Genesis HIGH SPEED

# User Manual

English

# Calibration and Verification Software Version 2.22

# ISOBE5600

I2716-4.0 en

HBM

Document version 4.0 - October 2014

For HBM's Terms and Conditions visit www.hbm.com/terms

HBM GmbH
Im Tiefen See 45
64293 Darmstadt
Germany
Tel: +49 6151 80 30
Fax: +49 6151 8039100
Email: info@hbm.com
**www.hbm.com/highspeed**

**LICENSE AGREEMENT AND WARRANTY**

For information about LICENSE AGREEMENT AND WARRANTY refer to www.hbm.com/terms.

## 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 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.**

**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 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 give additional information about the product. This information is not essential for correct operation of the instrument, but provides knowledge to make better use of the instrument.

## 1.2 Manual conventions

Throughout this manual the Perception software is described, and sometimes still depicted using Windows XP. When required for Windows Vista or Windows 7, differences will be explicitly stated.

When the wording “Click Start ...” is used, this refers to the Windows Start button. Compared to Windows XP, in Windows Vista and Windows 7 the Start Menu has undergone some significant changes. The taskbar icon is no longer labeled "Start" and is now simply the pearl icon (of the window-frame in an orb).

For clarity and convenience, these conventions are used throughout this manual:

- **Menu names** from the display appear in bold, blue lettering.
- **Settings** within a menu appear in bold, red lettering.
- **Front panel controls** and **control names** appear in bold, black lettering.

# 2 Safety Messages

## 2.1 Introduction

**IMPORTANT**

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

This instrument 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 instrument in a safe condition. The instrument should not be used when environmental conditions are exceeding the instruments specifications (e.g. damp, high humidity) or if the unit is damaged.

For the correct and safe use of this instrument 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 instrument 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 instrument shows visible damage or fails to operate normally.

**Appropriate use**
This instrument and the connected transducers may be used for measurement and directly related control tasks only. Any other use is not appropriate. To ensure safe operation, the instrument 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 instrument must not be operated with the covers removed.
- This instrument must not be used in life support roles.
- There are no user serviceable parts inside.

It is also essential to follow the respective legal and safety regulations for the application concerned 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 instrument is a maintenance-free product. However in case one wants to clean the housing please note the following:

- Before cleaning, disconnect the instrument completely.
- Clean the housing with a soft, slightly damp (not wet!) cloth. Never use solvents, since these could damage the display 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 instrument is a state of the art device and as such is fail-safe. This instrument may give rise to dangers if it is inappropriately installed and operated by untrained personnel. Any person instructed to carry out installation, commissioning, maintenance or repair of the unit must have read and understood the User Manual and in particular the technical safety instructions.

**Remaining dangers**
The scope of supply and performance of this instrument 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 remaining dangers. Prevailing regulations must be complied with at all times. There must be reference to the remaining dangers connected with measurement technology.

**Conversions and modifications**
This instrument must not be modified from the design or safety engineering point of view except with our prior express written agreement. Any modification shall exclude all liability on our part for any resultant damage. In particular, any repair or soldering work on motherboards (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, commissioning and operation of the product must have the appropriate qualifications. The product may only be installed and used by qualified personnel, strictly in 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 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 how to repair the automation systems. They are also authorized to activate, to ground and to label circuits and equipment in accordance with safety engineering standards. It is essential to comply with the legal and safety requirements for the product and any accessories 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 instrument must be used with a protective ground connected via the conductor of the supply cable. This is connected to the instrument before the line and neutral connections 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.

**WARNING**

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

For protection against electric shock, all external circuits or equipment shall have a safe insulation. Therefore it is not permitted to connect peripheral equipment to the system with a power supply without SELV (Separated Extra Low Voltage) rating unless explicitly mentioned.

Signal connections to the instrument should be connected after the ground 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 instrument 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 instrument's case becoming live in the event of a protective ground interruption, which could occur if the supply connector is accidentally disconnected from the instrument.**

The primary purpose of protective grounding is to provide adequate protection against electric shock causing possible 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**

## 2.4 Instrument symbols

On the system a variety of symbols can be found. 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.

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.

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 it is pressed the instrument state toggles between the operating and power-off mode. When 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 the IEC 61010-1 and the IEC 61010-2-030.
- IEC 61010-1 defines three overvoltage categories (CAT II, CAT III, and CAT IV) on the power supply side of an instrument.
- IEC 61010-2-030 defines three measurement categories (CAT II, CAT III, and CAT IV) on the measurement input side of an instrument, for measurement inputs which can be directly connected to mains.
- All measurement inputs, which are not specified to be connected to mains, have no CAT rating and are referred to as O (like Others).

**Categories according to IEC 61010-2-030:2010**
Electrical equipment, specifically measurement tools can according to IEC 61010-2-030:2010 be assigned into 4 categories. These measurement categories are indicated with the terms O (previously CAT I), CAT II, CAT III and CAT IV. Originally these categories are used to indicate the overvoltage or surge voltage that is likely to occur and can be sustained by the equipment. Actually the category indicates the amount of energy that can be released in the event of a short circuit. 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 mains. Think of measurement of: signal levels, regulated low voltage circuits or protected secondary circuits. For this category there are no standard over voltage or surge impulse levels defined.

**CAT II**: This category is for measurements directly connected to low-voltage mains. Think of measurement of: mains sockets in household applications or portable tools. This category is expecting to have a minimum of three levels of over current 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. Think of measurement of: circuit breakers, wiring, junction boxes etc. This category is expecting to have a minimum of two levels of over current 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. Think of measurement of: over current protection devices, ripple control units etc. This category is expecting to have a minimum of one level of over current protection between the transformer and connection point of the measurement circuit. (See Figure 2.1).

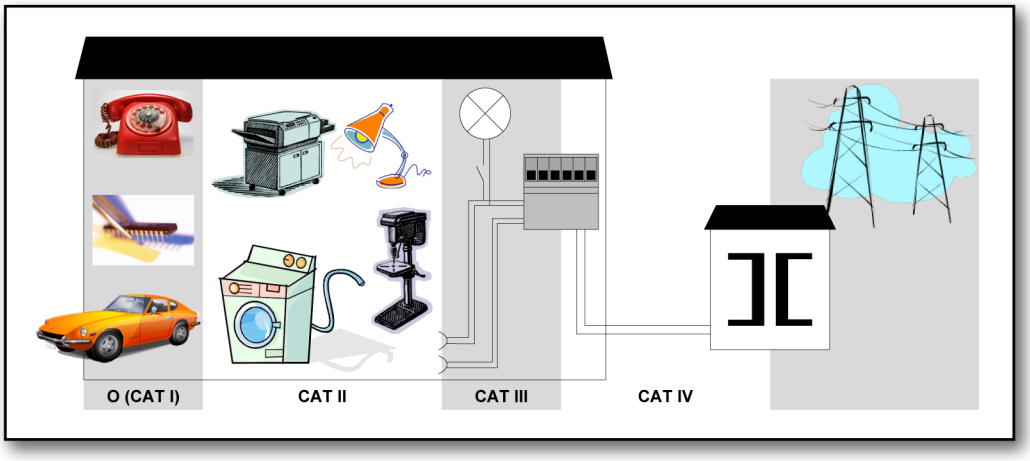



**Figure 2.1:** Category indication according to IEC 61010-2-030:2010

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

*Table 2.1: Insulation test voltages according to IEC 61010-2-030:2010*

| Nominal Voltage (V RMS or V DC) | IEC 61010-2-030:2010 | | | | | |
|---|---|---|---|---|---|---|
| | 5 sec. AC test (V RMS) | | | Impulse test (V) | | |
| | CAT II | CAT III | CAT IV | CAT II | CAT III | CAT IV |
| ≤ 150 | 840 | 1.390 | 2.210 | 1.550 | 2.500 | 4.000 |
| > 150 ≤ 300 | 1.390 | 2.210 | 3.310 | 2.500 | 4.000 | 6.000 |
| > 300 ≤ 600 | 2.210 | 3.310 | 4.260 | 4.000 | 6.000 | 8.000 |
| > 600 ≤ 1 000 | 3.310 | 4.260 | 6.600 | 6.000 | 8.000 | 12.000 |

Using the above table one can deduct that this specification informs the user the device passed the insulation tests; 5 sec at 2.210 V RMS and impulse 4.000 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 this instrument should not be used to measure high-energy signals of measurement categories CAT II, CAT III or CAT IV (IEC 61010-2-30:2010) (e.g. mains measurements) , unless specifically stated for the specific input.**

### 2.5.2 Basic versus reinforced insulation

For reference below one can find the basic insulation and supplementary insulation as well as the reinforced insulation test values for CATII.

*Table 2.2: Test voltages for testing electric strength of solid insulation in measuring circuits of measurement category II (IEC 61010-2-30:2010)*

| Nominal voltage line to neutral a.c r.m.s. or d.c. of MAINS being measured. (V) | Test voltage | | | |
|---|---|---|---|---|
| | 5 s a.c. test V a.c. r.m.s. | | Impulse test V peak | |
| | Basic insulation and supplementary insulation | Reinforced insulation | Basic insulation and suplementary 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 |

To protect a user from hazardous voltages there are several means of protection possible. As one can see below basic insulation + supplementary insulation is a possibility but also reinforced isolation is a means of protection. The test voltages are different per means as can be found in the above table.

**Additional means of protection in case of 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.

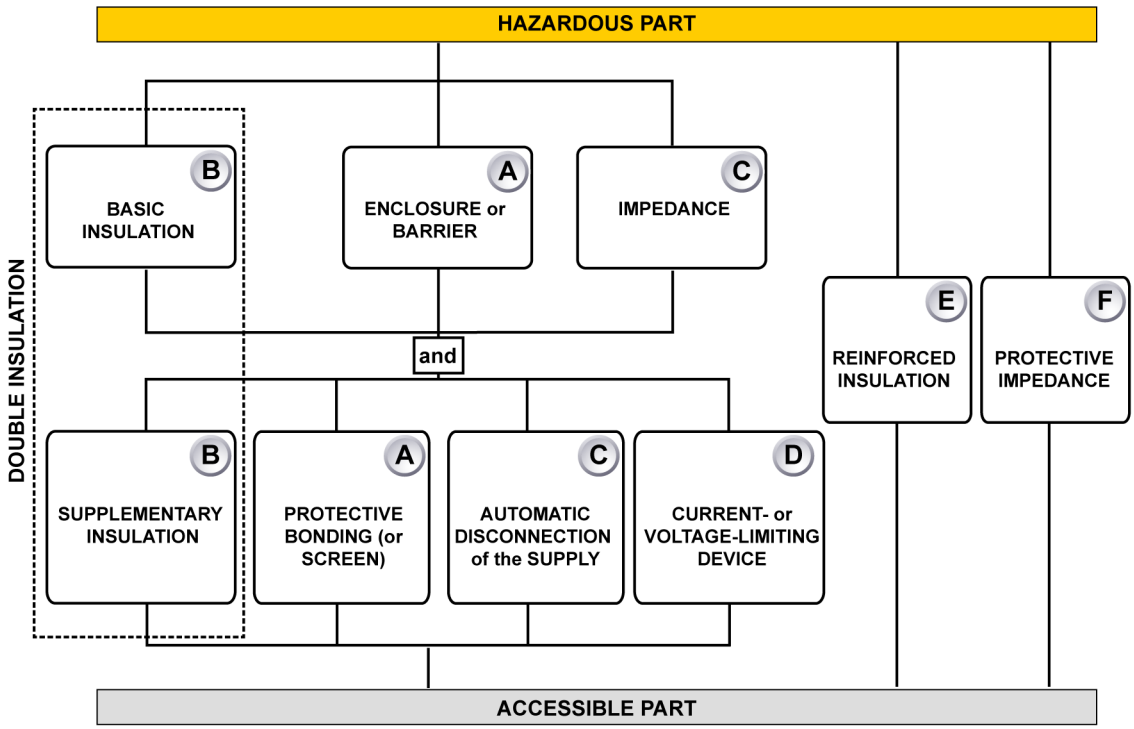



**Figure 2.2:** Acceptable arrangement of protective means against electric shock

Example: A measurement device is specified as 600 V CAT II reinforced insulation, maximum input voltage 1000 V DC.
Using the above information one can deduct that this specification informs the user that the measurement device is tested on input to chassis ground 5 s at 3.510 V RMS and impulse 6.400 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 shall 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, such as probes, used with the equipment.

**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 instrument is used in a manner not specified by HBM, the protection provided by the instrument can be impaired.

**WARNING**

**This instrument must not be operated in explosive atmospheres.**

**WARNING**

**This instrument 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 for servicing to qualified individuals.**

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

The instrument 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, such as probes, used with the instrument.

**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 instrument should be operated in a clean, dry environment with an ambient temperature of between 0 °C and +40 °C.

The instrument is specified for use in a Pollution Degree II environment, which is normally nonconductive 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.

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

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

If the instrument has a fan installed, leave space around the equipment for unrestricted ventilation.

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. When the equipment warms up to its normal operating temperature, moisture can form inside the equipment, which may damage the equipment's electronic circuit boards.

Do not drop, knock or shake the equipment. Rough handling can break internal circuit boards.

Do not use harsh chemicals, cleaning solvents or strong detergents to clean the instrument. To clean the instrument, 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, such as probes, used with the instrument.

## 2.7 Laser Safety

Some of the GEN series cards or systems use lasers. All laser products used are classified as a **Class 1 laser product**. It does not emit hazardous light but it is recommended to avoid direct exposure to the beam.


The built-in laser complies with laser product standards set by government agencies for Class 1 laser products:

- In the USA, the GEN series products are certified as a Class 1 laser product conforming to the requirements contained in the Department of Health and Human Services (DHHS) regulation CDRH 21 CFR, Chapter I Subchapter J Part 1040.10.
- Outside the USA, the GEN Series products are certified as a Class 1 laser product conforming to the requirements contained in IEC/EN 60825-1:1994+A1+A2 and IEC/EN 60825-2.

## 2.8 Manual handling of loads

The Manual Handling of Loads Directive 90/269/EEC from the European Community lays down the minimum health and safety requirements for the manual handling of loads where there is a risk particularly of back injury.

Before lifting or carrying a heavy object, the following questions should be asked:

- Can one person lift this load safely, or is it a two-person lift?
- How far will the load have to be carried?
- Is the path clear of clutter, cords, slippery areas, overhangs, stairs, curbs or uneven surfaces?
- Will closed doors be encountered that need to be opened?
- Once the load is lifted, will it block the carrier's view?
- Can the load be broken down into smaller parts?
- Should the carrier wear gloves to get a better grip and protect hands?

Contact the "Occupational Health and Safety" organization, or equivalent, in your country for more information.

## 2.9 International safety warnings

Dansk

**SIKKERHEDSADVARSEL**
Dette instrument skal anvendes med en sikkerhedsjordforbindelse, som er tilsluttet via lysnetkablets beskyttelsesjordledning eller via en sikkerhedsjordklemme, hvis instrumentet er forsynet hermed. Hvis sikkerhedsjordforbindelsen afbrydes, inden i eller uden for instrumentet, kan instrumentet 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.

Hvis netsikringen springer som følge af en fejl, er instrumentets vekselstrømsafbryder muligvis blevet beskadiget og skal derfor kontrolleres af en kvalificeret tekniker.

Afbryd instrumentet fra lysnettet ved at fjerne IEC-stikket. Instrumentets vekselstrømsafbryder er kun beregnet til funktionelle formål. Den er ikke beregnet eller egnet til at afbryde instrumentet 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**
Dit instrument mag uitsluitend worden gebruikt als een beschermde massa (aarde) is aangesloten via de beschermde massageleider van de voedingskabel, of indien het instrument daarvan is voorzien via de veiligheids-massa-aansluiting. Als de beschermde massa, binnen of buiten het instrument, 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 V (top-top) of 70 V DC (IEC 61010-1:2010) dient eveneens een signaalaarding aangesloten te zijn.

De deksels mogen nooit worden verwijderd.

Als de zekering doorbrandt als gevolg van een storing of een defect is het mogelijk dat de wisselstroom-schakelaar van het instrument beschadigd is en dient deze door een daarvoor gekwalificeerde en deskundige monteur te worden gecontroleerd.

Om dit instrument los te koppelen van de wisselstroomvoeding dient de IEC-aansluiting er uit te worden getrokken. De wisselstroom-voedingsschakelaar op dit instrument 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 laitetta käytettäessä sen tulee olla suojamaadoitettu joko verkkojohdon suojajohtimen tai erillisen suojamaadoitusliitännän kautta, mikäli laitteeseen on sellainen asennettu. Suojamaadoituksen katkaiseminen laitteen 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.

Mikäli laitteen verkkosulake palaa vian seurauksena, on mahdollista, että laitteen verkkokytkin on vaurioitunut ja se tulee tällöin tarkastuttaa ammattihenkilöllä.

Katkaise laitteen käyttöjännite irrottamalla IEC-liitin. Laitteen verkkokytkimellä on ainoastaan toiminnallinen tarkoitus. Sitä ei ole tarkoitettu, eikä se sovellu laitteen 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, cet instrument doit impérativement être mis à la masse par le conducteur de terre du câble d'alimentation ou, si l'instrument 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 de l'instrument. 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.

Le fait que le fusible d'alimentation saute par suite d'une anomalie risque de détériorer l'interrupteur d'alimentation secteur de l'instrument ; dans ce cas , le faire contrôler par un technicien qualifié.

Pour couper l'alimentation secteur de cet instrument, débrancher le cordon secteur. L'interrupteur d'alimentation secteur sur cet instrument 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!**
Dieses Gerät muss mit einer Schutzerde betrieben werden, die über den Schutzleiter des Speisekabels oder über die Erdungsklemme des Gerätes (falls vorhanden) anzuschließen ist. Bei einer Unterbrechung der Schutzerde außerhalb oder innerhalb des Gerätes kann eine Gefahr am Gerät entstehen. Eine beabsichtigte Unterbrechung ist nicht zulässig. Achtung! Bei Signalspannungen über 33 V Effektivwert, 46,7 V Spitzenwert oder 70 V Gleichstrom (IEC 61010-1:2010) muss die Signalmasse angeschlossen sein.

Die Schutzabdeckung nicht entfernen.

Wenn die Sicherung der Versorgung infolge eines Defektes durchbrennt, besteht die Möglichkeit einer Beschädigung des Wechselstromversorgungs-Schalters des Gerätes. Der Schalter muss dann von einem qualifizierten Elektriker geprüft werden.

Zum Trennen des Gerätes von der Wechselstromversorgung den IEC-Stecker abziehen. Der Wechselstromversorgungs-Schalter dient bei diesem Gerät 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 strumento 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 lo strumento ne sia dotato. Qualsiasi interruzione della messa a terra di protezione, sia all'interno che all'esterno dello strumento, 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 lo strumento.

Nel caso in cui il fusibile dell'alimentazione dovesse scattare a causa di un guasto, è possibile che l'interruttore dell'alimentazione a corrente alternata dello strumento possa essere danneggiato e dovrà pertanto essere controllato da un tecnico specializzato e qualificato.

Per disinnestare questo strumento dall'alimentazione a corrente alternata, levare il connettore IEC. L'interruttore dell'alimentazione a corrente alternata di questo strumento 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!**
Dette instrument må betjenes med beskyttelsesjord tilkoblet via beskyttelsesjordlederen til tilførselskabelen eller via beskyttelsesjordklemmen, hvis instrumentet er utstyrt med en slik. Ethvert brudd i beskyttelsesjorden inni eller utenpå instrumentet kan føre til at instrumentet 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.

