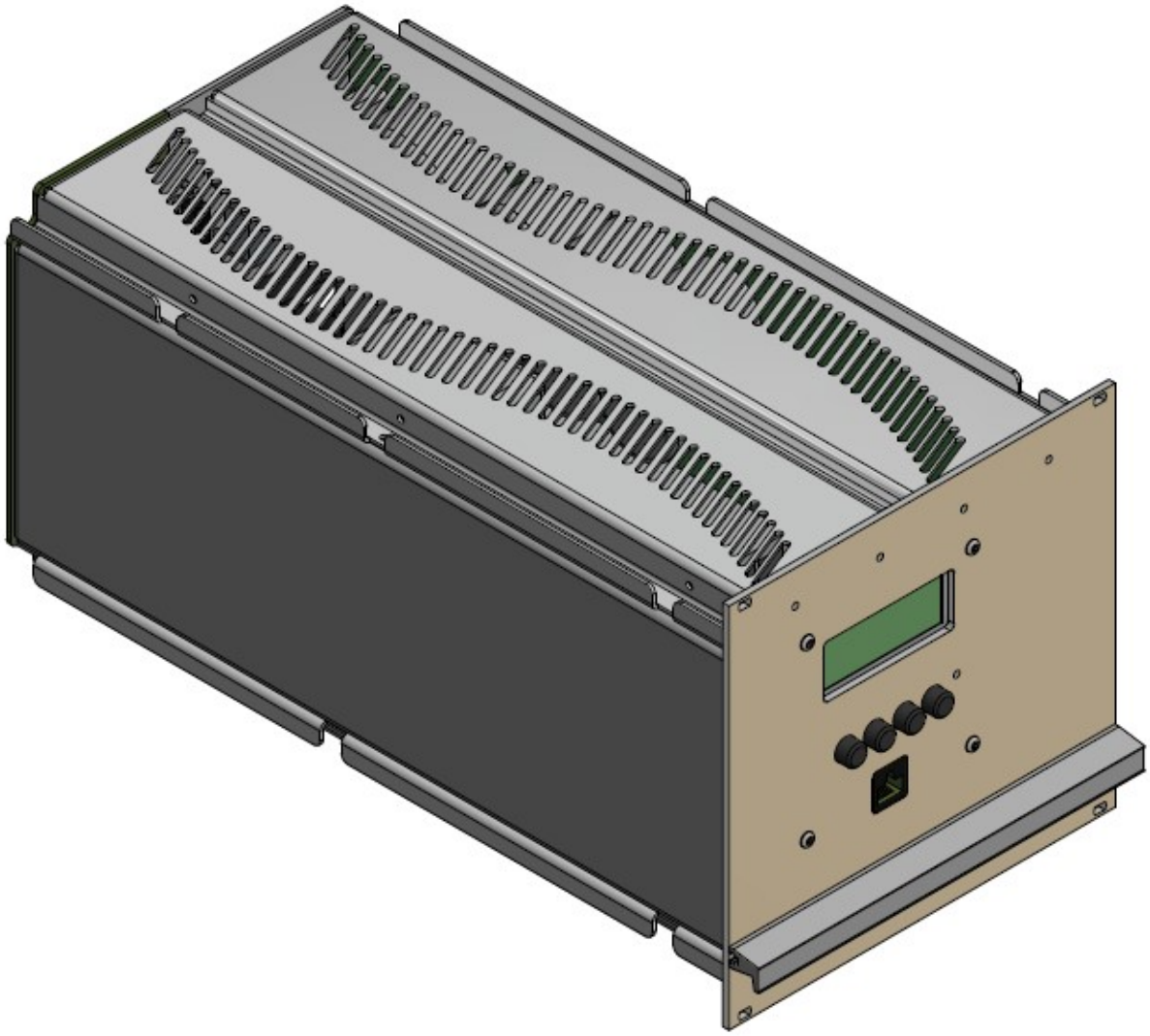
mpi ultrasonics

08’ 2024



ULTRASONIC EQUIPMENT

Adaptive auto-tunable digital ultrasound technology

Advanced functionality with various process control levels and options

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

Thank you for choosing our product!

This guide will help you with proper maintenance and proper operation of the device.
The information contained in this manual has been prepared with the utmost care by our professionals and serves as a description of the product without any liability for the purposes of commercial law.
This information does not release you from the obligation of self-assessment and verification.
We reserve the right to change product specifications without notice.
Please read the instructions carefully and follow the recommendations contained in them.

ATTENTION!

Failure to comply with this will result in a loss of warranty rights.

SAFETY INSTRUCTIONS

For your safety and to ensure that the equipment is in good working condition, read the following instructions carefully before start operating.

- Installation must only be carried out by qualified technical personnel!
- 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 user manual.
- However, should problems occur on start -up, please do not make any prohibited adjustments to the device.
- 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.
- Always observe any warnings or instructions provided on the device itself.
- 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. In- stead, 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.

- 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.
- The platform for the device must be sufficiently stable, as the device being jolted or falling could cause severe damage.
- Only those transducers which have the correct frequency, power output and dimensions may be used with this generator.
- With the exception of the permitted tasks listed in the handbook, you should never attempt to repair or modify the device yourself.

ATTENTION!

All connections for the signal or control lines are galvanically connected to the generator.

ATTENTION!

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 behavior than standard operation

ATTENTION!

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

ATTENTION!

Only competent, trained people, familiar with safety measures when working with electrical systems can have access to electrical panels!

ATTENTION!

FOLLOW ALL WARNINGS OR INSTRUCTIONS WRITTEN ON THE MODULES!

ATTENTION!

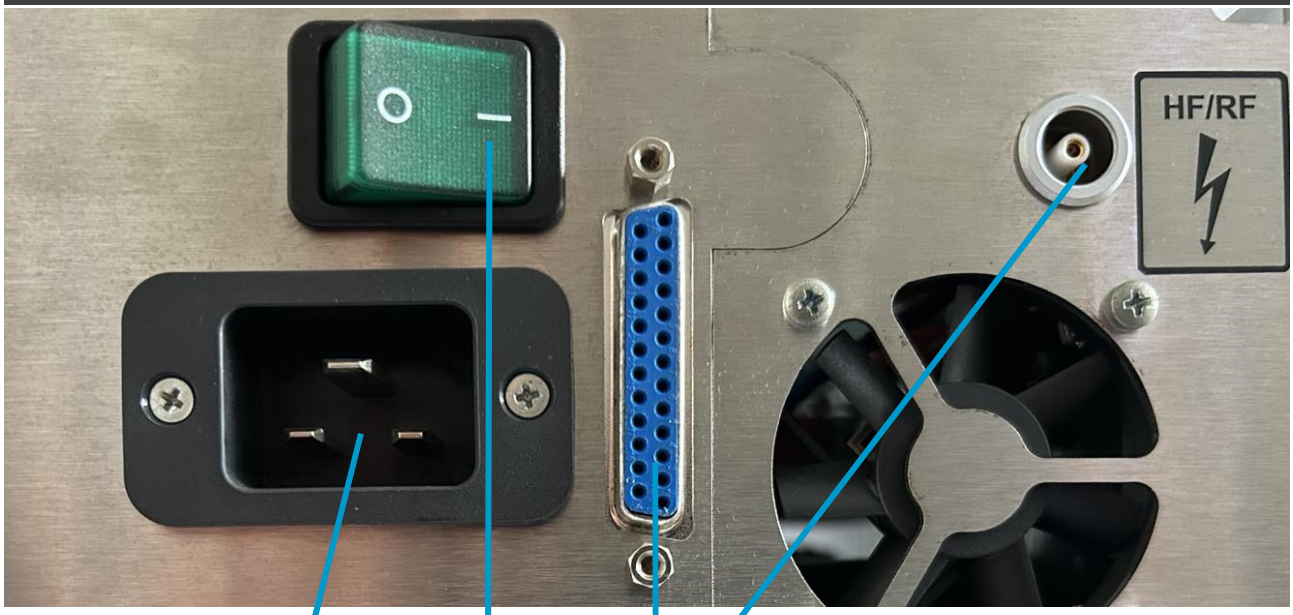
The manufacturer is not responsible for injuries caused when working with the equipment.

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 "OVERHEATING" error description).

