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1 Introduction

This chapter provides information on the manufacturer, the equipment and this operating manual.

1.1 About MICC Ltd

MICC Ltd and TRM Ltd manufacture the World’s largest range of Mineral Insulated heating, thermoelectric, compensating & Enhanced Fire Survival wiring cables along with ATEX / CSA / IECEx approved Heating Elements, Temperature Measurement Probes & Assemblies. We are headquartered out of our Washington factory in the North East of the United Kingdom, with over 85 years manufacturing experience and many approvals including: ISO9001, ISO14001 and TS16949. We design, manufacture and install, we also provide all required accessories, tools and training. We design for the most cost effective and efficient solution, not the most profitable. All our products and bespoke solutions are made to former BICC standards by former BICC staff in strict accordance with the same highest level of manufacturing standards obtainable. Our directors are all former BICC senior managers.
1.2 About the software

The software is designed to perform flexible tasks in the areas of:

- thermal forming,
- separating and cutting,
- gluing, riveting and welding.

The modular concept of the ultrasonic welding devices consists of:

- generators for 20 kHz and 35 kHz,
- an operating unit with software and display in various designs.

Advantages of the ultrasonic generators:

- simple operating concept,
- fast equipping when changing a product,
- virtual freedom from maintenance,
- connection of several ultrasonic welding devices in series to each generator,
- an interface for monitoring and controlling process-relevant functions.

1.2.1 Intended use

You can find notes on the intended use in the operating manual supplied with the generator.

The software controls the ultrasonic welding generators for thermal processing of thermoplastic workpieces by means of:

- thermal forming,
- separating and cutting,
- gluing, riveting and welding.

The control system allows the creation of different processing sequences.

NOTE

The operator bears sole responsibility for any damage caused by not using the equipment in accordance with its intended use!

Xfurth Ltd accepts no liability for material damage and bodily injury caused by unlawful use of the equipment.
1.3 Validity of the operating manual

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>This Operating manual only applies for the software versions listed. Claims referring to already supplied software cannot be derived from the information, illustrations and descriptions contained within this operating manual.</td>
</tr>
</tbody>
</table>

These operating instructions are valid for

- SONIC FULL DIGITAL + RS485 software, version 10.06 MULTI PURPOSE
1.4 About this document

1.4.1 Purpose

This operating manual provides a basic introduction to the design, method of functioning and intended operation of the equipment supplied. You can also find important notes on safe handling and proper maintenance.

In the interests of its customers, Xfurth Ltd continually develops and refines its equipment. For this reason, Xfurth Ltd reserves the right to make technical modifications without prior notice that may deviate from the information stated in this operating manual.

1.4.2 General structure

Instructions

The instructions comprise:

Objective

☐ Prerequisites, if applicable.
1. Step 1
2. Step 2
3. Further steps

☑ Interim result, if applicable.
4. Further steps

☐ Result of steps performed.

1.4.3 Abbreviations used

RF \(\equiv\) HF = high frequency, operating frequency of the generator
HF connection = transducer connection, transducer system connection
US = ultrasound/ultrasonic

1.4.4 Signal words used

DANGER Immediate danger of serious injury or death.
WARNING Potentially dangerous situation with the risk of serious injury or death.
CAUTION Potential risk resulting in minor injuries.
ATTENTION Risk of material damage to equipment and products, as well as harm to the environment.
PLEASE NOTE Important information, failure to comply results in loss of warranty.
INFO Additional information to aid understanding.
2 Operation

This chapter provides an overview of the software functions

2.1 Operating modes

The generator has the following operating modes:

- AUTOMATIC
- PROGRAMMING
- SETTINGS

2.2 Hierarchical role concept

The SONIC FULL DIGITAL control system allows roles and permissions to be set up on different hierarchical levels. The roles and permissions are assigned in the SETTINGS menu.

| NOTE |
| Keep the code number in a place where it is protected from unauthorised access. |
| If you lose the code number, please contact the service department of Xfurth Ltd. |

Factory (manufacturer = Xfurth Ltd)

Highest hierarchy level with all permissions:

- Access to all options
- Changes to parameters permitted
- Assignment of permissions to subordinate hierarchy levels:
  The permissions "Viewed", "Not Viewed" and "Change"

Distributor

Second hierarchy level with the following permissions:

- Access to all enabled options
- Changes to parameters permitted
- Assignment of permissions to subordinate hierarchy levels:
  The permissions "Viewed", "Not Viewed" and "Change"

Customer (operator)

Third hierarchy level with the following permissions:

- Access to all enabled options
- Changes to parameters permitted
- Assignment of rights to subordinate hierarchy levels (User):
  Enabled and Disabled

User

Lowest hierarchy level with the following permissions:

- Selection of default options within the enabled functions, e.g. program parameters
- Query of current values [RUNNING]
- Selection of production program [PROGRAM]
- Setting the display [DISPLAY]
2.3 Displays in the LCD menu

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depending on the assigned roles and permissions, certain displays may be:</td>
</tr>
<tr>
<td>- hidden,</td>
</tr>
<tr>
<td>- unchangeable.</td>
</tr>
<tr>
<td>Selected functions and/or values are displayed on a black background.</td>
</tr>
<tr>
<td>The display text is in English.</td>
</tr>
</tbody>
</table>

Welcome screen

Applies for all roles and permissions. Can be provided with customer-specific logo or text.

AUTOMATIC operating mode [RUNNING SCREEN]

In the AUTOMATIC operating mode, the start screen displays the following values:
- F = set frequency [Hz]
- E = current energy emitted [Ws]
  (the peak value of the last welding procedure at standstill)
- P = current power output [W]
  (the peak value of the last welding procedure at standstill)
- A = set amplitude [%]
- T = duration of the last welding procedure [s]
- Pr = set program [1 to 99] (if enabled)
2.4 Programming menus

<table>
<thead>
<tr>
<th>NOTE</th>
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<tbody>
<tr>
<td>Depending on the assigned roles and permissions, certain menus, submenus, selections or displays may be:</td>
</tr>
<tr>
<td>- hidden,</td>
</tr>
<tr>
<td>- unchangeable.</td>
</tr>
<tr>
<td>The display text is in English.</td>
</tr>
</tbody>
</table>

2.4.1 Overview

The following menus are available:

- At all times (green light)
- When enabled (optional, yellow light)
- Only if a code number is given (red light, key)

Fig. 2: Menu tree for user
### 2.4.2 PROGRAM menu (if enabled)

<table>
<thead>
<tr>
<th>Display text</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BREAK</strong></td>
<td>Press the encoder once: interrupts the procedure</td>
</tr>
<tr>
<td><strong>CLEAR</strong></td>
<td>Press the encoder once: deletes a program</td>
</tr>
<tr>
<td><strong>CONTINUE</strong></td>
<td>Press the encoder once: continues the process</td>
</tr>
<tr>
<td><strong>COPY</strong></td>
<td>Press the encoder once: copies the program</td>
</tr>
<tr>
<td><strong>EXIT</strong></td>
<td>Press the encoder once: exits the menu and enters the higher menu level</td>
</tr>
<tr>
<td><strong>LOAD</strong></td>
<td>Press the encoder once: loads the program</td>
</tr>
<tr>
<td><strong>PUSH TO ADJ</strong></td>
<td>The value or, if there are two values, the selected value (value displayed on a black background) can be adjusted by turning the encoder.</td>
</tr>
<tr>
<td><strong>PUSH TO CONF</strong></td>
<td>Press the encoder once: the set value is saved</td>
</tr>
<tr>
<td><strong>NEW</strong></td>
<td>Press the encoder once: creates a new program</td>
</tr>
</tbody>
</table>

**Function**  The generator can save up to 99 programs, which are numbered from 1 to 99. Program number 100 is a default program that can be used as a starting point when creating new programs.

**HW programs (if enabled)**  Functionality through which the programs defined above can be switched over via the hardware tooling interface. Further information on the pin assignment and use of the interface can be found in the description of the housing.
The PROGRAM menu has the following submenus:

- **LOAD**  load an existing program
- **NEW**   create a new program
- **COPY**  copy an existing program
- **CLEAR** delete an existing program

### Calling up the PROGRAM menu
1. Turn the encoder to the right.
   - The currently active program number XY appears on the display.
2. Press the encoder once.
   - The PROGRAM menu is active.

### Exiting the PROGRAM menu
1. Turn the encoder until EXIT appears on the display.
2. Press the encoder once.
   - The active program number appears on the display.
3. Turn the encoder to the left.
   - The RUNNING screen appears on the display.

### Calling up submenus
1. Press the encoder once, and then turn it to the right or left.
   - Displayed submenus: LOAD, NEW, COPY, CLEAR, EXIT.
2. Press the encoder once.
   - The submenu is selected.

### Exiting submenus
1. Press the encoder once.
   - The submenu is closed, the higher-level menu is active.
2. Turn the encoder until EXIT appears on the display.
3. Press the encoder once.
   - The active program number appears on the display.
4. Turn the encoder to the left.
   - The RUNNING screen appears on the display.
LOAD - loading an existing program

Function
Load program
You can select existing programs in this submenu.

1. Press the encoder once.
☐ An existing program can be selected.
2. Turn the encoder until the desired program number appears.
3. Press the encoder once.
☐ The program is loaded, the submenu is closed and the display shows the new current program.

Error message
"Program XY not used!"
The selected program does not exist.

1. Press the encoder once.
☐ Another existing program can be selected.
2. Turn the encoder until the desired program number appears.
3. Press the encoder once.
☐ The program is loaded, the submenu is closed and the display shows the new current program.
**NEW - creating a new program**

**Function**
You can create new programs in this submenu.

1. Press the encoder once.
   - A new program can be created.

2. Turn the encoder to the right until the desired program number appears.

3. Press the encoder once.
   - The default program number 100 is copied to the set program number.

4. Press the encoder once.
   - **The default program is saved under the new number, the submenu is closed and the display shows the new current program.**

**Error message**
**"Program XY used!"**
The selected program number has already been assigned.
- Select **BREAK** to cancel overwriting.
- Select **CONTINUE** to confirm overwriting.

**Cancelling overwriting [BREAK]**
1. Press the encoder once.
   - Overwriting is cancelled, a different program number can be selected.