Hvis tilførselssikringen går som følge av en feil, kan det hende at instrumentets AC-tilførselsbryter vil bli skadet, og den må sjekkes av en kvalifisert ingeniør.

For å koble dette instrumentet fra AC-tilførselen trekker du ut IEC-kontakten. AC-tilførselsbryteren på dette instrumentet 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 instrumento deve funcionar com uma terra de proteção conectada através do condutor da terra de proteção do cabo de alimentação ou, caso o instrumento esteja equipado com um, através do terminal da terra de proteção. Qualquer interrupção da terra de proteção, no interior ou no exterior do instrumento, poderá tornar o instrumento 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.

Se o fusível de alimentação fundir devido a uma falha, é possível que o interruptor de alimentação CA do instrumento seja danificado, devendo ser verificado por um engenheiro com qualificação adequada.

Para desconectar este instrumento da alimentação CA, retire o conector IEC da ficha. Neste instrumento, 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 instrumento deve ser operado com um terra de proteção conectado por meio do condutor do terra de proteção do cabo de alimentação ou, se o instrumento estiver equipado com um, por meio do terminal de aterramento de segurança. Qualquer interrupção do terra de proteção, no interior ou no exterior do instrumento, poderá tornar o instrumento 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.

Se o fusível de alimentação fundir como resultado de uma falha, é possível que o interruptor de alimentação CA do instrumento seja danificado, devendo este ser verificado por um engenheiro com qualificação adequada.

Para desconectar este instrumento da alimentação CA, desconecte o conector IEC. Neste instrumento, 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 instrumento 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 instrumento estuviera equipado con ella. Cualquier interrupción de esta puesta a tierra, dentro o fuera del instrumento, 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.

Si se fundiera el fusible de alimentación como consecuencia de una avería, cabe la posibilidad de que el interruptor de encendido del equipo esté dañado y sea necesario comprobarlo por personal técnico especializado y autorizado al efecto.

Para desconectar este instrumento de la red, 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**
Detta instrument måste användas med jordad anslutning via strömkabelns ledare eller, om sådan finns, via en isolerad jordterminal. Avbrott i den isolerande jordningen inuti eller utanför instrumentet kan göra instrumentet farligt. 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 höljet.

Om säkringen utlöses som ett resultat av ett fel är det möjligt att instrumentets strömförsörjningsbrytare skadas och ska därför kontrolleras av en kvalificerad ingenjör.

För att kopplas loss detta instrument från strömförsörjningen, dra ut IEC-kontakten. Brytaren för växelströmförsörjningen på detta instrument 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 instrument must be operated with a protective ground (earth) connected via the protective ground conductor of the supply cable or, if the instrument is fitted with one, via the protective ground terminal. Any interruption of the protective ground, inside or outside the instrument, is likely to make the instrument 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.

If the supply fuse blows as the result of a fault, it is possible that the instrument's AC supply switch will be damaged and should be checked by a suitably qualified engineer.

To disconnect this instrument from the AC supply, unplug the IEC connector. The AC supply switch on this instrument 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**
本機器の操作は、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。機器の内部または外部にある保護接地線が遮断されると、機器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）。

カバーは取り外さないでください。

電源ヒューズが故障により飛んだ場合、機器の AC 電源スイッチが損傷するおそれがあるため、然るべき認定を受けた適任者による点検を受けてください。

本機器を AC 電源から遮断するには、IEC コネクターを抜きます。本機器の 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**

该仪器必须通过电源电缆的保护接地线连接到保护接地（接地），如果该仪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设备存在危险。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。

如果电源保险丝因故障而熔断，则有可能损坏仪器的交流电源开关并应由具备资格的工程师检查。

拔下仪器上的 IEC 接头即可断开交流电源。仪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 прибора необходимо использовать защитное заземление, подключенное через проводник заземления кабеля питания или через терминал защитного заземления, если прибор оснащен таковым. В случае прерывания защитного заземления (внутри или снаружи прибора) прибор 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 снимать крышки.

Если в результате неисправности перегорает предохранитель, существует вероятность повреждения переключателя сети переменного тока прибора. В таком случае переключатель должен быть проверен квалифицированным инженером.

Для отключения данного прибора от сети переменного тока отсоедините разъем IEC. Переключатель питания переменного тока данного прибора 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 장비는 반드시 보안용 접지(접지)가 전원 공급 장치 케이블의 보안용 접지 도체를 통해 연결된 상태에서 작동해야 하며, 접지가 장착된 경우에는 보안용 접지 터미널을 통해 작동해야 합니다. 장비 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.

결함으로 인해 공급 퓨즈가 끊어진 경우, 장비의 **AC** 전원 공급 스위치가 손상될 수 있으므로 반드시 검증된 전문 기사에게 이상 유무를 의뢰하도록 합니다.

**AC** 공급 전원으로부터 장비를 분리하려면, **IEC** 커넥터를 뽑으십시오. 본 장비의 **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.)

## 2.10 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 whilst energized or whilst not 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 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).

# 3 Normative Documents and Declarations

## 3.1 Electrical

### 3.1.1 Electro Static 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 on the importance of ESD preventions when handling a GEN series 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 your electronic devices, including your GEN series data acquisition system, from ESD harm. Although HBM has built protections against ESD into its products, ESD unfortunately exists and, unless neutralized, could build up to levels that could harm your 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, if ESD events are noticed in the present environment, the user may want to take extra precautions to protect the electronic equipment against ESD.

**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 your 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 Electro-Magnetic Compatibility (EMC)

EMC stands for Electro-Magnetic Compatibility. The overall intention is that electronic equipment must be able to co-exist with other electronic equipment in its immediate vicinity and neither emits large amounts of electromagnetic energy. Thus there are two distinct requirements for electromagnetic compatibility: Emission and Immunity.

This instrument 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 instrument's control settings. Any of these tests may produce a spurious trigger. Measurements are not valid during and immediately after the immunity tests.

In demanding applications, if this instrument does cause minor harmful interference to other equipment, which can be determined by turning this instrument off and on, the user is encouraged to try to reduce the interference by one or more of the following measures:

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

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 WEEE - Waste Electrical and Electronic Equipment

Since February 2003, European Union legislation has been in force stating that EU members are now restricting the use of hazardous substances in electrical and electric equipment (Directive 2002/95/EC) as well as promoting the collection and recycling of such electrical equipment (Directive 2002/96/EC).

**Statutory waste disposal mark**

The electrical and electronic devices that bear this symbol are subject to European waste electrical and electronic equipment directive 2002/96/EC. 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. If you need more information about waste disposal, please contact your local authorities or the dealer from whom you purchased the product. As waste disposal regulations within the EU may differ from country to country, we ask that you contact your supplier as 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.

**Environmental protection**


The product will comply with general hazardous substances limits for at least 20 years, and will be ecologically safe to use during this period, as well as recyclable. This is documented by the 20 years symbol on the system as statutory mark of compliance with emission limits in electronic equipment supplied to China.

### 3.3 Declaration of conformity

For information about the CE Declaration refer to www.hbm.com/highspeed.

# 4 Getting Started

## 4.1 Introduction

The ISOBE5600 system is factory-calibrated when delivered to the customer. Swapping, replacing or removing of boards may result in minor deviations from the original calibration.

Always verify and if necessary, calibrate the ISOBE5600 system:

- After swapping, replacing or removing of boards or components.
- At one-year intervals.
- After any major event that may effect calibration.

If in doubt consult your local supplier.

The ISOBE5600 Calibration and Verification software can be used do calibrate and verify both the "high-voltage isolated" transmitter model (ISOBE5600t) and the "medium-voltage isolated" transmitter model (ISOBE5600tm).

The ISOBE5600 Calibration and Verification software tests against the published specifications!

Regardless of whether any remedy set forth herein fails of its essential purpose, in no event shall HBM be liable to you under any theory of recovery for any indirect, incidental, special, or consequential damages of any kind, including without limitation any lost profits or lost data arising out of the use or inability to use the software, even if HBM has been advised of the possibility of such damages. The limited warranty, limited remedies, and limitation of liability are fundamental elements of the basis of the bargain between you and HBM, and HBM would not be able to provide the software without such limitations.

## 4.2 Required fixtures

To be able to perform all the required steps several parts are required.

| Order No. | Article |
|---|---|
| 1-GN-CAL8-2 | ISOBE5600 Calibration and Verification Software |
| 1-GN-CAL-CABLES-2 | GEN DAQ Calibration basic cable set |

## 4.3 System requirements

| Calibration and Verification software | |
|---|---|
| The software comes on a CD with PDF manual and is ready to run after installation. | |
| Software language | English |
| Manual language | English |
| Software requirements | |
| Microsoft® Windows® | Vista™, WIN 7 Business, Ultimate or Enterprise<br>Works in 32 bit mode on 64 bit versions of Vista and WIN 7. |
| PC requirements | |
| Minimum CPU | Intel® Pentium® 4 class PC |
| Minimum RAM memory | 1 GByte |
| Minimum free disk size | 200 MB |
| Minimum graphics card | 16 bit color with 64 MB on-board video memory and hardware DirectX 9 support |
| Minimum screen resolution | 1024 x 768 pixels |
| Free USB 2.0 port | 2; for use with the NI GPIB-USB-HS controller and connection to ISOBE5600r<br>Optional one free COM (serial) port for the IOtech serial to GPIB interface |
| Others | CD-ROM drive used for installation of the software<br>Internal or external speakers for alerts and warnings |
| ISOBE5600 | |
| Receivers | ISOBE5600r and ISOBE5600m |
| Transmitters | ISOBE5600t and ISOBE5600tm |

## 4.4 Supported acquisition hardware

Supported ISOBE5600 receivers

- ISOBE5600r
- ISOBE5600m

Supported ISOBE5600 transmitters

- ISOBE5600t
- ISOBE5600tm

## 4.5 Supported/Required calibrators

The required calibration standards are:

- Fluke 5700A / Fluke 5720A Calibrator (LF-Generator)
- Fluke 5820A / Fluke 5900B Oscilloscope Calibrator (HF-Generator)
- Hewlett Packard HP 3458A Multimeter (DVM)

| **Required calibrators** | | | |
|---|---|---|---|
| | Fluke 5700A<br>or<br>Fluke 5720A | Fluke 5820A<br>or<br>Fluke 9500B | HP 3458A |
| ISOBE5600r | ✓ | | ✓ |
| ISOBE5600m | ✓ | | ✓ |
| ISOBE5600t | ✓ | ✓ | ✓ |
| ISOBE5600tm | ✓ | ✓ | ✓ |

## 4.6 Calibration system setup

**GPIB interface (IEEE488) device**
To control the calibration standards, the GEN series Calibration and Verification Software uses a GPIB interface.

This connection can be made with:

- The NI GPIB-USB-HS controller, included in the shipment
  or
- any National instruments GPIB controller with proper windows drivers installed.

**HINT/TIP**

During start of the software it will search for device GPIB0 in the NI device drivers. Make sure the GPIB controller of choice is named GPIB0 or the software will fail to connect to the GPIB controller.

**Note** *The most current version of the software at release of this manual still supports the legacy IOTech serial to GPIB interface*

**Connecting the hardware**
For the ISOBE5600 Calibration and Verification software to communicate with ISOBE5600, you need to connect the USB (2.0) port of the controlling PC to the ISOBE5600 Receiver.

For the ISOBE5600 Calibration and Verification software to communicate with and control the calibration standards:

- Connect the NI GPIB-USB-HS GPIB port to the standard.
- Connect the NI GPIB-USB-H USB cable to the USB port on your computer.

For further details, please refer to the NI GPIB-USB-HS GPIB controller manual.

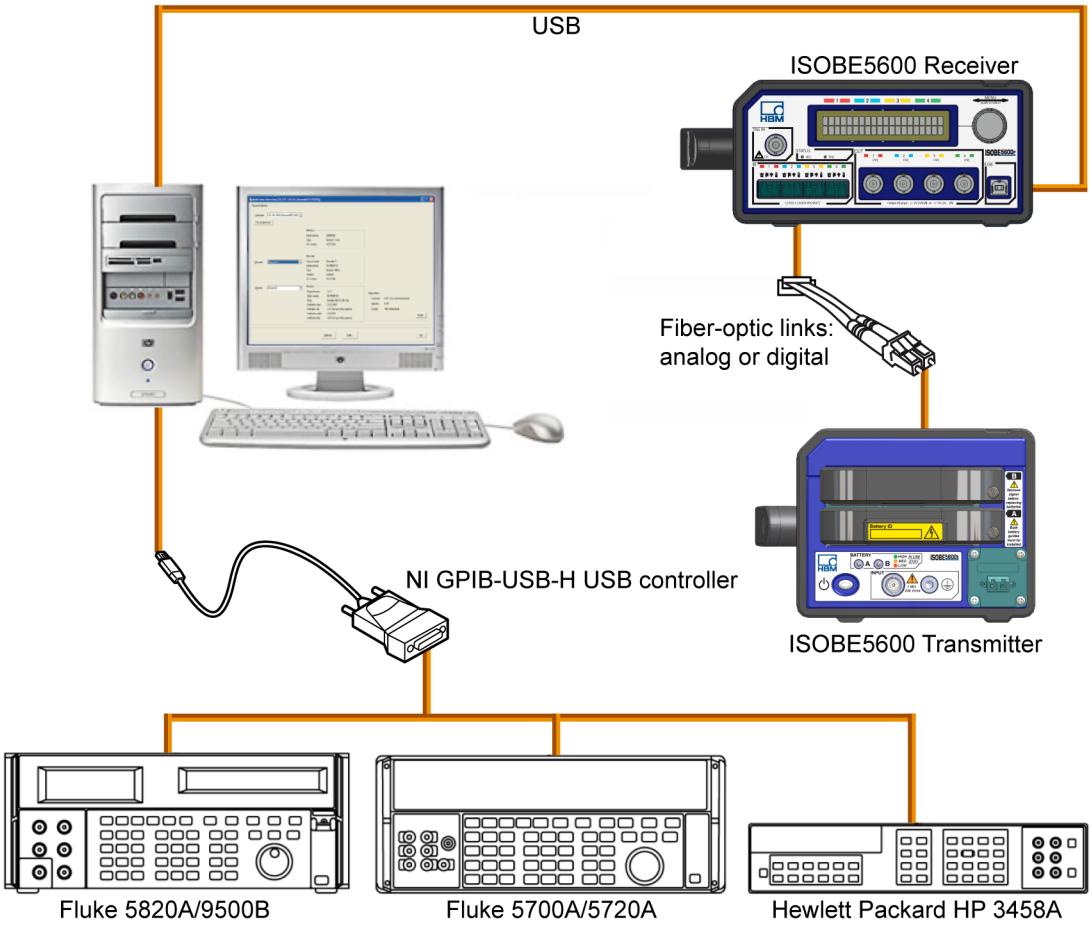



**Figure 4.1:** Connecting directly to your PC with the NI GPIB-USB-H USB controller

## 4.7 Installing the software

The following section explains how to install the program files in Microsoft® Windows® from the CD.

**Note** *You cannot run the software from the CD; you must install the components onto your hard drive and run the software from that drive.*

To install the ISOBE5600 Calibration and Verification software:

1. Insert the ISOBE5600 Calibration and Verification CD into your CD-ROM drive.
2. Click **Next** in the ISOBE5600 Calibration and Verification AutoPlay dialogue box.
   If the AutoPlay dialogue box does not appear, choose **Start Run**, enter **d:setup.exe** (where “d” is the letter of your CD-ROM drive), and click **OK**.
3. Click **ISOBE5600 Calibration and Verification**, read the information in the Setup dialogue box, and click **Next**.
4. Click **Next** and follow the on-screen instructions to complete the installation.
   When the process is complete, a message tells you that ISOBE5600 Calibration and Verification software is installed.
5. Click **Finish**.

The ISOBE5600 Calibration and Verification software is now installed.

## 4.8 Starting ISOBE5600 Calibration and Verification

The following section explains how to:

- Start the Calibration and Verification software.
- Fill in and change the Organization information.
- Select the Mainframe.
- Select the Recorder (board).
- Setup the Calibration standard(s).
- Exit the Calibration and Verification software.

### 4.8.1 Start the ISOBE5600 Calibration and Verification software

**CAUTION**

**Before starting a calibration or verification, it is recommended that the ISOBE5600 system, the receiver, transmitters and the calibration standards run at least one hour to achieve the best test specifications.**

To start the ISOBE5600 Calibration and Verification software:

1 Switch on the ISOBE5600 system and the calibration standard(s).
2 Choose **Start ► All Programs ► HBM ► ISOBE5600 ► ISOBE5600 Calibration and Verification**.

A searching message appears while searching for mainframes.

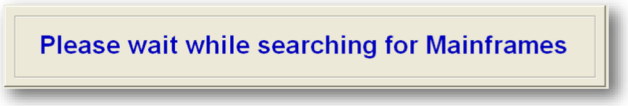



**Figure 4.2:** Searching message

The **ISOBE5600 Calibration and Verification** window will be displayed.

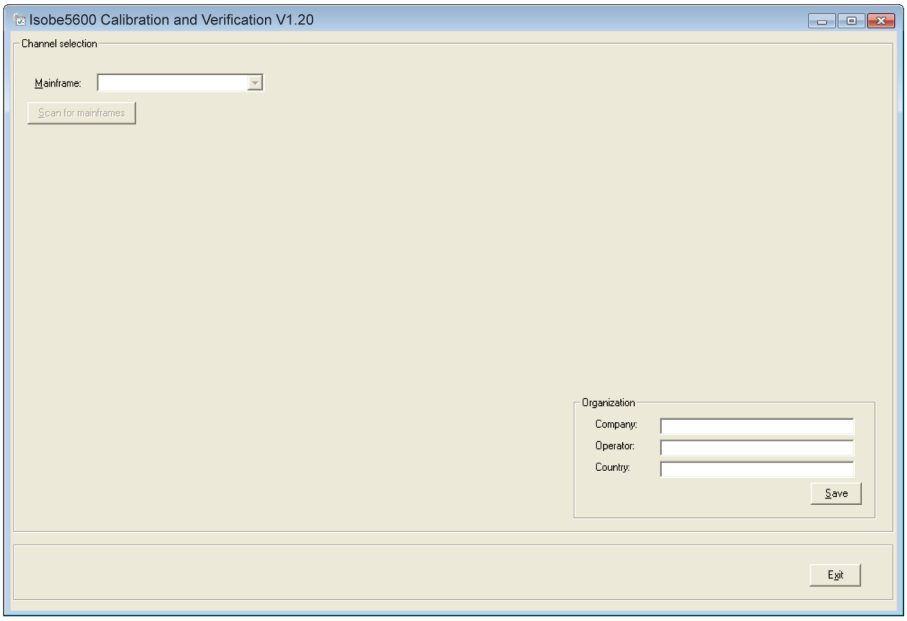



**Figure 4.3:** ISOBE5600 Calibration and Verification window

### 4.8.2 Organization information

The ISOBE5600 Calibration and Verification software allows you to specify the calibration lab name and the name of the operator.

**HINT/TIP**

This information is stored inside the acquisition card during the calibration and verification process. When using the ISOBE5600m to making any recordings with this card this information then is stored within the PNRF file for automatic traceability of your calibration information.

**Enter Organization information**

When you start the ISOBE5600 Calibration and Verification software the first time, the **Organization information** is empty and should be filled in.

