Genesis
HIGH SPEED

# User manual

English


# Ultra-Stable High Precision Sensors

## Current Transducers

HBM

A05305_02_E00_00 HBK: UNRESTRICTED

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**Trademarks and patents**
StatStream® is a registered trademark of HBK in the European Union and a trademark in other countries.

StatStream® is patented in the US, Patent No. 7,868,886; patent pending in other countries.

**Legal statement**
This product uses GNU General Public Licensed (GPL) software, the source code is available at:
www.hbm.com/highspeed

For more information please refer to the following website:
www.gnu.org

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit.
www.openssl.org/

## Table of Contents

# 1 About this manual

## 1.1 Symbols used in this manual

The following symbols are used throughout this manual to indicate warnings and cautions.

**WARNING**

**Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

**WARNING**

**Indicates an electrical shock hazard which, if not avoided, could result in death or serious injury.**

**CAUTION**

**Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury; or alerts against unsafe practices; or alerts against actions which could damage the product or result in a loss of data.**

**CAUTION**

**The ESD susceptibility symbol indicates that handling or use of an item may result in damage from ESD if proper precautions are not taken.**

**HINT/TIP**

The info icon indicates sections which provide additional information about the product. This information is not essential for correct operation of the current transducer, but provides knowledge to make better use of the current transducer.

# 2 Safety Messages

## 2.1 Introduction

**IMPORTANT**

**Read this section before using this product!**

The current transducer is mains powered and protective ground connections are required (unless otherwise specified for certain parts).

This manual contains information and warnings that must be observed to keep the current transducer safe. The current transducer should not be used when environmental conditions exceed the current transducer's specifications (e.g. damp, high humidity) or if the unit is damaged.

For the correct and safe use of this current transducer, it is essential that both operating and service personnel follow generally accepted safety procedures in addition to the safety precautions specified in this manual.

Whenever it is likely that safety protection has been impaired, the current transducer must be made inoperative and secured against any unintended operation. Qualified maintenance or repair personnel should be informed. Safety protection is likely to be impaired if, for example, the current transducer shows visible damage or fails to operate normally.

**Appropriate use**
This power supply and the connected current transducers may be used only for measurement tasks. Any other use is not appropriate. To ensure safe operation, the current transducer may only be used as specified in this user manual.

- The covers protect the user from live parts and should only be removed by suitably qualified personnel for maintenance and repair purposes.
- The current transducer must not be operated with the covers removed.
- The current transducer must not be used in life support roles.
- There are no user serviceable parts inside the power supply and current transducers.

It is also essential to follow the respective legal and safety regulations for specific applications during use. The same applies to the use of accessories. Additional safety precautions must be taken in setups where malfunctions could cause major damage, loss of data or even personal injury.
Some examples of precautions are: mechanical interlocking, error signaling, limit value switches, etc.

**Maintenance and cleaning**
The current transducer is a maintenance-free product. However, please note the following information about cleaning the housing:

- Before cleaning, disconnect the current transducer completely.
- Clean the housing with a soft, slightly damp (not wet!) cloth. Never use solvents, since these could damage the housing or the labeling on the front panel.
- When cleaning, ensure that no liquid gets into the housing or connections.

**General dangers, failing to follow the safety instructions**
This current transducer is a state-of-the-art device and as such is fail-safe. Using this current transducer may be hazardous if it has been installed incorrectly and is operated by untrained personnel. Any person assigned to install, maintain or repair the unit or to put the unit into operation must have first read and understood the user manual, particularly the technical safety instructions.

**Residual risks**
The current transducer's scope of supply and performance covers only a small area of measurement technology. In addition, equipment planners, installers and operators should plan, implement and respond to the safety engineering considerations of measurement technology in such a way as to minimize any residual risks. Prevailing regulations must be complied with at all times. The residual risks of the measurement technology must be referenced.

**Conversions and modifications**
Neither the design nor the safety features of the current transducer may be modified without our express prior written agreement. Any modification shall exclude all liability on our part for any resultant damage. In particular, any repair or soldering work on cards (replacement of components) is prohibited. When exchanging complete units, use only original parts from HBM. The unit is delivered from the factory with a fixed hardware and/or software configuration. Changes should only be made within the possibilities documented in this manual.

**Qualified personnel**

People entrusted with the installation, fitting, operation of the current transducer and putting the unit into service must have the appropriate qualifications. The current transducer may only be installed and used by qualified personnel, in strict accordance with the specifications and the safety rules and regulations. This includes people who meet at least one of the three following qualification levels:

- Project personnel: Have a working knowledge of the safety concepts of automation and test and measurement technology.
- Automation plant or test and measurement operating personnel: Have been instructed on how to handle the equipment and are familiar with the operation of the cards and technologies described in this documentation.
- Commissioning engineers or service engineers: Have successfully completed the training on how to repair the automation systems. They are also authorized to activate, to ground and to label circuits and equipment in accordance with engineering safety standards. It is essential that the legal and safety requirements for the product and any accessories are complied with during use.

## 2.2 FCC and general

The first WARNING note below is required by the FCC (Federal Communications Commission) and relates only to the interference potential of this equipment. This message is a direct quotation.

**WARNING**

**The equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. As temporarily permitted by regulation, it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart B or Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.**

## 2.3 Grounding

The current transducer must be used with a protective ground connection via the protective ground conductor of the supply cable. The protective ground conductor is connected to the current transducer before the line and neutral connections are made when the supply connection is made. If the final connection to the supply is made elsewhere, ensure that the ground connection is made before line and neutral connections are made.

**WARNING**

**Any current transducer of the ground connection, inside or outside the current transducer, is likely to make the current transducer dangerous. Intentional interruption is prohibited.**

For protection against electric shock, all external circuits or equipment need a safe insulation. Therefore, peripheral equipment must not be connected to the system with a power supply without the SELV (Separated Extra Low Voltage) rating unless explicitly mentioned.

Signal connections to the current transducer should be connected after the ground connection is made and disconnected before the ground connection is removed, i.e. the supply lead must be connected whenever signal leads are connected.

**WARNING**

**For safety, it is essential that the protective ground connector of the current transducer is used whenever voltages greater than 33 V RMS, 46.7 V PEAK or 70 V DC (IEC 61010-1:2010) are connected. This is to prevent the current transducer's case becoming live in the event of a protective ground interruption, which could occur if the supply connector is accidentally disconnected from the current transducer.**

The primary purpose of protective grounding is to provide adequate protection against electric shock that could cause death or injury to personnel while working on de-energized equipment. This is accomplished by grounding and bonding to limit the body contact or exposure to voltages at the work-site to a safe value if the equipment were to be accidentally energized from any source of hazardous energy. The greatest source of hazardous energy in most cases is direct energizing of the equipment from a power-system or source.

**WARNING**

**If connection to a protective ground is not possible for any reason, then please refer to the international safety standard EN 50191:2000**

### 2.3.1 Mains power cord

**WARNING**

**Do not use the equipment with damaged cords and/or cables. Replace a damaged cord and/or cable immediately.**

## 2.4 Current transducer symbols

A variety of symbols can be found in the system. Below is a list of symbols and their meaning.

This symbol is used to denote the measurement ground connection. This point is not a protective ground connection.

This symbol is used to denote a protective ground connection.

This symbol is used to denote a frame or chassis ground connection. This point is not a protective ground connection.

Where caution is required, this symbol refers to the user manual for further information.

This symbol warns that high voltages are present close to this symbol.

This symbol shows that the switch is a power switch. When pressed, the current transducer state toggles between the operating and power-off mode. When the system is in power-off mode, all electronics are disconnected from the power, except for a small circuit used to detect the switch state.

## 2.5 Protection and isolation

### 2.5.1 Measurement categories

- The international standards for test equipment safety are IEC 61010-1 and the IEC 61010-2-030.
- IEC 61010-1 defines three overvoltage categories (CAT II, CAT III, and CAT IV) for the power supply of a current transducer.
- IEC 61010-2-030 defines three measurement categories (CAT II, CAT III, and CAT IV) for a current transducer's input measurements which can be directly connected to mains supply.
- All measurement inputs which are not specified to be connected to the mains power have no CAT rating and are referred to as O (like Others).

**Categories in accordance with IEC 61010-2-030:2017**
Electrical equipment, specifically measurement tools, can be assigned into four categories in accordance with IEC 61010-2-030:2017. These measurement categories are indicated by the terms O (previously CAT I), CAT II, CAT III and CAT IV. Originally, these categories were used to indicate the overvoltage or surge voltage that was likely to occur and could be sustained by the equipment. Currently, the category indicates the amount of energy that can be released if a short circuit occurs. A higher category number indicates a higher energy level that can occur and can be sustained by the equipment.

**O** (Other) (previously referred to as **CAT I**): This category is for measurements not directly connected to a mains supply. Measurements for this category are signal levels, regulated low voltage circuits or protected secondary circuits. For this category, there are no defined standard overvoltage or surge impulse levels.

**CAT II**: This category is for measurements directly connected to a low voltage mains supply. Measurements for this category are mains sockets in household applications or portable tools. This category expects a minimum of three levels of overcurrent protection between the transformer and connection point of the measurement. (See Figure 2.1).

**CAT III**: This category is for measurements directly connected to the distribution part of a low voltage mains installation. Measurements for this category are circuit breakers, wiring, junction boxes, etc. This category expects a minimum of two levels of overcurrent protection between the transformer and connection point of the measurement. (See Figure 2.1).

**CAT IV**: This category is for measurements directly connected to the source of a low voltage mains installation. Measurements for this category are overcurrent protection devices, ripple control units, etc. This category expects that there is a minimum of one level of overcurrent protection between the transformer and connection point of the measurement circuit. (See Figure 2.1).

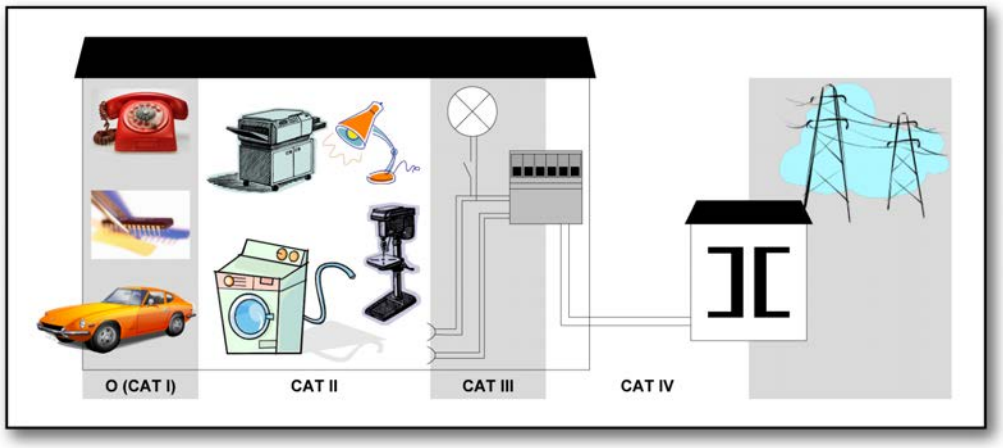



**Figure 2.1:** Category indication in accordance with IEC 61010-2-030:2017

**Example:** A measurement device is specified as 600 V CAT II, maximum input voltage 1000 V DC.

*Table 2.1: Insulation test voltages in accordance with IEC 61010-2-030:2017*

| Nominal Voltage (V RMS or V DC) | IEC 61010-2-030:2017 | | | | | |
|---|---|---|---|---|---|---|
| | 5 sec. AC test (V RMS) | | | Impulse test (V) | | |
| | CAT II | CAT III | CAT IV | CAT II | CAT III | CAT IV |
| ≤ 150 | 840 | 1390 | 2210 | 1550 | 2500 | 4000 |
| > 150 ≤ 300 | 1390 | 2210 | 3310 | 2500 | 4000 | 6000 |
| > 300 ≤ 600 | 2210 | 3310 | 4260 | 4000 | 6000 | 8000 |
| > 600 ≤ 1 000 | 3310 | 4260 | 6600 | 6000 | 8000 | 12000 |

Using the table above, it can be concluded that this specification informs the user that the device passed the insulation tests; 5 sec at 2210 V RMS and impulse 4000 V. The maximum operating input voltage is 1000 V DC. This device is to be used to measure CAT II circuitry up to 600 V.

**WARNING**

**Measurement inputs of the current transducer should not be used to measure high-energy signals of measurement categories CAT II, CAT III or CAT IV (IEC 61010-2-030:2017) (e.g. mains measurements) , unless specifically stated for the specific input.**

### 2.5.2 Basic insulation versus reinforced

For reference, the basic insulation and supplementary insulation and the reinforced insulation test values for CAT II can be found below.

*Table 2.2: Test voltages for the testing electric strength of solid insulation in measuring circuits in measurement category II (IEC 61010-2-030:2017)*

| Nominal voltage line to neutral AC RMS or DC of MAINS being measured. [V] | Test voltage | | | |
|---|---|---|---|---|
| | 5 s AC test [V RMS] | | Impulse test [V peak] | |
| | Basic insulation and supplementary insulation | Reinforced insulation | Basic insulation and supplementary insulation | Reinforced insulation |
| ≤ 150 | 840 | 1390 | 1550 | 2500 |
| > 150 ≤ 300 | 1390 | 2210 | 2500 | 4000 |
| > 300 ≤ 600 | 2210 | 3510 | 4000 | 6400 |
| > 600 ≤ 1000 | 3310 | 5400 | 6000 | 9600 |

Several means of protection can be used to protect a user from hazardous voltages. As can be seen below, basic insulation and supplementary insulation is one mean of protection, but reinforced insulation is also a means of protection.
The test voltages are different for each mean of protection, as can be found in the table above.

**Additional means of protection for single fault conditions**
Accessible parts shall be prevented from becoming HAZARDOUS LIVE IN SINGLE FAULT CONDITION. The primary means of protection (see Figure 2.2) shall be supplemented by one of **A**, **B**, **C** or **D**. Alternatively, one of the single means of protection **E** or **F** shall be used. See Figure 2.2.

