

INSTRUCTION MANUAL

700215C

WA2 WELD ANALYZER

MICROPROCESSOR BASED
Monitors

ENTRON

ENTRON Controls, LLC.
1402 S. Batesville Road
Greer, South Carolina 29650
(864) 416-0190
FAX: (864) 416-0195
www.entroncontrols.com

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ENTRON Controls, LLC.

MICROPROCESSOR BASED MONITORS

INSTALLATION AND OPERATION MANUAL FOR:
Model Series WA2 Weld Analyzer

!

CAUTION

!

READ THIS MANUAL COMPLETELY BEFORE ATTEMPTING
TO INSTALL OR OPERATE THIS MONITOR

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ENTRON Controls, LLC.
Greer, South Carolina 29650

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1.0 INTRODUCTION

The WA2 Weld Analyzer is a RISC-based instrument designed for the comprehensive real-time analysis of resistance welds. It is a compact hand-held battery operated unit that is an ideal tool for welding, maintenance and quality control personnel.

The WA2 is capable of measuring AC and MF DC welding current, the number of pulses in the weld and the duration of each weld. The information is displayed on a backlit FSTN LCD display and may be stored in non-volatile EEPROM. The WA2 may also be connected to a computer to extend its storage capabilities.

Every WA2 is supplied with a traceable calibration certificate (ENTRON Form 470129).

See WA2 Concise Manual on WA2 Manual/Software CD or Appendix A for quick guide on setup and use of the WA2 Weld Analyzer.



Figure 1-1. WA2 Weld Analyzer, Coil and Case

1.1 KEY FEATURES

- Portable, hand-held compact unit
- 128 x 64 LCD display with yellow/green backlight and antiglare coating
- Tactile keypad
- Powered by three rechargeable AA batteries
- Automatic power-down after 10 minutes of inactivity
- Menu driven commands
- USB port (data exchange only)
- Measures RMS AC and DC welding current
- Selectable ranges of 60, 120, 180, 240 and 300 kA
- High and low current indicators
- Measures welding time in ½ cycles up to 9999 cycles (AC) or 10 ms intervals up to 199.9 seconds (DC)
- Captures up to 300 ½ cycles (AC) or 3 seconds (DC)
- Measures conduction angle for each ½ cycle (AC)
- Over- and under-range indicators
- Weld indicator
- Multi-pulse weld indicator

1.2 SPECIFICATIONS

Dimensions	3-3/8" w x 1-1/8" d x 6-3/4" h
Weight	1 lb. including batteries
Operating Temperature	0° to 45° C ambient (32° to 113° F)
Power Source	Three rechargeable NiMH AA batteries
Battery Life	6 hours minimum, 2000 mAh @ 25° C (77° F)
Display	128 x 64 pixels FSTN transreflective
Keypad	Embossed disc tactile switches
Weld Current	2 to 300 kA, accuracy $\pm 2\%$ of full scale (see Section 6.0)
Weld Time	0.5 to 9999 cycles (AC) or 0.01 to 199.9 seconds (DC)
Capture Time	300 ½ cycles (AC) or 3 seconds (DC) with programmable end-of-capture
Conduction Angle	0° to 180° $\pm 4^\circ$ (AC)
Pulse Count	1 to 99

2.0 SETUP

2.1 BATTERIES

The rechargeable batteries supplied with the WA2 may be in a discharged state. It is recommended that the batteries are fully recharged before using the WA2.

! CAUTION !
Use only NiMH batteries rated at 1.2 volts in charger and WA2. Alkaline batteries rated at 1.5 volts must not be used.

2.1.1 INSTALLING THE BATTERIES

To install the batteries:

1. Remove the back cover of the WA2.
2. Carefully insert the batteries. The positive (+) terminals of all three batteries must be toward display (see Figure 2-1).
3. Replace the back cover.



Figure 2-1.
Battery orientation

2.1.2 CHARGING THE BATTERIES

! WARNING !

Do not connect or disconnect the charger while it is switched on.

NOTICE

The USB connection cannot be used to recharge the batteries.

Use only the supplied charger. Other chargers must not be used.

To charge the batteries:

1. Ensure that the correct AC adapter is fitted for your territory. Consult the documentation supplied with the charger.
2. Ensure that the 2.5 mm jack plug adapter is fitted and connected correctly – positive (+) terminal to positive (+) terminal.
3. Ensure that the batteries are fitted to the WA2 as described in Section 2.1.1.
4. Switch off the WA2.
5. **Ensure the charger is switched off.** Connect it to the WA2 and switch the charger on. The red Power LED indicates that the charger is ready for use.
6. If the WA2 batteries are new or have only been used a few times, use the charger's discharge mode before charging. Consult the charger's documentation.
7. If the batteries are older or have been conditioned by the charger's discharge cycle, the charger will fast charge the batteries and then revert to a trickle charge; this may take several hours depending on the condition of the batteries.
8. The green Ready LED indicates that the batteries are fully charged. The indicator will flash after two minutes and the charger will revert to trickle charge. At this stage, charging is complete.
9. **Switch off the charger** and disconnect it from the WA2. The WA2 is now ready to use.

