STER WELDING MONITOR

QUICK START MANUAL

STUDIO ELEKTRONIKE RIJEKA

STER WELDING MONITOR

STER WELDING MONITOR Quick Start Manual rev. 1.0.2557

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CE Mark on your equipment certifies that this equipment meets the requirements of the EU (European Union) concerning safety and interference causing equipment regulations

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Document Revisions Record

Revision	DESCRIPTION OF CHANGE	APPROVED BY	DATE APPROVED
1.0.1410	Initial publication	DB	2012-12-12
1.0.1532	Updated with: ▪ Aligned with firmware version 1.0.275 ▪ STERWeld Configuration tool	DB	2013-03-11
1.0.1538	Fixed: Labels for current clamp sockets	DB	2013-03-14
1.0.1541	Updated with: ▪ Printer maintenance instructions	DB	2013-03-18
1.0.1642	Update: ▪ Troubleshooting instructions ▪ List of supplied accessories	DB	2013-05-09
1.0.1750	Update: ▪ Printing setup screen, welding length settings ▪ STERWeld Configuration tool startup screen	DB	2013-07-08
1.0.2052	Additional safety recommendations before connecting the printing unit	DB	2014-07-28
1.0.2335	Updated Measurement Setup options (average calculation method selection)	DB	2016-02-24
1.0.2557	Updated Technical Specifications (measurement accuracy)	DB	2016-11-29

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1 Introduction

STER Welding Monitor is a system for performing and analyzing welding measurements. It consists of the STERWeld portable measuring unit, a Printing unit and STER Welding Monitor configuration software.

1.1 STERWELD PORTABLE WELDING MEASUREMENT UNIT

STERWeld is a portable, handheld welding measurement unit, capable of measuring up to 4 single ended inputs (common welding ground) voltages and 4 welding currents simultaneously.

It is designed to provide an easy to setup solution for welding measurements, recording and printing. Each unit is equipped with a rechargeable battery pack (10 hours of autonomy with supplied batteries), 8MB of internal flash memory (sufficient for storing 16 hours of measurements at 1s resolution, expandable to up to 32GB), and several options for instant measurement printing, as well as PC download and analysis.

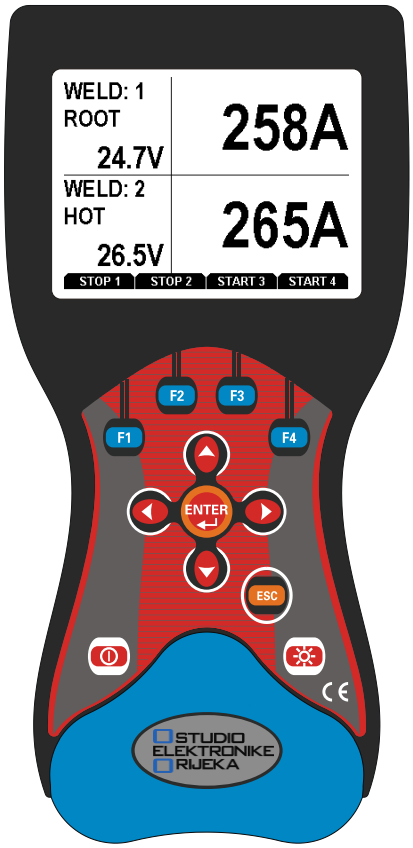


Figure 1.1: STERWeld device

1.1.1 MAIN FEATURES

- 4 voltage channels with wide measurement range: 0 ÷ 1000 Vrms, CAT III / 1000 V.
- 4 current channels with 1000 A, AC/DC range.
- Simultaneous 8 channels - 16bit AD conversion for accurate power measurements.
- Up to 10 hours of autonomous (battery) supply.
- 8Mb of internal flash memory for 16 hours of measurements (min/avg/max), or up to 32Gb of external flash memory (SD card) for practically unlimited measurement capacity (6 years at 1 measurement per second).

1.2 PRINTING UNIT WITH 4 DOT-MATRIX PRINTERS

STER Welding Monitor comes bundled with several variants of printing units. The default printing unit contains 4 separate dot-matrix printers, allowing simultaneous tracking of 4 separate welding points using a single STERWeld device. There is a battery backup sufficient for four hours of continuous printing operation embedded in the printing unit.

A connection of STERWeld and a printing unit is accomplished via single cable - to reduce cabling on a welding station, the power supply for the handheld measurement device is provided by printing unit through a single power/communication cable. Both 230V/50Hz and 110V/60Hz system can be used for powering the STERWeld monitor system.

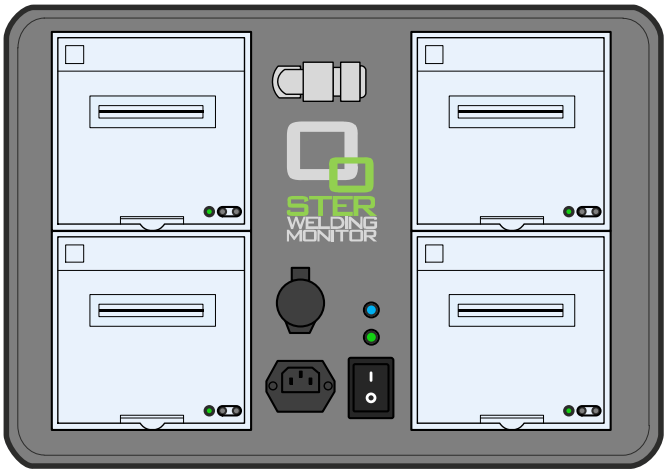


Figure 1.2: Printing unit with 4 dot-matrix printers

1.3 SAFETY CONSIDERATIONS

To ensure operator safety while using the STERWeld instruments and to minimize the risk of damage to the instrument, please note the following general warnings:

- The instrument is designed to ensure maximum operator safety. Usage in a way other than specified in this manual may increase the risk of harm to the operator!
- Do not use the instrument and/or any accessories if there is any damage visible!
- The instrument contains no user serviceable parts. Only an authorized dealer can carry out service or adjustment!
- All normal safety precautions have to be taken in order to avoid risk of electric shock when working on electrical installations!
- Only use approved accessories available from your distributor!
- Instrument contains rechargeable NiMh batteries. The batteries should only be replaced with the same type as defined on the battery placement label or in this manual. Do not use standard batteries while power supply adapter/charger is connected, otherwise they may explode!
- Hazardous voltages exist inside the instrument. Disconnect all test leads, remove the power supply cable and switch off the instrument before removing battery compartment cover.
- In hot (> 40 °C) environments, the battery lid screw might reach the maximum allowed temperature for metal part of handle. In such environment it is advisable not to touch the battery cover during or immediately after the charging.
- Maximum voltage between any phase and neutral input is 1000 V_{RMS}. Maximum voltage between phases is 1730 V_{RMS}.
- Always short unused voltage inputs (L1, L2, L3, L4) with the ground (GND) input to prevent measurement errors and false event triggering due to noise coupling.

1.4 APPLICABLE STANDARDS

STER WELDING MONITOR device is designed and tested in accordance with the following standards:

Electromagnetic compatibility(EMC)	
EN 61326-2-2: 2006	Electrical equipment for measurement, control and laboratory use. Emission: Class A equipment (for industrial purposes) Immunity for equipment intended for use in industrial locations
Safety (LVD)	
EN 61010-1: 2001	Safety requirements for electrical equipment for measurement, control and laboratory use
Measurement methods	
Voltage and current	Effective and mean values
Energy and heat input	Instantaneous energy measuring principle as specified by ASME-IX 2010 QW-409.1(c)(1) and non-mandatory appendix H.

NOTE ABOUT EN AND IEC STANDARDS:

Text of this manual contains references to European standards. All standards of EN 6XXXX (e.g. EN 61010) series are equivalent to IEC standards with the same number (e.g. IEC 61010) and differ only in amended parts required by European harmonization procedure.

2 Welding Monitor components

2.1 STERWELD MEASUREMENT UNIT FRONT PANEL

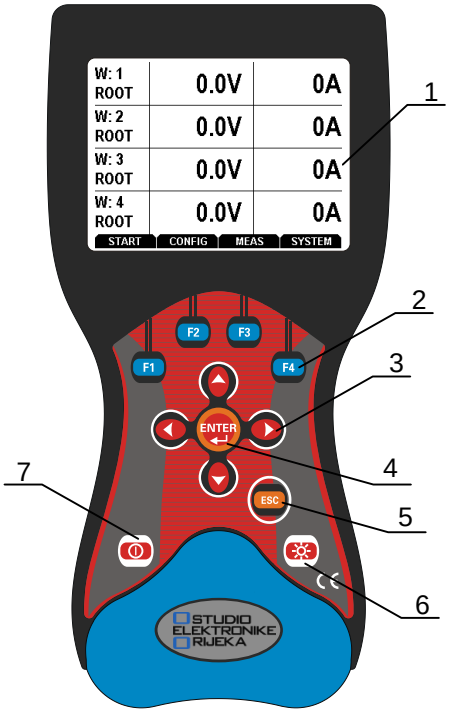
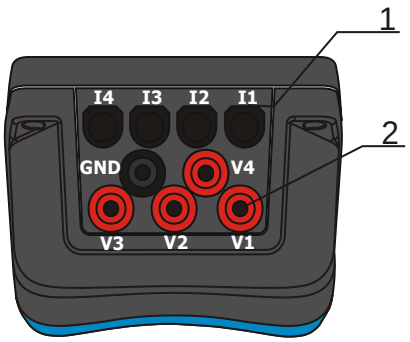


Figure 2.1: STERWeld handheld device - front panel

Front panel layout:

1	LCD	Graphic display with LED backlight, 320 x 200 pixels.
2	F1 – F4	Soft function keys. Active function is indicated for each screen separately, at the bottom of the LCD display.
3	ARROW keys	Move cursor and select parameters.
4	ENTER key	Accept new settings, step into a submenu.
5	ESC key	Exit any procedure, or exit from a submenu back to the previous menu.
6	LIGHT key	LCD backlight on/off and contrast key (backlight automatically turns off after 15 minutes if no key action occurs). For changing contrast hold the key down until *SET CONTRAST* dialog box appears.
7	ON-OFF key	Turn the instrument on/off.

2.2 CONNECTOR PANEL



⚠ Warning!

Use safety test leads only!

Max. permissible voltage between voltage input terminals and ground is 1000 V_{RMS}.

Max. permissible voltage between voltage input terminals is 1730 V_{RMS}.

Never connect current clamp cables to connectors other than these top front connectors.

Figure 2.2: Top connector panel

Top connector panel layout:

1	CURRENT TERMINALS	Current input terminals (I_1, I_2, I_3, I_4).
2	VOLTAGE TERMINALS	Voltage input terminals (V_1, V_2, V_3, V_4, GND).

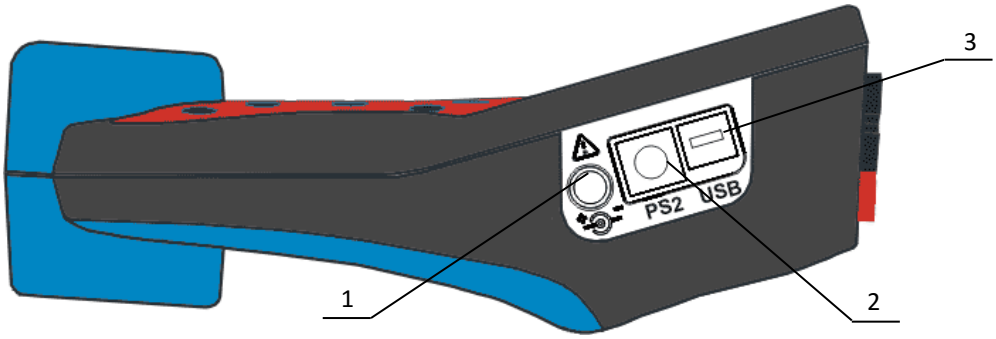


Figure 2.3: Side connector panel

Side connector panel layout:

1	Power/printer communication connector	Composite connector for the communication with the printing unit and power supply input when the device is connected to the printing unit. If the unit is not connected to the printing unit then the external power supply (12 VDC, 1.2A) is used.
2	PS2-type spare connector	Spare communication connector (reserved for future use)
3	USB/serial PC/maintenance connector	USB or serial link for download of recorded measurements to a PC using the STERWeld Monitor configuration tool, or for device diagnostics.

