



# UltraLab<sup>®</sup>

## ULS Advanced



## User Manual

Ver. 2.23

User notes:

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## 1 GENERAL

### 1.1 Safety instructions

For your own safety and for the safe operation of the system, please read the following instructions carefully PRIOR to operating the system for the first time.

The **UltraLab ULS Advanced** laboratory instrument, as well as the associated ultrasound sensors, represent state-of-the-art technology and comply with the latest safety regulations.

The manufacturer has made every effort to guarantee safe operation. The user must ensure that the instrument is set up and installed in such a way that its safe usage is not impaired.

The instruments are factory tested and were delivered in a safe operational condition.

This User Manual contains information and warnings, which must be observed by the user under all circumstances to ensure safe operation of the instruments.

- **The instrument may only be put into operation by authorised persons and only operated by trained personnel. All users working with this instrument must read the User Manual prior to any operation.**
- **The user may only perform the repair and maintenance work described. Only the specified parts are to be used.**

Service work may only be carried out by authorised service technicians from **GENERAL ACOUSTICS**.

- **All instruments and additional devices used for this purpose must be properly earthed.**
- **The earth leads must not be interrupted at any point.**
- **The *UltraLab ULS Advanced* laboratory instrument may only be operated within the specified temperature range of -20 to +70°C. Otherwise measurement inaccuracies and instrument faults or defects may occur.**

The temperature stability of connection cables must match the operating temperature of the measurement system.

- **The sensor should only be connected to the instrument when it is switched off.**
- **The sensors are to be treated with care and are only to be screwed in hand-tight; otherwise there is the risk of damage. Sufficient leverage is obtained from the sensor casing itself.**
- **Avoid electrostatic discharges.**
- **The *UltraLab ULS Advanced* instrument must not come into contact with liquids.**
- **Never operate the instrument at sites where water may get into the instrument.**
- **Also take care that the instrument is always operated above the water line of experimental reservoirs.**

Protect the instrument against falling into water.

- **Isolate all system devices from the mains before undertaking cleaning. Ensure there is no current. Do not use aggressive cleaning chemicals, liquid cleaners or sprays; only use a damp cloth. Never bring this or any other cloth into contact with parts of the system that will subsequently conduct electricity.**

- Never attempt to open instruments with objects or to insert objects into an instrument. The voltages existing in the instruments can lead to short-circuits and electric shocks.
- Ensure adequate ventilation when operating the *UltraLab ULS Advanced*. As the instrument has low power consumption, it requires no additional ventilation under normal conditions. However, the instrument should never be placed on a source of heat (computer monitors, radiators ...).

Only operate the *UltraLab ULS Advanced* at the intended mains voltage of 230 VAC (optionally 110 VAC).

- For safety reasons, the *UltraLab ULS Advanced* is provided with a sealed appliance plug with earth contact for its mains power. In this context, only appliance cables and plugs with earth contacts may be used. Operation of the system is prohibited if you do not have this option. Never use an extension cable without an earth contact.
- The instrument is protected from mains voltage by a blowout fuse in the appliance plug. A fine-wire fast-blow fuse (G fuse 5 x 20 mm) compliant with IEC with a nominal value of 0.8(f) A is to be used as a replacement. Only the specified values may be used. Higher tripping values or bridging of fuses is not permissible. If the fuse repeatedly blows, the Service Department of GENERAL ACOUSTICS should be informed, as the cause would need to be resolved.
- We recommend protecting the circuit with FI protective switches to ensure safe operation of your complete system.
- Take care that power cables are not worn, abraded or otherwise defective. When routing connecting cables, make certain that the cables do not represent an obstacle or risk of tripping.
- When using extension cables, the total nominal current of all the devices connected must not exceed the allowable maximum current of the cable. The current ratings of all devices connected to a single plug should never exceed 15 A, unless the plug is specifically designed for this purpose. If you are unsure what type of mains power exists in your premises, ask your Safety Officer or an authorised electrician.

It is imperative to isolate instruments from the mains in the following cases:

- If power cables or plugs are worn or damaged.
- If water or any other liquid has found its way into one of the instruments.
- If the instrument is not working correctly despite following the specified operating instructions.
- If one of the instruments has fallen down or the chassis is damaged.
- If the instrument shows any noticeable departure from normal operation.
- If the sensor connections have become wet.


With the exception of the actions explicitly specified in the manual, you should never attempt your own repairs on devices belonging to the *UltraLab ULS Advanced* system. Besides the resulting revocation of warranty coverage, you also risk an electric shock or other injury from the components. All maintenance work, unless explicitly described in the manual, should only be carried out by GENERAL ACOUSTICS.

## 2 INTRODUCTION

### 2.1 Overview

Ultrasound measurement of distances in laboratory measurement technology has become increasingly established in recent years. The advantages gained are quite clear: particularly in small-scale experimental set-ups, it is imperative to avoid any mechanical intervention that may affect the experiment, but at the same time, parameters must be measured and evaluated. This not only applies to laboratory operation and water. As the distance to an object is measured by sound propagation time measurement, and not by intensity measurement, as is the case in optical methods, ultrasound sensors have excellent background suppression. Almost all materials that reflect sound are reliably detected, irrespective of their colour. Even transparent materials and thin foils present no problems for our ultrasound sensors. As a result of their high sensitivity, our sensors are also predestined for the detection of liquid surfaces. The sensors measure in dusty air as well as through fine fog. Even thin deposition or splashes on the sensor membrane does not impair the sensor function. These characteristics, combined with extremely slender sound cones (with practically no side lobes), make for completely new laboratory applications.

The easy-to-use *UltraLab ULS Advanced* laboratory instrument excels as a consequence of the diverse functions implemented, making it suitable for use in complex measurement tasks without having to set a series of parameters. The measurement object can be, for example, the water surface as a level or the moving water surface as a wave. This is where the temporally highly resolved distance measurement comes into its own. A complex measurement algorithm ensures high measurement accuracy and resolution, as well as a high degree of data confidence.

