Operations Manual for ultrasonic
SONOROD Generator

THE MPI2000 ULTRASONIC SONOROD GENERATOR

ULTRASONIC GENERATOR – Manual

CONTENTS

INTRODUCTION

Dear Customer,

Thank you for your purchase of the MPI2000 product.

This ultrasonic sonorod-generator has been developed using the latest technologies to allow for greater overall performance and stability.

Please read and follow these operating instructions carefully before installing or commissioning your product. As with any electrically powered device, failure to observe these instructions can present a risk to life.

The device may only be operated and maintained by personnel who have read and understood this operating manual and are familiar with the applicable legal regulations for accident prevention and workplace safety. Failure to comply with this will result in a loss of warranty rights.

For ease of reading this operating manual, the MPI2000 may also be referred to by the terms *'unit'* or *'device'* interchangeably

SAFETY INSTRUCTIONS

Before starting up your device, please read through the following instructions carefully, both for your own safety and for the safety of the device.

Keep this manual where it can be readily accessed by all systems users.

Installation is to be carried out by qualified technical personnel only!

This ultrasonic generator is to be operated by properly trained personnel only!

Due to the way it operates, additional safety measures must be taken if the device is to be used in areas posing an explosion risk.

The electromagnetic compatibility corresponds to the standards and regulations listed in the specifications.

All necessary settings were either made in the factory or are described in this handbook.
However, should problems occur on start-up, please do not make any prohibited adjustments to the device, as this would endanger your warranty rights. If in doubt, please contact our technical service staff.

Please contact our technical service if at all in doubt. Please see the last page.

Inspection or diagnostic work inside the device may only be carried out to the extent described and, as with the electrical connection should only be performed by skilled personnel. When performing such work, the ultrasonic generator must be completely disconnected from the main power source. (unplug the mains connection).

The device must always be disconnected from the mains before cleaning or when installing/uninstalling an option. Do not use liquid cleaners or sprays. Only use a damp cloth.

Inputs or outputs that are used for controlling or monitoring purposes should be twisted and shielded.
The device must not be in close proximity to electrically charged components or cables.

The shielding should be connected to the generator's earth on one side of the generator.
Attention: All connections for the signal or control lines are galvanically connected to the generator.

Always observe any warnings or instructions provided on the device itself.

The platform for the device must be sufficiently stable, as the device being jolted or falling could cause severe damage.

Ensure that the power supply specifications given on the device are met.

Only those transducers which have the correct frequency, power output and dimensions may be used with this generator.

HF cables from the generator to the transducer as well as mains cables to the generator may not be rolled up if they are too long. Instead, they must be shortened to the required length due to the risk of overheating.

With the exception of the permitted tasks listed in the handbook, you should never attempt to repair or modify the device yourself.

⚠️⚡ **In the following cases you should disconnect the device from the mains and contact a qualified service engineer:**

· **If the mains cable or plug is damaged**
· **If liquid has penetrated into the device**
· **If the device has fallen over or the housing is damaged**
· **If the device displays noticeably different behaviour than standard operation**

ATTENTION: Repairs and modifications may only be carried out by competent, skilled personnel

GENERAL VIEW AND DIMENSIONS/mm/

89

348

316

371

252

125
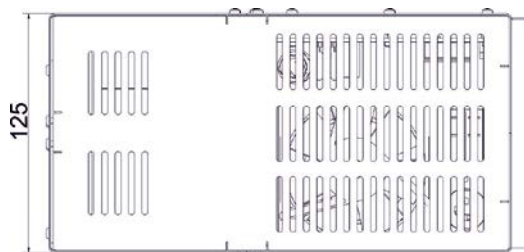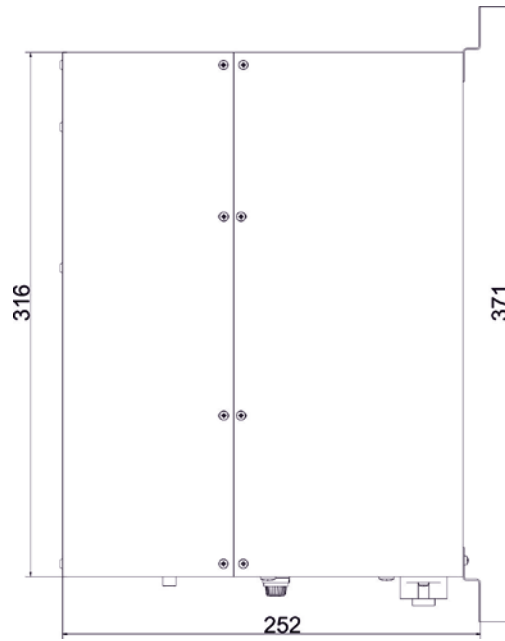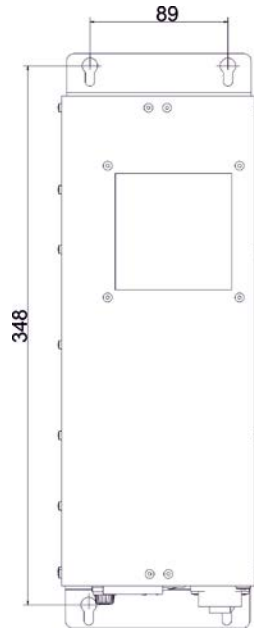
INSTALLATION & ENVIRONMENT

Choose a suitable location that will protect the device from moisture, water, excessive sunlight and heat. The selected location for the device should be in an area where ambient temperatures do not exceed 40°C.

If the generator cannot dissipate the heat sufficiently, it will display an error message due to excess temperature (see also the "OVER TEMPERATURE" error description).

ATTENTION: • **Choose a location that will prevent steam or any other aggressive vapours from penetrating the device.** Ambient temperatures of over 30°C should be avoided.

• **Over a period of time, chemically contaminated ambient air can lead to the device being irreparably damaged.**

Power supply
The ultrasonic generator draws its power (210-250VAC/50-80Hz) via the connection cable with **Power socket.**

It has an external main fuse (10 AF).