⚠ Only connect the power supply cable, or the printer communication cable to the socket 1 on the side connector panel. Connecting other cables which might fit this socket (like current clamps) to this socket may damage the device and clamps.

⚠ To avoid damaging the equipment when the printing unit is used, always connect the printer communication cable **before** connecting measurement leads (voltage, current).

⚠ To avoid damaging the device or other components, use only the cables and adapters provided with the device. Even when standard connectors may have their terminals arranged differently from common wirings to allow additional signals (like power supply), and are NOT SUITED for use with PC or similar equipment.

2.3 BOTTOM VIEW

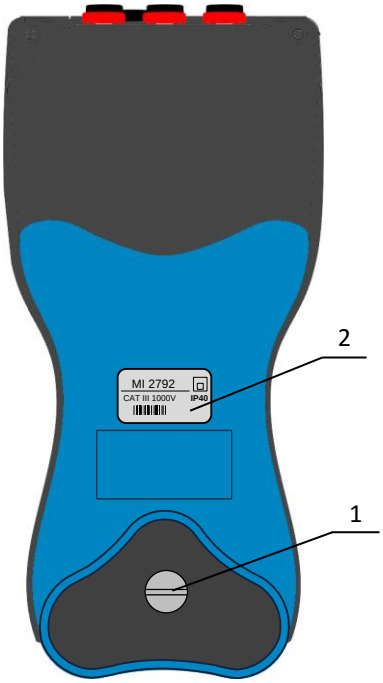


Figure 2.4: Bottom view

Bottom view layout:

1	Battery compartment	To replace the batteries, unscrew the lid screw using a large screwdriver or a coin. Refer to the *Maintenance* chapter for details.
2	Serial number label	Device serial number.

Warning! Refer to the *Maintenance* chapter for details about replacing the batteries. Never replace the batteries while the device is connected to the power supply and measurement leads.

2.4 PRINTING UNIT COMPONENTS

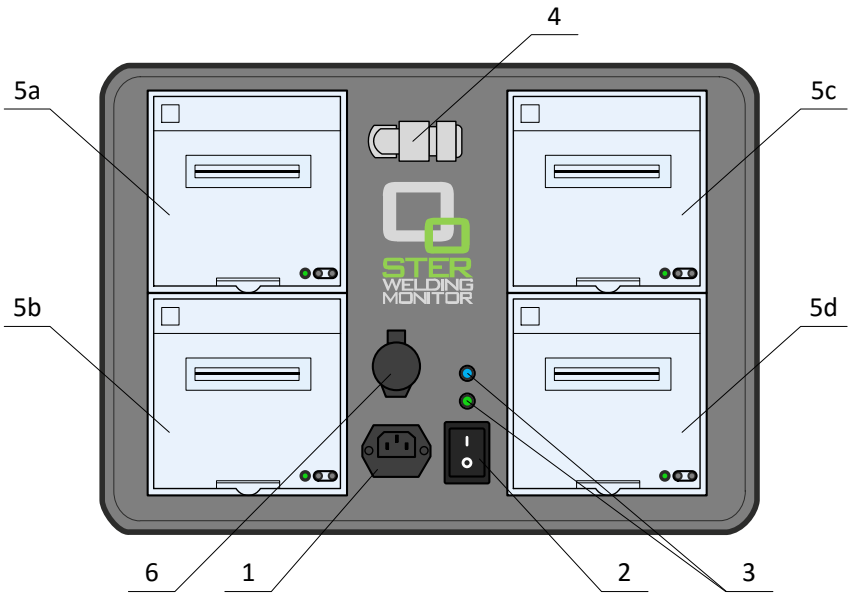


Figure 2.5: Printing unit panel

Printing unit panel layout:

1	**Power socket**	110-220VAC mains socket for the power supply.
2	**Mechanical ON/OFF switch**	Turns the device on or off.
3	**Status LEDs**	Power/battery status LEDs: ▪ Top multicolor LED: ○ Turned off: device is powered off ○ RED while powering on: Self-check in progress ○ RED while working: Printer unit battery low ○ GREEN: standard operation, battery OK ▪ Bottom green LED: ○ Turned off: operating on batteries ○ GREEN: External supply present
4	**Device power supply cable gland**	Power/communication cable for the connection with the STERWeld portable device.
5a - 5d	**Dot-matrix printers**	4 printers for printing of up to 4 welding measurements.
6	**RJ-45 Ethernet socket**	Maintenance socket.

2.5 ACCESSORIES

2.5.1 STANDARD ACCESSORIES

Table 2.1: STER WELDING MONITOR standard accessories

Description	Pcs.
Current clamp 1000 A / 1 V (AC/DC)	4
Crocodile clip, red	4
Crocodile clip, black	1
Voltage measurement cable, red	4
Voltage measurement cable, black	1
12 V / 1.2 A Power supply adapter for the STERWeld device	1
NiMH rechargeable battery, type HR 6 (AA)	6
Soft carrying bag	1
Instruction manual for the STERWeld and the STER WM PRINTING UNIT	1

3 Getting started

3.1 CABLING AND CONNECTING THE DEVICE

STER WELDING MONITOR devices are shipped with batteries partially charged and ready for use. Batteries must be inserted according to procedure described in chapter 5.1 *Changing batteries*. Device can operate on fully charged batteries for up to 10 hours before shutting down. If the device does not power on after pressing the ON-OFF key, batteries may need recharging.

⚠ When the device is used with a printing unit, it can be powered directly from the printing unit. In that case, the AC/DC adapter is not needed.

3.1.1 CONNECTING THE POWER SUPPLY IN STANDALONE MODE

If the device is not used with a printing unit, it has to be connected to the provided AC/DC adapter. Connect the charger to the bottom socket at the side panel, as shown on the picture below.

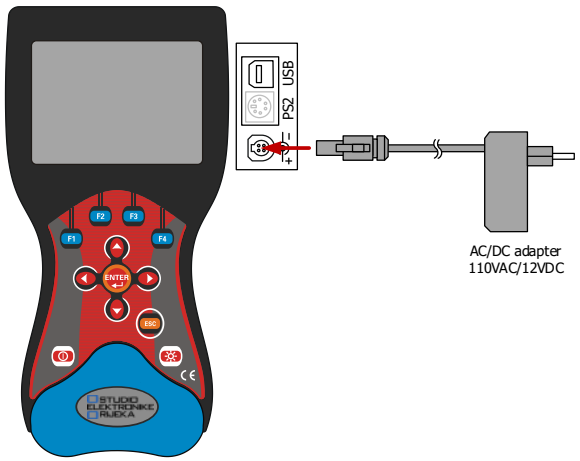


Figure 3.1: Connecting the charger (power supply) in standalone mode

After the device is connected to the power supply, press the ON-OFF key to turn on the device. Press the ON-OFF button again to turn the device off.

3.1.2 CONNECTING THE DEVICE TO THE PRINTING UNIT

To connect the printing unit to the device, disconnect the AC/DC adapter from the bottom socket, and connect the printing unit supply cable to the same socket:

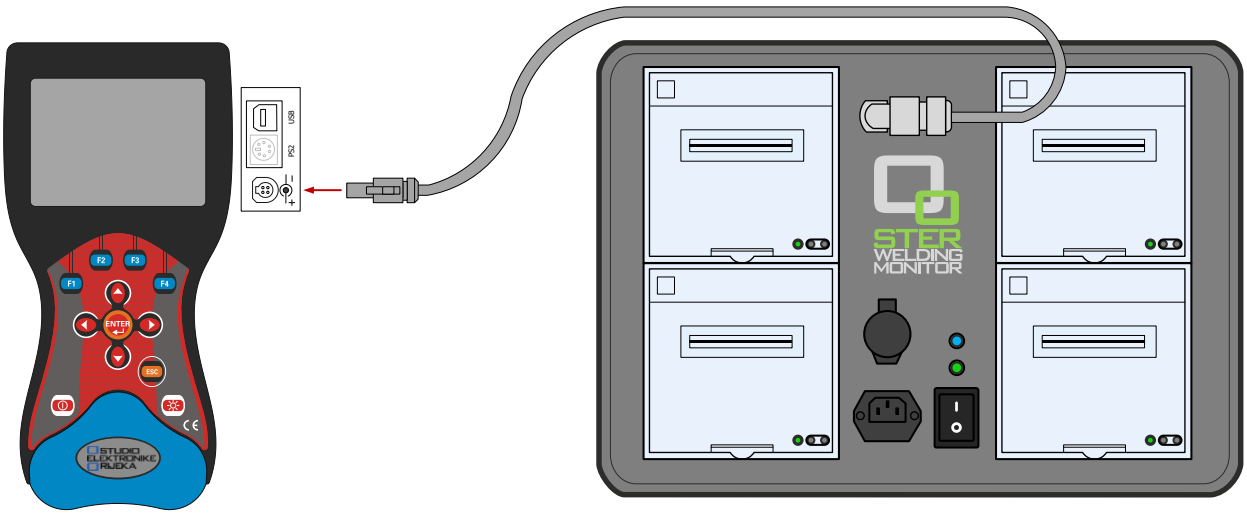


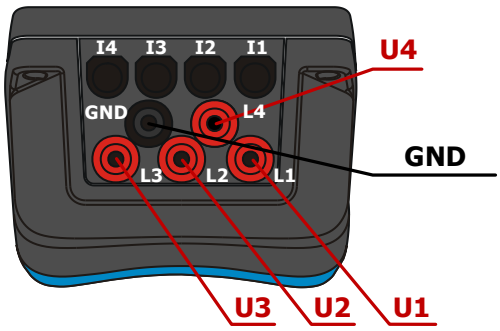
Figure 3.2: Connecting the charger (power supply)

⚠ To avoid damaging the equipment, always make sure that all measurement leads (voltage, current) are disconnected from the device before connecting the printer unit.

3.2 GENERAL CONSIDERATIONS FOR WIRING

- If the printing unit is used, make sure it is connected **before** wiring measurement terminals.
- Make sure that voltage and current inputs are **correctly paired** to avoid erroneous measurements.
- Check the direction of the **current flow**. Current clamp-on sensor should be mounted to measure the positive direction of the current flow, from generator on "+" cable or towards generator on "-" cable.
- Under the influence of parasite impedances, open voltage and current terminals which are not connected (floating inputs) can falsely measure unrealistically **high values**, creating large reading errors and false printouts. It is therefore recommended to disable unused inputs with the procedure described in Chapter 3.4.3 (*Measurement configuration*).

3.2.1 CONNECTING VOLTAGE TERMINALS

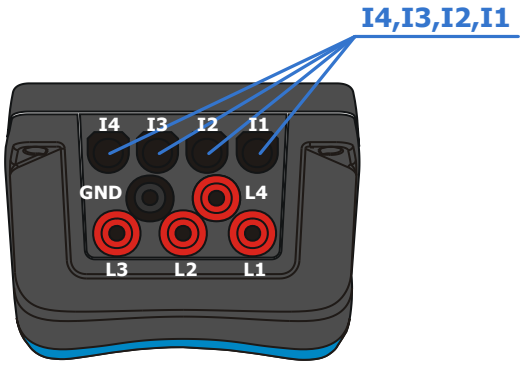


First, connect the ground voltage terminal (N) using the **black** measurement cable, followed by four voltage terminals (U1, U2, U3, U4) using **red** measurement cables.