The *UltraLab ULS Advanced* is dedicated for sound propagation time measurement of very fast moving waves. This device has four independent channels, each one is equipped with up to three sensors of the type USS13-HF. The first (with the Symbol ) of these three sensors - belonging to one measurement unit - are emitting the acoustic ping down to the water surface, whereas the reflected incoming signal can be detected by all sensors of a channel independently. This leads to reliable measurement at demanding applications.

Due to high repetition rate of 50/100 Hz, every measurement unit detects high dynamic processes in an impressive resolution of 0.36 mm. Thanks to the application of a special reference sensor all fluctuations of the sound velocity will be compensated internally. That means, the data obtained from the measurement device are independent of all the sound velocity interfering parameters, e.g. temperature, air humidity, air pressure, etc.. Nevertheless the last column of the data telegram contains the sound velocity in m/s.

After the switch on of the *UltraLab* device and a short system test procedure (needs some seconds), the device delivers continuous data.

An opto-isolated trigger input enables a synchronisation with external data acquisition.

The *UltraLab ULS Advanced* is equipped with an Ethernet interface. So it is possible to receive the output data stream at any PC in the local network.

Please, for configuration of the LAN and the software driver on the PC see the respective chapters (chapter 4).

## 2.2 System components

The fully equipped *UltraLab ULS Advanced* instrument system consists of the following components:

- 1 *UltraLab ULS Advanced* controller
- 12 ultrasound sensors of the type USS 13/HF (4x3)
- 1 ultrasound sensor of the type REF-300 for precise sound velocity measurement mounted in a calibrated distance unit
- 12 shielded 10m cables between the sensors and the instrument (4-pin LEMO plug / M12 industry standard)
- 1 cable between the REF sensor and the instrument (3-pin LEMO plug / M12 industry standard)
- 1 Ethernet cable
- 4 mounting plates for USS 13/HF


## 2.3 Sensor characteristics


Sensor identifier	Measurement frequency [kHz]	Measurement range [mm]	Technical resolution [mm]	Accuracy [mm]
USS13/HF	200	200 – 1.200	0.36	+/- 1

The *UltraLab ULS Advanced* sensors of the type USS 13-HF are based on an ultrasound pulse echo technique. They have been developed for temporally and spatially high-resolution airborne remote measurement of liquids. The sensors permit a distance measurement from 200 mm up to 1200 mm. The advantages of the ultrasound sensors made by **GENERAL ACOUSTICS** in comparison to common ultrasound sensors can be described as follows:

- The acoustic beam pattern could be narrowed to a beam cone below 3° and is valid not only for the sending but also for the reception of the echoes. This is important to reduce the area size of the acoustic footprint onto the water surface in order to get only some small sections instead of a full wave or many waves.
- The minor side lobe could quasi be eliminated. This means that there are no disturbances from objects outside the area of interest (e.g. basin walls, etc.).
- The sending power on one hand and the high receiving sensitivity on the other hand could be increased. This leads to a significant reduced number of lost pings at extreme conditions, which may occur on very steep flanks of waves or at bubbles.
- The sampling rate is accelerated and switchable from 50 to 100 Hz. This great achievement allows to measure fast waves or high dynamic processes in highest accuracy even though a measurement carriage is moving against the incoming wave.

### 3 MEASUREMENT SETUP

The *UltraLab ULS Advanced* is equipped with four independent and synchronised channels. Every channel or measurement unit can control up to three sensors. Whereas the first sensor (Symbol ) is sending the acoustic pulse, all sensors of a channel together are active for receiving of the reflected signals. This enables extraordinary results in combination with an easy adaption at very different and demanding applications. For example, an increased measurement speed and the detection of high dynamic or extreme processes of the water surface in high resolution and with a relative low measurement effort is possible.

Normally, all sensors belonging to the same measurement unit are mounted on a plate. For low relative wave speed the triangle arrangement of all three sensors with the sending sensor in front to the incoming waves is recommended (50 Hz measurement is recommended for quasi stationary measurements). Whereas for relative high wave speed to the carriage all sensors should be arranged in a line – oriented 90° towards the incoming wave front- with the sending sensor first (100 Hz measurement is suggested). As a matter of relative speed, the reflected beam comes up but the sound emitting sensor has relatively moved further. Therefore, the other sensors (Symbol ) are placed to receive the later incoming signals.



As depicted in Figure 1, all sensor cables are connected to the *UltraLab ULS Advanced* controller by a 4-pole LEMO socket at the front of the control panel. The reference sensor cable (REF-300) is connected by a 3-pole LEMO socket on the right hand side of the control panel. Right next to it a BNC socket is located (TRIGGER IN). Here the cable has to be connected coming from the trigger unit of the external data acquisition. It is an opto-isolated TTL type input, which triggers the time stamp to start counting every single data sample (see Data telegram chapter).

At the rear panel the internal power socket including a fuse (0.8 (f) A) is installed. Here, 230 volt has to be connected with after connecting the ground at the screw accordingly.