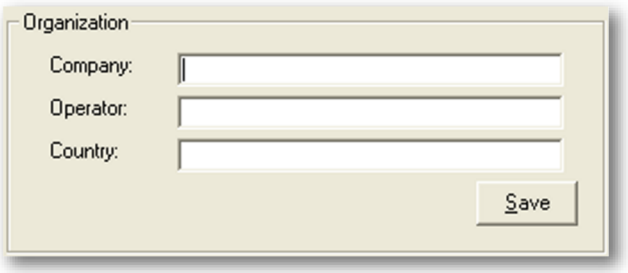



**Figure 4.4:** Organization information

1 Fill in the name of the:
   - Company
   - Operator
   - Country
2 Then click **Save** to save your information.

**HINT/TIP**

The company name that is entered here is also displayed in *Perception software* under *Hardware Properties*.

**Modify Organization information**
If you want to modify your organization information:

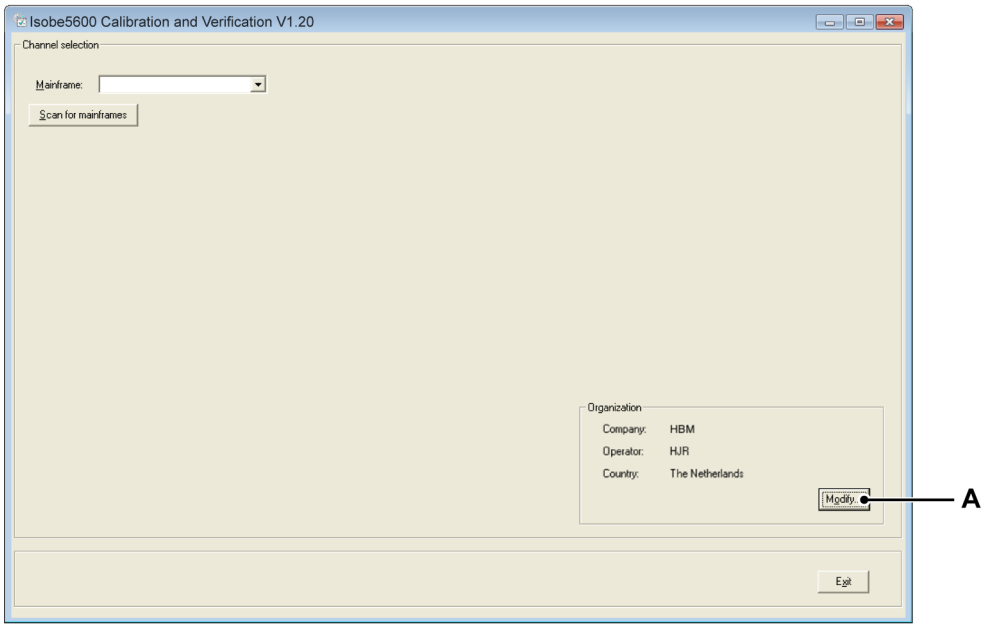



**Figure 4.5:** Change Organization information

**A** Modify...

**1** Click **Modify...**
**2** Make the required changes.


**Figure 4.6:** Organization changes

**3** Then click **Save** to save the changes.

### 4.8.3 Mainframe selection

When the ISOBE5600 Calibration and Verification software starts running, it will search the available USB ports for the ISOBE5600 system and display the **ISOBE5600 Calibration and Verification** window.

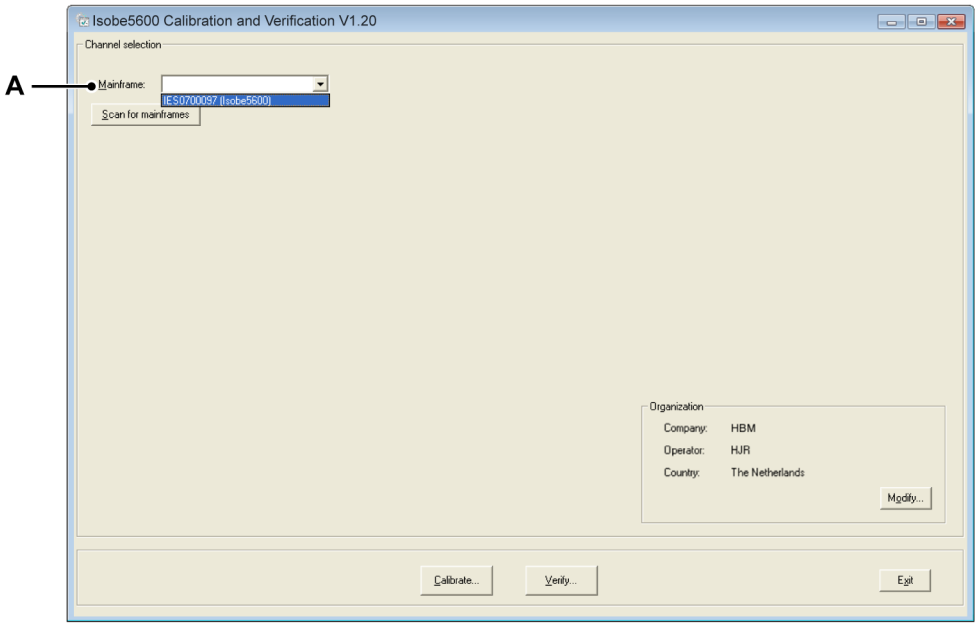



**Figure 4.7:** ISOBE5600 Calibration and Verification window

**A** Mainframe list

In the **Mainframe** list, click the ISOBE5600 mainframe that you want to calibrate or verify.
The ISOBE5600 serial number uniquely identifies each ISOBE5600 mainframe.

If no mainframe is recognized, click **Scan for mainframes**.
The software will search the available USB ports for ISOBE5600 systems. Once a mainframe has been recognized, it will be available in the Mainframe list.

After a mainframe has been selected the **Mainframe Selection** window will be displayed.

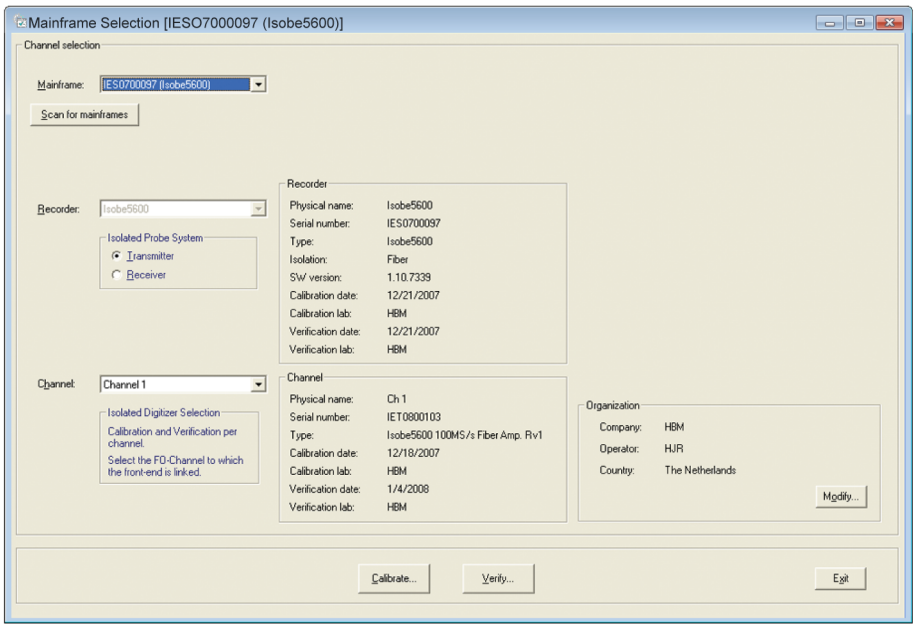



**Figure 4.8:** Mainframe Selection window

### 4.8.4 Transmitter/Receiver selection

Select which part of the ISOBE5600 system you want to calibrate or verify, Transmitter or Receiver.

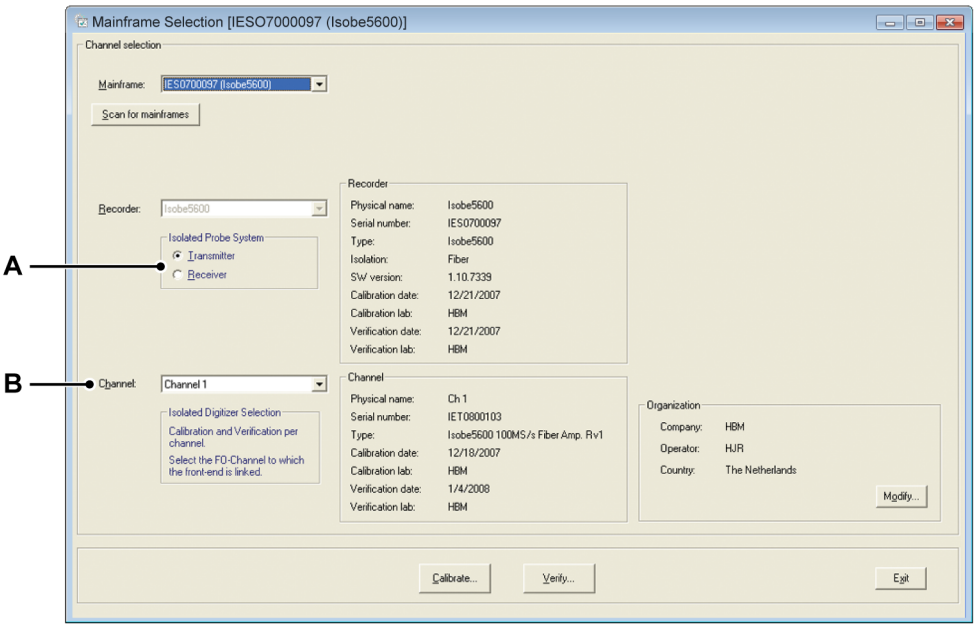



**Figure 4.9:** Transmitter/Receiver selection

**A** Transmitter/Receiver check box

**B** Channel list

In the **Transmitter/Receiver** check box, check Transmitter or Receiver.

In the **Channel** list, click a channel to display information about the selected channel (Channel 1, 2, etc.). Channel information is only valid if the Transmitter is connected and powered.

### 4.8.5 CalStack setup

Before starting a calibration or verification, you need to ensure that the ISOBE5600 Calibration and Verification software knows which calibration standard(s) you are using.

In the **Mainframe Selection** window:

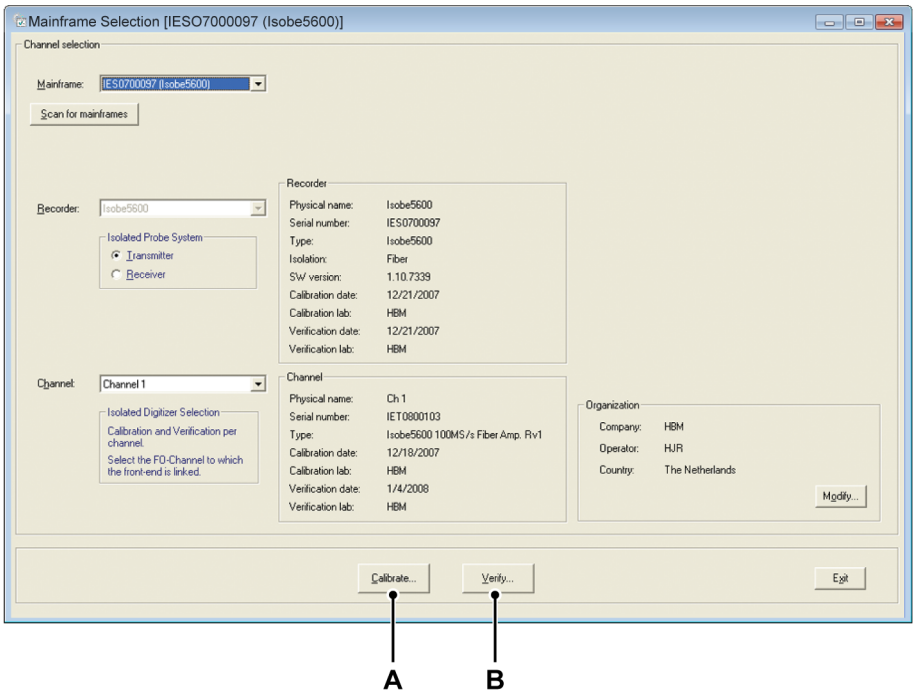



**Figure 4.10:** Mainframe Selection window

**A** Calibrate...

**B** Verify...

**1** Click **Calibrate...** to open the *Board Calibration* window,
**or**
click **Verify...** to open the *Board Verification* window.

The *Board Calibration* **or** *Board Verification* window will be displayed.

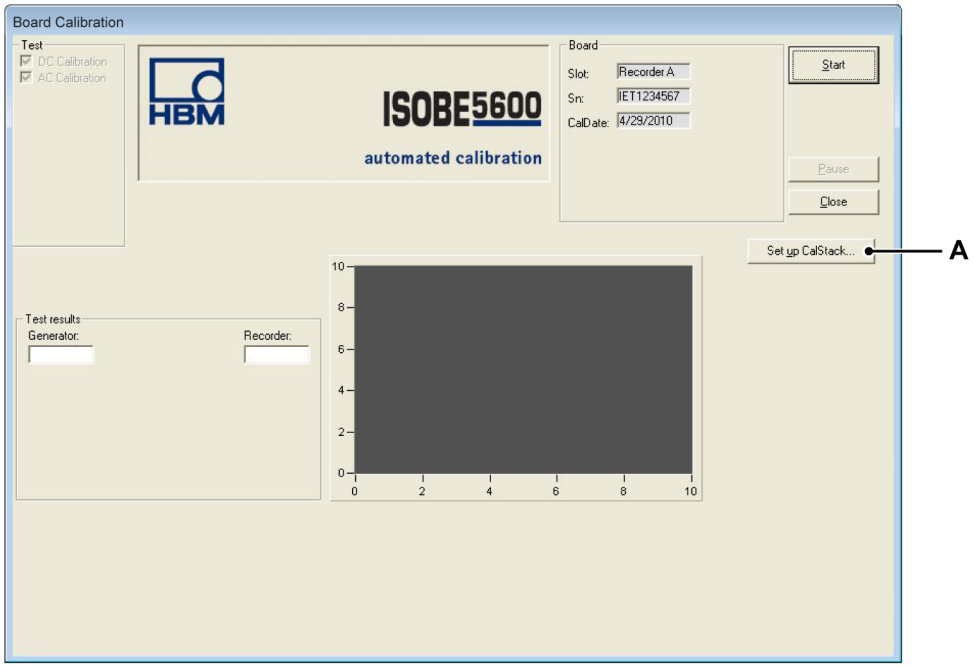



**Figure 4.11:** Board Calibration window (Transmitter)

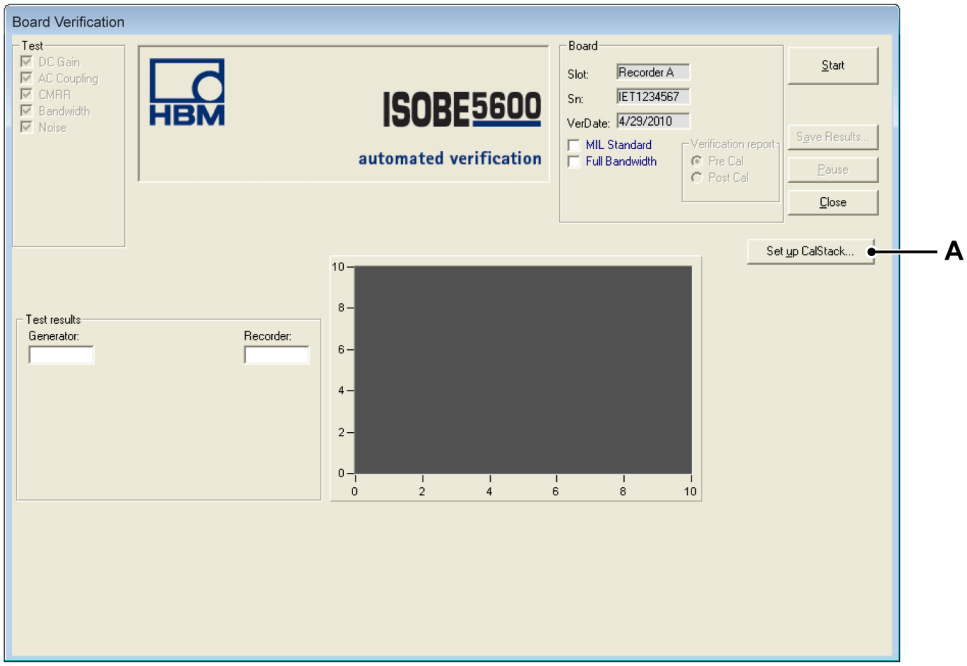



**Figure 4.12:** Board Verification window (Receiver)

**A** Set up CalStack...

In the *Board Calibration* **or** *Board Verification* window:

**2** Click **Set up CalStack...** to open the *CalStack Setup* window.
The **CalStack Setup** window will be displayed.

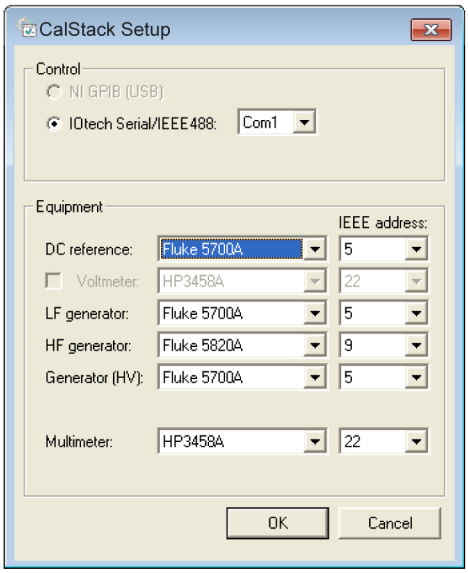



**Figure 4.13:** CalStack Setup window

Ensure that:

- The IEEE address for each component in the equipment list matches the actual device address of that component.

And, if you are using the IOtech Serial/IEEE488:

- The COM port of the IOtech Serial/IEEE488 controller matches the settings of your IOtech configuration.
  For details, please refer to the IOtech specifications.

**3** Click **OK** to save the changes you have made to the CalStack definition.
If you want to exit the CalStack setup, click **Cancel**.

For a few seconds the ISOBE5600 Calibration and Verification software will attempt to communicate with the instruments in the CalStack.

If the communication fails, a failure message will appear.

To check and correct your configuration, click **Set up CalStack...** again.

After setting up the CalStack, the ISOBE5600 Calibration and Verification software will return to the *Calibration* or *Verification* window.

### 4.8.6 Exit the ISOBE5600 Calibration and Verification software

You can exit the ISOBE5600 Calibration and Verification software in the *ISOBE5600 Calibration and Verification* or **Mainframe Selection** window.