ATTENTION!
- **Choose a location that will prevent steam or any other aggressive vapors 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 he device being**

CONNECTIONS ON THE BACK



POWER SUPPLY

MAIN SWITCH ON/OFF

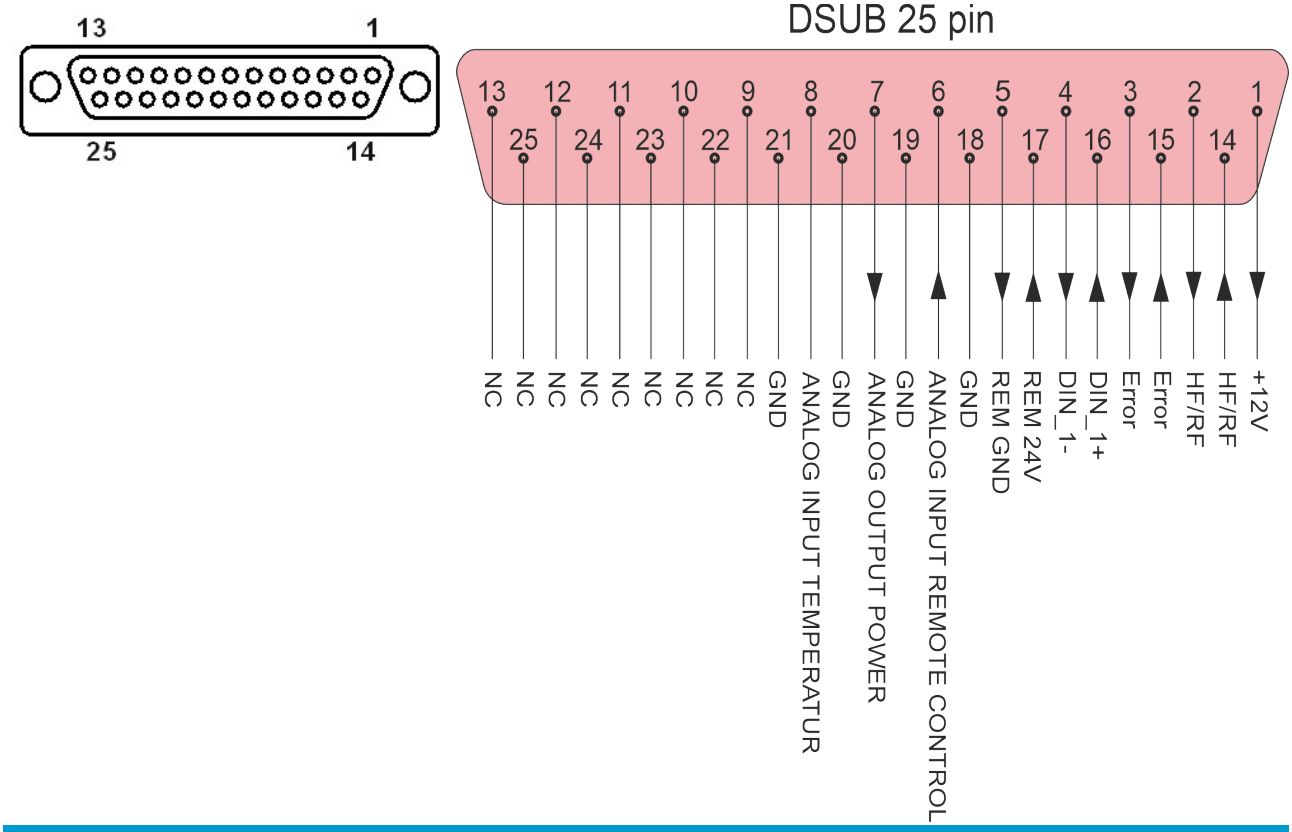
HF Output connector is a Lemo : ERA.1S.250.CTL

DSUB 25 PIN

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 GND pin on the generator side.**
- **GND and EARTH are internally connected.**
- **Only use cables with sufficient cross-section.**
- **Minimum cross-section: 1.5 mm2.**
- **DO NOT disconnect the POWER AND HF connector during operation.**

CONTROL I/O PANEL

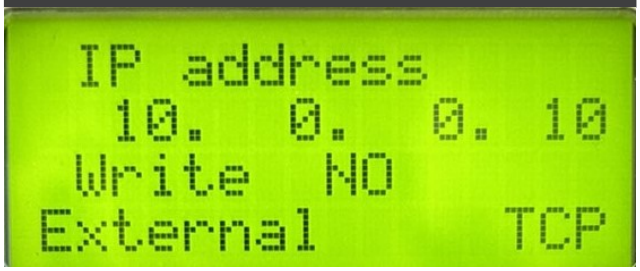


PIN	SIGNAL	DIRECTION	SIGNAL LEVEL	DESCRIPTION
1	+12 V	Output	+12 VDC	Supply voltage for external use 100mA max
14, 2	HF/RF	I/O	Up to 24 VDC	Input and output Relay HF-DA. Contact is closed depending on selected mode.
15, 3	Error	I/O	Up to 24 VDC	Input and output Relay Error. Contact is closed up on error.
16	DIN_1 +	Input	Up to 24 VDC	Digital input for external STOP
4	DIN_1 -	Output	Up to 24 VDC	Digital input for external STOP
17	REM 24 V	Input	Up to 24 VDC	Remote input (active high). Reference is "REM GND"
5	REM GND	Output	Up to 24 VDC	Remote input "REM GND"
6	Analog input remote control	Input	0-10V	Input for amplitude control. 2.5V=50% Output power. 5V=100% Output power. Reference is GND.
7	Analog output power	Output	0-10V	Voltage corresponding to the current output power 0- 100%. Reference is GND.
8	Analog input temperature	Input		Voltage corresponding to the transducer temperature. Reference is GND. 0V=0°C; 10V=100°C
18,19,20,21	GND	Output		Internal GND

OPERATION

LCD DISPLAY

INITIALIZING WINDOW DISPLAY



IP address - shows the IP address of the generator.
Write - When changes are made select to write to memory YES/NO with ***Menu*** ● *button*
External TCP– Access to the generator parameters is available only through ModBus over TCP connection. The generator may be connected to LabView software via TCP connection see page 15.
Note: *To switch to local control (other displays) go to External TCP with button* ***DOWN▼*** *on the front panel and push the* ***Menu*** ● *button once. Then the display will look like the picture bellow. From there you can switch through displays with buttons* ***UP▲ and DOWN▼****.*

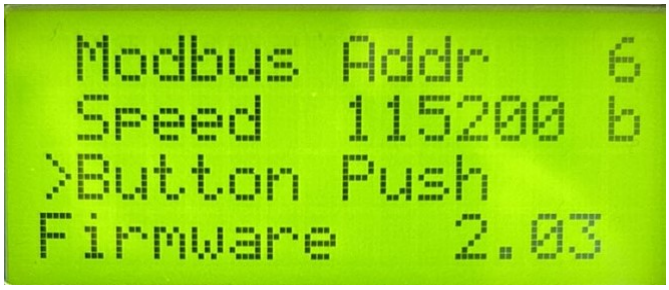
If Local control is selected the generator parameters are available through LCD display.
After Local control is selected, TCP connection is no more available , then connect via USB with LabView software.
Note: *In both cases USB connection is available.*

DISPLAY 1

After Local control is selected, the initial screen contains the following status information.
Power - setting for maximal power (W)
Freq – Frequency – setting for starting frequency (in kHz) - it should be higher (I.e. 100Hz) than the working resonance frequency of the load and when generator starts - it shifts down towards the exact resonance frequency.
Amplitude – setting for maximal amplitude (in % where 100% = 1200V)
P – Actual Output Power Value (W)
I – Actual Output current through the transducer (mA)

OPERATION

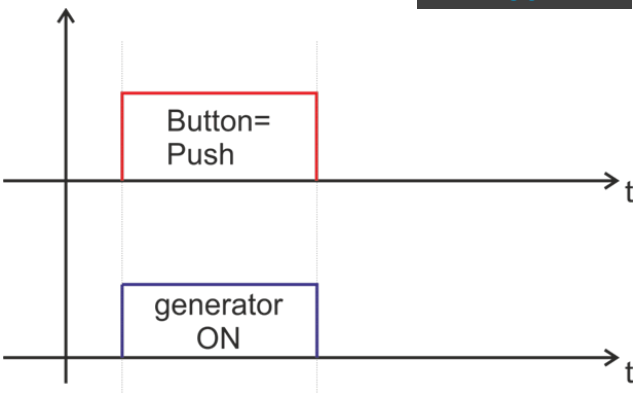
LCD DISPLAY - 2



Modbus Addr - shows the address of the generator in the Modbus network. The default Modbus Address is 6.
Speed - communication speed
Button - setting the functionality of the button.
This will be caused when there is a signal on X4 – START signal (START+ and START-)