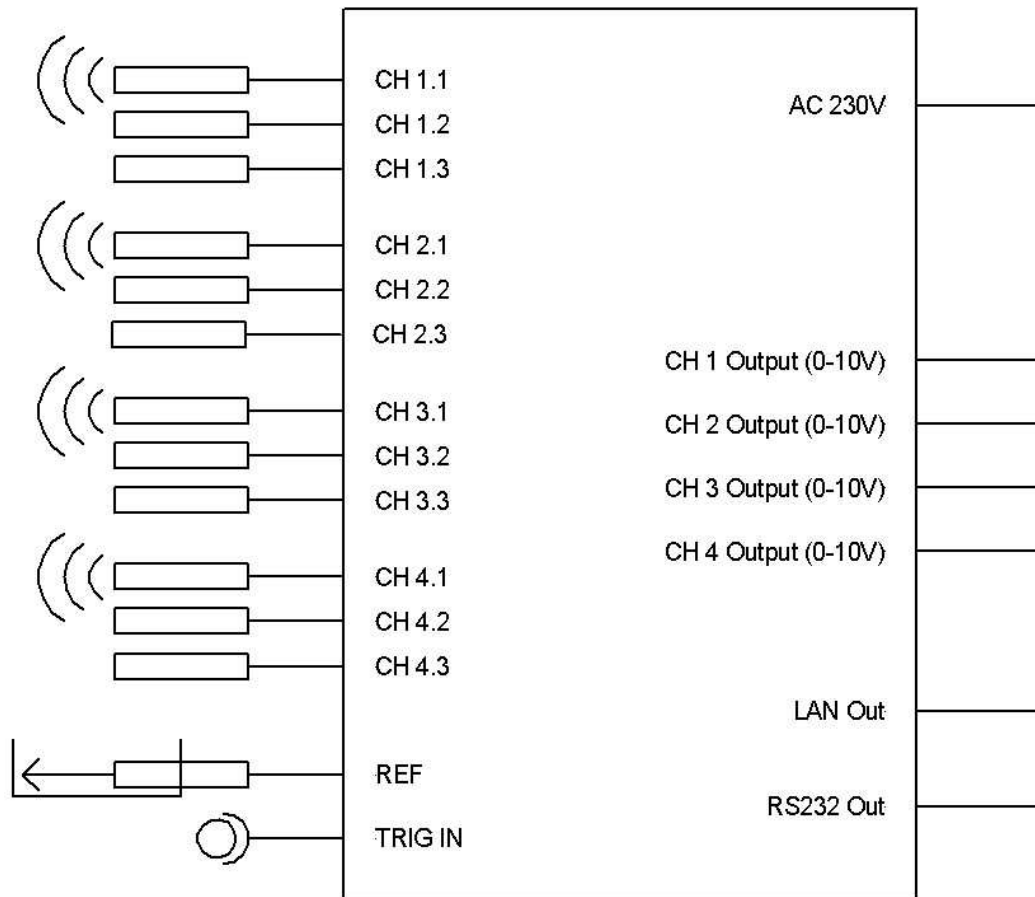
Furthermore, a serial cable and/or an Ethernet cable has to be plugged into the associated socket. The measured data of all four channels will be exported via this LAN. The switch on the frontpanel (Data /ON/OFF) is needed for configuration of the data





transfer to the remote PC. With its help one can switch between data transfer and LAN configuration. During the data transfer it is not possible to configure the LAN-interface. Therefore the data transfer must be switched off before with the DATA SWITCH on the front panel. The status of the data switch will be displayed with the LED-ring around the switch. After the system is configured it is necessary to switch it back to data transfer for normal operation.

**Please note:** After switch on of the power supply it needs 20 seconds to send the data via LAN. The system starts immediately with boot procedure, internal tests and initialisation with a count down from 19 every second. Right after that the data telegram output is starting.



## ULS Advanced

Figure 1: Connection scheme for the *UltraLab ULS Advanced*

### Hints for the applications:

Mount the sensors vertical to the water surface. A 50 cm to 60 cm distance to the surface is for the most demanding application (fast/steep waves) a good selection.

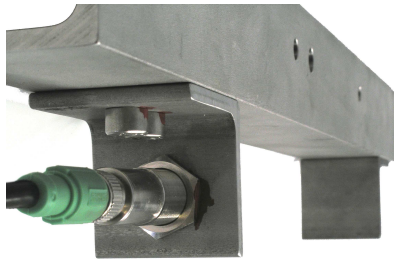
For the high speed mode(100 Hz) please optimise the sensor mounting and neighbour constructions according a small effective down-looking area to reduce the number of multiple and false echoes in the measuring path. The *UltraLab ULS Advanced* uses algorithms to suppress such false echoes, but basically a better signal quality leads to better end results in most cases.

The 50 Hz measuring mode is the preferred mode for stationary and quasi stationary measurements.

For small grid measurements please mount the different sensors at the same height to prevent false readings.

### 3.1 Compensation using a reference measurement

The most accurate type of sound velocity compensation is a reference measurement. This is the prerequisite for a calibration free, highest accuracy and ease of use ultrasonic distance measurement. In the case of density variation or stratification of air masses, through which the ultrasound pulse must pass, it is necessary to measure the real speed of sound.



The *UltraLab ULS Advanced* is equipped with a sound velocity sensor (reference sensor) REF-300 which has a very high accuracy. The ultrasonic sensor emits sound along a path of defined and highly calibrated length, ideal parallel to the measurement channel, through the same medium/media as the measurement path itself, onto a fixed target at a defined distance. The same influences on the speed of sound are necessarily measured as

those on the measuring path itself. Due to data recording of the ultrasound velocity and the internal calibration of the data received from all four channels, the influence of temperature, air pressure, as well as air humidity variations can be excluded. This method can consequently be used for highly accurate compensation of all parameters affecting the sound velocity. The highly precise reference sensor including the reference track (see Figure 2) should be mounted horizontal, upside down nearby the *UltraLab ULS Advanced* sensors to get a representative sound velocity measurement for the distance measurement path.

**Please note:** The reference sensor has to be protected from heat sources, splashing water and no object or cable has to be between sensor and target, in order to get high quality readings.

