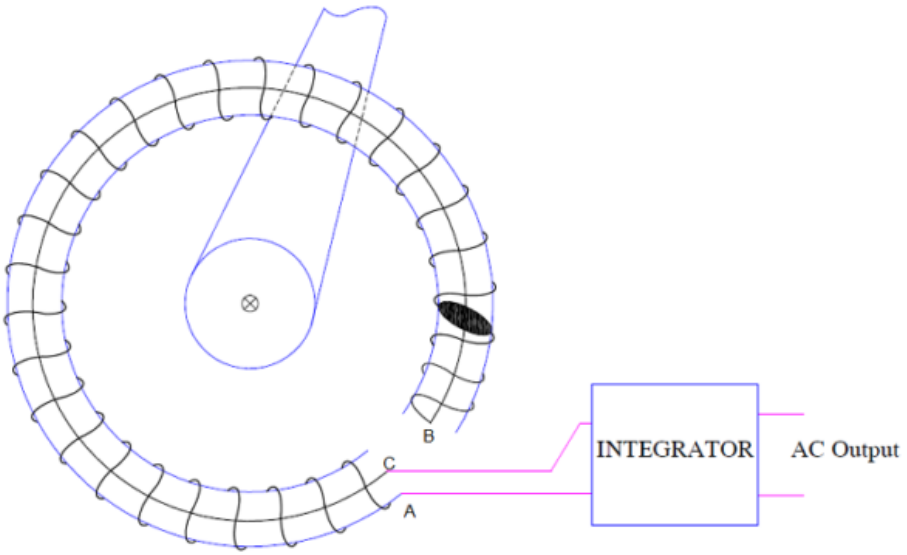

Figure 5: Working principle of a Rogowski Coil

3.2 Detailed specifications

	FLEX-MINI-300	FLEX-3000	FLEX-6000
Type	**Rogowski coil**	**Rogowski coil**	**Rogowski coil**
Range	30A / 300A / 3000A / 30kA	30A / 300A / 3000A / 30kA	30A / 300A / 3000A / 30kA
Bandwidth [-3dB]	PQA7000: up to 20 kHz PQA8000: up to 70 kHz PQA8000H: up to 500 kHz	PQA7000: up to 20 kHz PQA8000: up to 70 kHz PQA8000H: up to 500 kHz	PQA7000: up to 20 kHz PQA8000: up to 70 kHz PQA8000H: up to 500 kHz
Accuracy [+25° C]	≤ 1 % of reading[1)]	≤ 1 % of reading[1)]	≤ 1 % of reading[1)]
Phase Error [50Hz]	≤ 1 °	≤ 1 °	≤ 1 °
Temperature Coefficient	≤ 0,1 % / 10 °C typ.	≤ 0,1 % / 10 °C typ.	≤ 0,1 % / 10 °C typ.
GENERAL			
Coil length [mm]	170	450	800
Conductor Diameter [mm]	45	125	250
Cable length [m]	3	3	3
Weight [g]	45	90	145
Operating Temperature	-20 °C to +60 °C	-20 °C to +60 °C	-20 °C to +60 °C
Operating Humidity	10% to 90% (not condensing)		
Plug and measure (TEDS)	Yes		
STANDARDS / SAFETY			
Safety Standards	EN61010-1 EN61010-2-032:2012		
Safety category	CAT III 1000V CAT IV 600V		
EMC Standards	EN61326-2-2		