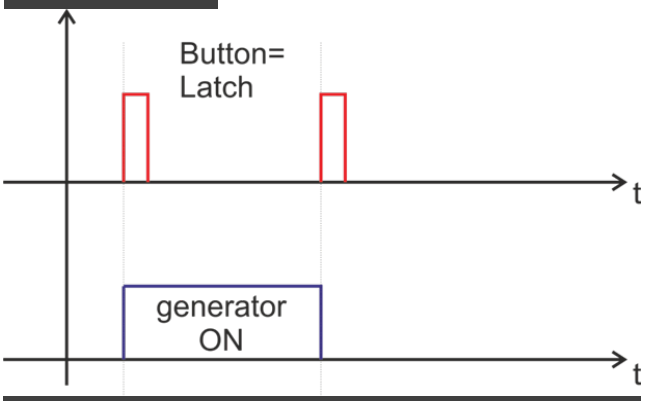
THERE ARE 4 OPTIONS OF OPERATION OF THE GENERATOR:

PUSH



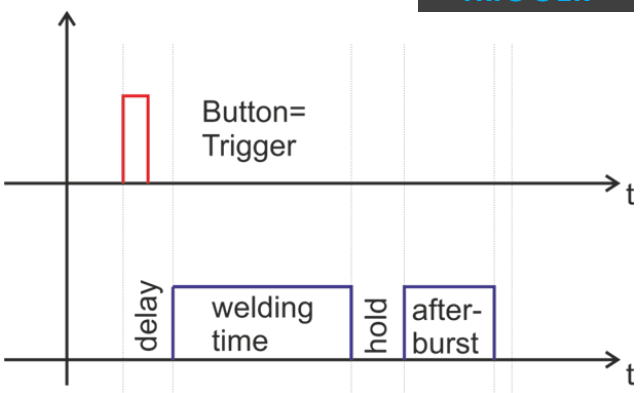
The button works as a test button – while pushed the generator is on, while released the generator is stopped.

LATCH



Pushing the button once the generator starts, pushing the button again the generator stops.

TRIGGER



Pushing the button once the welding cycle starts.

OFF

The button is off.

ATTENTION!
THE GENERATOR COULD GENERATE ERROR SIGNAL, WHEN THE TEMPERATURE IS OVER THE SET LIMIT .

OPERATION

LCD DISPLAY

DISPLAY 3

Imax – Set the maximum output current.
Start tune – Starts the auto tuning process by pressing the MENU● button on the front panel display. If better starting frequency is found the **Freq** value will be replaced with new one, or else the **Freq** value will remain the same.
Reg – regulator value (in RU-relative units)
Freq - Frequency – setting for starting frequency (in kHz) - it should be higher (I.e. 100Hz) than the working resonance frequency of the load and when generator starts - it shifts down towards the exact resonance frequency. By Start tune new or better starting frequency could be found. If better starting frequency is found the **Freq** value will be replaced with new one, or else the **Freq** value will remain the same. The new value could be saved by **Write to memory by press and hold for more than 5 seconds Menu ● button.**

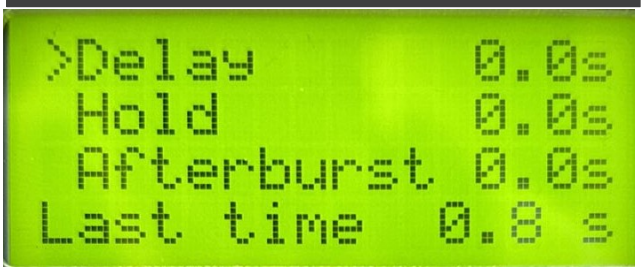
DISPLAY 4

These are welding regime settings. Welding by time:
Time - time when the generator is on (seconds)
Time plus - shows the maximum duration of the control signal (seconds)
Time minus - minimum duration of the control signal (seconds)
Last Time - duration of the last working cycle (seconds)
Note: *If entered a control signal from external control unit (PLC) out of limits Time Plus and Time minus, the bicolor LED will light in red and an error message Limit Time will be displayed.*

OPERATION

LCD DISPLAY

DISPLAY 5



Delay - after the start signal, the generator delays starting with the set value of the delay (seconds)
Hold - the generator delays with the set hold value before executing afterburst (seconds)
Afterburst - setting the value of afterburst (seconds)
Last Time - time for the last working process (seconds)
Note: *see diagram on page 9*

DISPLAY 6

These are welding regime settings. Welding by energy :
Energy - setting of nominal energy during the welding process (in Ws). If the setting is different from 0 and the generator reaches the set value the Welding process stops.
Energy plus - maximum allowed energy reached during the welding process. (Ws)
Energy minus - minimum allowed energy reached during the welding process (Ws)
Last Energy - energy of the last working cycle (Ws)
Note: *If the energy during the welding process is out of limits Energy Plus and Energy Minus, the bicolor LED will light in red and an error message Limit Energy will be displayed.*

WRITE TO MEMORY

This window appears when you PRESS AND HOLD the MENU button for more than 5 sec.

ERROR MESSAGES AND TROUBLESHOOTING

When error event occurs the bicolor LED will light up in red. The error message will appear over the dynamic bar graph. If you want to see it properly you need to press the rotary encoder once, to move to next window of the display (Power window), where on the last row an error message will be displayed. All types of error messages will be cleared after restarting the generator.

OVERCURRENT

OVERCURRENT - Over-limited high current is flowed through the power transistors

The electronic overcorrect trigger has detected an error.

POSSIBLE CAUSES:

- Short circuit in the cable or transducer.
- Starting frequency selected is too HIGH.
- Starting frequency selected may be too LOW.
- 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

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.

OVERVOLTAGE

OVERVOLTAGE - Overlimitted high voltage is applied over the transducer

POSSIBLE CAUSES:

- The cable between the generator and transducer is broken or just disconnected.
- Starting frequency selected is too HIGH
- Starting frequency selected may be too LOW

TROUBLESHOOTING:

- Rescan and re-adjust the generator as described in this manual.

ERROR MESSAGES AND TROUBLESHOOTING

LOAD ERROR

LOAD ERROR - the generator cannot find the resonance frequency of the transducer inside the chosen frequency window.

The electronic overcurrent trigger has detected an error.

POSSIBLE CAUSES:

- Starting frequency selected is too HIGH.
- Starting frequency selected may be too LOW – below the resonance frequency.
- Span selected may be too LOW.
- The cable between the generator and the transducer is broken.
- The transducer is defective.

TROUBLESHOOTING:

- Rescan and re-adjust the generator as described in this manual
- Check the cable between the generator and the transducer.
- Check the transducer for disconnection

FREQUENCY ERROR

POSSIBLE CAUSES:

- Bad frequency setting.
- Control board is damaged .
- The control board is damaged.

TROUBLESHOOTING:

- Check the frequency settings .

LIMIT ENERGY ERROR

POSSIBLE CAUSES:

- The energy during the welding process is out of limits Energy Plus and Energy Minus.

TROUBLESHOOTING:

- Check the Energy settings.
- Check the Welding Process for lapses.

LIMIT TIME ERROR

POSSIBLE CAUSES:

- Over limit for Time Plus or Time minus has been entered.

TROUBLESHOOTING:

- Check the Time settings.

SETTING THE SOFTWARE

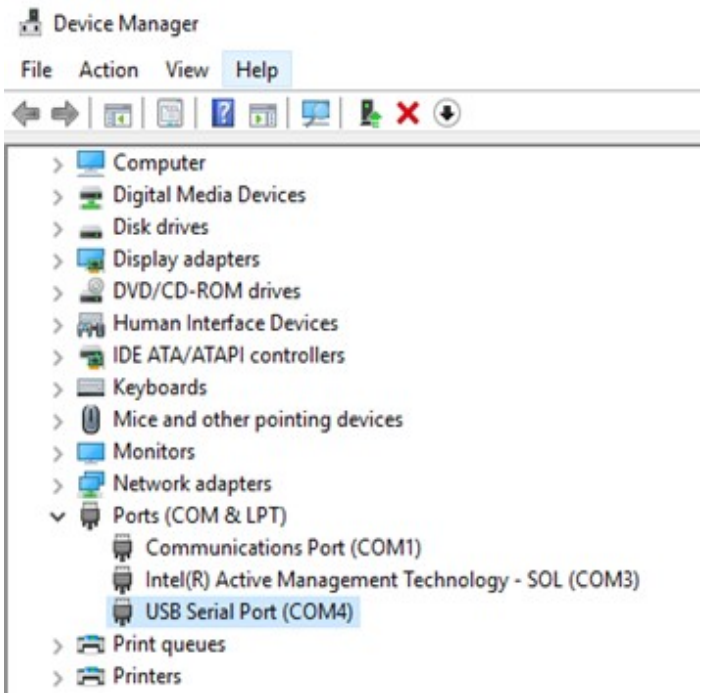
To connect to a PC you should use Ethernet connection or USB connection.