2.2 CONNECTION

Connect the WA2 as shown in Figure 2-2.

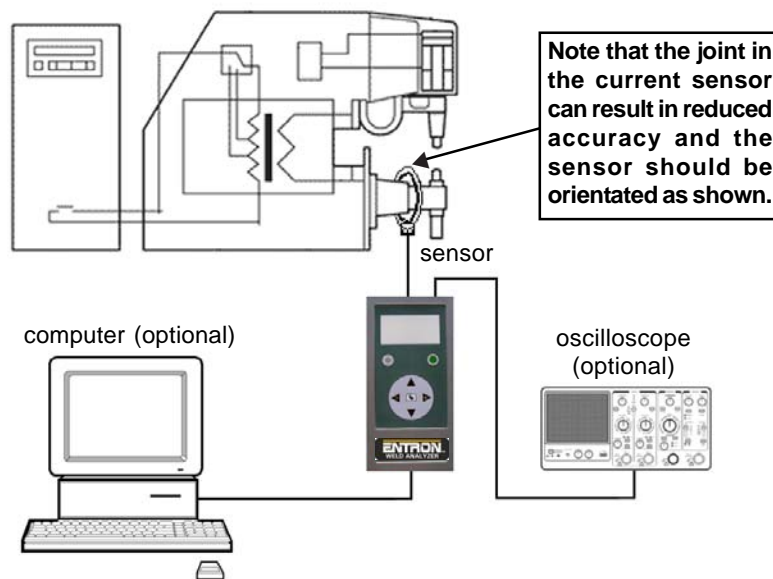


Figure 2-2. WA2 connections

2.2.1 CONNECTORS

Current sensor – Connect the calibrated current sensor to the WA2.



Figure 2-3. *Sensor connector*

USB port – Connect to a computer USB 2.0 port using a USB A to USB mini B cable if required.

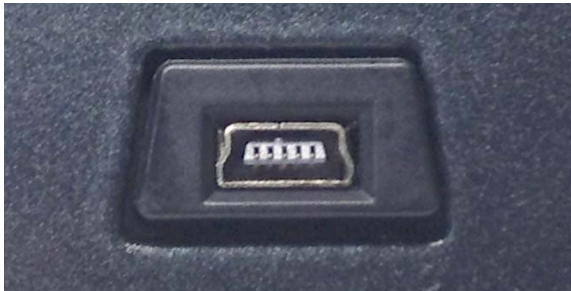


Figure 2-4. *USB port connector*

The USB device is provided by Future Technology Devices International Ltd. and Windows drivers are included on the WA2 Manual/Software CD. Updated drivers and drivers for Mac OS and Linux can be found on the FTDI website: <http://www.ftdichip.com/Drivers/VCP.htm>. Check for updated drivers and install the driver for your system by following the appropriate installation guide: <http://www.ftdichip.com/Support/Documents/InstallGuides.htm>.

Integrator output – Connect an oscilloscope or other recording instrument if required.



Figure 2-5. *Integrator connector*

! CAUTION !
The integrator output should only be connected to high impedance recording instruments.




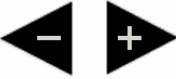

3.0 OPERATION

The WA2 is controlled via a tactile keypad in conjunction with a graphical LCD display.

3.1 KEYPAD

The function of the keys is described in Table 3-1.

Table 3-1. Keypad Functions

Key	Function			
	Data display	Detail display	Setup display	File display
	power on / off			
	backlight on / off			
	previous / next pulse	scroll up / down	previous / next parameter	
	n/a	goto start / end when used with scroll keys	decrease / increase value	
	go to next display / confirm			

3.2 DISPLAYS

The keypad allows navigation through the features of the WA2 via a number of different displays described in the next sections.

3.2.1 DATA DISPLAY

This is the default display and shows a summary of the most recent weld. Figure 3-1 shows an example for an AC weld.

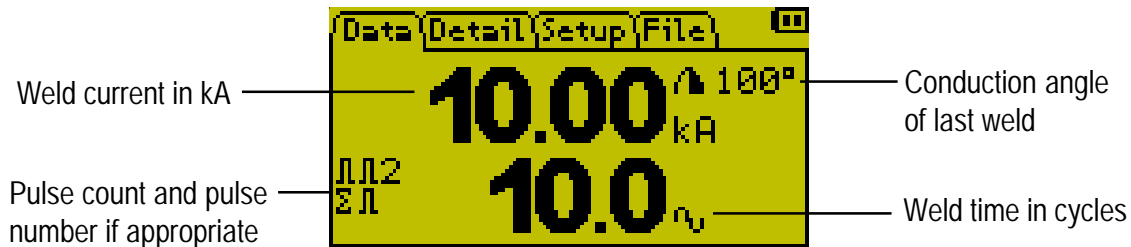


Figure 3-1. Data Display

For DC welds, the weld time is shown in ms and cycles. The conduction angle is not applicable to DC welds.