[1)] with NEO calibration typ. ≤ 0,3 % of reading

3.3 Dimensions and Pictures

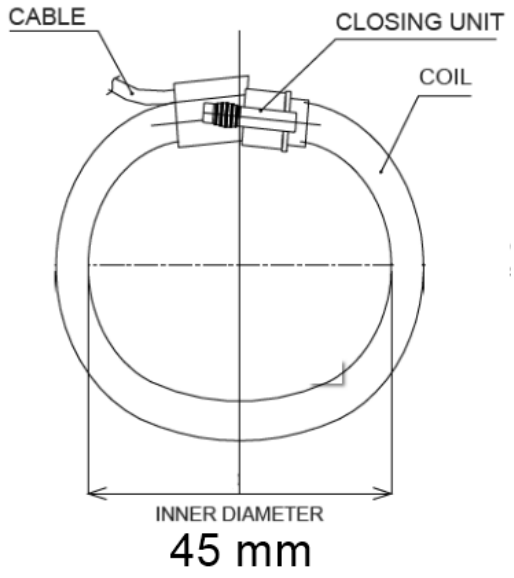

Figure 6: Dimensions (in mm) of FLEX-MINI-3000

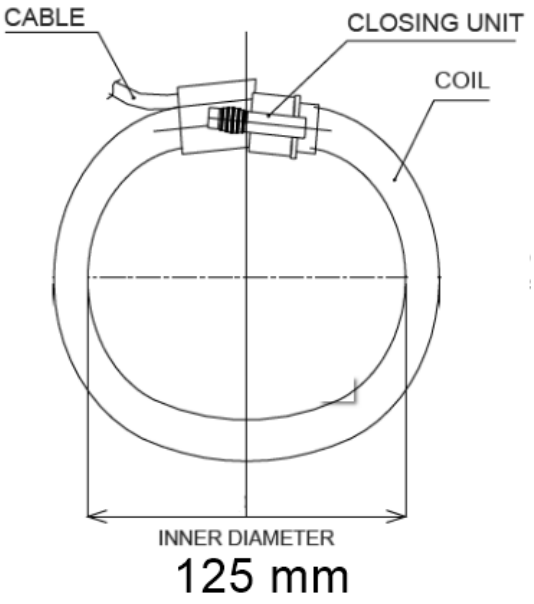

Figure 7: Dimension (in mm) of FLEX-3000

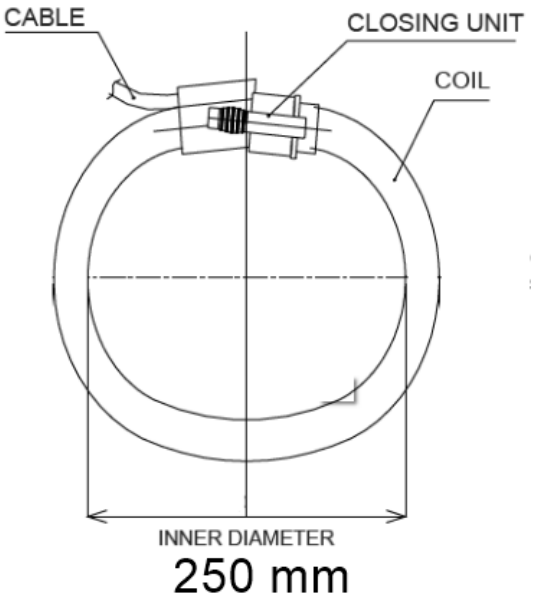

Figure 8: Dimension (in mm) of FLEX-6000

4 AC/DC Hall-compensated sensors

4.1 Technology (short) description

Hall Effect current sensors can measure both AC and DC current up to several kilohertz. Hall Effect clamps using an iron core but not in the same way like iron core clamps. The magnetic field generated by the conductor passes through the magnetic core's aperture, a magnetic flux is induced in the core. As this magnetic flux flows through the Hall element (which is placed in a gap in the core), a voltage is generated in proportion to the magnetic flux. The voltage output from the sensor needs to be amplified and scaled to represent the current flowing through the conductor. The voltage induction is known as the Hall effect. Hall Effect current clamps have the following characteristics:

- Measure DC and AC up to 100kHz (with compensation loop)
- Affordable
- Good Linearity
- Not suitable for long-term measurement due to drifting (e.g. Humidity)

