ITP Ultrastab
Manual
Doc. No.: 8800600009 ver. 09A.10

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Certificate of Compliance

Manufacturer:

LEM Danfysik A/S
Hassellunden 16
DK-2765 Smoerum
Denmark

LEM Danfysik A/S hereby states compliance of:

Product	Danfysik equivalent
Type no. ITP 600-SPR Ultrastab	**ULTRASTAB Saturn 600I**
Type no. ITP 600-SBPR Ultrastab	**ULTRASTAB Saturn 600U**
Type no. ITP 2000-SPR Ultrastab	**ULTRASTAB Saturn 2000I**
Type no. ITP 2000-SBPR Ultrastab	**ULTRASTAB Saturn 2000U**
Type no. ITP 5000-SPR Ultrastab	**ULTRASTAB Saturn 5000I**
Type no. ITP 5000-SBPR Ultrastab	**ULTRASTAB Saturn 5000U**
Type no. ITP 2000-S/SP1 Ultrastab	**ULTRASTAB Saturn 2000IHF**

to the following applicable regulatory standards:

EN61010-1
Safety requirements for electrical equipment for measurement, control and laboratory use. General requirements.

EN61000-3-2, EN61000-3-3, EN61000-6-4, EN61000-6-2
EMC Emission and Immunity.

Furthermore is stated compliance to technical specifications published on www.lem.com or in available datasheets.

Serial numbers:

Electronics	
Head	

LEM Danfysik A/S certifies that all involved procedures are ISO9001:2008 controlled.

Smoerum, January 20th, 2010

Morten Bruun-Larsen
R&D Manager

1 Compliance

FCC statement:

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

This product has been tested and found to comply with the following standards.

Emission: Product family standards industry EN61000-6-4/2001
EN61000-3-2; Harmonic current
EN61000-3-3; Flicker
FCC 47 CFR Part 15

Immunity: Product family standards industry 61000-6-2/1999

Safety: IEC 61010-1 / EN 61010-1 safety requirements for electrical equipment for measurement, control, and laboratory use.

See appendix A for a declaration of conformity.

2 Safety

2.1 Usage precautions and recommendations

The following precautions are recommended to insure your safety and to provide the best conditions of this instrument. If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

2.2 Terms and symbols

These terms and symbols may appear in this manual or on the product.

	**WARNING**: Warning statement identifying condition or practices that could result in human injury or loss of life.
	**CAUTION**: Caution statement indentifying conditions or practices that could result in damage to the product.
	**DANGER**: High Voltages.
	Protective Conductor Terminal.

2.3 Use and wear

 **Caution**

Do not place any heavy object on the instrument.
Avoid severe impacts or rough handling that could damage the instrument.
Use electrostatic discharge precautions while handling and making connections to the instrument.
Do not place wires into the connectors of the instrument, only mating connectors and adapters.
Do not block or obstruct the ventilation openings on the side panels and over the heat sink.

2.4 AC Power input

 **Caution**

AC power input should be within the range of the selected line voltages +/-10%.

2.5 Grounding

WARNING:

To avoid electrical shock the power cord protective grounding conductor must be connected to earth ground.

All transducerheads must be connected to earth ground as described in chapter 5.4.

Failure to establish a functional ground connection to earth may cause malfunction and lead to hazardous errors.

2.6 Fuses

WARNING:

For continued fire protection replace the fuses with the specified type and rating only.

The unit has two main fuses which are placed in the IEC inlet on the rear of the unit (see chapter 6.3). For countries with 100 or 115Vac mains voltage the unit is equipped with two 2A slow blown fuses (T2A/250Vac). For countries with 230Vac mains voltage the unit is equipped with two 1A slow blown fuses (T1A/250Vac).

To replace the fuses disconnect the mains cord. Open the cover of the IEC power inlet with a flat screwdriver. Pull out the fuse holders and replace the fuses.

3 Warranty

LEM Danfysik A/S warrants the equipment delivered from the company to be free from any defects in materials and workmanship for a period of:

12 Months from the date of shipment.

Within this warranty period LEM Danfysik A/S will repair or replace any defective parts free of charge either on the customer's site or at our factory at our choice.

LEM Danfysik A/S will pay or reimburse the lowest two way freight charges on any items returned to LEM Danfysik A/S or our designated agent-/represent-tative provided prior written authorization for such return has been given by LEM Danfysik A/S.

This warranty shall not apply to any equipment which our inspection shows to our satisfaction, to have become defective or unworkable due to mishandling, improper maintenance, incorrect use, or any other circum-stances, not generally acceptable for equipment of a similar type.

LEM Danfysik A/S reserves the right on standard products to make changes in design without incurring any obligation to modify previously manufactured units.

The foregoing is the full extent of the warranty and no other warranty is expressed or implied. If no event LEM Danfysik A/S shall be liable for special damage arising from the delivery, late delivery, or use of the equipment.

If any fault develops the following steps should be taken:

Notify LEM Danfysik A/S giving full details of the problems and include Model, Type, Serial number, and Order number.

On receipt of this information LEM Danfysik A/S will send you either service information or instructions for shipping.

All shipments of LEM Danfysik A/S equipment should be made according to our instructions and shipped in the original or a similar package.
For smaller parts a cardboard carton will be sufficient, providing the parts are wrapped in plastic or paper and surrounded with at least 10 centimetres of shock-absorbing material.

4 Receiving and unpacking

4.1 Receiving the Goods

The shipping package and the *ITP ULTRASTAB* should be thoroughly inspected for signs of obvious damage immediately upon receipt.
All materials in the package should be checked against the enclosed packing list and the list of standard delivery below.
LEM Danfysik A/S will not be responsible for any shortages unless notified immediately.

ITP ULTRASTAB Standard Delivery:

- 1 x *ITP ULTRASTAB* Electronics
- 1 x *ITP ULTRASTAB* **T**ransducer **H**ead (STH)
- 1 x Programming plug*
- 1 x Connection cable with plugs from the *ITP ULTRASTAB* to the transducer head**
- 1 x Analog out cable***
- 1 x Current adaptor cable
- AC power cord
- Manual
- Certificate of calibration (Only when delivered with a Voltage output!)

* If rating was not specified when ordering, the following programming plug will be delivered:
- 600 A type: 1 x 600 A
- 2000 A type: 1 x 2000 A
- 2000 HF type: None
- 5000 A types: 1 x 5000 A

** Unless specified when ordering, the following transducer head connection cable will be delivered:
- Current output: 10m connection cable with either Dsub plugs (part no. 6500894070) for 600A systems or Amphenol plugs (part no. 6500894110) for 2000/5000A systems.
- Voltage output: 2.5m connection cable with either Dsub plugs (part no. 6500892220) for 600A systems or Amphenol plugs (part no. 6500892210) for 2000/5000A systems.

*** Unless specified when ordering, the following Analog output cable will be delivered:
- Current output: Current output cable (part no. 6500893870) with 4mm banana sockets. See chapter 10.
- Voltage output: Analog output cable (high impedance) (part no. 6500893820) with 4m banana sockets. See chapter 10.

4.2 Instructions for unpacking

The *ITP ULTRASTAB* is shipped in a cardboard carton.

If the equipment is damaged in any way a claim should be filed with the shipping agent, and a full report of the damage should be forwarded to LEM Danfysik A/S or our local agent/representative immediately.
Upon receipt of this report you will be issued instructions for the repair, replacement, or return shipment.

Please include the rack unit type and serial no. as well as the transducerhead type and serial no, and the Order no. for the *ITP ULTRASTAB* on any communication with LEM Danfysik A/S or our representative.