2. Repeat the process for creating a new program.

**Confirming overwriting [CONTINUE]**
3. Turn the encoder to the right.
   - **CONTINUE** appears on the display.

4. Press the encoder once.
   - **The previously saved program is replaced by the default program, the submenu is closed and the display shows the new current program.**
COPY - copying an existing program

**Function**
The currently active program can be copied to a different program number in this submenu.

- **Selecting a target program number**
  1. Press the encoder once.
  2. Turn the encoder to the right until the desired program number appears.
  3. Press the encoder once.
  4. Press the encoder once.

**Error message**
"Program XY used!"
The selected program number has already been assigned.
- Select BREAK to cancel overwriting.
- Select CONTINUE to confirm copying of the program.

**Cancelling overwriting [BREAK]**
1. Press the encoder once.
   - Overwriting is cancelled, a different program number can be selected.
2. Repeat the procedure for copying a program.

**Confirming overwriting [CONTINUE]**
1. Turn the encoder to the right.
   - CONTINUE appears on the display.
2. Press the encoder once.
   - The previously saved program is replaced by the current program, the submenu is closed and the display shows the new current program.
CLEAR - deleting an existing program

Function
An existing program can be deleted in this submenu.

Deleting a program
1. Press the encoder once.
   □ An existing program can be selected.
2. Turn the encoder to the right until the desired program number appears.
   □ BREAK appears on the display.

Aborting a deletion process [BREAK]
1. Press the encoder once.
   □ Overwriting is cancelled, a different program number can be selected.
2. Repeat the procedure for deleting a program.

Confirming deletion [CONTINUE]
1. Turn the encoder to the right or left.
   □ CONTINUE appears on the display.
2. Press the encoder once.
   □ The program is deleted and the submenu is closed.

CHOSE PROG appears on the display if the current program has been deleted.
The current program number appears on the display if a different program has been deleted.
3. If CHOOSE PROG is displayed, you can load a new program via the LOAD menu.

Error message “Program XY not used!”
The selected program has not yet been assigned, CONTINUE appears on the display.
1. Press the encoder once.
   □ The program is deleted, the submenu is closed and the display shows the new current program. The deleted program cannot be restored.
2.4.3 **TRIGGER menu (if enabled)**

**Function**
The scope of application concerns welding devices.

The time lag prior to the start of the welding procedure is set in this menu. During the
time lag (TRIGGER), the welding device moves to the workpiece but does not emit
ultrasound.

The DELAY parameter is set.

**Setting the DELAY parameter**

1. Press the encoder once in the TRIGGER menu.
   - A display appears showing the current setting (DELAY (off) or
     DELAY xs).
2. Press the encoder once to change the setting.
3. Turn the encoder until the desired setting is displayed.

**Disabling TRIGGER**

1. DELAY (off): Press the encoder once to confirm.
   - TRIGGER is disabled.
   - The procedure for setting TRIGGER is complete.

**Activating TRIGGER**

1. DELAY xs: press the encoder once.
2. Turn the encoder until the desired time lag (0.01 s to 9.99 s) appears.
3. Press the encoder once to confirm.
   - DELAY time lag is saved and applied.
   - The procedure for setting TRIGGER is complete.
2.4.4 WELDING menu (if enabled)

Function

The generator has 5 welding modes:

- WELD BY REMOTE
- WELD BY TIME
- WELD BY ENERGY
- WELD BY PEAK POWER
- WELD BY PULSE

If only the WELD BY REMOTE welding mode is enabled and the window functions are switched off, the WELDING menu is no longer used as no additional programming is needed.

Calling up the WELDING menu

1. Press the encoder once.
   - The currently active welding mode appears on the display.

Exiting the WELDING menu

1. Turn the encoder to the left.
   - WELDING appears on the display.

Calling up submenus

1. Press the encoder once (PUSH TO ADJUST).
   - Displayed submenus: WELD BY REMOTE, TIME, ENERGY, PEAK POWER, and PULSE (if enabled).
2. Turn the encoder until the desired welding mode appears.
3. Press the encoder once.
   - The welding mode is selected.

Setting parameters

1. Turn the encoder to the right.
   - The enabled parameters appear one after the other. Press the encoder once to set the parameters.

Exiting the submenu

2. Turn the encoder to the right.
   - WELDING appears on the display.
**T, P, E-WINDOW submenus (if enabled)**

**Function**
The value windows Time, Power output and Energy support quality control. The parameters displayed in these value windows are set in this submenu (depending on the selected mode and whether it is enabled).

**Error message**
If a welding procedure is running outside the set parameters (HIGH VALUE window),
- the welding cycle is aborted,
- the error message appears in the display,
- the NOMINAL LED lights up on the control panel or
  the AUX1 LED lights up on the hand-held control unit.

**T-WINDOW parameter**
The T-WINDOW parameter indicates the time window for the welding procedure (between 0.01 and 9.99 seconds). The maximum time must always be 0.01 s greater than the minimum time.

**P-WINDOW parameter**
The P-WINDOW parameter indicates the power window for the welding procedure (between 1 W and the maximum power output of the generator). The maximum power output must always be 1 W greater than the minimum power output.

**E-WINDOW parameter**
The E-WINDOW parameter indicates the energy window (min. 1 Ws to max. 10 x the total output of the generator in Ws). The maximum energy must always be 1 Ws greater than the minimum energy.

**Setting parameters**
1. Turn the encoder to the right.
2. Press the encoder once.
   - The T-WINDOW, P-WINDOW and E-WINDOW submenus appear one after another on the display (depending on the selected mode and whether they are enabled).
3. Press the encoder once.
4. Turn the encoder.

**Disabling parameters**
1. WINDOW (min. value - max. value): set the minimum value = 0
2. Press the encoder once.
   - The called up window is disabled, and WINDOW (off) appears on the display. You can now set the next window or close the WINDOW menu.
### Activating parameters

1. WINDOW (min. value - max. value): press the encoder once.
   - The minimum value setting is active.
2. Turn the encoder until the desired minimum value appears.
3. Press the encoder once to confirm.
   - Minimum value is saved and applied, maximum value is active.
4. Turn the encoder until the desired maximum value appears.
5. Press the encoder once to confirm.
   - The parameters of the window you have just called up are saved and applied. WINDOW (min. value - max. value) appears on the display. You can now set the next window or close the WINDOW menu.

### WELD BY REMOTE welding mode (if enabled)

### Function
You can change the duration of the welding procedure by pressing the TEST button or activating one of the remote control inputs. The generator exits the welding mode by means of an inactive signal. The welding procedure starts after the pre-set time lag (TRIGGER) has elapsed.

The following parameters are set:
- T-WINDOW
- P-WINDOW
- E-WINDOW

### Starting the welding cycle
1. Press and hold down the TEST button or activate the remote control input.
   - The generator welds until the signal is disabled.

### Ending the welding cycle
1. Release the TEST button or disable the remote control input.
   - The generator ends the welding cycle.
   - The generator switches to the pre-set procedures HOLDING and/or AFTER BURST.

### Setting parameters
1. In the WELD BY REMOTE menu, press the encoder once.
   - T-WINDOW appears on the display.
2. Set and confirm the values for T-WINDOW.
3. P-WINDOW appears on the display.
4. Set and confirm the values for P-WINDOW.
5. E-WINDOW appears on the display.
6. Set and confirm the values for E-WINDOW.
   - The parameters are set. The WELDING menu appears on the display.
WELD BY TIME welding mode (if enabled)

Function
Control of the welding procedure throughout the defined time (TIME). The welding procedure starts after the pre-set time lag (TRIGGER) has elapsed.

The following parameters are set:
- P-WINDOW
- E-WINDOW

Starting the welding cycle
1. Press and hold down the TEST button or activate the remote control input until the pre-set HOLDING time has elapsed.
- The generator welds until the pre-set time has elapsed.
- The generator switches to the pre-set procedures HOLDING and/or AFTER BURST.

Ending the welding cycle
The welding cycle:
- ends when the welding time (TIME) has elapsed, or
- ends with the P-WINDOW error message if the P-WINDOW \( \text{Max} \) value has been exceeded, or
- ends with the E-WINDOW error message if the E-WINDOW \( \text{Max} \) value has been exceeded, or
- if the function is set to ENABLED.

WINDOW error message
This error message appears if:
- the TEST button is pressed before the welding time has elapsed or
- the remote control input becomes inactive before the welding time has elapsed.

CYCLE NOT COMPLETE error message

Setting parameters
1. In the WELD BY TIME menu, press the encoder once.
- TIME appears on the display.
2. Turn the encoder until the desired time is displayed (max. 9.99 s).
3. Press the encoder once.
- The selected time is saved. P-WINDOW appears on the display.
4. Set and confirm the values for P-WINDOW.
- E-WINDOW appears on the display.
5. Set and confirm the values for E-WINDOW.
- The parameters are set. The WELDING menu appears on the display.
WELD BY ENERGY welding mode (if enabled)

Function
Control of the welding procedure via the programmed energy value (ENERGY). The welding procedure starts once the pre-set time lag (TRIGGER) has elapsed and ends when the programmed energy value has been reached. The maximum energy value is 10 s multiplied by the total output of the generator (e.g. 1000 W * 10 s = 10,000 Ws).

The following parameters are set:
- T-WINDOW
- P-WINDOW

T, P, E-WINDOW submenus (if enabled)

Starting the welding cycle
1. Press and hold down the TEST button or activate the remote control input until the pre-set HOLDING time has elapsed.
   - The generator welds until the pre-set energy value is reached.
   - The generator switches to the pre-set procedures HOLDING and/or AFTER BURST.

CYCLE NOT COMPLETE error message
This error message appears if:
- the TEST button is pressed before the HOLDING time has elapsed or
- the remote control input is inactive before the HOLDING time has elapsed.

Ending the welding cycle
The welding cycle:
- ends when the HOLDING time has elapsed, or
- ends with the T-WINDOW error message if the T-WINDOW_max value has been exceeded, or
- ends with the P-WINDOW error message if the P-WINDOW_max value has been exceeded, or
- if the function is set to ENABLED.
1. In the WELD BY ENERGY menu, turn the encoder to the right.
   - ENERGY appears on the display.
2. Press the encoder once.
3. Turn the encoder until the desired energy value is displayed (max. 10 x the total output of the generator in Ws).
4. Press the encoder once.
   - The selected energy value is saved. T-WINDOW appears on the display.
5. Set and confirm the values for T-WINDOW.
   - P-WINDOW appears on the display.
6. Set and confirm the values for P-WINDOW.
   - The parameters are set.
   - The WELDING menu appears on the display.