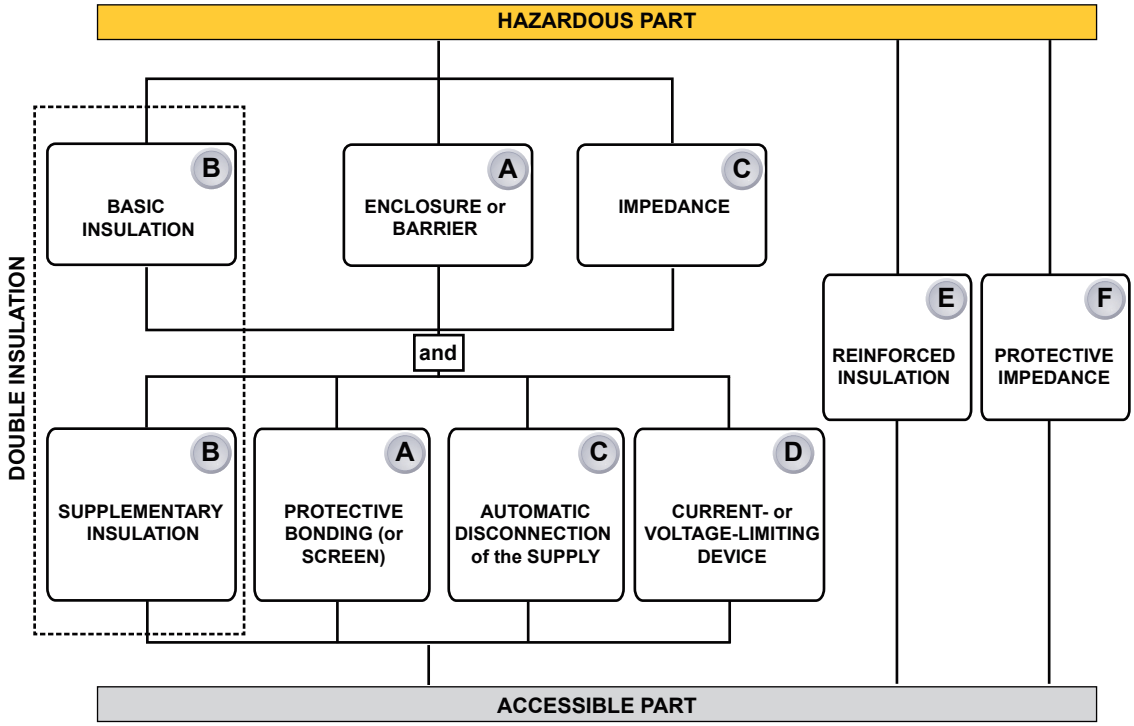



**Figure 2.2:** Acceptable arrangement of protective means against electric shock

Example: A measurement device is specified as 600 V CAT II reinforced insulation, with a maximum input voltage 1000 V DC.
Using the information above, it can be concluded that this specification informs the user that the measurement device is tested on input to chassis ground for five seconds at 3510 V RMS and impulse 6400 V. The maximum operating input voltage is 1000 V DC. This device is to be used to measure CAT II circuitry up to 600 V.

### 2.5.3 Protection

**WARNING**

**ELECTRICAL SHOCK HAZARD!**
**Any interruption of the protective conductor inside or outside the apparatus is likely to make the apparatus dangerous. Intentional interruption is prohibited.**
**When the apparatus is connected to its supply, terminals may be live, and the opening of covers for removal of parts is likely to expose live parts.**

Whenever it is likely that the protection has been impaired, the apparatus must be made inoperative and be secured against any unintended operation.

The protection is likely to be impaired if, for example, the apparatus shows visible damage or has been subjected to severe transport stresses.

It is the responsibility of the user to ensure the safety of any accessories used with the equipment, such as probes.

**WARNING**

**ELECTRICAL SHOCK HAZARD! Do not remove covers. Refer servicing to qualified individuals.**

Proper use of this device depends on careful reading of all instructions and labels.

If the current transducer is used in a manner not specified by HBM, the protection provided by the current transducer can be impaired.

**WARNING**

**The current transducer must not be operated in explosive atmospheres.**

**WARNING**

**The current transducer and related accessories are not designed for biomedical experimentation on humans or animals and should not be directly connected to human or animal subjects or used for patient monitoring.**

### 2.5.4 Overvoltage/current protection

All signal inputs are protected against overloads and transients. Exceeding the limits stated in the specifications, particularly when connected to potentially high-energy sources, can cause severe damage that is not covered by the manufacturer's warranty.

**WARNING**

**Do not remove covers. Refer to qualified individuals for servicing.**

The covers protect the user from live parts and should only be removed by suitably qualified personnel for maintenance and repair purposes.

The current transducer must not be operated with the covers removed.

There are no user serviceable parts inside.

### 2.5.5 Isolation

**CAUTION**

**For input channels with plastic BNCs (galvanically isolated from the chassis), the input conductors including the BNC shell may carry hazardous voltages. Only appropriate insulated BNC connectors should be used.**

It is the responsibility of the user to ensure the safety of any accessories used with the current transducer, such as probes.

**CAUTION**

**Even low voltage inputs may contain high voltage fast transients (spikes), which could damage the input. For this reason it is not safe, for instance, to make direct connections to an AC line supply, unless specifically stated otherwise for the specific input.**

## 2.6 Environment

The current transducer should be operated in a clean, dry environment with an ambient temperature as specified in the data sheets.

The current transducer is specified for use in a Pollution Degree II environment, which is normally non-conductive with temporary light condensation, but it must not be operated while condensation is present. It should not be used in more hostile, dusty or wet conditions, as specified in the Pollution Degree II environment.

Humidity should be between 0% and 80%. When moving the device from a cold to a warm environment, the device has to be left off for a period of 30 minutes to avoid short circuits as a result of condensation.

**Note** *Direct sunlight, radiators and other heat sources should be taken into account when assessing the ambient temperature.*

Do not store the equipment in hot areas. High temperatures can shorten the life of electronic devices and damage batteries.

Do not store the equipment in cold areas. Before the equipment warms up to its normal operating temperature, moisture can form inside the equipment, which may damage the equipment's electronic circuits.

Do not drop, knock or shake the equipment. Rough handling can break internal electronics and/or PCBs.

Do not use harsh chemicals, cleaning solvents or strong detergents to clean the current transducer. To clean the current transducer, disconnect all power sources and clean the housing with a soft, slightly damped (not wet!) cloth.

It is the responsibility of the user to ensure the safety of any accessories used with the current transducer, such as probes.

## 2.7 Safety information

**WARNING**

**Read the chapter before undertaking any action with the measuring device. For all information considered inadequate, please contact the manufacturer or your local representative.**

**WARNING**

**DO NOT TRY TO DISASSEMBLE THE UNIT.**
**If the green transducer diode is not operating when the system is powered up, disconnect power and contact HBK for further instructions.**
**If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.**

**CAUTION**

**This device is designed for indoor applications. Refer to the datasheet for the operating conditions.**

**CAUTION**

**It is mandatory to support the power supply unit when rack mounted, either on the sides or backside.**

## 2.8 International safety warnings

Dansk

**SIKKERHEDSADVARSEL**
Denne strømtransducer skal anvendes med en sikkerhedsjordforbindelse, som er tilsluttet via lysnetkablets beskyttelsesjordledning eller via en sikkerhedsjordklemme, hvis strømtransduceren er forsynet hermed. Hvis sikkerhedsjordforbindelsen afbrydes, inden i eller uden for strømtransduceren, kan strømtransduceren udgøre en farekilde. Sikkerhedsjordforbindelsen må ikke afbrydes. Der skal desuden tilsluttet en signaljordforbindelse, hvis et indgangssignal overstiger 33 V RMS, 46,7 V PEAK eller 70 V DC (IEC 61010-1:2010).

Dækslerne må ikke fjernes.

Afbryd denne strømtransducer eller dens strømforsyning fra lysnettet ved at fjerne IEC-stikket. Strømtransducerens vekselstrømsafbryder er kun beregnet til funktionelle formål. Den er ikke beregnet eller egnet til at afbryde strømtransduceren fra lysnettet.

Hvis målingerne et omfattet af EN 50110-1 og EN 50110-2, skal alle kort med en driftsspænding på mere end 50 V AC RMS eller 120 V DC tilsluttes af en kvalificeret tekniker eller en elektriker, og arbejdet skal kontrolleres af en kvalificeret tekniker. (En kvalificeret tekniker er en person, som i kraft af sin specialuddannelse, sin viden og erfaring samt sit kendskab til relevante bestemmelser kan vurdere omfanget af det arbejde, de skal udføre, og afdække de potentielle risici, og som er blevet udpeget som kvalificeret tekniker af deres arbejdsgiver).

## Nederlands

**VEILIGHEIDSWAARSCHUWING**
Deze stroomtransducer mag uitsluitend worden gebruikt als een beschermde massa (aarde) is aangesloten via de beschermde massageleider van de voedingskabel, of indien de stroomtransducer daarvan is voorzien via de veiligheids-massa-aansluiting. Als de beschermde massa, binnen of buiten de stroomtransducer, wordt onderbroken, dan kan dat hierdoor uitermate gevaarlijk worden. Het opzettelijk onderbreken van de massa is verboden. Indien er een signaal wordt aangeboden van meer dan 33 V RMS, 46.7 Vpeak of 70 V DC (IEC 61010-1:2010) dient eveneens een signaalaarding aangesloten te zijn.

De deksels mogen nooit worden verwijderd.

Om deze stroomtransducer los te koppelen of van het stroom af te halen, dient de IEC-aansluiting er uit te worden getrokken. De wisselstroom-voedingsschakelaar op de stroomtransducer is uitsluitend bestemd voor functionele doeleinden. Het is niet bedoeld of geschikt als een ontkoppelingsapparaat.

Voor metingen die binnen de EN 50110-1 en EN 50110-2 vallen: let op dat alle panelen met bedrijfsspanningen van meer dan 50 V AC RMS of 120 V DC alleen door een gekwalificeerde technicus mogen worden aangesloten of door een persoon die is opgeleid in de elektrotechniek en onder toezicht van een gekwalificeerde technicus staat. (Gekwalificeerde technici zijn personen, die op basis van hun specialistische opleiding, kennis en ervaring als ook hun kennis van de betreffende voorzieningen, in staat zijn om het werk dat aan hen is toevertrouwd te beoordelen en mogelijke gevaren te ontdekken en door hun werkgever zijn aangewezen als gekwalificeerde technici.)

## Suomi

**TURVAOHJEITA**

Tätä virta-anturia käytettäessä sen tulee olla suojamaadoitettu joko verkkojohdon suojajohtimen tai erillisen suojamaadoitusliitännän kautta, mikäli virta-anturiin on sellainen asennettu. Suojamaadoituksen katkaiseminen virta-anturin sisä- tai ulkopuolelta tekevät siitä vaarallisen. Tahallinen katkaisu on kiellettyä. Lisäksi signaalimaa on oltava kytkettynä, jos jokin tulosignaali ylittää tehollisarvon 33 V, huippuarvon 46,7 V tai 70 V DC (IEC 61010-1:2010).

Älä poista suojakansia.

Katkaise virta-anturin tai sen virtalähteen käyttöjännite irrottamalla IEC-liitin. Virta-anturin verkkokytkimellä on ainoastaan toiminnallinen tarkoitus. Sitä ei ole tarkoitettu, eikä se sovellu virta-anturin erottamiseen käyttöjännitteestä.

Mittauksissa, jotka kuuluvat EN 50110-1- ja EN 50110-2-standardien soveltamisalaan, huomaa, että kortit, jotka toimivat tehollisarvojännitteellä yli 50 V AC tai 120 V DC, saa kytkeä vain pätevä asentaja tai sähköteknisen koulutuksen saanut henkilö pätevän asentajan valvonnassa. (Pätevät asentajat ovat henkilöitä, jotka erikoiskoulutuksensa, tietojensa ja kokemuksensa sekä asiaan kuuluvien määräysten tuntemuksensa ansiosta pystyvät arvioimaan heille annettuja töitä ja havaitsemaan mahdolliset vaarat ja jotka heidän työnantajansa on nimennyt ammattitaitoisiksi asentajiksi).

Français

**ATTENTION - DANGER!**
Lorsqu'il est en fonctionnement, ce convertisseur de courant doit impérativement être mis à la masse par le conducteur de terre du câble d'alimentation ou, si le convertisseur de courant en comporte une, par la borne de terre. Il peut être dangereux en cas de coupure du circuit de terre, que ce soit à l'intérieur ou à l'extérieur du convertisseur de courant. Il est formellement interdit de couper intentionnellement le circuit de terre. De plus, une masse signal doit être connectée si l'un des signaux d'entrée, quel qu'il soit, dépasse 33 V RMS (valeur efficace), 46,7 V PEAK (valeur de crête) ou 70 V DC (courant continu) (CEI 61010-1:2010).

Ne pas déposer les panneaux de protection.

Pour déconnecter ce convertisseur de courant ou son alimentation de l'alimentation secteur, débrancher le cordon d'alimentation (CEI). L'interrupteur d'alimentation secteur sur ce convertisseur de courant est purement fonctionnel. Il ne s'agit pas d'un dispositif de coupure du courant, et n'est pas conçu pour cette fonction.

Pour les mesures entrant dans le champ d'application des normes EN 50110-1 et EN 50110-2, veuillez noter que tous les panneaux avec des tensions de service supérieures à 50 V AC RMS (tension efficace) ou 120 V DC (courant continu) ne peuvent être connectés que par un technicien qualifié ou une personne formée en ingénierie électrique et supervisée par un technicien qualifié. (Les techniciens qualifiés sont des personnes qui, du fait de leur formation, leurs connaissances et leur expérience spécialisées ainsi que leur connaissance des dispositions réglementaires appropriées, sont capables d'évaluer le travail qui leur est confié et détecter les risques possibles, et qui ont été désignées comme techniciens qualifiés par leur employeur).

Deutsch

**WARNHINWEIS!**
Dieser Stromwandler muss mit einer Schutzerde betrieben werden, die über den Schutzleiter des Speisekabels oder über die Erdungsklemme des Stromwandlers (falls vorhanden) anzuschließen ist. Bei einer Unterbrechung der Schutzerde außerhalb oder innerhalb des Stromwandlers kann eine Gefahr am Stromwandler entstehen. Eine beabsichtigte Unterbrechung ist nicht zulässig. Achtung! Bei Signalspannungen über 33 V Effektivwert, 46,7 V Spitzenwert oder 70 V Gleichspannung (IEC 61010-1:2010) muss die Signalmasse angeschlossen sein.