ATTENTION:

- **For safety reasons, always disconnect the unit from the mains before changing fuses.**
- **Plug racks into earthed sockets only.**
- **Always replace blown fuses with new fuses of the same type.**
- **This should only be performed by qualified, skilled personnel.**

Connections on the back of the generator

HF OUTPUT: HF Output connector is a Lemo : ERA.1S.250.CTL

ATTENTION:

- Output voltage could be between 600V and 1200V AC.

- Only use cables specified by the manufacturer.

- Use only shielded transducer connection cables.

- Connect the shielding to the PE conductor on the generator side.

- Only use cables with sufficient cross-section.

- Minimum cross-section: 1.5 mm2.

Interface socket RS485 ModBus
RJ 45 CONNECTOR:

RJ 45

RS 485

1 — GND
2
3
4 — A
5 — B
6
7 — 12 V DC
8
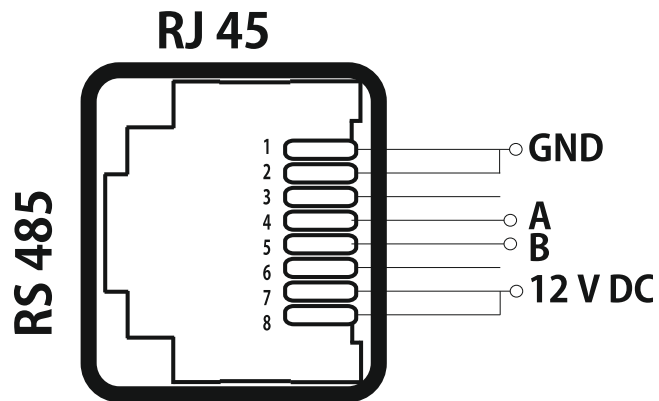
PINS	DESCRIPTION
1	GND
2	GND
3	N/C
4	A
5	B
6	N/C
7	12 V DC
8	12 V DC

25-pin DSUB I/O socket
Assignment of the 25-pin DSUB interface socket

```
        13                    1
   ┌─────────────────────────────┐
   │ ⃝  ⚬⚬⚬⚬⚬⚬⚬⚬⚬⚬⚬⚬⚬  ⃝ │
   │     ⚬⚬⚬⚬⚬⚬⚬⚬⚬⚬⚬⚬         │
   └─────────────────────────────┘
        25                    14
```

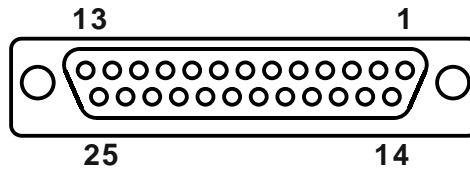| PIN NO. ON DSUB SOCKET INTERFACE X1	SIGNAL NAME	DESCRIPTION
1	+12 VOLT OUT	12 Volt for external use
2	POUT	Output 0 – 10 Volt = Power output 0 – 100 %
3	P-EXT.-IN	Analog Input 0 – 10 Volt for power control
4	GND	Shared reference point = Ground
5/9	HF-DA-ERROR	Optrone root (shared) for "HF-DA" and "ERROR"
6	HF-DA	Output "HF-DA"
7	ERROR	Output "ERROR"
8	A	A signal of RS 485 interface
9/5	HF-DA-ERROR	Optrone root (shared) for "HF-DA" and "ERROR"
10	B	B signal of RS 485 interface
11	<> Nominal	Output for nominal value
12	FAN-ON	Monitoring output = 12 Volt when the fan is running
13	FS-24 V	Remote control input (with 12 – 24 Volt)
14	GND	Shared reference point = Ground
15	GND	Shared reference point = Ground
16	N/C	Spare
17	FAN-ON	Monitoring output = 12 Volt when the fan is running
18	N/C	Spare
19	N/C	Spare
20		Reserved for internal use only
21		Reserved for internal use only
22		Reserved for internal use only
23		Reserved for internal use only
24		Reserved for internal use only
25		Reserved for internal use only
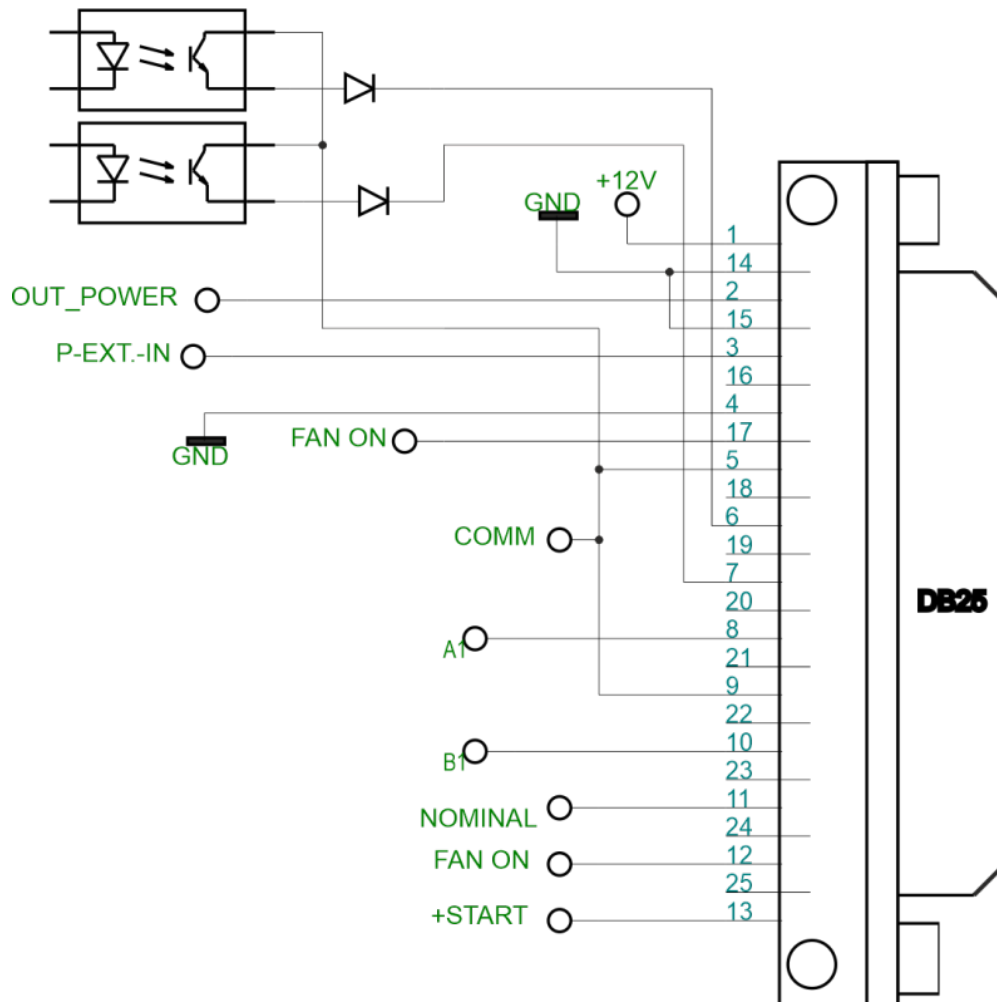
Picture shows internal schematic of generator.