NOTICE	
DC weld currents less than 4.0 kA may lead to inaccuracies in the measured weld time.	

The ▲ and ▼ keys may be used to select the previous or next pulse in the weld (if applicable). The pulse count is incremented if there is an interruption in the current of 1 cycle (AC) or 10 ms (DC); an interruption in the current of more than 200 ms is interpreted as the end-of-weld.

3.2.2 DETAIL DISPLAY

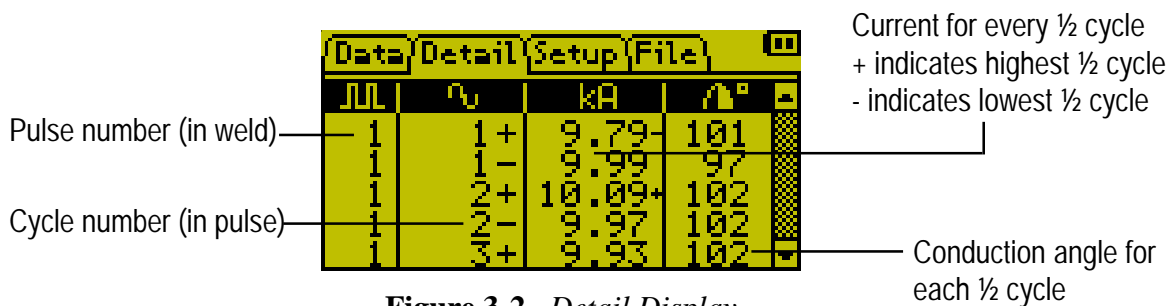


Figure 3-2. Detail Display

The Detail Display is accessible by pressing from the Data Display. The Detail Display shows the detailed results of the most recent weld. Figure 3-2 shows an example for an AC weld.

For DC welds, the ½ cycles are replaced with the cumulative weld time in ms. The conduction angle is not applicable to DC welds. The ▲ and ▼ keys may be used to scroll through the readings. Press ▲ and ◀ to go to the start of the list; press ▼ and ▶ to go to the end of the list.

3.2.3 SETUP DISPLAY

The Setup Display is accessible by pressing  from the Detail Display. The Setup Display allows the WA2 to be configured for specific applications. Figure 3-3 shows the typical settings for a 50 Hz AC application.

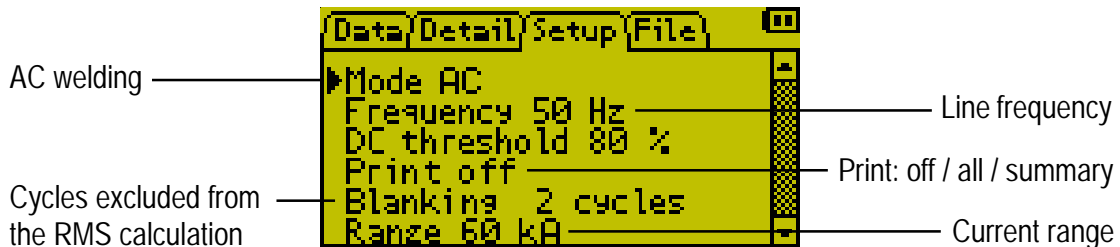


Figure 3-3. Setup Display

The **Mode** parameter determines the type of welding current to be measured – AC or DC.

The **Frequency** parameter relates to the AC frequency. If **DC mode** is selected, the **Frequency** parameter is used to calculate the equivalent weld time in cycles for the Data Display.

The **DC threshold** determines the percentage of the maximum weld current that is included in the current and duration calculations (see Figure 3-4); it is not applicable in **AC mode**. See Section 6.0 for low Amp current measurement.

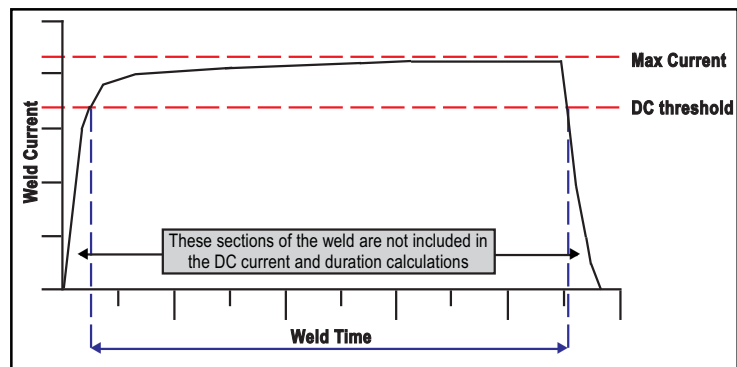


Figure 3-4. DC threshold

The **Print** parameter determines the output from the USB port at the end of each weld. If printing is **off**, there is no output; if printing is set to **all**, the WA2 outputs the results of every ½ cycle (AC) or 10 ms (DC) reading; if printing is set to **summary**, the WA2 outputs the average current and duration for the weld.

