

TECHNICAL REFERENCE MANUAL

DC-CT V23-1



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1. About this document

This is the Technical Reference Manual for DC-CT Sensors Version **V23-1**

DC-CT is a high-performance, low-power consumption current transducer, specially designed in a smaller housing than usual for easier mounting in E-mobility applications where enough space is usually an issue. Together with our measurement devices and power supply, it represents a high-speed, accurate and precise solution for current measurements of your choice.

The manual is divided into several chapters. You will find:

- A detailed description of the DC-CT current transducers
- A detailed description of the DC-CT accessories
- A description of the patented technology used for measurement
- A comprehensive introduction to the configuration of the modules using DewesoftX®
- Detailed technical data and electrical characteristics

1.1. Legend

The following symbols and formats will be used throughout the document.



Important

It gives you important information about the subject.
Please read carefully!



Hint

It gives you a hint or provides additional information about a subject.



Example

Gives you an example of a specific subject.

1.2. Online versions

1.2.1. Device Technical Reference Manual

The most recent version of this manual can be downloaded from our homepage:

<https://dewesoft.com/download/manuals>

In the *Hardware Manuals* section click the download link for the *Device® technical reference manual*.

1.2.2. DEWESoft® User Manual

The DEWESoft® User Manual document provides basics and additional information and examples for working with DEWESoft® and certain parts of the program.

The latest version of the DEWESoft® tutorials can be found here:

<https://dewesoft.com/download/manuals>

In the *Software Manuals* section click the download link of the DEWESoft X User Manual entry.

2. Safety instructions

Your safety is our primary concern! Please be safe!

3. Getting started

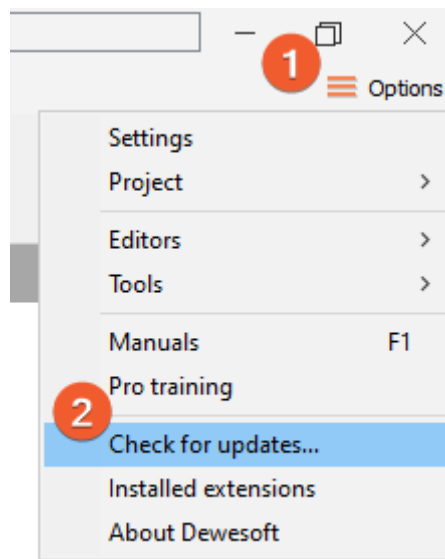
This chapter will help you install the software, connect your SIRIUSi system to the PC via USB and show you how to configure DewesoftX®.

To follow these steps, you need the following items:

- your brand new DC-CT sensor (included in the shipment)
- a DC-CT power supply SIRIUSi-PWR-MCTS2, SIRIUSir-PWR-MCTS2 or SIRIUSir-HD-PWR-MCTS2
- a SIRIUS device with LV, STG, STGS or UNI channel
- your PC with Windows 10/11 (older versions like Windows® 7 may also work)

3.1. Software installation

For optimal working, we recommend that you install the latest version of Dewesoft. If you already have installed the older version Dewesoft is recommended that you find the newest version on the website under the Support/Downloads/DewesoftX section. You can also check if a newer version is available in the software.



Check for update

3.2. Connecting standalone DC-CT® unit



DC-CT connection

3.2.1. List of required equipment:

Function	Dewesoft order code
Power supply for the system	PS-120-L1B2f (default), L1B2f-BAN-Xm
Power supply for the sensor	SIRIUSi-PWR-MCTS2 / SIRIUSir-PWR-MCTS2, D9m-D9f-Xm-MCTS
DSI adapter for current transducer	DSI-DC-CT-1000-0.3M
Measurement device	Any DEWESoft device with LV, STG, STGS or UNI channel

You can connect up to 4 DC-CT sensors within one system.



Warning

Never operate the DC-CT transducers without power supply (SIRIUSi-PWR-MCTS2, SIRIUS_ir-PWR-MCTS2). The DC-CT transducer can be damaged!

3.2.2. Wiring

1. Use DSI-DC-CT-1000-0.3M to connect the SIRIUS amplifier to SIRIUSi-PWR-MCTS2. Connect the male DB9 connector of the DSI cable to the SIRIUS amplifier and the female DB9 connector to the MCTS device.



Important

Do **NOT** connect the male DB9 connector of the DSI cable to the female connector on the MCTS device. In this case TEDS chip will be damaged!

2. Use D9m-D9f-Xm-MCTS to connect your DC-CT sensor to the SIRIUS-PWR-MCTS2 device. Connect the male DB9 connector of the cable to the MCTS device and the female DB9 connector to your DC-CT sensor.

3.2.3. Powering the unit

Power supply can be either:

1. bipolar: pin 9 (15 V), pin 5 (-15 V) and pin 4 (0 V) or
2. unipolar: pin 9 (30 V) and pin 5 (0 V)



Important

For best CMRR performance units should be earthed via the screw on the bottom or back-plate. Note that the D-SUB connector is also grounded, but may create a ground loop with the chassis. So make sure if the chassis is grounded, that the cable of the D-SUB connector is not grounded.

4. Product overview

4.1. Main features

The DC-CT-1000I-S22DA is a compact and accurate 1000 A zero-flux current transducer based on ISOTEL proprietary technology and patented Platiše Flux Sensor (PFS).

Features a typical D-SUB connector with 22 mm opening in Aluminium chassis delivering 500 kHz of flat bandwidth, 100 ppm linearity, and total offset including hysteresis below 100 ppm FS. Low standby power consumption of 0.5 W with flexible unipolar/bipolar power supply and differential current output.

- **EASY MOUNTING WITH PRECISE MEASUREMENTS:** single gap-less high-permeability core design, compact implementation of very high current sensors,
- **MADE FOR HARSH ENVIRONMENTS:** excellent immunity to external magnetic fields due to compact gap-less design, good temperature stability, a property of PFS.
- **HIGH BANDWIDTH:** wide and flat bandwidth due to good coupling between primary and secondary side,
- **VERY LOW OFFSET:** due to compact implementation and gap-less design
- **LOW POWER CONSUMPTION:** high sensitivity at low power consumption,
- **TYPICAL APPLICATIONS:** Test and Measuring Equipment, DC and AC Metering, Power Quality Analysis in Mains, Stable Precision Power Supplies, Battery Management Systems • Electrical Vehicle Chargers