**Warning: The reference distance is highly calibrated. The slightest deviation may cause inaccuracy of the measurements. Never unfix any screw or the sensor of this highly calibrated unit!**

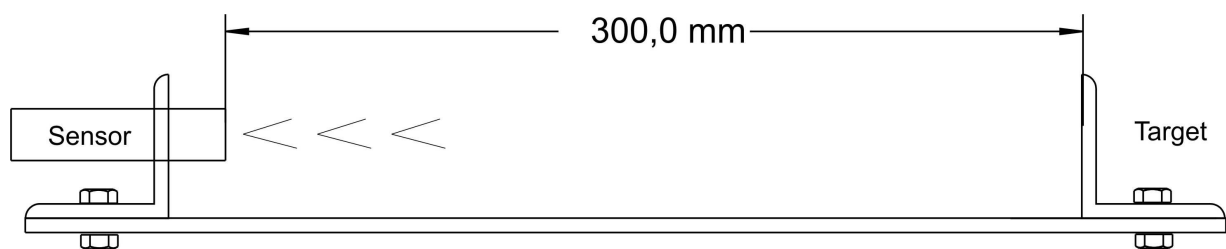


Figure 2: Reference sensor REF-300 mounted on calibrated distance unit

**Please note:** If the reference track is unconnected, a sound velocity of 344,00 m/s – proportional to a temperature of 20 °C , 50% relative air humidity and 100 kPa air pressure is used as a fixed value instead.

## 4 MEASUREMENT DATA OUTPUT

### 4.1 Calculation of the calibration curve for analogue output (Fisher Connectors)

The ultrasound measurement system outputs a voltage proportional to distance of between 0 and 10 V at the Fisher Connector outputs on the backside of the instrument. From Figure 3, it may be seen that the calibration curve is a) a straight line and b) does not pass through the origin. This means that a) the conversion of distance to voltage is linear and b) an offset (offset = 0.2 m) has to be added to the distance value because all ultrasound sensors have a so-called blind zone starting directly at the sensor's lower edge (see specifications of the individual sensors). Using an example, it will be shown here how the calibration curve is calculated with the parameters. It is recommended that the experimental set-up be measured beforehand, the expected wave heights determined and then to set the sensors accordingly. If e.g. wave heights of 10 mm are expected, the sensor should be placed close to the expected waves but considering the blind zone of the sensor.

$$h_m = U_m \times 0.1 \text{ m/V} + 0.2 \text{ m}$$

whereas:

$h_m$  = measured height to the sensor's low edge

$U_m$  = measured Voltage

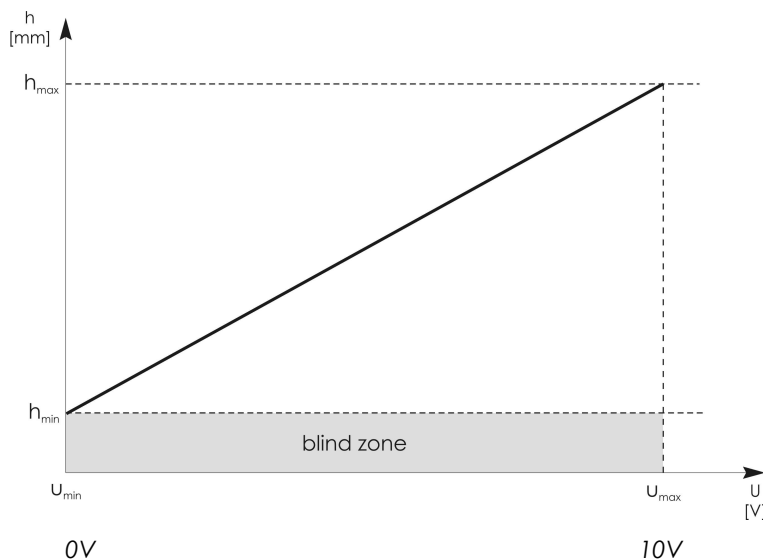


Figure 3 The calibration curve

### 4.2 Data telegram and trigger

With a help of a RS 232/ethernet converter the *UltraLab ULS Advanced* transmits ASCII telegrams to a remote PC via Local Area Network (LAN). There, a program like Hyperterminal can be used to view and log the data externally. The telegrams contain six numbers separated by <tab> characters and ending with <CR> <LF>:

Column 1      The time stamp

- Columns 2-5    Measuring channels 1-4 [in xxxx.xx mm]
- Column 6      Reference channel with the actual value of the sound velocity in xxx.xx m/s] (see figure 3).

A TTL type I/O port triggers the time stamp to start counting the telegrams beginning from 0000000, 0000001, 0000002, ..., up to 9999999 (see first column of figure 3). Before the time stamp is triggered or after the measurement has stopped the value of the time stamp is -1 in the 100 Hz mode and -2 in the 50 Hz mode.

At that moment, the measuring system software program on the PC starts to measure, the rising edge of the time-stamp-reset-signal at the I/O-port – being on high level - starts counting. This situation continues until the measurement is stopped. Then the decreasing edge of the time-stamp-reset-signal provokes a negative value -1 respectively -2 for the telegram column 1.

One counter step stands for a 10 ms time span. That means at a 50 Hz sampling rate a decrease of the counter in steps of 2. Nevertheless of the time stamp status the applied sensors are continuously sending measuring data for data preview purposes to the external PC.