### INFO

T-WINDOW is enabled in this WELD BY ENERGY menu, as this maximum value is a switch-off criterion.

This also applies if T-WINDOW is set to DISABLED in the SETTINGS menu.

The T-WINDOW parameter indicates the time window for the welding procedure (between 0.01 and 9.99 seconds). The maximum time must always be 0.01 s greater than the minimum time.
WELD BY PEAK POWER welding mode (if enabled)

Function
Control of the welding procedure via the programmed power output (PEAK POWER). The welding procedure starts once the pre-set time lag (TRIGGER) has elapsed and ends when the programmed power output has been reached.

The following parameters are set:
- Power output (PEAK POWER)
- T-WINDOW
- E-WINDOW

T, P, E-WINDOW submenus (if enabled)

Starting the welding cycle
1. Press and hold down the TEST button or activate the remote control input until the pre-set HOLDING time has elapsed.

- The generator welds until the pre-set power output value is reached.
- The generator switches to the pre-set procedures HOLDING and/or AFTER BURST.

CYCLE NOT COMPLETE error message
This error message appears if:
- the TEST button is pressed before the HOLDING time has elapsed or
- the remote control input is inactive before the HOLDING time has elapsed.

Ending the welding cycle
The welding cycle:
- ends when the HOLDING time has elapsed, or
- ends with the T-WINDOW error message if the T-WINDOW \( \text{Max} \) value has been exceeded, or
- ends with the E-WINDOW error message if the E-WINDOW \( \text{Max} \) value has been exceeded, or
- if the function is set to ENABLED.
Setting parameters

1. In the WELD BY PEAK POWER menu, turn the encoder to the right.
   POWER appears on the display.
2. Press the encoder once.
3. Turn the encoder until the desired power output is displayed (min. 1 W up to the maximum power output of the generator in W).
4. Press the encoder once.
   The selected power output value is saved. T-WINDOW appears on the display.
5. Set and confirm the values for T-WINDOW.
6. E-WINDOW appears on the display.
7. Set and confirm the values for E-WINDOW.
   The parameters are set. The WELDING menu appears on the display.

INFO

T-WINDOW is enabled in this WELD BY ENERGY menu, as this maximum value is a switch-off criterion.
This also applies if T-WINDOW is set to DISABLED in the SETTINGS menu.
The T-WINDOW parameter indicates the time window for the welding procedure (between 0.01 and 9.99 seconds). The maximum time must always be 0.01 s greater than the minimum time.
**WELD BY PULSE welding mode (if enabled)**

**Function**
You can change the duration of the welding procedure by pressing the TEST button or activating one of the remote control inputs. The generator exits the welding mode by means of an inactive signal. The welding procedure starts once the pre-set time lag (TRIGGER) has elapsed. The generator emits ultrasound during the ON-TIME and switches off during the OFF-TIME.

The following interval parameters are set:

- Ultrasound on (ON-TIME)
- Ultrasound off (OFF-TIME)
- P-WINDOW
- E-WINDOW

**T, P, E-WINDOW submenus (if enabled)**

**Starting the welding cycle**
1. Press and hold down the TEST button or activate the remote control input if you intend to weld in WELD BY PULSE mode.
   - The generator repeats the ON-TIME / OFF-TIME cycle until the TEST button is released or the remote control input is inactive.

**Ending the welding cycle**
1. Release the TEST button or disable the remote control input.
   - The generator ends the welding cycle.
   - The generator switches to the pre-set procedures HOLDING and/or AFTER BURST.

**WINDOW error message**
The welding cycle:

- ends with the P-WINDOW error message if the P-WINDOW Max value has been exceeded, or
- ends with the E-WINDOW error message if the E-WINDOW Max value has been exceeded, or
- if the function is set to ENABLED.
1. In the WELD BY PULSE menu, turn the encoder to the right.
   ON-TIME appears on the display.
2. Press the encoder once.
3. Turn the encoder until the desired time is displayed (min. 0.01 s to max. 9.99 s).
4. Press the encoder once.
   The selected time span for the delivery of ultrasound is saved. OFF-TIME appears on the display.
5. Press the encoder once.
6. Turn the encoder until the desired time is displayed (min. 0.01 s to max. 9.99 s).
7. Press the encoder once.
   The selected pause time is saved. P-WINDOW appears on the display.
8. Set and confirm the values for P-WINDOW.
9. E-WINDOW appears on the display.
   Set and confirm the values for E-WINDOW.
\[\text{The parameters are set.}\]
\[\text{The WELDING menu appears on the display.}\]
2.4.5 HOLDING menu (if enabled)

**Function**
The scope of application concerns welding devices.

You can set the cooling time of the workpiece in this menu. During the cooling time (HOLDING), the welding device continues to press the workpiece with the same force, but does not emit any ultrasound.

The HOLD TIME parameter is set.

<table>
<thead>
<tr>
<th>Setting the HOLD TIME parameter</th>
<th>1. Press the encoder once in the HOLDING menu.</th>
<th>A display appears showing the current setting (HOLD TIME (off) or HOLD TIME xs).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. Press the encoder once to change the setting.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Turn the encoder until the desired setting is displayed.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disabling HOLD TIME</th>
<th>4. HOLD TIME (off): Press the encoder once to confirm.</th>
<th>The HOLD TIME is disabled. The procedure for setting HOLD TIME is complete.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Activating HOLD TIME</th>
<th>5. HOLD TIME xs: press the encoder once.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6. Turn the encoder until the desired hold time (0.01 s to 9.99 s) appears (when the setting is 0.00 s, OFF is displayed automatically).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. Press the encoder once to confirm.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☑ The hold time is saved and applied. The procedure for setting HOLD TIME is complete.</td>
<td></td>
</tr>
</tbody>
</table>
2.4.6   AFTER BURST menu (if enabled)

**Function**  
The scope of application concerns welding devices.

The cleaning of the sonotrode is set in this menu: after the welding procedure, the sonotrode blasts off any residual material through an emission of ultrasound (AFTER BURST). The AFTER BURST welds with the programmed amplitude.

The following parameters are set:
- AB-Delay (time lag between the end of the welding procedure (or, if applicable, the HOLDING time) and the AFTER BURST).
- AB-Time (duration of the AFTER BURST ultrasonic emission).

**Setting the AFTER BURST parameter**
1. Press the encoder once in the AFTER BURST menu.
   - A display appears showing the current setting (AB-Delay (off) or AB-Delay xs).
2. Press the encoder once to change the setting.
3. Turn the encoder until the desired setting is displayed.

**Disabling the AFTER BURST**
1. Set the AB-Time to 0.00 s = OFF.
2. Press the encoder once.
   - The AFTER BURST TIME is disabled.
   - The procedure for setting AFTER BURST is complete.

**Activating the AFTER BURST**
1. AB-Delay xs: press the encoder once.
2. Turn the encoder until the desired time lag (0.01 s to 9.99 s) appears (when 0.00 s is set, OFF is automatically displayed).
3. Press the encoder once to confirm.
   - The AB-Delay time lag is saved and applied.
   - AB-Time is displayed.
4. Press the encoder once.
5. Turn the encoder until the desired duration of the ultrasonic emission (0.01 s to 30.99 s) appears.
6. Press the encoder once.
   - The duration of the ultrasonic emission (AFTER BURST) is saved and applied. The procedure for setting AFTER BURST is complete.
2.4.7 AMPLITUDE menu

**Function**

The amplitude of the welding procedure (50 % to 100 % in 1 % steps) is set in this menu (setting is not performed if A-SOURCE = EXTERNAL VOLTAGE in SETTINGS).

The amplitude can also be changed during the welding procedure. If the value is adjusted, the change is implemented immediately.

**Setting the amplitude**

1. Press the encoder once in the AMPLITUDE menu.
   - The current amplitude setting appears on the display.
2. Turn the encoder until the desired % value is displayed (min. 50 % to max. 100 %).
   - The selected value is applied directly for the running welding cycle.
3. Press the encoder once.
   - The selected amplitude value is saved.
2.4.8 SOFT START menu (if enabled)

Function
The transducer system is started with an amplitude of 50 %, which is increased in steps (STEP) within the time unit (TIME) until the programmed amplitude has been reached. This preserves sensitive transducer systems which would not be started at 100 % amplitude and the corresponding contact pressure.

The following parameters are set:
- S-START (off)
- STEP x% (increment value per time unit)
- TIME ys (time unit)

Setting the STEP parameter
1. Press the encoder once in the SOFT START menu.
   - The current setting (S-START (off) or S-START STEP x% and TIME ys) appears on the display.
2. If S-START (off) appears, turn the encoder to the right.
   - STEP and TIME appear on the display.
3. Press the encoder once to change the setting.
4. Turn the encoder until the desired setting (min. 1 %) of the STEP increment value per time value is displayed.
5. Press the encoder once to confirm.
   - The increment value is saved and applied and the time unit can now be set.
6. Turn the encoder until the desired time unit setting is displayed (min. 0.01 s to max. 2.55 s).
7. Press the encoder once to confirm.
   - The time unit setting is saved and applied.
   - The procedure for setting SOFT START is complete.

Disabling SOFT START
1. Set the parameter STEP = 0 %.
2. Press the encoder once to confirm.
   - SOFT START is disabled. The procedure for setting SOFT START is complete.
2.4.9 SOFT OFF menu (if enabled)

**Function**
The output voltage is slowly reduced during the time period (TIME). This protects sensitive transducer systems.

The following parameters are set:
- S-OFF (off)
- TIME ys (time unit)

**Setting the TIME parameter**
1. Press the encoder once in the SOFT OFF menu.
   - A display appears showing the current setting (Soft-OFF (off) or Soft-OFF Time xs).
2. Press the encoder once to change the setting.
3. Turn the encoder until the desired time unit setting is displayed (min. 0.01 s to max. 2.55 s).
4. Press the encoder once to confirm.
   - The time unit setting is saved and applied.
   - The procedure for setting SOFT OFF is complete.