The **Blanking** parameter is used to mask transient conditions at the start of the weld.

The **Range** parameter is used to determine the maximum current that can be measured. This parameter should match the setting on the optional attenuator module or set to 60 kA if no attenuator module is used.

The **Auto shutdown** parameter (not shown) is used to enable or disable the automatic shutdown feature. If this parameter is set to **on**, the WA2 will shutdown after 10 minutes of inactivity to conserve battery power. If this parameter is set to **off**, the WA2 will not automatically shutdown.

The **Stop** parameter (not shown) can be used to capture a specific section of a long weld. The WA2 will capture 300 cycles (AC) or 3 seconds (DC) of welding prior to the **Stop** parameter.

If **DC mode** is selected, the **Blanking** and **Stop** parameters are programmed in ms.

3.2.4 FILE DISPLAY


The File Display is accessible by pressing  from the Setup Display. The File Display allows welds to be stored and retrieved for analysis at a later date.



Figure 3-5. *File Display*

The first line of display shows the memory that is available for storing welds using a bar graph; the value will change according to the quantity and duration of welds that are stored.








The **Action** parameter determines if the weld will be **saved**, **loaded** from memory, **erased** from memory or **printed**. If none of these functions are desired, choose **cancel**.

The **ID** is a numeric identifier that is used to access the stored weld.

Select an action and an ID (if applicable), then press  to confirm the action. The WA2 will perform the action and then revert to the Data Display.

4.0 MEASURING WELDS

When the WA2 is charged and installed as described in Section 2.0, it is ready to measure the parameters of every weld as follows:

1. Connect the WA2 sensor to the welding machine and ensure the sensor is connected securely to the WA2 (see Figure 2-2).
2. Switch on the WA2 by pressing the  button; wait for the Data Display to appear (see Sections 3.1 and 3.2.1).
3. Use the  button to access the Setup Display and check that the values correspond to the application. Select the Print format if required (see Section 3.2.3).
4. Use the  button to return to the Data Display (see Section 3.2.1).
5. Use the welding machine to produce a weld and check that the WA2 has read the welding current, duration and the conduction angle and pulses (if appropriate). The Data Display shows a summary of the weld.
6. Use the  button to view the results in greater detail using the Detail Display. Use the  and  to scroll through the list (see Section 3.2.2).
7. Use the  button to access the File Display (see Section 3.2.4) and save the results if required. The results can be retrieved, printed or erased at a later date if required.

5.0 CAPTURING DATA

The WA Terminal utility is a Microsoft Windows compatible program that allows capturing of data from the WA2 in applications where long-term data logging is required.

WA Terminal connects to the WA2 via a computer's USB port. As the WA2 records each weld, the information is transmitted to WA Terminal where the information can be inspected, saved or printed. The program has minimal setup requirements and virtually unlimited storage capacity.

Key features

- Microsoft Windows compatible
- Minimal installation
- Minimal set-up requirements
- Minimal performance overhead
- Virtually unlimited storage capacity
- Data is recorded in real time
- Data can be saved automatically

Specifications

Compatibility	Microsoft Windows: 8 / 7 / Vista / XP Server 2008
Minimum Requirements	Pentium 233-megahertz (MHz) processor or faster (300 MHz is recommended) At least 64 megabytes (MB) of RAM (128 MB is recommended) At least 1.5 gigabytes (GB) of available space on the hard disk Keyboard and a compatible pointing device Video adapter and monitor with Super VGA (800 x 600) or higher resolution USB 2.0 port USB A to USB mini B cable
User Interface	Conforms to user's display and scheme settings Resizable main window with persistent settings Horizontally and vertically scrollable data display Start/Stop recording function Start/Stop recording indicator Save data function Auto-save data function
Communication Ports	COM1 to COM8

5.1 INSTALLING WA TERMINAL

WA Terminal is a self-contained program and requires no installation. The program is supplied as a single executable file named WAT.EXE and is included on the WA2 Manual/Software CD. Copy the WAT.exe file to desired location on computer and run the program from there.