⚠ Always connect the cables to the device **before** connecting them to live voltage.

Figure 3.3: Voltage terminals

3.2.2 CONNECTING CURRENT TERMINALS



Connect the four current clamp connectors to the top 4 current terminals.

⚠ Always connect the cables to the device **before** mounting the clamps.

⚠ In case of usage of non-clamp-on sensors, connection to secondary CT circuits must be performed with extreme care.

⚠ Never connect current clamps to any other terminals other than these four terminals.

Figure 3.4: Current terminals

3.3 WIRING CONFIGURATIONS

Voltage inputs can be connected in two basic configurations:

- **Basic Type-I monitoring:** 4 single ended inputs with common ground
- **Basic Type-II monitoring:** 2 differential inputs with 2 separate grounds

Current inputs are connected using 4 provided clamp sensors equally in both cases.

3.3.1 BASIC TYPE-I MONITORING – NORMAL MEASUREMENT

When connected in this configuration, Welding Monitor can measure 4 welding points with a common ground (4 voltages and 4 currents) simultaneously:

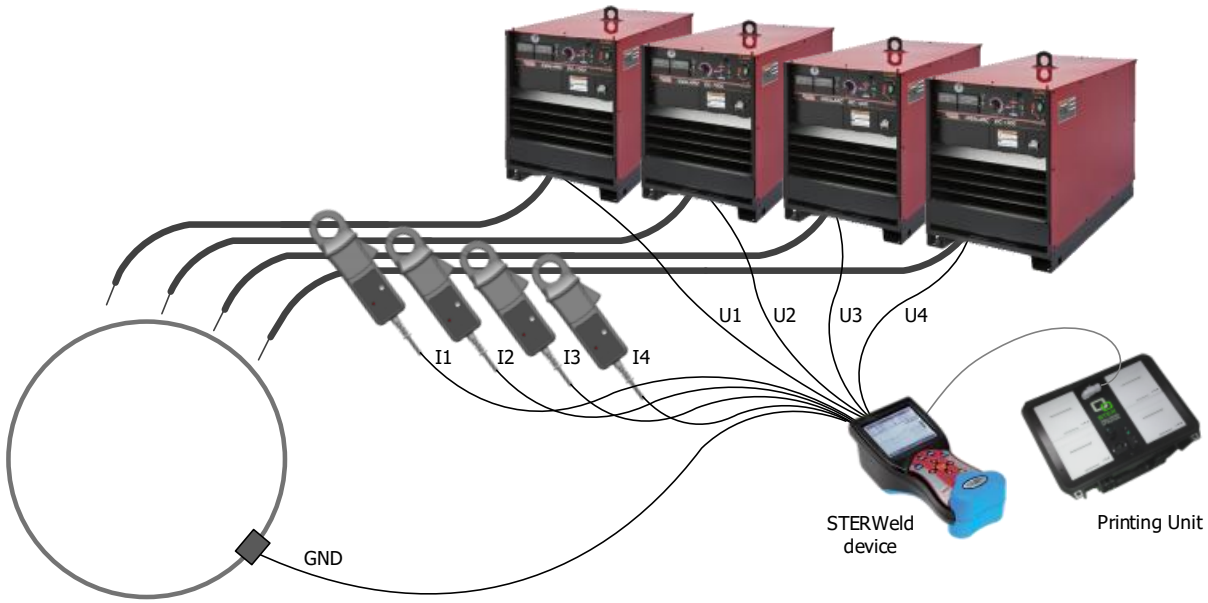


Figure 3.5: Measuring four welding points with a common ground

Measurement cables should be connected as follows:

- **Black** measurement cable to the common ground (GND)
- **Red** measurement cables to each of the welding point voltage output (U1, U2, U3, U4)
- **Current clamp sensors** to each of the welding point current output (I1, I2, I3, I4)

3.3.2 BASIC TYPE-II MONITORING – DIFFERENTIAL MEASUREMENT

Second monitoring configuration (Type-II) allows measurement of two welding points with separate ground potentials:

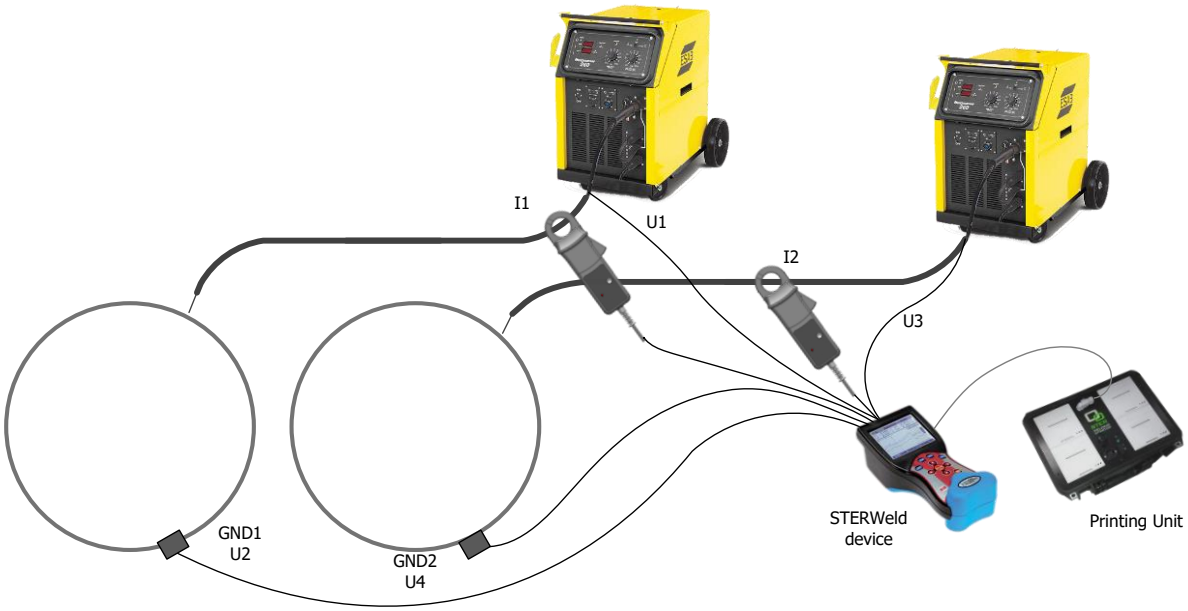


Figure 3.6: Measuring two welding points with separate ground potentials

Measurement cables should be connected as follows:

- **Red** measurement cable connected to the **input U1** or **U3** connect to the welding system **I** or **II respectively**
- **Red** measurement cable connected to the **input U2** or **U4** connect to the ground potential of the welding system **I** or **II respectively**
- **Current clamp sensors** to each of the welding system current output (**I1**, **I2**)
- Inputs not used in this measurement configuration: **GND**, **I3** and **I4**.

3.4 WORKING WITH THE DEVICE

3.4.1 WELDING MEASUREMENT SCREEN

Welding measurement screen contains central functions of the STERWeld device during measurements. It can display two enlarged real-time current measurements simultaneously, or all four measurement channels in the details menu.

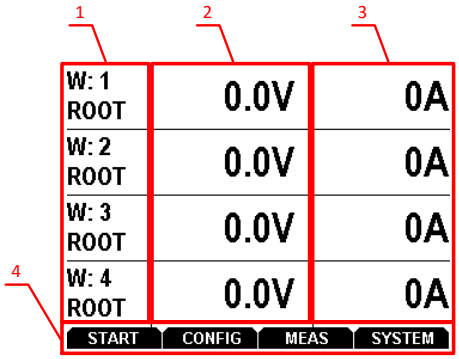


Figure 3.7: WELDING MEASUREMENT screen for Normal/Differential measurement type

1	Channel information	Shows channel ID number and pass name.
2	Real-time voltage measurements	Displays voltage measurements for up to four channels.
3	Real-time current measurements	Displays current measurements for up to four channels.
4	Soft function keys	Soft keys for measurement control: ▪ F1 - **START / RESET**: Functionality dependent on selected measurement type. ▪ F2 - **CONFIG**: Channel configuration. ▪ F3 - **MEAS**: Measurement configuration. ▪ F4 - **SYSTEM**: System configuration.

Before starting the measurement, welding monitoring settings should be configured using three main configuration screens:

1. CHANNEL CONFIGURATION setup
2. MEASUREMENT CONFIGURATION setup
3. SYSTEM CONFIGURATION setup

3.4.2 CHANNEL CONFIGURATION

In the CHANNEL CONFIGURATION screen operator can select information that will be printed in header information on ticket printouts. Since there are fore measurement inputs (i.e. torches), one can set four independent printouts.

To enter the CHANNEL CONFIGURATION screen, press the F2 key:

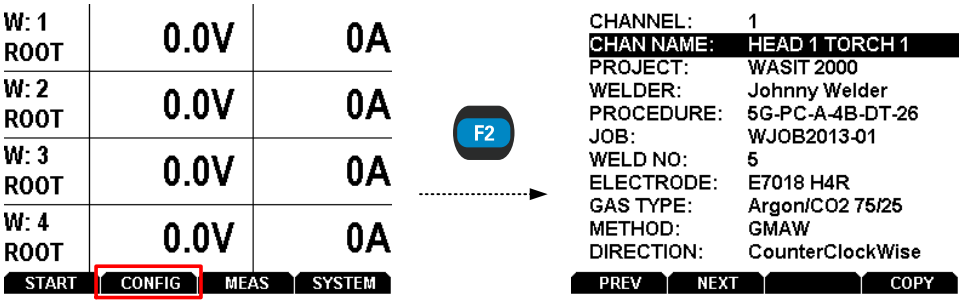


Figure 3.8: Entering the CHANNEL SETUP screen

Inside the CHANNEL SETUP screen, use the Up ( ) and Down ( ) arrow keys to **select** a parameter that must be changed from the menu. Press ENTER to open a list box with the predefined values for the selected parameter.

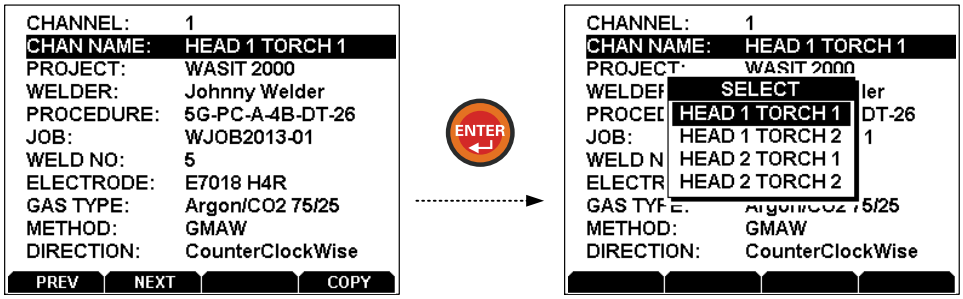


Figure 3.9: Setting CHANNEL NAME

Select the parameter using the Up ( ) and Down ( ) arrow keys, and press ENTER to confirm your selection.

Use F1 and F2 function keys to navigate through configurations of the four input channels. To shorten configuration setup time use function key F4 to copy the configuration of the currently viewed channel to the remaining three.

Press the ESC key to return back to the WELDING MEASUREMENT screen.

Prior to setting channel configuration, parameter database used for setup needs to be transferred to the unit using the STERWeld Monitor Configuration tool. Please refer to chapter 4 (*Working with the Configuration Tool*) for instructions on transferring channel settings.