5 Quick start

5.1 System overview

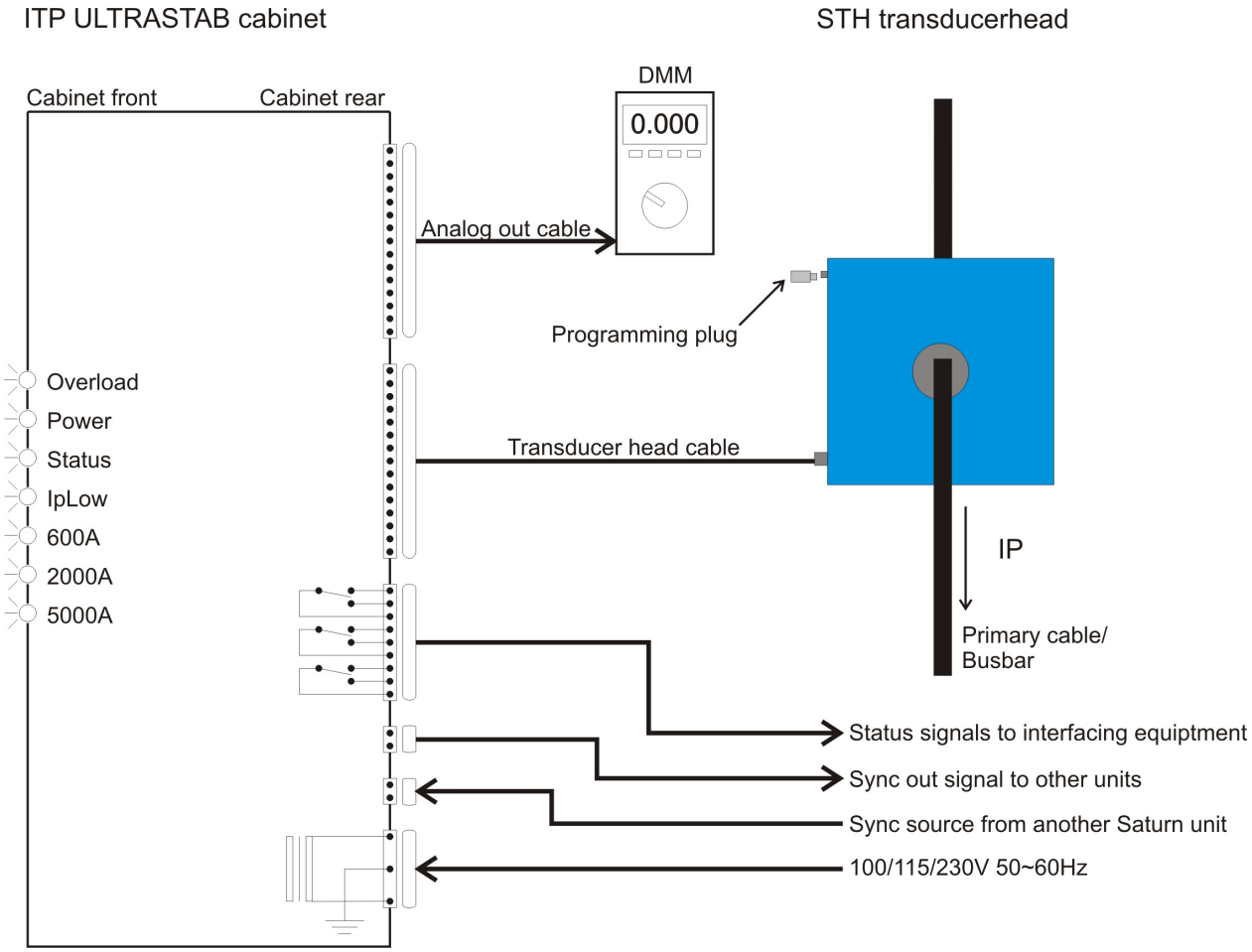


Figure 1

5.2 Power up

To quickly get your new *ITPULTRASTAB* up and running follow the following instructions.

1: Connect the transducer head to the unit using the supplied transducer head cable and mount the programming plug in the connector on the transducerhead (on STH2000 HF heads no programming plug is needed).

2: Connect a DMM to the unit in one of two ways.

<u>If your unit has a voltage output:</u>
Connect the Analog output cable (part No.: 6500893820) to the Analog out port. Using standard 4mm banana test leads, connect the red wire of the cable to the positive terminal on the DMM and

the black wire to the common terminal. Set the DMM to measure DC voltage in a range greater then ±10V.

If your unit has a current output:
Connect the current output adaptor (part no. 6500894180) to the Analog out port. Using standard 4mm banana test leads, connect the red wire on the adaptor to the current input terminal on the DMM and the black wire of the adaptor to the common terminal on the DMM. Set the DMM to measure DC current in a range greater than ±1A (or ±2A if you bought a 5000A system).

3:

 **Caution**

Make sure the voltage selector on the IEC inlet is set to the local voltage and the fuses is of the right type (see chapter 2.6). Connect the power cord.

4: The *ITP ULTRASTAB* will now measure the current running through the transducer head. On the front plate the status of the unit can be monitored using the 7 LED's.

6 Introduction

6.1 Main Features

The *ITP ULTRASTAB* is a high precision current measuring device based on the Flux-gate principle. It can measure current in both the DC and AC domain. The instrument can be configured in a variety of ways to suit the user's demands. Amongst the *ITP ULTRASTAB* main features are:

- Current or voltages output
- Input range from 0 to ±5000A
- Status signals for interfacing with other equipment
- Synchronization of flux-gate driver option in multichannel setup

The current to be measured can be between 0 to ±5000A depending on the transducerhead. A selection of 4 standard and 1 special transducerhead is available.

6.2 Standard transducerheads

1. STH600: 600A transducerhead, programmable in steps of 20A from 40A to 620A. Maximum nominal output current 1A.
2. STH2000: 2000A transducerhead, programmable in steps of 125A from 125A to 2000A. Maximum nominal output current 1A.
3. STH5000-62: 5000A transducerhead, programmable in steps of 250A from 2500A to 5000A. Maximum nominal output current 2A.
4. STH5000-140: 5000A transducerhead with wide body hole, programmable in steps of 250A from 2500A to 5000A. Maximum nominal output current 2A.

6.3 Special transducerheads

The STH2000 HF transducerhead is a special transducerhead developed to measure currents up to 2000A with a bandwidth of 0 to 300 kHz.
It is nonprogrammable and has a nominal output current of 2A.
As the construction of the STH2000 HF is different from the standard transducerheads a special setup of the electronic unit has to be done.
This means that the electronic unit can not be used with any other type of transducerhead. To check whether your *ITP ULTRASTAB* is setup for a standard transducerhead or a STH2000 HF transducerhead look for a label on the rear of the unit indicating a special setup (see 6.4).

All systems with a STH2000 HF transducerhead will be setup by LEM Danfysik A/S prior to shipment.

6.3 Voltage output module

In addition to the different transducerheads a system can also be equipped with a VOM (**V**oltage **O**utput **M**odule). This module will convert the output current to a voltage of ±10V. Two types VOM's are available. One for transducerheads with 1A nominal output current, and one for transducerheads with 2A nominal output.

6.4 Current transfer ratio and programabillity

The system can be seen as a current transformer (also working at DC). The primary winding is the wire through the transducerhead, and the secondary winding is the compensation winding of the transducerhead. The ratio between these too windings defines the current transfer ratio (N) of the system.

As the nominal output current (I_{sn}) is fixed (defined by the transducerhead) and the maximum input current (I_p) can be changed using a programming plug, the current transfer ratio can be changed enabling the user to program the system to many different maximum input currents.

Ex.:
A system with a STH2000 head programmed to 1500A will produce 1A when the primary current is 1500A. The current transfer ratio of the system is then:

$$N = \frac{I_p}{I_{sn}} = \frac{1500A}{1A} = 1500$$

A system with a STH5000 head programmed to 3500A will produce 2A when the primary current is 3500A. The current ratio of the system is:

$$N = \frac{I_p}{I_{sn}} = \frac{3500A}{2A} = 1750$$

When a system is equipped with a VOM (**V**oltage **O**utput **M**odule) the output current will be converted to a voltage. The maximum nominal output voltage (V_{on}) is fixed at 10V. Thus The ratio (G) can be found as shown below:

Ex.:
A system with a STH2000 head programmed to 1500A and a VOM installed will produce 10V when the primary current is 1500A. The ratio of the system is:

$$G = \frac{I_p}{V_{on}} = \frac{1500A}{10V} = 150\,A/V$$

The STH2000 HF transducerhead was designed to measure currents with a greater bandwidth than the other transducerheads is capable of. To obtain this high bandwidth the concept of programming was sacrificed. Thus the nominel

primary current of the STH2000 HF will always be 2000A. Furthermore the secondary current has been boosted to 2A. This means that the current transfer ratio of the STH2000 HF always stays fixed at: $N = \frac{I_p}{I_{sn}} = \frac{2000A}{2A} = 1000$ or $G = \frac{I_p}{V_{on}} = \frac{2000A}{10V} = 200\,A/V$ for a system with voltage out.

6.5 Front

Figure 2

On the front of the *ITP ULTRASTAB* there are 7 LED's for indication of system status, warning and error.

POWER:
This LED is lit (Blue) when the *ITP ULTRASTAB* is on.

STATUS:
This LED is lit (Green) when the status of the unit is OK.

I_p LOW:
This LED is lit (Yellow) when the current passing through the transducer head is below 5‰ of the programmed maximum current.