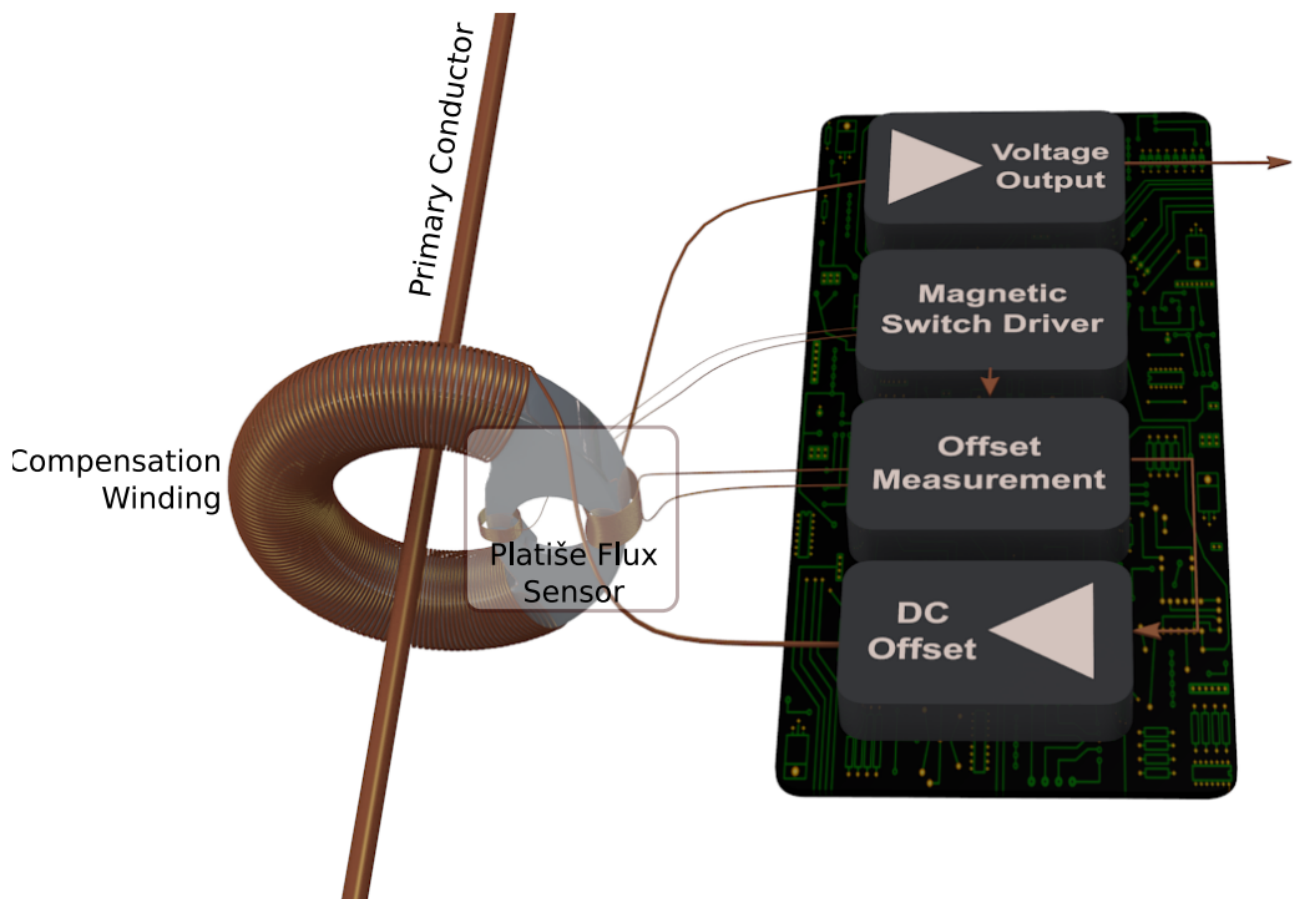


4.2. The DC-CT technology

The DC-CT technology at its core consists of a high-permeability core and a zero-flux closed-loop null method measurement principle, using the innovative Platiše Flux Sensor (PFS) zero-flux sensor.

The DC-CT-1000I in addition comprises zero-flux, or null method to achieve highest accuracy and compensates non-linearities caused by the magnetic material, in similar way as other closed-loop DC-CT sensors. Key blocks of the Platiše Flux Sensor are represented in the image below.

The primary current flows through the magnetic core wound by a secondary compensating winding of N turns, defining a current transformation ratio. To a small part of the magnetic core additional modulating winding, driven by magnetic switch driver, and sensing winding, sensed by offset measurement circuitry, are added. The residual flux is added to the output amplifier to compensate the DC component, while the AC component of the DC-CT basically passes through the sensor, directly to the output



DC-CT technology schematics

More information about the technology can be found at www.dc-ct.com.

4.2.0.1. A brief comparison of different current measurement technologies

The table below summarizes the key features across different technologies:

Technology	Type	Isolated	Current range	AC Bandwidth	Linearity	Accuracy
DC-CT	DC/AC	Yes	High	High	Excellent	Very High
Flux-Gate	DC/AC	Yes	High	High	Excellent	Excellent
Hall	DC/AC	Yes	High	Medium	Medium	Medium
Shunt	DC/AC	No	Medium	Medium	Good	High
Rogowsky	AC	Yes	High	High	Good	Medium
CT	AC	Yes	High	Medium	Medium	Medium