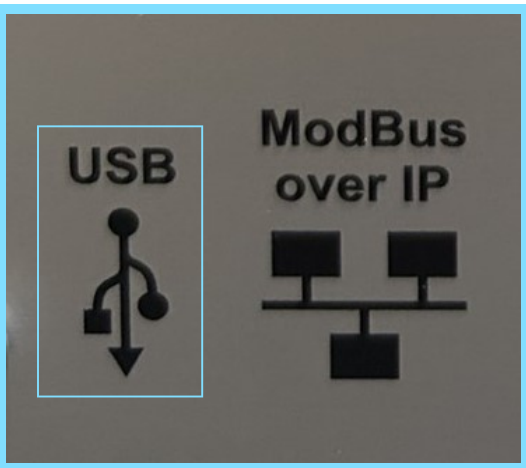
Install the software in the sequence as follows:

- CDM v2.12.00 WHQL Certified - driver for USB to adapter using FTDI chip FT232RL - you can download the latest version, updated for your OS from here: https://www.ftdichip.com/Drivers/VCP.htm. (The PC's operating system will install it itself when you make a connection.)
- Start the installation file \metal_welding_10kW\Volume\setup.exe, of the software of your generator. Complete all steps needed for the installation of the software. After install run the LabView application form Windows menu (now it shows by name "Metal welding 10kW").
- Normally the application installs in C:\Program Files (x86)\metal_welding_10kW.
- First action after activating the specific generator software, is to connect your PC with the ultrasonic generator. There are two ways to make that connection: TCP and USB. (pages 14-15)

USB CONNECTION

- USB - connection via USB cable between the generator and your PC. After connecting with USB cable, open Device Manager and go to "Ports (COM & LPT)", a new COM port will show automatically as shown in the picture bellow.



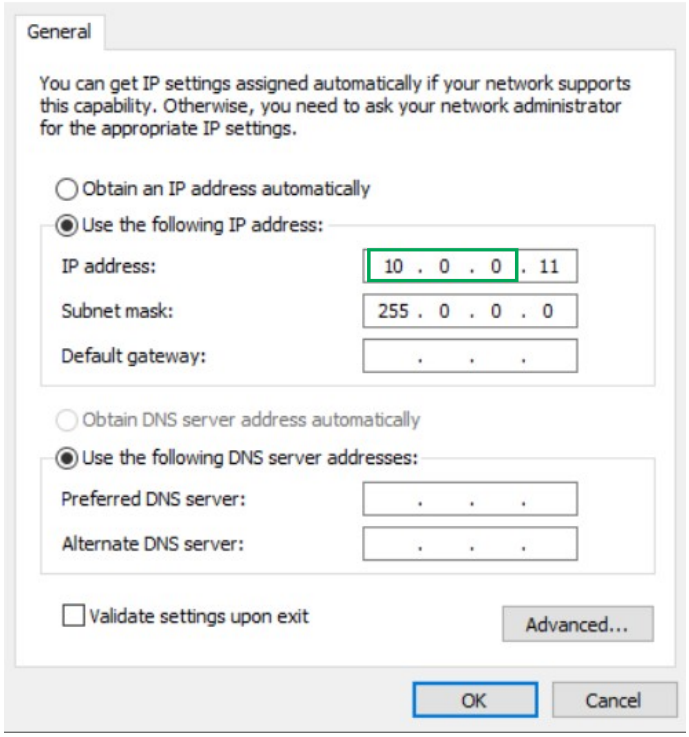


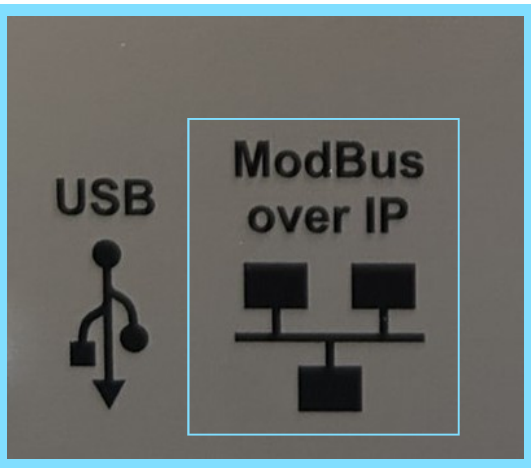
Insert the USB cable under the "USB" icon.

SETTING THE SOFTWARE

TCP CONNECTION

- TCP - connection is available only when External - TCP is selected on the Initializing window display (page 8).
- To connect the generator and your PC via Ethernet - set proper IP settings on your Ethernet network adapter as shown in the picture bellow.

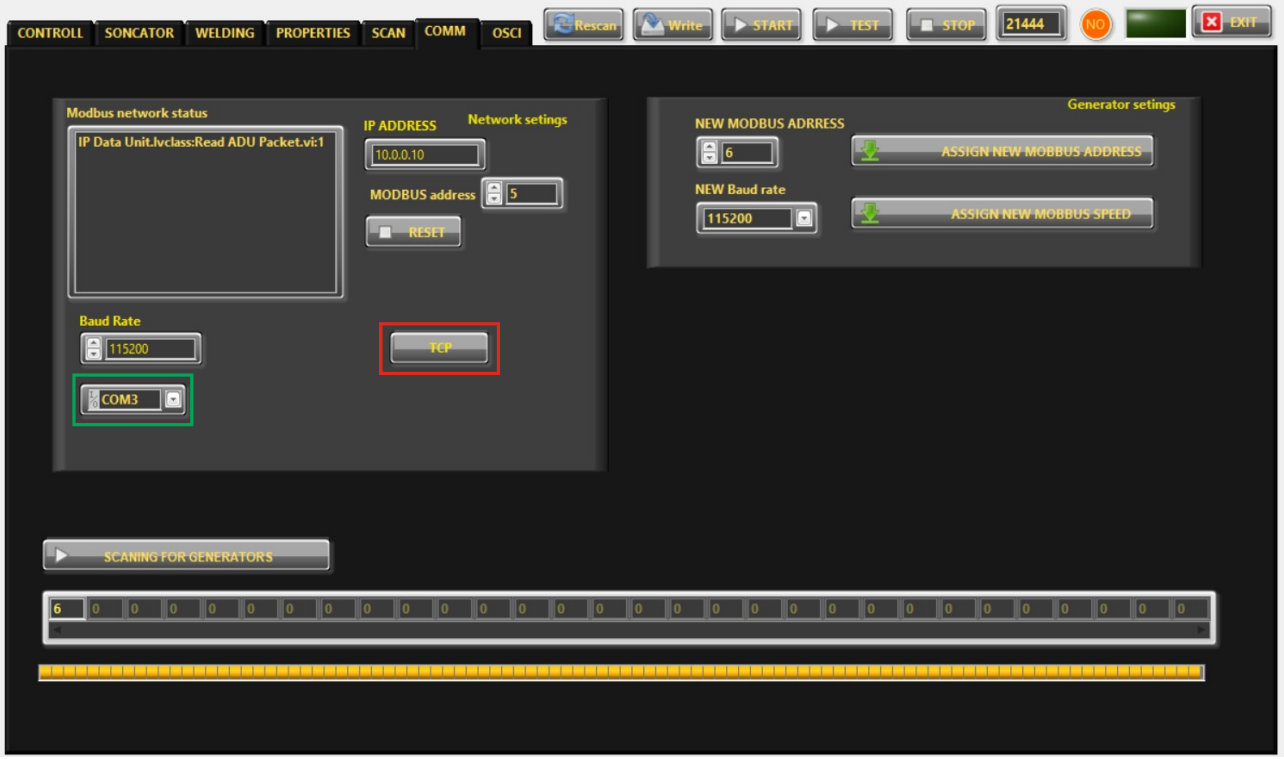




Insert the Ethernet cable under the “ModBus over IP” icon.