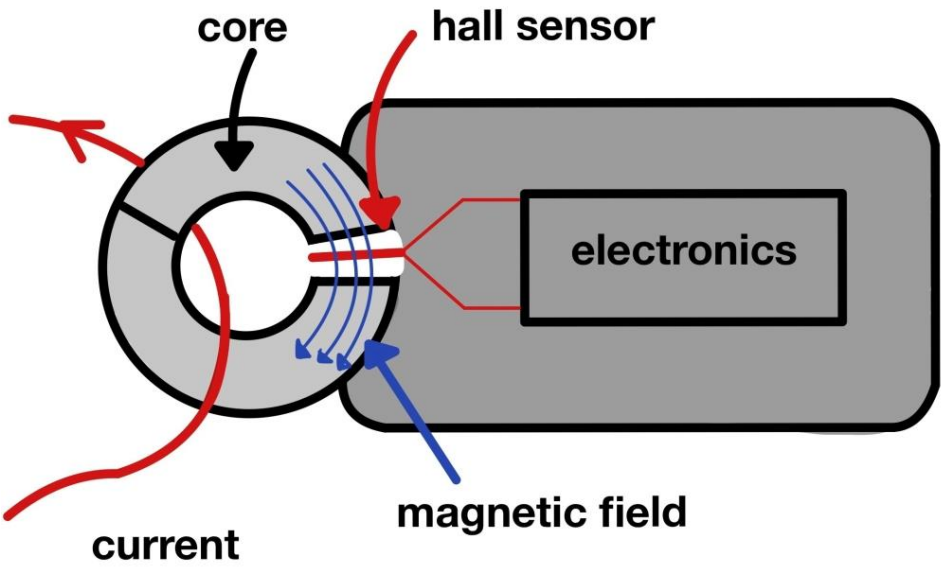

Figure 9: Working principle of a Hall Effect current clamp

4.2 Detailed specifications

	CLAMP-300DC	CLAMP-2000DC	SPLIT-300DC
Type	**Hall Compensated**	**Hall Effect**	**Hall Compensated**
Range	300 A DC or ACpk	20 A AC rms	300 A DC or ACpk
Bandwidth	DC to 100 kHz [-1dB]	40 Hz to 20 kHz[1] [-3dB]	40 Hz to 10 kHz [-3dB]
Accuracy [+25° C]	± 2 % of reading ± 2mA[2]	**DC (0 - 1000A)** ± 0,8 % of reading ± 0,5 A **DC (1000 - 1500A)** ± 1,8 % of reading ± 0,5 A **Overall Acc. (0 - 1000 A)** ± 2,5 % of reading ± 0,5 A[3] **Overall Acc. (1000 - 1500 A)** ± 3,5 % of reading **Overall Acc. (1500 - 1800 A)** ± 5 % of reading	± 2 % of reading ± 2mA[2]
Phase Error [50Hz]	**5 mA - 0,5 A** ± 2 ° **0,5 A - 1 A** ± 1 ° **1 A - 12 A** ± 1 °	**100 mA - 0,5 A** not specified **0,5 A - 1 A** ± 2 ° **1 A - 20 A** ± 2 °	**0,5 A - 10 A** not specified **10 A - 40 A** ≤ 5 ° **40 A - 100 A** ≤ 3 ° **100 A - 240 A** ≤ 2,5 °
Sensitivity [mV/A]	20	10	20
Temperature Coefficient	± 0,02 % of reading per °C	± 0,15 % of reading per °C	± 0,02 % of reading per °C
GENERAL			
Dimension [mm]	205 x 60 x 15	205 x 60 x 15	106 x 100 x 25
Conductor Diameter [mm]	32	32	25?
Cable length [m]	3	3	3
Operating Temperature	0 °C to +60 °C	0 °C to +50 °C	0 °C to +60 °C
Operating Humidity	15% to 85% (not condensing)		
Supply voltage	± 15V	+ 9V	± 15V
Plug and measure (TEDS)	Yes		
STANDARDS / SAFETY			
Safety Standards	EN61010-1:2010 EN61010-2-032:2012	EN61010-1:2010 EN61010-2-031:2002 EN61010-2-032:2012	EN61010-1:2010 EN61010-2-032:2012
Safety category	CAT III 300V	CAT I 300V	CAT III 300V
EMC Standards	EN61326-2-2:2013		