5. DC-CT Sensors

5.1. DC-CT-1000I-S22DA



DC-CT-1000I-S22DA: front



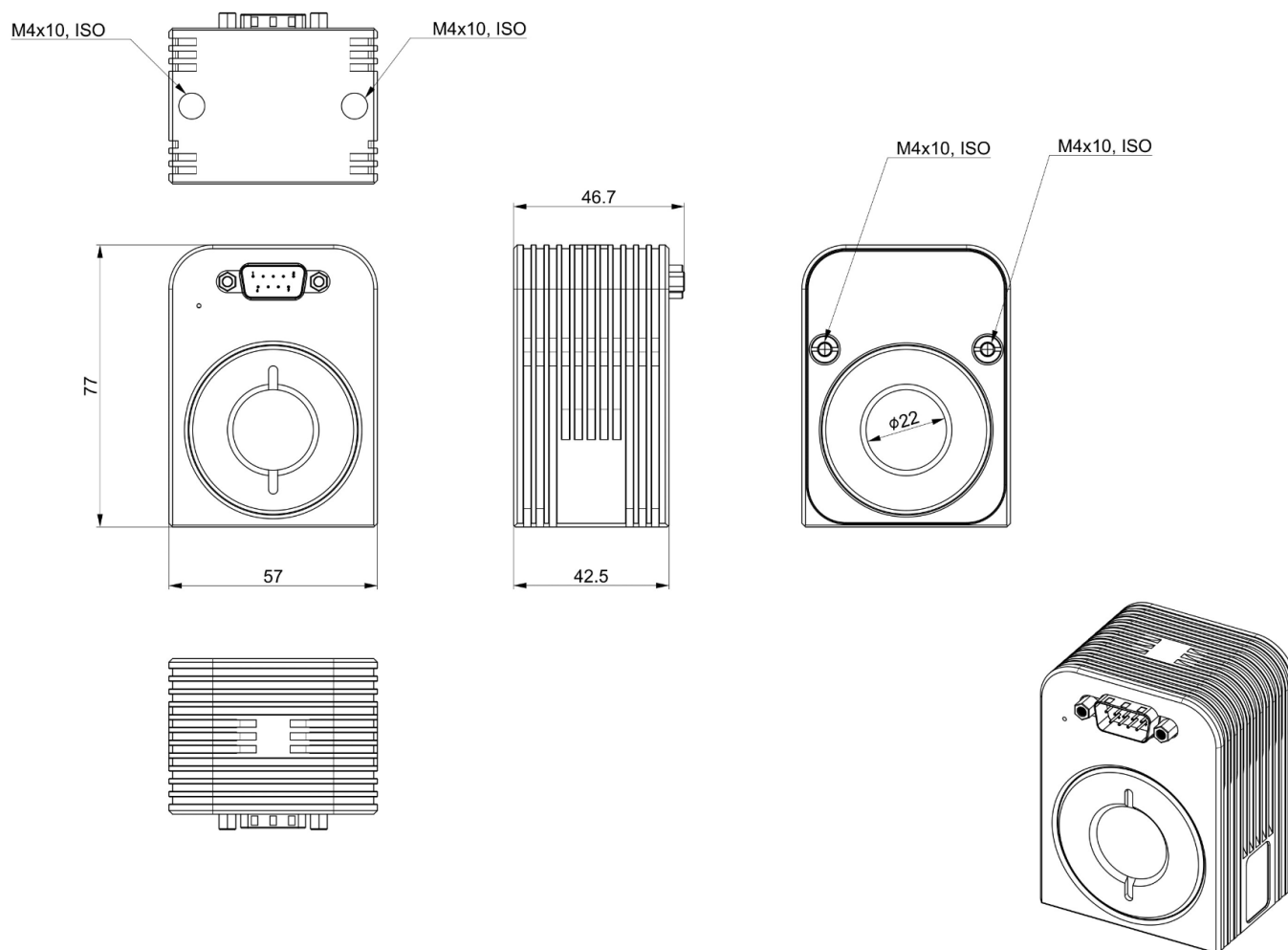
DC-CT-1000I-S22DA: back

5.1.1. DC-CT-1000I-S22DA: Specifications

	DC-CT-1000I-S22DA		
Type	Zero-Flux		
Primary Current Range DC (max)	1000 A		
Primary Current Range AC rms (max)	700 A		
Conversion ratio	1:1680		
DC Accuracy			
Nominal Burden Resistance	1 Ohm (max. 3 Ohm)		
Temperature influence (typ.)	3 ppm/K		
Nominal secondary current	~595.2 mA @ 1000 A		
Bandwidth (-3 dB) (typ.)	DC ... 500 kHz		
Gain Linearity @1000 A range	Typ. 34 ppm (max. <100ppm)		
Offset including hysteresis	Typ. 65 mA (max. 100 mA)		
AC Accuracy			
Frequency Bandwidth @ -0.5 dB, IP = 0.8 ARMS	500 kHz		
Frequency Bandwidth @ -3 dB, IP = 0.7 ARMS	750 kHz		
Noise (ppm rms)	Min [mA]	Typ [mA]	Max [mA]
0 - 10000 Hz	0.4	0.6	1.3
0 - 100000 Hz	0.8	1.2	2
0 - 1000000 Hz	5.4	5.5	6.5
Platiše Flux Sensor Frequency (seen as ripple)	220 kHz		
D-Class Switching Frequency (seen as ripple)	750 kHz		
Other			
Time to Out of Range Detection (Status Deasserted)	300 μs		
Primary to Secondary Maximum Difference RTI	±1500 mA		
Status Open Collector Max Current	Typ. 25 mA (Max. 50 mA)		
Status Open Collector Max Voltage	Typ. 60 V (Min. -5 V, Max. 80 V)		
Immunity to external magnetic field, 5 mT in any direction RTI	Typ. ±30 mA (Max. < 50 mA)		
Induced RMS voltage on primary conductor at IP = 0	32 μV		
Induced RMS voltage on primary conductor during Search	1223 μV		
Power Supply			
	Min	Typ	Max
Power Supply Voltage between pin 9 and 5	24 V	30 V	35 V
500 A Range Power Supply Voltage	12 V	30 V	35 V
Power Supply Max. In-rush/working current @ 30 V	< 0.5 A		
Standby (Idle) Power Consumption	Typ. 0.56 W (Max. 0.7 W)		

Power Consumption @IP = 500 A and Burden 3 Ω	3 W @IP = 500 A and Burden 3 Ω 6.6 W (max. 8 W) @IP = 1000 A and Burden 1 Ω 7.6 W (max. 9 W) @IP = 1000 A and Burden 3 Ω
Environmental	
Operating temperature	-40 °C to +85 °C
Isolation CAT II / CAT III non-insulated wire IEC 61010-1 standards, EN 50178 standards	1000 V CAT II 600 V CAT III
Isolation CAT II / CAT III insulated wire IEC 61010-1 standards, EN 50178 standards	1000 V CAT II 1000 V CAT III
Clearance / Creepage	12 mm
Weight	500 g
Inner diameter	22 mm
Dimensions	77 x 57 x 46.7 mm
DEWESoft® Shunt	1 Ω
PWR-MCTS2 needed	Yes (± 15 V)

5.1.2. DC-CT-1000I-S22DA: Technical drawing

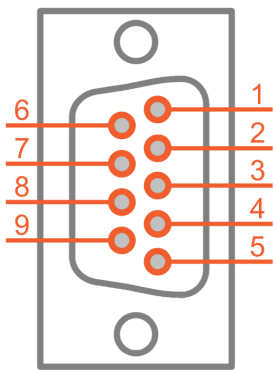


DC-CT-1000I-S22DA technical drawing

5.1.3. DC-CT-1000I-S22DA: Pinout



5.1.3.1. DC-CT-1000I-S22DA: Pinout: D9 connector



Pin	Name	Description
1	RETURN	Output -
2	TEDS	TEDS
3	STATUS -	Status -
4	GND	Ground
5	Vs-	Supply - (see 1)
6	OUTPUT	Output +
7	NC	Not connected
8	STATUS +	Status +
9	Vs+	Supply + (see 1)

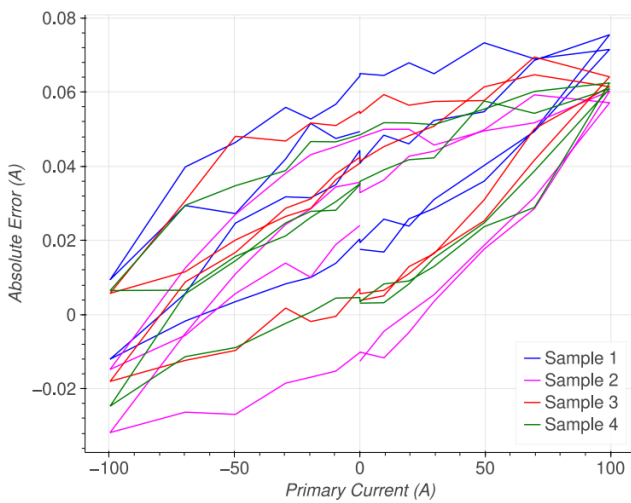
Pinout (DSUB-9 **male**)

- 1) Check the [Powering the unit](#) chapter for more information in case you are not using the PWR-MCTS.

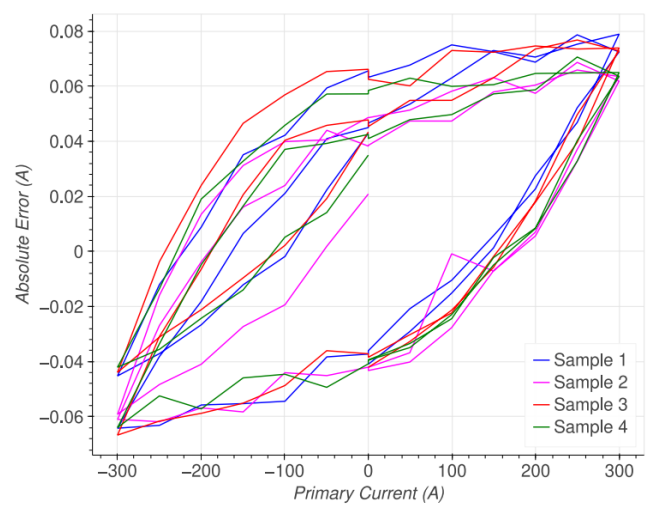
5.1.4. DC-CT-1000I-S22DA: Characteristics

5.1.4.1. Accuracy

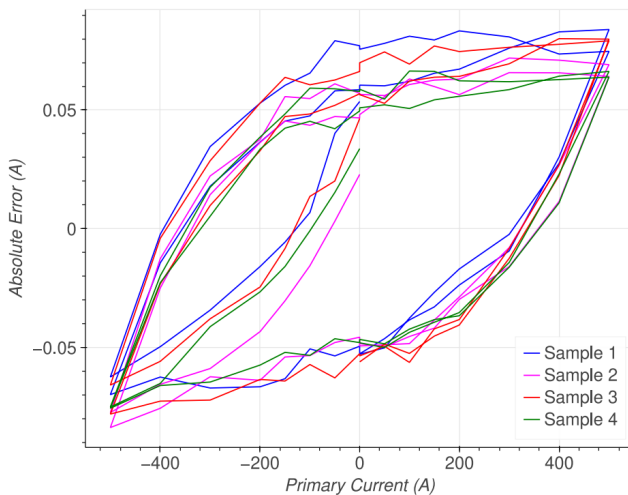
The following typical characteristics were obtained at nominal power supply of ± 15 V (NGE100), burden resistor of $1\ \Omega$, cable length between DC-CT and burden resistor 5 m, DMM Keithley DMM7510, reference current sensor IN2000S, ambient temperature T_A of $23 \pm 5\ ^\circ\text{C}$, primary conductor of a square bar 15×15 mm in center position, and total measurement uncertainty of the system of 21 mA @ 1000 A. Before each measurement, DC-CT-1000I was restarted.