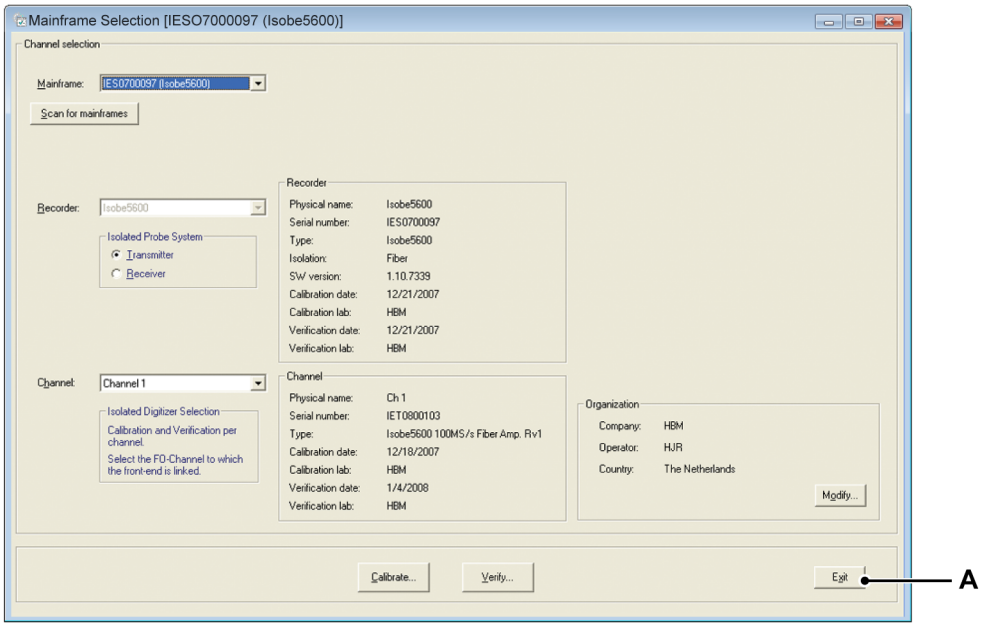



**Figure 4.14:** Exit (Mainframe Selection window)

**A** Exit

Click **Exit** to exit the Calibration and Verification software.

# 5 Calibration

## 5.1 Introduction

The calibration process contains the following tests depending on the selected devices:

- Transmitter - DC Calibration
- Transmitter - AC Calibration
- Receiver - DC Out Cal

**CAUTION**

**Before starting a calibration or verification, it is recommended that the ISOBE5600 system and the calibration standards run at least one hour to achieve the best test specifications.**

**CAUTION**

**HBM uses state-of-the-art electronic components in its equipment. These electronic components can be damaged by discharge of static electricity (ESD). Therefore we must emphasize the importance of ESD preventions when removing or installing boards.**

**Note** *The calibration and verification tests depend on the installed and selected board. Therefore the windows displayed may differ from the illustrations used in this manual.*

## 5.2 Calibrating

Before calibrating you must select which probe system to calibrate; the Transmitter or the Receiver.

### 5.2.1 Starting the calibration

In the **Mainframe Selection** window:

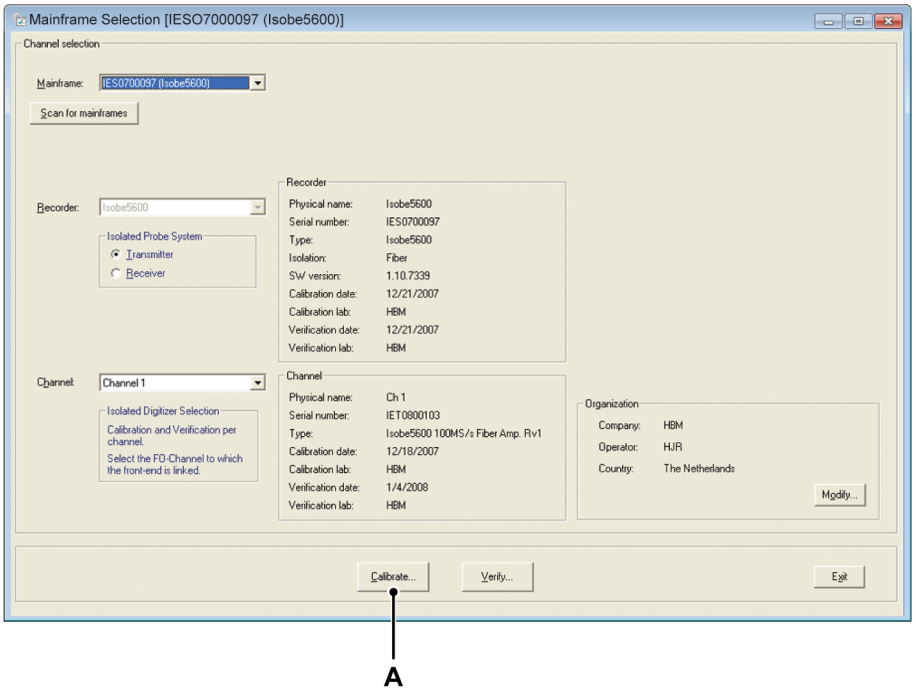



**Figure 5.1:** Mainframe Selection window

**A** Calibrate...

Select the probe system you wish to calibrate. Click **Calibrate...** to open the *Calibration* window.

The **Calibration** window will be displayed.

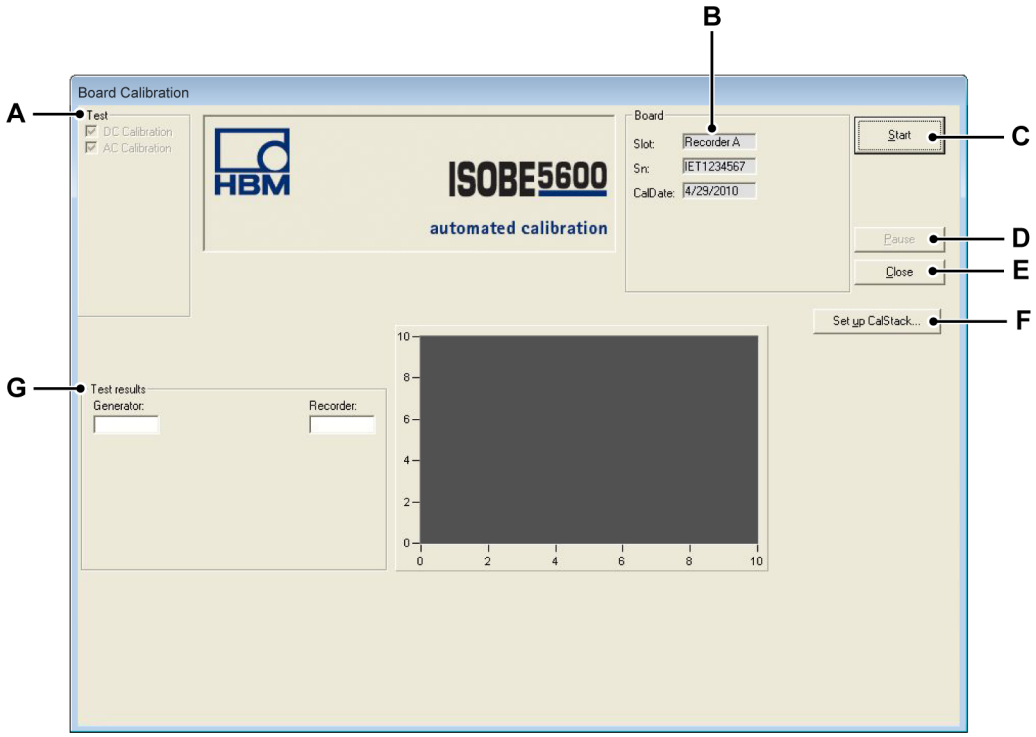



**Figure 5.2:** Board Calibration window overview (Transmitter)

**A** Test: Lists the tests to be performed (depending on the selected device)

**B** Board: Shows information about the selected device

**C** Start: To start the calibration process

**D** Pause: To pause or stop while testing

**E** Close: To end the calibration process

**F** Set up CalStack...: To open the CalStack Setup window

**G** Test results: Shows the test results

**Note** *Recorder values may differ from the Generator and DVM values and do not compromise the calibration!*

**CAUTION**

**Before starting a calibration or verification, it is recommended that the ISOBE5600 system and the calibration standards run at least one hour to achieve the best test specifications.**

**CAUTION**

**If you have not already done so, set up the CalStack before starting a calibration or verification to ensure that the ISOBE5600 Calibration and Verification software knows which calibration standard(s) you are using.**

To begin the calibration process of the selected device:

1 Click **Start**.
2 Connect the testing fixture to the calibration standard(s) as displayed on your screen.

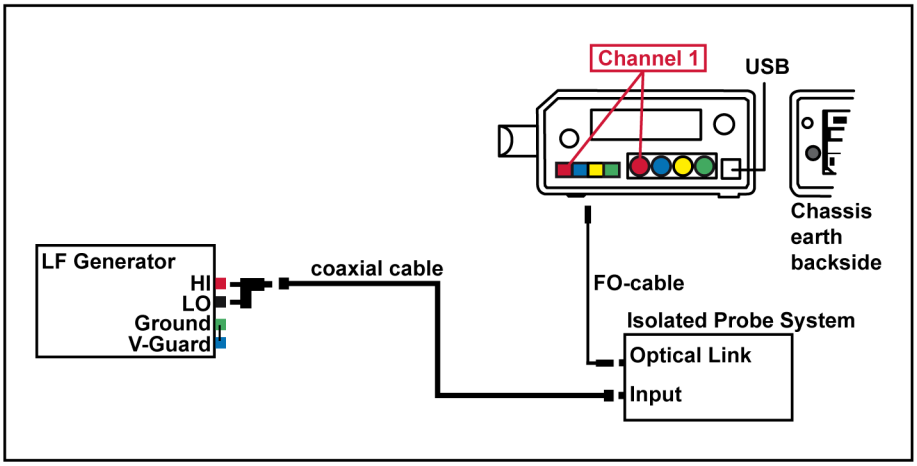



**Figure 5.3:** Example of an ISOBE5600 Connection window

**Note** *The color of your cables may differ from the cables displayed on the ISOBE5600 Connection window.*

**3** When connected, click **OK** to start testing.
The system will start the calibration process.

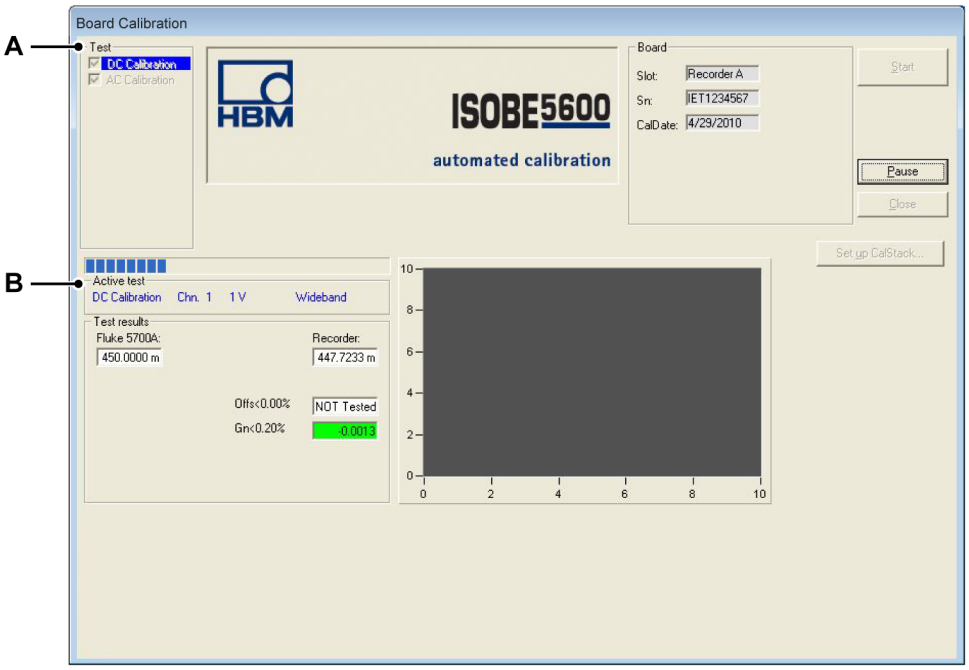



**Figure 5.4:** DC Calibration - Transmitter

**A** Test: Indicates the test to be performed

**B** Active test progress bar

### 5.2.2 DC Calibration

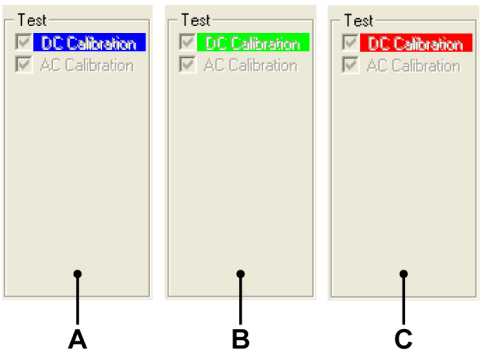



**Figure 5.5:** Test performing

**A** As the system performs the test “DC Calibration”, you will see a blue background behind the “DC Calibration”

**B** When the test is passed, the background behind “DC Calibration” will turn to green.

**C** When the test is failed, the background behind “DC Calibration” will turn to red.

**Note** *If you performed a receiver test you will only see the available DC test for that selection.*


**Figure 5.6:** Receiver - Test Performing

The **Active test** progress bar gives information on what is currently happening.


**Figure 5.7:** Active test progress bar

### 5.2.3 AC Calibration (depending on device)

**CAUTION**

**Before performing the AC calibration, it is recommended to have access to any necessary physical adjustments to AC gain. After AC calibration, the device should be put together as it will be used for measurement.**

When the DC Calibration test is finished, the calibration process continues with the AC Calibration test:

1 Connect the testing fixture to the calibration standard(s) as displayed on your screen.

**Note** *This should be the same setup as the DC calibration of the Transmitter*

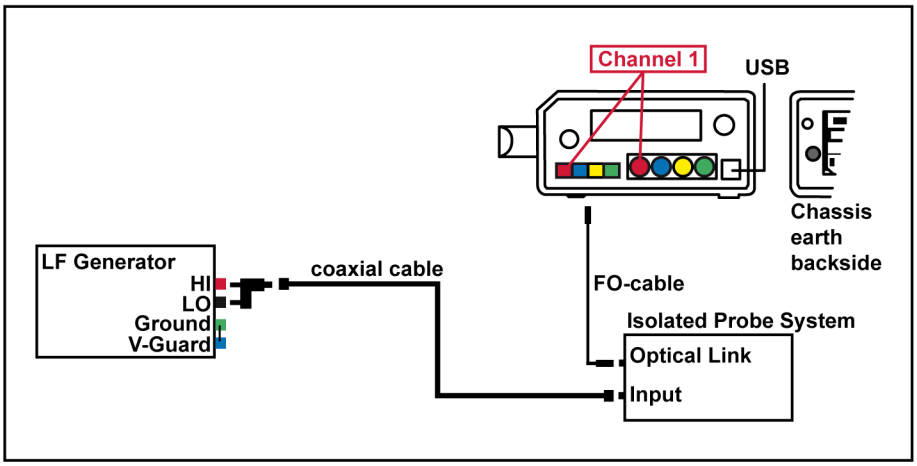



**Figure 5.8:** Example of an ISOBE5600 Connection window

**Note** *The color of your cables may differ from the cables displayed on the ISOBE5600 Connection window.*

2 If connected, click **OK** to start testing.

When necessary, adjust the channels of the board.

**WARNING**

**Only use a ceramic or other non-conductive adjustment tool.**

**CAUTION**

**HBM uses state-of-the-art electronic components in its equipment. These electronic components can be damaged by discharge of static electricity (ESD). Therefore we must emphasize the importance of ESD preventions when removing or installing boards.**

For details on how to Open the ISOBE5600 for calibration please see appendix A “ISOBE5600 Calibration Adjustments” on page 119.

The position of the adjustments is depends on the device.
Please refer to appendix A “ISOBE5600 Calibration Adjustments” on page 119 of this manual.

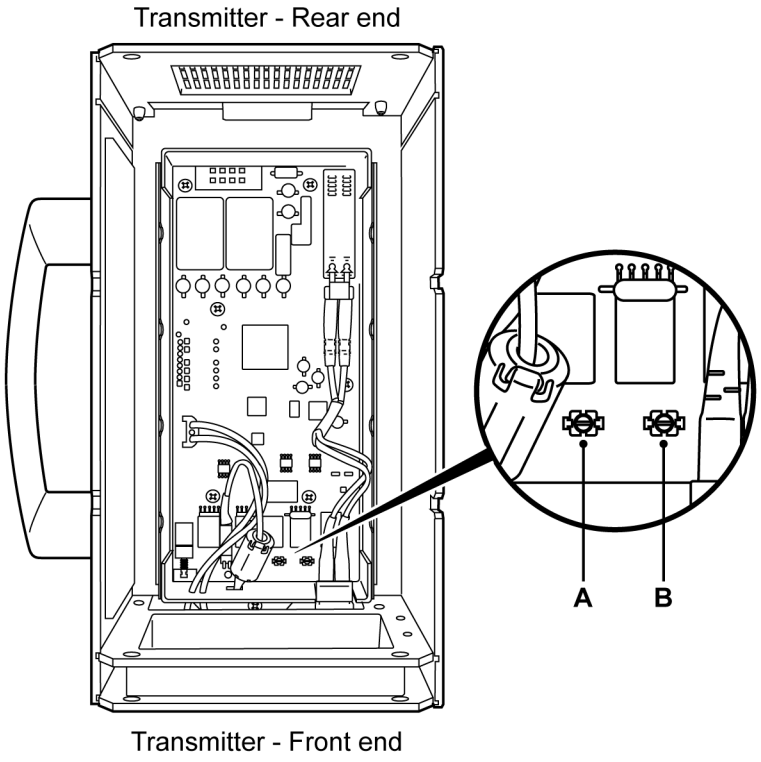



**Figure 5.9:** AC Calibration adjustments (example)

**A** T118

**B** T127

**Note** *Use a nylon adjustment device to modify the position of the adjustment screws as shown in Figure 5.9.*

Adjust the channel using the adjustment tool until the needle enters the green section.
Repeat this adjustment for each channel.

When all channels have been properly adjusted, the **Next Step** or **Ready** button (depending on the selected device) will be enabled.

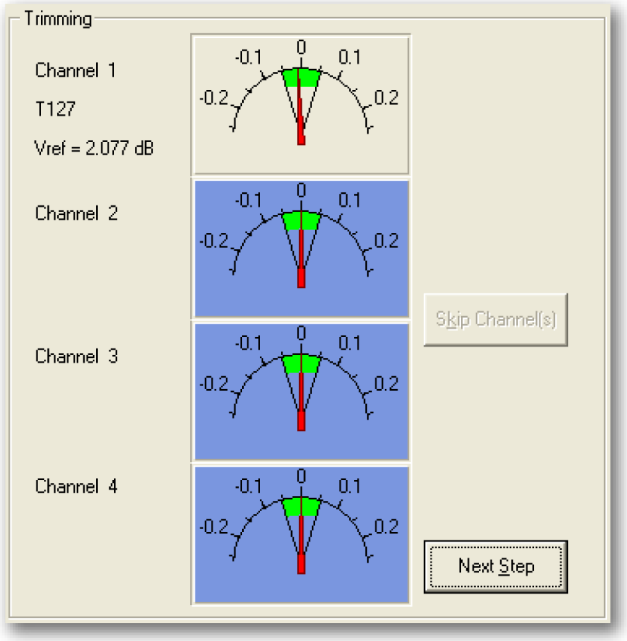



**Figure 5.10:** Channel adjustment (T127)

Click **Next Step** to continue the adjustment.

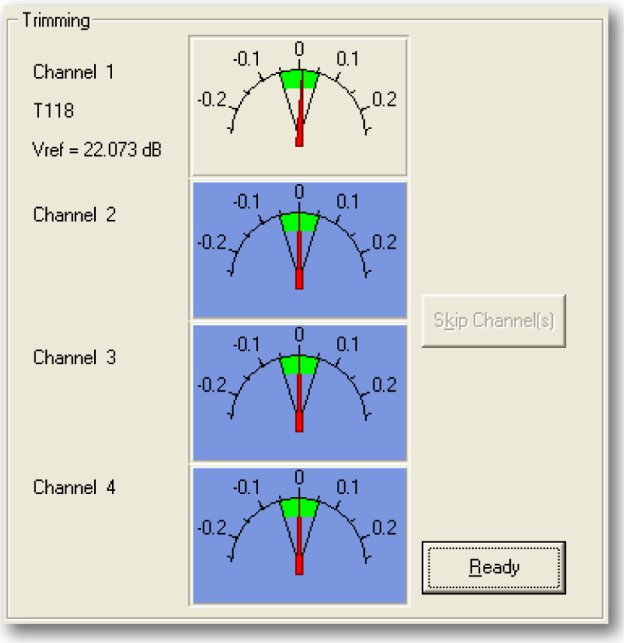



**Figure 5.11:** Channel adjustment Ready (T118)

Click **Ready** after you have adjusted all channels. The software will then continue the calibration process.