The TTL level – trigger input is connected by a BNC socket at the front of the control panel. It is electrically isolated from internal electronics by an opto-coupler.

```
// ULTRALAB ULS Advanced
// Ver. 2.10
// GENERAL ACOUSTICS 2009
//
```

//Count	CH1	CH2	CH3	CH4	C-REF
-1	0362.79	0353.13	0204.59	0622.09	338.74
-1	0362.46	0352.96	0204.59	0621.92	338.74
-1	0362.79	0353.13	0204.76	0622.26	338.74
-1	0362.79	0352.96	0204.76	0622.26	338.74
0000000	0362.79	0352.79	0204.59	0622.09	338.74
0000001	0362.66	0352.96	0204.59	0622.09	338.74
0000002	0362.66	0352.79	0204.76	0622.26	338.74
0000003	0362.79	0352.79	0204.76	0622.09	338.74
0000004	0362.79	0352.96	0204.76	0622.09	338.74
0000005	0363.12	0352.79	0204.76	0622.26	338.74
0000006	0362.79	0352.79	0204.76	0622.26	338.74
0000007	0363.12	0352.79	0204.76	0622.09	338.74
0000008	0363.29	0352.96	0204.76	0622.09	338.74
0000009	0363.29	0352.96	0204.59	0622.09	338.74
0000010	0363.29	0352.79	0204.76	0622.09	338.74
0000011	0362.79	0352.79	0204.59	0622.09	338.74
0000012	0363.29	0352.96	0204.59	0621.92	338.74
0000013	0363.46	0352.96	0204.59	0622.26	338.74
0000014	0363.46	0352.96	0204.59	0622.09	338.74
0000015	0362.79	0352.96	0204.59	0622.09	338.74
0000016	0362.79	0353.30	0204.76	0622.09	338.74
0000017	0362.79	0352.79	0204.76	0622.26	338.74
0000018	0363.12	0352.96	0204.76	0622.26	338.74
0000019	0362.79	0352.96	0204.76	0622.26	338.74
0000020	0363.29	0352.79	0204.76	0622.26	338.74
-1	0362.79	0352.96	0204.76	0621.92	338.74
-1	0363.29	0352.96	0204.76	0621.58	338.74
-1	0362.79	0352.96	0204.59	0622.26	338.74

Figure 4: Example of data telegram

**Please note:**

After switch on of the power supply it needs 20 seconds to start the measurement and get the data via RS232 and/or LAN. After 10 seconds of internal tests the system starts the count down from 10. Right after the data telegram is

### 4.3 Output configuration

For local data transmission a serial COM-port (RS232) is mounted at the rear panel of the system. To guarantee the maximum throughput of the measurement data in 100 Hz mode a fixed baud rate of 115 kBaud (8-N-1) is used.

For additional data transmission via LAN an internal RS232-to-Ethernet converter that sends the data over the Ethernet to any PC is implemented. The software *Network Enabler Administration* must be installed on this computer/s for the reception of the data. This software generates a virtual serial port. The data can be logged and evaluated on it. Up to four different PC's on the local network can receive the *UltraLab ULS Advanced* data stream at the same time.

### 4.4 LAN - Moxa interface-converter

For data transmission an interface-converter of the company Moxa is used. This packs the output data of *UltraLab ULS Advanced*'s internal RS232 interface in IP-packages and sends it over TCP/IP to the desired PC.

Each module must be adapted:

the four most important settings are

- Basic
- Network
- Serial
- Operation Mode

For defining the parameters the software *Network Enabler Administration* is required. This software generates a virtual interface for the real COM mode, needed for *UltraLab ULS Advanced* operation.

### 4.5 Software installation

Open this folder on the enclosed CD.

CD:\Moxa\NEA\ Serial to ethernet standard Version

(CD = drive letter)

and start the program setup.exe.

Follow the instructions in the installation.

## 5 CONFIGURING THE LAN INTERFACE

### Important:

The module is set and tested by GENERAL ACOUSTICS to the parameters desired by the customer. Each change can lead to communication problems between the *UltraLab ULS Advanced* and the logging computer and is under your own responsibility.

### 5.1 Preparation

1. Turn on the *UltraLab ULS Advanced*.
2. Turn off the data switch on the back side. The data transmission is stopped. This is important because the module cannot be configured during the transmission of data. The module will not accept the data or only part of them, that can on the other hand lead to the module taking on its default parameters again.
3. Connect the twisted paired x-cross cable to the LAN-jack to connect a PC direct to the *UltraLab Advanced* or use a normal twisted pair LAN cable to connect via a switch.
4. Start the program *Nport Search Utility*.

### 5.2 Changing the IP settings

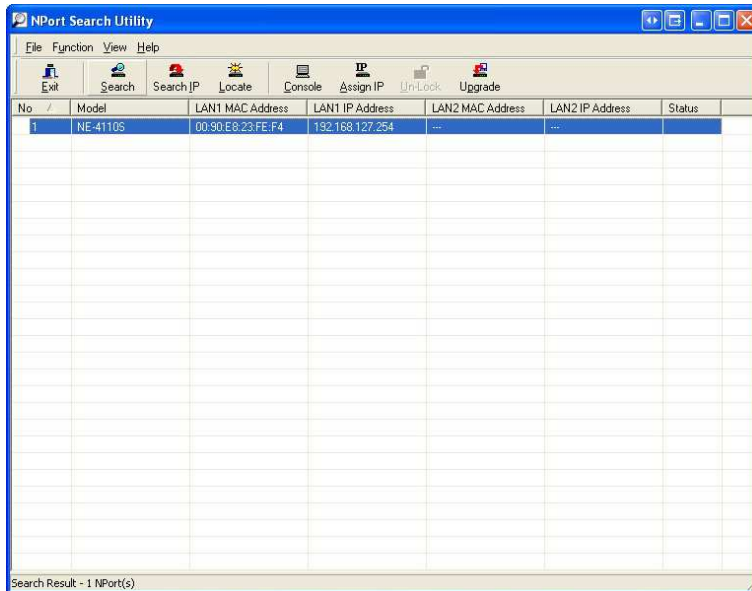
The default IP Address of the Moxa NE-4110S is **192.168.127.254** and therefore it already assigned the Subnet mask must be 255.255.255.0 To change the settings follow the following steps.

**Attention: Don't change settings during data transmission! It may result in loading the default parameters and a new setting of the module is necessary.**

### 5.2.1 Search of a Moxa module a changing the IP address

1. Broadcast:

By clicking on **“Search”** a Broadcast will be performed. This operation finds all Moxa modules on the network, after that one or several of them can be selected.