[1]) Additional error of 1% at 20kHz

[2]) with NEO calibration typ. ≤ 0,3 % of reading

[3]) with NEO calibration typ. ≤ 1,5 % of reading

4.3 Dimensions and Pictures

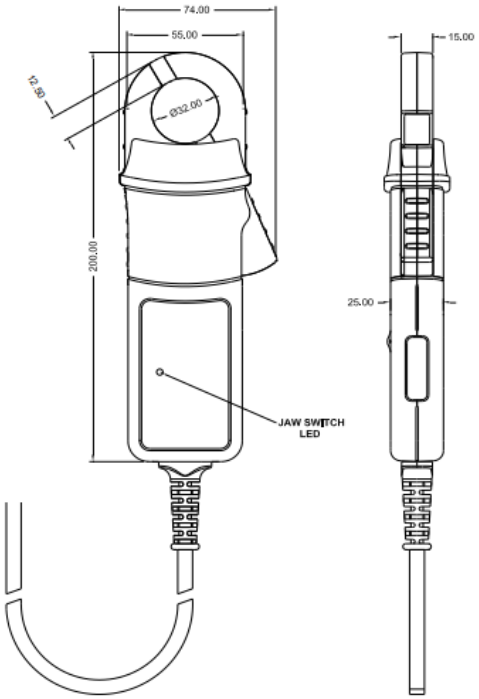

Figure 10: Dimensions (in mm) of CLAMP-300DC

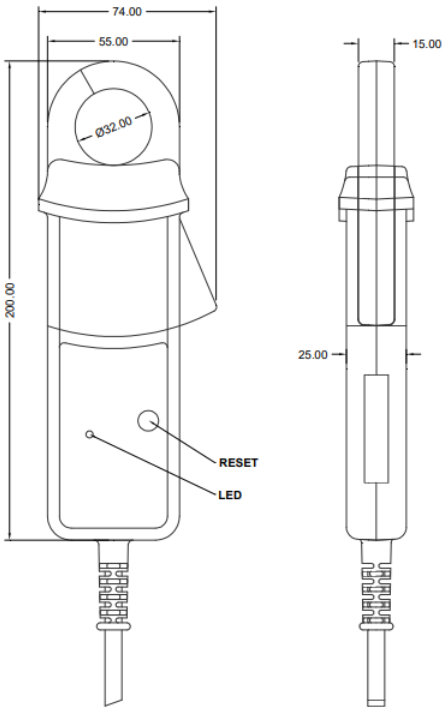

Figure 11: Dimension (in mm) of CLAMP-2000DC

Figure 12: Dimension (in mm) of SPLIT-300DC

5 AC/DC Zero-flux transducers

5.1 Technology (short) description

Zero flux current transducers are precision instruments for AC and DC measurements. A detection winding senses the magnetic flux in the core. A closed control loop with an amplifier and a feedback winding generates a secondary current which cancels the flux generated the primary current. On the secondary side there is a precision burden resistor where the secondary current flows through and generates a voltage signal proportional to the primary current. For DC measurements or at low frequencies the flux does not cancel as the detection winding is unable to measure the residual flux. Therefore, a DC flux sensor is added, either a Hall Element embedded in the core or a flux gate circuit with two more control and sensing windings. The characteristics of Zero flux transducers are:

- Very high bandwidth (up to MHz)
- Low offset
- Low phase error
- Robust against electromagnetic interference
- Sensor needs power supply