**Note** *If you do not adjust a particular channel or if you click **Skip Channel(s)**, the calibration process will continue but the result will fail.*

### 5.2.4 Calibration test results

If all calibration tests are passed:

- A “Saving Calibration date ....” message appears.
- The passed tests and results are indicated by a green background.

If one of the calibration tests is failed:

- A “Calibration failed" message appears.
- The failed tests and results are indicated by a red background.

You can see the test results once all tests have been performed.

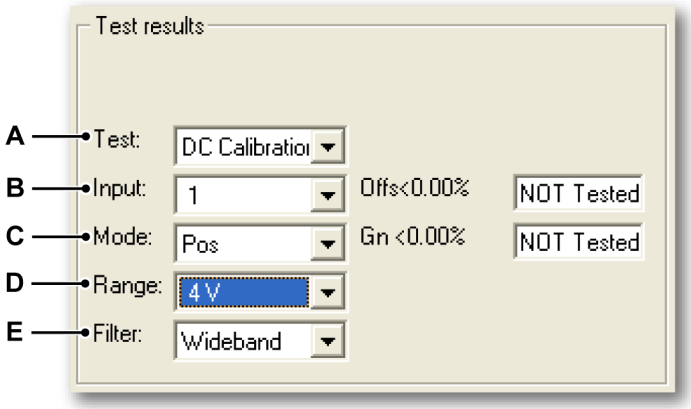



**Figure 5.12:** Test results

**A** Test list

**B** Input list

**C** Mode list

**D** Range list

**E** Filter list

Click in one of the lists (**A** to **E**) to select the appropriate test and see the result.

**Passed test results**
Passed tests and results are indicated by a green background.
If the calibration process is successfully completed, you will see a “Saving Calibration date ....” message appear in the bottom left-hand corner of the screen.


**Figure 5.13:** Saving Calibration date message

**Failed test results**
If one of the tests is failed, a "Calibration failed" message appears.

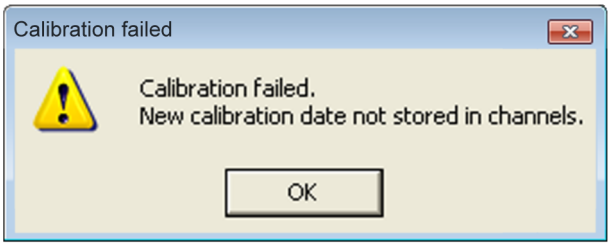



**Figure 5.14:** Calibration failed message

**Note** *The new calibration date will not be stored in the channels.*

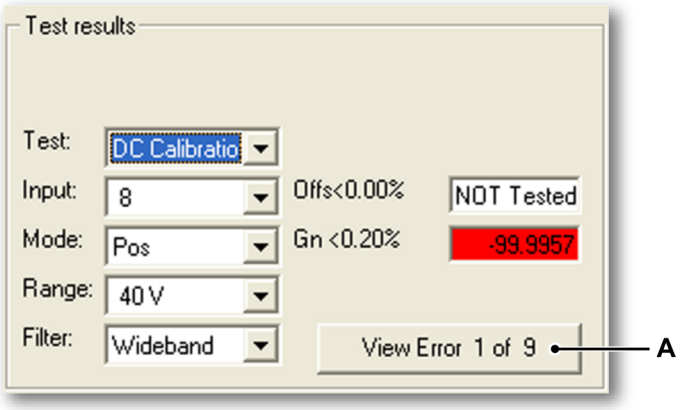



**Figure 5.15:** Failed test results

**A** View Error

Click **View Error** repeatedly to see each failed test result.

Failed tests and results are indicated by a red background.

The ISOBE5600 Receiver and Transmitter are calibrated independently. Transmitter calibration does not depend on the channel number. The calibrated Transmitter can be verified in each channel slot. After calibration, the device(s) should be verified as outlined in the “Calibration Verification” section of this manual.

# 6 Calibration Verification

## 6.1 Introduction

The Verification process performs all verifications that have been done at the factory.
The Verification process contains the following tests depending on the selected device:

- DC Gain
- AC Coupling
- Bandwidth
- Noise
- CMRR (Common Mode Rejection Ratio)
- DC Output
- Output Noise
- Output Res.

**Note** *The calibration and verification tests depend on the installed and selected board. Therefore the windows displayed may differ from the illustrations used in this manual.*

**Note** *The timebase accuracy will not be verified!*

**CAUTION**

**Before starting a calibration or verification, it is recommended that the ISOBE5600 system and the calibration standards run at least one hour to achieve the best test specifications.**

## 6.2 Verifying

### 6.2.1 Setting up the Verification test

In the **Mainframe Selection** window:

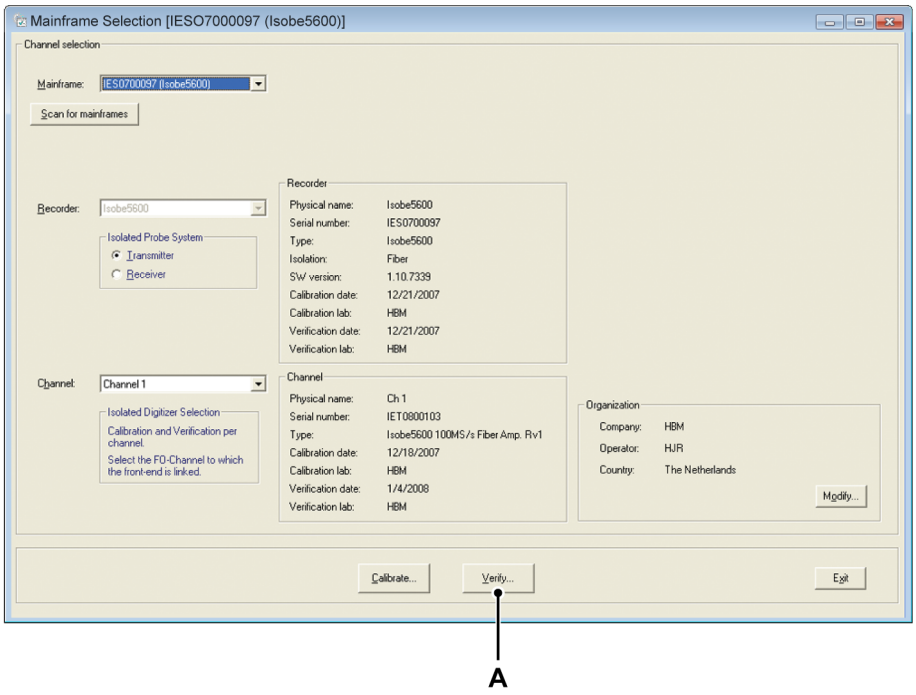



**Figure 6.1:** Mainframe Selection window

**A** Verify...

Click **Verify...** to open the *Board Verification* window.

The *Board Verification* window will be displayed.

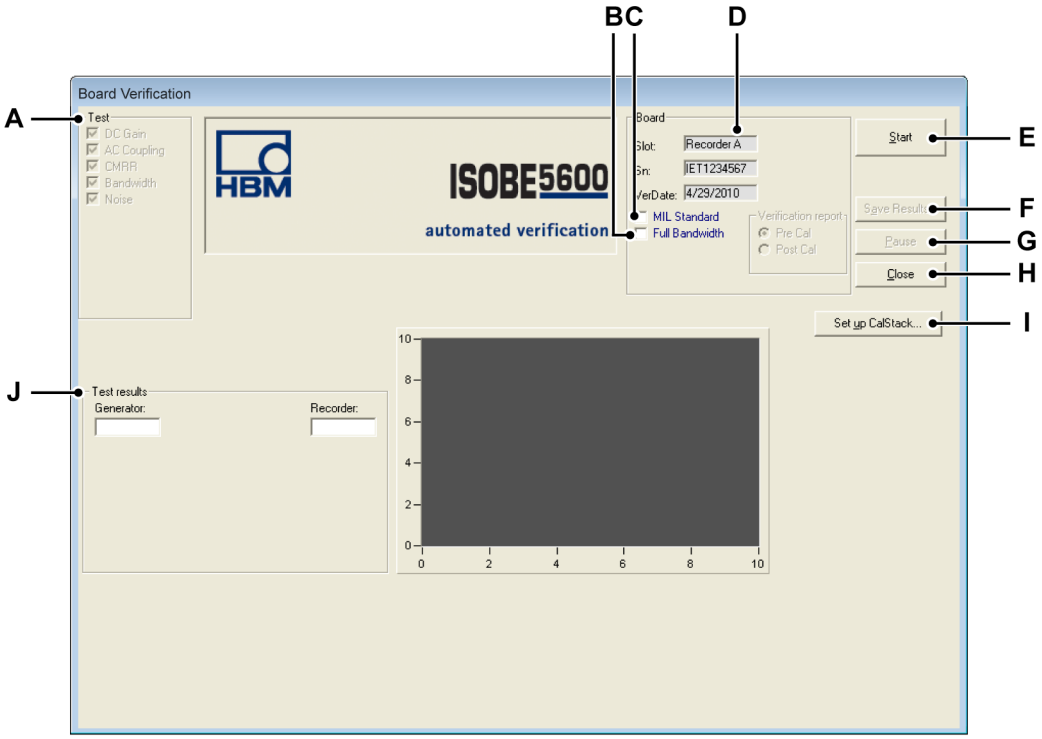



**Figure 6.2:** Board Verification window overview (Transmitter)

**A** Test: Indicates the tests to be performed (depending on the selected device)

**B** Optional: Full Bandwidth tests

**C** Optional: MIL standard test

**D** Board: Shows information about the selected device

**E** Start: To start the verification process

**F** Save Results...: To save the verification test results

**G** Pause: To pause or stop while testing

**H** Close: To end the verification process

**I** Set up CalStack...: To open the CalStack Setup window.

**J** Test results: Shows the test results

**CAUTION**

**If you have not already done so, set up the CalStack before starting a calibration or verification to ensure that the ISOBE5600 Calibration and Verification software knows which calibration standard(s) you are using.**

**CAUTION**

**Before starting a calibration or verification, it is recommended that the ISOBE5600 system and the calibration standards run at least one hour to achieve the best test specifications.**

### 6.2.2 Starting the Verification test

When selecting bandwidth testing; there are now optional tests that can be performed based on the depth of information required.

The basic Bandwidth test is performed by default and will calculate only the -3 db bandwidth value.

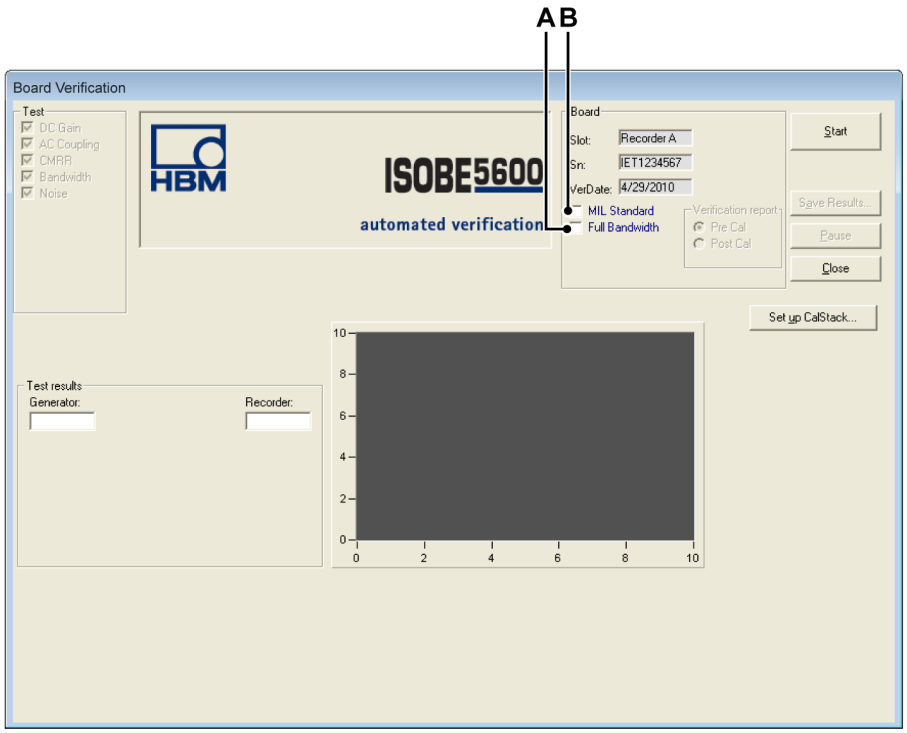



**Figure 6.3:** Board Verification window (Bandwith tests)

**A** **Full Bandwith** Selecting the **Full** check box:
This test is longer than the quick bandwidth test. It tests more input values to give a better picture of the bandwidth curve before and after the -3db value, A separate log file is produced.

**B** **Mil standard** Selecting the **Mil**itary **standard** check box:
This will test all DC Gain input ranges possible and takes the most time. When selecting **Mil** you will have the option to select the report to save and display as a pre or post **Cal**ibration, these will then be separate files.

**Note** *A log file is produced with all DC Gain results available, refer to appendix "Log files and reports" on page 109 for more details.*

To begin the verification process of the selected device:

1 Click **Start**.
2 Connect the testing fixture to the calibration standard(s) as displayed on-screen.

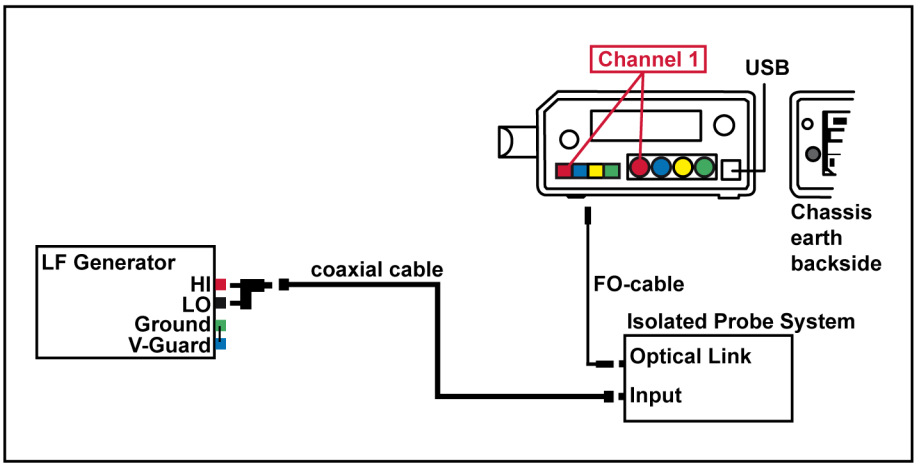



**Figure 6.4:** Example of an ISOBE5600 Connection window

**Note** *The color of your cables may differ from the cables displayed on the ISOBE5600 Connection window.*

3 When connected, click **OK** to start testing.
The system will start with the verification process.

### 6.2.3 During Verification Testing

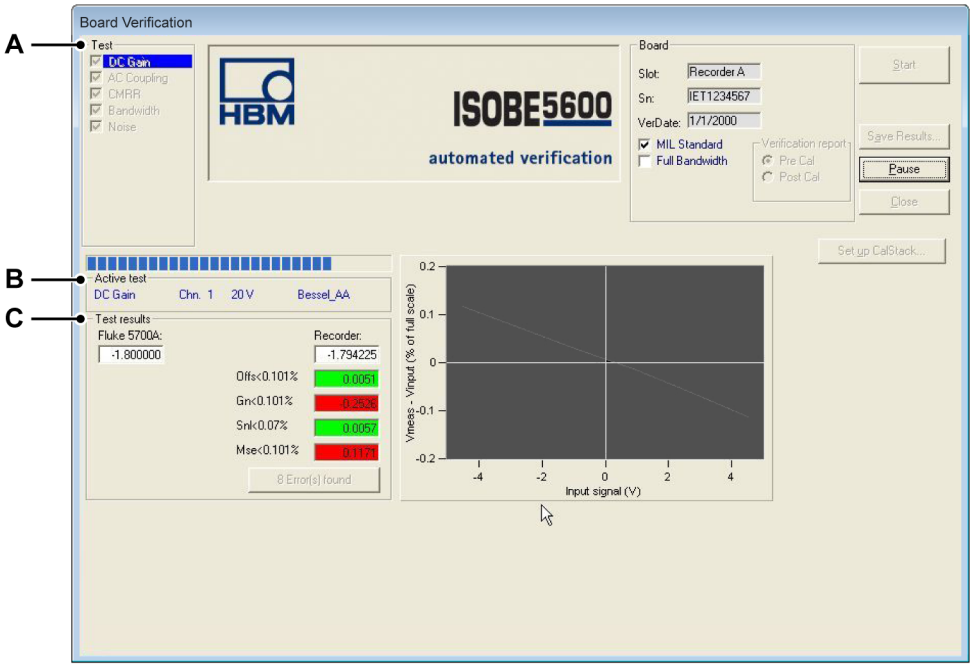



**Figure 6.5:** DC Gain

**A** **Test** Indicates the test to be performed

**B** Active test progress bar

**C** Test results

**A** **Test** performing

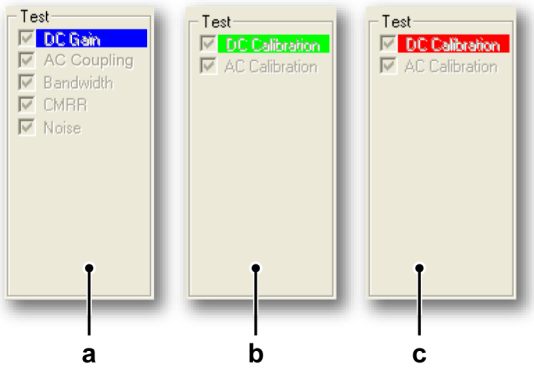



**Figure 6.6:** Test performing

**a** As the system performs the test “DC Gain”, you will see a blue background behind the “DC Gain”.

**b** When the test is passed, the background behind “DC Gain” will turn to green.

**c** When the test is failed, the background behind “DC Gain” will turn to red.

If the receiver verification was chosen you will see the same screen layout but with the tests available as in Figure 6.7.


**Figure 6.7:** Receiver verification

**B Active test**

The “Active test” progress bar gives information on what is currently happening.


**Figure 6.8:** Active test progress bar

**C Test results**

For more information please refer to chapter “Verification test results” on page 90.

### 6.2.4 Verification test results

When all verification tests are passed:

- A “Saving Verification date.....” message appears.
- The passed tests and results are indicated by a green background.

When one of the verification tests is failed:

- A "Verification failed" message appears.
- The failed tests and results are indicated by a red background.

You can see the test results once all tests has been performed.