600A:
This LED is lit (yellow) when a 600A transducer head is connected to the *ITP ULTRASTAB.*

2000A:
This LED is lit (yellow) when a 2000A transducer head is connected to the *ITP ULTRASTAB.*

5000A:
This LED is lit (yellow) when a 5000A transducer head is connected to the *ITP ULTRASTAB.*

OVERLOAD:
This LED is lit (red) when the current passing through the transducer head exceeds 130% of the maximum current for the transducer head (including programming) or the transducer head saturates.

6.6 Rear

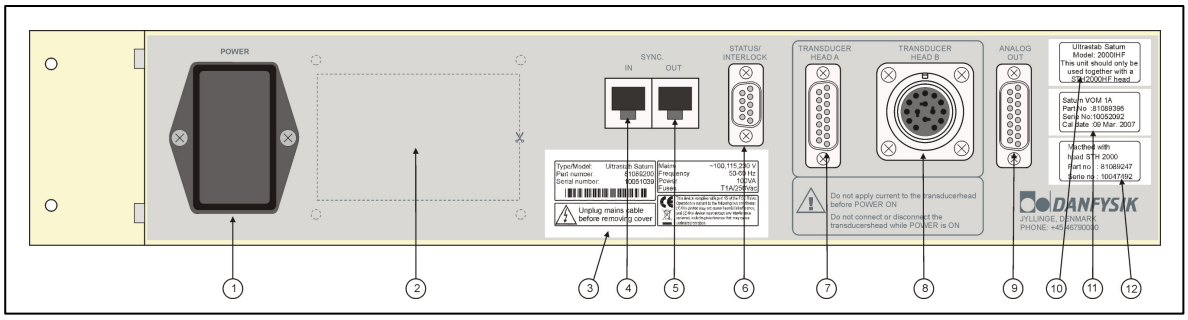


Figure 3

All connectors on the *ITP ULTRASTAB* are placed on the rear of the unit.

1: IEC power inlet and voltage selector: This connector accepts a standard IEC power cord (supplied). The voltage can be changed using the voltage selector code wheel in order to match local voltages. Furthermore, the unit's two mains fuses are located in the IEC power inlet. To change the fuses (see 2.6)
2: Punch out plate: This plate is for future expansion or customization
3: Type / Serial number plate
4: Sync in: Synchronization input when slaved to another *ITP ULTRASTAB* in a multichannel system (see 10.5)
5: Sync out: Synchronization out when the unit is master or part of a daisy-chain in a multichannel system (see 10.5)
6: Status/Interlock signal outputs.
7: Transducer head A: Connection to the STH600 head.
8: Transducer head B: Connection to the STH2000A and STH5000A head.
9: Analog out: Output connection to a DMM or other equipment.
10: Label indicating that the electronics unit is a special type only to be used with the stated transducerhead.
11: Calibration date label (on units with VOM installed)
12: Serial no. label of matched transducerhead. This label is only mounted if a transducerhead is delivered with the electronics unit.

6.7 Transducer heads

All transducer heads (except the STH2000 HF) contains 2 connectors. A connector for connecting the transducer head with the transducer head cable and a connector for the programming plug.

The programming plug connector is a Dsub 25 Male connector on all programable transducer heads while the connector for the transducer head cable is a Dsub15 Male connector on the STH600 head and a Amphenol C16-3 Female connector on the STH2000, STH2000 HF, STH5000-62 and STH5000-140.

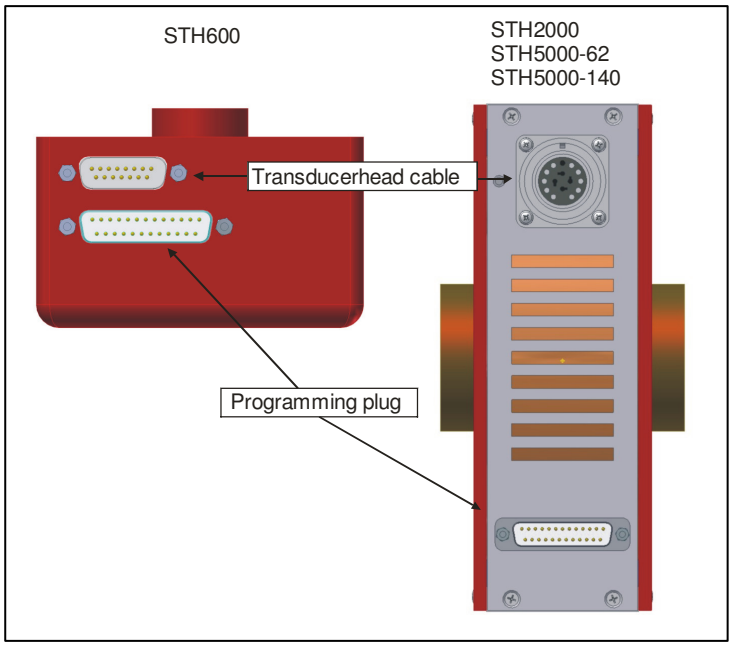


Figure 4

7 Installation

7.1 Mounting requirements

The *ITP ULTRASTAB* can be mounted in either a rack based system or as a stand alone unit using the supplied rubber feet.

Caution:

The unit must be mounted horizontally. To ensure proper cooling, the heat sink on the right and the air inlet on the left side of the unit must be kept free. Failure to do this may result in improper cooling of the system which may lead to malfunction of the unit.

7.2 Mounting requirements for the transducer heads

STH 600: Use the mounting bracket (part no.: 7100088284) to mount the 600A transducer head. It may be installed in any orientation.

STH 2000 / STH2000 HF: The 2000A transducer head must be installed using two M8 screws. The head may be mounted in any orientation. Please observe that the length of the screws may not exceed the length D shown in figure 5. To calculate the maximum length of the mounting screw, measure the thickness of the mounting substrate C and add the length A + B which is 10mm + 15mm.

Max. Screw length:
D = 10 + 15 + C [mm]

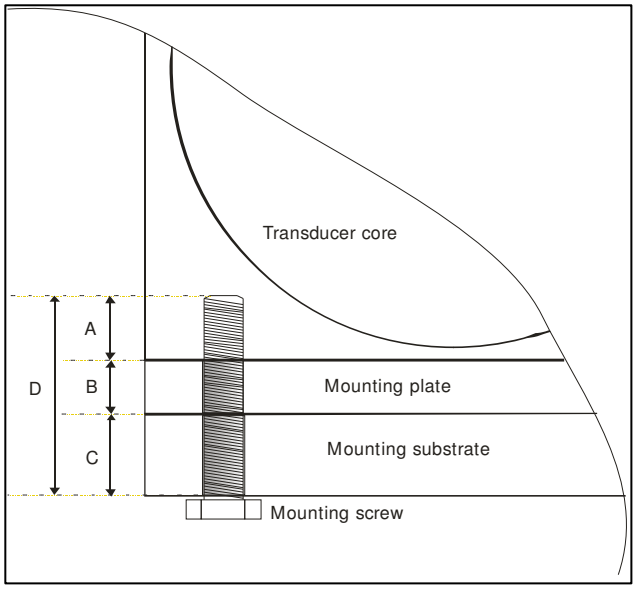


Figure 5

Caution:

Using too long screws may cause harm to the inner parts of the transducer head and lead to malfunction.

STH 5000A-62/STH 5000-140: These transducer heads are mounted using four M10 screws inserted into the holes on the brackets. These heads may be installed in any orientation.

7.3 Installation

1. Check that the mains inlet is set to match the local line voltage. If not, the proper voltage on the selector wheel (100, 115 or 230 VAC) must be selected to match the line voltage. Also check that the fuses are of the correct type (see chapter 2.6)

2. Establish the Ground connection (see 7.4)

3. Mount the provided connection cable between the *ITP ULTRASTAB* and the transducer head. Please note that only one transducer head may be connected to either transducer head A or transducer head B plug.

4. Connect the Analog output terminal as described in chapter 10.1.

5. Check that all cables terminated in a plug are correctly installed and that the lock screws are tightened firmly.

6. Connect the supplied power cord to the IEC inlet on the unit to turn it on.

The transducer head and electronics can be installed with a transducerhead connecting cable of maximum 30 metres. The transducer head may be installed in any orientation.

7.4 Grounding the transducer heads

For safety reasons all types of transducerhead must be connected to earth. Follow the description below for the appropriate transducerhead in order to establish a good earth connection.

STH 600: An earthed wire with an ø4.3 ringtounge must be connected to the transducerhead. The ringtounge is fastened to the M4 stud in the lower rightmost corner of the STH600 using a M4 nut.

STH 2000 / STH2000 HF: An earthed wire with an ø8.3 ringtounge must be connected to the transducerhead. The ringtounge is placed on one of the 4 mounting screws before mounting the head.