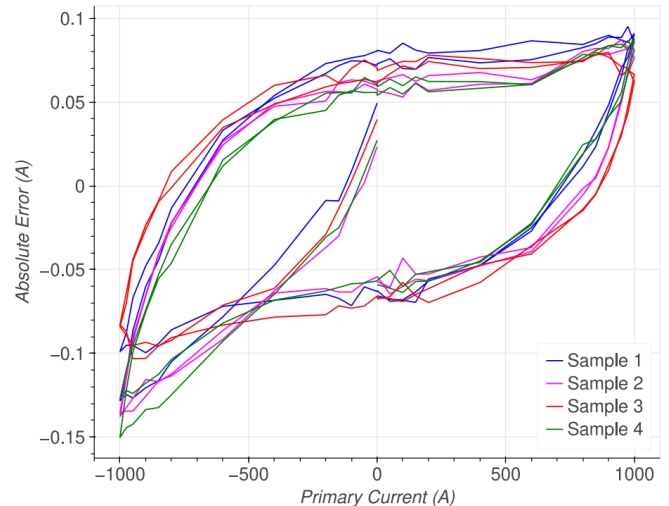
Typical Accuracy at $I_P = \pm 100$ A



Typical Accuracy at $I_P = \pm 300$ A

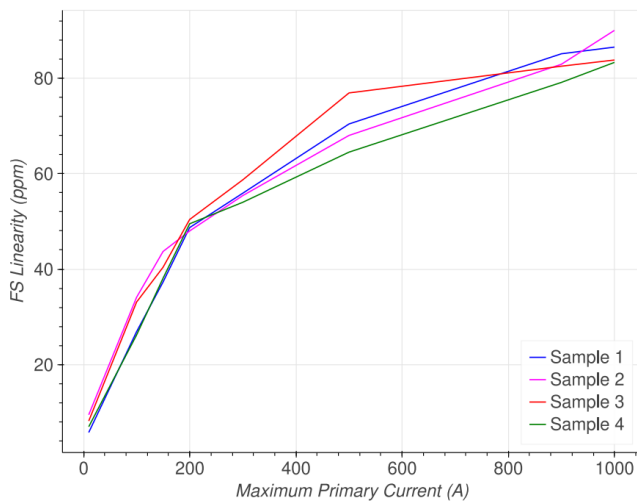


Typical Accuracy at $I_P = \pm 500$ A

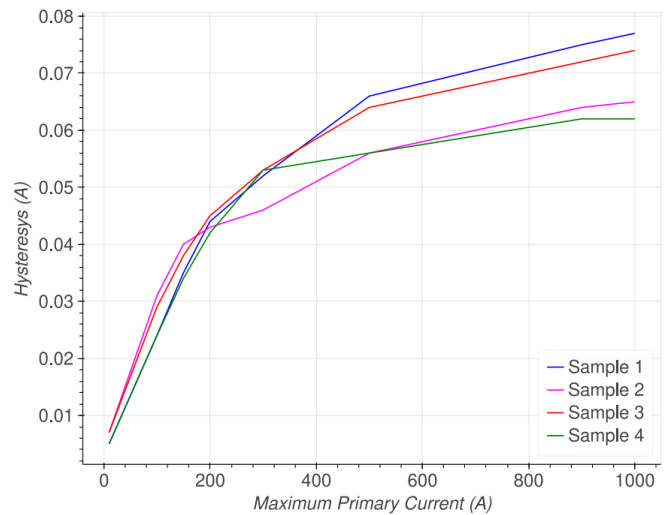


Typical Accuracy at $I_P = \pm 1000$ A

The next two charts represents the non-linearity as maximum distance from the BFSL (best-fit-straight-line) vs primary current and peak-to-peak hysteresis amplitude vs primary current, calculated from given ± 100 A, ± 300 , ± 500 and ± 1000 A characteristics above.



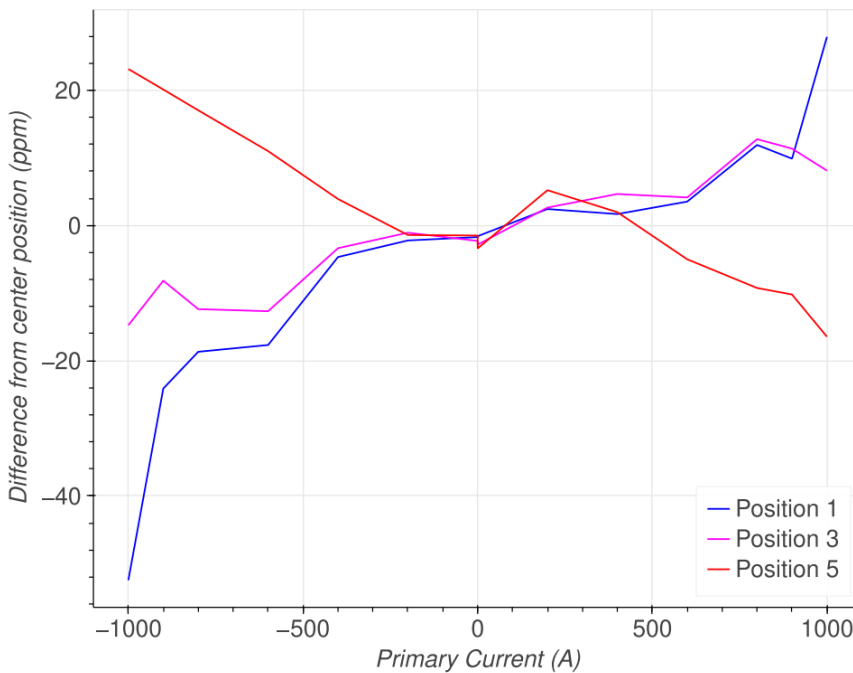
Linearity Referred to Full Scale IP=1000 A



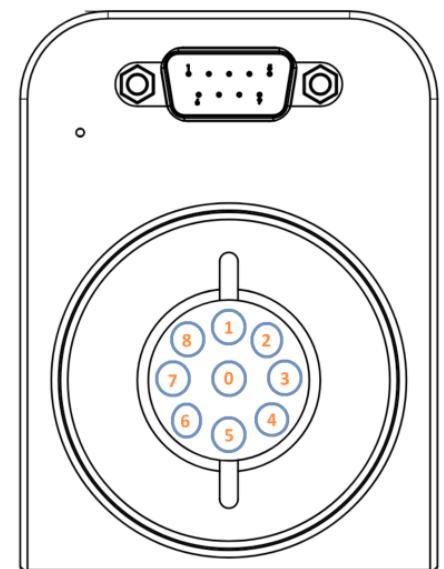
Offset (Hysteresis) vs. IP

5.1.4.2. Off-Center Error

The position of the primary conductor affects the accuracy vs primary current:



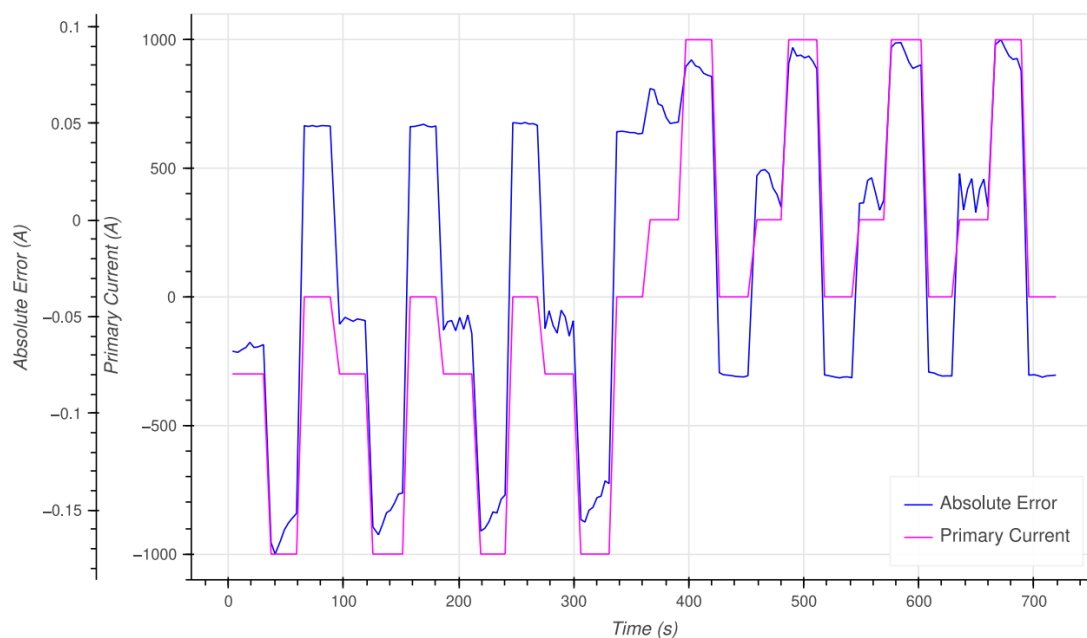
Position Error vs Test Location relative to Location 0