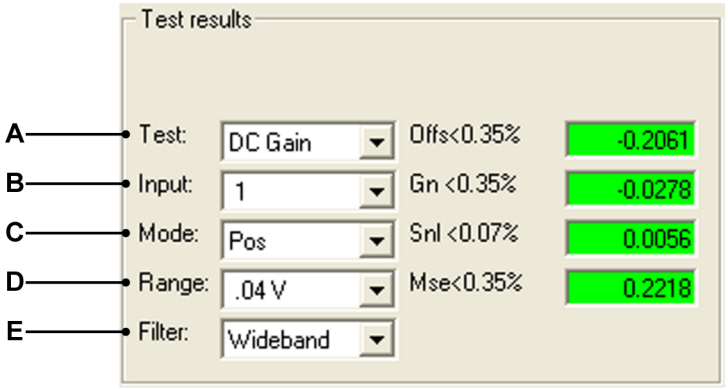



**Figure 6.9:** Test results

**A** Test list

**B** Input list

**C** Mode list

**D** Range list

**E** Filter list

Click in one of the list (**A** to **E**) to select the appropriate test and see the result.

**Passed test results**
Passed tests and results are indicated by a GREEN background.
When the verification process is passed, you will see a
“Saving Verification date.....” message appear in the bottom left hand corner of the screen.


**Figure 6.10:** Saving Verification date message

**Failed test results**
Failed tests and results are indicated by a RED background.

If one of the tests is failed, a **Verification failed** message appears.

**Figure 6.11:** Verification failed message

**Note** *The new verification date will not be stored in the channels.*

Failed tests and results are indicated by a red background.

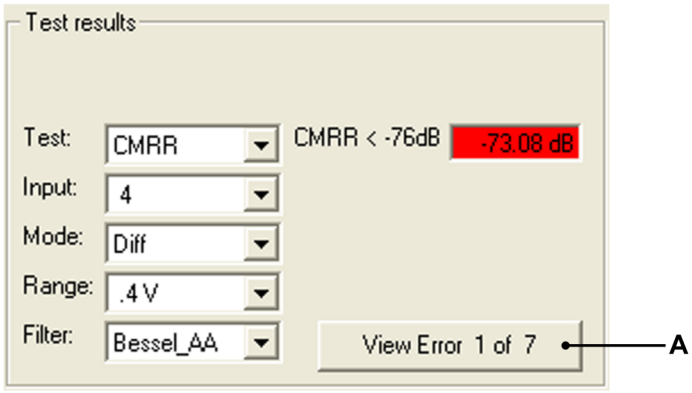



**Figure 6.12:** Failed test results

**A** View Error

Click **View Error** repeatedly to see each failed test result.

**Save results**
Click **Save Results...** to save the verification test results to a report.

The report is a Word file containing:

- Mainframe information
- Board (recorder) information
- Verification test results for each test on each channel

# 7 Theory of Operation

## 7.1 DC Gain (Voltage or Current) Test

### General information

Required equipment:

- DC reference
- Multimeter (DVM)
  (Only required when the accuracy of the DC reference is not adequate).

Acquisition settings:

- Maximum sample rate
- All channels DC-coupled
- Mode-, Filter- and Range settings as defined by the verification process.

**HINT/TIP**

The standard DC gain process uses a selected set of all Mode Filter and Range settings supported by the **D**evice **U**nder **T**est (DUT). The selection is done based on the technical design of the DUT to ensure all design combinations are tested.

**Procedure:**

Six voltages are input one at a time, using the DC reference. These voltages are equally divided from -45 % of Range to +45 % of Range.

Each of the six voltages are stored and denoted as $\mathbf{Vin_i}$

For each applied voltage an average value is calculated.

- For sample rates < 10 MS/s 100 k samples are averaged.
- For sample rates ≥ 10 MS/s 10 M samples are averaged.

Each averaged value is denoted as $\mathbf{Vmeas_i}$.

A “least squares regression” line is then calculated as follows:

**DC Gain Test**

$$\mathrm{SumX} = \sum_{i=V_{\min}}^{5} \mathrm{Vin}_i \qquad \mathrm{SumY} = \sum_{i=V_{\min}}^{5} \mathrm{Vmeas}_i$$

$$\mathrm{Sum}X^2 = \sum_{i=V_{\min}}^{5} \mathrm{Vin}_i{}^2 \qquad \mathrm{SumXY} = \sum_{i=V_{\min}}^{5} \mathrm{Vin}_i * \mathrm{Vmeas}_i$$

$$\mathrm{MeanX} = \mathrm{SumX} \ / \ 6$$

$$\mathrm{MeanY} = \mathrm{SumY} \ / \ 6$$

$$\mathrm{Slope} = \frac{(6 * \mathrm{SumXY}) - (\mathrm{SumX} * \mathrm{SumY})}{\left(6 * X^2\right) - (\mathrm{SumX})^2}$$

$$\mathrm{Intercept} = \mathrm{MeanY} \text{ - } (\mathrm{Slope} \ * \mathrm{MeanX})$$

$$\mathrm{BestFit} = (\mathrm{Slope} \ * \ \mathrm{Vin}_i) + \mathrm{Intercept}$$

- **Gain Err** = (Slope - 1) * 100%
- **Offset Err** = (Intercept / Range) * 100%
- **SINL** = Maximum( Absolute($\mathrm{Vmeas}_i$ - $\mathrm{BestFit}_i$) ) / Range * 100%
- **MSE** = Maximum( Absolute($\mathrm{Vmeas}_i$ - $\mathrm{Vin}_i$ )) / Range * 100%

### 7.1.1 The MIL (Military) standard test

This is also a DC gain test and is different to the basic test in several ways. It covers all voltage ranges and all filters and is not a selective test as the basic DC gain test is.

In General because this test is fully comprehensive it takes a lot longer to perform than the basic DC gain test.

## 7.2 AC Coupling Test

### General information

Required equipment:

- LF generator

Acquisition settings:

- Sample rate 10 kS/s
- All channels are set to AC-coupling.
- Mode-, Filter- and Range- settings as defined by the verification process.

**HINT/TIP**

As the AC coupling is not depending on the filter or range settings only a selected combination of these settings are tested to guarantee AC coupling works in all possible settings combinations.

**Procedure:**

- A DC-signal (90 % full scale) is applied.
- 4000 samples are acquired.
- The standard deviation of this data is calculated.
- This value must be < 0.5 * signal value.

- An AC-signal (90 % full scale (pk-pk)) at 200 Hz is applied.
- 4000 samples are acquired.
- The standard deviation of this data is calculated.
- This value must be > 0.5 * signal value.

Test results is either **pass or fail**. The test does not verify the exact -3 dB point for the AC coupling as the AC coupling frequency is defined by a single capacitor and not adjustable.

## 7.3 Bandwidth Test

### General information

Required equipment:

- The HF generator
- 50 ohm termination plug

Acquisition settings:

- Maximum sample rate
- All channels are DC coupled
- Mode-, Filter- and Range- settings as defined by the verification process.

**HINT/TIP**

The bandwidth test uses a selected set of all Mode Filter and Range settings supported by the **D**evice **U**nder **T**est (DUT). The selection is done based on the technical design of the DUT to ensure all design combinations are tested.

There are two types of bandwidth test:

- The quick bandwidth test
- The Full bandwidth test

The quick bandwidth test is always run as standard to determine the -3 dB point. If **Full** bandwidth is selected, an enhanced test is also performed on the different signal frequencies.

### 7.3.1 Quick Bandwidth Test

AC-gain is measured using a total of 3 frequency values, to check if the - 3 dB point is within specifications.

A 90 % full scale AC signal is input from the HF generator into the device under test. The initial signal frequency is set to 500 Hz using Fluke 5700A or 5720A or 50 kHz using the Fluke 5820A or 9500B.

4000 samples are acquired and the standard deviation calculated and stored as **Vref**.

The -3 dB point is calculated as (.7071* Vref) and is denoted as **3dBval**.

The frequency is then incremented to the Minimum Bandwidth specification value **($Freq_{lo}$)**. 4000 samples are acquired and the standard deviation is calculated to get a **$Vmeas_{lo}$**. **$Vmeas_{lo}$** must be higher than **3dBval**.

The frequency is then incremented to the Maximum Bandwidth specification value **($Freq_{hi}$)**. 4000 samples are acquired and the standard deviation is again calculated to get a **$Vmeas_{hi}$**. **$Vmeas_{hi}$** is compared with **Vref** and must be lower than **3dBval**.

A fictitious line is drawn between the two measured points. From the point where this line meets the **3dBval** the frequency is calculated.

$$ACgain_{lo} = 20\log_{10} (Vmeas_{lo} / Vref)$$

$$ACgain_{hi} = 20\log_{10} (Vmeas_{hi} / Vref)$$

$$Bandwidth = ((ACgain_{lo} + 3) / (ACgain_{lo} - ACgain_{hi})) * (Freq_{hi} - Freq_{lo}) + Freq_{lo}$$

### 7.3.2 Full Bandwidth test

During this test the amplitude behavior of the amplifier is tested over the frequency range the amplifier supports.

The start frequency is set to maximum sample rate of the channel / 2000 = Fstart. The end frequency is set to the maximum sample rate of the channel = Fstop. The frequency range from Fstart to Fstop is divide in frequency ranges of decades and per decade we test 5 steps.

The used Frequency decades are:
100 Hz to 1 kHz
1 kHz to 10 kHz
10 kHz to 100 kHz
100 kHz to 1 MHz
1 MHz to 10 MHz
10 MHz to 100 MHz
etc.

During the test a sine-wave of the selected frequency is applied using 90 % peak to peak amplitude of the full scale amplifier range that is currently being tested.

**Note** *The Fluke 5820A or 5900B calibrator only supports a maximum of a 5.5 V peak to peak signal. So any amplifier range above 50 V-results will be negatively influenced by the maximum of the 10 % full scale signal.*

The test then starts at Fstart and applies the calibrator amplitude (Voutput) and measures the RMS value of the channel (Vmeasured).

**Note** *Actual frequencies used during the tests are rounded to the step-size of the calibrator used and are slightly increased to overcome beat-frequency measurements. The results logged in the extra results file is the amplifier attenuation in dB; 20 * log (Vmeasured/Voutput).*

## 7.4 Noise Test

### General information

Required equipment:

- 50 Ohm termination plug

Acquisition settings:

- Maximum sample rate
- All channels are terminate together with a single external 50 Ohm plug
- Mode-, Filter- and Range settings as defined by the verification process.

**HINT/TIP**

The noise test uses a selected set of all Mode Filter and Range settings supported by the **D**evice **U**nder **T**est (DUT). Typically in one filter setting all ranges are tested where all other filter settings are only tested in reduced range settings as the filters used are range independent.

**Procedure:**

For each test setting 4000 samples are taken.
The standard deviation of this data is then calculated, $\mathbf{Vmeas}_{\mathbf{std}}$

$\mathbf{Noise}_{\mathbf{rms}} = \mathbf{Vmeas}_{\mathbf{std}}$ / Range * 100 %

## 7.5 CMRR (Common Mode Rejection Ratio) Test

### General information

Required equipment:

- The LF generator

Acquisition settings:

- 1 kS/s sample rate
- All channels are DC-coupled
- Mode-, Filter- and Range settings as defined by the verification process.

**HINT/TIP**

The CMMR process uses a selected set of all Mode Filter and Range settings supported by the **D**evice **U**nder **T**est (DUT). The selection is done based on the technical design of the DUT to ensure all design combinations are tested.

**Procedure:**

For isolated channels, the AC signal from the LF generator is between channel input (signal and isolated ground) and system ground.
For non-isolated channels, only differential amplifiers can be CMRR-tested and then the AC signal is applied between channel inputs (pos. and neg.) and channel/system ground.

The input signal frequency is set to 80 Hz.
The input signal voltage (peak) is set to 3 * Range, unless the value is limited by the amplifier specification or the LF generator. In this case the maximum allowed/available voltage is used.

2000 Samples are acquired. The standard deviation of this data is then calculated: **Vmeas**.
The LF generator RMS output voltage is denoted as **Vin**.

The **CMRR** is calculated in dB as follows:

**CMRR** = $20\log_{10}$ (**Vmeas** / **Vin**)

## 7.6 DC Output Test

### General information

Required equipment:

- Multimeter

Isolated Probe System settings:

- The DC Output test can be done without the Transmitter connected.

**Procedure:**

Six voltages are generated by the ISOBE5600 Receiver one at a time. The voltages are equally divided from -45 % to +45 % of Range and are denoted as **$Vout_i$**.

These output voltages are measured with the Multimeter and denoted as **$Vmeas_i$**.

A “least squares regression” line is then calculated as follows:

**DC Output Test**

$$\mathrm{SumX} = \sum_{i=V_{\min}}^{5} \mathrm{Vout}_i \qquad \mathrm{SumY} = \sum_{i=V_{\min}}^{5} \mathrm{Vmeas}_i$$

$$\mathrm{Sum}X^2 = \sum_{i=V_{\min}}^{5} \mathrm{Vout}_i{}^2 \qquad \mathrm{SumXY} = \sum_{i=V_{\min}}^{5} \mathrm{Vout}_i * \mathrm{Vmeas}_i$$

$$\mathrm{MeanX} = \mathrm{SumX} \ / \ 6$$

$$\mathrm{MeanY} = \mathrm{SumY} \ / \ 6$$

$$\mathrm{Slope} = \frac{(6 * \mathrm{SumXY}) - (\mathrm{SumX} * \mathrm{SumY})}{\left(6 * X^2\right) - (\mathrm{SumX})^2}$$

$$\mathrm{Intercept} = \mathrm{MeanY} - (\mathrm{Slope} * \mathrm{MeanX})$$

$$\mathrm{BestFit} = (\mathrm{Slope} * \mathrm{Vout}_i) + \mathrm{Intercept}$$

- **Gain Err** = (Slope - 1) * 100 %
- **Offset Err** = (Intercept / Range) * 100 %

## 7.7 Output Noise Test

### General information

Required equipment:

- Multimeter

Isolated Probe System settings:

- The Output Noise test can be done without the Transmitter connected.

**Procedure:**

The output is set to 0 V. The output AC voltage (rms) is measured with the Multimeter: $\mathbf{Vmeas_{rms}}$

$\mathbf{Noise_{rms}} = \mathbf{Vmeas_{rms}}$ / Range * 100 %

## 7.8 Output Res. Test

### General information

Required equipment:

- Multimeter
- DC Reference used for resistive load

Isolated Probe System settings:

- The Output Res. test can be done without the Transmitter connected.

**Procedure:**

The output is set to 90 % full scale. This output voltage is measured with the Multimeter twice.
First without resistive load (DC reference, Rload1 = 100 MΩ): **$Vmeas_1$**.
The second time with a resistive load (DC reference, Rload2 = 100 Ω): **$Vmeas_2$**.

The output resistance is calculated as follows:

$$Output\mathrm{Res.} = 100 \times \left(\frac{Vmeas1 - Vmeas2}{Vmeas2}\right)$$

# A Specifications

## A.1 B4190-1.0 en ISOBE5600 Calibration Kit

- Fully automated Calibration/Verification of all ISOBE5600 models
- Supports all adjustments
- Verification using published ISOBE5600 specifications
- Pass or Fail report generation
- Supports standard calibrators and digital multimeter

The ISOBE5600 calibration kit enables the user to perform a full calibration or just a verification of any ISOBE5600 model. The calibration kit consists of the calibration/verification software, a manual, USB-IEEE488 converter and a ceramic trimmer. Additionally the user will need the basic cable set to calibrate and verify the ISOBE5600 systems. Using this calibration kit, the proper calibration equipment and calibration fixtures enable easy, fast and on-site self calibration of the ISOBE5600 system. This reduces downtime significantly by preventing shipping the system to HBM for verification and/or adjustments.
The calibration software not only calibrates and tests according to HBM published specs, but also automatically or semi automatically adjusts the system back to the best accuracy possible. For users who only want to verify the system still meets specs but don't want to change anything, the verification procedure does the job and is included in the package as well.

### ISOBE5600 Calibration Kit Setup Overview

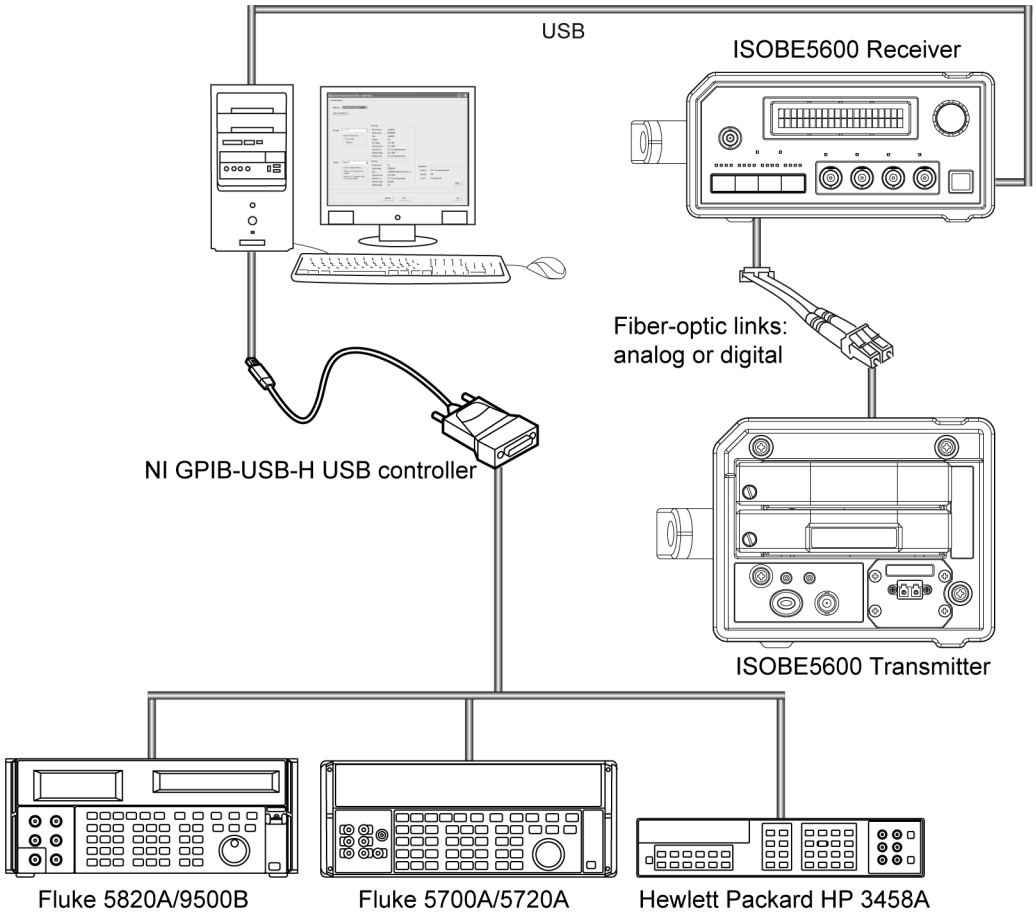



**Figure A.1:** ISOBE5600 calibration kit setup

| Calibration and Verification software | |
|---|---|
| The software comes on a CD with PDF manual and is ready to run after installation. | |
| Software language | English |
| Manual language | English |
| Software requirements | |
| Microsoft® Windows® | Vista™, WIN 7 Business, Ultimate or Enterprise<br>Works in 32 bit mode on 64 bit versions of Vista and WIN 7. |
| PC requirements | |
| Minimum CPU | Intel® Pentium® 4 class PC |
| Minimum RAM memory | 1 GByte |
| Minimum free disk size | 200 MB |
| Minimum graphics card | 16 bit color with 64 MB on-board video memory and hardware DirectX 9 support |
| Minimum screen resolution | 1024 x 768 pixels |
| Free USB 2.0 port | 2; for use with the NI GPIB-USB-HS controller and connection to ISOBE5600r<br>Optional one free COM (serial) port for the IOtech serial to GPIB interface |
| Others | CD-ROM drive used for installation of the software<br>Internal or external speakers for alerts and warnings |
| ISOBE5600 | |
| Receivers | ISOBE5600r and ISOBE5600m |
| Transmitters | ISOBE5600t and ISOBE5600tm |

| Calibration Equipment (Not supplied by HBM) | |
|---|---|
| Beyond the calibration kit itself, the following calibration equipment is needed in order to perform a calibration or verification. | |
| LF-Generator | Fluke 5700A/Fluke 5720A |
| HF-Generator | Fluke 5820A/Fluke 9500B |
| Multi-Meter | HP 3458A |

## Calibration Fixtures and Cables (options, to be ordered separately)

As calibration voltages range from mV to tens of V and go up to MHz, the proper input connections are essential to get repeatable, reliable results. A cable kit containing all required cables, adapters and termination resistors to ensure a proper connection between the calibrator and the GEN series system can also be ordered separately.
The calibration software refers to the fixtures and gives on-line help on how to use them and how to wire it up properly. The software also will indicate whenever voltages are used above the accepted safe levels so operators can take proper safety precautions.