Die Schutzabdeckungen nicht entfernen.

Zum Trennen des Stromwandlers oder seiner Spannungsversorgung von der Wechselstromversorgung den IEC-Stecker abziehen. Der Wechselstromversorgungs-Schalter dient bei diesem Stromwandler nur für Funktionszwecke. Er ist nicht als Trennvorrichtung bestimmt bzw. geeignet.

Für Messungen gemäß EN 50110-1 und EN 50110-2 bitte berücksichtigen, dass alle Platinen mit Betriebsspannungen über 50 V AC RMS oder 120 V DC nur durch einen qualifizierten Elektriker oder einer elektrotechnisch unterwiesenen Person unter Aufsicht eines qualifizierten Technikers durchgeführt werden dürfen. (Qualifizierte Techniker sind aufgrund ihrer fachlichen Ausbildung, Kenntnisse und Erfahrungen sowie Kenntnis der einschlägigen Bestimmungen in der Lage, die ihnen anvertrauten Arbeiten zu beurteilen und mögliche Risiken zu erkennen, sowie Personen, die durch ihren Arbeitgeber zu qualifizierten Technikern ernannt worden sind).

Italiano

**AVVISO DI SICUREZZA**
Questo trasduttore di corrente deve esser utilizzato con un collegamento protettivo di messa a terra tramite il filo di messa a terra del cavo di alimentazione o tramite il terminale di messa a terra in sicurezza, nel caso in cui il trasduttore di corrente ne sia dotato. Qualsiasi interruzione della messa a terra di protezione, sia all'interno che all'esterno del trasduttore di corrente, lo renderà pericoloso. È vietata qualsiasi interruzione causata intenzionalmente. Inoltre, la connessione di terra deve essere collegata se ad uno qualsiasi degli ingressi viene applicato un segnale superiore a 33 V RMS, 46,7 V di picco o 70 V c.c. (IEC 61010-1:2010).

Non aprire il trasduttore di corrente.

Per disinnestare questo trasduttore di corrente o l'alimentazione dalla corrente alternata, scollegare il connettore IEC. L'interruttore dell'alimentazione a corrente alternata di questo trasduttore di corrente viene fornito esclusivamente per scopi operativi e non viene inteso, né è adatto, per essere utilizzato come dispositivo di disinnesto.

Si noti che per le misurazioni che rientrano nell'ambito di applicazione delle norme EN 50110-1 ed EN 50110-2, tutte le schede con tensioni di esercizio superiori a 50 V c.a. RMS o 120 V c.c. possono essere collegate esclusivamente da un tecnico qualificato o da una persona in possesso di una formazione specifica nel campo dell'ingegneria elettrica sotto la supervisione di un tecnico qualificato. (Per tecnico qualificato si intende una persona che, in virtù della propria formazione , preparazione ed esperienza specialistica, nonché conoscenza delle disposizioni di settore, è in grado di valutare il lavoro che gli viene assegnato e di individuare possibili rischi, oltre ad essere stato nominato tecnico qualificato dal proprio datore di lavoro).

## Norsk

**ADVARSEL!**
Denne strømtransducer må betjenes med beskyttelsesjord tilkoblet via beskyttelsesjordlederen til tilførselskabelen eller via beskyttelsesjordklemmen, hvis strømtransduceren er utstyrt med en slik. Ethvert brudd i beskyttelsesjorden inni eller utenpå strømtransduceren kan føre til at strømtransduceren blir farlig. Tiltenkt brudd er tillatt. I tillegg må en signaljord tilkobles hvis et inngangssignal overskrider 33 V RMS, 46,7 V PEAK eller 70 V DC (IEC 61010-1:2010).

Ikke fjern dekslene.

For å koble denne strømtransducer eller dens strømforsyning fra AC-tilførselen, trekker du ut IEC-kontakten. AC-tilførselsbryteren på denne strømtransducer er kun for funksjonelle formål. Den er ikke beregnet for, eller egnet til frakoblingsenhet.

For målinger som faller innenfor EN 50110-1 og EN 50110-2 må man være oppmerksom på at alle kort med arbeidsspenninger over 50 V AC RMS eller 120 V DC kun kan kobles til av en kvalifisert tekniker eller elektriker og overvåket av en kvalifisert tekniker. (Kvalifiserte teknikere er personer som på grunn av sin spesialistopplæring, kunnskap og erfaring, samt sin kunnskap om relevante bestemmelser, er i stand til å gå inn i arbeidet som de har fått i oppdrag å utføre og detektere mulige farer, og som er blitt utnevnt som kvalifiserte teknikere av sin arbeidsgiver.

Português

**AVISO DE SEGURANÇA**
Este transdutor de corrente deve funcionar com uma terra de proteção conectada através do condutor da terra de proteção do cabo de alimentação ou, caso o transdutor de corrente esteja equipado com um, através do terminal da terra de proteção. Qualquer interrupção da terra de proteção, no interior ou no exterior do transdutor de corrente, poderá tornar o transdutor de corrente perigoso. A interrupção intencional é proibida. Além disso, deve ser conectado um sinal de terra se qualquer sinal de entrada exceder 33 V RMS, 46,7 V PICO ou 70 V CC (IEC 61010-1:2010).

Não retirar as tampas.

Para desconectar este transdutor de corrente ou a respetiva fonte de alimentação da alimentação CA, retire o conector IEC da ficha. Neste transdutor de corrente, o interruptor de alimentação CA é fornecido apenas para fins funcionais. Não se destina a, nem é adequado para, ser utilizado como dispositivo de desconexão.

Para medições abrangidas pelas normas EN 50110-1 e EN 50110-2, tenha em atenção que todos os quadros com tensões de funcionamento superiores a 50 V CA RMS ou 120 V CC apenas poderão ser conectados por um técnico qualificado ou por alguém com formação em engenharia elétrica e supervisionados por um técnico qualificado. (Técnicos qualificados são pessoas que, devido à sua formação especializada, ao conhecimento e à experiência, bem como ao seu conhecimento das disposições relevantes, são capazes de avaliar o trabalho que lhes é confiado e detetar possíveis riscos e são pessoas que foram nomeadas técnicos qualificados pelo seu empregador.)

Português (Brasil)

**AVISO DE SEGURANÇA**
Este transdutor de corrente deve ser operado com um terra de proteção conectado por meio do condutor do terra de proteção do cabo de alimentação ou, se o transdutor de corrente estiver equipado com um, por meio do terminal de aterramento de segurança. Qualquer interrupção do terra de proteção, no interior ou no exterior do transdutor de corrente, poderá tornar o transdutor de corrente perigoso. A interrupção intencional é proibida. Além disso, deve ser conectado um sinal de terra se qualquer sinal de entrada exceder um máximo de 33 V RMS, 46,7 V PICO ou 70 V CC (IEC 61010-1:2010).

Não retirar as tampas.

Para desconectar este transdutor de corrente ou a fonte de alimentação dele da alimentação CA, desconecte o conector IEC. Neste transdutor de corrente, o interruptor de alimentação CA é fornecido somente para fins funcionais. Não se destina a, nem é adequado para, ser usado como dispositivo de desconexão.

Para medições no escopo das normas EN 50110-1 e EN 50110-2, note que todos os quadros com tensões de funcionamento superiores a 50 V CA RMS ou 120 V CC poderão somente ser conectados por um técnico qualificado ou por alguém com formação em engenharia elétrica e supervisionados por um técnico qualificado. (Os técnicos qualificados são pessoas que, devido à sua formação acadêmica, conhecimento e experiência, bem como ao seu conhecimento das provisões relevantes, são capazes de avaliar o trabalho que lhes é confiado e detectar possíveis riscos e são pessoas que foram nomeadas técnicos qualificados por seu empregador.)

Español

**ADVERTENCIA SOBRE SEGURIDAD**
Este transductor de corriente debe utilizarse conectado a tierra a través del conductor de puesta a tierra del cable de alimentación o de la borna de seguridad, si dicho transductor de corriente estuviera equipado con ella. Cualquier interrupción de esta puesta a tierra, dentro o fuera del transductor de corriente, hará que el manejo del mismo resulte peligroso. Queda terminantemente prohibido dejar en circuito abierto dicha puesta a tierra. Además, debe conectarse una señal de tierra si cualquier señal de entrada sobrepasa los 33 V eficaces, los 46,7 V de PICO o los 70 V de CC (IEC 61010-1:2010).

No quite las tapas.

Para desconectar este transductor de corriente o su fuente de alimentación de la CA, desenchufe el conector IEC. El interruptor de entrada de CA (encendido) se incluye solo para fines funcionales. No está pensado para utilizarse como medio de desconexión, ni tampoco es adecuado para ello.

En cuanto a las mediciones que se clasifiquen bajo el alcance de las normas EN 50110-1 y EN 50110-2, tenga en cuenta que los cuadros con tensión de funcionamiento por encima de los 50 V de CA eficaces o los 120 V de CC solo puede conectarlos un técnico cualificado o una persona con formación en ingeniería eléctrica y supervisada por un técnico cualificado. (Los técnicos cualificados son personas que, debido a su formación especializada, conocimientos y experiencia, así como por su conocimiento de los suministros pertinentes, son capaces de evaluar el trabajo encomendado y detectar posibles riesgos, al igual que personas nombradas como técnicos cualificados por la empresa contratadora).

Svenska

**SÄKERHETSVARNING**
Denna strömgivare måste användas med jordad anslutning via strömkabelns ledare eller, om sådan finns, via en isolerad jordterminal. Avbrott i den isolerande jordningen inuti eller utanför strömgivaren kan göra strömgivaren farlig. Avsiktligt avbrott är förbjudet. Dessutom måste en signaljordning anslutas om någon ingångssignal överskrider 33 V RMS, 46.7 V PEAK eller 70 V DC (IEC 61010-1:2010).

Ta inte bort skydden.

Dra ut IEC-kontakten för att koppla loss strömgivaren eller dess strömkälla från strömförsörjningen. Brytaren för växelströmförsörjningen på denna strömgivare är endast avsedd för funktionella syften. Den är inte avsedd eller lämplig som frånkopplingsenhet.

För mått inom intervallen som anges i EN 50110-1 och EN 50110-2, observera att alla kort med arbetsspänning över 50 V AC RMS eller 120 V DC kan endast anslutas av en kvalificerad tekniker eller en person som är utbildad i elteknik och övervakas av en kvalificerad tekniker. (Kvalificerade tekniker är personer som på grund av sin specialistutbildning, kunskap och erfarenhet liksom sin kunskap om relevanta enheter kan utvärdera arbetet som tilldelas dem och göra kvalificerade riskbedömningar samt utses av sina arbetsgivare till kvalificerade tekniker).

English

**SAFETY WARNING**

This current transducer must be operated with a protective ground (earth) connection via the protective ground conductor of the supply cable or, if the current transducer is fitted with one, via the protective ground terminal. Any interruption of the protective ground, inside or outside the current transducer, is likely to make the current transducer dangerous. Intentional interruption is prohibited. In addition, a signal ground must be connected if any input signal exceeds 33 V RMS, 46.7 V PEAK or 70 V DC (IEC 61010-1:2010).

Do not remove the covers.

To disconnect this current transducer or its power-supply from the AC supply, unplug the IEC connector. The AC supply switch on this current transducer is provided for functional purposes only. It is not intended, or suitable, as a disconnecting device.

For measurements falling within the scope of the EN 50110-1 and EN 50110-2, please note that all cards with working voltages above 50 V AC RMS or 120 V DC may only be connected by a qualified technician or a person trained in electrical engineering and supervised by a qualified technician. (Qualified technicians are persons who, due to their specialist training, knowledge and experience as well as their knowledge of the relevant provisions are able to assess the work with which they are entrusted and detect possible risks and who have been nominated as qualified technicians by their employer).

日本語

**安全上の警告**
この電流センサの操作は、電源ケーブルの保護接地線で接地（アース）を施した上で行ってください。また、安全接地用端子が存在する場合は、これを経由して本機器を接地してください。電流センサの内部または外部にある保護接地線が遮断されると、電流センサが危険な状態に陥る可能性があります。故意に保護接地線を遮断することを禁止します。また、入力信号が 33V RMS、ピーク時に 46.7V RMS、または 70V DC を超える場合は、信号接地線を接続してください（IEC 61010-1:2010）。

カバーを外さないでください。

この電流センサまたはその電源供給を AC 電源供給から遮断するには、IEC コネクターを抜きます。この電流センサの AC 電源スイッチは、機能上の目的のためだけに提供しています。したがって、機器の主電源遮断用として意図されていないか、適応していません。

EN 50110-1 と EN 50110-2 の適用範囲に該当する測定を行う際、使用電圧が 50 V AC RMS または 120 V DC を超えるすべての基板の接続作業は、適正な資格を持つ技術者が、または電気工学の訓練を受けた者が適正な資格を持つ技術者の監督の下、行わなければなりませんのでご注意ください。(適正な資格を有する技術者とは、専門技術者に向けた訓練を受け、知識と経験を有し、該当する規定についても熟知しているため、委託された作業の内容を評価し、存在する可能性のあるリスクを特定することができ、雇用主により適正な資格を有する技術者として任命されている者を指します。)

## 中文

**安全警告**

该电流传感器必须通过电源电缆的保护接地线连接到保护接地（接地），如果该电流传感器已配备了安全接地端子，则通过该端子接地。断开仪器内外的任何保护接地可能使电流传感器存在危险。严禁有意断开。此外，若任何输入信号高于 33 V RMS, 46.7 V 峰或 70 V DC，则必须将信号接地 (IEC 61010-1:2010)。

不要取下保护盖。

要将此电流传感器或其电源断开交流电源，请拔下 IEC 接头。电流传感器上的交流电源开关仅用于功能性目的。而不是用于或适用于断开设备。

对于 EN 50110-1 和 EN 50110-2 中的测量，请注意：所有工作电压高于 50 V AC RMS 或 120 V DC 的板卡只能由合格的技术人员或在由受过电气工程培训的人员在合格技术人员的监督下进行连接。( 合格技术人员指的是其专业培训、知识和经验以及相关规定的指示能够胜任委托给他们的工作并能检查出可能风险的人，这些人会被其雇主指定为合格技术人员)。

## РУССКИЙ

**ПРЕДУПРЕЖДЕНИЕ**
Для эксплуатации данного преобразователя тока необходимо использовать защитное заземление, подключенное через проводник заземления кабеля питания или через терминал защитного заземления, если преобразователь тока оснащен таковым. В случае прерывания защитного заземления (внутри или снаружи прибора) преобразователь тока может стать травмоопасным. Преднамеренное прерывание заземления запрещено. Кроме того, необходимо подключить сигнальное заземление, если напряжение входного сигнала превышает 33 В среднеквадр. знач., 46,7 В пиков. знач. или 70 В пост. тока (IEC 61010-1:2010).