3.4.3 MEASUREMENT CONFIGURATION

To enter the MEASUREMENT CONFIGURATION menu, press the F3 key:

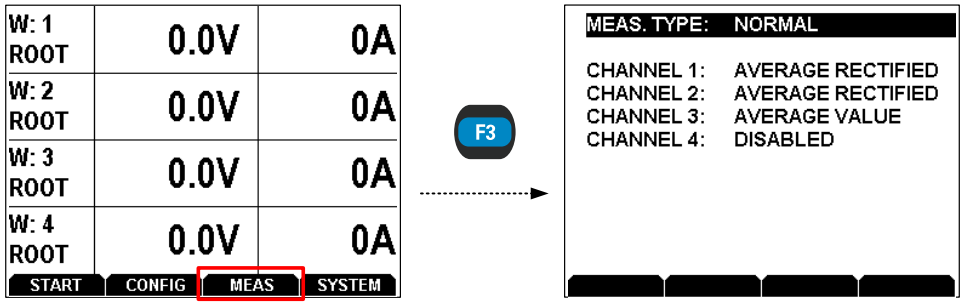


Figure 3.10: Entering the MEASUREMENT SETUP screen

Measurement configuration defines the measurement type used for welding monitoring and defines channel type for each of the supported input channels by the chosen measurement type.

Table 3.1: Measurement type and supported channels

Measurement Type	CHANNEL			
	1	2	3	4
NORMAL	✓	✓	✓	✓
DIFFERENTIAL	✓	✓		
PULSE	✓			

Select the parameter using the Up ( ) and Down ( ) arrow keys. Use Left ( ) and Right ( ) arrow keys to modify the selected parameter. After the selection of a particular measurement type, all channels that are supported in selected type will be enabled as a default option.

For Pulse measurements, each channel can be enabled or disabled separately. For Normal and Differential measurements, each channel type can be configured to one of the options:

1	DISABLED	This channel will not be included in the recording.
2	AVERAGE RECTIFIED (default)	Average of rectified current and voltage values will be calculated.
3	AVERAGE VALUE	Unrectified mean value (pure DC value) will be calculated for this channel.

3.4.4 SYSTEM CONFIGURATION

To enter the SYSTEM CONFIGURATION menu, press the F4 key:

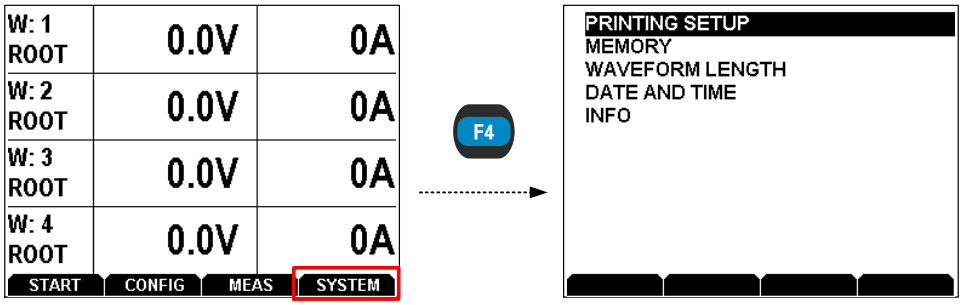


Figure 3.11: Entering the SYSTEM SETUP screen

System configuration consists of the following menu items:

- ***PRINTING SETUP***: setting printing interval and header printing flags
- ***MEMORY***: viewing and deleting memory records
- ***WAVEFORM LENGTH***: setting the length of the captured waveform
- ***DATE AND TIME***: viewing and setting current date and time.
- ***INFO***: device specific information

Navigate the menu by using the Up ( ) and Down ( ) arrow keys and press ENTER on the selected menu item.

PRINTING SETUP

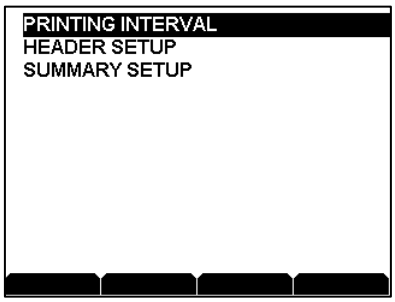


Figure 3.12: PRINTING SETUP menu

Printing setup menu is used to set the printing interval of the measurement results, define the header layout and configure whether operator will be asked for the weld length before printing the summary.

To define the printing interval for measurement results, select ***PRINTING INTERVAL*** and press the ENTER key. The ***PRINTING INTERVAL*** dialog box will appear.

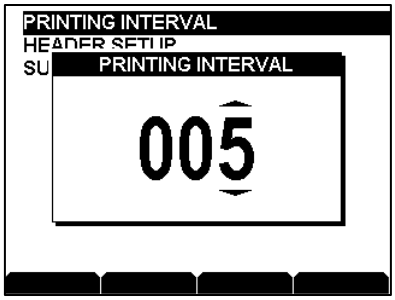


Figure 3.13: Printing interval dialog box

The interval can be set in the range from 2 to 120 seconds. Use Left ( ) and Right ( ) arrow keys to select digits, and Up ( ) and Down ( ) arrow keys to modify them. Press ENTER to confirm the printing interval.

To change the header layout, select ***HEADER SETUP*** and press the ENTER key. Select items from the list and then add or remove them from the header layout using Left ( ) and Right ( ) arrow keys.

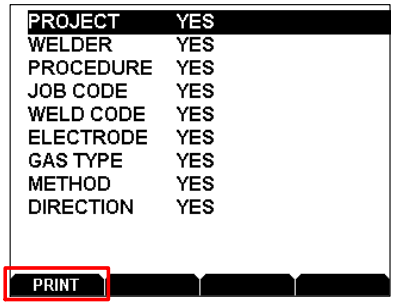


Figure 3.14: HEADER SETUP screen

To verify header layout press function key F1 to print headers.

Note that STERWeld has to be connected to the printing unit to print the layout. Please refer to the chapter 3.1.2 *Connecting the device to the Printing Unit* for connecting to the printing unit.

To change summary settings, select ***SUMMARY SETUP*** and press the ENTER key. In the following screen, use Left ( ) and Right ( ) arrow keys to determine if STERWeld should ask for the weld length before printing the summary. If this setting is set to **NO**, length value printout will be left empty and will have to be written on the printout by hand.

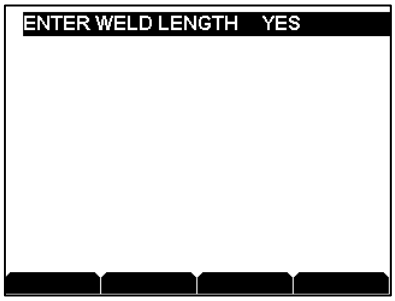


Figure 3.15: Summary setup dialog box

MEMORY

Memory screen shows basic information about memory usage, allows printing and viewing previously saved welding measurements and also clearing recording memory.

Clearing the memory will cause all data to be erased. Before doing this, make sure to transfer all saved measurements using the STERWeld Monitor Configuration Tool.

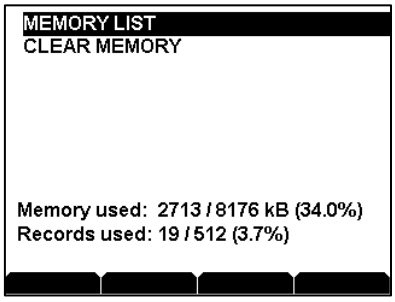


Figure 3.16: Memory screen

Select Memory list and press ENTER to view list of saved measurements. Use function keys F3 and F4 to browse the list.

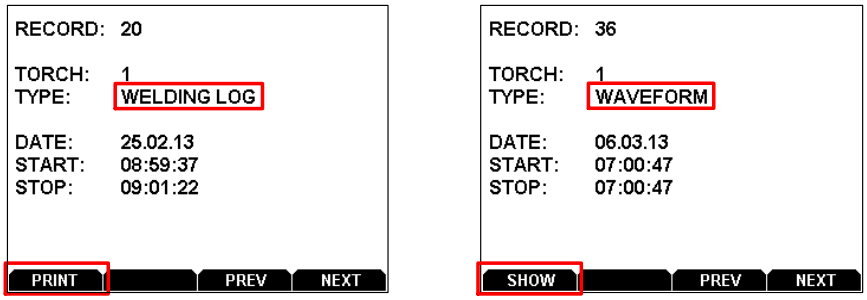


Figure 3.17: Memory list examples: welding log (left), waveform (right)

Normal (differential) welding measurements can be printed, while pulse welding waveforms can be shown on the SCOPE screen. Both actions are executed using the F1 function key.

Measurement type must be set to **pulse** in order to enable showing saved waveforms. Please refer to chapter 3.4.3 (*Measurement configuration*) to change measurement type.

WAVEFORM LENGTH

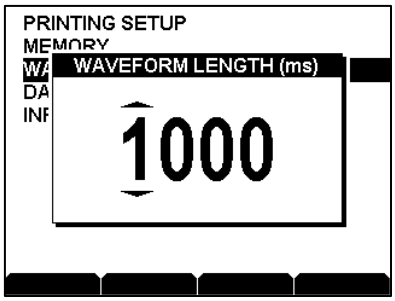


Figure 3.18: Waveform length setup

Duration of the captured waveform can be set in the range of 5 to 1894 milliseconds. Use Left ( ) and Right ( ) arrow keys to select digits, and Up ( ) and Down ( ) arrow keys to modify them. Press ENTER to confirm waveform length.

DATE & TIME

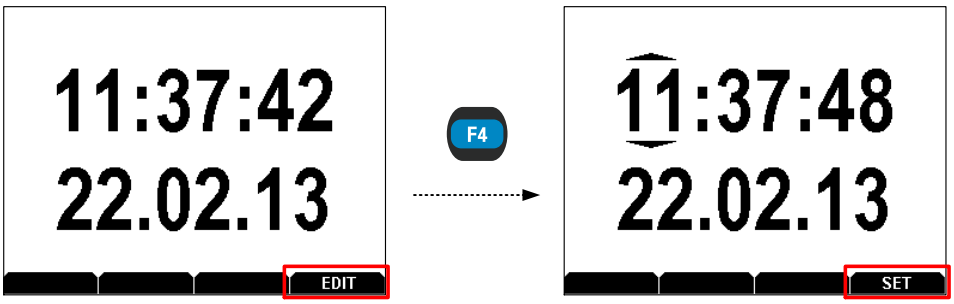


Figure 3.19: Setting date and time

Press function key F4 to enable date and time editing. Use Left ( ) and Right ( ) arrow keys to move the cursor and select a certain part of time or date, and Up ( ) and Down ( ) arrow keys to modify it. Press function key F4 to confirm date and time.

INFO

Info screen contains device specific information.

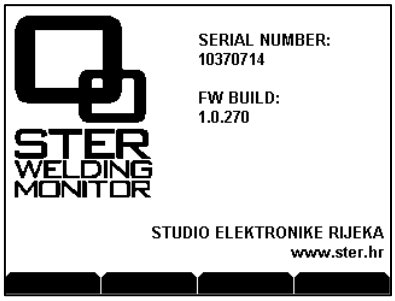


Figure 3.20: Info screen

3.5 NORMAL (DIFFERENTIAL) WELDING MEASUREMENT

3.5.1 STARTING THE MEASUREMENT

Before starting the normal welding measurement, please refer to chapters 0 (*Channel* configuration) and 3.4.3 (*Measurement configuration*) to set the measurement configuration.

Enter the WELDING MEASUREMENT screen and press the F1 function key to get the measurement pre-start functionality of the function keys:

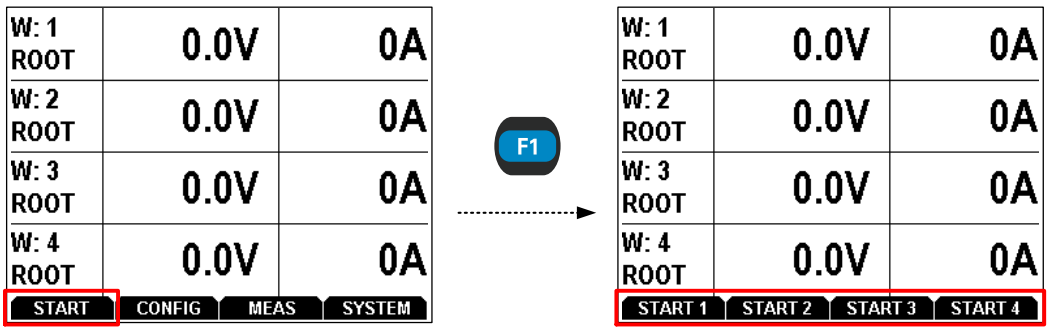


Figure 3.21: Enabling measurement pre-start

Depending on the measurement configuration, up to four independent welding measurements can be started by pressing the corresponding function key. Pressing the function key opens up the *SELECT PASS* dialog box.