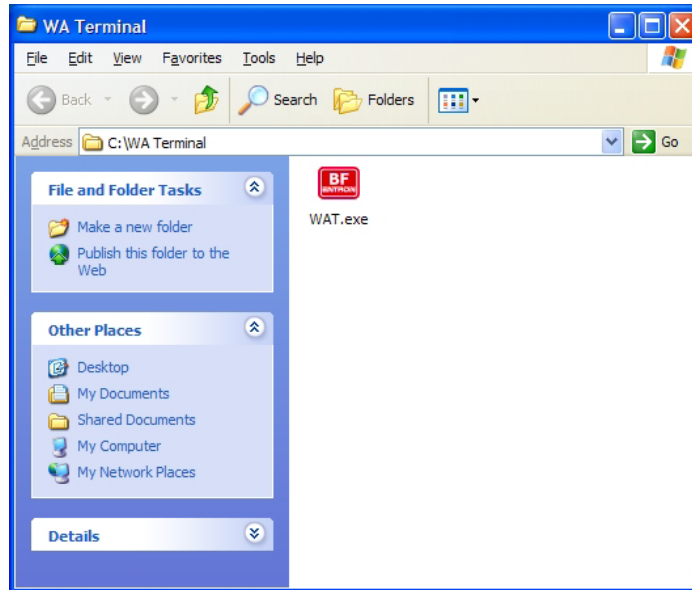


Figure 5-1. *WA Terminal program file*

5.2 CONNECTING WA2

Connect the WA2 as shown in Figure 5-2.

USB port (see Figure 5-3) – Connect to a computer USB 2.0 port using a USB A to USB mini B cable.

The USB device is provided by Future Technology Devices International Ltd. and Windows drivers are included on the WA2 Manual/Software CD. Updated drivers and drivers for Mac OS and Linux can be found on the FTDI website: <http://www.ftdichip.com/Drivers/VCP.htm>. Check for updated drivers and install the driver for your system by following the appropriate installation guide: <http://www.ftdichip.com/Support/Documents/InstallGuides.htm>.

The USB driver will allocate a COM port number to be used for the connection. The COM port number can be determined via Windows Device Manager as follows:

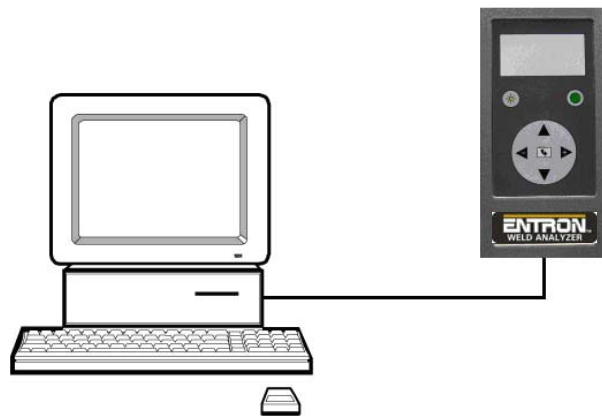


Figure 5-2. *Computer connection*



Figure 5-3.
USB port connector

5.2 CONNECTING WA2 (cont.)

Windows 8

- type: **device manager**, select Device Manager and then press enter

Windows 7/Vista

- Select the Start Orb.
- In the Start Search box, type: **device manager** and then press enter.

Windows Server

- Open the Administrative Tools in Control Panel.
- Within the Administrative Tools, select Computer Management.

Windows XP/2000

- Right-click on My Computer and select Properties or open the Control Panel and select the System applet.
- In the System Properties window, select the Hardware tab.
- In the Hardware tab, select the Device Manager button.

A typical example is shown in Figure 5-4.

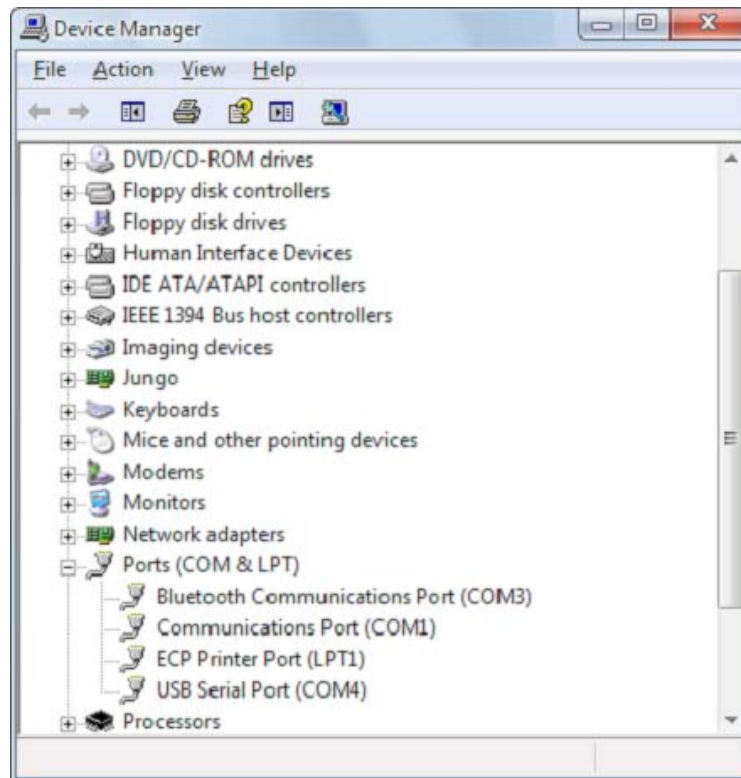


Figure 5-4. *Device Manager example*

Expand the Ports node and determine which COM port has been allocated to the USB port (in this example, the connection has been allocated to COM4). Select this COM port when using WA Terminal.