Не демонтируйте крышки.

Для отключения данного преобразователя тока или его блока питания от сети переменного тока отсоедините разъем IEC. Переключатель питания переменного тока данного преобразователя тока предусмотрен только для функциональных целей и не должен использоваться в качестве устройства отключения.

Для проведения измерений в соответствии со стандартами EN 50110-1 и EN 50110-2 следует учесть, что подключение всех плат, рабочее напряжение которых превышает 50 В перемен. тока среднеквадр. знач. или 120 В пост. тока, может выполнять только квалифицированный технический персонал или сотрудники, прошедшие курс обучения по электротехнике, под наблюдением квалифицированного персонала. (Квалифицированным техническим персоналом считаются сотрудники, которые после специальной подготовки, получения требуемых знаний и опыта, а также знакомые с основными процедурами, способны оценить доверенную им работу, определив возможные риски. При этом назначение на должность квалифицированного технического работника осуществляет работодатель.)

## 안전 경고

**안전 경고**
본 전류 트랜스듀서는 반드시 보안용 접지(접지)가 전원 공급 장치 케이블의 보안용 접지 도 체를 통해 연결된 상태에서 작동해야 하며, 접지가 장착된 경우에는 보안용 접지 터미널을 통해 작동해야 합니다. 전류 트랜스듀서 내부 혹은 외부적으로 접지 방해 요인이 있는 경우 사용자에게 위험할 수 있습니다. 고의적인 방해는 금지됩니다. 또한, 입력 신호가 **33 V RMS, 46.7 V** 피크 또는 **70 V DC (IEC 61010-1:2010)**를 초과하는 경우 신호 접지를 연결해야 합니다.

덮개를 제거하지 마십시오.

**AC** 공급 전원으로부터 이 전류 트랜스듀서 또는 전원 공급 장치를 분리하려면 **IEC** 커넥터를 뽑으십시오. 본 전류 트랜스듀서의 **AC** 전원 공급 스위치를 장비 작동 외에 다른 용도로 사용하지 마십시오. 본 스위치는 단절 용도로 설계되지 않았으며, 이에 적합하지도 않습니다.

**EN 50110-1** 및 **EN 50110-2** 범위에 속한 측정값의 경우, **50 V AC RMS** 또는 **120 V DC** 를 초과하는 작동 전압의 모든 보드는 검증된 전문 기사 또는 전기 공학 교육을 받고 검증된 전문 기사의 감독을 받는 사람만이 연결할 수 있습니다. (검증된 전문 기사는 전문가 교육, 지식 및 경험뿐만 아니라 관련 규정의 지식을 보유하고 있어 그들에게 위임된 작업을 수행하고 가능한 위험을 탐지할 수 있으며 고용주가 자격을 갖춘 기술자로 지명한 사람입니다.)

## 2.9 Operation of electrical installations

Working on, with, or near electrical installations implies certain dangers. These electrical installations are designed for the generation, transmission, conversion, distribution and use of electrical power. Some of these electrical installations are permanent and fixed, such as a distribution installation in a factory or office complex, others are temporary, such as on construction sites, and others are mobile or capable of being moved either while energized or while neither energized nor charged.

The European Standard EN 50110-1 sets out the requirements for the safe operation of and work activity on, with, or near these electrical installations. The requirements apply to all operational, working and maintenance procedures. The European Standard EN 50110-2 is a set of normative annexes (one per country) which specify either the present safety requirements or give the national supplements to these minimum requirements at the time when this European Standard was prepared.

**WARNING**

**High voltage and qualified personnel**

For measurements falling within the scope of the EN 50110-1 and EN 50110-2, please note that working with voltages above 50 V AC RMS or 120 V DC may only be connected by a qualified technician or a person trained in electrical engineering and supervised by a qualified technician. (Qualified technicians are persons who, due to their specialist training, knowledge and experience, as well as their knowledge of the relevant provisions, are able to assess the work with which they are entrusted and detect possible risks and who have been nominated as qualified technicians by their employer).

# 3 Normative Documents and Declarations

## 3.1 Electrical

### 3.1.1 Electrostatic Discharge (ESD)

When handling disconnected devices, electrostatic discharge (ESD) can cause damage if discharged into or near sensitive components on the device. Take steps to avoid such an occurrence.

**CAUTION**

**HBM uses state-of-the-art electronic components in its equipment. These electronic components can be damaged by discharge of static electricity (ESD). ESD damage is quite easy to induce, often hard to detect, and always costly. Therefore, we must emphasize the importance of ESD preventions when handling a current transducer system, its connections or a plug-in card.**

**Description of ESD**

Static electricity is an electrical charge caused by the buildup of excess electrons on the surface of a material. To most people, static electricity and ESD are nothing more than annoyances. For example, after walking over a carpet while scuffing your feet, building up electrons on your body, you may get a shock - the discharge event - when you touch a metal doorknob. This little shock discharges the built-up static electricity.

**ESD-susceptible equipment**

Even a small amount of ESD can harm circuitry, so when working with electronic devices, take measures to help protect the electronic devices, including the current transducer series system, from ESD harm. Although HBM has built protections against ESD into its products, ESD exists and, unless neutralized, could build up to levels that could harm the equipment. Any electronic device that contains an external entry point for plugging in anything from cables to acquisition cards is susceptible to entry of ESD.

**Precautions against ESD**

Any built-up static electricity should be discharged from the user and the electronic devices before touching an electronic device, before connecting one device to another, or replacing acquisition cards. This can be done in many ways, including the following:

- Grounding oneself by touching a metal surface that is at earth ground. For example, if the computer has a metal case and is plugged into a standard three-prong grounded outlet, touching the case should discharge the ESD on the body.
- Increasing the relative humidity of the environment.
- Installing ESD-specific prevention items, such as grounding mats and wrist straps.

While appropriate precautions to discharge static electricity should always be taken, the user may want to take extra precautions to protect the electronic equipment against ESD if ESD events are observed in the present environment.

**The use of wrist straps**
Use an ESD wrist strap whenever you open a chassis, particularly when you will be handling circuit cards and components. In order to work properly, the wrist strap must make good contact at both ends (with the user's skin at one end, and with the chassis at the other).

**WARNING**

**The wrist strap is intended for static control only. It will not reduce or increase your risk of receiving an electric shock from electrical equipment. Follow the same precautions you would use without a wrist strap.**

**WARNING**

**Wrist straps should only ever be used in situations where no direct power is connected to the circuit or system being handled.**

### 3.1.2 Electromagnetic Compatibility (EMC)

EMC stands for Electromagnetic Compatibility. The overall intention is that electronic equipment must be able to co-exist with other electronic equipment in its immediate vicinity and that the electronic equipment does not emit large amounts of electromagnetic energy. Thus, there are two distinct requirements for electromagnetic compatibility: emission and immunity.

This current transducer generates, accepts and can radiate radio frequency energy and, if not installed and used in accordance with the operator manual, may cause harmful interference to other equipment. However, there is no guarantee that interference will not occur in a particular installation.

Immunity test: All immunity tests are done with the failure criterion being a change of the current transducer's control settings. Any of these tests may produce a spurious trigger. Measurements are not valid during and immediately after the immunity tests.

Whether the current transducer causes interference to other equipment can be determined by turning the current transducer on and off. If the current transducer does cause minor harmful interference to other equipment, the user is encouraged to try reducing the interference by one or more of the following measures:

- Re-orient or relocate the affected equipment.
- Increase the distance between the current transducer and the affected equipment.
- Re-orient or relocate interface cables.
- Connect the current transducer to an outlet on a different supply circuit to the affected equipment.

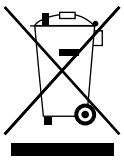
Electrical supply cables, interface cables and probes should be kept as short as practical, preferably a maximum of 1 m. Interface cables should be screened and interface cables longer than 3 m are not acceptable in terms of interference port immunity.

## 3.2 Environment

### 3.2.1 RoHS and WEEE - Waste Electrical and Electronic Equipment

Since February 2003, European Union legislation stating that EU members now restrict the use of hazardous substances in electrical and electric equipment (Directive 2011/65/EU and amendment 2015/863) and promotes the collection and recycling of such electrical equipment (Directive 2012/19/EU) has been in force.

**Statutory waste disposal mark**



The electrical and electronic devices that bear this symbol are subject to the European waste electrical and electronic equipment directive 2012/19/EU. The symbol indicates that the device must not be disposed of as household garbage.

In accordance with national and local environmental protection and material recovery and recycling regulations, old devices that can no longer be used must be disposed of separately and not with normal household garbage. For more information about waste disposal, please contact local authorities or the dealer from whom the product was purchased. As waste disposal regulations may differ from country to country within the EU, please contact the supplier about waste disposal regulations if necessary.

**Packaging**

The original packaging of HBM devices is made from recyclable material and can be sent for recycling. For ecological reasons, empty packaging should not be returned to us.

### 3.2.2 China RoHS


The product will comply with general hazardous substances limits for at least 10 years, and will be ecologically safe to use during this period, as well as recyclable. This is documented by the 10 years symbol on the system as statutory mark of compliance with emission limits in electronic equipment supplied to China.

*Table 3.1: Hazardous substances*

| **Part Name 部件名称** | **Hazardous Substances 有害物质** | | | | | |
|---|---|---|---|---|---|---|
| | Lead 铅 (Pb) | Mercury 汞 (Hg) | Cadmium 镉 (Cd) | Hexavalent Chromium 六价铬 (Cr (VI)) | Polybrominated biphenyls 多溴联苯 (PBB) | Polybrominated diphenyl ethers 多溴二苯醚 (PBDE) |
| Main PCB | X | O | O | O | O | O |
| PSU-module | X | O | X | O | O | O |
| CPU-module | O | O | O | O | O | O |
| Metal Parts | O | O | O | O | O | O |
| Plastic Parts | O | O | O | O | O | O |
| Cables | O | O | O | O | O | O |
| This table is prepared in accordance with the provisions of SJ/T 11364.<br>本表格依照 SJ/T 11364 规定的规定编制。 | | | | | | |

O Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.
表示该有毒有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。

X Indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.
表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

## 3.3 CE and UKCA Declaration of conformity

### 3.3.1 CE Declaration of conformity

For information about the CE Declaration of conformity, please refer to
www.hbm.com/fileadmin/mediapool/hbmdoc/technical/ce356.pdf

### 3.3.2 UKCA Declaration of conformity

The manufacturer declares on its sole responsibility that the product is in conformity with the essential requirements of the applicable UK legislation and that the relevant conformity assessment procedures have been fulfilled.

Manufacturer:

**Hottinger Brüel & Kjaer GmbH**
Im Tiefen See 45
64293 Darmstadt
Germany

Importer:

**Hottinger Bruel & Kjaer UK Ltd.**
Millbrook Proving Ground
Station Lane
Millbrook
Beds
MK45 2RA
United Kingdom

### 3.4 FCC Class A Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1 This device may not cause harmful interference.
2 This device must accept any interference received, including interference that may cause undesired operation.

**Note** *This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.*

**IMPORTANT**

**Any modifications made to this device that are not approved by HBM may void the authority granted to the user by the FCC to operate this equipment.**

# 4 Introduction

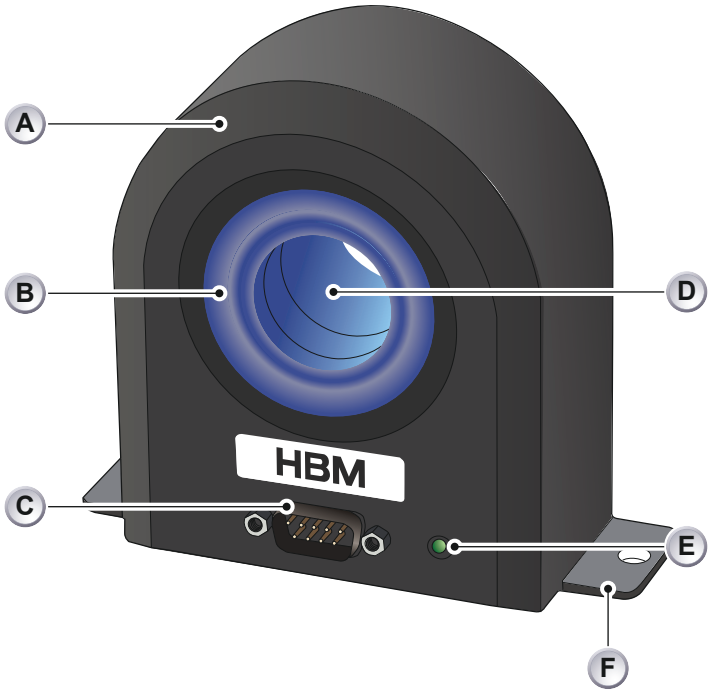
## 4.1 Integrated body current transducers

The ultra-stable and high precision current transducers are based on closed loop flux gate principle allowing to achieve ppm level accuracy, excellent linearity and stability versus time. The integration of the sensing head and the control electronics in a single housing allows a compact design. The following table shows the rated current range overview and model names.

| Current Transducer Family Overview | | | | |
|---|---|---|---|---|
| **Type** | **Maximum current** | **Bandwidth (-3 dB)** | **Ratio Primary : Secundary** | **Aperture size** |
| CTS50ID | 50 A RMS | 1000 kHz | 1 : 500 | 27.6 mm |
| CTS200ID | 200 A RMS | 500 kHz | 1 : 500 | 27.6 mm |
| CTS400ID | 400 A RMS | 300 kHz | 1 : 2000 | 27.6 mm |
| CTS600ID | 600 A RMS | 500 kHz | 1 : 1500 | 27.6 mm |
| CTM1200ID | 1200 A RMS | 300 kHz | 1 : 1500 | 45.0 mm |
| Other values available on request(1) | | | | |

(1) Contact custom systems at: customsystems@hbm.com
Request quote/information for special products for GEN series.