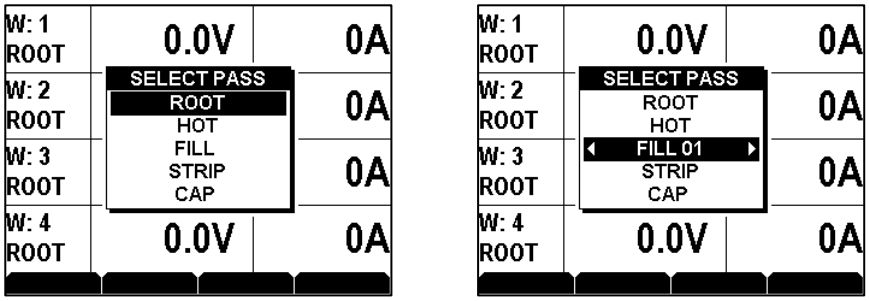


Figure 3.22: SELECT PASS dialog box

Use the Up ( ) and Down ( ) arrow keys to select the welding pass. Pass numbering can be set for **FILL** and **CAP** passes in the range from 1 to 99 by using the Left ( ) and Right ( ) arrow keys. Press ENTER to confirm the selected pass and start the measurement.

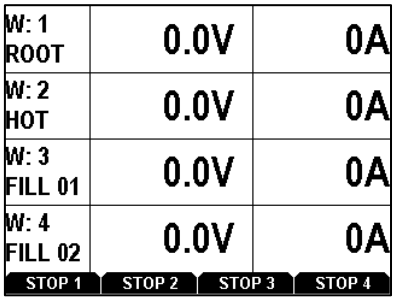


Figure 3.23: Welding measurement screen upon measurement start

Measuring results are initially shown for all four measurement channels, but as welding starts, only the ones with the arc activated will be displayed on the screen. They will be displayed accordingly to the time the arc was detected for the very first time, meaning that the channel with the first detected arc will be in the first row of the screen, the second one in the second row, etc.

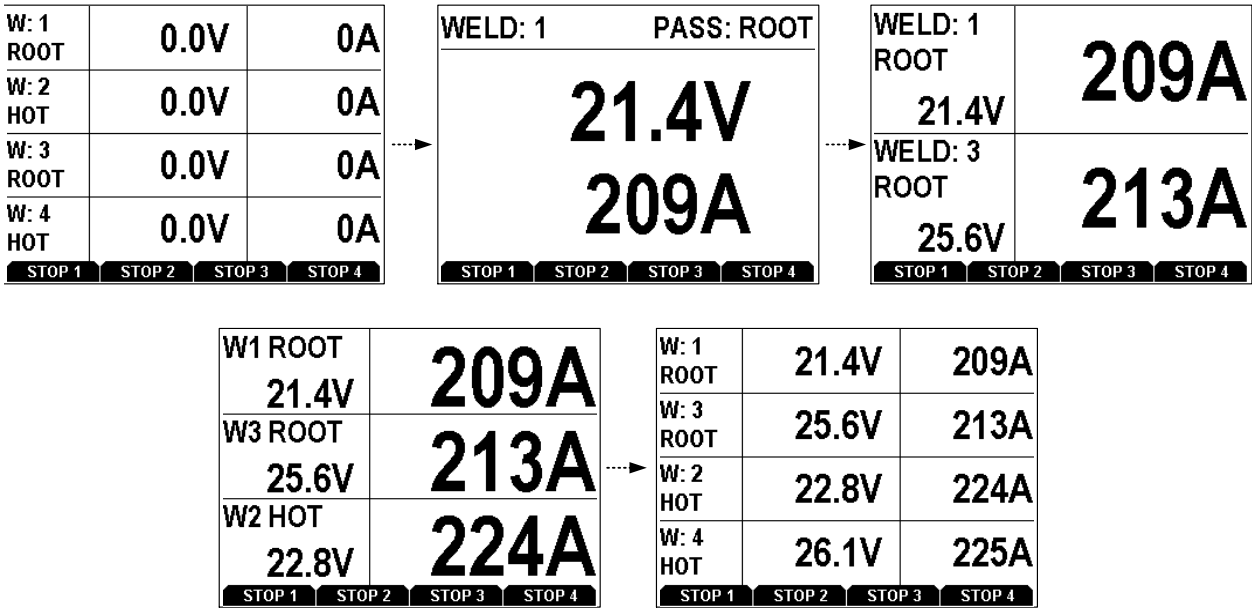


Figure 3.24: Welding measurement example (arc detected subsequently on channels 1, 3, 2 and 4)

If previously detected arc ended, the display of the current measurement result for the corresponding channel will be displayed on a black background.

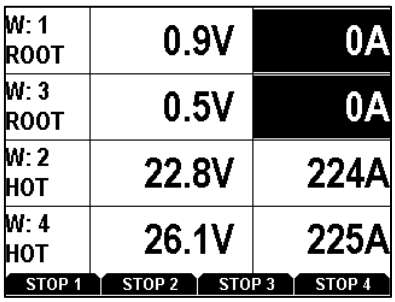


Figure 3.25: No active arc on channels 1 and 3

3.5.2 STOPPING THE MEASUREMENT

Normal welding measurement can be stopped by pressing the function key associated with the channel where welding ended i.e. where no arc is active. Issuing a measurement stop on a channel with welding still in progress (arc still active) will result in a warning message and the measurement will not be stopped.

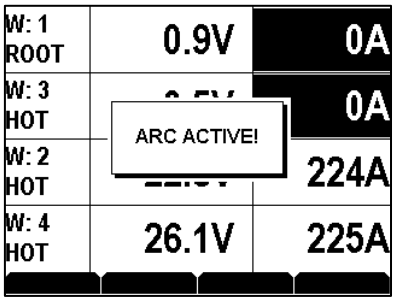


Figure 3.26: Warning message

Once all measurement have finished, press ESC key to get the main functionality of the function keys (START, CONFIG…) in the WELDING MEASUREMENT screen.

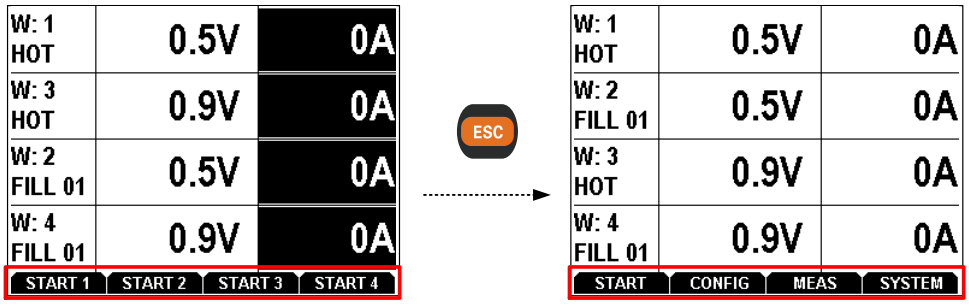


Figure 3.27: Exiting measurement pre-start

3.5.3 MEASUREMENT CALCULATION AND RESULT REPORTING

In normal and differential mode, current and voltage values are presented on LCD and on printouts are calculated according mean i.e. average values. Arc status and timing is performed in 0.01 s internal resolution and reported at ticket printouts in 0.1 s resolution.

Sampling frequency is 25.6 kSamples per second per channel allowing that power and energy calculation is performed according to the instantaneous power principle specified by ASME-IX 2010 QW-409.1(c)(1) and non-mandatory appendix H. Energy calculation is performed at rate of 25600 times per second in normal mode.

3.6 PULSE WELDING MEASUREMENT

3.6.1 STARTING THE MEASUREMENT

Prior to starting pulse welding measurement, proper measurement configuration has to be set. Please refer to chapter 3.4.3 (*Measurement configuration*) for setting the configuration.

Pulse welding measurement can be monitored using METER, SCOPE and U-I RESULTS screens. Switching between the screens is done by pressing the ENTER key.

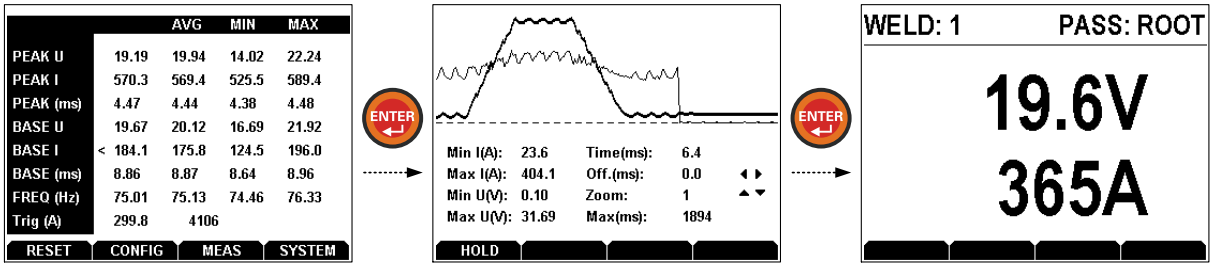


Figure 3.28: Switching through Pulse welding measurement screens

Pulse welding METER screen contains all relevant measurement information: peak and base values, frequency and trigger value. User can reset the measurement by pressing the F1 function key.

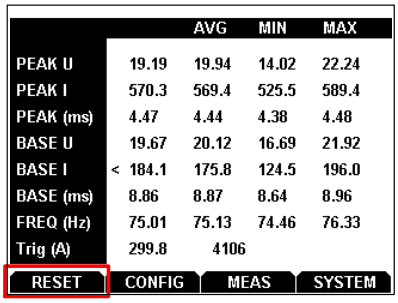


Figure 3.29: Pulse welding METER

Pulse welding voltage and current waveforms are displayed on the SCOPE screen with current waveform displayed using the ticker curve. Use the Left (◀) and Right (▶) arrow keys to change waveform time offset in milliseconds and the Up (▲) and Down (▼) arrow keys to change the zoom factor of the displayed waveforms.

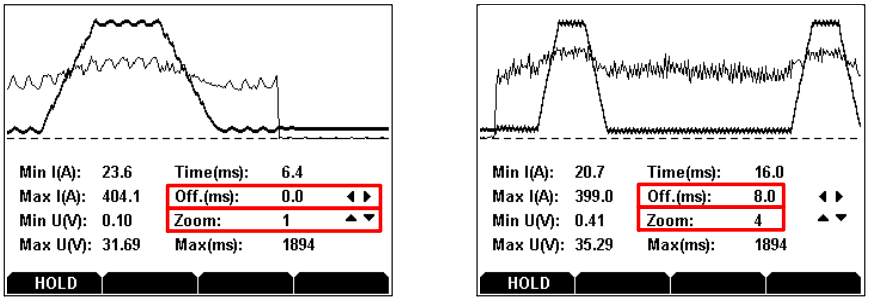


Figure 3.30: SCOPE screens: Zoom in (left), Zoom out with time offset (right)

Voltage and current waveforms are constantly collected and displayed until User decides to hold the currently displayed waveform by pressing F2 key. Once the waveform is being held, press F2 key to save the waveform. To continue collecting and displaying new waveforms press the F1 function key.