5.3 USING WA TERMINAL

NOTICE

The WA2's Print parameter determines the data that is transmitted to WA Terminal at the end of each weld. If printing is **off**, no data is transmitted; if printing is set to **all**, the WA2 transmits the results of every ½ cycle (AC) or 10 ms (DC) reading; if printing is set to **summary**, the WA2 transmits the average current and duration for the weld.

The Print parameter can be accessed via the Setup screen on the WA2.

The user interface is shown in Figure 5-5.

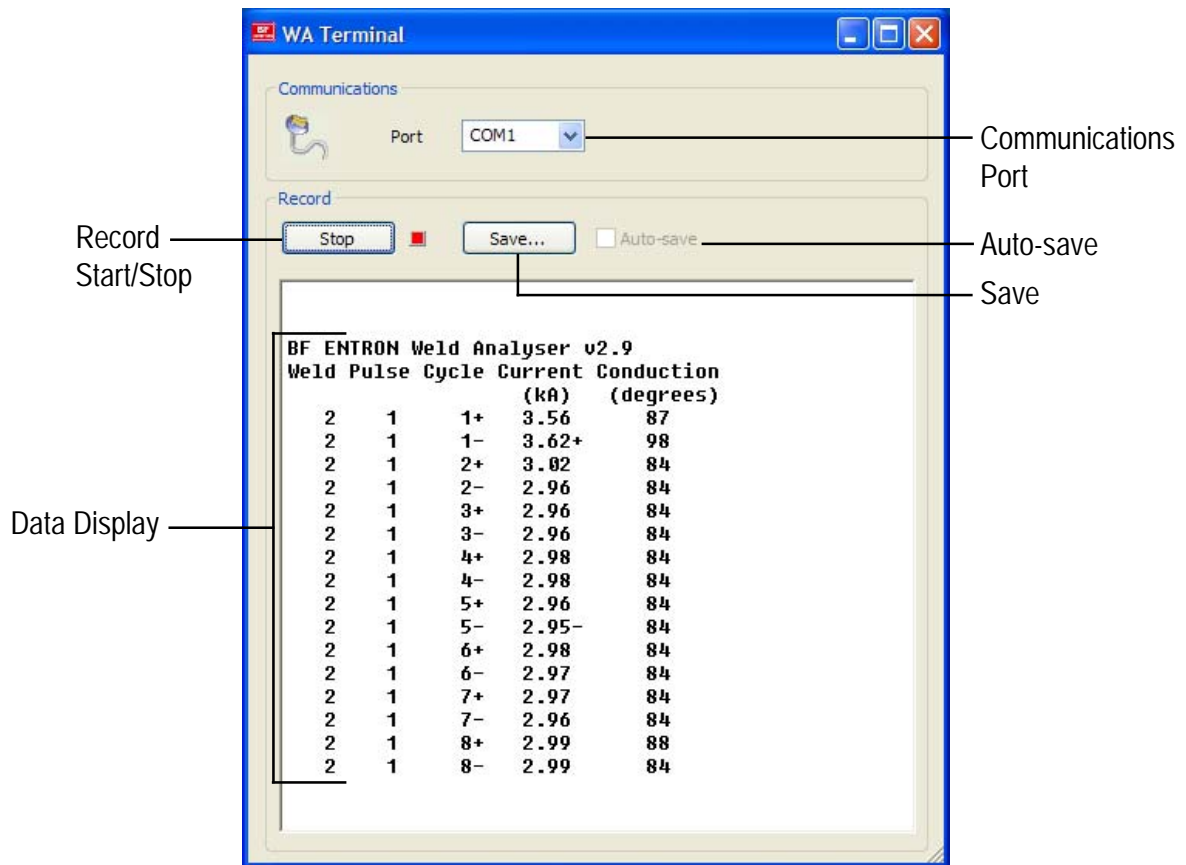


Figure 5-5. User Interface

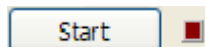
Following is a detailed description of each function.

Communications Port



The WA2 should be connected to a computer via a USB port. Use this function to select the appropriate COM port that will be used for communications. WA Terminal will reprogram the port with the appropriate settings.

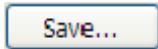
Record Start/Stop



Use this button to start recording from the WA2. The indicator will activate and WA Terminal will start capturing data via the COM port. Use the button again to stop recording data.

5.3 USING WA TERMINAL (cont.)

Save



Use this button to save the recorded data to a disk file. A File Save dialog box will be displayed (see Figure 5-6). Choose a location and a filename and the recorded data will be saved as a plain text file.