STH 5000-62 / STH 5000-140: An earthed wire with an ø10.3 ringtounge must be mounted to the transducerhead.The ringtounge is placed on one of the 4 mounting screws before mounting the head.

8 Jumpers

8.1 Jumper settings

The *ITP ULTRASTAB* contains a number of jumpers which are used to configure the unit.

The default factory setting should in most cases be the preferred configuration. However, it may be necessary to alter the settings to match the unit to your application.

To change the jumper settings first make sure the unit is powered off and the power cord is detached. Then remove the top cover using a screwdriver. Locate the jumper you need to change and change the setting.

In an *ITP ULTRASTAB* there are 4 jumpers. 2 on the **T**ransducer **E**lectronic **M**odule (TEM) and 2 on the **M**other**B**oard (MB) as shown in figure 6. All other jumpers must be left as they are in order for the unit to work properly.

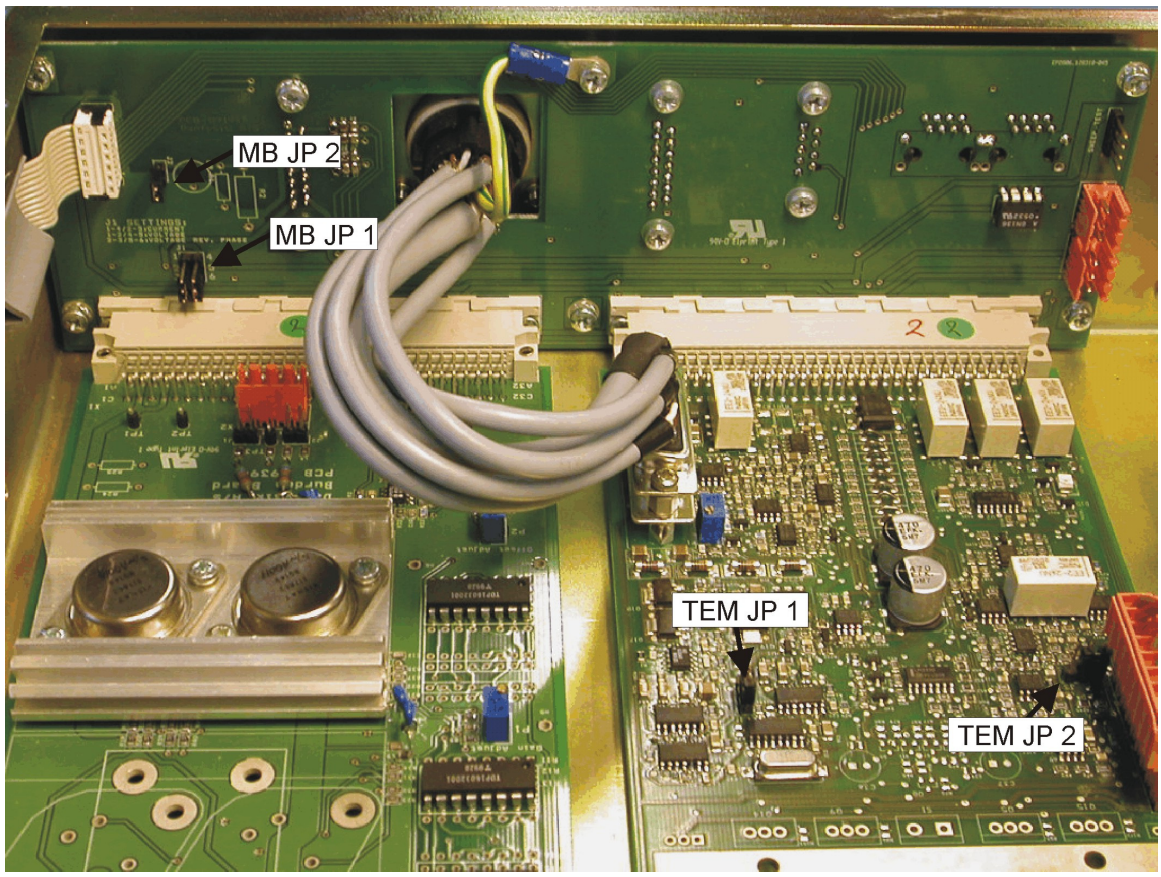
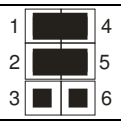
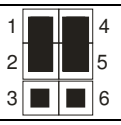
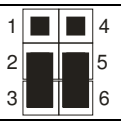


Figure 6

8.2 MB Jumper 1: Current / Voltage out

This is a 3 by 2 pin jumper and is used to choose between current output (no VOM installed), or voltage output (VOM installed).

	1*	2	3*
Configuration			
Function	VOM not installed	VOM installed	VOM installed
Mode	Current out	Voltage out	Voltage out reversed

*) Factory defaults depending on the output type.

Note:

As the amplifiers on the VOM module are inverting the signal, mode 3 should be used to obtain correct polarisation. In this mode a positive voltage will be present when the primary current flows in the direction indicated by the arrow on the transducerhead.

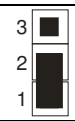
8.3 MB Jumper 2: Chassis / GND

This is a 2 pin jumper and is used to connect or disconnect the chassis of the unit with its internal GND plane. With a jumper mounted Chassis and GND is shorted.

Factory default: Shorted

8.4 TEM Jumper 1: Sync. Source selector

This is a 3 pin jumper and is used to define whether the unit's clock source is taken from its own internal clock, or from the SYNC IN connector on the rear of the unit.

	1	2
Configuration		
Function	Internal clock (Master)	External clock (Slave)

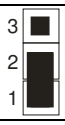
Factory default: 1

8.5 TEM Jumper 2: Saturation fault mode selector

This 3 pin jumper is used to select which action the *ITP ULTRASTAB* must take if the transducer head is saturated.

Mode 1: the unit will automatically begin to sweep in order to lock on to the current again.

Mode 2: the *ITP ULTRASTAB* will shut down the measuring circuit and wait until the current through the transducer head is near zero. Then the measuring will begin again. This mode is useful in systems where the *ITP ULTRASTAB* is part of a feedback line.

	1	2
Configuration		
Mode	Sweep mode	Measuring disable mode

Factory default: 2

9 Offset adjust

The *ITP ULTRASTAB* should occasionally have a current offset adjustment made to ensure the highest accuracy.

All *ITP ULTRASTAB* are offset adjusted by LEM Danfysik with the ordered transducer head prior to shipment. In case the *ITP ULTRASTAB* has been recalibrated or serviced, and minimum after ½ years of operation, it is advisable to perform an offset adjustment with the selected transducer head connected prior to any measurement in order to achieve the highest accuracy.

9.1 Adjusting the current offset

 **DANGER**

 **CAUTION**

During offset adjustment the unit needs to be powered up with the top lid removed. This will potentially expose the operator to high voltages. As a consequence the operator is requested not to touch anything inside the unit.

Note:

If the unit is equipped with a VOM be sure not to adjust any of the potentiometers on the VOM as this will void the calibration of the VOM, and the unit will need a new calibration.

To adjust the *ITP ULTRASTAB* please follow these steps.

1. Unplug the mains cord
2. Remove the screws holding the cover and remove it.
3. Connect a DMM capable of measuring µA to the analog output port using the current output adaptor (part no.:6500894180) supplied with the unit (see chapter 10.3.)
4. Connect the mains cord to the IEC inlet.
5. Wait for approx. 15 minutes while the unit is heating up.
6. Locate the offset adjustment potentiometer on the TEM (see fig. 7)
7. Use a trim screwdriver to adjust the offset until the current is as close to zero as possible.
8. After adjustment unplug the mains cord and mount the cover again.