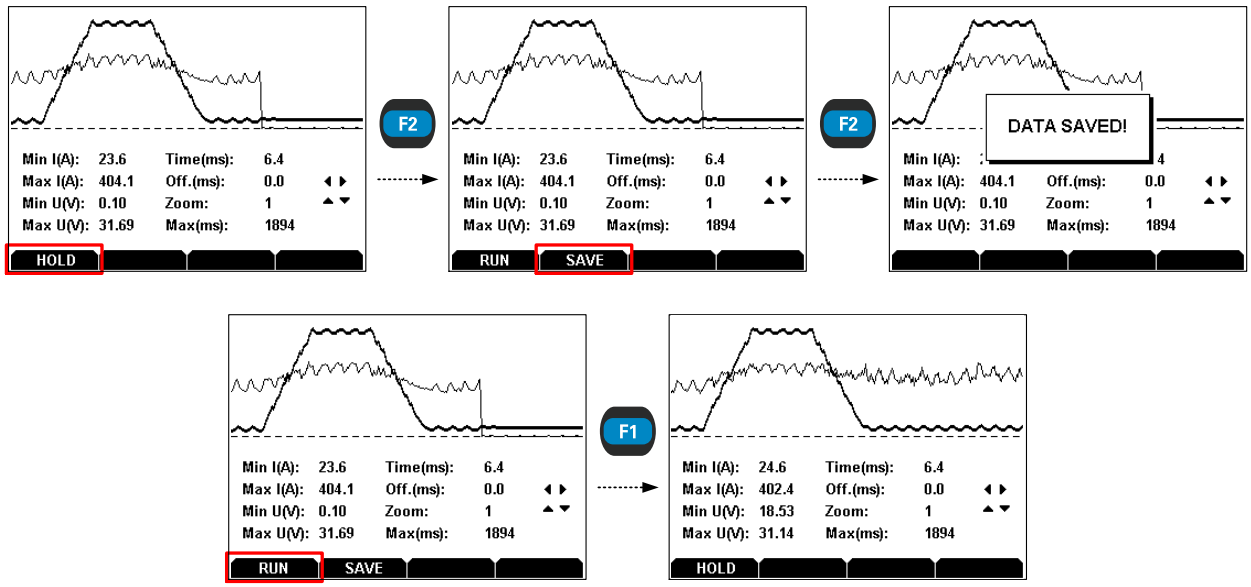


Figure 3.31: Holding, saving and running pulse welding measurement

3.6.2 MEASUREMENT CALCULATION AND RESULT REPORTING

In pulse measuring mode, current and voltage values are presented on LCD are calculated according effective i.e. r m s values. Sampling frequency is 100 kSamples per second per channel. Arc status detection and timing is performed in 0.01 ms.

In order to mitigate false readings, software filtering is included in arc detection status. Pulse current that last less than 1 ms will be filtered out. Similar to this principle, cycles lasting less than 4 ms will be filtered out too.

Power and energy calculation is performed according to the instantaneous power principle specified by ASME-IX 2010 QW-409.1(c)(1) and non-mandatory appendix H. Energy calculation is performed at rate of 100.000 times per second in pulse measurement mode.

4 Working with the Configuration Tool

4.1 INSTALLATION

Configuration Tool for the STERWeld device can be downloaded from www.sterweld.com.

4.1.1 SYSTEM REQUIREMENTS

Before installing the Configuration Tool, you should check that your system meets the following requirements:

SUPPORTED OPERATING SYSTEMS:

- Windows XP Service Pack 3
- Windows Server 2003 Editions
- Windows Vista
- Windows 7
- Windows 8

INSTALLED SYSTEM MEMORY (RAM):

- Windows XP / Server 2003: 256 MB (512 MB recommended)
- Windows Vista / 7 / 8 / Server 2008 / 2012: 512 MB (1024 MB recommended)

HARD DISK SPACE:

- at least 5 MB of free space for the installation files and documentation
- additional 50 MB if you don't have Microsoft .NET Framework 4 previously installed

4.1.2 INSTALLING THE SOFTWARE

To install the software, insert the CD into your CD-ROM drive and start **`setup.exe`**. The wizard will guide you through the installation process.

4.2 GETTING STARTED

After the tool is started, initial screen will be shown up:

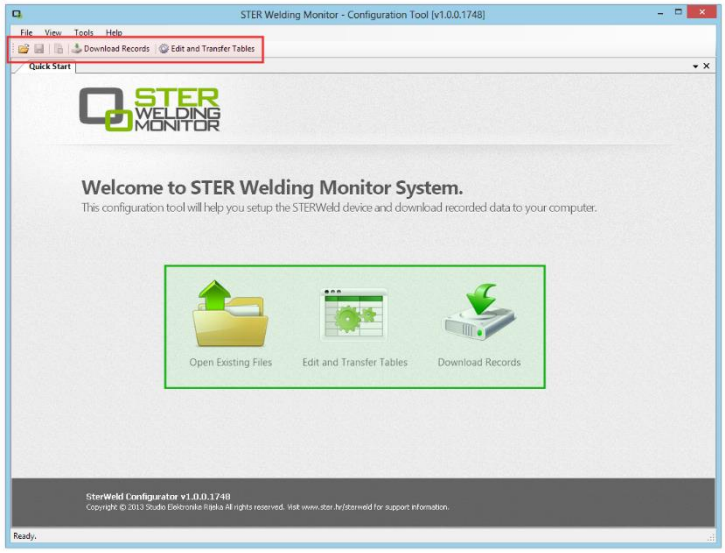
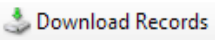
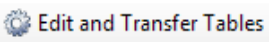


Figure 4.1: Welcome screen for the STERWeld configuration tool. Red rectangle shows the toolbar with most commonly used functions (Open, Save, Export, Download, Edit tables), while the green rectangle shows the large quick access buttons for these same functions

Below the main menu strip, there is a toolbar with 5 most commonly used functions (shown in red in the picture above):

1		Opens a previously saved STERWeld file, containing one or more downloaded records.
2		Saves the currently open file to disk.
3		Exports the currently open printout to a textual file.
4		Opens the **Download** window, which allows selection and download of welding measurement records from the STERWeld device to the PC.
5		Opens the **Table Editor** window, which allows defining property sheets for the device (Projects, Welders,

4.3 CONFIGURING THE INSTRUMENT FOR MEASUREMENT

Before first use, the device must be configured using the **Table editor**. To start the editor, click the Configure button in the toolbar. Table editor will be opened as shown below:

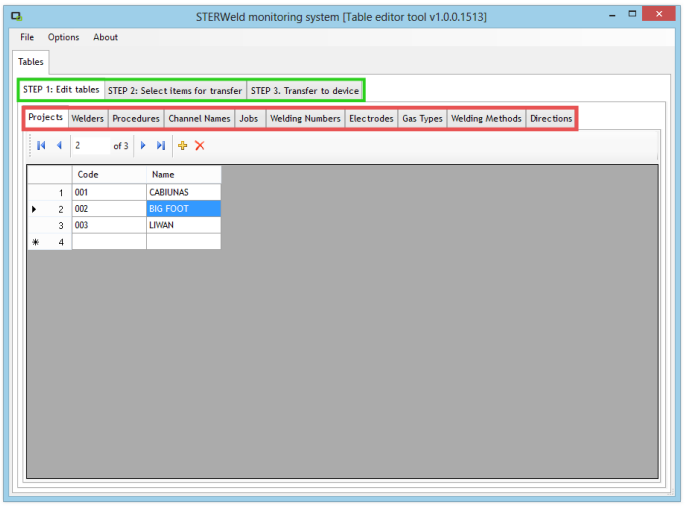


Figure 4.2: Table editor tool window.

Configuring the instrument is done in three steps (individual steps are shown in green rectangle in the image above):

- Step 1, editing tables: in this step, table data can be defined for each table separately. A table can be selected for editing using the secondary tab strip (shown in red rectangle in the image). Data stored in these tables is automatically saved to disk whenever it is modified.
- Step 2, selecting tables for transfer: in this step, up to 5 items from each table can be selected for transfer. This selection can be saved to disk through the File menu.
- Step 3, transferring tables to the device: in this step, device has to be connected to the PC using the provided USB cable, after which the data is transferred (as seen in the next figure).

Make sure that the device is connected to the PC using the supplied USB cable, powered on, and not measuring. If the device is currently recording (i.e. arc recording has not been stopped), the device will not communicate with the PC.

When connecting the device for the first time, allow some time for the USB driver installation to be finished. Windows may indicate that it is installing the driver by showing an installation window, or a balloon in the notification area. Before the installation is completely finished, the connection status will appear red in the configuration tool.

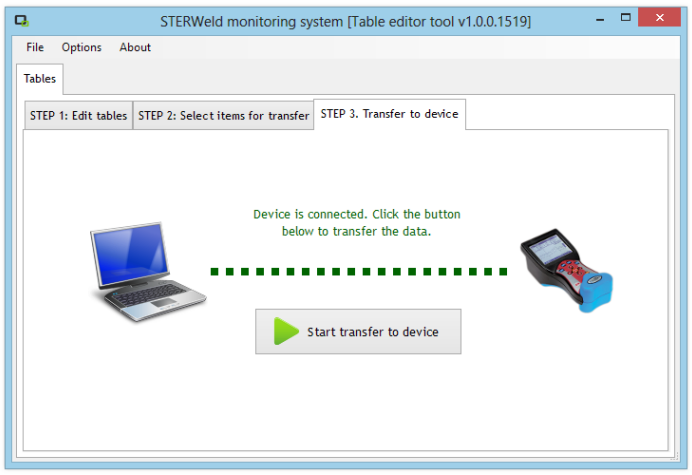


Figure 4.3: To transfer selected items to the device, connect the device to the PC and click "Start transfer to device"

4.4 DOWNLOADING DATA

To download the measurements from the device, click the **Download** button in the main toolbar. Download window will be shown, indicating the device connection status:

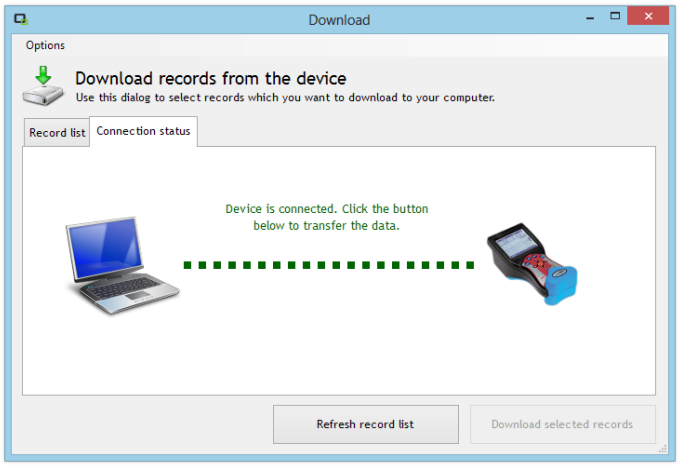


Figure 4.4: Download form

When the window is shown and the device has been connected to the PC, click the "Refresh record list" button at the bottom of the window to get the list of all records stored in the device. Depending on the list contents, you may wish to download all or only specific records from the device.

After the list is loaded from the device, it will be displayed in the first tab.