CONNECTING WITH GENERATOR USING THE PC SOFTWARE

COMM Tab



Open the application from Windows menu ("Metal welding 10kW") and go to **COMM** tab. You will notice on the upper right side of the screen an orange circle with NO in it, that means "No connection". Follow the instructions corresponding to the type of connection you made between your PC and the ultrasonic generator.

TCP - there is a button on the screen (outlined in red) - it has two options when pressed (TCP and USB). For Ethernet connection press the button to TCP.

USB - there is a button on the screen (outlined in red) - it has two options when pressed (TCP and USB). For USB connection press the button to USB. Then open the "COM3" drop-down menu (outlined in green) and choose the COM port that showed up in Device Manager (page 15). If you don't see your COM port click on Refresh and it shall be visible.

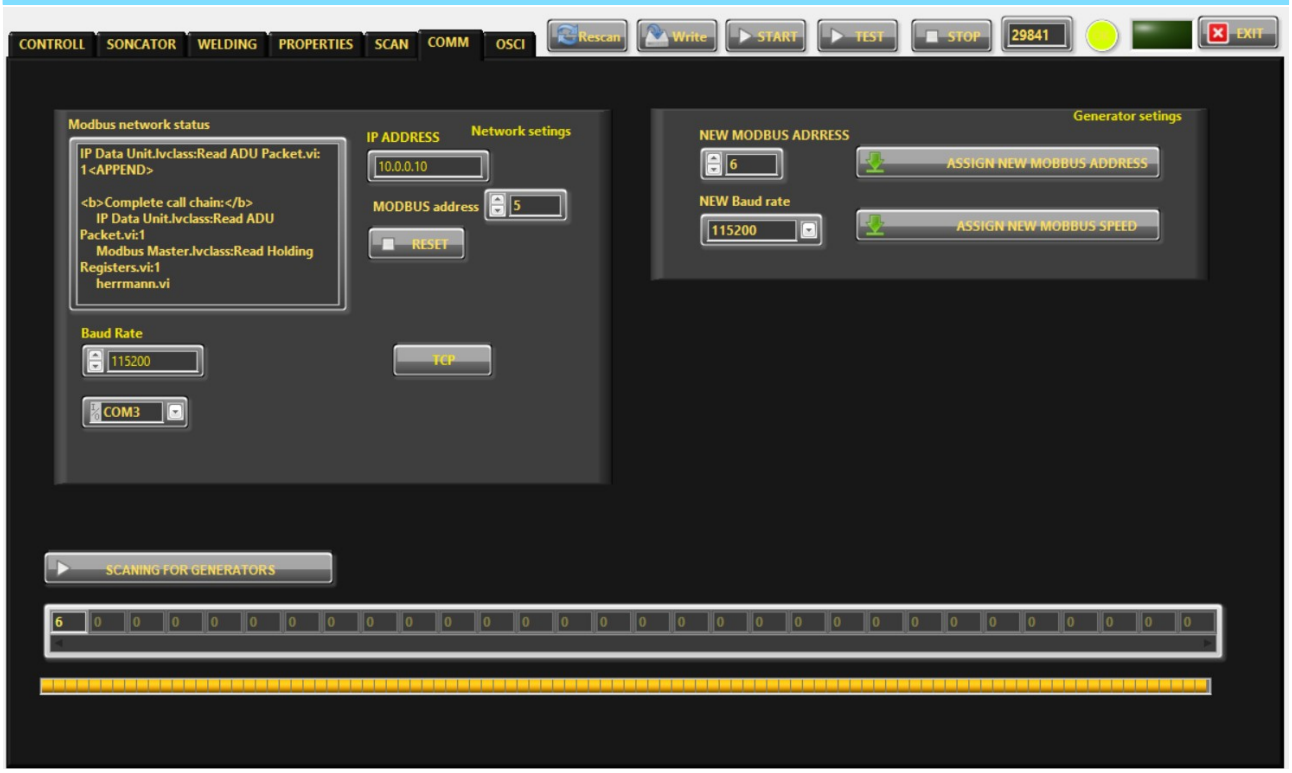
Select the ModBus address of the generator you want to connect to.

NOTE: Every new generator has a default ModBus address 6 for the ModBus USB connection. Every new generator has a default ModBus address 5 for the ModBus over TCP connection.

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.

ADJUSTING THE GENERATOR USING THE PC SOFTWARE

COMM



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 center of the window).

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 MODBUS SPEED**" .

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

ADJUSTING THE GENERATOR USING THE PC SOFTWARE

CONTROL

If the generator is connected to the software, the indicator light CONNECTION glows in lime-green (OK).

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.
- In the slider Start Frequency set Start frequency.
- If the transducer is 20 kHz choose for **Start Frequency** set a little bit higher of 20 - for example 20,5. **Save this setting by pressing button "WRITE" (top centre of the window).**
- In "SPAN slider" set initially safety operation window 2 kHz, it means Span=2 kHz.

CONTROLL - SLIDERS and VALUES

Start Frequency - sets the start frequency of the generator. Here you must select a proper starting frequency according to the SCAN procedure on tab SCAN.
Power Set Point - Set the top limit of the consumed power of the transducer during operation. For example, if you expect 2000 W during process - set the value to 2,2 Kw.
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. For 20kHz operating transducers 1kHz is normal. For higher frequency transducers it could be 4kHz or more.
Phase - This is the phase difference between output voltage and output current. The optimal value is between 2000 and 2400. (in relative units x 100) There the phase difference between output voltage and output current is close to 0. Operating on values between 2000 and 2400 means that the transducer is operating on the optimal frequency regime and is consuming ACTIVE power.
NOTE: Use the Phase signal to assess the proper operation of the transducer and load.
I max - Set the maximum allowed current over the transducer. It must be well selected during adjustment of the generator, because together with "Phase" are the main properties for matching the generator to the load. Best if you start with relatively low level for **I max** and slowly increase till the Actual Phase signal reaches levels 2000-2400 **during operation under load**. If the transducer operates on air (no load) - the generator will operate on selected Phase setting and actual value of **I max** will be very low.
NOTE: Use this parameter as the MAIN control of the output power during the operation.
Amplitude - Set maximum voltage over the transducer (in % of the maximum allowed). The value must be selected between 70% and 100% in normal operation.
NOTE: Use this parameter as the SECOND ONE to control the output power during the operation.
Actual Values:
Frequency Shift - Shows (kHz) how much the starting frequency is changed by the frequency regulator of the generator.
Frequency - shows (kHz) the actual working frequency of the transducer.
Analog Set Point - Shows (Watts) the actual value of the analog set point AISET - pin of X4. By connecting a voltage between 5V and 10V, the power of the generator can be set between 50% and 100% of its nominal power.
Out_current - Shows (mA) the output RMS current through the transducer.
PWM - Shows (%) PWM ratio over the gates of the power transistors.
Power - Shows (Watts) the actual output power.
Phase - Shows (in ru = relative units) actual working phase .
Amplitude - The actual voltage over the transducer (Volts)
Temperature - Voltage over X4 connector AITEMP-pin, corresponding to the transducer temperature. Reference is GND. 0V= 0°C, 10V = 100°C (°C).

CONTROLL - BUTTONS

TUNE - Starts the auto tuning process. If better starting frequency is found the **Freq** value will be replaced with new one, or else the **Freq** value will remain the same.

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 according to settings on "WELDING" tab.

STOP - By pushing STOP the generator stops working.