**Disabling SOFT OFF**
1. Set the parameter TIME = 0.00 s.
2. Press the encoder once to confirm.
   - SOFT OFF is disabled. The procedure for setting SOFT OFF is complete.
2.4.10 SCAN menu

**Function**
The scan function of the generator automatically determines the resonant frequencies of the connected systems. The scan is automatically started after every welding procedure in order to detect the resonance shift caused by heating.

After an adjustable time period, the scan is repeated in order to detect the resonance shift caused by cooling. This method allows the generator to determine the ideal starting frequency every time.

The scan can be started manually in this menu, e.g. following a sonotrode change. The time period until the scan is repeated can be adjusted.

The following parameters are set:
- T Scan P (period)
- T Scan AW (after welding)

**Setting parameters T Scan P and AW**

1. Press the encoder once in the SCAN menu.
   - **Action**: appears on the display.
2. Press the encoder once.
   - **T Scan P** appears on the display.
3. Turn the encoder until the desired setting is displayed.
4. Press the encoder once to confirm.
   - **T Scan AW** appears on the display.
5. Turn the encoder until the desired setting is displayed.
6. Press the encoder once to confirm.
   - The values are saved and applied.
   - The adjustment of T Scan P and AW is complete.

**Performing a manual scan**

1. Press the encoder once in the SCAN menu.
   - **Action**: appears on the display.
2. Turn the encoder until **Start Scan** appears on the display.
3. Press once to start the scan.
   - **Scanning**... appears on the display.
4. If the scan was OK: **Scan OK**.
   - If an error occurs: **Scan failed**.
5. Press the encoder to confirm.
   - The scan is complete.
2.4.11 BACKLIGHT menu

**Function**  
Switching the backlight of the display on and off.

<table>
<thead>
<tr>
<th>Setting parameters</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Press the encoder.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Turn the encoder until the desired option has been reached.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Press the encoder.</td>
<td></td>
</tr>
</tbody>
</table>

☐ The setting is saved and applied.

**Recommendation**  
Switch on the backlight of the display.

2.4.12 CONTRAST menu

**Function**  
Changing the LCD contrast.

<table>
<thead>
<tr>
<th>Setting parameters</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Press the encoder.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Turn the encoder until the desired contrast has been reached.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Press the encoder.</td>
<td></td>
</tr>
</tbody>
</table>

☐ The setting is saved and applied.

**Recommendation**  
Switch on the backlight of the display.
2.5 Menus for the operator (customer)

NOTE

Depending on the assigned roles and permissions, certain menus, submenus, selections or displays may be:
- hidden,
- unchangeable.

The display text is in English.

2.5.1 Calling up the SETTINGS menu

Function

The SETTINGS menu can only be accessed with the four-digit code number. The number of attempts is not limited.

NOTE

Keep the code number in a place where it is protected from unauthorised access.

If you lose the code number, please contact the service department of your supplier or Xfurth Ltd.

Entering the code number

1. Press the encoder once in the SETTINGS menu.
   □ An input window appears on the display.
2. Turn the encoder until the 1st digit appears.
3. Press the encoder once to confirm.
4. Turn the encoder until the 2nd digit appears.
5. Press the encoder once to confirm.
6. Turn the encoder until the 3rd digit appears.
7. Press the encoder once to confirm.
8. Turn the encoder until the 4th digit appears.
9. Press the encoder once to confirm.
□ The SETTINGS menu appears.

WRONG PASSWORD error message

1. Press the encoder once to acknowledge the error message.
□ An input window appears on the display.
The input can be repeated.

Password for customer access to the SETTINGS menu:

6354

Error message:

Password for customer access to the SETTINGS menu:
2.5.2 OVERVIEW

The following menus and information displays are available:

- Parameter settings accessible with code number (yellow light = optionally enable/hide with factory password)
- Information and status displays, no settings possible (blue circle with i)

Fig. 3: Menu tree for operator (customer)
### Overview of parameter settings in customer menu

<table>
<thead>
<tr>
<th>Menu</th>
<th>Submenu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONF. PROGRAM</td>
<td>TRIGGER</td>
<td>Enabling for users: ENABLE or DISABLE</td>
</tr>
<tr>
<td></td>
<td>HOLDING</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AFTER BURST DELAY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AFTER BURST TIME</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WELD MODE REMOTE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WELD MODE TIME</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WELD MODE ENERGY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WELD MODE PEAK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>POWER</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WELD MODE PULSE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CYCLE CONTROL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OUTPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T-WINDOW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P-WINDOW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E-WINDOW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SOFT START</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SOFT OFF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PROGRAM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HW PROGRAMS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PI-REGLER/SCAN</td>
<td></td>
</tr>
<tr>
<td>FREQUENCY</td>
<td>Displaying the current working</td>
<td></td>
</tr>
<tr>
<td></td>
<td>frequency of the generator</td>
<td></td>
</tr>
<tr>
<td>I-LIMITS</td>
<td>$I_{\text{min}}$ [digit];</td>
<td>Setting the minimum current of the transducer.</td>
</tr>
<tr>
<td></td>
<td>$I_{\text{max}}$ [digit];</td>
<td>Setting the maximum current of the transducer.</td>
</tr>
<tr>
<td></td>
<td>$I_{\text{protect}}$ [digit];</td>
<td>Setting the maximum current at which the ultrasonic output is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>switched off.</td>
</tr>
<tr>
<td>PWM</td>
<td>$\text{PWM}_{\text{min}}$;</td>
<td>Setting the minimum value of the PWM control.</td>
</tr>
<tr>
<td></td>
<td>$\text{PWM}_{\text{max}}$;</td>
<td>Setting the maximum value of the PWM control.</td>
</tr>
<tr>
<td></td>
<td>$\text{PWM}_{\text{step}}$;</td>
<td>Setting the increment of the PWM control.</td>
</tr>
<tr>
<td>TEMPERATURE</td>
<td>SHUTOFF ['C]</td>
<td>Displaying temperature at which the generator automatically</td>
</tr>
<tr>
<td></td>
<td></td>
<td>switches off for protective purposes</td>
</tr>
<tr>
<td></td>
<td>FAN THRESH. ['C]</td>
<td>Displaying temperature at which the fan is automatically switched on.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>It switches off again at a hysteresis threshold of 10 °C.</td>
</tr>
<tr>
<td>F-LIMITS</td>
<td>$F_{\text{Search Otr}}$;</td>
<td>Setting the frequency search direction for the &quot;scan&quot; and</td>
</tr>
<tr>
<td></td>
<td>$F_{\text{max}}$ [Hz];</td>
<td>&quot;PI controller&quot; generator functions.</td>
</tr>
<tr>
<td></td>
<td>$F_{\text{min}}$ [Hz];</td>
<td>Displaying the maximum or minimum frequency of the transducer system.</td>
</tr>
<tr>
<td></td>
<td>$F_{\text{Start Offset}}$ [Hz];</td>
<td>Displaying the offset of the start and stop frequency of the</td>
</tr>
<tr>
<td></td>
<td>$F_{\text{Stop Offset}}$ [Hz]</td>
<td>transducer.</td>
</tr>
<tr>
<td>PI CONTROL</td>
<td>Kp</td>
<td>Setting control parameters.</td>
</tr>
<tr>
<td></td>
<td>Ki</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIMIT Ki</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T-START</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LEVEL 1 [%]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LEVEL 2 [%]</td>
<td></td>
</tr>
</tbody>
</table>

Only when T-START > 0.
<table>
<thead>
<tr>
<th>Menu</th>
<th>Submenu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCAN</td>
<td>REMOTE INPUT</td>
<td>Setting HIGH or LOW signal</td>
</tr>
<tr>
<td></td>
<td>ERROR OUTPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RF-DETECTED OUTPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WINDOW OUTPUT</td>
<td></td>
</tr>
<tr>
<td>I/O POLARITIES</td>
<td>REMOTE INPUT</td>
<td>Setting HIGH or LOW signal</td>
</tr>
<tr>
<td></td>
<td>ERROR OUTPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RF-DETECTED OUTPUT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WINDOW OUTPUT</td>
<td></td>
</tr>
<tr>
<td>A-SOURCE</td>
<td></td>
<td>Setting the signal source (front / ext. voltage)</td>
</tr>
<tr>
<td>P-OUT</td>
<td></td>
<td>Displaying P-OUT</td>
</tr>
<tr>
<td>SOFT START</td>
<td>ENABLE/DISABLE</td>
<td>Enabling for users: ENABLE or DISABLE</td>
</tr>
<tr>
<td></td>
<td>STEP [%]</td>
<td>Setting steps in %</td>
</tr>
<tr>
<td></td>
<td>TIME [s]</td>
<td>Setting time in s</td>
</tr>
<tr>
<td>SOFT OFF</td>
<td>ENABLE/DISABLE</td>
<td>Enabling for users: ENABLE or DISABLE</td>
</tr>
<tr>
<td></td>
<td>TIME [s]</td>
<td>Setting time in s</td>
</tr>
<tr>
<td>TEST BUTTON</td>
<td>DISABLE/PUSH/TOGGLE</td>
<td>Setting the function of the TEST button</td>
</tr>
<tr>
<td>STATUS SENSORICS</td>
<td></td>
<td>Displaying SENSORICS</td>
</tr>
<tr>
<td>MODULE</td>
<td>NOT AVAILABLE</td>
<td>Display of optional interface not available</td>
</tr>
<tr>
<td></td>
<td>AVAILABLE</td>
<td>Display of optional interface is available</td>
</tr>
<tr>
<td></td>
<td>PROGRAM NO.</td>
<td>Display of program number of the optional interface</td>
</tr>
<tr>
<td></td>
<td>IP-ADDRESS</td>
<td>Setting the IP address of the optional interface</td>
</tr>
<tr>
<td>INFO</td>
<td></td>
<td>Fro.SW = firmware version number of the front panel board</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gen.SW = firmware version number of the generator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ser. No. = serial number of the generator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assemb. = manufacturing date of the generator</td>
</tr>
<tr>
<td>EXIT</td>
<td></td>
<td>Leaving the SETTINGS menu</td>
</tr>
</tbody>
</table>

Tab. 1: Overview of parameter settings in the customer menu
2.5.3 CONF. PROGRAM menu (if enabled)

Function
The menu is for enabling menus for the user.
These options are available for each menu:

- ENABLE  The menu is enabled for the user
- DISABLE  The menu is hidden for the user

Setting parameters

1. In the CONF. PROGRAM menu, press the encoder once.
   - The first menu appears on the display.
2. Turn the encoder until the desired option has been reached.
3. Press the encoder once to confirm.
   - The option is saved and applied. The next menu appears on the display. The higher-level CONF. PROGRAM menu appears after the last PROGRAM menu.