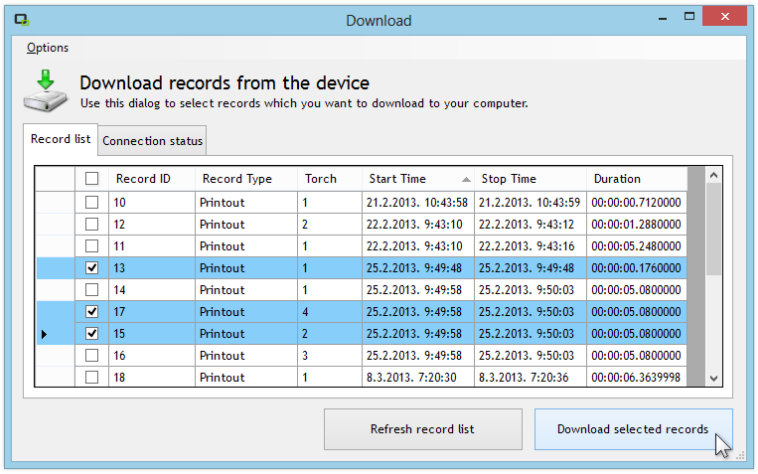


Figure 4.5: Download form after loading the Record list

To select records for download, make sure there is a check in the first column of each record. Each selected row will be shown in blue. To select all rows, click the topmost check box in the header row.

To download selected record, click the “Download selected records” button. Device will start transferring data.

4.5 ANALYZING DATA

Once the data has been transferred, it will be shown as a new document tab in the main window. Each document (i.e. a STERWeld file) can contain multiple records (depending on your selection in the record list).

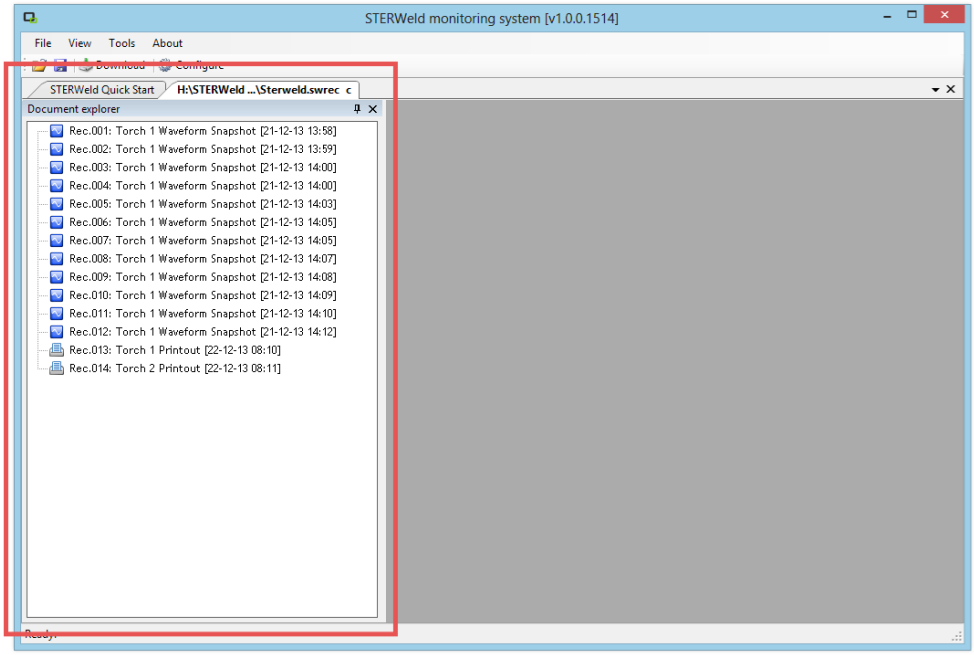


Figure 4.6: Document window after downloading record to PC. Document explorer tool window (inside the red rectangle) shows all records in this file.

Document windows are, by default, docked inside the main parent window, but can be easily undocked by dragging the tab away. STERWeld Configuration Tool allows complex docking arrangements with multiple records or document windows.

Each document contains a Document explorer tool window (red rectangle in the image above), which shows all records contained in that file. Double-clicking a record in the Document explorer tool window opens it and docks it in a new tab in the right panel, allowing multiple records to be opened simultaneously:

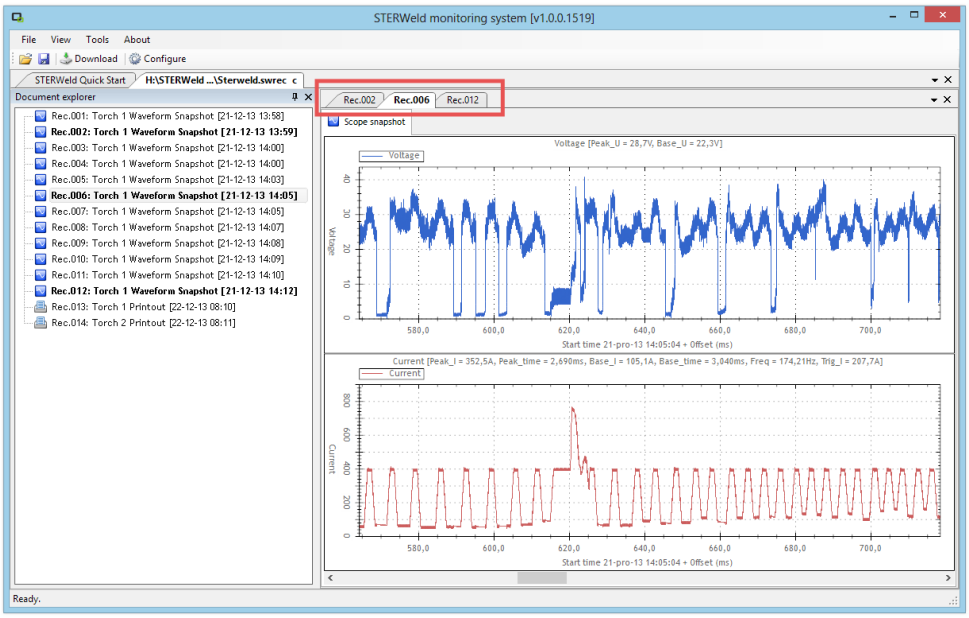


Figure 4.7: Document window with multiple records open. Red rectangle shows the tab strip which can be used to switch between records.

To switch between open records, use the record tab strip (red rectangle in the figure above), or select the record in the Document explorer tree.

Multiple record windows can also be docked as needed by clicking the record tab and dragging it away. For example, figure below shows a window with two printout records, docked vertically to allow easier comparison:

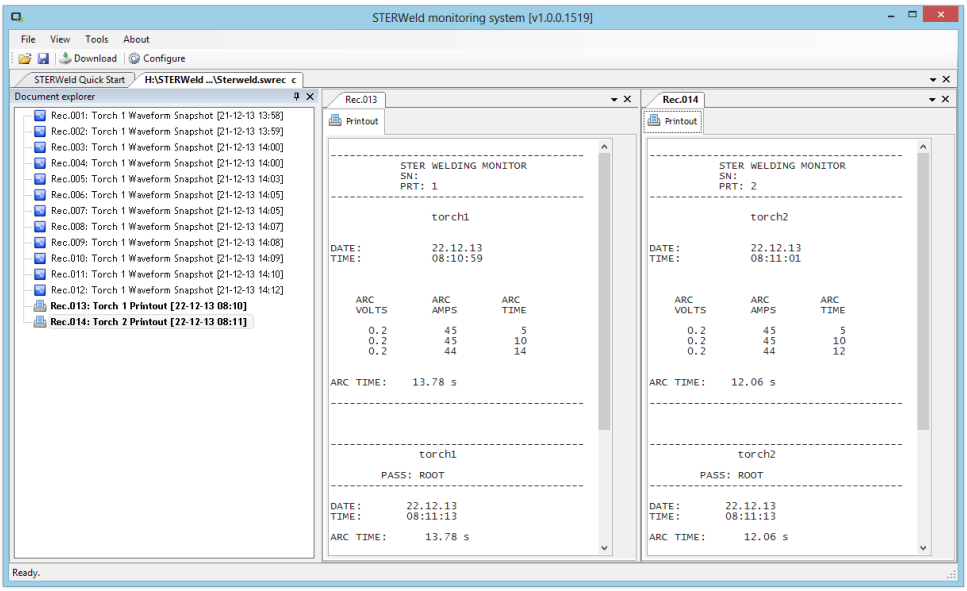


Figure 4.8: By dragging the record tab, it is possible to arrange record windows using a mouse.

4.6 HELP AND SUPPORT

For additional help and support, please visit www.sterweld.com, or contact Studio Elektronike Rijeka at info@sterweld.com.

5 Maintenance

5.1 CHANGING BATTERIES

STERWeld uses six rechargeable NiMh batteries, type HR 6 (size AA) for battery backup. Existing batteries can only be replaced with new batteries of the same type.

Make sure that the power supply adapter/charger and measurement leads are disconnected and the instrument is switched off before opening the device. Turn the device upside down as shown on the picture below to keep the batteries from falling out after the lid is opened. Using a coin or a screwdriver, unscrew the battery lid and remove it.

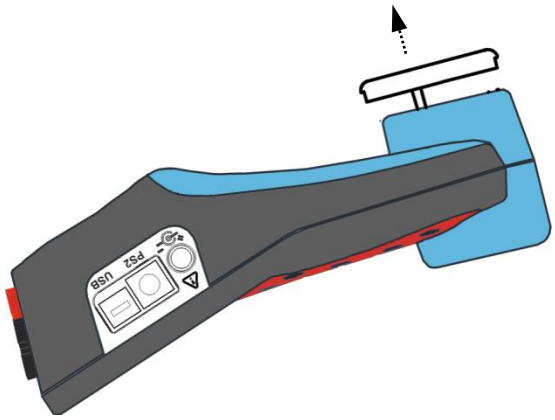


Figure 5.1: Removing the battery holder

Remove old batteries and insert new ones as shown in figure below:

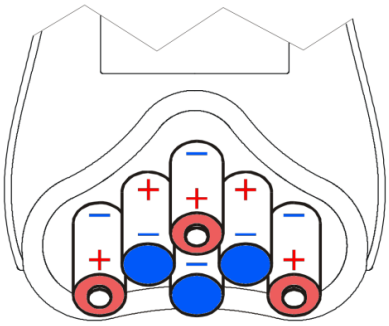


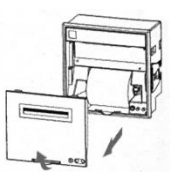
Figure 5.2: Battery placement (positive shown in red, negative in blue)

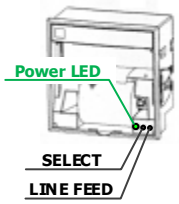
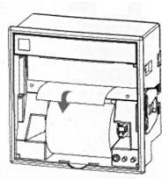
⚠ Warning! Always double-check that the polarities are correct **before** placing the battery holder lid to avoid damaging the equipment.

When batteries are in place, tilt the instrument as shown in the first picture, and screw the lid back on.

5.2 CHANGING THE PRINTER PAPER

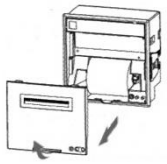
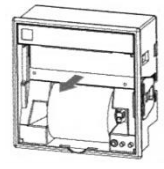
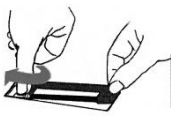
To change the paper inside the printing unit, use the following procedure:

1		Pull the printer compartment cover in the direction pointed by the arrow and remove it.

2		Remove the empty roll and replace it with the new roll. Make sure that the roll is firmly inserted. Pull a bit of the paper from the bottom of the roll and fold it to make it easier to slip it through the ribbon hatch. Next, place it into the bottom side of the ribbon hatch.
3		Make sure that the entire Printing unit is turned on by switching the main power switch to on. Next, press the SELECT button to turn off the printing unit (green Power LED should be off), and press the LINEFEED button to start feeding the paper.
4		When the paper is fed through the ribbon hatch, press LINEFEED again to stop feeding. Green LED will turn on automatically.
5		Pull the paper through the plastic cover and close the cover back in place until a click is heard. After closing the cover, lightly pull the paper again to tighten it, making sure that it is not bent under the cover.