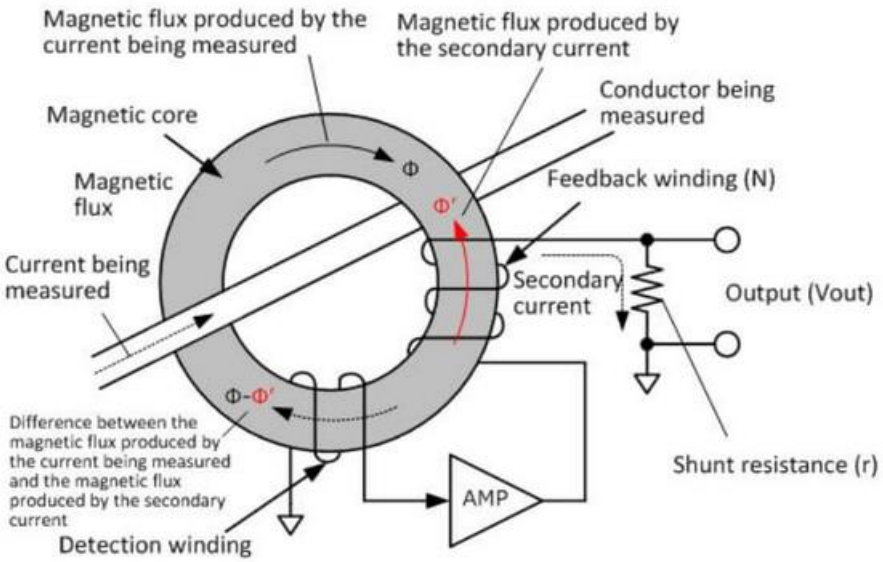

Figure 13: Working principle of a Zero Flux Transducer

5.2 Detailed specifications

	IT-65S	IN-500S	IN-1000S	IN-2000S
Type	**Zero-Flux**	**Zero-Flux**	**Zero-Flux**	**Zero-Flux**
Range	60 A DC or AC rms	500 A DC or AC rms	1000 A DC or AC rms	2000 A DC or AC rms
Conversion ratio	1:600	1:750	1:1500	1:2000
Bandwidth (0,5 % of Ip) [-3dB]	DC to 800 kHz	DC to 520 kHz	DC to 440 kHz	DC to 140 kHz
Accuracy [+25° C]	0,0033 % of full scale	0,0015 % of full scale	0,0012 % of full scale	0,0012 % of full scale
Max. burdon resistor [Ω]	10	2,5	4	3,5
Linearity error	± 9 ppm	± 3 ppm	± 3 ppm	± 3 ppm
GENERAL				
Dimension [mm]	77 x 93 x 47	106 x 128 x 104	106 x 128 x 104	191 x 231 x 153
Conductor Diameter [mm]	26	38	38	70
Cable length [m]	5	5	5	5
Weight [g]	190	600	600	1500
Operating Temperature	-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C
Operating Humidity	15% to 85% (not condensing)			
Supply votlage	± 15V	± 15V	± 15V	± 15V
Plug and measure (TEDS)	Yes			
STANDARDS / SAFETY				
Safety Standards	EN61010-1			
Safety category	CAT III 600V			
EMC Standards	EN61326-2-2			