The following menus can be enabled or hidden:

- TRIGGER
- HOLDING
- AFTER BURST DELAY
- AFTER BURST TIME
- WELD MODE REMOTE
- WELD MODE TIME
- WELD MODE ENERGY
- WELD MODE PEAK POWER
- WELD MODE PULSE
- CYCLE CONTROL OUTPUT
- T-WINDOW
- P-WINDOW
- E-WINDOW
- SOFT START
- SOFT OFF
- PROGRAM
- HW PROGRAMS
- PI REGLER/SCAN

2.5.4 FREQUENCY display

Function
Display of the operating frequency of the generator.
2.5.5  I-LIMITS menu (if enabled)

### Function

The menu is for setting the minimum and maximum current of the controller. This allows damage to the transducer system to be prevented. If a transducer is damaged, the generator is protected from excessive currents and switches off the ultrasonic output through the third parameter \( I_{\text{protect}} \).

The following parameters can be set:

- \( I_{\text{min}} \): Minimum current that can be set by the controller [digit].
- \( I_{\text{max}} \): Maximum current that can be set by the controller [digit].
- \( I_{\text{protect}} \): Maximum current that causes the ultrasonic output to be switched off [digit].

### Setting parameters

1. Press the encoder once in the I-LIMITS menu.
   - \( I_{\text{min}} \) and \( I_{\text{max}} \) appear on the display. The \( I_{\text{min}} \) value is displayed on a black background and can be set between 0 – 1023 digits.
2. Turn the encoder until to the desired value.
3. Press the encoder once to confirm.
   - The value is saved and applied.
   - The \( I_{\text{max}} \) value is displayed on a black background and can be set between 0 – 1023 digits.
4. Turn the encoder until to the desired value.
5. Press the encoder once to confirm.
   - The value is saved and applied.
6. \( I_{\text{protect}} \) appears on the display. The value is displayed on a black background and can be set between 0 – 1023 digits.
7. Turn the encoder until to the desired value.
8. Press the encoder once to confirm.
   - The value is saved and applied.
   - The higher-level I-LIMITS menu appears on the display.
2.5.6  PWM menu (if enabled)

**NOTE**

Before changing these settings:
- Get in touch with Xfurth Ltd.

Improper alterations can result in faulty operation and destruction of the generator or transducer system.

<table>
<thead>
<tr>
<th>Function</th>
<th>The menu is for setting the values for the PWM controller/pre-regulator. The following parameters can be set:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- PWM_Start  Setting the minimum value of the PWM control.</td>
</tr>
<tr>
<td></td>
<td>- PWM_Stop   Setting the maximum value of the PWM control.</td>
</tr>
<tr>
<td></td>
<td>- PWM_Step   Setting the increment of the PWM control.</td>
</tr>
</tbody>
</table>

**Setting parameters**

1. Press the encoder once in the PWM menu.
   - PWM\_Start and PWM\_Stop appear on the display. The PWM\_Start value can be adjusted (displayed on a black background).
2. Turn the encoder until the desired value is reached.
3. Press the encoder once to confirm.
   - The value is saved and applied.
4. Turn the encoder until the desired value is reached.
5. Press the encoder once to confirm.
   - The value is saved and applied.
6. PWM\_Step appears on the display. The value can be adjusted (displayed on a black background).
7. Turn the encoder until the desired value is reached.
8. Press the encoder once to confirm.
   - The value is saved and applied.

**The higher-level PWM menu appears on the display.**
2.5.7 TEMPERATURE menu (if enabled)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before changing these settings:</td>
</tr>
<tr>
<td>- Get in touch with Xfurth Ltd.</td>
</tr>
<tr>
<td>Improper alterations can result in faulty operation and destruction of the generator or transducer system.</td>
</tr>
</tbody>
</table>

**Function**

The current operating temperature of the generator [°C] appears on the display. The parameters for protecting the generator from overheating can be adjusted:

- **SHUTOFF** The generator is automatically switched off at an operating temperature of x°C.
- **FAN THRESH.** The fan is automatically switched on if the operating temperature set is exceeded or automatically switched off at a hysteresis threshold of 10 °C.

**Setting parameters**

1. Press the encoder once in the TEMPERATURE menu.
   - SHUTOFF and FAN THRESH. appear on the display. The SHUTOFF value can be set (displayed on a black background).
2. Turn the encoder until the desired value for SHUTOFF is reached (20 °C to 99 °C).
3. Press the encoder once to confirm.
   - The value is saved and applied. The FAN THRESH. value can be adjusted in the display (displayed on a black background).
4. Turn the encoder until the desired value is reached (20 °C to 99 °C).
5. Press the encoder once to confirm.
   - The value is saved and applied. The higher-level TEMPERATURE menu appears on the display.
2.5.8  F-LIMITS menu

**Function**  In this menu you can adjust the start and stop frequency of the controller's frequency band. This allows damage to the transducer system to be prevented. The two frequencies are normally determined automatically by means of the scan function. If the scan is not performed reliably, the parameters can be set manually in this menu.

The following parameters can be set:

- **F**\textsubscript{Search Dir}  Sets the frequency search direction for the generator functions "scan" and "PI controller"
- **F**\textsubscript{Max}  Maximum frequency of the generator [Hz]
- **F**\textsubscript{Min}  Minimum frequency of the generator [Hz]
- **F**\textsubscript{Start}  Start frequency of the transducer system [Hz]
- **F**\textsubscript{Stop}  Stop frequency of the transducer system [Hz]
- **F**\textsubscript{Start Offset}  Start frequency of the transducer system [Hz]
- **F**\textsubscript{Stop Offset}  Stop frequency of the transducer system [Hz]
### Setting F-LIMITS parameters

1. Press the encoder once in the F-LIMITS menu.
   - $F_{\text{Search Dir}}$ appears on the display.
The value can be adjusted (displayed on a black background).
2. Turn the encoder to the desired value.
3. Press the encoder once to confirm.
   - The value is saved and applied.
4. $F_{\text{Max}}$ and $F_{\text{Min}}$ appear on the display.
The $F_{\text{Max}}$ value can be adjusted (displayed on a black background).
5. Turn the encoder to the desired value.
6. Press the encoder once to confirm.
   - The value is saved and applied.
7. $F_{\text{Max}}$ and $F_{\text{Min}}$ appear on the display.
The $F_{\text{Min}}$ value can be adjusted (displayed on a black background).
8. Turn the encoder to the desired value.
9. Press the encoder once to confirm.
   - The value is saved and applied.
10. $F_{\text{Start}}$ and $F_{\text{Stop}}$ appear on the display.
The $F_{\text{Start}}$ value can be adjusted (displayed on a black background).
11. Turn the encoder to the desired value.
12. Press the encoder once to confirm.
   - The value is saved and applied.
13. $F_{\text{Start Offset}}$ and $F_{\text{Stop Offset}}$ appear on the display.
The $F_{\text{Start Offset}}$ value can be adjusted (displayed on a black background).
14. Turn the encoder to the desired value.
15. Press the encoder once to confirm.
   - The value is saved and applied.
   - The higher-level F-LIMITS menu appears on the display.
2.5.9  **PI CONTROL menu (if enabled)**

**NOTE**

Before changing these settings:
- Get in touch with Xfurth Ltd.

Improper alterations can result in faulty operation and destruction of the generator or transducer system.

**Function**

The menu is for setting the controller. The following parameters can be set:

- $K_P$ (0 – 65000)
- $K_I$ (0 – 65000)
- Limit $K_I$ (0 – 65000)
- $T_{Start}$ (off, 0 s – 1000 ms)
- Level 1 (0 – 100 %)
- Level 2 (0 – 100 %)

![Diagram](image)

Fig. 4: Application of parameters "Level 1", "Level 2" and "$T_{Start}$"
Setting parameters

1. Press the encoder once in the PI CONTROL menu.
   - \( K_P \) and \( K_i \) appear on the display. The \( K_p \) value can be adjusted (displayed on a black background).
2. Turn the encoder to the desired value.
3. Press the encoder once to confirm.
   - The value is saved and applied. The \( K_i \) value can be adjusted on the display (displayed on a black background).
4. Turn the encoder to the desired value.
5. Press the encoder once to confirm.
   - The value is saved and applied. The Limit \( K_i \) value can be adjusted on the display (displayed on a black background).
6. Turn the encoder to the desired value.
7. Press the encoder once to confirm.
   - \( T_{\text{Start}} \) appears on the display. The parameter can be adjusted.
8. Turn the encoder to the desired value.
9. Press the encoder once to confirm.
   - If a value greater than 0 is set for \( T_{\text{Start}} \), Level 1 and Level 2 appear on the display. The value for Level 1 can be adjusted (displayed on a black background).
10. Turn the encoder to the desired value.
11. Press the encoder once to confirm.
   - The value is saved and applied. The Level 2 value can be adjusted on the display (displayed on a black background).
12. Turn the encoder to the desired value.
13. Press the encoder once to confirm.
   - The value is saved and applied. The higher-level PI CONTROL menu appears on the display.
2.5.10 SCAN menu (if enabled)

**Function**
The scan function of the generator automatically determines the resonant frequencies of the connected systems. The scan is automatically started after every welding procedure in order to detect the resonance shift caused by heating.

After an adjustable time period, the scan is repeated in order to detect the resonance shift caused by cooling. This method allows the generator to determine the ideal starting frequency every time.

The scan can be started manually in this menu, e.g. following a sonotrode change. The time period until the scan is repeated can be adjusted.