ATTENTION: **A shielded control cable must always be used for the interface.**

Interface Description

1.) Signal "+12 Volt Out"   **DSUB PIN 1**
A voltage of 12 V is available at this output. This voltage can be loaded with max. 100 mA and can, for example, be used to output a voltage for the function "HF-DA" and/or "Error".

This voltage can also be used to switch on the generator on the input "FS-24 V".

2.) Signal "POUT"   **DSUB PIN 2**
At this output a voltage proportional to the power output of between 0 and 10 V
(= 0 – 100 % power output) is available.
Reference point = "GND".

3.) Signal "P-EXT.-IN"   **DSUB PIN 3**
By connecting a voltage between 0V and 10 V, the output of the generator can be set to between 0% and 100 % of its nominal amplitude or power. **This is only possible when the value of parameter " POWER SET POINT" is set to 0 from the LCD or PC software.**
Reference point = "GND".

4.) Signal "GND"   **DSUB PIN 4**

5.) Signal "HF-DA ERROR"   **DSUB PIN 5/9**
Shared in/output for the internal optrone "HF-DA" and "ERROR" (these PINs are connected internally).

6.) Signal "HF-DA"   **DSUB PIN 6**

If the ultrasonic generator has been switched on via of the signals "FS-24 V", "FS-GND"
and is emitting HF voltage (i.e. there is no malfunction), an internal optrone is
closed. (between PIN 6 and PIN 5/9)
The "root" of this optrones leads through to a PIN 5/9 (these pins are connected internally)
in the DSUB socket.
A voltage connected to Pin 5/9 can be switched through (max. 36 VDC / 20 mA).

7.) Signal "Error"   **DSUB PIN 7**

This is the output of an internal optrone (root to PIN 5/9).
This optrone reports generator malfunctions. This means that if the generator is switched on and,
for some reason the power output does not correspond to the set level, this optrone is activated.
An external voltage connected to "HF-DA-Error" can, of course, also be switched through here (max. 36 VDC /
20 mA).

8.) Signal "A"   **DSUB PIN 8**

A signal of RS 485 interface

10.) Signal "B"   **DSUB PIN 10**

B signal of RS 485 interface

11.) Signal "<> Nominal"   **DSUB PIN 11**

Open Collector output: high signal if a window function is active and the generator
is operated outside the window set; low signal if a window function is active and
the generator is operated within the window set.

12.) Signal "FAN-ON"   **DSUB PIN 12**

At this output, there is a control voltage (12 Volt) for monitoring the fan
function when the internal fan is running.

13.) Signal "FS-24 Volt"   **DSUB PIN 13**

Switching on the generator (Ultrasound On) by connecting a voltage between
12 – 24 Volt between PIN 13 and GND (PIN 4,14 or15).

14.) Signal "GND"   **DSUB PIN 14**

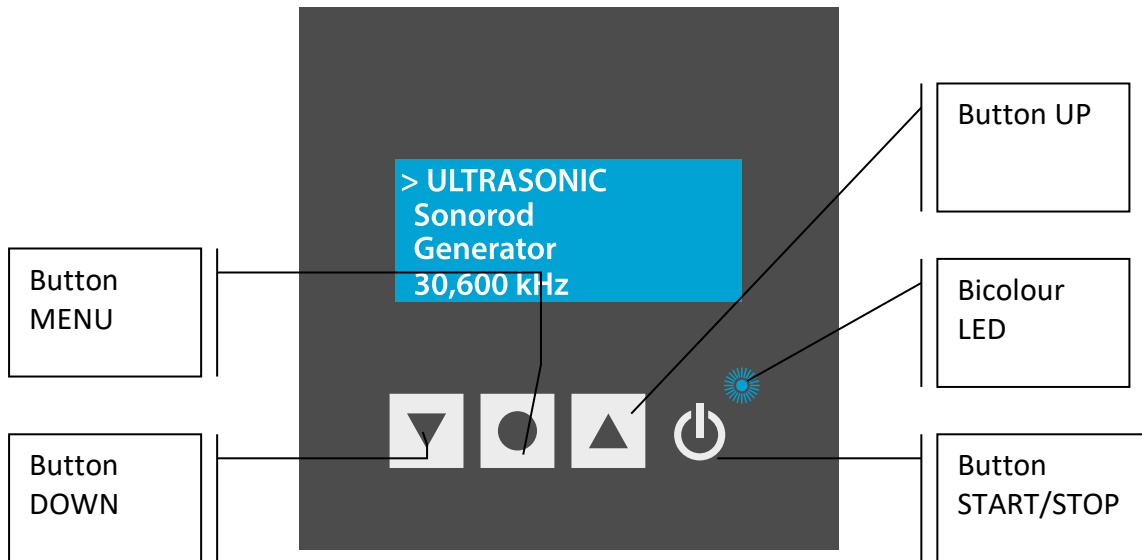**15.) Signal "GND"**   **DSUB PIN 15**

17.) Signal "FAN-ON"   **DSUB PIN 17**

At this output, there is a control voltage (12 Volt) for monitoring the fan
function when the internal fan is running.

!!! INTERNAL USE ONLY from 20 to 25!!!