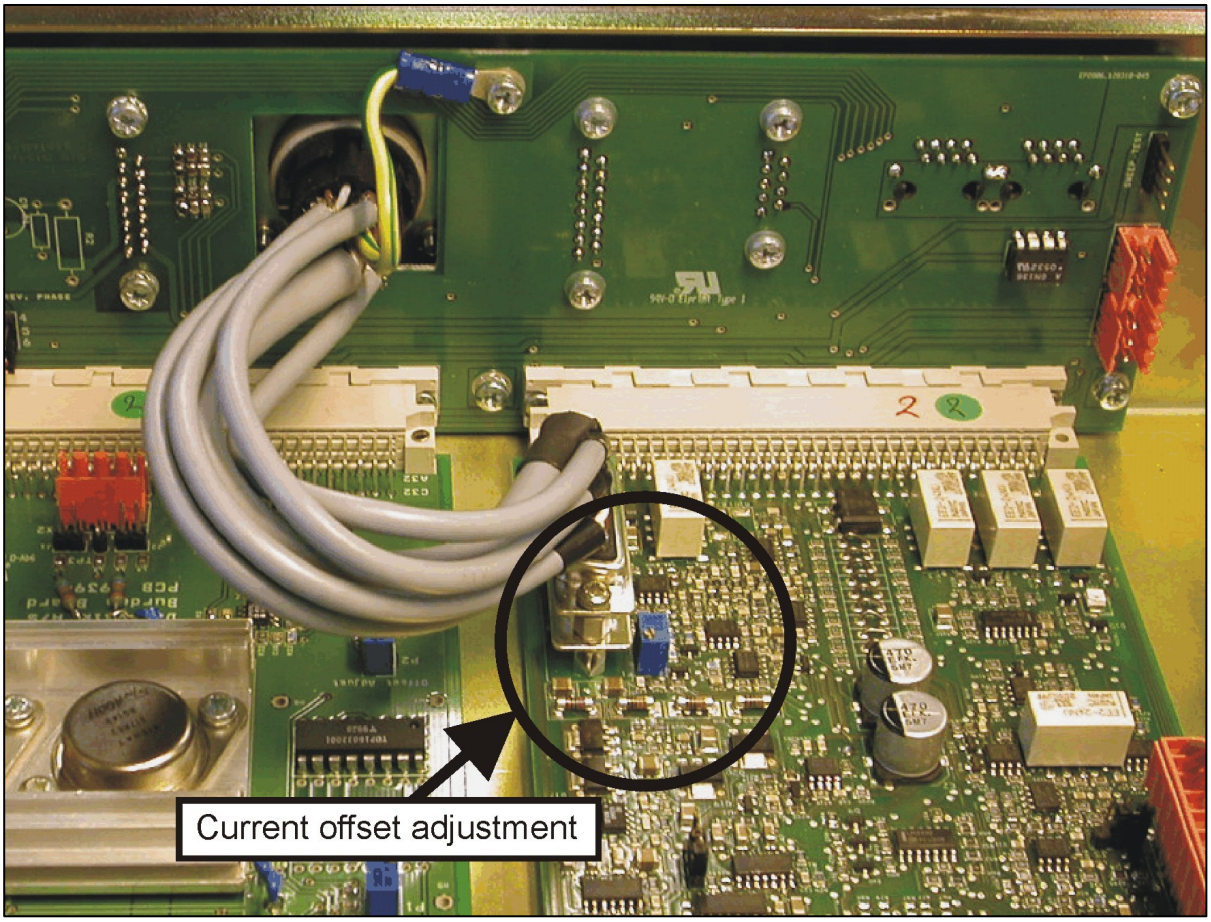


Figure 7

10 IO-ports

10.1 Analog out connector

The Analog out connector (Dsub15 Female) contains the following signals:

1: Current return	2: Current return	3: Not used	4: Vo High Sense	5: Vo High Out	6: Ground	7: Vo Low Sense	8: Vo Low Out

9: Current out	10: Current out	11: Not Used	12: Vo High Sense	13: Vo High Out	14: Vo Low Sense	15: Vo Low Out

When using the *ITP ULTRASTAB* in current out mode (no VOM installed) only pin 1, 2, 9, 10 should be used.
-Pin 9, 10: Is the current output from the *ITP ULTRASTAB*.
-Pin 1, 2: Current return path.

When using the *ITP ULTRASTAB* in voltage out mode (VOM installed) pin 1 - 9 as well as pin 2 - 10 must be shorted. This will loop the current output to the VOM. The voltage output is then present at pin 4 - 8 and 12 - 15.
-Pin 4, Pin 12: Voltage output High sense
-Pin 6: Signal Ground
-Pin 7, Pin 14: Voltage output Low Sense
-Pin 8, Pin 15: Voltage output Low
-Pin 5, Pin13: Voltage output high

10.2 Status/Interlock connector

All signals on the Status/Interlock port are floating relay type. All signals are therefore galvanically isolated from the electrical circuits of the unit.

Caution:

Maximum allowed voltage on the relay switches is 33VAC or 70VDC. Exceeding this limit may cause malfunction or damage the equipment.

The Status/Interlock connector (Dsub9 Male) contains the following signals:

1: Normal operation Fault	2: Normal operation OK	3: Ip Low common	4: Overload warning True	5: Overload warning False

6: Normal operation common	7: Ip Low True	8: Ip low False	9: Overload warning common

-Pin 1: Normal operation Fault.
When the unit status is faulty (error, overload warning etc.) this pin is connected to the Normal operation common.
-Pin 2: Normal operation OK
When the unit status is OK (Normal operation) this pin is connected to the Normal operation common pin.
-Pin 3: Ip Low common
This pin is connected to either Ip Low on or Ip Low off depending on the unit's status.
-Pin 4: Overload warning True
This pin is connected to the Overload common pin when the current through the transducer head exceeds 10% of the maximum programmed current.
-Pin 5: Overload warning False
This pin is connected to the Overload common pin when the unit is in normal mode and the current through the transducer head is within the measurement area.
-Pin 6: Normal operation common
This pin is connected to either Normal operation on or the Normal operation off depending on the unit's status.
-Pin 7: Ip Low True
This pin is connected to Ip Low common when the current through the transducer head is below 5‰ of the programmed current.
-Pin 8: Ip Low False
This pin is connected to the Ip Low common when the current through the transducer head is above 5‰ of the programmed current.
-Pin 9: Overload warning common
This pin is connected to either Overload warning on or Overload warning off pin depending on the unit's status.

10.3 Transducer head A connector

The transducer head A connector is used to connect the STH 600 transducer head (part no: 8100089254) to the *ITP ULTRASTAB*. The connection is made using the transducer head cable type A (part no. 6500892220, 6500894060, 6500894070, 6500894080, 6500894090). These cables are 2.5 to 30 meters long non-halogen cable with a Dsub15 Male connector in each end.

1:ICR	2:ICO	3:NC	4:FB-	5:IDEN-	6:NC	7:ZD1-	8:ZD1+
9:ICR	10:ICO	11:FB+	12:NC	13:IDEN+	14:ZD2-	15:ZD2+	

-Pin 1: Compensation current return
-Pin 2: Compensation current out
-Pin 3: No connection
-Pin 4: Feedback coil – (AC pickup)
-Pin 5: Identification
-Pin 6: No connection

-Pin 7: Zero detector coil 1 –
-Pin 8: Zero detector coil 1 +
-Pin 9: Compensation current return
-Pin 10: Compensation current out
-Pin 11: Feedback coil + (AC pickup)
-Pin 12: No connection
-Pin 13: Identification +
-Pin 14: Zero detector coil 2 –
-Pin 15: Zero detector coil 2 +

10.4 Transducer head B connector

The transducer head B connector is used to connect the STH 2000, STH2000 HF, STH 5000-62 or STH 5000-140 transducer head (part no: 8100089247, 8100089448, 8100089248, 8100089249) to the *ITP ULTRASTAN.* The connection is made using the transducer head cable type B (part no. 6500892210, 6500894100, 6500894110, 6500894120, 6500894130). These cables are from 2.5 to 30 meters long non halogen cable with an Amphenol C16-3 Male connector in each end.

-Pin Earth: Chassis
-Pin 1: No connection
-Pin 2: Compensation current out
-Pin 3: Compensation current return
-Pin 4: Identification -
-Pin 5: Identification +
-Pin 6: Zero detector coil 1 +
-Pin 7: Zero detector coil 2 +
-Pin 8: No connection
-Pin 9: Zero detector coil 1 –
-Pin 10: Zero detector coil 2 –
-Pin 11: No connection
-Pin 12: Feedback coil + (AC pickup)
-Pin 13: Feedback coil - (AC pickup)
-Pin 14: No connection

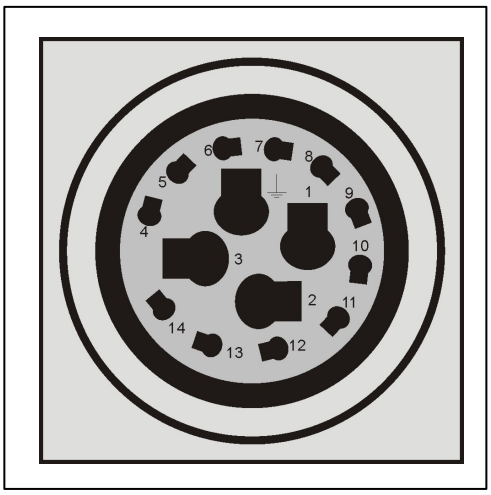


Figure 8

10.5 Sync In and Sync out

The Sync In connector is used to input an external synchronization signal from another *ITP ULTRASTAB*.