The following parameters are set:
- **T Scan P** \( P = \) period
- **T Scan AW** \( AW = \) after welding (period of time after welding)
- **Multi Scan** selection of desired frequency of the transducer system
- **Mode:**
  - Normal Scan
  - Burst Mode
  - No Scan

**Setting parameters**

1. Press the encoder once in the SCAN menu.
   - **Action:** appears on the display.
2. Press the encoder once.
   - **T Scan P** and **T Scan AW** appear on the display. The **T Scan P** value can be adjusted (displayed on a black background).
3. Turn the encoder until the desired setting is displayed.
4. Press the encoder once to confirm.
   - The value is saved and applied.
5. Turn the encoder until the desired setting is displayed.
6. Press the encoder once to confirm.
   - The value is saved and applied.
7. **Multi Scan** appears on the display.
8. Turn the encoder until the desired setting is displayed.
9. Press the encoder once to confirm.
   - The value is saved and applied.
10. **Mode:** appears on the display.
11. Turn the encoder until the desired setting is displayed.
12. Press the encoder once to confirm.
   - The adjustment of the parameters is complete.
| Performing a manual scan | 1. Press the encoder once in the SCAN menu. 
| | | Action: appears on the display. 
| | 2. Turn the encoder and press it once in **Start Scan** in order to start the scan. 
| | | **Scanning**… appears on the display during scanning. 
| | | **Scan OK** or, in the event of an error, **Scan failed** appears on the display. 
| | 3. Press the encoder to confirm. 
| | | **The scan is complete.** |

| Manually performing a fast scan (if enabled) | 1. Press the encoder once in the SCAN menu. 
| | | Action: appears on the display. 
| | 2. Turn the encoder and press it once in **Start Fast Scan** in order to start the scan. 
| | | **Scanning**… appears on the display. 
| | | **Scan OK** or, in the event of an error, **Scan failed** appears on the display. 
| | 3. Press the encoder to confirm. 
| | | **The scan is complete.** |

| Temporarily deactivating the scan (if enabled) | 1. Press the encoder once in the SCAN menu. 
| | | Action: appears on the display. 
| | 2. Turn the encoder and set **!! Skip Scan !!** on the display. 
| | 3. Press the encoder once. 
| | | **Scan skipped** appears on the display. 
| | 4. Press the encoder to confirm. 
| | | **The scan is temporarily deactivated.** |

| Determining the neutral line (if enabled) | 1. Press the encoder once in the SCAN menu. 
| | | Action: appears on the display. 
| | 2. Turn the encoder and set **Neutral Line!** on the display. 
| | 3. Press the encoder once to start the scan. 
| | | **Scanning**… appears on the display. 
| | | **Scan done** appears on the display when the scan is complete. 
| | 3. Press the encoder to confirm. 
| | | **The scan is complete.** |
2.5.11 I/O POLARITIES menu (if enabled)

Function

This menu is for setting the polarities of the inputs and outputs. The following parameters can be set:

- REMOTE IN  HIGH or LOW option
- ERROR OUT  HIGH or LOW option
- RF-DETECT  HIGH or LOW option
- WINDOW OUT HIGH or LOW option
- ERROR QUIT  Generator-Start or Generator-Stop option

Setting parameters

1. Press the encoder once in the I/O POLARITIES menu.
   - REMOTE IN appears on the display.
2. Turn the encoder until the desired option has been reached.
3. Press the encoder once to confirm.
   - The value is saved and applied. ERROR OUT appears on the display.
4. Turn the encoder until the desired option has been reached.
5. Press the encoder once to confirm.
   - The value is saved and applied. RF-DETECT appears on the display.
6. Turn the encoder until the desired option has been reached.
7. Press the encoder once to confirm.
   - The value is saved and applied. WINDOW OUT appears on the display.
8. Turn the encoder until the desired option has been reached.
9. Press the encoder once to confirm.
   - The value is saved and applied. The higher-level I/O POLARITIES menu appears on the display.

ERROR QUIT at generator start

If "ERROR QUIT at generator start" is selected, the error is automatically reset (acknowledged) when the power output of the generator is restarted.

ERROR QUIT at generator stop

If "ERROR QUIT at generator stop" option is selected, the existing error is reset (acknowledged) when the remote signal falls to 0 or the START button is released (in PUSH mode).

This option is suitable for automatic processes in which the generator is operated via a control unit (PLC).
2.5.12 **A-SOURCE menu (if enabled)**

**Function**
The menu is for setting the signal source for the amplitude:
- from the front (e.g. MCU),
- from external voltage.

**Setting parameters**

1. Press the encoder once in the A-SOURCE menu.
   - AMPLITUDE ACCEPTED FROM appears on the display.
2. Turn the encoder until the desired option has been reached.
3. Press the encoder once to confirm.
   - The value is saved and applied. The higher-level A-SOURCE menu appears on the display.

2.5.13 **P-OUT menu (if enabled)**

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before changing these settings:</td>
</tr>
<tr>
<td>- Get in touch with Xfurth Ltd.</td>
</tr>
<tr>
<td>Improper alterations can result in faulty operation and destruction of the generator or transducer system.</td>
</tr>
</tbody>
</table>

**Function**
Setting the maximum power output of the generator.
The following parameters can be set:
- P-OUT  maximum power output of the generator [W]

**Setting parameters**

1. Press the encoder once in the P-OUT menu.
   - P-OUT appears on the display.
2. Turn the encoder until the desired option has been reached.
3. Press the encoder once to confirm.
   - The value is saved and applied. The higher-level P-OUT menu appears on the display.
2.5.14 SOFT START menu (if enabled)

Function
The transducer system is started with an amplitude of 50 %, which is increased in steps (STEP) within the time unit (TIME) until the programmed amplitude has been reached. This preserves sensitive transducer systems which would not be started at 100 % amplitude and the corresponding contact pressure.

The following parameters are set:
- S-START (ENABLE option = user may change settings, DISABLE option = the SOFT START menu is hidden to the user)
- STEP x% (increment value per time unit (0 to 50 %))
- TIME ys (time unit, min. 0.01 s to max. 2.55 s, setting 0.00 s = OFF)

Setting parameters

1. Press the encoder once in the SOFT START menu.
   - The current setting ENABLE or DISABLE appears on the display.
2. Turn the encoder until the desired option has been reached.
3. Press the encoder once to confirm.
   - The value is saved and applied:
     - DISABLE = display shows the higher-level SOFT START menu,
     - ENABLE = STEP and TIME appear on the display. The STEP value can be set in the display (displayed on a black background).

Setting the STEP parameter

1. Press the encoder once to change the setting.
2. Turn the encoder until the desired setting (min. 1 %) of the STEP increment value per time value is displayed.
3. Press the encoder once to confirm.
   - The increment value is saved and applied and the time unit can now be set.

Setting the TIME parameter

1. Turn the encoder until the desired time unit setting is displayed (min. 0.01 s to max. 2.55 s).
2. Press the encoder once to confirm.
   - The time unit setting is saved and applied.

The procedure for setting SOFT START is complete.
2.5.15 **SOFT OFF menu (if enabled)**

**Function**
The output voltage is slowly reduced during the time period (TIME).
This protects sensitive transducer systems.

The following parameters are set:

- S-START (ENABLE option = user may change settings,
  DISABLE option = the SOFT START menu is hidden to the user)
- TIME ys (time unit, min. 0.01 s to max. 2.55 s, setting 0.00 s = OFF)

**Setting parameters**

1. Press the encoder once in the SOFT START menu.
2. Turn the encoder until the desired option has been reached.
3. Press the encoder once to confirm.

- The current setting ENABLE or DISABLE appears on the display.
- The value is saved and applied:
  - DISABLE = display shows the higher-level SOFT OFF menu,
  - ENABLE = TIME appears on the display
  - The TIME value can be set on the display
  (displayed on a black background).

**Setting the TIME parameter**

1. Turn the encoder until the desired time unit setting is displayed
   (min. 0.01 s to max. 2.55 s).
2. Press the encoder once to confirm.

- The time unit setting is saved and applied.
- The procedure for setting SOFT START is complete.

2.5.16 **TEST BUTTON menu (if enabled)**

**Function**
The function of the ON/OFF button on the control element (e.g. MCU) is defined in this menu.

The following options are available:

- **PUSH**
  - Generator ON = hold down the ON/OFF button
  - Generator OFF = release the ON/OFF button
- **TOGGLE**
  - Generator ON = press the ON/OFF button once
  - Generator OFF = press the ON/OFF button again
- **DISABLED**
  - ON/OFF button has no function

**Setting parameters**

1. Press the encoder once in the TEST BUTTON menu.
2. Turn the encoder until the desired option has been reached.
3. Press the encoder once to confirm.

- The current setting appears on the display.
- The option is saved and applied. The higher-level TEST BUTTON menu appears on the display.
2.5.17  STATUS menu (if enabled)

**Function**  The status of the generator is defined in this menu.

The following options are available:

- **NOT CONFIGURED**  The generator cannot be switched on. Setting for commissioning or maintenance of the generator.
- **CONFIGURED**  Generator can be switched on, all enabled menus are available.
- **LOCKED**  Generator can be switched on, but parameters cannot be altered.
- **TOOL 100**  Disables / enables program 100 (default program) for changes by the user.

**Setting parameters**

1. Press the encoder once in the STATUS menu.
   □ The current setting appears on the display.
2. Turn the encoder until the desired option has been reached.
3. Press the encoder once to confirm.
   □ The option is saved and applied and TOOL 100 appears on the display.
4. Turn the encoder until the desired option has been reached.
5. Press the encoder once to confirm.
   □ The option is saved and applied. The higher-level STATUS menu appears on the display.

2.5.18  SENSORICS display (if enabled)

**Function**  Displays the externally defined analogue amplitude.

**Calling up the display**

1. Press the encoder once in the INFO menu.
   □ A display appears.
2. Press the encoder once.
   □ The higher-level SENSORICS menu appears on the display.
2.5.19 MODULE menu (if enabled)

**Function**
This menu allows you to access an optional module. The following functions are set:

- **HW-Tooling**
  Defining a binary program number which is switched over to after the generator has started.
  Four 24 V inputs are available for this purpose.

- **RS485**
  Setting the IP address of the RS485 interface.

*See the chapter RS485 interface.*

**Setting parameters**

1. Press the encoder once in the MODULE menu.

   - MODULE NOT AVAILABLE or
   - MODULE AVAILABLE appears on the display.