OPERATION

Operator elements and display on the front panel

Bicolour LED: Lights up blue when generator is switched on and works properly
                               Lights up red in the event of an error

START/STOP button: The generator is switching on and off by pressing this button.

Button UP ▲ and Down ▼: For moving up and down to change the value of selected parameter.

Button Menu ●:   Multifunction button:

1. By pressing the button MENU you can move the cursor and select parameters on the current window;
2. By press+hold for 2 seconds you can switch between windows;
3. By press+hold for 5 seconds you will WRITE TO MEMORY all present settings of the generator.

The LCD display

1.Initializing window display:

After the generator is powered on, the initial screen contains the following status information.
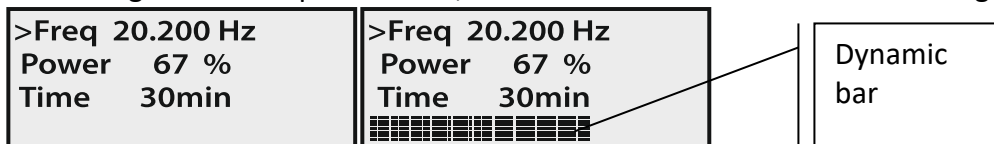
Freq – Starting frequency of the generator.

Power – percentage from the max power

Time – working time in minutes

Dynamic bar shows the power consumption.

2. Sweeping window

```
>Sweep        20 Hz
 SW F         10 Hz
 Smooth        6  ru
```

Sweeping depth– This is the deviation of the sweeping frequency around the central operation frequency in Hz.
Sweeping frequency – Here you can set the desired sweeping frequency in *Hz*.
Smoothing – This changes the shape of the sweeping frequency from rectangular to similar to sinusoidal.

3. Amplitude Modulation(AM) window

```
>AM F1        25.0 Hz
 AM F2        30.0 Hz
 Depth         80 %
```

AM F2 - Amplitude modulation frequency F2 – This the maximum value of the frequency of the amplitude modulation.
Depth - Modulation Depth – This the the depth of the amplitude modulation.
AM F1 - Amplitude modulation frequency F1 – This the maximum value of the frequency of the amplitude modulation.

4. Degasing window

```
>Ton      2 s
 Toff     2 s
 Degasing  4min
```

Ton – time when the generator is on(in seconds)
Toff – time when the generator is off(in seconds)
Degasing – total time for the degassing procedure(in minutes)

5. System window

```
>Modbus Addr  4
 Speed  115200 b
 Pass     0
```

ModBus Addr – shows the address of the generator in the ModBus network
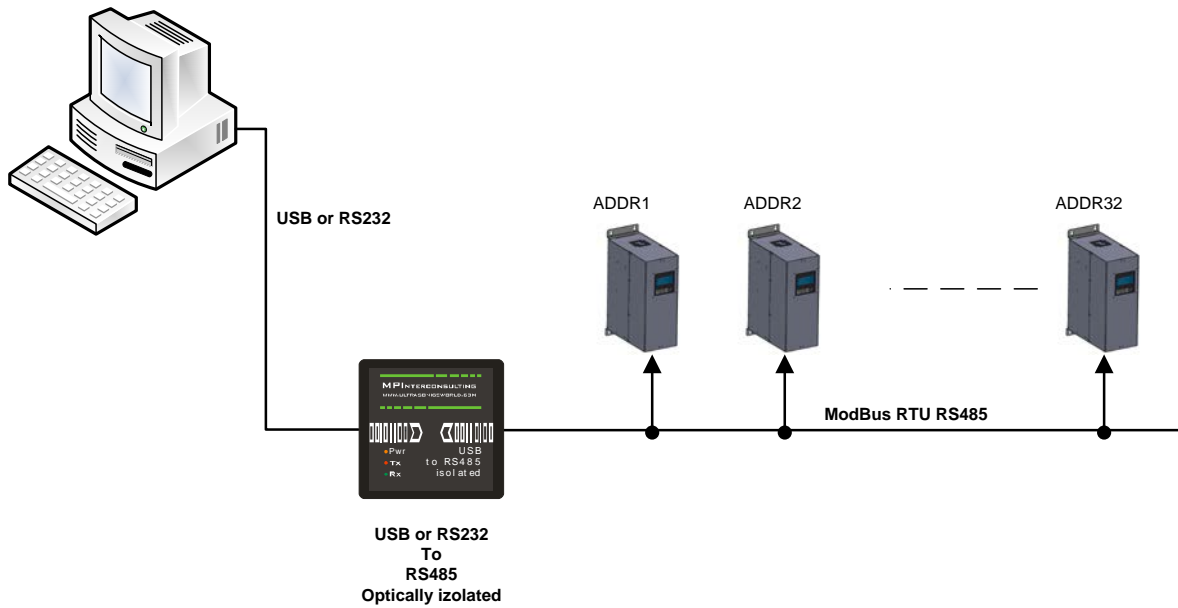**Speed** – communication speed

6. Write to memory window

```
Write to memory
    please
        wait
▊▊▊▊▊▊▊
```

This window appears when you press AND HOLD the MENU button for 5 sec.

SETTING THE SOFTWARE

The generator has a standard communication interface ModBus RTU over RS 485. To connect to a PC you should use MPI adapter USB or RS 232 to RS 485 optically isolated.

Before starting the software for the generator, you need to follow and execute the following steps

Download the generator software here (and later install it):

Directory of / documents/ mmm_basics/ mmm_power_supplies/ SONOROD-generators:

[Mastersonic - wideband sonic and ultrasonic technology for cleaning, welding, liquid processing and sonochemistry (mastersonics.com)](mastersonics.com)

[?] CDM+v2.12.36.1+WHQL+Certified.zip   1.4 Mb 29 May 2021

[?] SONORODE_sonicator.zip   182.8 Mb 10 Jun 2021

Download Manual here:

SONOROD_GENERATOR user manual_18072019.pdf 1.4 Mb 20 Jul 2019

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Software installation for older Sonorod generators produced until 2019
Download to your PC and install all software that is here:
http://www.mastersonics.com/documents/mmm_basics/mmm_power_supplies/AMMM/NI%20Runtime%202012/

Install the software in the sequence as follows:

1. LVRTE2012f3std - this is the Runtime Engine of National Instruments LabView2012

2. niser360f3   - drivers for serial communication ports of National Instruments LabView 2012

3. CDM v2.12.00 WHQL Certified   - driver for USB to RS485 adapter using FTDI chip FT232RL - you can use she attached here file (for Windows), or download
the latest version, updated for your OS from here: https://www.ftdichip.com/Drivers/VCP.htm

Now download all generyator software files and place them on your PC desktop. Mentioned software is here:

SONORODE_AM_AMMM_04182019.ZIP 576.8 Kb 18 Jul 2019

Now you are ready to start the executable file, "sono_clean_sweep.exe", of the software of your generator.
A) First action (regarding all generators and all software we are offering), after activating specific generator software, is to connect your PC with ultrasonic generator using our RS485-USB adapter.
B) Then you need to select and activate proper operating COM port from the generator software tabs. This will open communication between your PC and your ultrasonic generator.
C) Then you need to select initial setting conditions regarding expected frequency range.
D) Then you need to make Scanning to see where ultrasonic load is able to operate.

ADJUSTING THE GENERATOR USING THE PC SOFTWARE
COM Tab
1. **Start with COMM tab**, and select proper COM port.
NOTE: Every new generator has 6 modbus address by default.
To connect the generator to the labview software we need to cover the following three conditions:
  1. To know the Modbus address of the generator. Every new generator has 6 modbus address by default.
  2. To know the exact COM port where the USB to RS485 driver is installed. Go to the Device Manager of your PC and find the USB Serial Port(The USB adapter must be plugged to one of the USB ports of your PC).
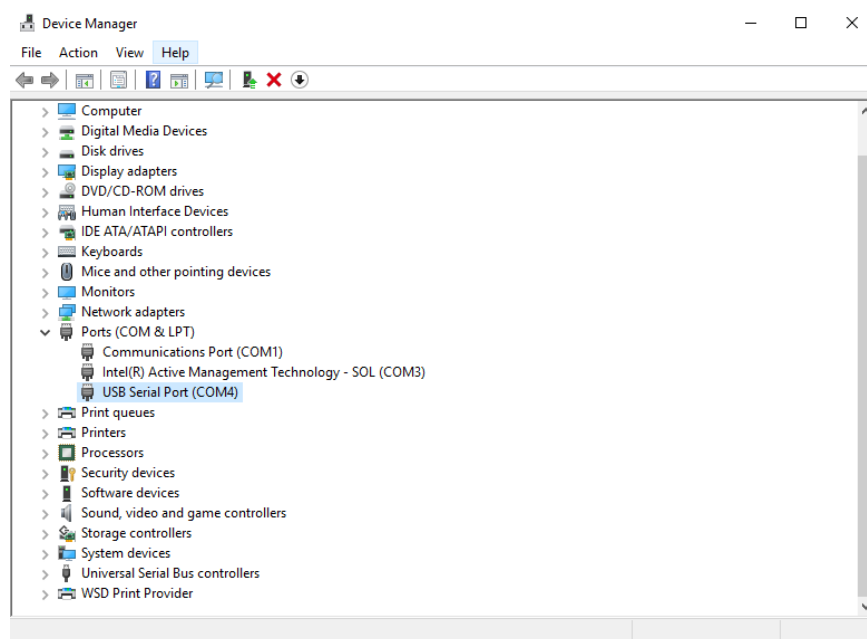
3. To set the correct communication baud rate.
At this moment you will have NO connection (initialized in red on top of the window)(2).
After validating the com port you will have connection (initialized in lime green on top of the window).
4. Select the ModBus address of the generator you want to connect to. Every new generator has default ModBus address 6.

Press "SCANNING FOR GENERATORS". After scanning (the yellow bar will become full in a few seconds), you will find the address (es) of the available generator(s) you will drive . Check if the value of the address in "MODBUS address" field is correct and if needed change it with the value shown in the table below the button "SCANNING FOR GENERATORS". Beat counter will become alive and will start changing the figures. Connection (lime-green) light should be active. Now you are connected to the generator with the selected address.

NOTE: Every new generator has 6 ModBus address by default.

That's why you have the possibility in the upper right side of the window to change the Modbus address selecting a new value in the field "NEW MODBUS ADDRESS" and then press the button ASSIGN NEW MODBUS ADDRESS.

DO NOT FORGET TO CHANGE THE MODBUS ADDRESS IN THE FIELD WITH THE NEW ASSIGNED MODBUS ADDRESS.

Save this setting in generator's EEPROM Memory by pressing button WRITE (top centre of the window).

5. Select "Baud Rate". The default value is 115 200 bauds/sec.

At this stage you could replace the ModBus address and the Baud Rate of the generator. This could be necessary in case you have more than one generator to adjust in the same network. The Baud Rate should be matched to the topology of your network.

The replacement is performed by pressing the button "Assign New ModBus Address" and / or button "Assign New Baud Rate".

The change is saved after pressing the button "WRITE" (top centre of the window).

6. If the generator is connected to the software, the indicator light CONNECTION glows green (YES).

Go to the first tab "CONTROL"

<u>CONTROL Tab</u>

7. Go to CONTROLL Tab. The very first step is to press the button RESCAN to have all parameters and settings from the generator uploaded in Labview software.

8. In the slider Start Frequency set Start frequency.

9. If the transducer is 20 kHz choose for Fstart set a little bit higher of 20 -for example 20,5. Save this setting by pressing button WRITE (top centre of the window).

10. In "SPAN slider" set initially safety operation window 2 kHz, it means Span=2 kHz.

Buttons:

RESCAN – By pushing RESCAN all parameters saved in the generator's memory will upload into Labview software.

WRITE - By pushing WRITE all parameters set in Labview software will download into the generator's memory.

START - By pushing START the generator starts the welding cycle.

STOP - By pushing STOP the generator stops working.

TEST - Button "TEST" will start the generator even the Time is selected 1sec. and will stop only when button "STOP" is pressed.

WRITE PARAMETERS TO FILE - WRITES all parameters set in Labview software into a text format(.txt) file on the hard disk of the computer.

READ PARAMETERS FROM FILE - READS all parameters from text format(.txt) file on the hard disk of the computer and downloads the data into the generator.