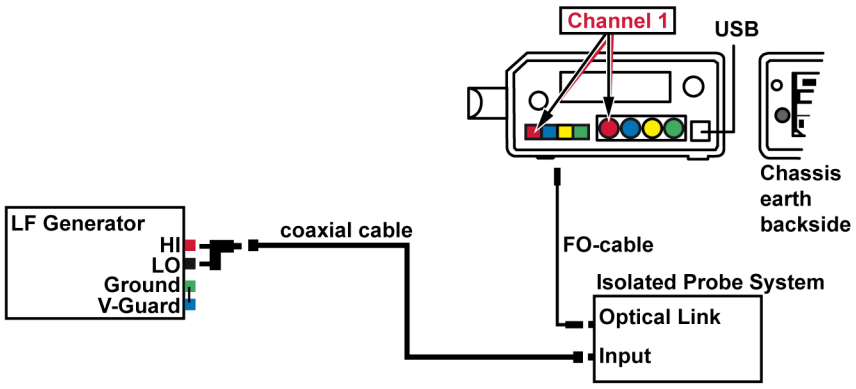



**Figure A.2:** Example of an ISOBE5600 Connection window

## Calibration Process

The complete verification process is fully automated and delivers PASS / FAIL information with the press of a button.
The same applies to most of the calibration process, where electronic intelligence is used to retain the best performance possible. Most of this is fully automated and no user interaction is needed to restore the modules to the best accuracy achievable.
Only in the rare case that AC bandwidth could be improved the use of manual user interaction is required. Then the manual and the software itself help guide you through the needed steps. Exact process description and direct readouts make even manual procedures easy to work with.

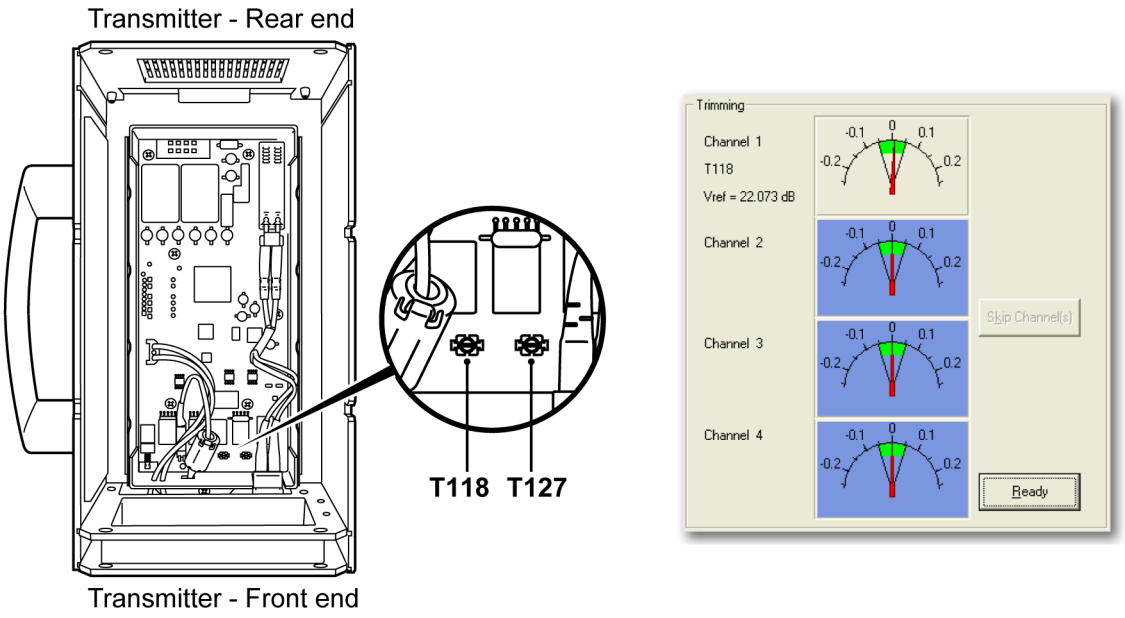



**Figure A.3:** ISOBE5600 AC adjustment description and readouts

## Verification Process

During the fully automated verification, no changes are made to any settings. The end result of the verification is a listing of all findings and an overall PASS / FAIL result. The manual explains every verification process the software uses, including a detailed description of the calculation methods to establish the specifications.

| | |
|---|---|
| Supported verification steps<br>(Not every model requires all steps) | Voltage DC Gain, Offset, Linearity and MSE (Maximum Static Error)<br>AC Coupling<br>Input Bandwidth<br>Input Noise<br>CMRR (Common Mode Rejection Ratio)<br>DC Output Gain and Offset<br>Output Noise |

## Calibration Report Printout

As an end result, the ISOBE5600 system saves all the results in a RTF-Text file. From there it can be stored for later reference or printed out.

---

**ISOBE5600 Calibration and Verification Software** : V2.22

---

Calibration Verification results
Verification Date : Nov 19 , 2014
SPEC-File version : ISOBE 2.10.02

**Recorder Info**
Physical Name : Recorder A
Serialnumber : IFA0800121
Type : ISOBE5600m Memory
SW version : 2.00.12339
No. channels : 4

**Channel Info**
Physical Name : Ch 1
Serialnumber : IET0900255
Type : ISOBE5600 100MS/s
Channel Type : HV Fiber Amplifier Rv1

Channel Test **PASSED**

Note: Calibration/Verification is valid with any calibrated Receiver-channel

Used Equipment for testing board:
DC reference : Fluke 5700A
LF generator : Fluke 5700A
HF generator : Fluke 5820A
Generator (HV) : Fluke 5700A
PWG : Unspecified (manual)
Multimeter : HP3458A
Signal Switch : Unspecified (manual)

---

Filter: Wideband
Input: 1

| Range (V) | Offset (%) | DCGain (%) | SINL (%) | MSE (%) | BWdth (kHz) | CMRR (dB) | Noise (%) | ACCpl |
|---|---|---|---|---|---|---|---|---|
| 0.2 | -0.044 | 0.038 | 0.011 | 0.064 | 29951.8 | NA | 0.031 | NA |
| 0.4 | -0.022 | 0.006 | 0.010 | 0.028 | 32296.5 | NA | 0.024 | NA |
| 1.0 | -0.014 | 0.064 | 0.010 | 0.045 | NA | NA | 0.019 | NA |
| 2.0 | -0.015 | 0.046 | 0.010 | 0.039 | NA | NA | 0.018 | Passed |
| 4.0 | -0.005 | 0.009 | 0.011 | 0.012 | 32998.3 | NA | 0.023 | NA |
| 10.0 | -0.010 | 0.057 | 0.009 | 0.039 | NA | NA | 0.018 | NA |
| 20.0 | -0.011 | 0.044 | 0.010 | 0.033 | NA | NA | 0.018 | NA |
| 40.0 | -0.005 | 0.005 | 0.011 | 0.011 | 34088.1 | NA | 0.023 | NA |
| 100.0 | -0.008 | 0.051 | 0.009 | 0.034 | NA | NA | 0.019 | NA |

| Ordering Information[1] | | | |
|---|---|---|---|
| **Article** | | **Description** | **Order No.** |
| ISOBE5600 Calibration and Verification Software |  | ISOBE5600 Calibration and Verification software. Comes with software CD, electronic user manual, USB to GPIB convertor and AC trimmer | 1-GN-CAL8-2 |

(1) All GEN series systems are intended for exclusive professional and industrial use.

| Options, to be ordered separately [1] | | | |
|---|---|---|---|
| **Article** | | **Description** | **Order No.** |
| GEN series Calibration basic cable set |  | GEN series Calibration basic cable set contains cables, adapters and termination resistors to ensure a proper connection between the calibrator and any GEN series Acquisition card | 1-GN-CAL-CABLES-2 |

(1) As calibration voltages range from mV to tens of V and go up to MHz, the proper input connections are essential to get repeatable, reliable results. The use of HBM calibration fixture garantees validated setups.

# B Log Files and Reports

## B.1 Introduction

During the calibration and verification process, several log files are produced in the default folder

The following is a matrix of the log files that are produced. These log files can be imported into Excel to make graphical representations of the data contained inside them.

| | Test specifications file | Standard verification report rich text | Standard verification report plain text | Extra report |
|---|---|---|---|---|
| **Standard verification** | Yes | Yes | Yes | Yes, DC gain test measured values |
| **Full bandwidth verification** | Yes | Yes | Yes | Yes, DC gain test measured values + FULL bandwidth test values |
| **MIL pre-calibration verification** | Yes | Yes + pre-cal ver MIL | Yes + pre-cal ver MIL | Extended version of full bandwidth |
| **MIL post-calibration verification** | Yes | Yes + post-cal ver MIL | Yes + post-cal ver MIL | Extended version of full bandwidth |

## B.2 The Standard log file

ISOBE5600 Calibration and Verification software V1.20

Verification results (Manufacturing Specifications)

| **Verification Results (Manufacturing Specifications)** | |
|---|---|
| Verification Date | Jan 17, 2008 |
| SPEC File Version | ISOBE 1.20.00 |

| **Recorder Info** | |
|---|---|
| Physical Name | ISOBE5600 |
| Serial Number | IES0700097 |
| Type | ISOBE5600 |
| SW Version | 1.10.7339 |
| No. of channels | 4 |

| **Channel Info** | |
|---|---|
| Physical Name | Ch 4 |
| Serial Number | IET0800103 |
| Channel Type | Fiber Amplifier Rv1 |
| Channel Test | **PASSED** |

| **Board Test PASSED** | |
|---|---|
| Used Equipment for Testing Board: | |
| DC Reference | Fluke 5700A |
| LF Generator | Fluke 5700A |
| HF Generator | Fluke 5820A |
| Generator (HV) | Fluke 5700A |
| PWG | Unspecified (manual) |
| Multimeter | HP3458A |
| Filter | Bessel_AA |
| Input | 4 |

**Note** *Calibration/Verification is valid with any calibrated Receiver channel.*

| Test results | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Range** | **Offset** | **DCGain** | **SINL** | **MSE** | **BWdth** | **CMRR** | **Noise** | **ACCpl** |
| (V) | (%) | (%) | (%) | (%) | (kHz) | (dB) | (%) | |
| 0.2 | -0.022 | 0.015 | 0.005 | 0.030 | NA | NA | 0.021 | NA |
| 0.4 | -0.008 | 0.030 | 0.004 | 0.023 | NA | -111.5 | 0.017 | NA |
| 1.0 | -0.003 | 0.005 | 0.004 | 0.006 | NA | NA | 0.015 | NA |
| 2.0 | 0.001 | -0.001 | 0.005 | 0.006 | NA | NA | 0.016 | Passed |
| 4.0 | -0.001 | 0.010 | 0.004 | 0.005 | 10181.9 | -107.0 | 0.018 | NA |
| 10.0 | -0.001 | -0.013 | 0.005 | 0.010 | NA | NA | 0.016 | NA |
| 20.0 | 0.001 | -0.016 | 0.005 | 0.009 | NA | NA | 0.016 | NA |
| 40.0 | 0.000 | -0.002 | 0.005 | 0.004 | NA | -113.1 | 0.018 | NA |
| 100.0 | 0.002 | -0.026 | 0.005 | 0.013 | NA | NA | 0.016 | NA |

**Note** *This table shows only a part of the report.*

### B.2.1 The Extra log file

**Verification test report**
When the Full **(extra)** test is selected, an **extra** log file will be present in the log save folder with the **Full** bandwidth results inside.

ISOBE5600 Calibration and Verification Software: V2.10

| Verification Results | |
|---|---|
| Date | 27-Apr-2010 |

| Recorder Info | |
|---|---|
| Physical Name | Recorder A |
| Serialnumber | IFA1234567 |
| Type | ISOBE5600m Memory |
| SW version | 2.00.10113 |
| No. channels | 4 |

| Channel Info | |
|---|---|
| Physical Name | Ch 1 |
| Serialnumber | IET1234567 |
| Type | ISOBE5600 100 MS/s |
| Channel Type | Fiber Amplifier Rv1 |

**Test name: DCgain test**

| | |
|---|---|
| Mode: | Positive |
| Filter: | Wideband |
| Range: | .2 V |
| Expected | Ch 1;Ch 2;Ch 3;Ch 4; |

-0.090000;-0.090063;0.000000;0.000000;0.000000;
-0.054000;-0.054053;0.000000;0.000000;0.000000;
-0.018000;-0.018048;0.000000;0.000000;0.000000;
0.018000;0.017955;0.000000;0.000000;0.000000;
0.054000;0.053942;0.000000;0.000000;0.000000;
0.090000;0.089935;0.000000;0.000000;0.000000;

| | |
|---|---|
| Range: | .4 V |
| Expected | Ch 1;Ch 2;Ch 3;Ch 4; |

-0.180000;-0.180040;0.000000;0.000000;0.000000;
-0.108000;-0.108046;0.000000;0.000000;0.000000;
-0.036000;-0.036027;0.000000;0.000000;0.000000;
0.036000;0.035968;0.000000;0.000000;0.000000;
0.108000;0.107933;0.000000;0.000000;0.000000;
0.180000;0.179918;0.000000;0.000000;0.000000;

// TEXT REMOVED FROM OTHER RANGES
// FOR DOCUMENATION PURPOSES

| | |
|---|---|
| Filter: | Bessel_AA |
| Range: | .2 V |
| Expected | ;Ch 1;Ch 2;Ch 3;Ch 4; |

-0.090000;-0.090069;0.000000;0.000000;0.000000;
-0.054000;-0.054055;0.000000;0.000000;0.000000;
-0.018000;-0.018050;0.000000;0.000000;0.000000;
0.018000;0.017958;0.000000;0.000000;0.000000;
0.054000;0.053941;0.000000;0.000000;0.000000;
0.090000;0.089931;0.000000;0.000000;0.000000;

Range: 4 V
Expected; Ch 1;Ch 2;Ch 3;Ch 4;
-0.180000;-0.180060;0.000000;0.000000;0.000000;
// TEXT REMOVED FROM OTHER RANGES
// FOR DOCUMENATION PURPOSES

**Test name: Bandwith test**

Mode: Positive
Range: .2 V
Filter: Wideband
Test amplitude: ;0.18;Vpp;
Freq;Chn. 1 ;
[Hz];[dB] ;
60000;0.050;
100000;0.060;
160000;0.056;
250000;0.059;ni
400000;0.058;
630000;0.062;
1000000;0.056;
1590000;0.051;
2510000;0.042;
3990000;0.016;
6320000;-0.017;
10010000;-0.112;
15860000;-0.527;
25140000;-2.078;
39850000;-6.643;
63160000;-16.390;
100100000;-33.155;
-3dB frequency:;28.1;MHz;(linear interpolation);

**Test name: Bandwith test**

Mode: Positive
Range: .4 V
Filter: Wideband
Test amplitude: 0.36;Vpp;

Freq;Chn. 1 ;
[Hz];[dB] ;
60000;0.038;

// TEXT REMOVED FROM OTHER RANGES
// FOR DOCUMENATION PURPOSES

**Test name: Bandwith test**

| | |
|---|---|
| Mode: | Positive |
| Range: | .2 V |
| Filter: | Bessel_AA |
| Test amplitude: | 0.18;Vpp; |

Freq;Chn. 1 ;
[Hz];[dB] ;
60000;0.075;

// TEXT REMOVED FROM OTHER RANGES
// FOR DOCUMENATION PURPOSES

### B.3 Producing graphical results - DC Gain

The extra log file can be imported into excel to make a visual plot of the graphical data.

**Note** *Be sure to select; Original data type = Delimited ▸ Delimiter = Semi colon, to be able to import the data correctly.*

Figure B.1 is an example of the expected graphical output of the **DC Gain** section of a log file. (“Test name: DCgain test” on page 112).

| | | | | | | |
|---|---|---|---|---|---|---|
| 18 | | | | | | |
| 19 | Test name | DCgainTest | | | | |
| 20 | Mode: | Positive | | | | |
| 21 | Filter: | Wideband | | | | |
| 22 | Range: | .2 V | | | | |
| 23 | Expected | Ch 1 | Ch 2 | Ch 3 | Ch 4 | CH1-Expected |
| 24 | -0.09 | -0.09003 | 0 | 0 | 0 | -3E-05 |
| 25 | -0.054 | -0.05403 | 0 | 0 | 0 | -2.7E-05 |
| 26 | -0.018 | -0.01803 | 0 | 0 | 0 | -3.1E-05 |
| 27 | 0.018 | 0.01798 | 0 | 0 | 0 | -2.4E-05 |
| 28 | 0.054 | 0.05397 | 0 | 0 | 0 | -2.9E-05 |
| 29 | 0.09 | 0.08995 | 0 | 0 | 0 | -4.9E-05 |
| 30 | | | | | | |
| 31 | Range: | .4 V | | | | |
| 32 | Expected | Ch 1 | Ch 2 | Ch 3 | Ch 4 | |
| 33 | -0.18 | -0.17998 | 0 | 0 | 0 | 2.2E-05 |
| 34 | -0.108 | -0.10799 | 0 | 0 | 0 | 1.3E-05 |
| 35 | -0.036 | -0.03599 | 0 | 0 | 0 | 1.5E-05 |
| 36 | 0.036 | 0.03602 | 0 | 0 | 0 | 2.1E-05 |
| 37 | 0.108 | 0.10801 | 0 | 0 | 0 | 7E-06 |
| 38 | 0.18 | 0.17999 | 0 | 0 | 0 | -1.5E-05 |
| 39 | | | | | | |

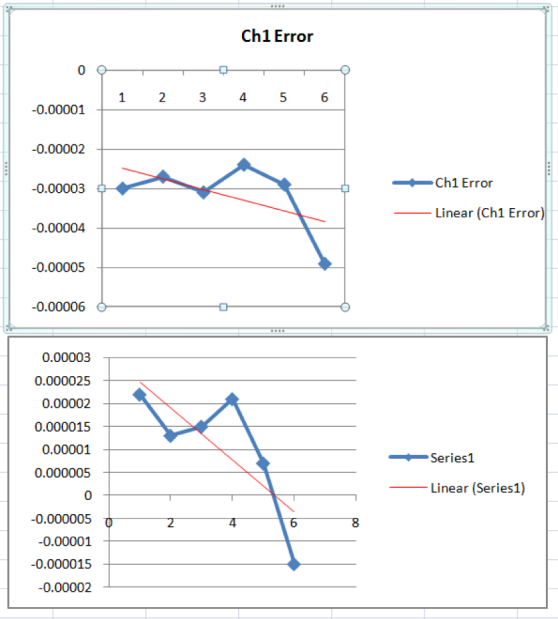



**Figure B.1:** Example of a graphical output (DC Gain Test)

One extra column (highlighted in blue) has been created to show the difference between the two columns of the expected and actual results. Doing this will give you the error in the results which you can add a trendline to (shown in red).