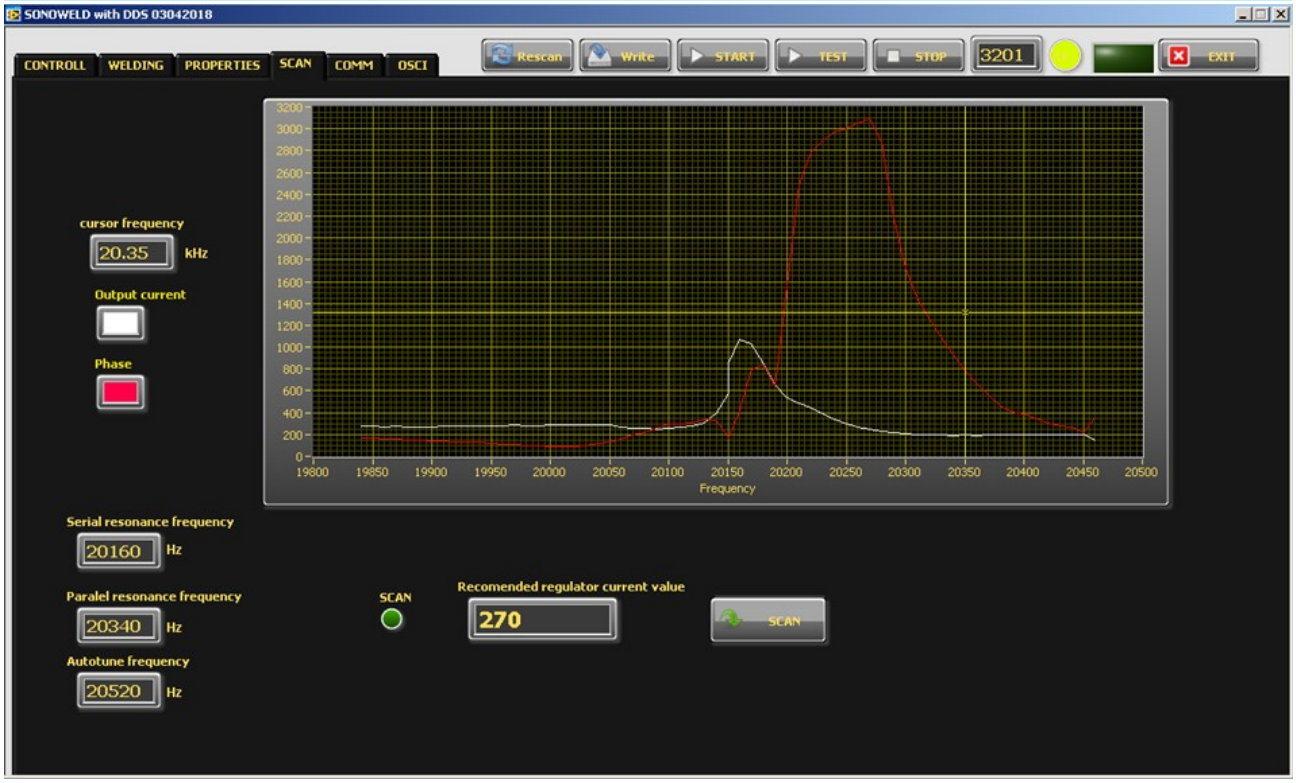
TEST - Button "TEST" will start the generator even the Time is selected 1sec. and will stop only when button "STOP" is pressed .

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.

ADJUSTING THE GENERATOR USING THE PC SOFTWARE

SCAN



Scan procedure must be made when the transducer and horn are not loaded - operation "on air".

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.

The Phase curve must reach levels higher than 2700, else the transducer or the horn with poor resonance characteristics and must be inspected.

The difference between Parallel and Serial resonance frequency is related to the mechanical amplification of the load. The lower difference - the higher the amplification.

A recommended Current regulator value appears. It is good to be used as a starting value when adjusting the time constant Ki of the output current regulator Regulator on "OSCI" tab.

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 in the CONTROL Tab you need to select frequency=parallel resonance frequency + 100Hz.

ADJUSTING THE GENERATOR USING THE PC SOFTWARE

OSCI

There is an inserted function for recording data – frequency, output current, phase, amplitude and power. Select the duration of the record in the field **"time to write"** – in seconds. The recording starts of the generator and ends when the selected time to write is finished. After recording is finished, when the button read is pressed, the data from generator is uploaded in the LabView software and is visualized graphically.

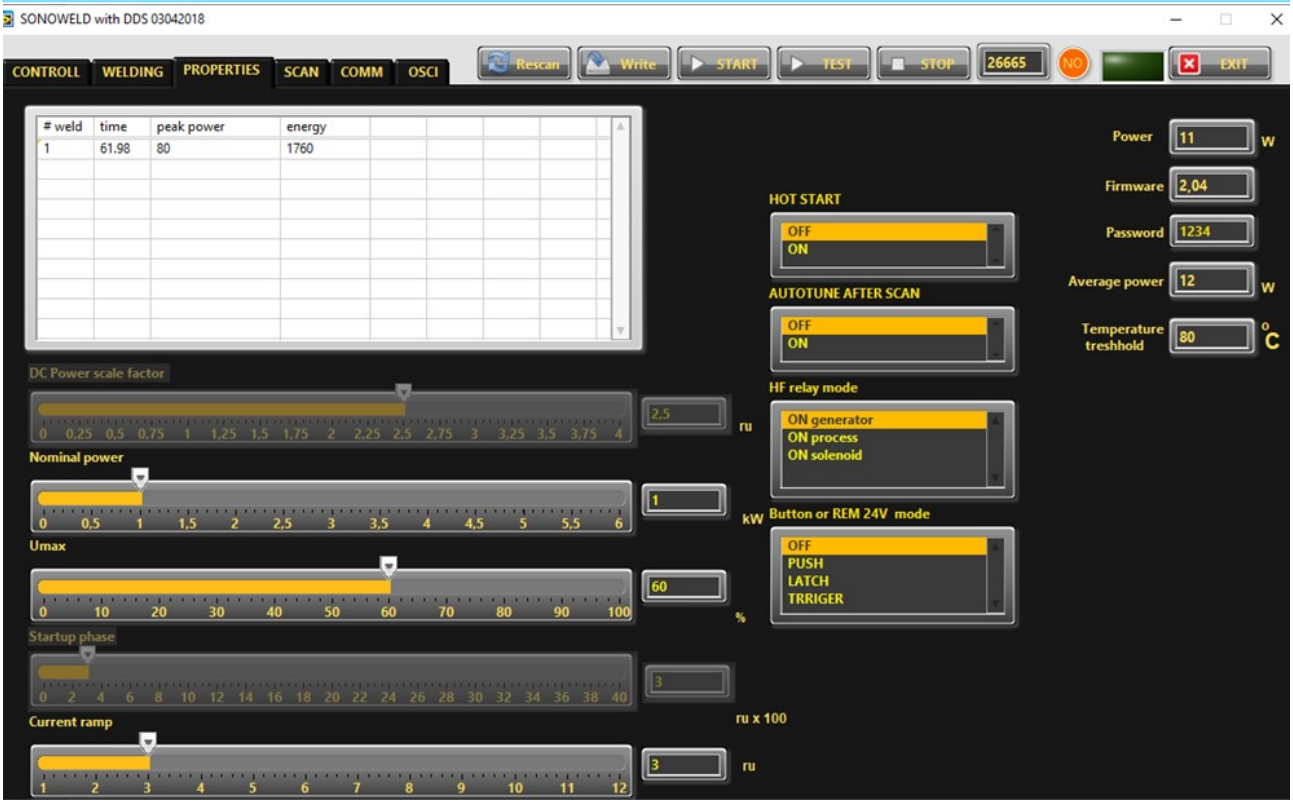
Regulator voltage - This is the K_i of the output voltage regulator (amplitude).

Regulator current - This is the K_i of the output current/frequency regulator.

Ramp Frequency - This is the ramp that sets the speed of shifting the frequency down- big ramp set value – slow speed, small ramp set value – fast speed.

Ramp Amplitude - This is the ramp that sets the speed of growing the amplitude- big ramp set value – slow speed, small ramp set value – fast speed.

PROPERTIES



Current Ramp - This is a type of regulator of the speed of growing of the current, which starts regulating when Imax is close to the set limit in case when the phase set value is still not reached (in ru). When Current Ramp value is small – the current grows fast, when Current Ramp is big – the current grows slow.

Nominal Power - The nominal power of the generator (kW).

Umax - the maximum output voltage (in % where 1000V RMS = 100%).

TEMPERATURE TRESHHOLD - setting of the External Temperature Limit (°C). The generator could generate error signal, when the temperature is over the set limit.

The limit for the External temperature is set in LabView software in PROPERTIES Tab in Temperature Threshold .

DROP DOWN MENU - Button or REM 24V mode:

PUSH - the button works as a test button – while pushed the generator is on, while released the generator is stopped.

LATCH - pushing the button once the generator starts, pushing the button again the generator stops.

TRIGGER - pushing the button once the welding cycle starts.

SETTING THE WELDING CYCLE PROPERTIES

WELDING

Before setting the welding regime you need to select **TRIGGER Mode** for the button – you can do it in **PROPERTIES Tab** or from the Display .

The generator allows carrying out the welding cycle by three criteria:

By TIME - reaching the preset time, the generator stops.

When an external start signal (from PLC for example.) enters on pin 5, pin 17 on the 25-pin DSUB interface socket, the generator starts the programmed welding cycle (as shown on the graphic above).

Welding cycle includes:

Delay - delay after the start signal to turn the generator ON.

Time - the generator is ON.

Hold - the generator is OFF for the preset hold time.