5.3 Dimensions and Pictures

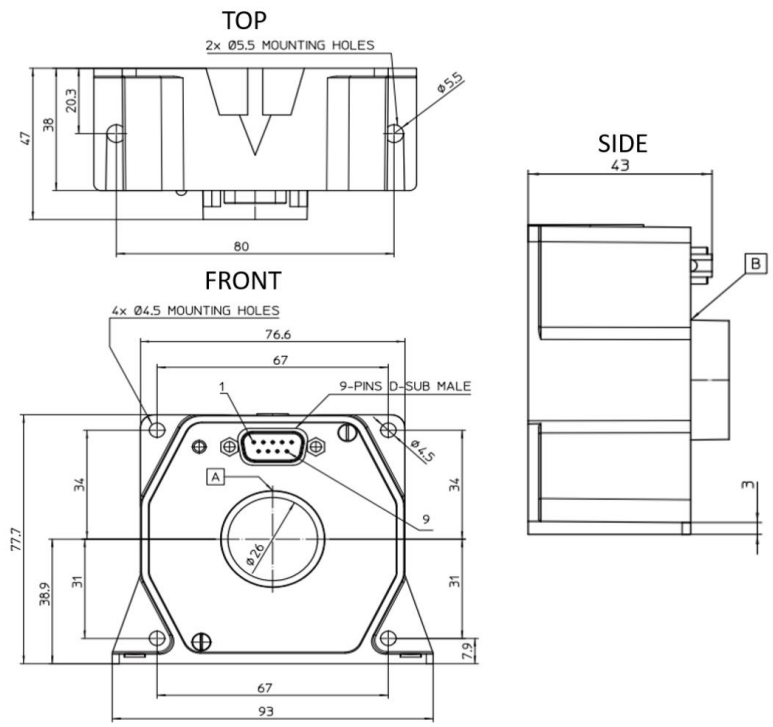

Figure 14: Dimensions (in mm) of IT-65S

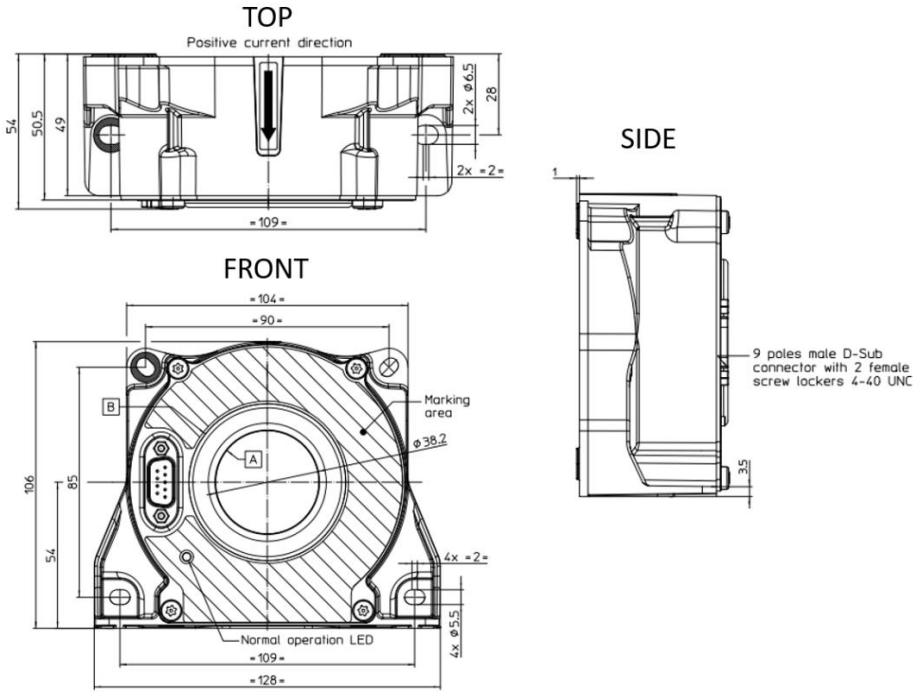

Figure 15: Dimension (in mm) of IN-500S and IN-1000S

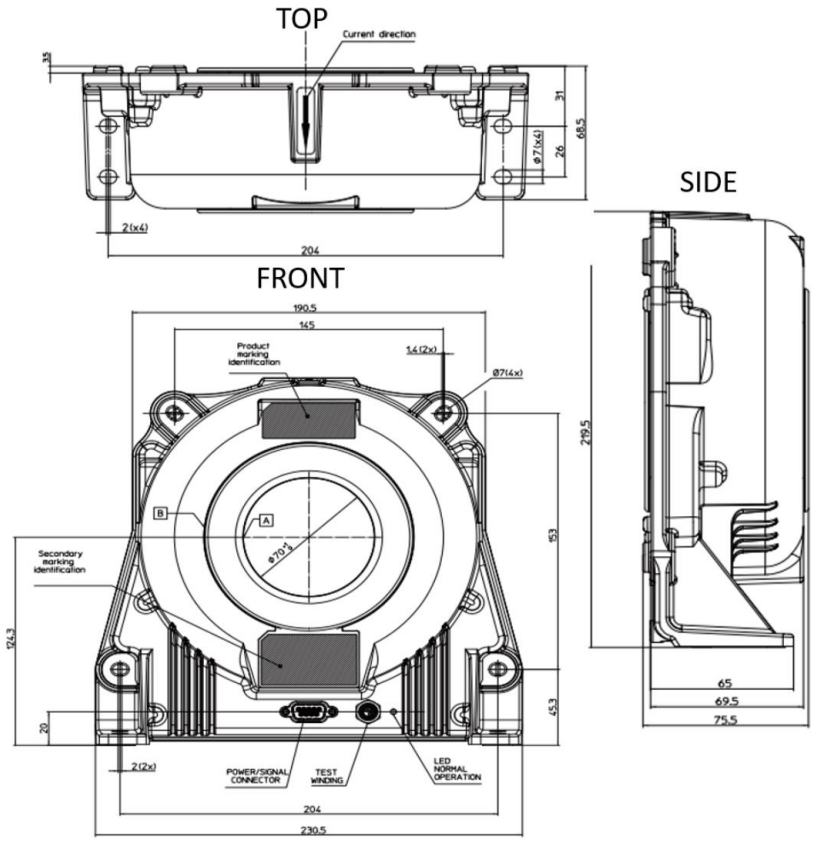

Figure 16: Dimension (in mm) of IN-2000S

6 Further Manuals and Links

There are a couple of additional manuals and information available for our products.
All information can be found on our webpage in the download section.

www.neo-messtechnik.com

- **Technical Reference Manual**
  Describes the basics of power and power quality calculations with all formulas and calculations.
- **Accessories Manual**
  Shows technical data of all sensors. For all current sensors detailed technical information are found as well as accuracy specifications for different applications and use-cases.
- **Measurement Software Manual**
  Detailed information for the measurement software with all functionalities described.
- **Classical Report Tool Manual**
  Detailed information for the classical report tool, detailed description to all analysis and data visualization functionalities.
- **NEO Messtechnik Brochure**
  Showing all products and accessories available.
- **Quick Start Manual**
  This quick start manual is available online and as PDF.

7 Services and Training

7.1 Regular calibration

The Instrument must be calibrated at regular intervals as determined by the accuracy requirements of the application. For most applications a one-year cycle is appropriate. Accuracy specifications are only guaranteed if adjustments are made at regular calibration intervals. Accuracy specifications are not guaranteed unless a one-year calibration cycle is followed. Calibration cycles beyond 2 years are not recommended for any application.
Regardless of which calibration cycle you choose, it is always a good to perform a complete readjustment at each calibration cycle. This keeps the instrument within specification for the next calibration cycle and provides the best stability in the long run. Before your instrument is delivered, it is calibrated. Detailed calibration reports can be requested.

7.2 Services

Service & Repair

The team of NEO Messtechnik performs any kinds of service and repairs to your system to assure a safe and proper operation in the future. Contact us for more information. Maintenance work should be done by NEO Messtechnik only.

Training

We offer various training options (In-House, On-Site, Remote). Contact your local distributor or NEO Messtechnik directly.

Measurement Service

We are happy to execute measurement services for our clients. From supporting measurement setups, data analysis to complete measurements with measurement reports we offer the full scope of services.

7.3 Revision History

23.08.2023 V1.0 Initial Version

7.4 Contact

When you are working with our products we want to provide you with the greatest possible benefits. If you need any support, we are her to assist you.

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