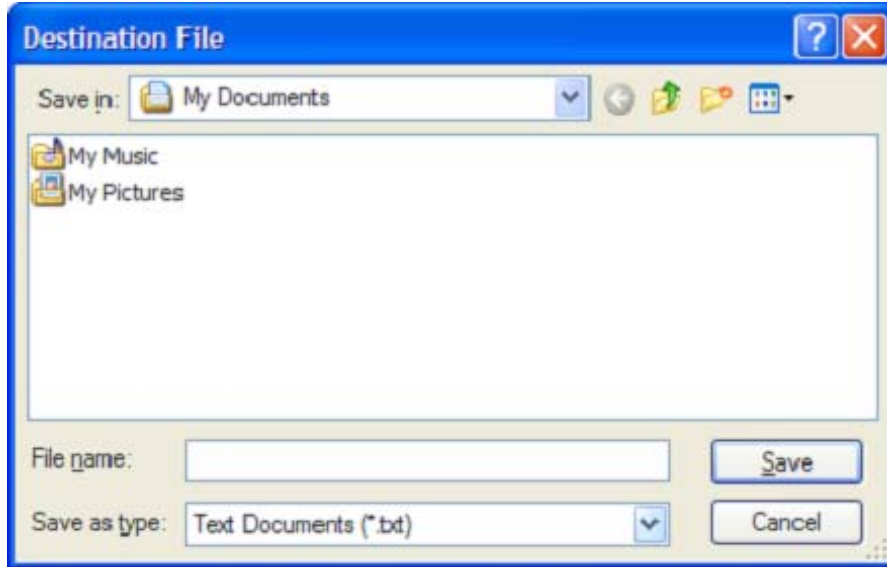
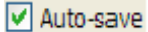


Figure 5-6. File Save dialog box

Auto-save



Use this function to automatically save the recorded data each time it is updated. The data is saved to the file selected via the Save button. If no file has been selected, the Auto-save function is disabled.

Data Display

The data display shows the data that has been recorded from the WA2. The exact format depends on the configuration of the WA2.

BF ENTRON Weld Analyser v2.9				
Weld Pulse Cycle Current Conduction				
			(kA)	(degrees)
2	1	1+	3.56	87
2	1	1-	3.62+	98
2	1	2+	3.02	84
2	1	2-	2.96	84
2	1	3+	2.96	84
2	1	3-	2.96	84
2	1	4+	2.98	84
2	1	4-	2.98	84
2	1	5+	2.96	84
2	1	5-	2.95-	84
2	1	6+	2.98	84
2	1	6-	2.97	84
2	1	7+	2.97	84
2	1	7-	2.96	84
2	1	8+	2.99	88
2	1	8-	2.99	84

Figure 5-7. Data Display example

5.3 USING WA TERMINAL (cont.)

Closing WA Terminal

The program can be closed at any time using any of the standard Windows actions. Recorded data that has not been saved will be discarded.

Removing WA Terminal

The program can be removed from the computer by deleting the WAT.exe file. There are no other associated files.

Data Persistence

! WARNING !	
Editing the Registry incorrectly can cause serious system-wide problems that may require re-installing Windows to correct. Changes made to the Windows Registry happen immediately, and no backup is automatically made. Do not edit the Windows Registry unless confident about doing so.	

The size and position of WA Terminal's main window, together with the last used COM port, is stored in the System Registry. The registry key is:

HKEY_CURRENT_USER\Software\BF ENTRON WA Terminal

6.0 LOW AMP CURRENT MEASUREMENT

The WA2 weld analyzer is designed to measure weld current from 2 kA up to 60 kA. When welding with a secondary current lower than 2 kA, the WA2 cannot display the average value on the screen. To measure and display weld current which is lower than 2 kA, two methods can be used.

METHOD 1 – INCREASE THE SENSITIVITY OF COIL/TOROID

The simplest way to increase coil/toroid's sensitivity is to make several turns (**N**) with coil/toroid around the secondary. With this method, the actual current value (I_{actual}) will be amplified **N** times and displayed on WA2; in other words, the current value shown on the WA2 (I_{display}) divided by **N** equals the actual current value (I_{actual}). The relation between I_{actual} and I_{display} is given by the following equation:

$$I_{\text{actual}} = I_{\text{display}} / N$$

For example, as shown on Figure 6-1, if the coil/toroid makes 2 turns around the secondary (**N=2**) and the current value shown on WA2 is 2.4 kA, the actual current is $2.4 / 2 = 1.2$ kA.

METHOD 2 – INCREASE THE PRIMARY TURNS OF COIL/TOROID

If the tested current is carried by bendable cable, making several turns (**K**) of cable through the coil/toroid will amplify the actual current value **K** times; in other words, the current value shown on the WA2 (I_{display}) divided by **K** equals the actual current value (I_{actual}). The relation between I_{actual} and I_{display} is given by the following equation:

$$I_{\text{actual}} = I_{\text{display}} / K$$

For example, as shown on Figure 6-2, if the cable makes 3 turns around the coil/toroid (**K=3**) and the current value shown on WA2 is 2.7 kA, the actual current is $2.7 / 3 = 0.9$ kA.