Afterburst - the generator is switched on briefly when the tool goes up so that it can disengage from the weldment if it has been stuck.

By ENERGY - reaching the preset energy, the generator stops only the programmed Welding Time (as shown on the graphic above) and keep on to execute hold and afterburst.

By PEAK POWER - reaching the preset peak power, the generator stops only the programmed Welding Time (as shown on the graphic above) and keep on to execute hold and afterburst.

There is an option to set limits for TIME, ENERGY and PEAK POWER or any combination of these 3 criteria. If there are preset limits for TIME, ENERGY and PEAK POWER together or combination of them, different from zero, the generator will stop after reaching any of the given parameters. If there are preset limits for TIME, ENERGY and PEAK POWER together or combination of them, equal to zero, the generator will work continuously.

WELDING - SLIDERS

(correspond to the parameters on the display of the generator)

Welding by time:

Time - time when the generator is on (seconds)
Time Plus - shows the additional safety time. This maximum duration of the control signal (seconds)
Time minus - minimum duration of the control signal (seconds)
Last Time - duration of the last working cycle (seconds)

Note: If entered a control signal from external control unit (PLC) out of limits Time Plus and Time minus, the bicolor LED will light in red and an error message Limit Time will be displayed.

Welding by energy:

Energy - setting of nominal energy during the welding process (Ws). If the setting is different from 0 and the generator reaches the set value the generator automatically stops.
Energy plus - maximum allowed energy reached during the welding process. (Ws)
Energy minus - minimum allowed energy reached during the welding process. Ws)
Last Energy - energy of the last working cycle. (Ws)

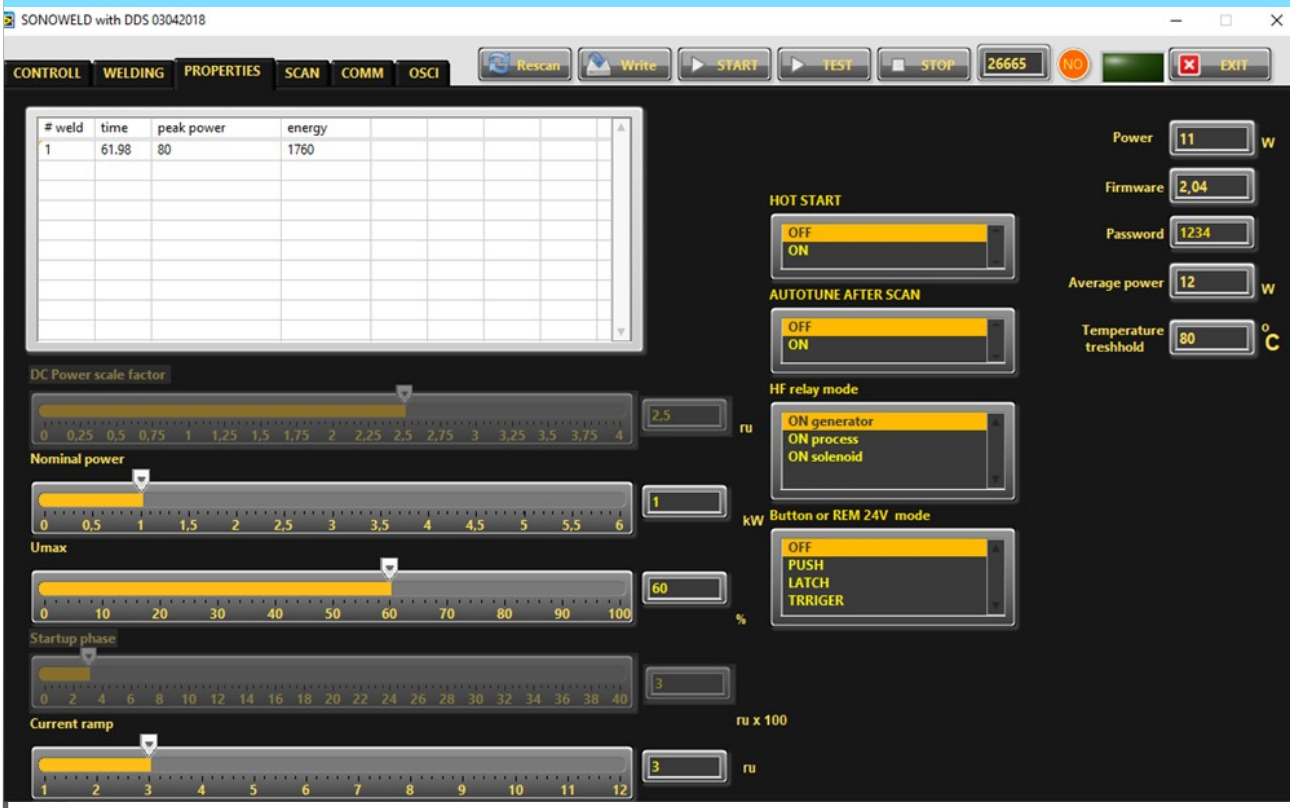
Note: If the energy during the welding process is out of limits **Energy Plus** and **Energy Minus,** the bicolor LED will light in red and an error message **Limit Energy** will be displayed. Error signal on X2 - ERR will set to HIGH.

Welding by peak power:

Peak Power - setting of the peak power (W). If the setting is different from 0 and the generator reaches the set value of the peak power, the generator automatically stops.
Peak plus - maximum allowed peak power reached during the welding process (W)
Peak minus - minimum allowed peak power reached during the welding process (in W)
Last pk Power - peak power of the last working process (W)
Delay - after the start signal, the generator delays starting with the set value of the delay (seconds)
Hold - the generator delays with the set hold value before executing **Afterburst** (seconds)
Afterburst - setting the value of afterburst (seconds)
Last Time - time for the last working process (seconds)
Note: If the **Peak Power** during the welding process is out of limits **Peak Plus** and **Peak minus**, the bicolor LED will light in red and an error message **Limit Peak Power** will be displayed. Error signal X2 - ERR will set to HIGH.

SETTING THE GENERATOR PROPERTIES

PROPERTIES



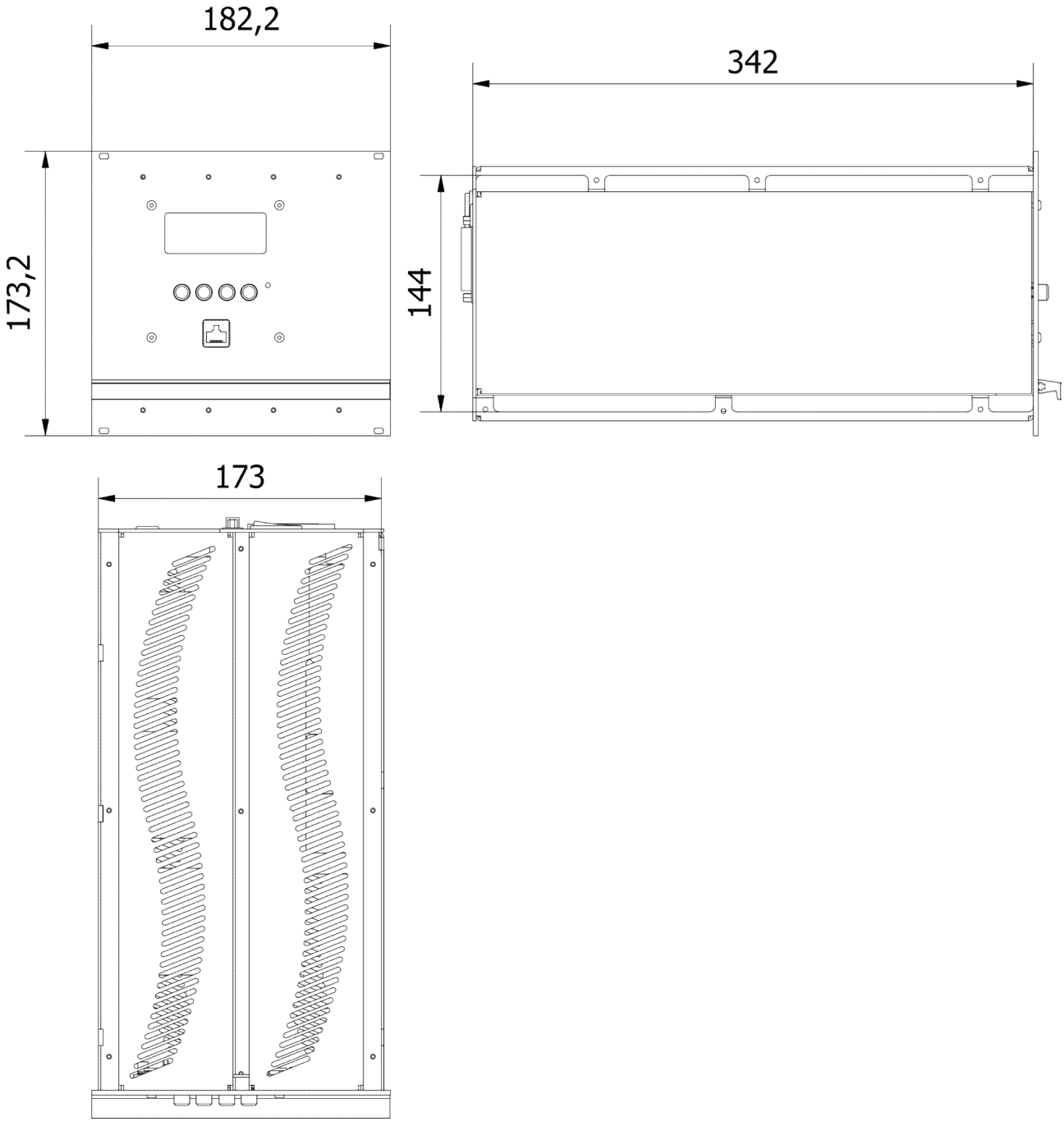
In PROPERTIES Tab you can select the HF Relay Mode (drop down menu) from three options:

ON generator - the relay is ON only during welding time.

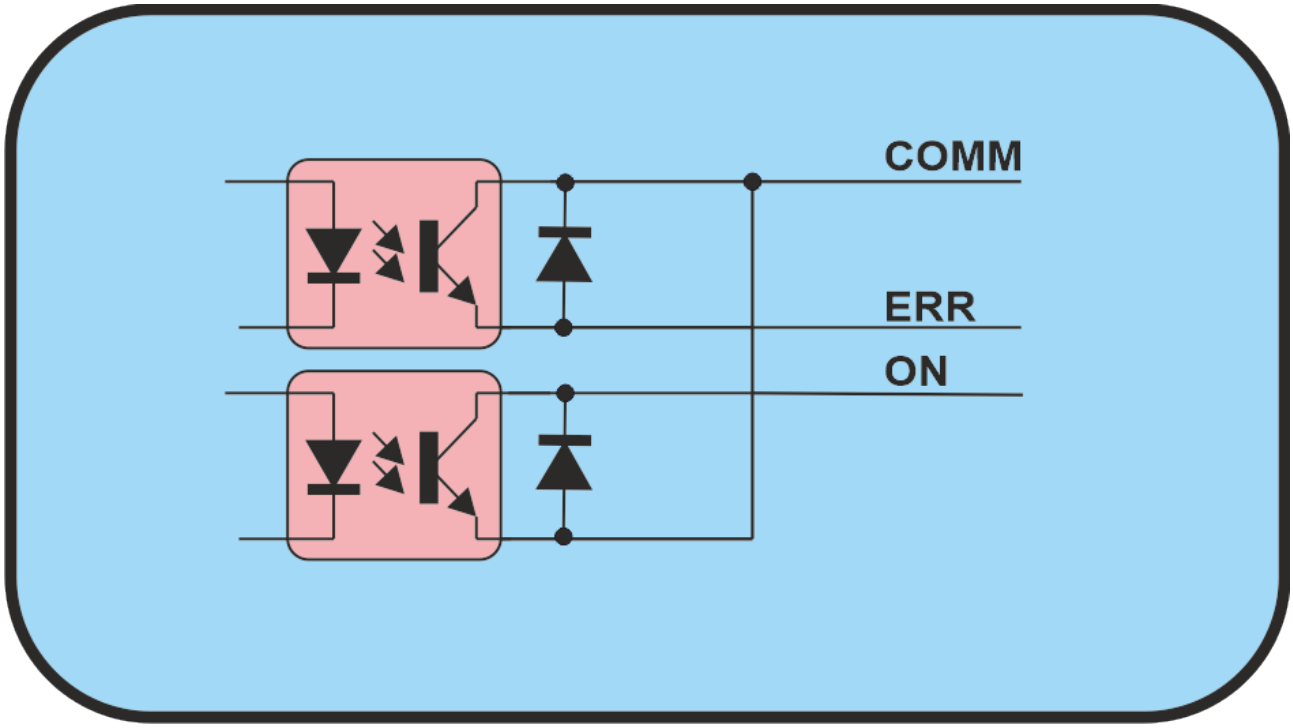
ON process - the relay is ON during whole process, including delay, welding time, hold and afterburst.

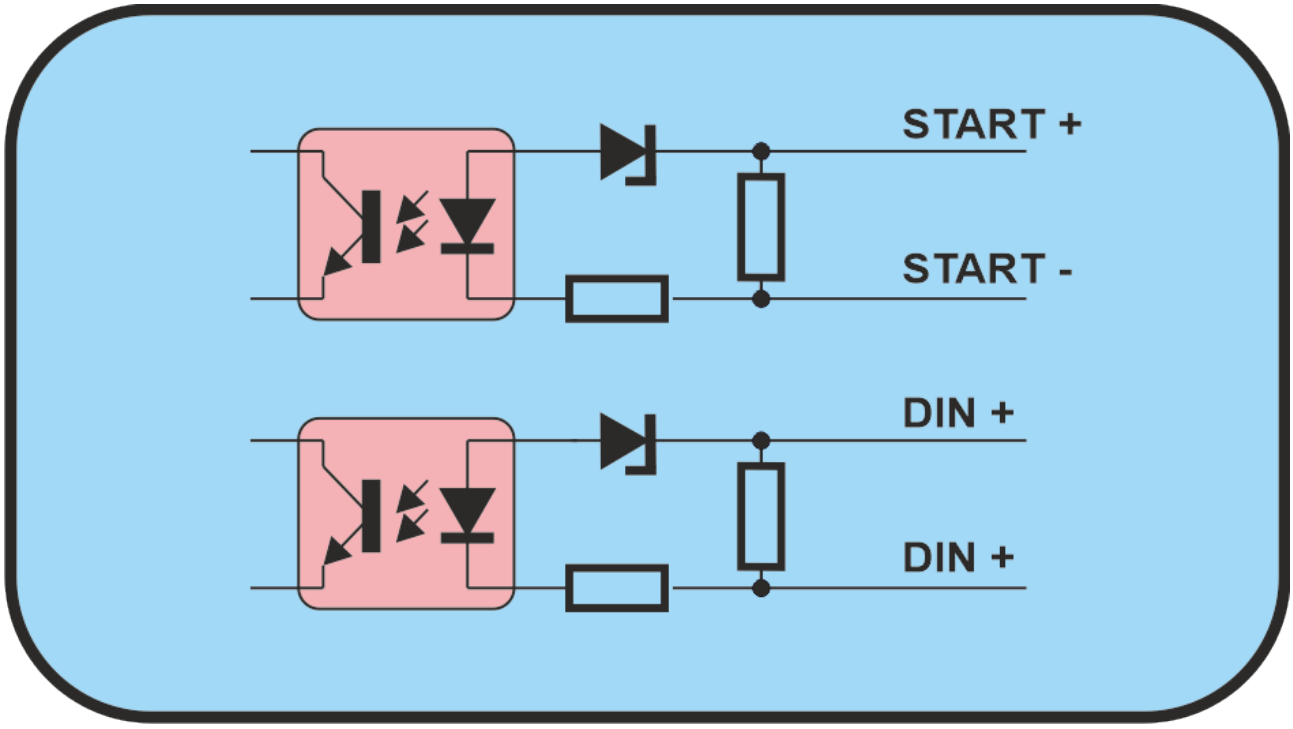
ON solenoid - the relay is ON during delay, welding time and hold together.

DIMENSIONS



INTERNAL SCHEMATIC OF THE GENERATOR





TECHNICAL SPECIFICATIONS

PARAMETERS	DATA
FREQUENCY	20 kHz
OPERATING VOLTAGE	230 VAC
POWER CONSUMPTION	MAX 18 A
MAXIMUM OUTPUT	4 000 W
FUSE PROTECTION	20 A
CASING DIMENSIONS	W x H x D/mm/ 182 x173,2 x 367
WEIGHT	kg
PROTECTION CLASS	IP 20, IEC 60 529, EN 60 525
OPERATIONG TEMPERATURE RANGE	-10 to +40°C

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!**

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