The Sync out connector is used to send out a synchronization signal to another *ITP ULTRASTAB*.

An optocoupler in the Sync In circuitry ensures that no galvanic connection exists between the sync master and the sync slave.

Both connectors are standard 8 ways modular jack connector (RJ45), and accept standard network patch cables. Cables may be straight or cross-over cables as the *ITP ULTRASTAB* only uses those wires in the cable that are always straight (connection 4 and 5).

The Sync signal is present on Pin 4 while Pin 5 is ground (0V)

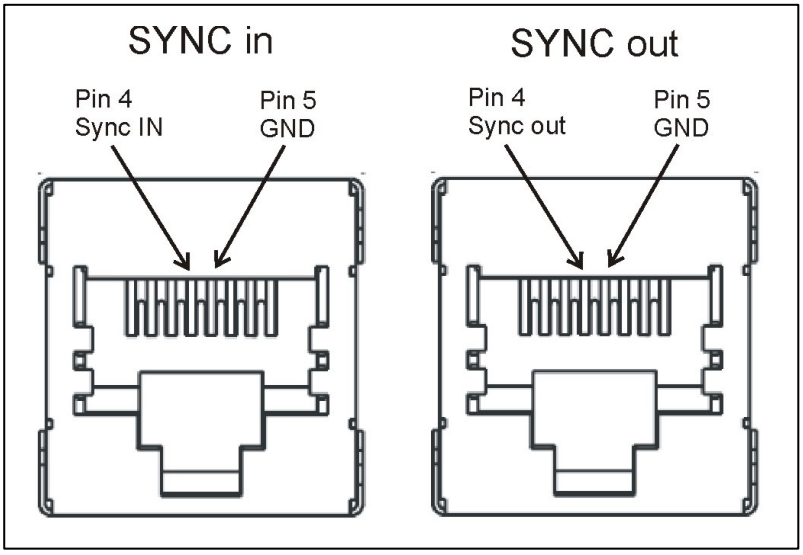


Figure 9

11 Operating instructions

11.1 Switching on power

Caution:

Before switching on the power make sure that there is no current running through the transducer head.

Note:

The disconnecting device on this equipment is the **mains plug**. To power off the unit disconnect the mains plug at the power inlet.

Before powering up the *ITP ULTRASTAB* be sure to check the following:

1. Check that all jumper settings are correct
2. Check that all cables terminated in a plug are correctly installed and that the lock screws are tightened firmly.
3. Check that the voltage selector is set to match the local line voltage and that the earth connection is correct according to local law and regulation.
4. Connect the power cord to the mains inlet.
5. The *ITP ULTRASTAB* will now run through its power up sequence. After a few second the unit is ready and the status of the unit can be seen on the front panel LED's. The power, status, I_PLOW and one of the transducer head LED's should now light up.
6. Switch the current through the transducer head on. The I_PLOW LED should turn off and the unit is running.

11.2 Using the *ITP ULTRASTAB* in current mode

When using the *ITP ULTRASTAB* without a VOM installed there are essentially two ways to measure the output. Connecting it to a DMM or connecting it to an external burden resistor.

In either way the user must observe that the maximum burden resistance does not exceed the value given in the specifications of the unit.

11.3 Connecting directly to a current measuring device

Connecting the *ITP ULTRASTAB* directly to a current measuring device like a DMM or a Power analyzer, can easily be done using the Current output adaptor (part no.: 6500894180) which is supplied with all delivered *ITP ULTRASTAB*. The adaptor accepts male 4mm banana plugs. The red wire carries the output current while the black is the current return path. Simply connect these two wires to your current measuring device using standard laboratory test leads with 4mm banana terminals (see figure 10).

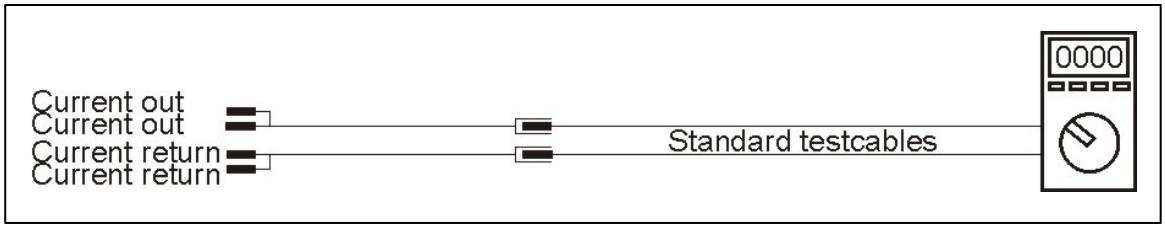


Figure 10

11.4 Connecting to an external burden resistor

If an external burden resistor is to be connected to the *ITP ULTRASTAB* the connection shown in fig. 11 should be used. This diagram is equal to the *ITP ULTRASTAB* output cable type C (part no.:6500893870)

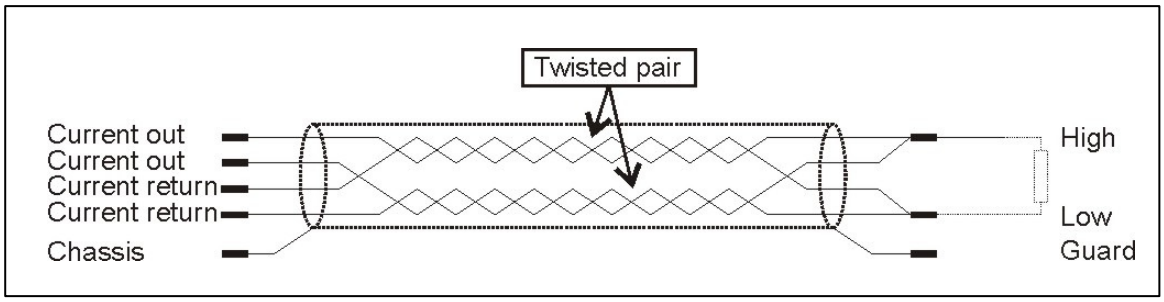


Figure 11

In addition to the standard current output cable a 5M current output cable is also available (part no.: 6500894560). Both cables uses two twisted pairs in order to reduce the resistance, and are terminated in three 4mm female banana sockets for easy connection to other equipment.

11.5 Using the *ITP ULTRASTAB* in voltage mode (VOM installed)

When a VOM is installed there are two ways to connect the *ITP ULTRASTAB* to an external load.

11.6 Connecting the *ITP ULTRASTAB* to a DMM or high impedance amplifier

When connecting the *ITP ULTRASTAB* to a DMM or high impedance load in voltage mode use the connection shown in fig. 12. This diagram is equal to the standard voltage output cable. *ITP ULTRASTAB* output cable type B (part no.: 6500893820). This cable uses a single twisted pair, and is terminated in three female banana sockets for easy connection to other equipment.

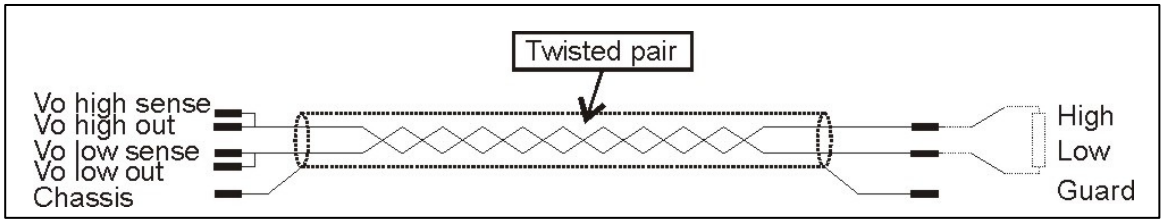


Figure 12

11.7 Connecting the *ITP ULTRASTAB* to a low resistance load.

When connecting the *ITP ULTRASTAB* to a low resistance load in voltage mode use the connection shown in fig. 13. This diagram is equal to the *ITP ULTRASTAB* output cable type A (part no.: 6500893740). This cable two twisted pairs, and are terminated in three 4mm female banana sockets for easy connection to other equipment.

Please note that this setup will have a small negative impact on the precision of the *ITP ULTRASTAB* due to the resistance in the sense wires which will alter the feedback resistance slightly in the output amplification circuitry.