2. click on the found module and then click on **“Assign IP”**. In the following screen you can change the IP Adress of the MOXA module to a a IP adress of your network by clicking in the **“IP address”** field.



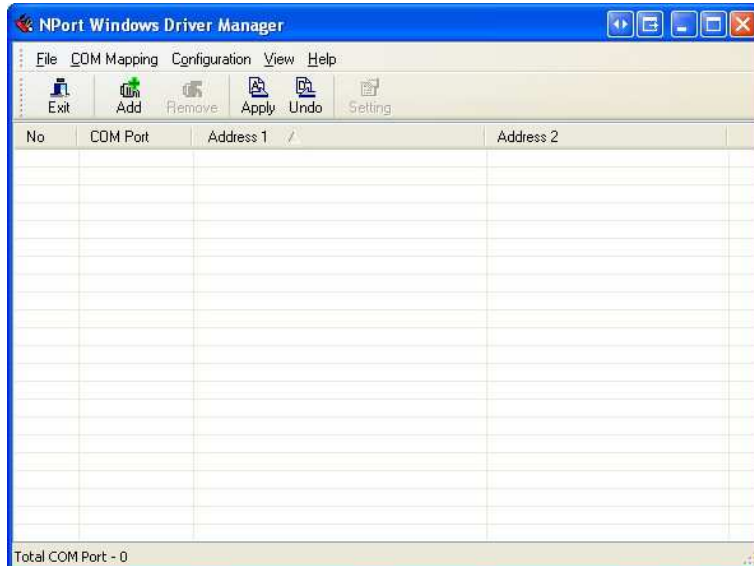
after you have changed the IP, click on **OK**.



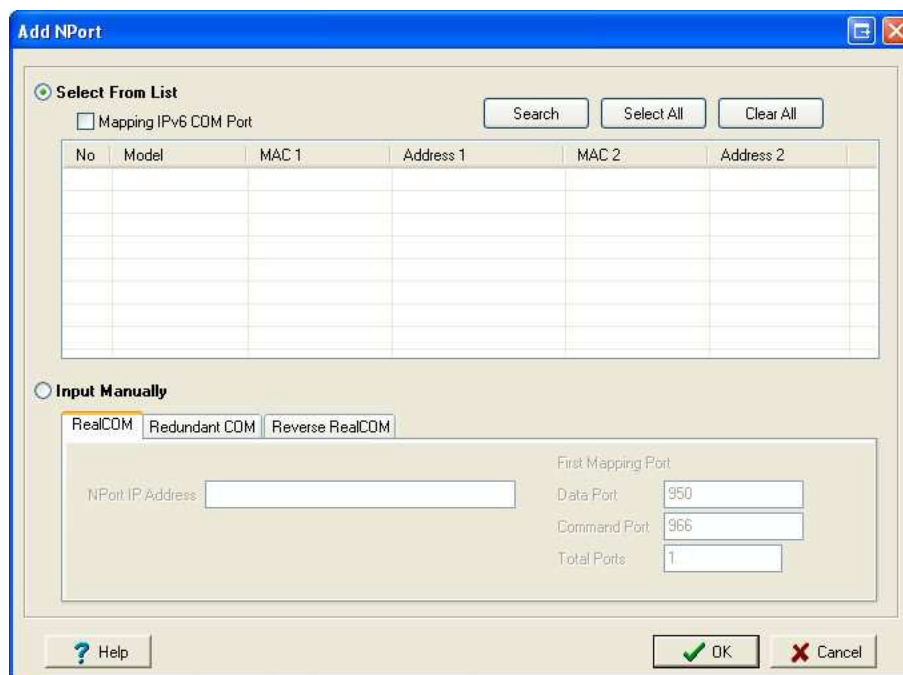
3. Close the Nport Search Utility

### 5.3 Map the IP address to a virtual COM Port

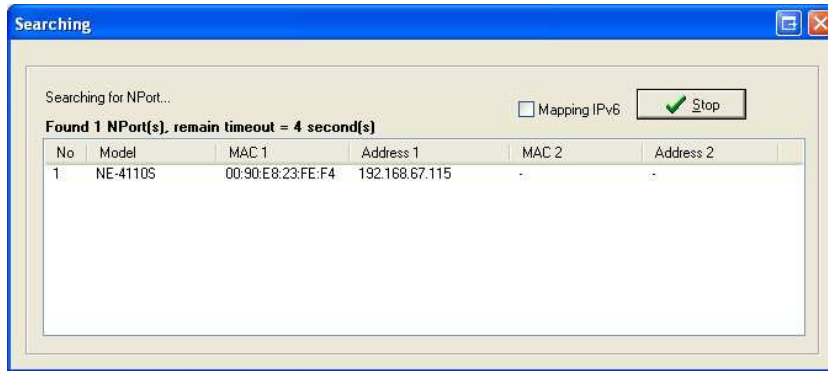
1. Start the program Nport Windows Driver Manager



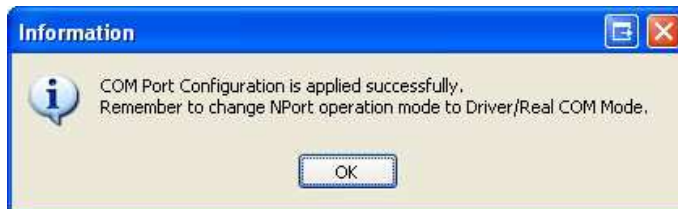
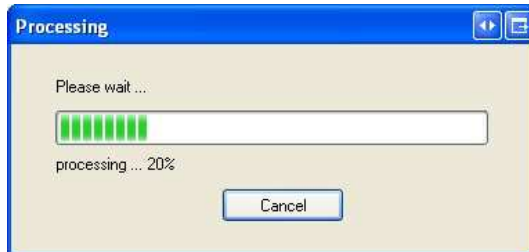
2. Click on **“Add”**
3. In the following screen click on **„search“**