5.3 CHANGING THE PRINTER RIBBON

To change the ribbon cartridge, go through the following procedure:

1		Pull the printer compartment cover in the direction pointed by the arrow and remove it.
2		Push the empty ribbon cartridge where indicated as "PUSH". This will tilt the cartridge like a lever, ejecting the opposite part of the ribbon.
3		Put the replacement ribbon in place. Use the knob on the cartridge to tighten the ribbon a bit to ensure that it is not twisted and that it passes between the paper and the printer matrix. If needed, adjust the knob slightly to fit the plastic gears. The opposite part of the ribbon should rest on the other side (there is no locking mechanism).
4		Pull the paper through the plastic cover and close the cover back in place until a click is heard. After closing the cover, lightly pull the paper again to tighten it, making sure that it is not bent under the cover.

5.4 SAFETY CONSIDERATIONS

Hazardous voltages exist inside the instrument. Always turn off the instrument, disconnect all test leads and remove the power supply cable before removing battery compartment cover.

No other parts, except those previously stated in this chapter, are user serviceable. Please contact your distributor for service information.

- If the instrument is not going to be used for long periods of time, it is advisable to remove all batteries from the battery holder after powering it off.
- Always turn off the instrument before opening the battery compartment cover.
- Use only the original power supply adapter/charger to avoid possible fire or electric shock.
- Rechargeable NiMh batteries type HR 6 (1.2V, size AA) are recommended. The charging time and the operating hours are given for batteries with a nominal capacity of 2300 mAh.
- Never use standard batteries while power supply adapter/charger is connected to prevent explosion!
- Do not mix batteries of different types, brands, ages, or charge levels.
- When charging batteries for the first time, make sure to charge batteries for at least 24 hours before switching on the instrument.

5.5 BATTERIES

Instrument contains rechargeable NiMh batteries. These batteries should only be replaced with the same type as defined on the battery placement label or in this manual. If batteries are going to be stored outside the device for a longer period of time, it is advisable to precharge them fully to prolong their life.

If it is necessary to replace batteries, all six have to be replaced. Ensure that the batteries are inserted with the correct polarity; incorrect polarity can damage the batteries and/or the instrument.

PRECAUTIONS ON CHARGING NEW BATTERIES OR BATTERIES UNUSED FOR A LONGER PERIOD

Unpredictable chemical processes can occur when charging new batteries or batteries that were unused for a longer period of time (more than 3 months). This effect, sometimes referred to as *memory effect*, can affect both NiMH and NiCd batteries. As a result, device operation time can be significantly reduced.

Therefore it is recommended:

1. To completely charge the batteries.
2. To completely discharge the batteries (can be performed with normal working with the instrument).
3. Repeating the charge/discharge cycle for at least two times (four cycles are recommended).
4. When using external intelligent battery chargers one complete discharging /charging cycle is performed automatically.

After performing this procedure a normal battery capacity should be restored, and operation time of the device should meet the data in the technical specifications.

NOTES

The charger in the instrument is a pack cell charger: batteries are connected in series during the charging. This means that all batteries have to be in similar state (similarly charged, same type and age). Even one deteriorated battery (or just of another type) can cause an improper charging of the entire battery pack (heating of the battery pack, significantly decreasing their operation time).

If no improvement is achieved after performing several charging/discharging cycles the state of individual batteries should be determined (by comparing battery voltages, checking them in a cell charger etc.). It is very likely that only some of the batteries are deteriorated.

The effects described above should not be mixed with normal battery capacity decrease over time. All charging batteries lose some of their capacity when repeatedly charged/discharged. The actual decrease of capacity versus number of charging cycles depends on battery type and is provided in the technical specification of batteries provided by battery manufacturer.

5.6 POWER SUPPLY CONSIDERATIONS

Warning!

- Use only charger supplied by manufacturer.
- Disconnect power supply adapter if you use standard (non-rechargeable) batteries.
- When using the original power supply adapter/charger the instrument is fully operational immediately after switching it on. The batteries are charged at the same time, nominal charging time is 4 hours.
- The batteries are charged whenever the power supply adapter/charger is connected to the instrument. Inbuilt protection circuit controls the charging procedure and assure maximal battery lifetime.
- If the instrument is left without batteries and charger for more than 2 minutes, time and date settings are reset.

5.7 CLEANING

To clean the surface of the instrument use a soft cloth slightly moistened with soapy water or alcohol. Then leave the instrument to dry totally before use.

Warning!

- Do not use liquids based on petrol or hydrocarbons!
- Do not spill cleaning liquid over the instrument!

5.8 PERIODIC CALIBRATION

To ensure correct measurement, it is essential that the instrument is regularly calibrated. If used continuously on a daily basis, a six-month calibration period is recommended, otherwise annual calibration is sufficient. Contact your distributor for calibration details.

5.9 SERVICE

For other repairs, either under or outside of warranty, please contact your distributor for further information.

6 Troubleshooting

This chapter provides some quick guides on how to resolve common configuration issues. If you are unable to remedy your problem by following these guides, please contact our support.

6.1 STERWELD DEVICE TROUBLESHOOTING

Problem	Possible causes	How to resolve it
The device cannot be turned on using the power button, or appears to be locked.	If *Esc* or *Enter* button is held pressed while switching on the instrument, the instrument will enter the firmware upgrade mode and fail to start.	The device needs to be reset. Remove all cables from the device to make sure it is not connected to a power supply. Open the battery compartment and the remove the batteries before starting the instrument again.
	If the instrument is switched on with flat batteries and without power supply adapter connected, power supply circuitry may lock itself.	
	Device is operating on old batteries.	The device needs to be reset and batteries must be replaced and fully recharged. Remove all cables from the device to make sure it is not connected to a power supply. Open the battery compartment, remove all batteries and replace them with new batteries as explained in Chapter 5.1 *Changing batteries*. When charging batteries for the first time, make sure to charge batteries for at least 24 hours before switching on the instrument.

6.2 PRINTING UNIT TROUBLESHOOTING

Problem	Possible causes	How to resolve it
Device is connected to the printing unit, but printers are not printing.	If green power LEDs on all printers are turned off, then the entire printing unit does not have a proper power supply.	Make sure that the printing unit is turned on, using the main power switch. If main power LED on the printing unit is not lit after turning on, then the printing unit's internal battery may be depleted. In that case, make sure to connect the unit to mains in order to recharge it.
One of the printers is not printing.	If both the SELECT and LINEFEED buttons on a printer are pressed simultaneously, the printer goes into the self-test mode, printing a list of supported characters. To return to the normal mode, entire unit needs to be restarted.	Turn off the printing unit off using the main power switch. Wait a couple of seconds until all green power LEDs are off. Turn on the printing unit using the main power switch.

Problem	Possible causes	How to resolve it

One of the printers is not printing.	It is possible that printer communication settings were accidentally changed. If that is the case, settings must be reprogrammed before turning the printer back on.
	
	Printer needs to be configured to communicate in “Mode 1”, at baud rate of 19.200 bps.
		1. Turn off the printing unit off using the main power switch. Wait a couple of seconds until all green power LEDs are off.
		
		2. Hold both SELECT and LINEFEED buttons on the printer together while turning on the printing unit. This will power on the printer in the configuration mode.
		
		3. If the printer starts in configuration mode, it will print out a list of characters, together with current communication mode and speed, similar to:
		
		`MODE: 1`
		`Serial Port 19200bps`
		
		If these characters are not printed initially, repeat the procedure until the device starts in this mode.
		
		4. Serial port settings should be configured to match those shown above (MODE: 1, 19200 bps). If they differ, use the SELECT and LINEFEED buttons to change these settings until they match. Each time a button is pressed, printer will print out new settings.
		
		5. When the settings are properly configured, turn off the printing unit to finish configuration.

Printout is mirrored (upside down) on one of the printers.	If both SELECT and LINEFEED are held pressed for a longer time, printer settings will be reset and text direction will be reversed.	Turn off the printing unit off using the main power switch. Wait a couple of seconds until all green power LEDs are off. Turn on the printing unit using the main power switch.

7 Technical specifications

7.1 GENERAL SPECIFICATIONS

General specifications for the STERWeld device are provided in the table:

Working temperature range:	-10 °C ÷ +50 °C	
Storage temperature range:	-20 °C ÷ +70 °C	
Max. humidity:	95 % RH (0 °C ÷ 40 °C), non-condensing	
Pollution degree:	2	
Insulation class:	double insulation	
Over voltage category:	CAT IV / 600 V; CAT III / 1000 V	
Protection degree:	IP 42	
Dimensions:	(220 x 115 x 90) mm	
Weight (without accessories):	0.65 kg	
Display:	Graphic liquid crystal display (LCD) with backlight, 320 x 200 dots.	
Memory:	8 MB Flash	
Batteries:	6 x 1.2 V type HR 6 (AA) NiMh rechargeable batteries Enable full device operation for up to 10 hours (2300mAh version)	
External DC supply:	12 V, min 1.2 A	
Maximum power consumption:	150 mA – without batteries 1 A – while charging batteries	
Communication:	USB 1.0	Standard USB Type B 2400 baud ÷ 921600 baud
	RS232	8 pin PS/2 – type 2400 baud ÷ 115200 baud

7.2 MEASUREMENTS

7.2.1 VOLTAGE MEASUREMENTS

Four voltages connected to inputs V1, V2, V3 and V4 are measured according to RMS (root mean square) principle with reference to the neutral (N) connector in normal measurement mode. Two differential voltages (difference V1 to V2 and difference V3 to V4) are measured in differential voltage mode.

NOTE: Assure that all voltage clips are connected during measurement and logging period. Unconnected voltage clips are susceptible to EMI and can trigger false measurement. It is advisable to short them with instrument neutral voltage input.

Max. input voltage (L1 .. L4 – Neutral):	1000 V_{RMS}
Max. input voltage (Lx – Lx):	1730 V_{RMS}
Phase - Neutral input impedance:	6 MΩ
Phase – Phase input impedance:	6 MΩ
Nominal voltage:	U_D = 100 V

Recommended voltage range:	5 V ÷ 150 V AC/DC
Voltage measurement resolution:	0.1 V display, 0.01 internal
Accuracy:	±(1 % of reading + 0.5 V)

7.2.2 CURRENT MEASUREMENTS

Four currents I1, I2, I3 and I4 are measured in normal mode according to the RMS algorithm. Two currents I1 and I2 are measured in differential mode. The default scope of delivery contains four AD/DC current clamps. The alternative current sensors can be supplied upon the request.

Max. input voltage non-insulated cable:	150 V_{RMS}
Measurement range:	25 A – 1000 A
Current measurement resolution:	1 A display, 0.1 internal
Accuracy:	±(2 % of reading + 5 A)

7.2.3 ENERGY MEASUREMENTS

Energy is calculated by integration of instantaneous power during arc interval time.

Range:	2 000 000 kJ
Energy measurement resolution:	0.1 kJ
Accuracy:	±2%

7.2.4 WELDING MONITOR HARDWARE

AD converter	16 bit 8 channels, simultaneous sampling
Reference temperature	23 °C ± 2 °C
Temperature influence	60 ppm/°C

7.2.5 REAL TIME CLOCK (RTC) UNCERTAINTY

Accuracy at operating range -20 °C ÷ 70 °C:	± 3.5 ppm (0.3 s/day)
Accuracy at operating range 0 °C ÷ 40 °C:	± 2.0 ppm (0.17 s/day)

7.2.6 ARC DURATION TIME-STAMP UNCERTAINTY

Arc duration:	30 ms ÷ 20 000 s
Duration resolution:	0.01 s
Maximum error:	0.1% ± 0.05 s

7.3 PRINTING UNIT SPECIFICATIONS

7.3.1 PRINTERS

Printing method:	Dot matrix printing
Paper width:	57mm
Print width:	48mm
Resolution:	240 dots/line, 40 characters/line
Paper type:	Plain paper (non-thermal), 57mm - Ø50mm
Operating temperature / humidity:	0°C – 50°C / 10% – 85%
Storage temperature / humidity:	-20°C – 60°C / 10% – 90%

8 Notes