## 4.2 Description of current transducers




**A** Complete metal housing

**B** Insulating conductor guide

**C** Main connector (power supplies, output signal, status etc.)

**D** Primary conductor feed-through hole

**E** Green LED status indicator (lit in normal operation)

**F** Fixation plate

### 4.3 Electrical connection instructions

Electrical connection is ensured by a standard D-SUB9 connector. Jackscrew socket tapped hole UNC 4-40 inches (“D-SUB JACKSKT-SCREW, UNC 4-40, UNC 4-40” inches ). The pin assignement is shown Figure 4.1.

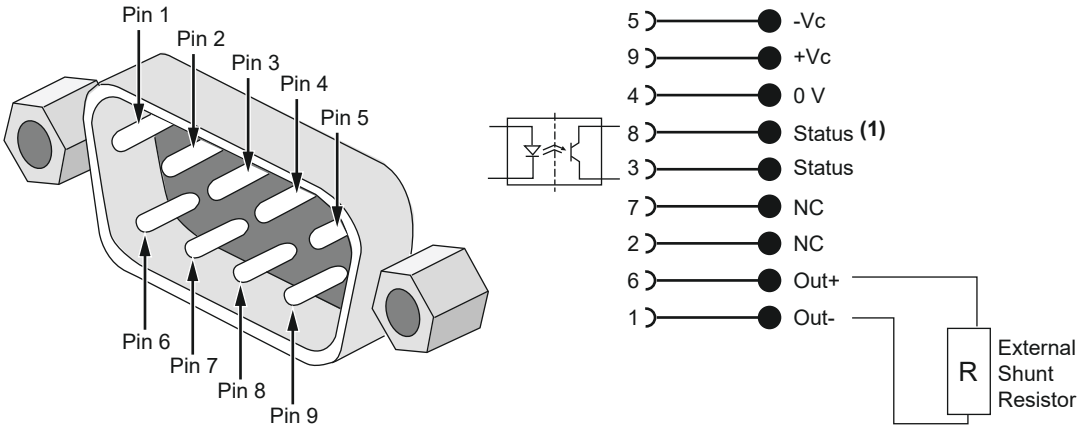
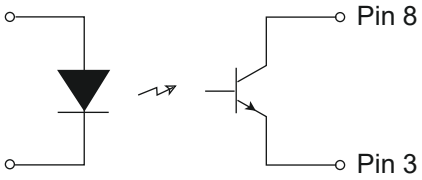



**Figure 4.1:** D-SUB connector pin assignement

**Note** ***(1)*** *Open collector for status signal: when the transducer is operating in normal condition, status pins are shorted. Status pins are open in case the “zero flux” state is not maintained (transducer is saturated or faulty).*

*Table 4.1: Status pin properties*

- Forward direction pin 8 to pin 3
- Maximum forward current 10 mA
- Maximum forward voltage 630 V
- Maximum reverse voltage 5 V




It is necessary to connect the output pins to an **External Burden Resistor** to enable the current feedback loop (zero flux) for a correct operation of the device. Please refer to "Derating of external burden resistor R" on page 65 for more details.

# 5 Installation and Operation

## 5.1 Positive current flow

Each transducer is marked with an embossed arrow at the back of the housing for the positive current direction, as shown in Figure 5.1. Check the current flow indication to ensure that the output signal is in phase with the input signal.

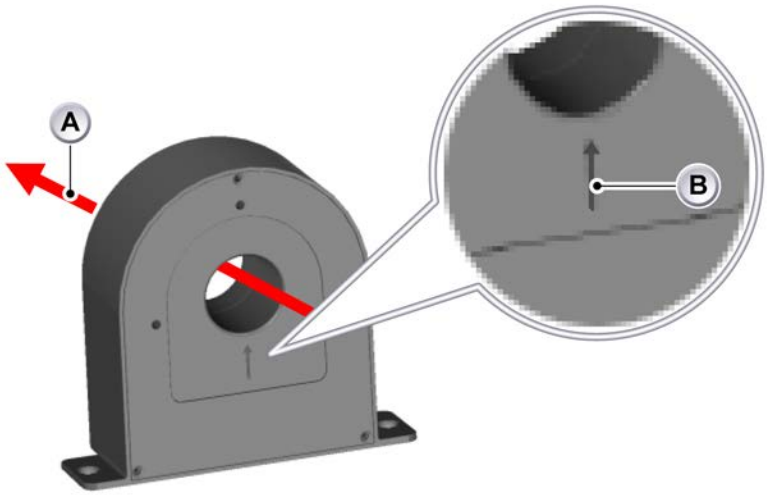



**Figure 5.1:** Positive current flow

**A** Arrow symbol

**B** Positive current

## 5.2 Mounting instructions

The devices are suitable for different fixation configurations, using the mounting plates designed for that purpose.

**Note** *Consider the fastening torques indicated below to avoid damaging the device.*

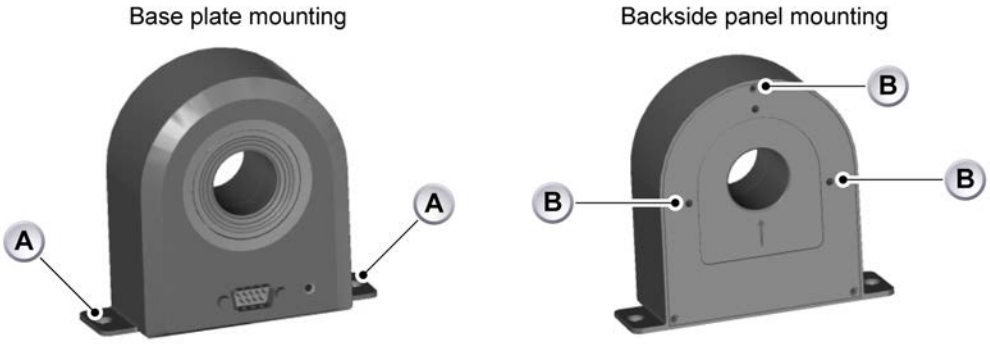



**Figure 5.2:** Mounting holes

**A** 2 holes Φ 6.5 mm for
2 x M5 steel screws / 6 N.m

**B** 3 tapped holes Φ 4.0 x 6 H for
3 x M4 steel screws / 4 N.m

## 5.3 Power supply requirements

The current transducers are designed for operation with a ± 15 V DC power supplies with the following requirements:

- Input voltage: ± 15 V DC ± 5%
- Max. ripples: 15 mV RMS
- Minimum current requirement (1): I consumption (Ips or Ins) + secondary current Is @ max. primary current (see example below)

(1) E.g. DS600ID measuring up to ± 900 A.

- I consumption (see datasheet): Positive current consumption Ips: 104 mA; Negative current consumption Ins: 96 mA
- Secondary current Is (ratio: 1:1500): Is = ± 900 A x (1:500) = ± 600 mA

The minimum current that the power supply needs to provide is:

- For +15 V DC: I output = Ips + Is = 104 + 600 = 704 mA
- For –15 V DC: I output = Ins + Is = 96 + 600 = 696 mA

## 5.4 Current transducer power supply

**Note** *HBM recommends the use of 1-CTPSIU-6-1U power supply. The 1-CTPSIU-6-1U power supply offers guaranteed performance and useful features to successful operate the current transducers.*

| **Model** | **1-CTPSIU-6-1U** |
|---|---|
| Number of channels | 6 |
| Current output | Mini XLR connector |
| Terminals for calibration winding | 4mm Banana jacks (yellow) |
| Output voltage | ± 15 V ± 5% (per channel) |
| Input voltage | AC 100 V to 240 V, 47 Hz to 63 Hz |
| Dimensions | 19" rack, 1 U in height |

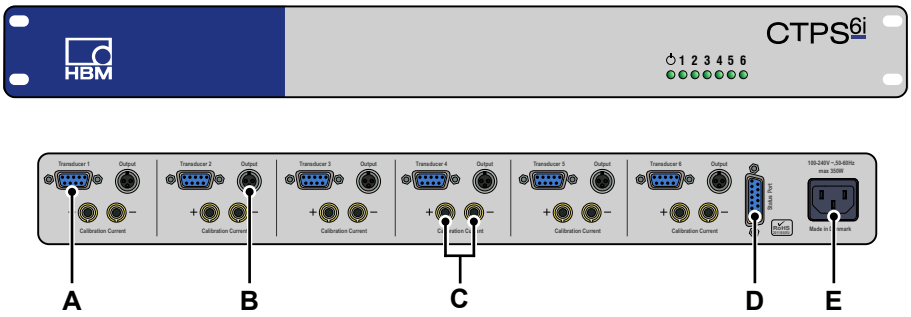



**Figure 5.3:** 1-CTPSIU-6-1U

**A** D-SUB9 connector for transducer connection

**B** Mini XLR socket for transducer's current outputs

**C** Banana jacks for calibration winding terminals

**D** Status connector

**E** Mains voltage

**CAUTION**

**It is mandatory to support the unit when rack mounted, either on the sides or backside.**

### 5.4.1 XLR connector pinning

**Output connection**

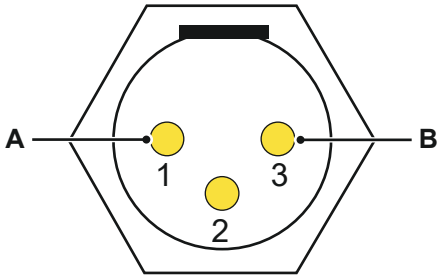



**Figure 5.4:** Mini XLR connector

**A** Pin 1: Positive current

**B** Pin 3: Return current

**Note** *Recommended connector: AG3F Amphenol*

### 5.4.2 Using the 1-CTPSIU-6-1U power supply

The 1-CTPSIU-6-1U is intended to be used for powering up to six HBM current transducers.

**Instruction for use:**

**1** **WARNING**

**Do NOT power up the current transducers before all cables are connected!**

**2** Complete the mounting of the 1-CTPSIU-6-1U.

**2a** **Desk use:** Mount the rubber feet which are part of the package.

**2b** **Rack mounting:** Use the screw kit for mounting and do not mount the rubber feet.

**3** Connect a 1-KAB2133-x cable between DSSIU-6-1U-V and each current transducer.

**4** Connect an output cable for each channel used either by:

**4a** Use **1-KAB2134-2** to connect to GN310B.

**4b** Use **1-KAB2135-2** to connect to a burden resistor inserted in GN610B.

**4c** Use **1-KAB2135-2** to connect to a burden resistor of any measuring device.

**5** Ensure that no calibration connectors are attached when measuring primary current!
Always avoid to create a calibration short circuit, between **+** and **-** calibration connection.

**6** When all connection are secured, connect mains power.

**7** When mains is applied a green light diode on the front under the power symbol will light green.

## 5.5 1-CTPSIU-6-1U current input and output cables

These cables are availabe as optional accessories.

| Current Transducers Cables, to be ordered separately | |
|---|---|
| **Order No.** | **Description** |
| 1-CTPSIU-6-1U<br>CT Interface unit | 100 - 240 V AC 50/60 Hz AC input voltage.<br>120 - 370 V DC input voltage.<br>1U height 19" rack mountable.<br>  |
| 1-KAB2133-2<br>1-KAB2133-5<br>1-KAB2133-10<br>1-KAB2133-15<br>1-KAB2133-20<br>CT cables | Industry standard current transducer connection cable. Shielded, low ohmic 9 wire cable with D-SUB 9 connectors on both ends.<br>Supports power, status, current output and calibration current input.<br>Lengths: 2, 5, 10 and 20 meters (6, 16, 32 and 65 ft)<br>  |
| 1-KAB2134-2<br>XLR to LEMO cable for GN31XB | CT interface unit to GN31xB DAQ power card connection cable. Uses XLR and LEMO connectors for a direct current output connection to the GEN DAQ card.<br>Length 2 m (6 ft)<br>  |

| Current Transducers Cables, to be ordered separately | |
|---|---|
| 1-KAB2135-2<br>XLR to Banana cable for GN61XB | CT interface unit to GN61xB DAQ 1kV card connection cable. Uses XLR and banana connectors for a current output connection to the GEN DAQ card. Requires an additional burden resistor in front of the GN61xB card to convert current to voltage.<br>Length 2 m (6 ft)<br>  |

## 5.6 Connection overview

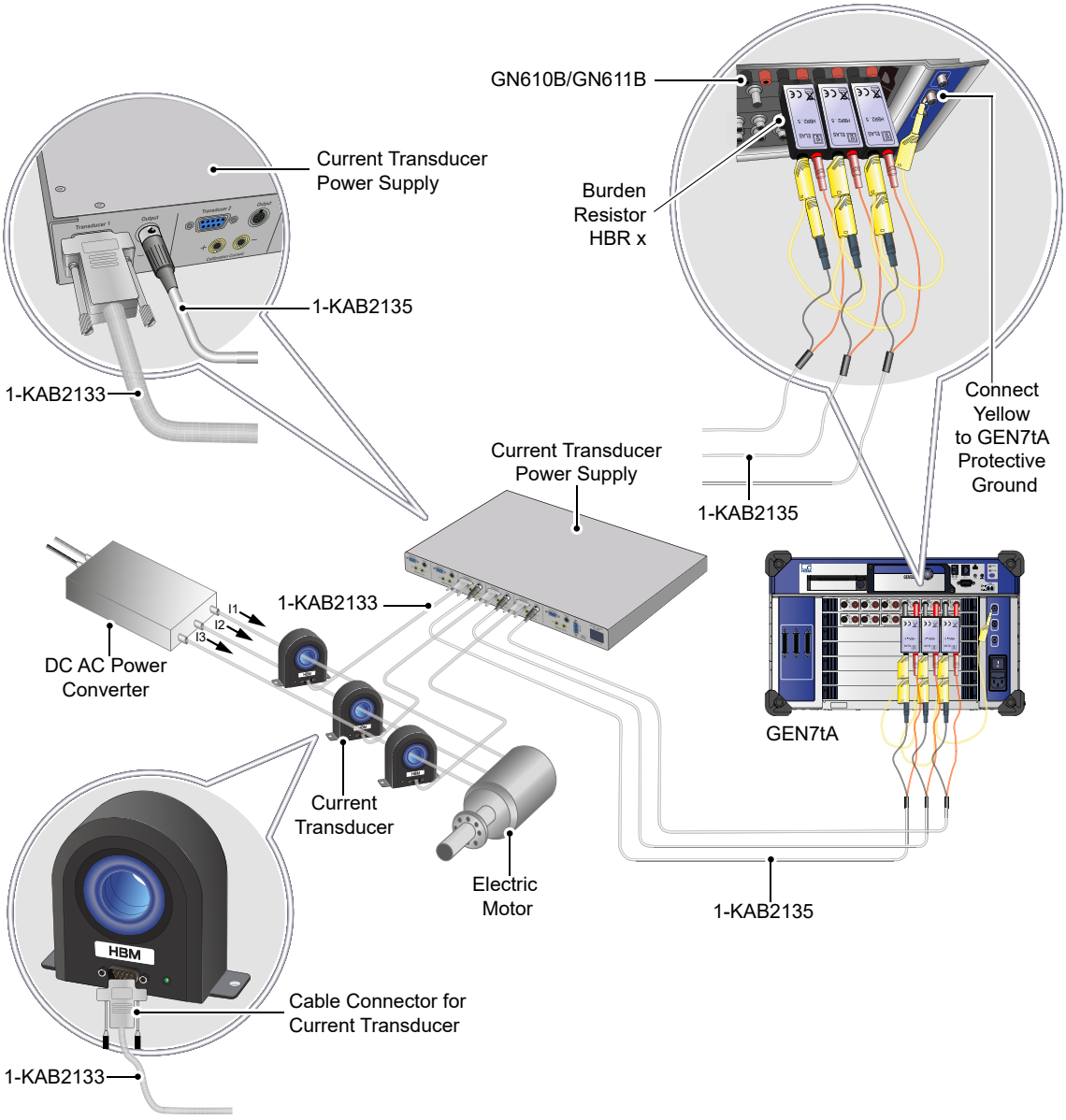



**Figure 5.5:** Current transducer connection diagram

# 6 Improve measurement accuracy

## 6.1 Common mode noise sources

A typical common mode noise source is the high rise time of voltage signals (**dV/dt**) in electronic power switching circuits such as inverters, switch mode power supplies etc.