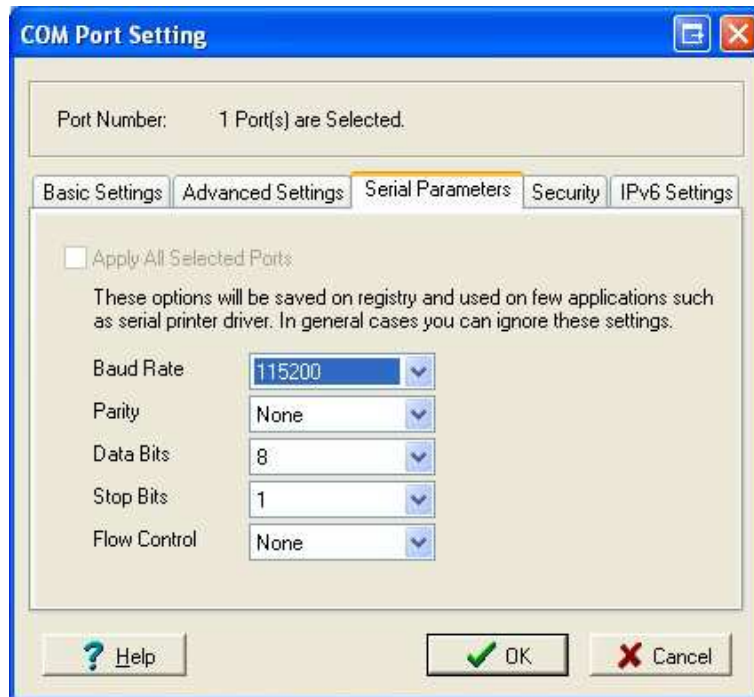


4. After the module is found just click on OK
5. In the next screen you will be asked if you want to activate the COM Port now. Click on **“Yes”**



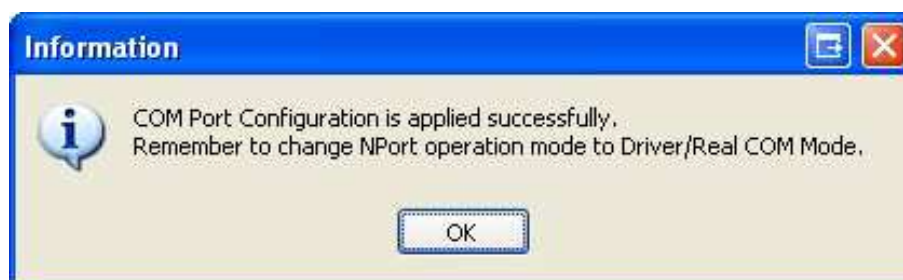
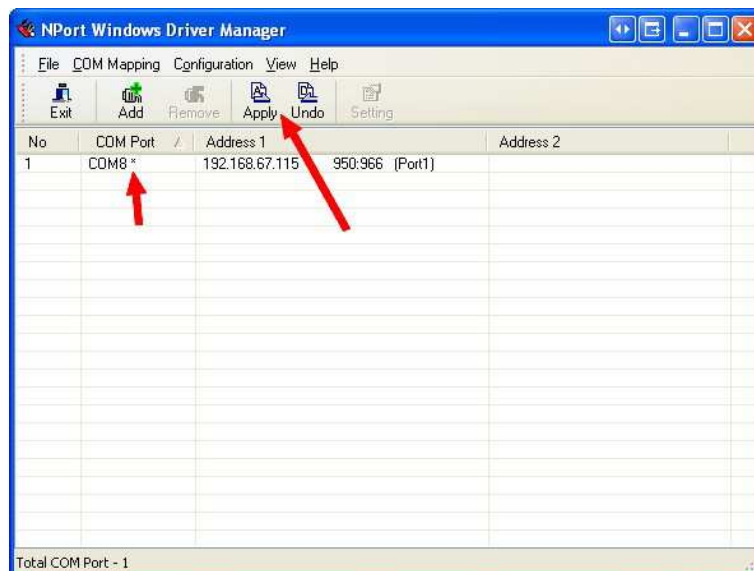
The Nport Windows Driver Manager has automatically chosen a free COM Port for the UltraLab System.

6. Click on the module and then click on **“setting”**
7. Change to the Serial Parameters tab and change the Baud Rate to 115200; Parity: None; Data **Bits 8; Stop Bits 1; Flow Control None**



No other changes are necessary. Click on OK

8. In the next screen you can see a little star behind the COM Port. That shows you that you have made changes which are not saved right now. To save them to the module click on **"Apply"**



9. The configuration is finished. As a result the COM Port is generated and can then be used by a terminal program or an application to log and analyse data. Don't forget to switch the Data on the UltraLab ULS Advanced back to on, so that the data will be send out of the LAN interface.

## 5.4 Web Console

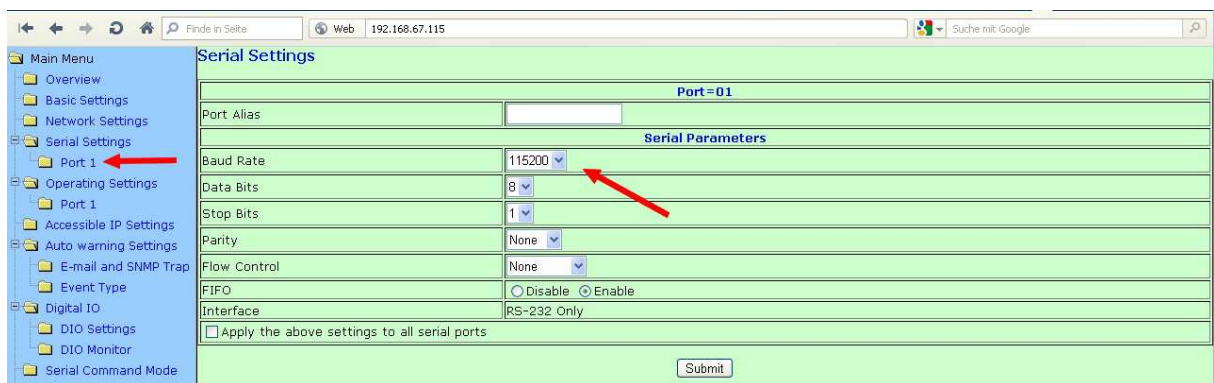
You can also change all the settings of the module by typing in the IP Address in a Webbrowser. The MOXA module has a integrated Web console.