Sliders:

Start Frequency – sets the start frequency of the generator.

Power Set Point – sets the output power of the generator.

Span – sets the working window, where the generator seeks the working frequency of the transducer, because the working frequency could change because of loading the transducer and/or the temperature of the transducer.

I max - This is the maximum allowed current over the transducer. You need to check the label on your transducer and set the value.

Actual Values:

Firmware – this is the latest version of the software

Frequency Shift – shows (in kHz) how many the starting frequency is changed by the frequency regulator of the generator.

Frequency – shows (in kHz) the actual working frequency of the transducer.

Analog Set Point – shows(in Watts) the actual value of the analog power set point(0-10V) over the 25-pin connector(see page 10, pin3).

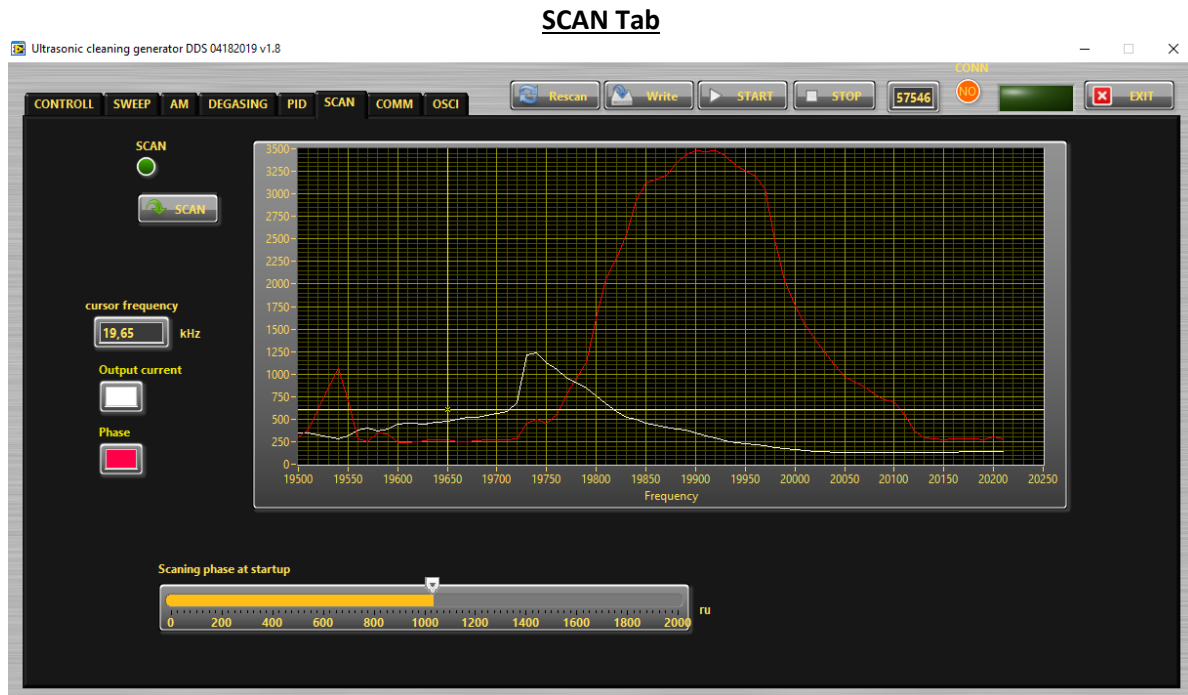**Out_current –** shows (in mA) the output RMS current through the transducer.

PWM – shows (in %) PWM ratio over the gates of the power transistors.

Power – shows (in W) the actual output power.

Phase– shows (in ru=relative units) actual working phase.

Peak Out Voltage – The actual voltage over the transducer (in Volts)

Go to "SCAN" tab and activate SCAN.

11. Press the SCAN button. The scanning procedure starts. There is a drawing consisting of phase characteristic (red line) and current characteristics (white line). It should be similar to the picture with well-defined phase feature. This diagram shows the actual operating parameters of the transducer. If necessary, pick new Fstart and SPAN (in CONTROL tab).

You will see an active operating area of transducers, like on the picture above. It starts a scanning procedure on low power that indicates the Phase characteristic (red line) and consumed output current (white line). **For F-start you need to select, by dragging the yellow cursor, the value closed to the working frequency of your transducer, which is where the red line just starts to grow+400 Hz**. On the left side of the SCAN window you will see the value of "cursor frequency", also shown in a small box "cursor frequency from scan tab" in the right down corner of the CONTROL tab. Now you need to go back to CONTROL tab and check if the frequency is the same value as "cursor frequency". If it is not you need to change it to the same value as "the value of "cursor frequency".

Scanning Phase at Startup (slider) – During normal operation the operating phase is 2000-2500 ru. After starting the generator, the generator scans and finds the load by reaching Scanning Phase at Startup value. This means the load is found and after that regulating of the set power and set current is possible.

Click the WRITE button on top of the window to write in generator's memory all present settings.

Now you are ready to start working.

12. In "POWER Set Point " in CONTROL tab, set the desired value for maximum power, of your generator.

Phase Protection Set Point – If everything is normal and normal work of the transducer, the operating phase will be 2000-2500 units. If the transducer works on air(no load) the phase will increase 3000 units and higher. Use this as a protection against "No load operation" to save the transducer.

Filter Depth – During the operating process, some small fluctuations of the phase signal are possible. By Filter Depth you could set how fast to react the phase protection.

Regulator voltage – This is the K_i of the output voltage regulator(amplitude)

MIN Power – This is the minimum aload power of operation of the transducer. This is a kind of protection from"Low Load" or "No Load" operation. It could be "low level liquid in the tank" protection.

Output Voltage – the maximum output voltage(in V RMS).