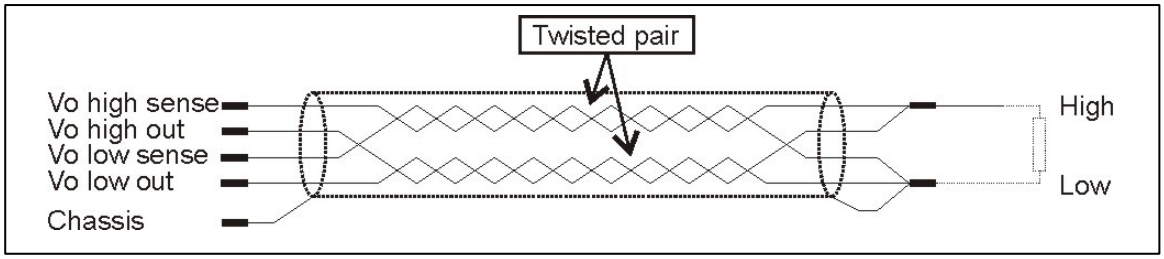


Figure 13

11.8 Using the *ITP ULTRASTAB* in a multichannel system.

To use the *ITP ULTRASTAB* in a multichannel system the first unit can be configured as synchronization master (see jumper settings) and the following units as synchronization slave. This insures that all units are working with the same clock which will limit noise and interference. It is however, not mandatory to use the synchronization, for many applications it is not necessary due to the low noise floor of the system.

Fig. 14 shows a multichannel setup with 3 units.

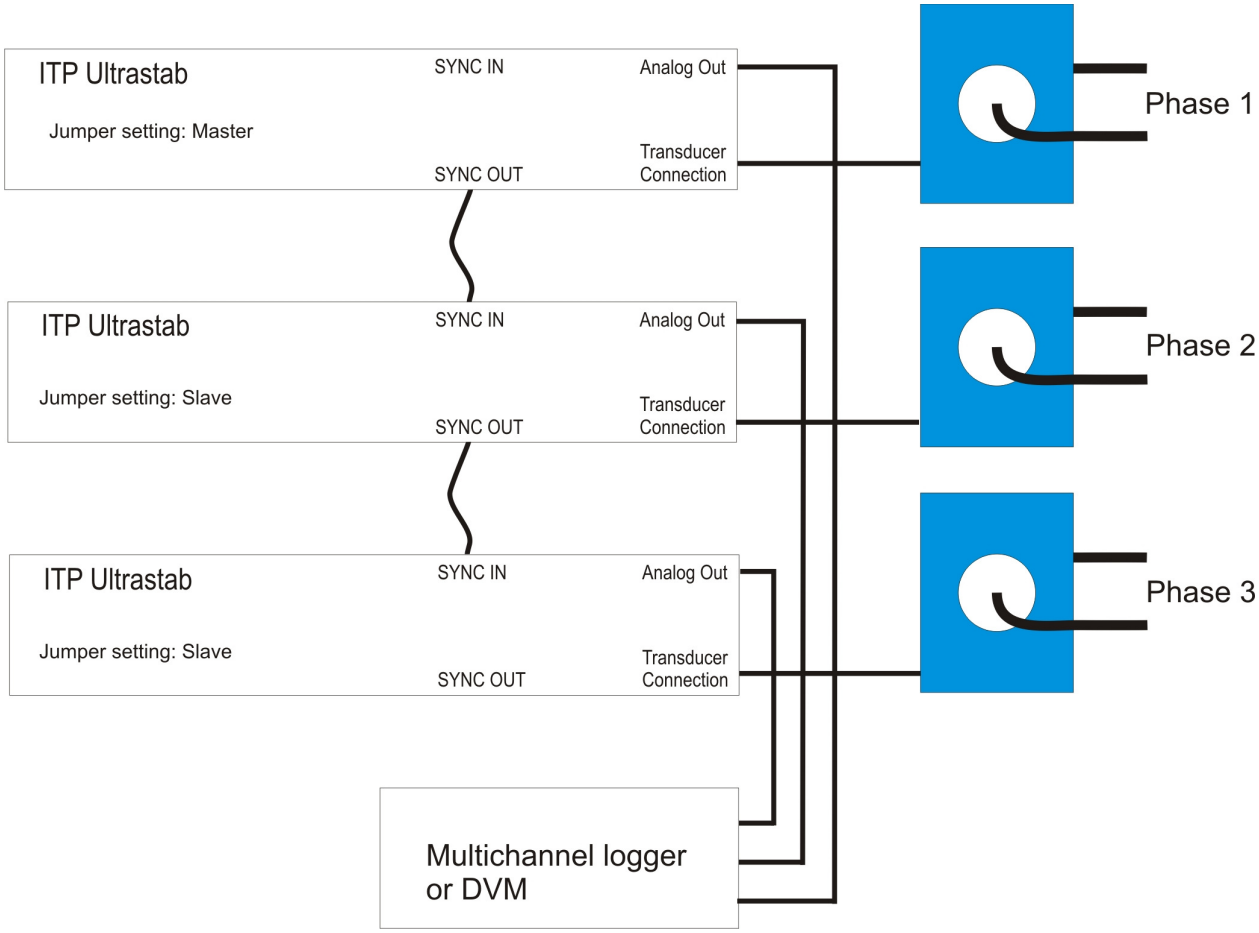

ITP Ultrastab
Jumper setting: Master
SYNC IN
SYNC OUT
Analog Out
Transducer Connection
ITP Ultrastab
Jumper setting: Slave
SYNC IN
SYNC OUT
Analog Out
Transducer Connection
ITP Ultrastab
Jumper setting: Slave
SYNC IN
SYNC OUT
Analog Out
Transducer Connection
Multichannel logger or DVM
Phase 1
Phase 2
Phase 3

Figure 14

12 Theory of operation

12.1 Basic principle of *ITP ULTRASTAB* current transducers

The *ITP ULTRASTAB* current transducers are delivered in a programme covering galvanic isolated measurements of currents from DC to 500 kHz ranging from 40 A to 25 kA.
The precision current transducers are using a zero flux detector principle controlling a compensation current which counterbalance the ampere turns generated of the primary current. Due to a balanced zero flux detector principle the output noise level is by nature very low and a resolution in the order of 2 x 10-8 is achieved.

Fig. 15 shows a block diagram of the zero flux detector transducer principle.

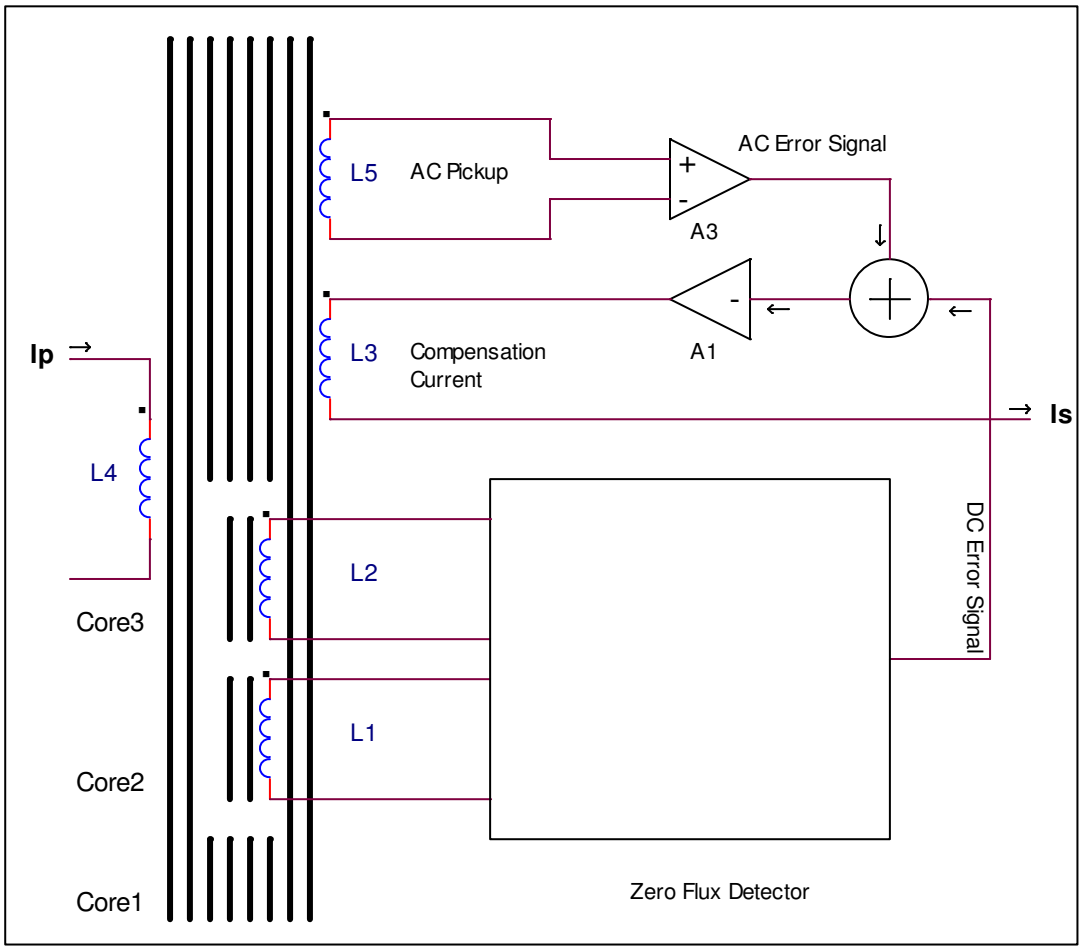


Figure 15

The transducer head core (1) is the basic body structure. The cores (2) and (3) are flux detector cores coupled to the electronics zero flux detector circuitry by means of the coils L1 and L2.
L1 and L2 are coupled in parallel or serial, depending of model, with opposite phase to reduce the unwanted flux generated in core 1.