**Please note** that you PC needs to be in the same IP Range as the module to get this step worked. Please follow the steps under point 5.1 first.



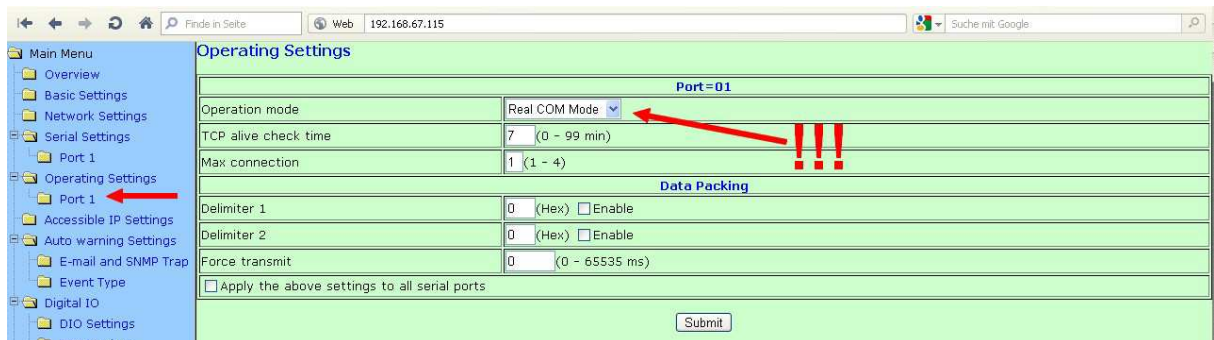
The important settings are under the following points:

- Serial Settings
- Operating settings



### 5.4.1 Real COM Mode

The real COM Mode is adjusted and recommended by GENERAL ACOUSTICS. In this mode (transparent connection) four connections to different computers can be established.



After you change something always click on **“Submit”** to get the changes saved.

The Webconsole is also described in the MOXA Manual on the supplied CD.

## 6 WARRANTY STATEMENT

### (1) Warranty period

GENERAL ACOUSTICS GmbH, as manufacturer, will, itself or through its authorised sales partners, provide end-users with warranty coverage on all GENERAL ACOUSTICS products purchased as new and unused for a period of 12 months from the date of sale.

### (2) GENERAL ACOUSTICS procedure

Any part, which has been correctly used and is found to be defective as a result of manufacturing and/or material faults within the above-mentioned warranty period, will either be repaired or replaced with a new part by GENERAL ACOUSTICS after expert opinion has been sought. Material and/or labour costs arising as a result will not be charged. All exchanged parts become the property of GENERAL ACOUSTICS

### (3) Conditions for labour rendered under warranty

Instruments delivered must have been operated correctly, unauthorised modifications or repairs must not have taken place and the benchtop instrument must not have been opened.

### (4) No warranty claim exists in the following cases

- Parts subject to normal wear
- Damage caused by incorrect maintenance, fitting and addition of non-approved parts and devices, as well as unauthorised modification of components
- Damage caused by electrolysis
- Damage caused by fire or accident, incorrect usage, misuse or negligence
- Damage/rust/corrosion caused by the entry of water

### (5) Explicit or tacit guarantees

These guarantees confer special rights to you, and you may also have other rights, which differ from country to country or from province to province. Where these guarantee claims apply, all other explicit or tacit guarantees provided by GENERAL ACOUSTICS automatically lose their validity, incl. all market access guarantees or guarantees of fitness for every specific purpose. Conversely, the guarantees thus arising are limited to the period of this warranty. Neither sales partners nor traders are authorised to make any other assurances, representation of facts or warranty offers than those contained in the warranty conditions.

## 7 CE CONFORMITY STATEMENT



*The instrument conforms to the requirements of the EEC directive 89/336/EWG and the revisions through 92/31/EWG and 93/68/EWG Article 5 pertaining to “Electromagnetic Compatibility”, as well as 73/23/EWG and the revisions through 93/68/EWG Article 13 pertaining to “Safety”.*

## 8 TECHNICAL SPECIFICATIONS

Instrument model	<i>UltraLab ULS Advanced</i>
Sensors	USS13-HF, IP 65, M30x1.5
Parameter setting	Virtual com-port via Ethernet (LAN)
Measuring range	From 200 mm up to 1200 mm
Technical resolution	0.36 mm
Accuracy	+/- 1 mm
Sample rate	50Hz/100 Hz switchable (optional interpolated output of 100Hz by a sample rate of 50Hz)
Data readout	RS232/LAN via ASCII data telegram
Electric power supply	230 VAC, 250 mA (110 VAC optional)
Chassis	ca. 330 / 120 / 260 mm width / height / depth IP 50
Temperature range	-20 ...+70°C
Delivery package (fully equipped)	<i>UltraLab ULS Advanced</i> instrument, 12 pc. ultrasound sensors USS13_HF, 12 pc. 10m sensor cable, 1 reference sensor REF-300 including calibrated distance unit, 1 reference sensor cable, 1 Ethernet cable, 1 power supply cable, 1 User Manual

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