DC Power Scale Factor – internal use only

AM Tab(Amplitude Modulation Tab)
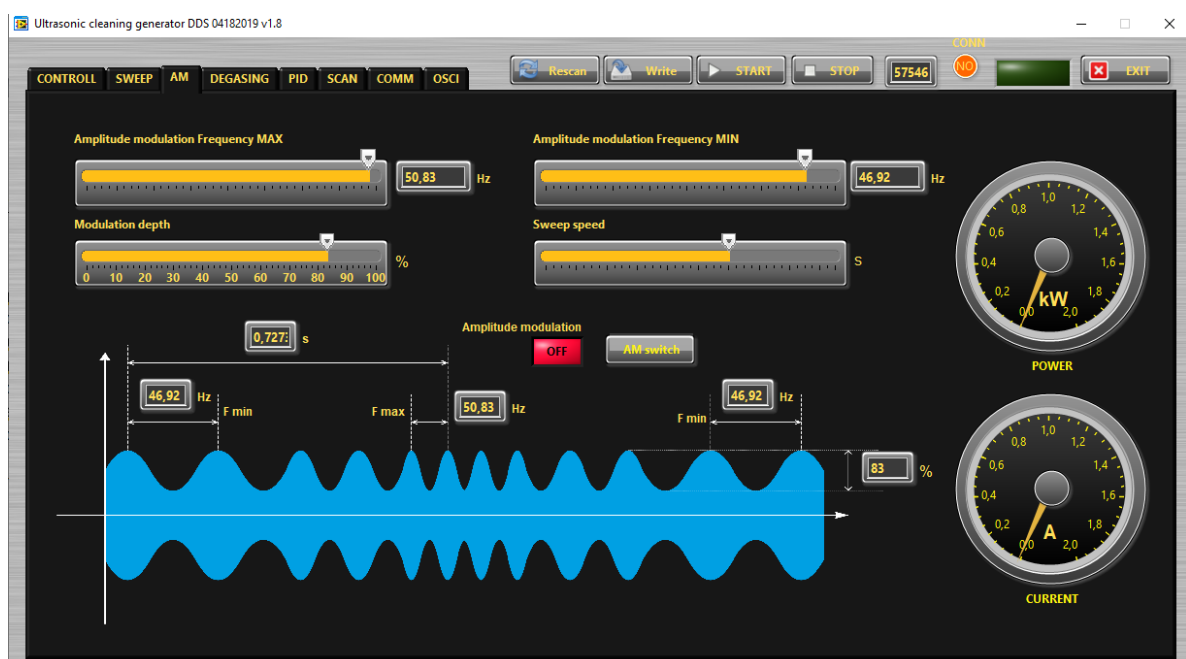
Amplitude modulation frequency MAX – This the maximum value of the frequency of the amplitude modulation.
Modulation Depth – This the the depth of the amplitude modulation.
Amplitude modulation frequency MIN – This the maximum value of the frequency of the amplitude modulation.
Sweep speed – This the speed of changing from Amplitude modulation frequency MIN to Amplitude modulation frequency MAX.

- Find and activate the optimal AM regime, when you need it.

SWEEP Tab

Sweeping depth– This is the deviation of the sweeping frequency around the central operation frequency in Hz.
**Sweeping frequency –** Here you can set the desired sweeping frequency in *Hz*.
Smoothing – This changes the shape of the sweeping frequency from rectangular to similar to sinusoidal.
Sweeping Type – in three possible modes: OFF – no sweeping; AMMM – semi-random sweeping; Periodic – periodic sweeping.

- Find and activate the optimal Degasing regime, when a cleaning liquid has lot of dissolved gas.
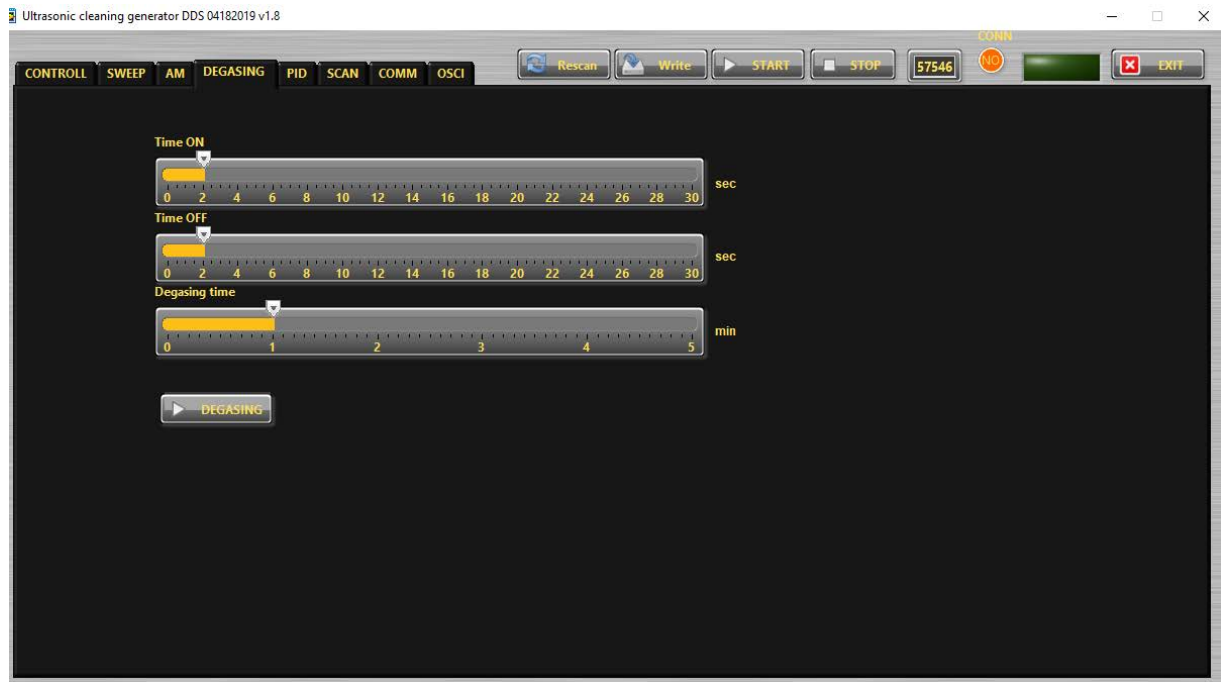
Time ON – Set the operation time of the generator in degasin regime.
Time OFF – Set the non-operation time of the generator in degasin regime.
Degasing time – This the total time the generator was switched ON in degassing mode.