Position Error Test Locations

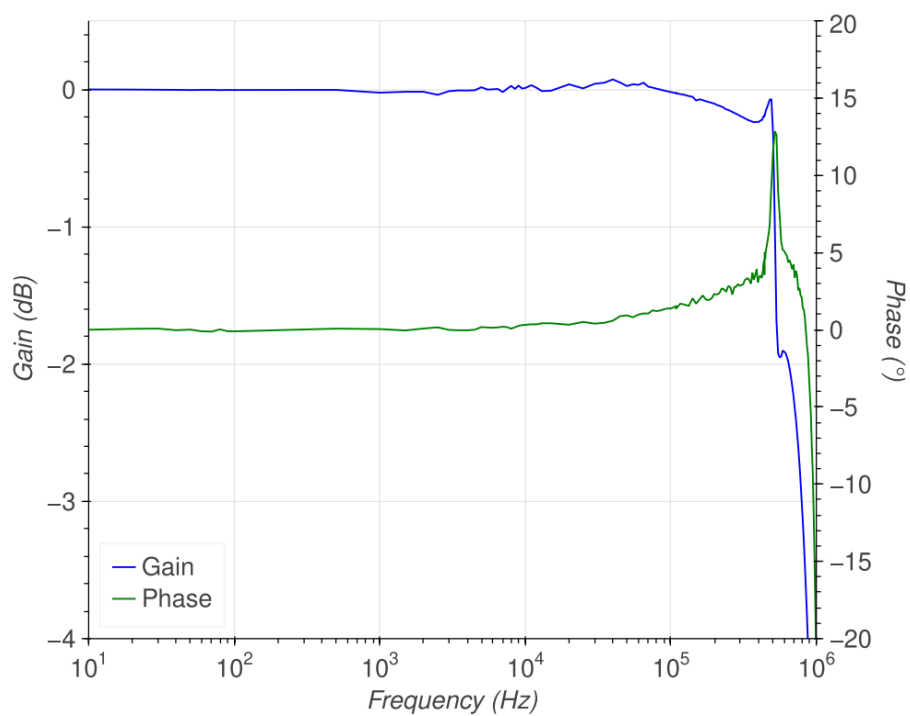
5.1.4.3. A Peak-to-Peak Cycling Test

The following test shows a sequence test with current cycling, representing a primary current and absolute error:



Cycling Test at $T_A = 23 \pm 5^\circ\text{C}$

1.1.4 AC Response

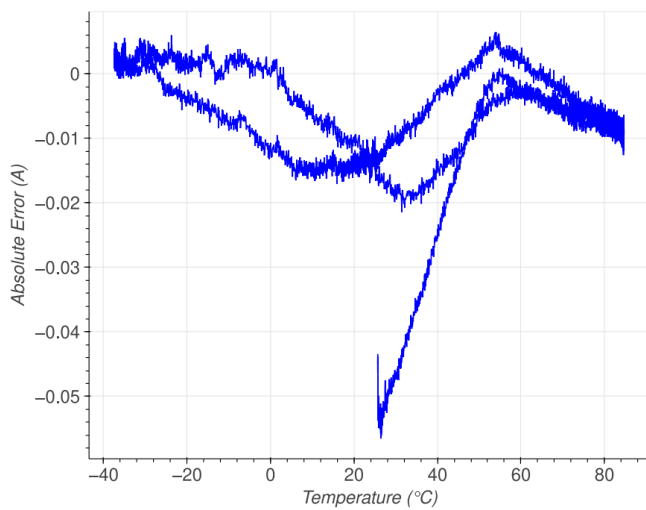


Small Signal AC Response at $I_P \approx 0.8 \text{ ARMS}$

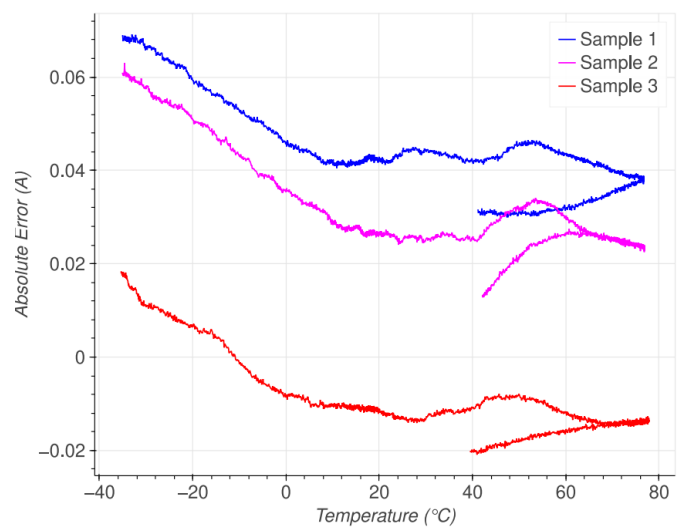
5.1.4.4. Temperature Drift

5.1.4.4.1. Offset Drifting

In the following two tests we have used a burden resistor $2.5\ \Omega$ and current source reference Fluke 5502A. The first chart represents sensor output at $I_P=0\text{ A}$ and intentionally magnetized core (offset) to maximum possible value. The second chart represents drift from $-35\text{ }^\circ\text{C}$ and magnetized cores at constant current of 100 A . It has been found out, that temperature stress in whatever direction reduces the offset resulted from the hysteresis.



Temperature Drift at $I_P=0\text{ A}$

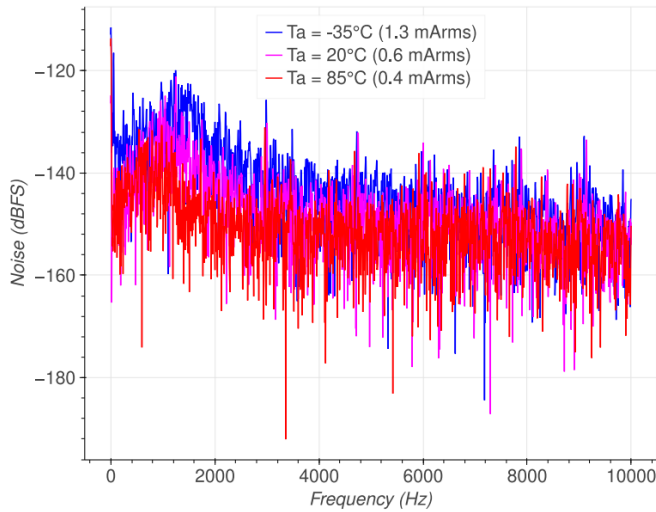


: Temperature Drift at $I_P=100\text{ A}$

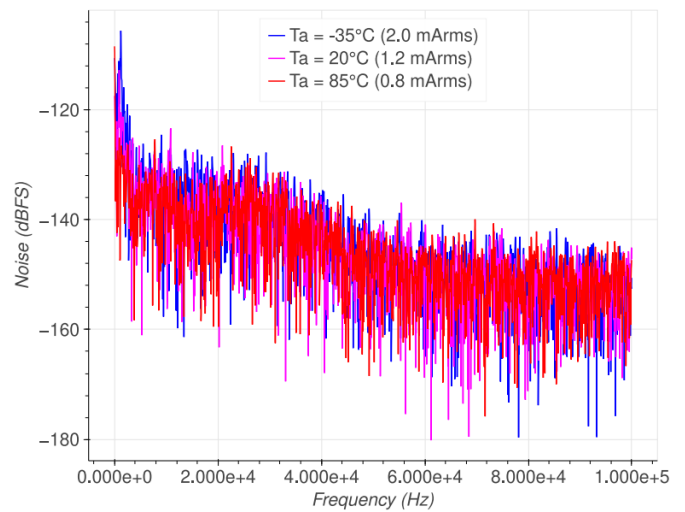
5.1.4.5. Noise

Noise was evaluated using the INA849 amplifier with $G=50$, $2.5\ \Omega$ burden resistor, R&S RTO1004, and primary current IP of 0 A.