2. Press the encoder once in the MODULE AVAILABLE submenu.

   - PROGRAM No. appears on the display with the currently active program.

3. Press the encoder once.

   - IP-ADDRESS appears on the display.

4. Turn the encoder until the desired value appears.

5. Press the encoder once to confirm.

   - The value is saved and applied.
   - The higher-level MODULE menu appears on the display.

2.5.20 INFO display

**Function**
Display of version numbers:

- Fro.Sw = software version number of the front plate
- Gen.Sw = software version number of the generator
- Ser. No. = serial number of the generator
- Assemb. = manufacturing date of the generator

**Calling up the display**

1. Press the encoder once in the INFO menu.

   - A display appears.

2. Press the encoder once.

   - The higher-level INFO menu appears on the display.

2.5.21 EXIT menu

1. Press the encoder once.

   - The higher-level SETTINGS menu appears on the display.
3 Error messages

3.1 Error table

<table>
<thead>
<tr>
<th>Error Nr.</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Error</td>
</tr>
<tr>
<td>1</td>
<td>Temperature Error</td>
</tr>
<tr>
<td>2</td>
<td>A Protect</td>
</tr>
<tr>
<td>3</td>
<td>No Rf Detect</td>
</tr>
<tr>
<td>4</td>
<td>Cycle Not Completed</td>
</tr>
<tr>
<td>5</td>
<td>F-Search</td>
</tr>
<tr>
<td>6</td>
<td>T-Window</td>
</tr>
<tr>
<td>7</td>
<td>P-Window</td>
</tr>
<tr>
<td>8</td>
<td>E-Window</td>
</tr>
<tr>
<td>9</td>
<td>Choose a program</td>
</tr>
<tr>
<td>10</td>
<td>Generator not configured</td>
</tr>
<tr>
<td>11</td>
<td>Data invalid</td>
</tr>
<tr>
<td>12</td>
<td>Interrupt Error</td>
</tr>
<tr>
<td>13</td>
<td>No Transducer while Start</td>
</tr>
<tr>
<td>14</td>
<td>Multiresonance detected</td>
</tr>
</tbody>
</table>

Tab. 2: Error table

Error 1 – TEMPERATURE REACHED

The generator is too hot

Possible causes
- The generator's ventilation slits are covered
- Unsuitable generator location
- Transducer is defective
- Fan is defective

Remedy
- Check the air supply and air extraction of the generator: the fan must be mounted facing down or to the side
- Check the transducer
Error 2 – A-PROTECT ACTIVE

The electronic overcurrent protection has detected an error.

Possible causes
- Transducer is defective.
- Supply cable or plug is defective.

Remedy
1. Unscrew the transducer connector on the housing.
2. Switch on the generator without the transducer being connected.
   - Error message still displayed: generator is defective.
   - Error message disappears: check the transducer and power supply.

Error 3 – NO RF DETECTED

The electronic overload/short-circuit protection has detected an error.

Possible causes
- Transducer is defective.
- Supply cable or plug is defective.

Remedy
1. Unscrew the transducer connector on the housing.
2. Switch on the generator without the transducer being connected.
   - Error message still displayed: generator is defective.
   - Error message disappears: check the transducer and power supply.

Error 4 – CYCLE NOT COMPLETE

Possible causes
- The welding cycle was not completed.
- EMERGENCY STOP button has been pressed.

Remedy
For welding mode
- Time
- Energy
- Peak Power

Activate the REMOTE input until the end of the hold time
or
Press and hold down the TEST button until the end of the hold time.
Press the EMERGENCY STOP button.
Error 5 – SEARCH

The generator cannot find the operating frequency.

Possible causes

- No transducer system is connected.
- Transducer system is defective.
- Supply cable or plug is defective.

Remedy

- Connect or replace the transducer system.
- Check the power supply and connections.

Error 6 – T-WINDOW

Cause

The limit values of the T-WINDOW were violated during welding.

Remedy

- Check all mechanical process parameters and, if necessary, correct them:
  e.g. welded part bearing, transducer system, pressure ...
- Compare the power output values with the programmed values via the RUNNING screen.

Error 7 – P-WINDOW

Cause

The limit values of the T-WINDOW were violated during welding.

Remedy

- Check all mechanical process parameters and, if necessary, correct them:
  e.g. welded part bearing, transducer system, pressure ...
- Compare the power output values with the programmed values via the RUNNING screen.

Error 8 – E-WINDOW

Cause

The limit values of the E-WINDOW were violated during welding.

Remedy

- Check all mechanical process parameters and, if necessary, correct them:
  e.g. welded part bearing, transducer system, pressure ...
- Compare the power output values with the programmed values via the RUNNING screen.

Error 9 – CHOOSE PROG

Cause

The current program has been deleted, the invalid program no. 0 is now selected.

Remedy

Select a valid program.
Error 10 – GENERATOR NOT CONFIGURED

**Cause**  
The generator is disabled as it is not configured. The settings must be made by a trained member of staff, which then enable the generator.

**Remedy**  
Contact Xfurth Ltd Service.

Error 11 – DATA INVALID

**Cause**  
Faulty communication via RS485. Parameters are described that are not enabled, or the values are outside the tolerance limits.

**Remedy**  
Check the communication string.
Check whether you can adjust the parameters you wish to transfer to the generator via the RS485 using the hand-held control unit. If necessary, enable the function in the settings.

Error 12 – INTERRUPT ERROR

**Cause**  
Error in process handling

**Remedy**  
Please make a note of the conditions that caused this error and inform Xfurth Ltd Service.

Error 13 – NO TRANSDUCER DURING START

**Cause**  
No transducer connected, no scan started after changing the transducer or transducer defective.

**Remedy**  
Start the scan via the manual control unit, RS485 or by disconnecting the power supply for approx. 30 seconds.
Check the electrical connection to the transducer.
Remove any residue from the transducer.
Have Xfurth Ltd Service check the transducer.

Error 14 – MULTIRESONANCE DETECTED

**Cause**  
The scan has detected multiple resonant frequencies in the set frequency range.

**Remedy**  
Reduce the frequency range and start the scan again.
4 RS485 interface

The RS485 interface is designed for serial data transfer over long distances (up to 500 metres) and is used for industrial applications. The connection concept of the Xfurth Ltd RS485 interface is bi-directional.

Fig. 5: Schematic diagram of the interface

1) Housing with one generator

4.1 Interface

4.1.1 9-pole D-SUB socket

Pin assignment of the 9-pole D-SUB socket (e.g. for Xfurth Ltd DIN rail generators)

<table>
<thead>
<tr>
<th>Pin no.</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td>4</td>
<td>D+</td>
</tr>
<tr>
<td>9</td>
<td>D-</td>
</tr>
</tbody>
</table>

4.2 Pre-setting

The interface is pre-set to:

- 38400 baud
- 8 data
- No parity
- 1 stop bit
4.3 The master-slave principle

4.3.1 Introduction

The RS485 interface handles the communication between
- host control system = master (PC or other control systems) and
- generator(s) = slave.

A generator only responds when it is queried.

INFO

A generator responds within approximately 20 ms.
If no response is issued within this time, the host control system must send a new inquiry (telegram).

4.3.2 Master-slave communication

The host sends a telegram to the generator, and the generator responds. This telegram can be operated in cycles, i.e. it can be sent every 20 ms.

Error caused by host control system

If the host control system commences a new communication (<START OF TEXT>) during the response time, the generator discards its response and does not respond.

Error detected by generator

If the generator detects a transmission error, it still responds with its response telegram but ignores the telegram received.
4.4 **Telegram**

In the following text and examples, hexadecimal numbers are identified by the prefix 0x or an h immediately after the number. Decimal numbers are displayed without a prefix or suffix or with a d immediately following the number.

A telegram consists of the following components:

<START OF TEXT> (start of telegram) (SOT)
<Data> ... <Data>
<Checksum, 2 characters> (CS)
<END OF TEXT> (end of telegram).

4.4.1 **Start of text**

The <START OF TEXT> character is:

<table>
<thead>
<tr>
<th>Character</th>
<th>Hex</th>
<th>Decimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;$&gt;</td>
<td>0x24</td>
<td>36</td>
</tr>
</tbody>
</table>

Tab. 3: The START OF TEXT character

When a generator receives this character, the telegram commences for that generator.

If a generator receives <START OF TEXT> again during a telegram,
- it discards all characters received during the first telegram and
- starts with the new telegram.

**Data**

The data controls the action.

Data is displayed in hexadecimal form.

**Example** The value 1000d is transmitted as 03E8h ("30" "33" "45" "38").
4.4.2 Checksum

A checksum with 2 characters is integrated in the telegram. The checksum guarantees the integrity of the data during data transmission.

**Calculation**
- All characters from `<START OF TEXT>` (inclusive) up to the last data entry are added together producing a hexadecimal value,
- carryover values are discarded,
- the byte with the lowest value makes up the checksum.

**Example**
This example demonstrates how the checksum is calculated on the basis of the first parameters.

<table>
<thead>
<tr>
<th>Function</th>
<th>Value</th>
<th>Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control byte</td>
<td>0x01</td>
<td>Data valid bit set</td>
</tr>
<tr>
<td>Amplitude</td>
<td>0x64</td>
<td>100 % amplitude</td>
</tr>
<tr>
<td>Trigger delay</td>
<td>0x123</td>
<td>2.91 s trigger delay</td>
</tr>
</tbody>
</table>

*Tab. 4:

<table>
<thead>
<tr>
<th>Designation</th>
<th>ASCII</th>
<th>Hex</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOT</td>
<td>$</td>
<td>0x24</td>
</tr>
<tr>
<td>Control byte</td>
<td>1</td>
<td>0x31</td>
</tr>
<tr>
<td>Amplitude</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Byte 1</td>
<td>6</td>
<td>0x36</td>
</tr>
<tr>
<td>Amplitude</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Byte 2</td>
<td>4</td>
<td>0x34</td>
</tr>
<tr>
<td>Trigger delay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Byte 1</td>
<td>1</td>
<td>0x31</td>
</tr>
<tr>
<td>Trigger delay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Byte 2</td>
<td>2</td>
<td>0x32</td>
</tr>
<tr>
<td>Trigger delay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Byte 3</td>
<td>3</td>
<td>0x33</td>
</tr>
</tbody>
</table>

*Tab. 5:

Addition of hexadecimal values:

\[ 0x24 + 0x31 + 0x36 + 0x34 + 0x31 + 0x32 + 0x33 = 155 \]

Discarding of carryover value \( 155 \rightarrow 55 \)

Checksum \( 55 \)

Telegram \$164123......55<cr>
4.4.3 End of text

The character for <END OF TEXT> (end of telegram) is:

<table>
<thead>
<tr>
<th>Character</th>
<th>Hex</th>
<th>Decimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;cr&gt;</td>
<td>0x0D</td>
<td>13</td>
</tr>
</tbody>
</table>

*Tab. 6: The END OF TEXT character*

When a generator receives this character, the telegram ends for that generator.
4.5 General communication

Communication to the generator is designed for cyclical communication. This can take place every 20 ms. It is vital that the host waits for the answer of the generator!