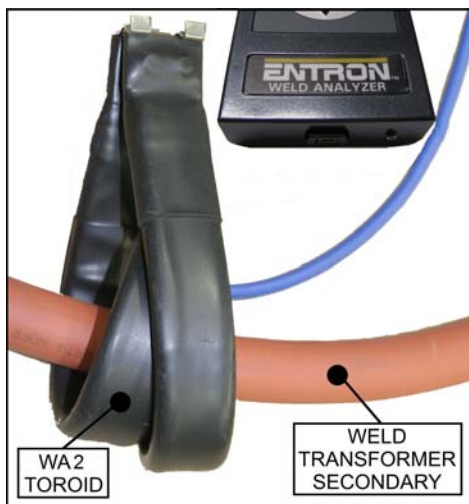


Figure 6-1. Method 1 example




Figure 6-2. Method 2 example

APPENDIX A WA2 WELD ANALYZER CONCISE MANUAL

This WA2 Concise Manual 700228 is included on WA2 Manual/Software CD. It is intended as a quick guide to setup and use the WA2 weld analyzer.

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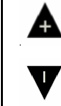

WA2 Weld Analyzer Concise Manual 700228



ENTRON
ENTRON Controls, LLC.
1402 S. Batesville Road
Greer, SC 29650
(864) 416-0190
FAX (864) 416-0195
www.entroncontrols.com

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WA2 Weld Analyzer

Keypad operations		Function		
Key	Data	Detail	Setup	File
		power on / off		
		backlight on / off		
	previous / next pulse	scroll up / down	previous / next parameter	
	n/a	goto start/end when used with scroll keys	decrease / increase value	
		go to next display / confirm		

USB connection

USB 2.0 port
USB A to USB mini B cable

The USB device is provided by Future Technology Devices International Ltd. and Windows drivers are included on the WA2 Manual/Software CD. Updated drivers and drivers for Mac OS and Linux can be found on the FTDI website: <http://www.ftdichip.com/Drivers/VCP.htm>.

Check for updated drivers and install the driver for your system by following the appropriate installation guide: <http://www.ftdichip.com/Support/Documents/InstallGuides.htm>.

Specifications

LCD	128 x 64 pixels FSTN transreflective with yellow/green backlight
Keypad	Embossed disc tactile switches with antiglare display window
Maximum Weld Current	60 kA
Maximum Weld Time	9999 cycles (AC) or 199.9 seconds (DC)
Maximum Capture	300 1/2 cycles (AC) or 3 seconds (DC)
Conduction Angle	0° to 180° ± 4° (AC)
Battery Life	6 hours continuous with NiMH batteries
Auto Power-off	10 minutes
Dimensions	3-3/8" w x 1-1/8" d x 6-3/4" h
Weight	1 lb. including batteries

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APPENDIX A WA2 WELD ANALYZER CONCISE MANUAL (cont.)

AC Operation on WA2 Weld Analyzer

Data Display

Weld current in kA
Pulse count and pulse number if appropriate
Conduction angle of last weld
Weld time in cycles

Detail Display

Pulse number (in weld)
Cycle number (in pulse)
Conduction angle for each 1/2 cycle
Current for every 1/2 cycle + indicates highest 1/2 cycle - indicates lowest 1/2 cycle

Setup Display

AC welding
Cycles excluded from the RMS calculation
Line frequency
Print off / all / summary
End of capture for long welds

DC Operation on WA2 Weld Analyzer

Data Display

Weld current in kA
Pulse count and pulse number if appropriate
Weld time in cycles
Weld time in ms

Detail Display

Pulse number (in weld)
Cycle number (in pulse)
Current for every 1/2 cycle + indicates highest 1/2 cycle - indicates lowest 1/2 cycle

Setup Display

% of weld included in RMS and duration calculations
Time excluded from the RMS calculation
Print off / all / summary
End of capture for long welds

File operation

Available memory
E=Empty
F=Full
File ID 0 to 99 or all
Action: cancel / save / load / erase / print

Setup notes

- **Mode** should be set to the type of welding current – AC or DC.
- **Frequency** should be set to the supply frequency – 50 or 60 Hz (AC welding only).
- **DC threshold** readings below this percentage of the maximum current will be excluded from the RMS and duration calculations (DC welding only).
- **Print via PC**
 - off** – no printing; **all** – prints every 1/2 cycle (AC) or 10 ms (DC) reading; **summary** – prints average current and duration for each weld pulse.
- **USB driver** – www.fidichip.com/Drivers/VCP.htm
- **Blanking** is the number of cycles/ms after the start of the weld that will be excluded from the RMS calculation.
- **Range** determines the maximum current that can be measured.
- **Auto shutdown** enables or disables power saving mode.
- **Stop after nn cycles/ms** can be used to capture a specific section of a long weld. If the weld is longer than this parameter, a **e** symbol will be shown alongside the weld time.