5.1.4.5.1. kHz Bandwidth Noise

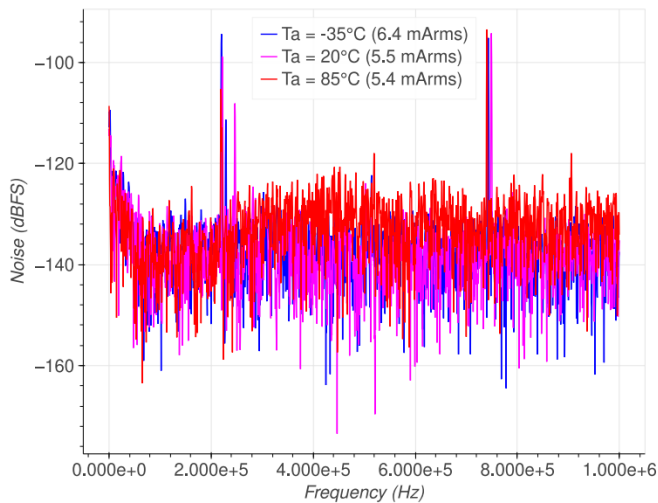


Noise spectrum vs. TA up to 10 kHz

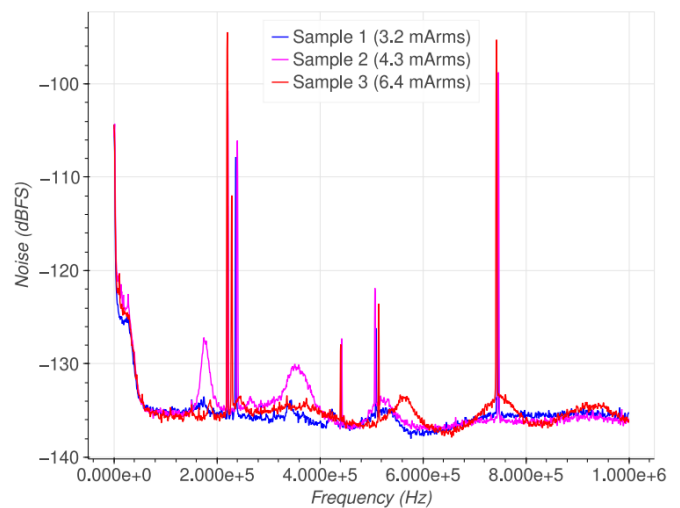


Noise spectrum vs. TA up to 100 kHz

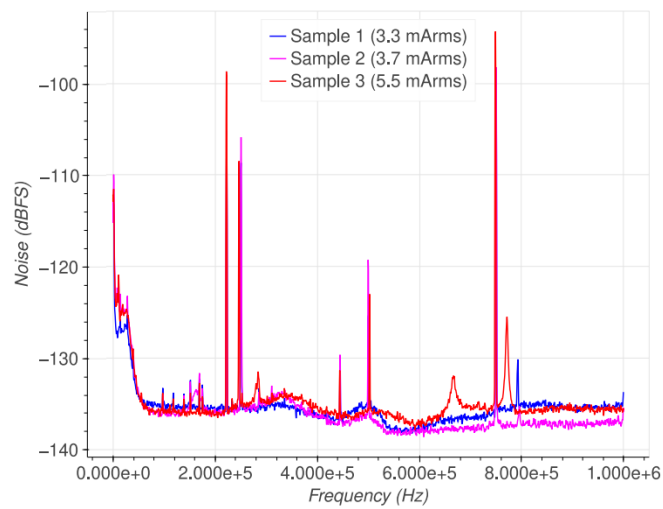
5.1.4.5.2. MHz Bandwidth Noise and Ripple



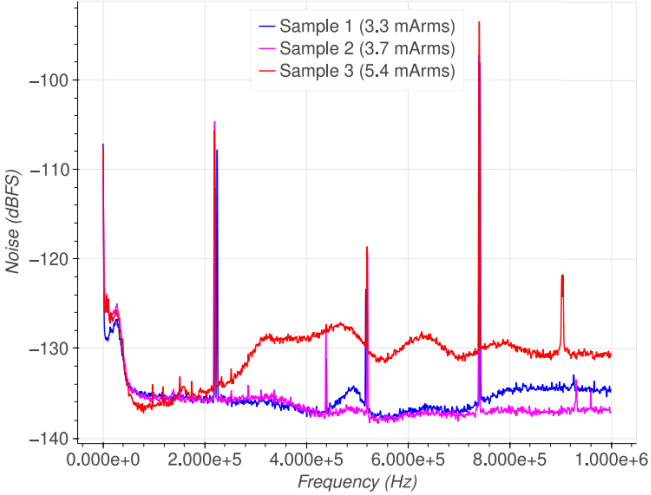
Noise spectrum vs. TA up to 1 MHz



Averaged noise spectrum at TA= -35°C



Averaged noise spectrum at TA= 20°C

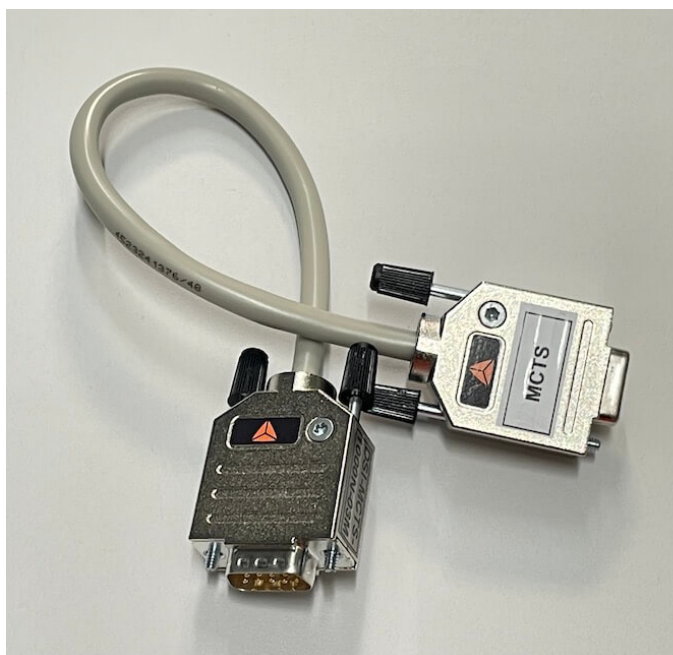


Averaged noise spectrum at TA= 85°C

5.2. DSI adapters

5.2.1. DSI-DC-CT-1000I-0.3m

DSI-DC-CT-1000I-0.3m is the DSI adapter for the DC-CT-1000I sensors. It fits between the Dewesoft DAQ device and the PWR-MCTS2 device. It comes with a $1\ \Omega$ shunt resistor and TEDS chip.