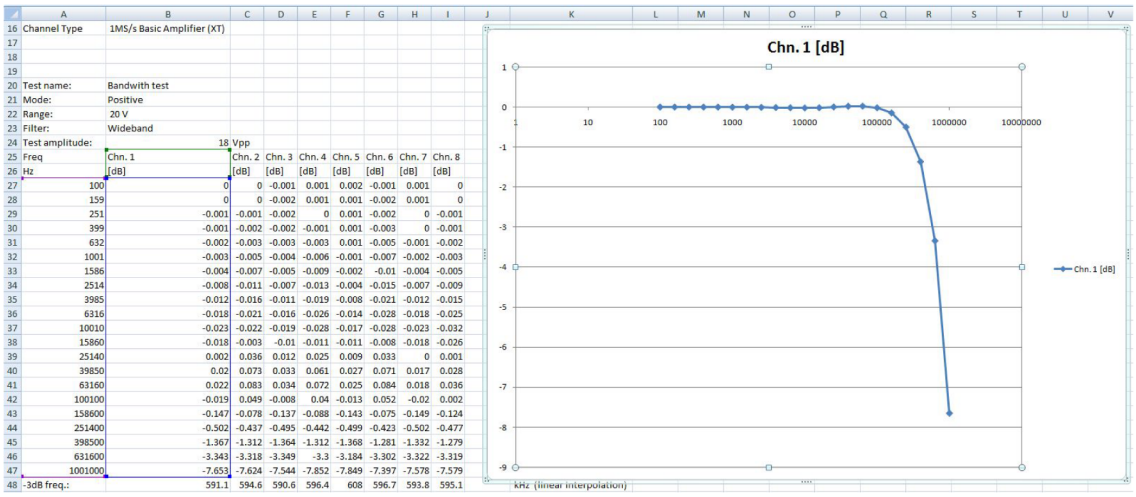
### B.3.1 Producing graphical results - Full Bandwidth

When the Full **(extra)** test is selected, an **extra** log file will be present in the log save folder with the **Full** bandwidth results inside.

This file can be imported into excel to make a visual plot of the graphical data.

**Note** *Be sure to select; Original data type = Delimited ▸ Delimiter = Semi colon, to be able to import the data correctly.*

Figure B.2 is an example of the expected graphical output for a selected **Full** bandwidth test.



| | | |
|---|---|---|
| Channel Type | 1MS/s Basic Amplifier (XT) | |
| Test name: | Bandwith test | |
| Mode: | Positive | |
| Range: | 20 V | |
| Filter: | Wideband | |
| Test amplitude: | 18 Vpp | |

| Freq | Chn. 1 | Chn. 2 | Chn. 3 | Chn. 4 | Chn. 5 | Chn. 6 | Chn. 7 | Chn. 8 |
|---|---|---|---|---|---|---|---|---|
| Hz | [dB] | [dB] | [dB] | [dB] | [dB] | [dB] | [dB] | [dB] |
| 100 | 0 | 0 | -0.001 | 0.001 | 0.002 | -0.001 | 0.001 | 0 |
| 159 | 0 | 0 | -0.002 | 0.001 | 0.001 | -0.002 | 0.001 | 0 |
| 251 | -0.001 | -0.001 | -0.002 | 0 | 0.001 | -0.002 | 0 | -0.001 |
| 399 | -0.001 | -0.002 | -0.002 | -0.001 | 0.001 | -0.003 | 0 | -0.001 |
| 632 | -0.002 | -0.003 | -0.003 | -0.003 | 0.001 | -0.005 | -0.001 | -0.002 |
| 1001 | -0.003 | -0.005 | -0.004 | -0.006 | -0.001 | -0.007 | -0.002 | -0.003 |
| 1586 | -0.004 | -0.007 | -0.005 | -0.009 | -0.002 | -0.01 | -0.004 | -0.005 |
| 2514 | -0.008 | -0.011 | -0.007 | -0.013 | -0.004 | -0.015 | -0.007 | -0.009 |
| 3985 | -0.012 | -0.016 | -0.011 | -0.019 | -0.008 | -0.021 | -0.012 | -0.015 |
| 6316 | -0.018 | -0.021 | -0.016 | -0.026 | -0.014 | -0.028 | -0.018 | -0.025 |
| 10010 | -0.023 | -0.022 | -0.019 | -0.028 | -0.017 | -0.028 | -0.023 | -0.032 |
| 15860 | -0.018 | -0.003 | -0.01 | -0.011 | -0.011 | -0.008 | -0.018 | -0.026 |
| 25140 | 0.002 | 0.036 | 0.012 | 0.025 | 0.009 | 0.033 | 0 | 0.001 |
| 39850 | 0.02 | 0.073 | 0.033 | 0.061 | 0.027 | 0.071 | 0.017 | 0.028 |
| 63160 | 0.022 | 0.083 | 0.034 | 0.072 | 0.025 | 0.084 | 0.018 | 0.036 |
| 100100 | -0.019 | 0.049 | -0.008 | 0.04 | -0.013 | 0.052 | -0.02 | 0.002 |
| 158600 | -0.147 | -0.078 | -0.137 | -0.088 | -0.143 | -0.075 | -0.149 | -0.124 |
| 251400 | -0.502 | -0.437 | -0.495 | -0.442 | -0.499 | -0.423 | -0.502 | -0.477 |
| 398500 | -1.367 | -1.312 | -1.364 | -1.312 | -1.368 | -1.281 | -1.332 | -1.279 |
| 631600 | -3.343 | -3.318 | -3.349 | -3.3 | -3.184 | -3.302 | -3.322 | -3.319 |
| 1001000 | -7.653 | -7.624 | -7.544 | -7.852 | -7.849 | -7.397 | -7.578 | -7.579 |
| -3dB freq.: | 591.1 | 594.6 | 590.6 | 596.4 | 608 | 596.7 | 593.8 | 595.1 |



**Figure B.2:** Example of a graphical output

# C Test Fixtures and Cables

## C.1 1-GN-CAL8-2 ISOBE5600 Calibration kit

The 1-GN-CAL8-2 ISOBE5600 calibration kit is the basic software and tools required to get started.

| 1-GN-CAL8-2 ISOBE5600 Calibration kit | | |
|---|---|---|
| **Part number** | **Number** | **Description** |
| LD-426-036200 | 1 | Software CD inc. Manual (V1.10) |
| LD-869-911800 | 1 | NI Converter USB-IEEE |
| LD-869-923300 | 1 | Tool Ceramic Adjuster |

## C.2 1-GN-CAL-CABLES-2

The 1-GN-CAL-CABLES-2 is the basic cable set and support tools required to work with any of the Genesis High Speed systems. As such it is required for any calibration kit.

| 1-GN-CAL-CABLES-2 GHS calibration cable set | | |
|---|---|---|
| **Part number** | **Number** | **Description** |
| LD-024-924600 | 3 | CON/SAFETY ADAPTER BNC-4 MM |
| LD-024-927200 | 3 | CON/SAFETY ADAPTER BNC-4 MM modified |
| LD-085-997900 | 2 | CBL/BNC SAFETY |
| LD-024-924700 | 1 | CON/INSULATED SHORT |
| LD-085-998100 | 1 | BANANA CABLE 1.50 M RED ISO |
| LD-085-009000 | 1 | BANANA CABLE 1.50 M RED ISO modified |
| LD-085-998300 | 1 | BANANA CABLE 1.50 M BLACK ISO |
| LD-085-009100 | 1 | BANANA CABLE 1.50 M BLACK ISO modified |
| LD-085-998200 | 1 | BANANA CABLE 1.50 M BLUE NONISO |
| LD-024-924800 | 2 | CON/SAFETY ADAPTER BNC-4 MM |
| LD-869-901700 | 1 | 50 OHM TERM BNC PLUGSOCKET |
| LD-085-998700 | 1 | SHORT CIRCUIT PLUG |
| LD-085-999100 | 1 | CBL/6600 HV ID AC CAL PWR |
| LD-085-998600 | 1 | BNC-T F-M-F |
| LD-085-977100 | 1 | USB CABLE A-B ± 6FT |

# D Locations for AC Calibration Adjustments

## D.1 Introduction

This section describes how to open the ISOBE5600 for calibration and adjustment.

To make adjustments to the AC calibration of the ISOBE5600 you will need:

- Cable: CBL/6600 HV ID AC CAL PWR
- Nylon Adjustment screw: TOOL CERAMIC ADJUSTER

**Opening the Isolated Digitizers**

1. Turn of the unit by using the power switch and remove the power cord when using the ISOBE5600tm Isolated Digitizers.
2. Remove rubber protectors at each end of the Isolated digitizer.
3. Only when working with the ISOBE5600t use a flat head screw driver to remove the battery screw (1 fixed "captive" screw for each battery). Pull out the batteries from the casings using the battery handle.
4. Remove the two (top) black plastic cross-head fasteners **and plugs** at each end of the Isolated Digitizer outer casing.
5. Remove the blue casing lid to reveal the metal battery housing.
6. Carefully lift-out the metal battery/power supply casing.

**Note** *This might be difficult! at one end of the casing is a connector pin and plug assembly which you will have to pull apart.*

7. Plug in the supplied cable accessory (CBL/6600 HV ID AC CAL PWR), from the digitizer-base to the bottom of the battery/power supply fixture.
8. Only when working with the ISOBE5600t re-Insert the removed battery/ batteries into the battery-casing.
9. Connect the optical fibre communication lead and the power cord when using the ISOBE5600tm Isolated Digitizers.
10. Turn on the unit using the power switch.

**WARNING**

**The orientation of the battery should be such that the battery pins connect with the battery-casing plug inside the fixture.**
**Only use HBM approved batteries to avoid damaging the unit.**

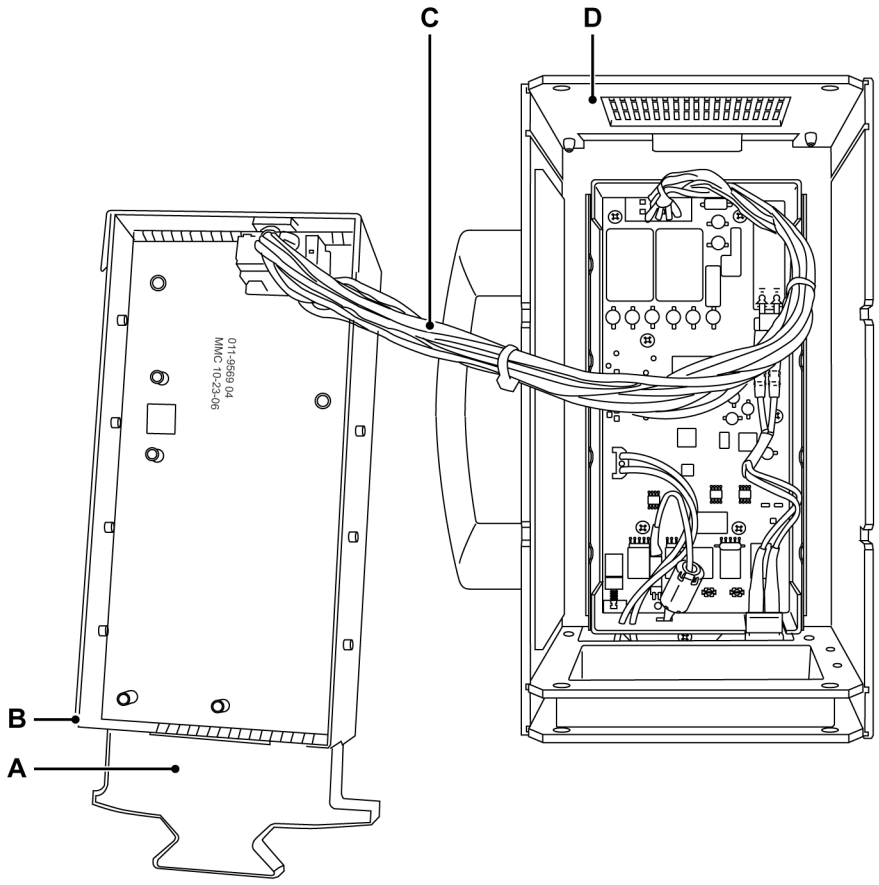



**Figure D.1:** Accessing the Isolated Digitizers

**A** Handle of battery (Only when working with the ISOBE5600t)
**B** Battery/power supply casing
**C** CBL/6600 HV ID AC CAL PWR
**D** Isolated Digitizer Casing

**Note** *Use plastic adjustment tools only. Metal tools will impact the accuracy.*

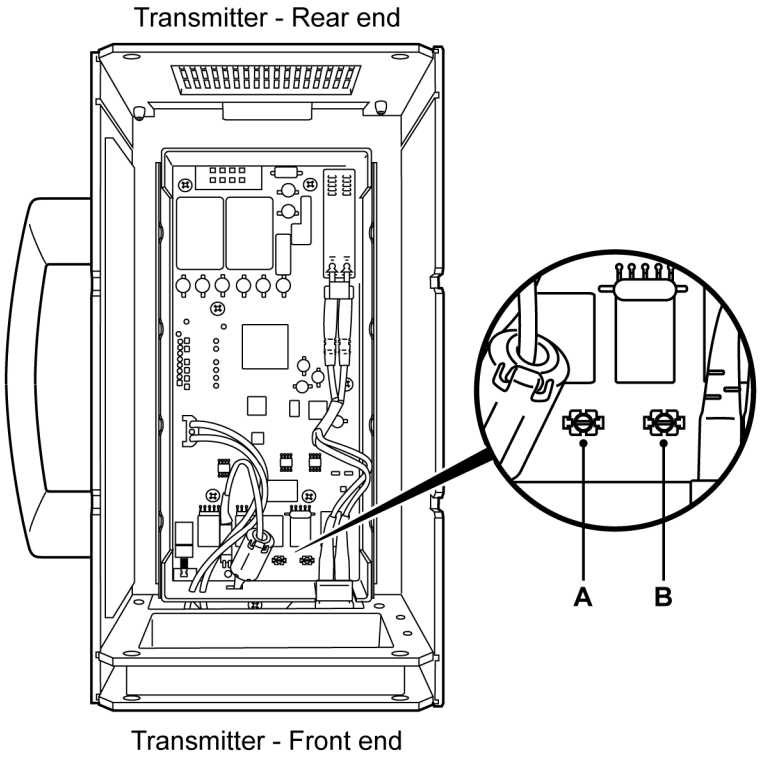



**Figure D.2:** ISOBE5600tm and ISOBE5600t adjustment points

**A** T118 Adjustment point DIV/10

**B** T127 Adjustment point DIV/100

**Closing the Isolated Digitizers**
When AC calibration is completed, reassemble the Isolated Digitizer in reverse order from the opening steps.

**WARNING**

**Never complete an official unit verification process with an open system.**

# E Legacy Information

## E.1 IOTech RS232 to GPIB interface

Early deliveries of the calibration setup included an IOTech RS232 to GPIB convertor. Altough the software still supports this it is strongly recommended to replace the IOTech with a USB to GPIB convertor.

- Connect the calibrator equipment to the GPIB side of the IOTech serial to GPIB interface.
- Connect the serial side of the IOTech interface to a COM port on the PC running the software.
  For further details, please refer to the IOTech manual.

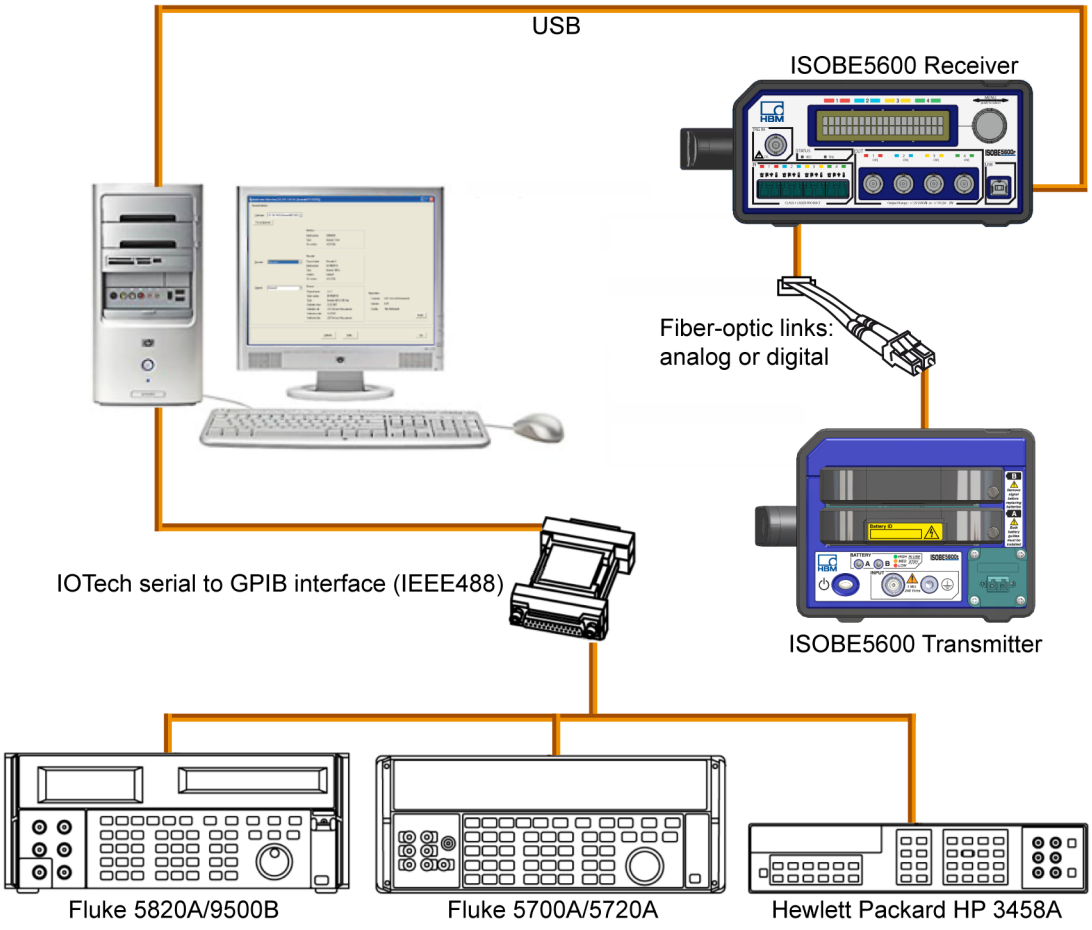



**Figure E.1:** Connection diagram using the IOTech serial to GPIB interface

# Index

**V**



**W**

Head Office
**HBM**
Im Tiefen See 45
64293 Darmstadt
Germany
Tel: +49 6151 8030
Email: info@hbm.com

France
**HBM France SAS**
46 rue du Champoreux
BP76
91542 Mennecy Cedex
Tél:+33 (0)1 69 90 63 70
Fax: +33 (0) 1 69 90 63 80
Email: info@fr.hbm.com

UK
**HBM United Kingdom**
1 Churchill Court, 58 Station Road
North Harrow, Middlesex, HA2 7SA
Tel: +44 (0) 208 515 6100
Email: info@uk.hbm.com

USA
**HBM, Inc.**
19 Bartlett Street
Marlborough, MA 01752, USA
Tel : +1 (800) 578-4260
Email: info@usa.hbm.com

PR China
**HBM Sales Office**
Room 2912, Jing Guang Centre
Beijing, China 100020
Tel: +86 10 6597 4006
Email: hbmchina@hbm.com.cn



**measure and predict with confidence**

I2716-4.0 en