OSCI Tab

Startup – This is the speed of shifting down the operating frequency until reaching Scanning Phase at Startup value.
Regulator Current – This sets the k_i of the current/power regulator.
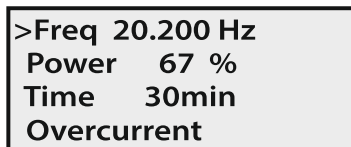
ERROR MESSAGES AND TROUBLESHOOTING

When error event occurs the bicolour LED will ligh up in red.
All types of error messages will be cleared after restarting the generator.
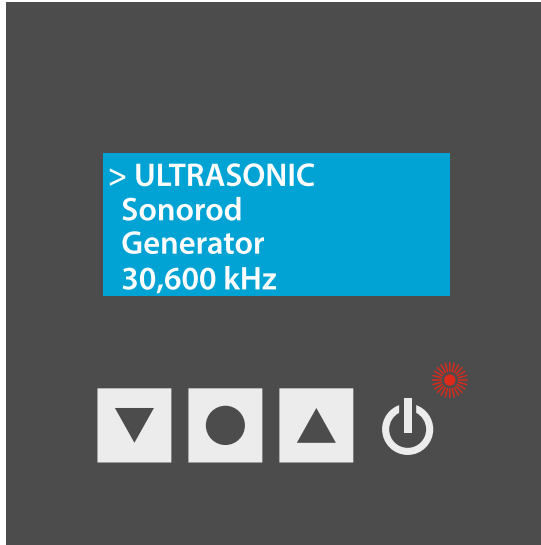
The following error messages may appear on the display:

OVERCURRENT – Overlimitted high current is flowed through the power transistors

```
>Freq  20.200 Hz
 Power    67 %
 Time     30min
 Overcurrent
```

The electronic overcurrent trigger has detected an error.

Possible causes:

· Short circuit in the cable or transducer
· Starting frequency selected is too HIGH(see ADJUSTING THE GENERATOR)
· Starting frequency selected may be too LOW(see ADJUSTING THE)
· There is a problem with the transducer.

Troubleshooting:

· Switch on the generator without the transducer connected. If OVERCURRENT message does not appear on the display, this means that the generator is in good working condition.
· Check the cable between the generator and the transducer.
· Check the transducer for short circuit.
· Change and set properly the starting frequency, if it is not in range as described in this manual(see ADJUSTING THE GENERATOR).

Error message:

OVERHEATING

```
>Freq  20.200 Hz
 Power     67 %
 Time      30min
 Overheating
```

The electronic overheating trigger has detected an error

Possible causes:
· Not enough space around the generator.
· Ambient temperature is too high.
· The fan is dirty or malfunctioning .

Error message:

OVERVOLTAGE -Overlimitted high voltage is applied over the transducer

```
>Freq  20.200 Hz
 Power     67 %
 Time      30min
 Overvoltage
```

Possible causes:
· Starting frequency selected is too HIGH(see ADJUSTING THE GENERATOR)
· Starting frequency selected may be too LOW(see ADJUSTING THE)

Troubleshooting:
· Re scann and re-adjust the generator as described in this manual(see ADJUSTING THE GENERATOR)

Error message:

LOAD ERROR – the generator cannot find the resonance frequency of the transducer inside the choosen frequency window.

```
>Freq  20.200 Hz
 Power     67 %
 Time      30min
 Load Error
```

Possible causes:
· Starting frequency selected is too HIGH(see ADJUSTING THE GENERATOR)
· Starting frequency selected may be too LOW(see ADJUSTING THE GENERATOR)
· Span selected may be too LOW(see ADJUSTING THE GENERATOR)
· The cable between the generator and the transducer is broken
· The transducer is defective
· Imax selected is too high
· Output power selected is too high.

Troubleshooting:

· Re scann and re-adjust the generator as described in this manual(see ADJUSTING THE GENERATOR)
· Select lower value for Imax
· Select lower value for Output Power.
· Check the cable between the generator and the transducer.
· Check the transducer for disconnection.

Error message:
NO LOAD

```
>Freq  20.200 Hz
 Power    67 %
 Time     30min
 No Load
```

Possible causes:
· The transducer and the generator are in good working condition, BUT the transducer is not loaded(for ex. Is not submersed in water)

Troubleshooting:
· Make necessary steps to load the transducer

Error message:
FREQUENCY ERROR
Possible causes:
· Bad frequency setting
· Control board is damamged

Troubleshooting:
· Check the frequency settings

MAINTENANCE

The ultrasonic generator does not need special maintenance.

Dust and dirt should be removed regularly using a damp cloth.

ATTENTION: • **Do not use aggressive cleaners!**
          • **Not suitable for ultrasonic cleaning!**

SPECIFICATIONS:

Frequency	SONOROD 2000 20 kHz	
Operating voltage	230 V +/- 15%	
Power consumption	9 A	
Effective power output	1500 W	
Maximum output	2,000 W	
Fuse protection	10 A	
Dimension casing	**W x H x D/mm/** 125x371x252	**Weight** 6 kg
Operating Temperature range	-10 to +40°C	**Protection class** IP 20, IEC 60 529, EN 60 525

WARRANTY

The length and coverage of the warranty can be found in the terms of delivery as part of the general terms and conditions (valid at the time of purchase) or in the sales contract / order confirmation, should any special agreements have been made.

The following cases are not covered by warranty:

- Damage caused by inappropriate operation
- The device not being used for its intended purpose
- Inappropriate alterations or modifications made without prior authorisation from the manufacturer
- Damage caused by extreme circumstances, such as knocks, falling over, moisture and dirt
- Insufficiently qualified operating staff
- Non-compliance with current safety and accident-prevention regulations
- Damage resulting from modifications made to the operating instructions

SERVICE HOTLINE

Should you still have questions after reading through this operating manual,
please feel free to call our service hotline.

Service contact details
ADDRESS
TEL
FAX
EMAIL
SKYPE
Etc.

Please have the device type and serial number at hand, to help us quickly answer your questions (the serial number is on the backside of the generator)

SPARE PARTS

Parts are available upon request. Please provide us the serial number of your device, to ensure we supply you with the appropriate replacements.