With a primary current Ip flowing through L4 a magnetic flux will be generated in the body structure and detected by the detector cores. An error signal will be generated, controlling the amplifier A1 to drive a current through the compensation winding L3. When counterbalance is obtained, i.e. zero flux is reestablished, the compensation current, multiplied with the number of turns in L3, is a true expression of the primary current Ip.

The zero flux detector circuitry operates from true DC to about 1Hz. For higher frequencies the "AC pick up winding" L5 performs a feed back error signal which via the amplifier A3 widens the active bandwidth of the transducer up to more than 10 kHz.

Above 10 KHz the DCCT operates as a passive current transformer with it's -3dB limit variation from 300 KHz to 1 MHz depending on size and construction of the DCCT.

13 Maintenance

The *ITP ULTRASTAB* with current output does not require any maintenance under normal operation except for the offset adjustment explained in chapter 9.

The *ITP ULTRASTAB* with voltage output requires yearly or biyearly calibration, as well as offset adjustment as described in chapter 9.

To get your *ITP ULTRASTAB* recalibrated we recommend to ship it to LEM Danfysik A/S. Alternatively customers can recalibrate the unit according to LEM Danfysik A/S *ITP ULTRASTAB* calibration manual (doc. no.: 8800600010) available on request or on www.danfysik.dk

If the unit needs service please contact LEM Danfysik A/S or our local sales representative.

14 Parts and accessories

8100089200 *ITP ULTRASTAB* electronic unit
8100089254 STH 600, 600A transducer head
8100089247 STH 2000, 2000A transducer head
8100089248 STH 5000-62, 5000A transducer head, 62mm centre hole
8100089248 STH5000-140, 5000A transducer head, 140mm centre hole

8100089395 1A VOM (For STH 600/STH 2000)
8100089396 2A VOM (For STH 5000-62/ STH 5000-140)

7100088285 STH 600 mounting bracket
7100088062 Busbar for STH600 transducerhead
7100088291 Busbar for STH2000/STH2000 HF transducerhead

6500892220 Transducer head cable for STH 600, 2.5M
6500894060 Transducer head cable for STH 600, 5M
6500894070 Transducer head cable for STH 600, 10M
6500894080 Transducer head cable for STH 600, 20M
6500894090 Transducer head cable for STH 600, 30M
6500892210 Transducer head cable for STH 2000, STH 5000-62, STH 5000-140, 2.5M
6500894100 Transducer head cable for STH 2000, STH 5000-62, STH 5000-140, 5M
6500894110 Transducer head cable for STH 2000, STH 5000-62, STH 5000-140, 10M
6500894120 Transducer head cable for STH 2000, STH 5000-62, STH 5000-140, 20M
6500894130 Transducer head cable for STH 2000, STH 5000-62, STH 5000-140, 30M

6500893740 Voltages output cable type A (Remote sense), Dsub to 4mm banana sockets, 1.5M
6500893820 Voltages output cable type B (Standard sense), Dsub to 4mm banana sockets, 1.5M
6500893870 Current output cable type C, Dsub to 4mm banana sockets, 1.5M
6500894560 Current output cable type C, Dsub to 4mm banana sockets, 5M
6500894180 Current output cable Dsub to 4mm banana sockets adaptor, 0.1M

8100089259 40A/125A Programming plug for STH 600/ STH 2000
8100089260 60A/250A Programming plug for STH 600/ STH 2000
8100089261 80A/250A Programming plug for STH 600/ STH 2000
8100089262 100A/375A Programming plug for STH 600/ STH 2000
8100089263 120A/375A Programming plug for STH 600/ STH 2000
8100089264 140A/500A Programming plug for STH 600/ STH 2000
8100089265 160A/500A Programming plug for STH 600/ STH 2000
8100089266 180A/625A Programming plug for STH 600/ STH 2000
8100089267 200A/625A Programming plug for STH 600/ STH 2000
8100089268 220A/750A Programming plug for STH 600/ STH 2000
8100089269 240A/750A Programming plug for STH 600/ STH 2000
8100089270 260A/875A Programming plug for STH 600/ STH 2000

8100089271 280A/875A Programming plug for STH 600/ STH 2000
8100089272 300A/1000A Programming plug for STH 600/ STH 2000
8100089273 320A/1000A Programming plug for STH 600/ STH 2000
8100089274 340A/1125A Programming plug for STH 600/ STH 2000
8100089275 360A/1125A Programming plug for STH 600/ STH 2000
8100089276 380A/1250A Programming plug for STH 600/ STH 2000
8100089277 400A/1250A Programming plug for STH 600/ STH 2000
8100089278 420A/1375A Programming plug for STH 600/ STH 2000
8100089279 440A/1375A Programming plug for STH 600/ STH 2000
8100089280 460A/1500A Programming plug for STH 600/ STH 2000
8100089281 480A/1500A Programming plug for STH 600/ STH 2000
8100089282 500A/1625A Programming plug for STH 600/ STH 2000
8100089283 520A/1625A Programming plug for STH 600/ STH 2000

8100089284 540A/1750A Programming plug for STH 600/ STH 2000
8100089285 560A/1750A Programming plug for STH 600/ STH 2000
8100089286 580A/1875A Programming plug for STH 600/ STH 2000
8100089287 600A/1875A Programming plug for STH 600/ STH 2000
8100089288 620A/2000A Programming plug for STH 600/ STH 2000

8100089289 2500A Programming plug for STH 5000-62/ STH 5000-140
8100089290 2750A Programming plug for STH 5000-62/ STH 5000-140
8100089291 3000A Programming plug for STH 5000-62/ STH 5000-140
8100089292 3250A Programming plug for STH 5000-62/ STH 5000-140
8100089293 3500A Programming plug for STH 5000-62/ STH 5000-140
8100089294 3750A Programming plug for STH 5000-62/ STH 5000-140
8100089295 4000A Programming plug for STH 5000-62/ STH 5000-140
8100089296 4250A Programming plug for STH 5000-62/ STH 5000-140
8100089297 4500A Programming plug for STH 5000-62/ STH 5000-140
8100089298 4750A Programming plug for STH 5000-62/ STH 5000-140
8100089299 5000A Programming plug for STH 5000-62/ STH 5000-140

Appendix A: Declaration of conformity

CE

Certificate of Compliance

Manufacturer:

LEM Danfysik A/S
Hassellunden 16
DK-2765 Smoerum
Denmark

LEM Danfysik A/S hereby states compliance of:

Product	Danfysik equivalent
Type no. ITP 600-SPR Ultrastab	**ULTRASTAB Saturn 600I**
Type no. ITP 600-SBPR Ultrastab	**ULTRASTAB Saturn 600U**
Type no. ITP 2000-SPR Ultrastab	**ULTRASTAB Saturn 2000I**
Type no. ITP 2000-SBPR Ultrastab	**ULTRASTAB Saturn 2000U**
Type no. ITP 5000-SPR Ultrastab	**ULTRASTAB Saturn 5000I**
Type no. ITP 5000-SBPR Ultrastab	**ULTRASTAB Saturn 5000U**
Type no. ITP 2000-S/SP1 Ultrastab	**ULTRASTAB Saturn 2000IHF**

to the following applicable regulatory standards:

EN61010-1
Safety requirements for electrical equipment for measurement, control and laboratory use. General requirements.

EN61000-3-2, EN61000-3-3, EN61000-6-4, EN61000-6-2
EMC Emission and Immunity.

Furthermore is stated compliance to technical specifications published on www.lem.com or in available datasheets.

Serial numbers:

Electronics	
Head	

LEM Danfysik A/S certifies that all involved procedures are ISO9001:2008 controlled.

Smoerum, January 20th, 2010

Morten Bruun-Larsen
R&D Manager