Between any two conducting elements a stray capacitance exist (**Cs**). If the two conducting elements change in potential, the stray capacitance needs to be (de)charged to match the voltage difference between the two elements. (De)Charging stray capacitors requires parasitic currents **ip**.

**Note** *If the metal housing of the CT is not grounded, these parasitic currents will run into the sensing head back to the CT power supply. As an unwanted side effect the current transducer will report the parasitic currents as measured currents.*

Grounding of the current transducer housing deflects the parasitic currents to the housing and directly to earth. As the parasitic currents no longer run through the sensing head of the CT, the measured current will not be impacted.

The value of **ip** is determined by both the value of the stray capacitance as well as the rise time of the external voltage changes. The value can be calculated by using the following formula:

$$ip = Cs \times dV/dt$$

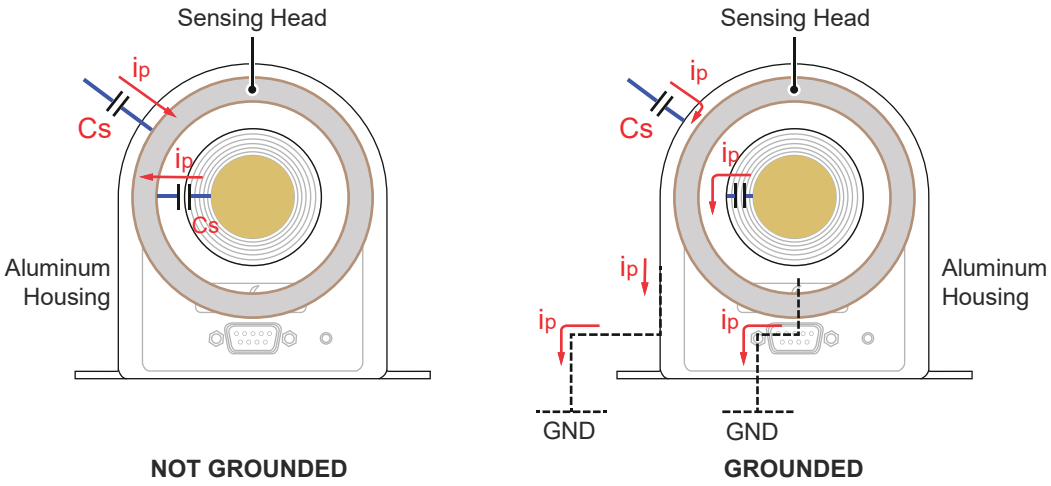



**Figure 6.1:** Grounding to reduce noise sources

**HINT/TIP**

Grounding of aluminum housing helps to divert capacitive currents off the sensing head and as a consequence greatly improve immunity to common mode noise (see Figure 6.1).

**HINT/TIP**

The parasitic capacitance value between two conducting elements can be reduced by increasing the distance between the two conducting elements. Keeping voltage cables and sources far away from the CT will improve measurement accuracy.

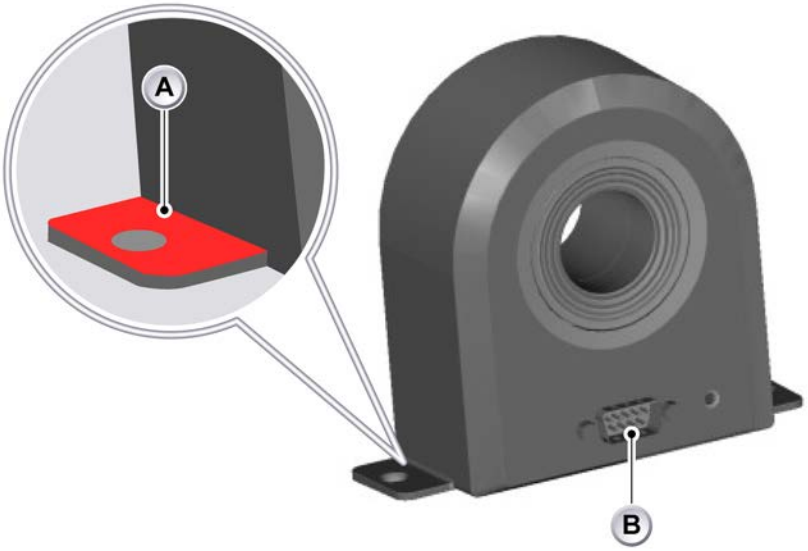



**Figure 6.2:** Recommended grounding points

**HINT/TIP**

As the aluminum case is painted with a black insulated coating, it is recommended to slightly scratch the surface of the housing, at the area around the fixation hole(s) ***(A)*** to expose the metal material for grounding purpose (see Figure 6.2).

**HINT/TIP**

The external shell of the D-SUB9 connector **(B)** is electrically connected to the aluminum housing (see Figure 6.2). The D-SUB9 connector can be an alternative way of grounding the CT.

## 6.2 Saturation behavior

The device is operating based on the flux compensation principle in which the magnetic flux generated by the primary current in the fluxgate element is cancelled to zero by the opposite magnetic flux from the secondary winding of the current transducer.

**Saturation** occurs when the current transducer is in a situation where it cannot output sufficient current to balance the magnetic flux from the primary current.

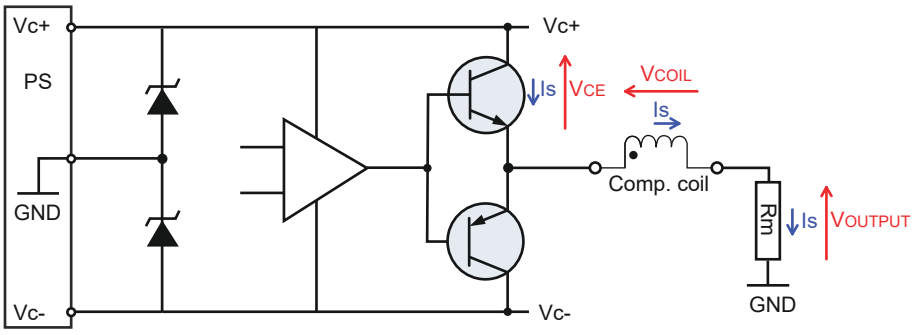



**Figure 6.3:** Saturation behavior

$$V_{C+} = V_{OUTPUT} + V_{CE} + V_{COIL}$$

The above equation sets an upper limit value for **VOUTPUT** (useful voltage). Consequently the output current **Is** cannot go higher even if **Ip** further increases. This is called saturation.
Saturation occurs when:

- Maximum input current of transducer is exceeded
- Burden (RM) resistance value is too high
- Current transducer is unpowered with currents running through the conductor feed-through hole

During saturation the current transducer will hold the output current at maximum level for a period up to 1 second. If the saturation disappears within 1 second, the current transducer will resume normal operation (see Figure 6.4).

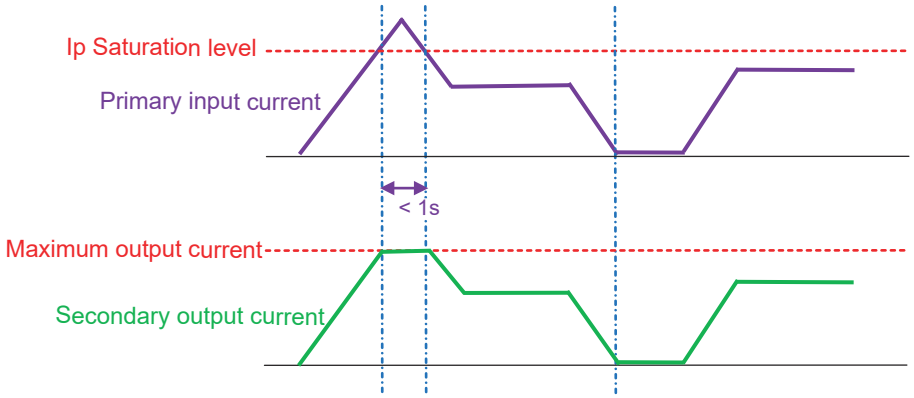



**Figure 6.4:** Saturation - less then 1 second

If the saturation of the current transducer lasts longer than 1 second, the output current will drop to zero. The primary input current must return to near zero before the current transducer will restart the secondary output current (see Figure 6.5).

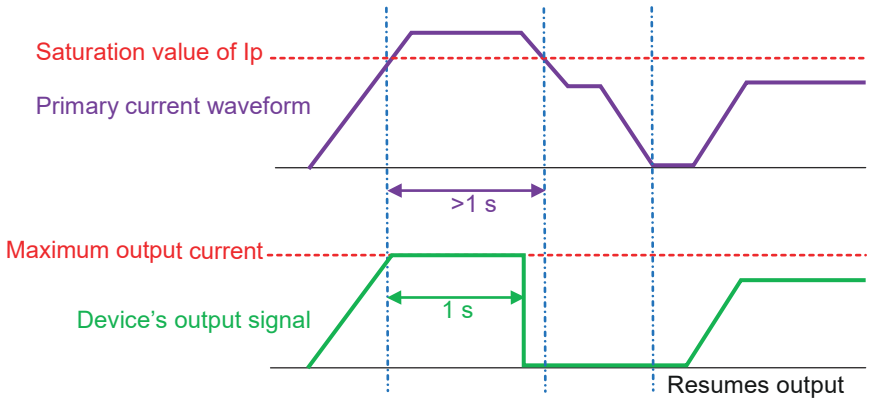


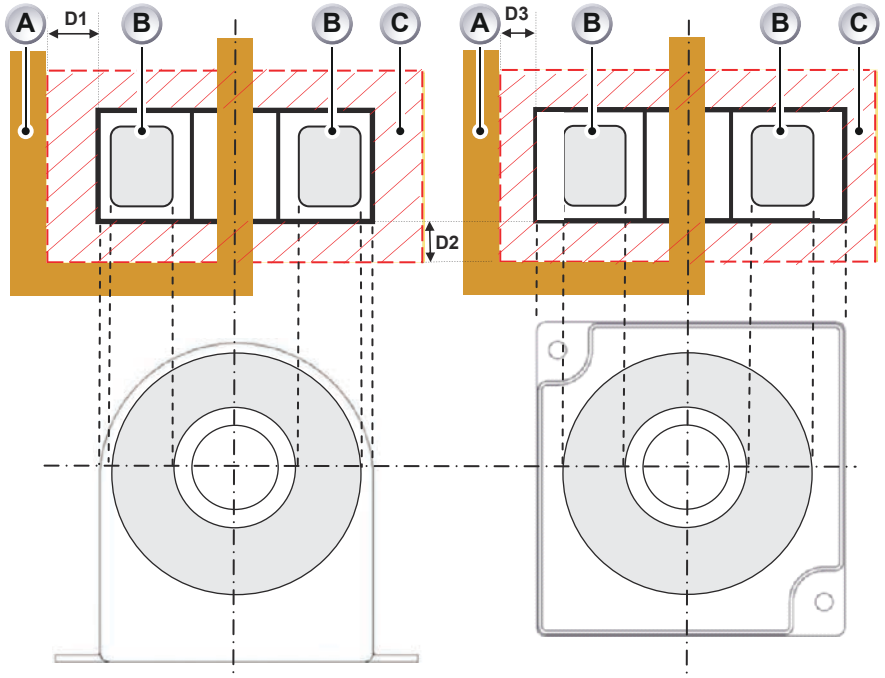

**Figure 6.5:** Saturation - saturation longer than 1 second

## 6.3 Influence of the return conductor

The magnetic field from the return branch of the primary current (cable / busbar) or adjacent conductors (e.g. the remaining phases of a 3-phase configuration) creates an imbalance of the sensing core of a fluxgate current transducer resulting in a measurement error.

**HINT/TIP**

To minimize the error caused by the return conductor it is recommended to maintain a “return conductor FREE zone”.




**A** Return conductor

**B** Sensing core of a fluxgate current transducer

**C** Return conductor FREE zone

| Model | CTS50ID | CTS200ID | CTS400ID | CTS600ID | CTM1200ID |
|---|---|---|---|---|---|
| D1 (mm) | tbd | tbd | tbd | tbd | tbd |
| D2 (mm) | tbd | tbd | tbd | tbd | tbd |
| D3 (mm) | tbd | tbd | tbd | tbd | tbd |

### 6.4 Derating of external burden resistor $R_M$

**Note** *The external burden resistor **$R_M$** is a very important component to ensure the zero flux compensation and consequently a correct output current. For more information, please refer to chapter "Saturation behavior" on page 62.*

To avoid saturation of the current transducer, the value of $R_M$ must be determined according to the derating curves shown in the individual datasheet.