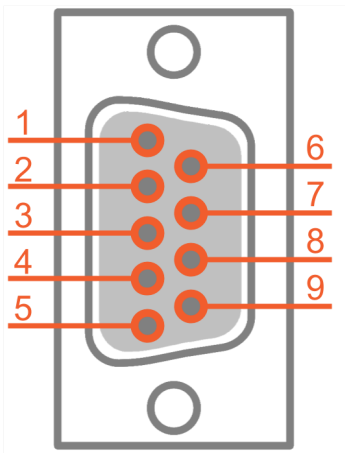


DSI-DC-CT-1000I-0.3m

5.2.1.1. DSI-DC-CT-1000I-0.3m: Specifications

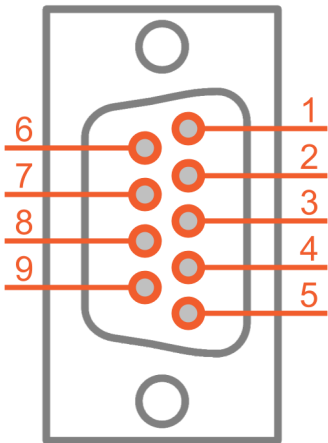
Resistor	
Technology	Metal Foil
DSI-MCTS-DC-CT-1000-03M	$1\ \Omega$ / 2 Watt
Pulse Power (5 sec)	200 %
Accuracy	
Amplitude Accuracy	$\pm 0.01\ %$
Temperature Coefficient	Typ: $\pm 2\ \text{ppm}/^\circ\text{C}$ (max. $\pm 5\ \text{ppm}/^\circ\text{C}$)
Load Life Stability	$\pm 0.005\ %$ @ $25\ ^\circ\text{C}$, 2000 h at rated power
Frequency Characteristics	
Angular Accuracy	$< 1^\circ$ @ 500 kHz
Frequency Range	$< 0.5\ \text{dB}$ @ 1000 kHz
Rise Time	1 ns
Inductance (L)	max. $0.1\ \mu\text{H}$ (typical $0.03\ \mu\text{H}$)
Capacitance (C)	max. $1\ \text{pF}$ (typical $0.5\ \text{pF}$)

5.2.1.2. DSI-DC-CT-1000I-0.3m: Pinout



DSI-MCTS-x-03M connector: pinout (DSUB-9 **female**)

Pin	Name	Description
1	RETURN	Return
2	NC	Not connected
3	GND	Ground
4	GND	Ground
5	NC	Not connected
6	OUT	Output
7	NC	Not connected
8	Normal op. st.	Normal op. st.
9	NC	Not connected

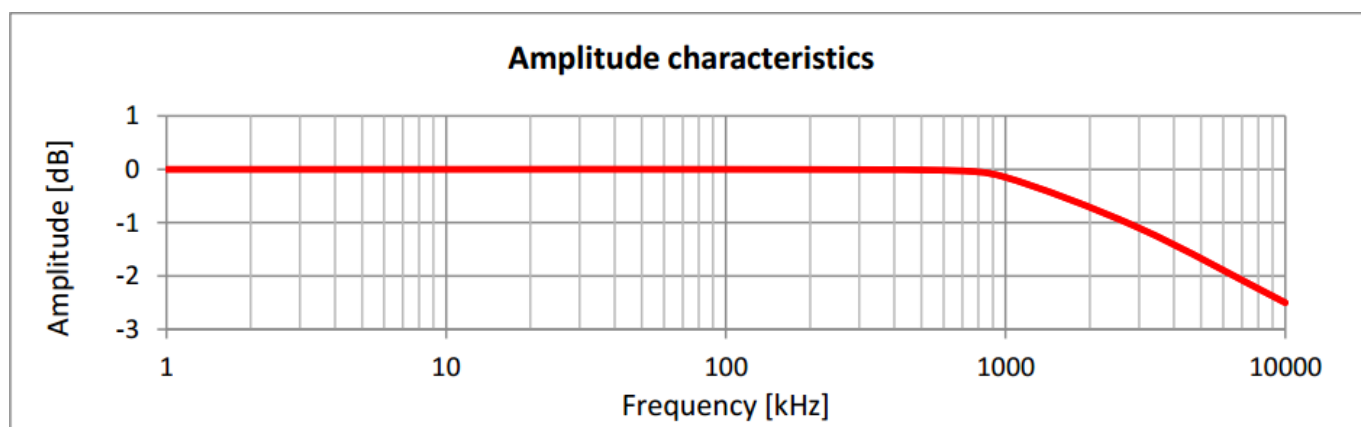


DSI-MCTS-x-03M connector: pinout (DSUB-9 **male**)

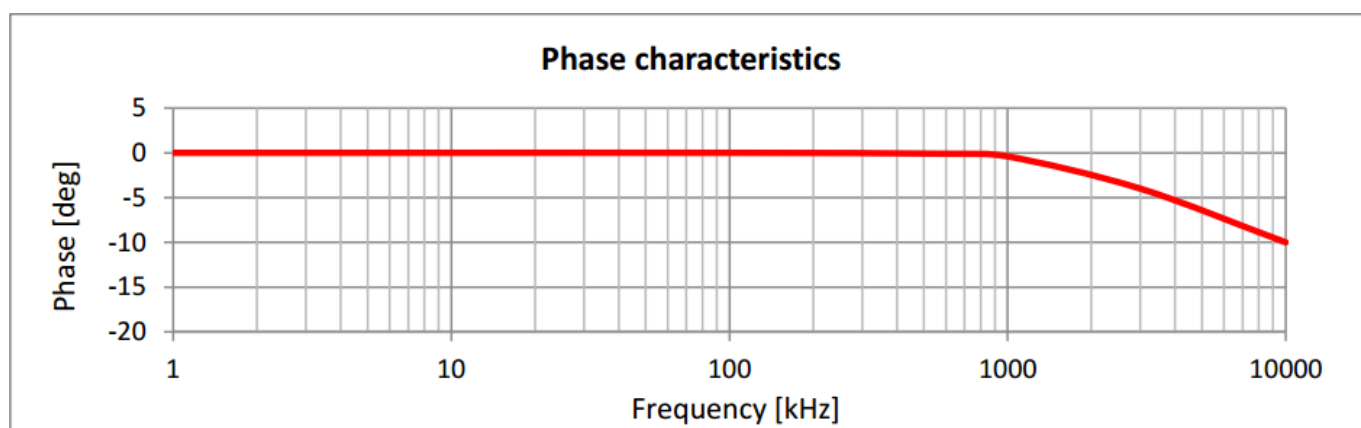
Pin	Name	Description
1	NC	Not connected
2	In+	In+
3	NC	Not connected
4	GND	Ground
5	Digital IO	Digital IO
6	NC	Not connected
7	In-	In-
8	NC	Not connected
9	TEDS	TEDS

5.2.1.3. DSI-DC-CT-1000I-0.3m: Characteristics

5.2.1.3.1. Magnitude response



5.2.1.3.2. Phase response



Ordering Code	Description
DC-CT-1000I-S22DA	1000A, Standalone, 22 mm Opening, D-SUB, Analog Current Output
	Key Specifications <ul style="list-style-type: none"> • Round Opening 22 mm diameter • Rated primary current IP =1000 ADC, 700 AAC • Linearity of <100 ppm • Typical Offset including Hysteresis <100 mA RTI • Bandwidth 500 kHz @ -0.5 dB • Immunity <50 mA RTI at 5 mT in any direction • CMRR <TBD $\mu\text{A/V}$ @ 100 kHz • TEDS (Current Loop Output Sensors Template) • Range OK Signal • Power Supply: Unipolar 30 V or Bipolar ± 15 V with floating current output • Standby Power Consumption 0.5 W • Typical Power consumption 6.6 W at rated IP • Withstands rated DC/AC primary currents without being powered • Operational Range -40 to 85°C

6. Warranty information

Notice

The information contained in this document is subject to change without notice.

Note:

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The copy of the specific warranty terms applicable to your Dewesoft product and replacement parts can be obtained from your local sales and service office. To find a local dealer for your country, please visit <https://dewesoft.com/support/distributors>.

6.1. Calibration

Every instrument needs to be calibrated at regular intervals. The standard norm across nearly every industry is annual calibration. Before your Dewesoft data acquisition system is delivered, it is calibrated. Detailed calibration reports for your Dewesoft system can be requested. We retain them for at least one year, after system delivery.

6.2. Support

Dewesoft has a team of people ready to assist you if you have any questions or any technical difficulties regarding the system. For any support please contact your local distributor first or Dewesoft directly.