When the generator receives a telegram (SOT ... EOT), it calculates the checksum and compares this with the received checksum.

- If the checksums are identical, the telegram is processed further;
- if they are not identical, the telegram is rejected.

A response will be sent regardless of whether the received telegram was valid.

There is no confirmation of whether the received telegram was valid. The status byte informs the host of whether the commands were executed.

Please note: if the EOT byte is corrupted during communication, the generator does not respond, as from its perspective the telegram is not yet finished. The host must then send the telegram again after a timeout of 20 ms.

Attention:

Please note that the functions on the generator are also enabled for the parameters described here.

For example, no T-window low and T-window high parameters can be transmitted (values not equal to 0) if the T-window function on the generator is disabled:

- The generator then switches to fault mode and displays the text "Data invalid" on the hand-held control unit.
- It sets the error flag in the response telegram.
- It sets the corresponding error code in the error byte.

4.5.1 Communication – power on

Attention:

The transmitted data is not saved persistently in the generator. This means that each time the generator is switched on (power on), the data must be loaded on the generator again. After the power is switched on, the data that was last set using the control element is present on the generator.

After switching the power on, the ready bit in the status byte is set to 0. This indicates to the host that no valid data has been loaded from the host.

The host now communicates with the generator, as described in the chapter Communication – transmitting parameters, unless the ready bit is already 0 and therefore does not need to be set to 0.
4.5.2 Communication – transmitting parameters

If the host wishes to change the parameters on the generator, it sets the data valid bit in the control byte to 0. The other parameters are not taken into account at this point.

If the string is OK, the generator sets the ready bit in the status byte to 0.

The host now checks that the ready bit in the status byte of the received data string is 0.

- If it is not 0, the string must be sent from the host again, as it is possible that the previous string was a communication error.
- If the ready bit in the status byte is now 0, the host sets the data valid bit in the control byte to 1 and sets the parameters to the desired values. The string is then sent to the generator until the ready bit of the status byte of the received telegram is set to 1. The parameters have then been saved successfully.

If in the response telegram the error flag = 1 and the error byte with the error code 0x0B are received in the status byte, an attempt is made to write incorrect values to the generator or to describe parameters that are not enabled.

The host must now correct the parameters in its string and reset the error on the generator.

For this purpose, the error acknowledgement bit in the control byte is set to 1. When the string is sent, the generator resets the error (error flag in the status byte is set to 0 and the error byte is also set to 0). The host subsequently sets the error acknowledgement bit in the control byte to 0.

4.5.3 Communication – acknowledging an error

The host checks the error flag in the status byte within the received data string.

- If this is 0, there is no error on the generator.
- If this is 1, there is an error on the generator.
  The error byte shows the error code in accordance with the errors table.

If the host wishes to reset the error, it sets the error acknowledgement bit in the control byte to 1. As a result of this, the generator sets the error flag in the status byte to 0 and the error byte also to 0. The host then sets the error flag in the control byte to 0 again and the error is acknowledged.

4.5.4 Communication – starting the generator

If the host wishes to start the generator, the generator start bit in the control byte is set to 1. The generator starts welding and sets the generator running bit in the status byte to 1.

Once the welding process is complete, the generator sets the generator running bit in the status byte to 0. The host then sets the generator start bit in the control byte to 0.

Attention:

It is not recommended to start the generator via serial communication. If communication to the generator is interrupted, the generator only switches off after three seconds. In the event of an emergency stop this may be too long.
### 4.6 Data string – host to generator

The following table explains the data string sent from the host to the generator.

<table>
<thead>
<tr>
<th>Char.</th>
<th>Parameter</th>
<th>No. of bytes</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>$</td>
<td>Start of text</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>Control byte</td>
<td>1</td>
<td>Bit 0  data valid&lt;br&gt;Bit 1 generator start&lt;br&gt;Bit 2  frequency scan&lt;br&gt;Bit 3  error acknowledgement</td>
</tr>
<tr>
<td>bb</td>
<td>Amplitude</td>
<td>2</td>
<td>50 % to 100 %</td>
</tr>
<tr>
<td>ccc</td>
<td>Trigger delay</td>
<td>3</td>
<td>0.00 ... 9.99 s&lt;br&gt;0 = function off</td>
</tr>
<tr>
<td>d</td>
<td>Welding mode</td>
<td>1</td>
<td>0 = remote&lt;br&gt;1 = time&lt;br&gt;2 = energy mode&lt;br&gt;3 = peak power mode</td>
</tr>
<tr>
<td>eee</td>
<td>Welding time</td>
<td>3</td>
<td>0.01 s ... 9.99 s</td>
</tr>
<tr>
<td>ffff</td>
<td>Energy</td>
<td>4</td>
<td>1 Ws … 65000 Ws</td>
</tr>
<tr>
<td>gggg</td>
<td>Peak power</td>
<td>4</td>
<td>1 W … 9000 W</td>
</tr>
<tr>
<td>hhh</td>
<td>T-window low</td>
<td>3</td>
<td>0.01 s ... 9.99 s&lt;br&gt;0 = function off</td>
</tr>
<tr>
<td>iiii</td>
<td>T-window high</td>
<td>3</td>
<td>0.01 s ... 9.99 s&lt;br&gt;0 = function off</td>
</tr>
<tr>
<td>jjjj</td>
<td>P-window low</td>
<td>4</td>
<td>0 ... 9000 W&lt;br&gt;0 = function off</td>
</tr>
<tr>
<td>kkkk</td>
<td>P-window high</td>
<td>4</td>
<td>0 ... 9000 W&lt;br&gt;0 = function off</td>
</tr>
<tr>
<td>llll</td>
<td>E-window low</td>
<td>4</td>
<td>0 ... 65000 Ws&lt;br&gt;0 = function off</td>
</tr>
<tr>
<td>mmmm</td>
<td>E-window high</td>
<td>4</td>
<td>0 ... 65000 Ws&lt;br&gt;0 = function off</td>
</tr>
<tr>
<td>nnn</td>
<td>Holding time</td>
<td>3</td>
<td>0.00 s ... 9.99 s&lt;br&gt;0 = function off</td>
</tr>
<tr>
<td>ooo</td>
<td>After burst delay</td>
<td>3</td>
<td>0.00 s ... 9.99 s&lt;br&gt;0 = function off</td>
</tr>
<tr>
<td>ppp</td>
<td>After burst pulse</td>
<td>3</td>
<td>0.00 s ... 29.99 s&lt;br&gt;0 = function off</td>
</tr>
<tr>
<td>qqqq</td>
<td>Start frequency</td>
<td>4</td>
<td>1...65535 Hz</td>
</tr>
<tr>
<td>rrrr</td>
<td>Stop frequency</td>
<td>4</td>
<td>1 ...65535 Hz</td>
</tr>
<tr>
<td>00000</td>
<td>Filling bytes with 0</td>
<td>5</td>
<td>Filling bytes with 0</td>
</tr>
<tr>
<td>ss</td>
<td>Checksum</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>0x0D</td>
<td>End of text</td>
<td>1</td>
<td>&lt;cr&gt;</td>
</tr>
</tbody>
</table>

Tab. 7: Data string– host to generator
4.7 Response string – generator to host

The following table explains the response string sent from the generator to the host.

<table>
<thead>
<tr>
<th>Char.</th>
<th>Parameter</th>
<th>No. of bytes</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>Start of text</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
| A     | Status byte | 1            | Bit 0  ready bit  
|       |            |              | Bit 1  generator running  
|       |            |              | Bit 2  frequency scan running  
|       |            |              | Bit 3  error flag |
| bb    | Error byte | 2            | Error code 00 … see Error Table |
| cccc  | Current frequency | 4          | 0.. 65000 Hz |
| dd    | Temperature | 2            | 0 … 100 °C |
| eeee  | Power output | 4            | 0 … 9000 W |
| ffff  | Maximum power output | 4          | 0 … 9000 W |
| ggg   | Welding time | 3            | 0.00 … 9.99 s |
| hhhh  | Energy | 4            | 0 … 65000 Ws |
| ii    | Ext. amplitude | 2           | 50 … 100 % |
| jjjj  | Current start frequency | 4        | 0… 65000 Hz |
| 00    | Filling bytes with 0 | 2          | Filling bytes with zero |
| kk    | Checksum | 2            |        |
| 0x0d  | End of text | 1            |        |

Tab. 8: Response string – generator to host
4.8 Control and status bytes sequences

4.8.1 Power on

![Diagram for Power on bytes sequences]

Fig. 6: Power on bytes sequences

4.8.2 Changing program data

![Diagram for Sequence for changing program data]

Fig. 7: Sequence for changing program data

4.8.3 Generator start

![Diagram for Generator start sequence]

Fig. 8: Generator start sequence
## 4.8.4 Error acknowledgement

![Error acknowledgement sequence diagram]

**Fig. 9:** Error acknowledgement sequence
5 SERVICE

Spare parts
Spare parts and accessories can only be supplied if the serial number of the device is specified.

Service hotline
Should you still have any questions after having carefully read the operating instructions, call our service hotline.

Please have the following information to hand to help us answer your questions quickly:
Device type and serial number (you find the serial number on the generator's front or rear panel and base plate. It can also be called up in the graphical display under Info).

Our service hotline number:

+44 (0) 191 416 8884