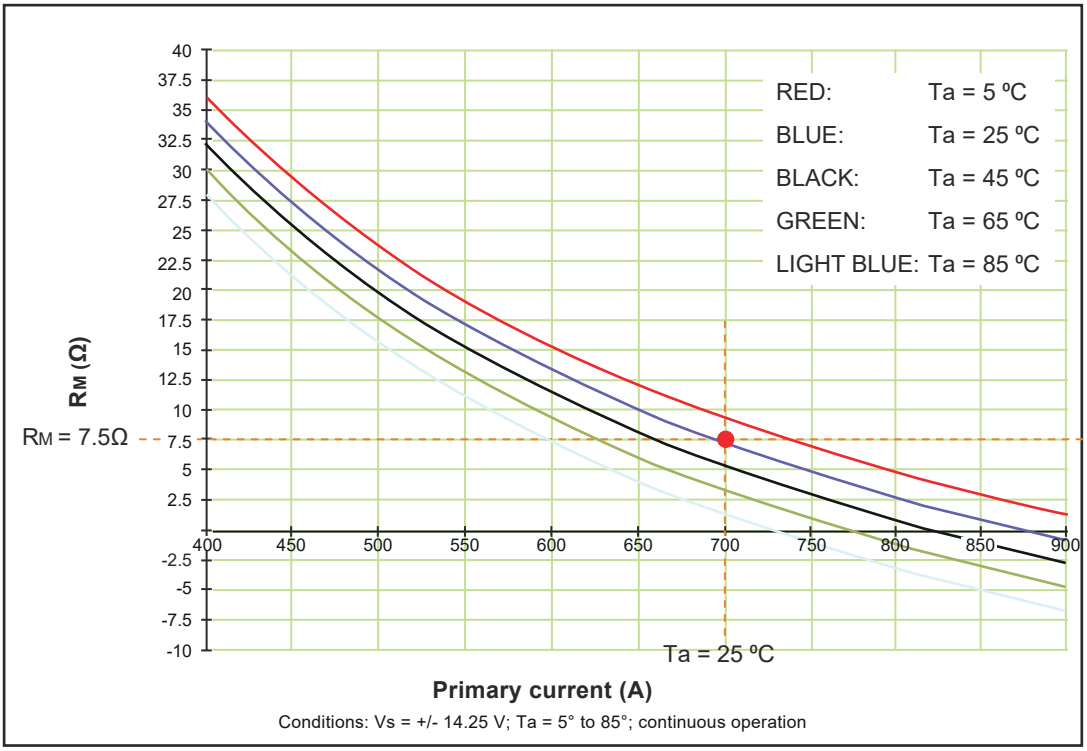



**Figure 6.6:** Example of a derating curve for the CTS400ID

In the example curves of Figure 6.6, at ambient temperature Ta = 25 ºC, the blue curve shows that to measure up to 700 A, $R_M$ must be less than 7.5 Ω

**Note** *The maximum value of $R_m$ must include the cable resistance of both the current transducer cable connected to the power supply as well as the power supply output cable connecting the measurement device. When calculating the measurement cables impedance keep in mind that both cables use a sensing and return line that both introduce cable resistance that must be added to the actual burden resistance value used by the measurement device.*

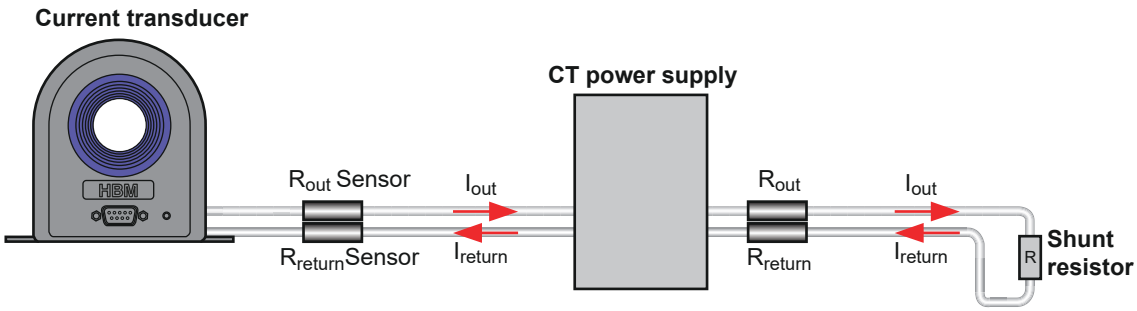



**Figure 6.7:** Measurement cables

## 6.5 Frequency derating

HBM fluxgate current transducers offer extreme precision in DC and low frequency. However, they also have excellent frequency bandwidth thanks to fast switching speed of the fluxgate excitation circuit. Any high frequency AC current produces heat in the magnetic core. The frequency derating curves in the individual data sheets allow calculation of the maximum allowed primary RMS current at a given ambient temperature, without damaging the transducer.

**Frequency derating**

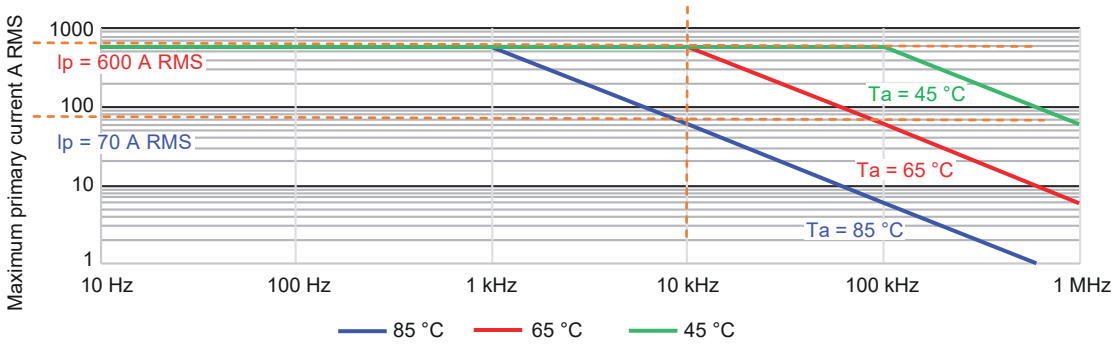



**Figure 6.8:** Frequency derating example of CTS600ID

The blue curve shows that at ambient temperature Ta = 85 ºC and f = 10 kHz, the max. current measurable without overheating the current transducer is around 70 A RMS only. However, if Ta = 65 ºC the red curve shows that the max. current measurable at 10 kHz is 600 A RMS.

## 6.6 Measuring a current with two transducers

If a current larger as the maximum specified current of the current transducer needs to be measured, two CT's in parallel can be used.

Split the main conducting cable or bus bar in two identical cables or bus bars.

**Note** *It is essential that the resistance of both split cables is as close as possible to do an even split of current across both cables.*

Use the first CT to measure the current flowing through **cable 1** and the second CT to measure the current flowing through **cable 2**.

Wire the output secondary current outputs of both CTs to a single burden resistor $R_m$. The secondary current of both CTs will flow through (added) $R_m$ representing the total value of the original large current.

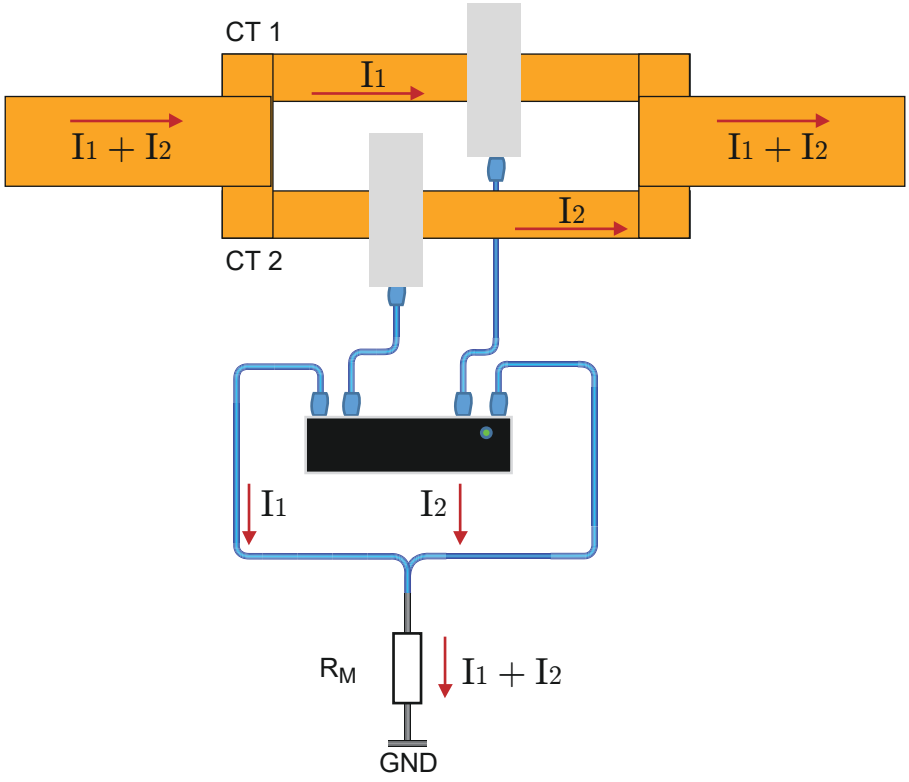



**Figure 6.9:** Measuring high current with two transducers

**Note** *Consideration must be given to the value of the measuring resistor $R_M$ to avoid saturation. Please consult HBM or your nearest local HBM representative for advice.*

## 6.7 Measuring small currents with multiple primary turns

HBM's ultra-stable and high precision fluxgate current transducers exhibit excellent linearity error. For instance, model CTS600ID has a linearity error of 1 ppm which is 0.6 µA secondary or 0.9 mA  primary. Excluding offset error, the accuracy at small primary current, e.g.: 10 A will be 0.009% or 90 ppm.

To reduce the impact of the linearity error on small primary currents, multiple turns of the same conductor can be measured by a single CT. The CT will measure the number of turns times the conductor current . E.g. when using 50 turns of 10 A RMS the CT will measure (50 * 10) 500 A RMS. The linearity error will then be reduced to (0.9 mA on 500 A) 0.00018% or 1.8 ppm.

**HINT/TIP**

To achieve the best accuracy of a multi turn current measurement, it’s recommended to have a regular repartition of the turns around the hole (see Figure 6.10) to avoid unbalance (local saturation) of the magnetic core.

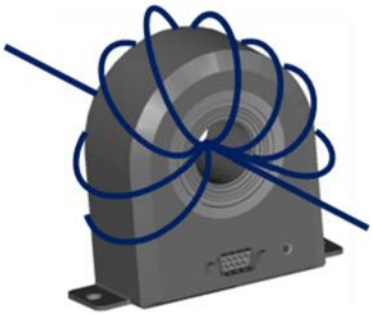


**Figure 6.10:** Regular repartition of the turns

## 6.8 Advanced Sensor Protection Circuit (ASPC)

**WARNING**

**As shown in chapter “Saftety information” on page 23 of this Product Manual, this is a high precision electronic device containing current transducer class operational amplifiers, magnetic core with windings etc. which requires special attention for handling and operating to avoid damage to the device and to prevent high induced voltage by the AC current effect.**

- Turn OFF all power sources before connecting - disconnecting the device.
- Check the pin assignment of the connector.
- Check the INSULATION class of the device.
- Ensure that the current transducer’s output is NOT open.
- Device must be powered and ready (green LED lit) before turning ON the primary current.

**Note** *HBM's fluxgate devices are equipped with an Advance Sensor Protection Circuit to provide protection of the device during transitory period.*

ASPC working principle and design covers:

- Short circuit of the coil’s terminals when power supplies are not connected or when they are OFF.
- Limit the coil’s induced voltage in case the device’s output is open (RM not connected)
- Protect the electronics in case of overvoltage spikes from the power supplies

**CAUTION**

**Please observe the absolute maximum rating values specified in the individual datasheets to avoid damaging the device.**

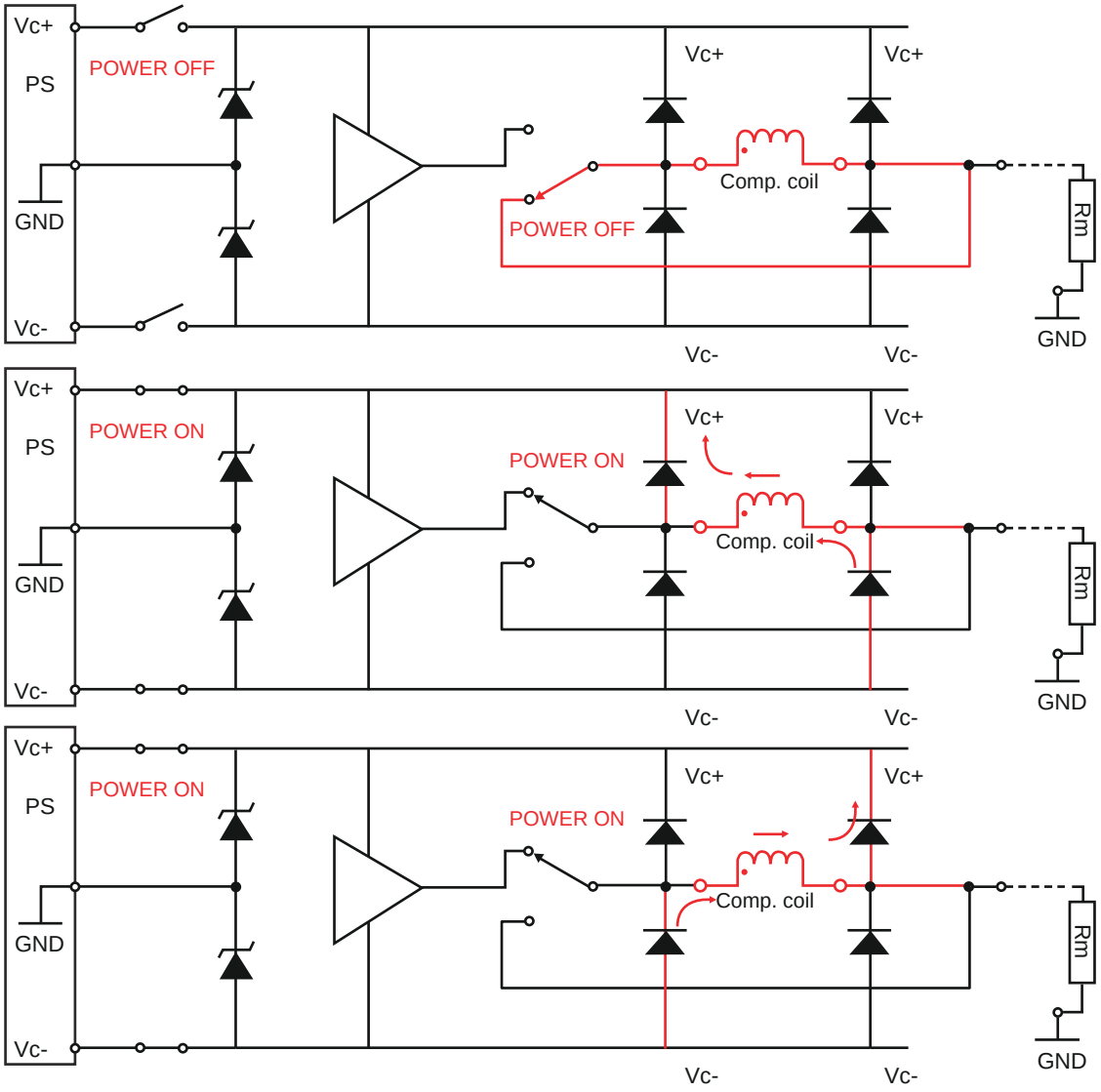



**Figure 6.11:** ASPC overview

# 7 Current Transducers with Calibration Winding

## 7.1 Overview

**Note** *Calibrating with high currents at high frequencies is extremely difficult. Significantly reducing the required calibration current value makes the calibration process easier.*

**Note** *For some applications, it is preferable to perform a prior functional / accuracy check of the device at Full Scale or a fraction of Full Scale before apllying the power.*

For Full Scale calibration using low currents, a multi turn primary winding is added. The terminals of this winding are available at pin 2 and 7 of the D-SUB9 connector as shown in Figure 7.1.