Dewesoft d.o.o.
Gabrsko 11a
1420 Trbovlje Slovenia

Europe Tel.: +386 356 25 300
Web: <http://www.dewesoft.com>
Email: Support@dewesoft.com
The telephone hotline is available Monday to Friday from 07:00 to 16:00 CET (GMT +1:00)

6.3. Service/repair

The team of Dewesoft also performs any kinds of repairs to your system to assure a safe and proper operation in the future. For information regarding service and repairs please contact your local distributor first or Dewesoft directly on <https://dewesoft.com/support/rma-service>.

6.4. Restricted Rights

Use Slovenian law for duplication or disclosure. Dewesoft d.o.o. Gabrsko 11a, 1420 Trbovlje, Slovenia / Europe.

6.5. Printing History

Version 2.0.0, Revision 217 Released 2015 Last changed: 23. July 2018 at 16:54.

6.6. Copyright

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6.7. Trademarks

We take pride in our products and we take care that all key products and technologies are registered as trademarks all over the world. The Dewesoft name is a registered trademark. Product families (KRYPTON, SIRIUS, DSI, DS-NET) and technologies (DualCoreADC, SuperCounter, GrandView) are registered trademarks as well. When used as the logo or as part of any graphic material, the registered trademark sign is used as a part of the logo. When used in text representing the company, product or technology name, the ® sign is not used. The Dewesoft triangle logo is a registered trademark but the ® sign is not used in the visual representation of the triangle logo.

7. Safety instructions

Your safety is our primary concern! Please be safe!

7.1. Safety symbols in the manual



Warning

Calls attention to a procedure, practice, or condition that could cause the body injury or death



Caution

Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.

7.2. General Safety Instructions



Warning

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Dewesoft d.o.o. assumes no liability for the customer's failure to comply with these requirements.

All accessories shown in this document are available as an option and will not be shipped as standard parts.

7.2.1. Environmental Considerations

Information about the environmental impact of the product.

7.2.2. Product End-of-Life Handling

Observe the following guidelines when recycling a Dewesoft system:

7.2.3. System and Components Recycling

Production of these components required the extraction and use of natural resources. The substances contained in the system could be harmful to your health and to the environment if the system is improperly handled at its end of life! Please recycle this product in an appropriate way to avoid unnecessary pollution of the environment and to keep natural resources.



This symbol indicates that this system complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). Please find further information about recycling on the Dewesoft web site www.dewesoft.com



Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment and is outside the scope of the 2002/95/EC RoHS Directive. However, we take care of our environment and the product is lead-free.

7.2.4. General safety and hazard warnings for all Dewesoft systems

Safety of the operator and the unit depend on following these rules.

- Use this system under the terms of the specifications only to avoid any possible danger.
- Read your manual before operating the system.
- Observe local laws when using the instrument.
- DO NOT touch internal wiring!
- DO NOT use higher supply voltage than specified!
- Use only original plugs and cables for harnessing.
- You may not connect higher voltages than rated to any connectors.
- The power cable and connector serve as Power-Breaker. The cable must not exceed 3 meters, the disconnect function must be possible without tools.
- Maintenance must be executed by qualified staff only.
- During the use of the system, it might be possible to access other parts of a more comprehensive system. Please read and follow the safety instructions provided in the manuals of all other components regarding warning and security advice for using the system.
- With this product, only use the power cable delivered or defined for the host country.
- DO NOT connect or disconnect sensors, probes or test leads, as these parts are connected to a voltage supply unit.
- Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal), a non-interruptible safety earth ground must be provided from the mains power source to the product input wiring terminals.
- Please note the characteristics and indicators on the system to avoid fire or electric shocks. Before connecting the system, please read the corresponding specifications in the product manual carefully.

- The inputs must not, unless otherwise noted (CATx identification), be connected to the main circuit of category II, III and IV.
- The power cord separates the system from the power supply. Do not block the power cord, since it has to be accessible for the users.
- DO NOT use the system if equipment covers or shields are removed.
- If you assume the system is damaged, get it examined by authorized personnel only.
- Adverse environmental conditions are Moisture or high humidity Dust, flammable gases, fumes or dissolver Thunderstorm or thunderstorm conditions (except assembly PNA) Electrostatic fields, etc.
- The measurement category can be adjusted depending on module configuration.
- Any other use than described above may damage your system and is attended with dangers like short-circuiting, fire or electric shocks.
- The whole system must not be changed, rebuilt or opened.
- DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until the safe operation can be verified by service-trained personnel. If necessary, return the product to Dewesoft sales and service office for service and repair to ensure that safety features are maintained.
- If you assume a more riskless use is not provided anymore, the system has to be rendered inoperative and should be protected against inadvertent operation. It is assumed that a more riskless operation is not possible anymore if the system is damaged obviously or causes strange noises. The system does not work anymore. The system has been exposed to long storage in adverse environments. The system has been exposed to heavy shipment strain.
- Warranty void if damages caused by disregarding this manual. For consequential damages, NO liability will be assumed!
- Warranty void if damage to property or persons caused by improper use or disregarding the safety instructions.
- Unauthorized changing or rebuilding the system is prohibited due to safety and permission reasons (CE).
- Be careful with voltages >25 VAC or >35 VDC! These voltages are already high enough in order to get a perilous electric shock by touching the wiring.
- The product heats during operation. Make sure there is adequate ventilation. Ventilation slots must not be covered!
- Only fuses of the specified type and nominal current may be used. The use of patched fuses is prohibited.
- Prevent using metal bare wires! Risk of short circuit and fire hazard!
- DO NOT use the system before, during or shortly after a thunderstorm (risk of lightning and high energy over-voltage). An advanced range of application under certain conditions is allowed with therefore designed products only. For details please refer to the specifications.
- Make sure that your hands, shoes, clothes, the floor, the system or measuring leads, integrated circuits and so on, are dry.
- DO NOT use the system in rooms with flammable gases, fumes or dust or in adverse environmental conditions.
- Avoid operation in the immediate vicinity of high magnetic or electromagnetic fields, transmitting antennas or high-frequency generators, for exact values please refer to enclosed specifications.
- Use measurement leads or measurement accessories aligned with the specification of the system only. Fire hazard in case of overload!

- Lithium ion batteries are classified as not hazardous when used according to the recommendations of the manufacturer described in Battery Safety Data Sheet, which is available for download from [this link](#).
- Do not switch on the system after transporting it from a cold into a warm room and vice versa. The thereby created condensation may damage your system. Acclimatise the system unpowered to room temperature.
- Do not disassemble the system! There is a high risk of getting a perilous electric shock. Capacitors still might be charged, even if the system has been removed from the power supply.
- The electrical installations and equipment in industrial facilities must be observed by the security regulations and insurance institutions.
- The use of the measuring system in schools and other training facilities must be observed by skilled personnel.
- The measuring systems are not designed for use in humans and animals.
- Please contact a professional if you have doubts about the method of operation, safety or the connection of the system.
- Please be careful with the product. Shocks, hits and dropping it from already- lower level may damage your system.
- Please also consider the detailed technical reference manual as well as the security advice of the connected systems.
- This product has left the factory in safety-related flawlessness and in proper condition. In order to maintain this condition and guarantee safety use, the user has to consider the security advice and warnings in this manual.

EN 61326-3-1:2008

IEC 61326-1 applies to this part of IEC 61326 but is limited to systems and equipment for industrial applications intended to perform safety functions as defined in IEC 61508 with SIL 1-3.

The electromagnetic environments encompassed by this product family standard are industrial, both indoor and outdoor, as described for industrial locations in IEC 61000-6-2 or defined in 3.7 of IEC 61326-1.

Equipment and systems intended for use in other electromagnetic environments, for example, in the process industry or in environments with potentially explosive atmospheres, are excluded from the scope of this product family standard, IEC 61326-3-1.

Devices and systems according to IEC 61508 or IEC 61511 which are considered as “operationally well-tried”, are excluded from the scope of IEC 61326-3-1.

Fire-alarm and safety-alarm systems, intended for the protection of buildings, are excluded from the scope of IEC 61326-3-1.

7.3. Documentation version history

Version	Date	Notes
V23-1	30.10.2023	- Initial version of the manual including: specifications and characteristics, technical drawing, corresponding cable