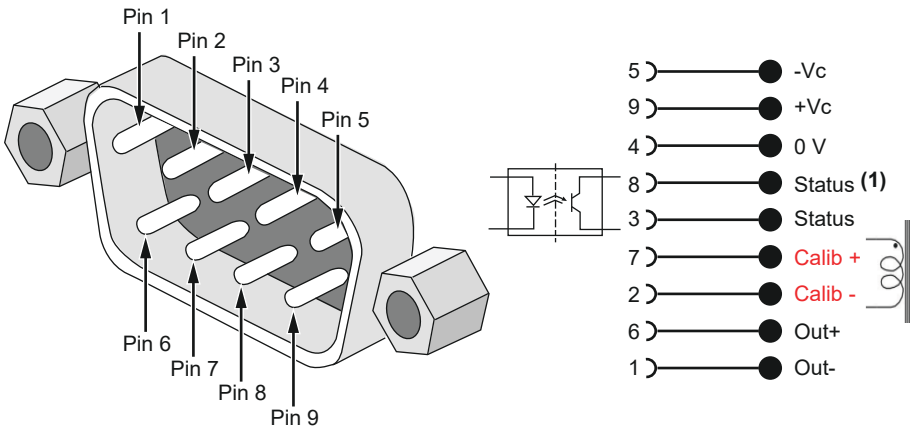



**Figure 7.1:** D-SUB connector pin assignement with calibration winding

**(1)** Open collector for status signal: when the transducer is operating in normal condition, status pins are shorted. Status pins are open in case the “zero flux” state is not maintained (transducer is saturated or faulty).
See also chapter “Electrical connection instructions” on page 50.

**Note** *Due to space restrictions, thin wires are used for the calibration winding. Check the data sheet for the specified current limit of the calibration winding. Avoid higher currents to prevent damage to the winding wire*

## 7.2 Connection of calibration winding with 1-CTPSIU-6-1U

When a current transducer with calibration winding type - CD[n turns] is connected to the 1-CTPSIU-6-1U using the optional 1-KAB2133-x cable, the terminals of the calibration winding are accessible via the yellow banana sockets at the back panel.

**Note** *Using other connection cables than 1-KAB2133-x might not support the calibration winding wires.*

**HINT/TIP**

Simultaneous calibration of six current transducers connected in serial is possible and reduces overall calibration time (see Figure 7.2).

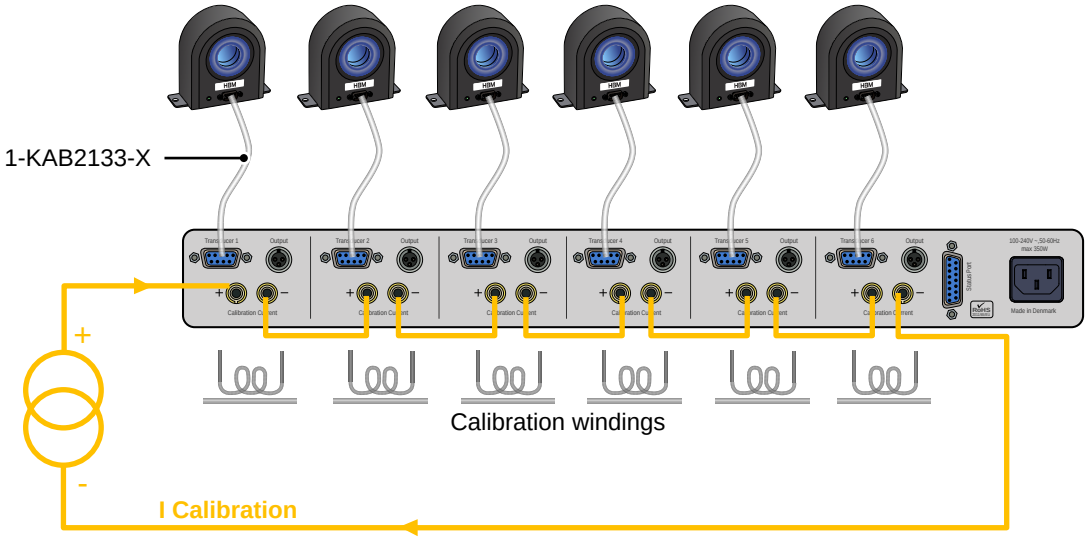



**Figure 7.2:** Example for a series connection of calibration winding

### 7.3 Principle for calibration

**Note** *It is important to use a stable current source. If the current source is calibrated then there is no need for an ampere meter on the calibration current.*

1. Connect transducer(s) to channel 1 (.. n) on 1-CTPSIU-6-1U.
2. Connect the 1-CTPSIU-6-1U output of the used channels to a burden resistor.
3. Ensure light is on for all channels on the frontside of the 1-CTPSIU-6-1U (transducer is in normal operation).
4. Ensure no primary current runs through the transducer.
5. Measure the current output from channel X - This is the offset of the transducer **Ioffset**.
6. Connect a stable current source to the calibration winding of all channel(s) **Ical** (e.g. 100 mA).
7. Let the current stabilize according to current source specification.
8. Measure the current output on all channels **Imax**.
9. Change polarity of the calibration current. Either by swapping the calibration cable from **+** to **-**, or if possible by changing the polarity directly on the current source.
10. Let the current stabilize according to current source specification.
11. Measure the current output on all channel(s) - **Imin**.

**Calculate the gain error**

To improve the overall accuracy **Ioffset** and **GainError** can be used to define a sensor in the Perception Sensor Database. The established errors will then be corrected within the GEN DAQ recording files.

**GainError** = ((**Imax** - **Imin**) / (2 * **Ical** * NumberOfCalibrationWindings) - 1) * 100%

# A Definition of Parameters

## A.1 Overview

| Electrical Specifications | | | |
|---|---|---|---|
| **Parameter** | **Symbol** | **Unit** | **Comment** |
| Nominal primary AC current | $I_{PN}$ AC | A RMS | Rated AC current for continuous operation |
| Nominal primary DC current | $I_{PN}$ DC | A | Rated DC current for continuous operation |
| Measurement range | $I_{PM}$ | A | Max. DC current (or peak value) that can be accurately measured. |
| Overload capacity | $\hat{I}_{OL}$ | A | Max. primary current without damage. Device will be saturated during the overload period. |
| Nominal secondary current | $I_{SN}$ | mA | Value of the device's output signal when a current of nominal value flows in a conductor placed inside the device's center hole |
| Primary / secondary ratio | n1:n2 | none | E.g. 1:1500 means if primary current is 600 A, then secondary current (device's output signal) is 600 A / 1500 = 0.4 A or 400 mA |
| Measurement resistance | $R_M$ | Ω | The device's output current must be "closed" to enable the flux compensation<br>Refer to Figure A.1. |
| Linearity error | $\varepsilon_L$ | ppm<br>µA | Maximum deviation or error (in ppm or in absolute µA value) between the output signal of the current transducer at any given point between 0 and ± $\hat{I}_{PM}$ and the linear regression line obtained from a series of actual output values from -$\hat{I}_{PM}$ to +$\hat{I}_{PM}$ measured at regular current value intervals between these two extremes.<br>Refer to Figure A.2. |
| Offset current (including earth field) | $I_{OE}$ | ppm<br>µA | Value of the device's output signal when there is no primary current in the device's center hole.<br>Refer to Figure A.3. |

## Measuring resistance diagram

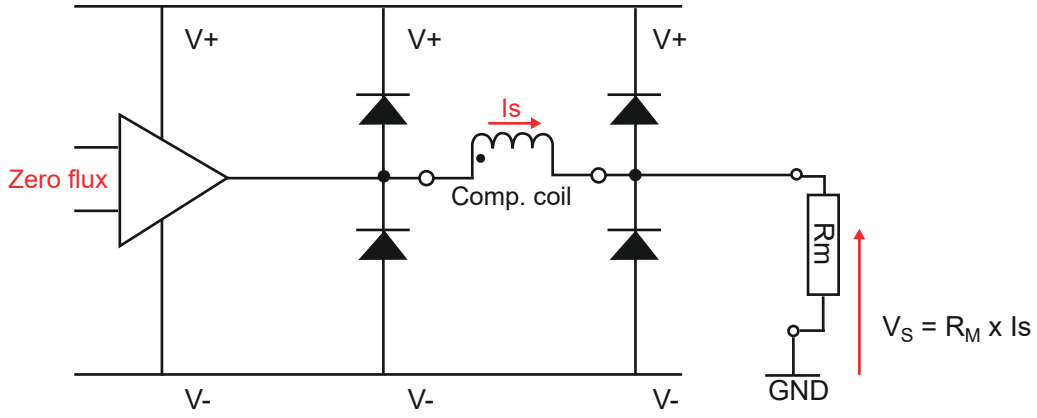



**Figure A.1:** Measuring resistance

## Linearity error diagram

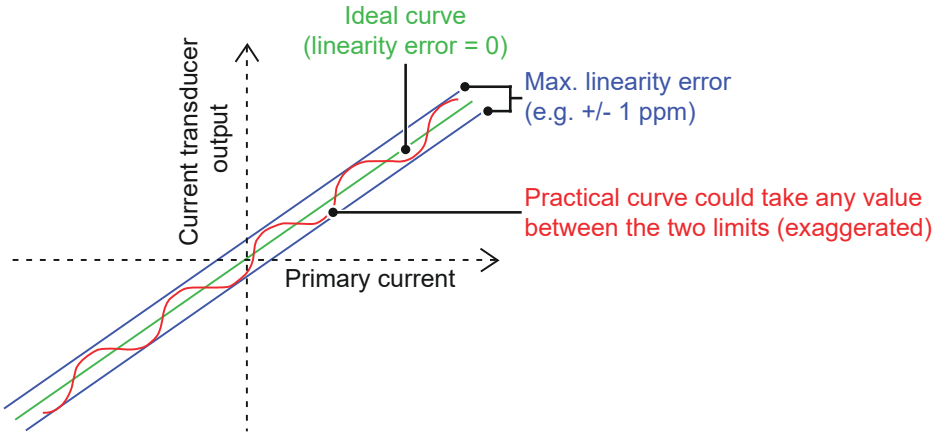



**Figure A.2:** Linearity error

## Offset current diagram

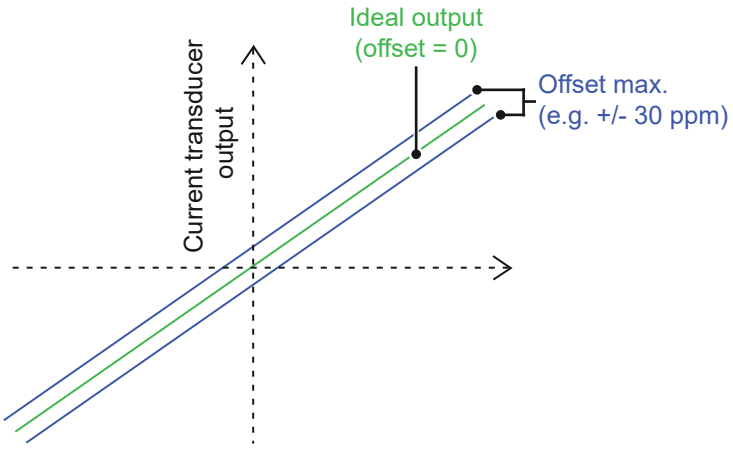



**Figure A.3:** Offset current

# B Rack Mount Instructions

## B.1 Mount a current transducer

The control unit is rack mountable which can be mechanically fixed by using the mounting holes on the front side as shown in Figure B.1.

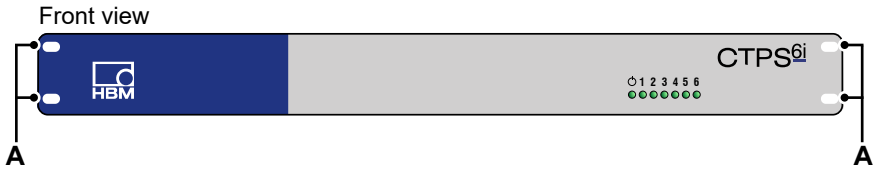



**Figure B.1:** Current transducer rack mount

**A** 4 tapped holes Φ 8.0 x 12.0 mm
Rack mountable, 1U high control unit

# Index

**S**



**W**



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