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# WPM ™
# Weld Process Monitor

## Operation / Installation Manual

Manual Part Number: S8M5016
Revised: January 23, 2008

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# 1.0 GENERAL DESCRIPTION

## 1.1 SYSTEM DESCRIPTION

The Weld Process Monitor (WPM™) is an HMI Industrial Computer based system combined with the Micro ADM Weld Monitor to provide single point continuous data acquisition and weld monitoring for quality control of critical welding operations. It can be employed as a stand-alone unit or it can be connected via EATHER NET to a network for remote/Ethernet access. The features and benefits of the WPM™ are:

**FEATURES:**

*8.4"/10.4"/12.1" Touch Screen LCD supports 800 x 600 SVGA resolution*

*Network: Single Realtek RTL 8139B 10/100 Ethernet*

*Dual USB ports*

*1 - RS-485 port for communication to host PLC or ROBOT*

*Dual Micro ADM RS-485 serial interface connections*

*Micro ADM Status Panels and Limit Configuration Windows*

*Micro ADM Weld Data display window and Graphing Function*

*Monitoring, Limit Testing and logging of Voltage, Current, Wire Feed Speed and Gas Pressure data*

*Weld Trend DATA for Statistical Process Control Graphing Function*

*Three Levels of Fault notification (Parameter, Weld, Part)*

*Seven days storage of Weld Trend Data and Fault Data*

*E-Mail/Text Message Notification of Fault Data (WPM must have Ethernet connection with POP3 and STMP server for this feature)*

*Compact, versatile, rugged and lightweight design*

*Customized Monitor display of Part with PASS/FAIL weld flag(s) (Photo of Part and Weld Locations provided by customer)*

**BENEFITS:**

*Provides continuous weld monitoring and data collection*

*Instant Visual Notification of Parameter, Weld and Part PASS or FAIL*

*Single point user password protected access to Micro ADM(s)*

*Direct connect to user Ethernet for remote access*

*Simplified data acquisition and storage using Microsoft Excel® file format*

*Provides documentation and data trend analysis relating to the welding process on a non-invasive basis*

*Easily installed in new or existing applications*

*Provides versatility and flexibility for installation*

## 1.2 SPECIFICATIONS

| | |
|---|---|
| Dimensions | 5.125”H X 9.5”W X 14.25”L (76mm X 165mm X 280mm) |
| Weight | 9.5 lbs (4.3kg) |
| Power Requirements | 115 VAC or 220 VAC 50/60 Hz @ 1 amp |
| Communications | Realtek RTL 8139B 10/100 Ethernet port, Dual USB ports |
| Display | 8.4”/10.4”/12.1” Touch Screen LCD supports 800 x 600 SVGA resolution |

### TOUCH SCREEN SPECIFICATION

- Type: 4-wire resistive
- Resolution: 800 x 600
- Transparency: >=81%
- Light Transmission: None
- Lifetime: >1 million touches
- Scratch Resistance: >= 3H
- Interface: RS-232
- OS support: Windows CE

# 2.0 INSTALLATION

This chapter contains the following information on the installation of the WPM™ system:

Mounting and Installation of WPM and Micro ADM (s)

Power-up

Ethernet Connection

## 2.1 MOUNTING AND INSTALLATION

Select a suitable location for mounting the WPM™ with respect to the following:

- Mount WPM in a location that provides a clear view of the screen and easy access to the Touch Screen, Micro ADM Connectors, Ethernet and USB Ports.
- The WPM must be installed within 5.5 meters of the Micro ADM (Micro ADM interface cables are 6 meters long).
- Mount the WPM utilizing the four mounting holes of the mounting tabs on the box (see mounting dimensions Figure 1).
- Mount and install the Micro ADM(s) in accordance with the Micro ADM Manual Chapter 2.
- Provide Remote I/O Interface to Micro ADM in accordance with Micro ADM Manual Chapter 6.

## 2.2 POWER-UP

After the installing of the WPM™ system perform the following:

1. Plug the power cable into a suitable power source.

   ***NOTE:*** *The WPM™ unit has AUTO VOLTAGE SWITCHING and is capable of operating from either 115 VAC or 220 VAC 50/60 HZ.*

2. Apply AC power to the unit.

3. During power up, the WPM™ will display screens normally associated with the power up of any computer. The WPM runs on the Windows 5.0 CE platform.

4. Once Power Up is complete the WPM™ will Auto Load the Weld Monitor Start screen (see Figure 2 “Default Screen”) (Custom Screens displaying the part with weld tags are available at additional charge upon customer request).

5. If for any reason the WPM™ does not load the “Default Screen”, power the WPM™ OFF and back ON.

## 2.3 ETHERNET CONNECTION

To install the ETHERNET connection, perform the following:

1. Provide a 10/100 Mbps Ethernet RJ-45 (T-568B Color Code) drop with a Fixed TCP/IP address at the installation site.

2. Provide POP3 and SMTP e-mail server IP address.

3. Email account name and password for WPM™ email server account.

4. Send To: and CC: email addresses to receive the fault e-mail messages generated by the Micro ADM and WPM™. See FIGURE 4 for location to enter address.

5. Plug the RJ-45 connector into the ETHERNET Port located on the bottom panel of the WPM™.

**RJ-45 (T-568B Color Code)**

| Pin | Wire Color | Pair | Description |
|---|---|---|---|
| 1 | WHT/ORG | 2 | TxData+ |
| 2 | ORG | 2 | TxData- |
| 3 | WHT/GRN | 3 | RecvData+ |
| 4 | BLU | 1 | |
| 5 | WHT/BLU | 1 | |
| 6 | GRN | 3 | RecvData- |
| 7 | WHT/BRN | 4 | |
| 8 | BRN | 4 | |

# 3.0 OPERATION

## 3.1 DEFAULT MAIN SCREEN

Once the WPM™ has been installed and power applied, the unit will display the main screen (Figure 2).

The MAIN SCREEN provides the user with visual information pertaining to:

- Run Time and Average Weld Parameter Data, Part Time and Weld Count
- A Pass/Fail notification for each Parameter, Weld and Part
- Micro ADM (uADM) Communication, Input and Weld Active Status
- Access to uADM Limits, Configuration and Weld Data Screens
- Access to Weld Data Trend Analysis Graphs
- Fault Data History Information based on selected fault level

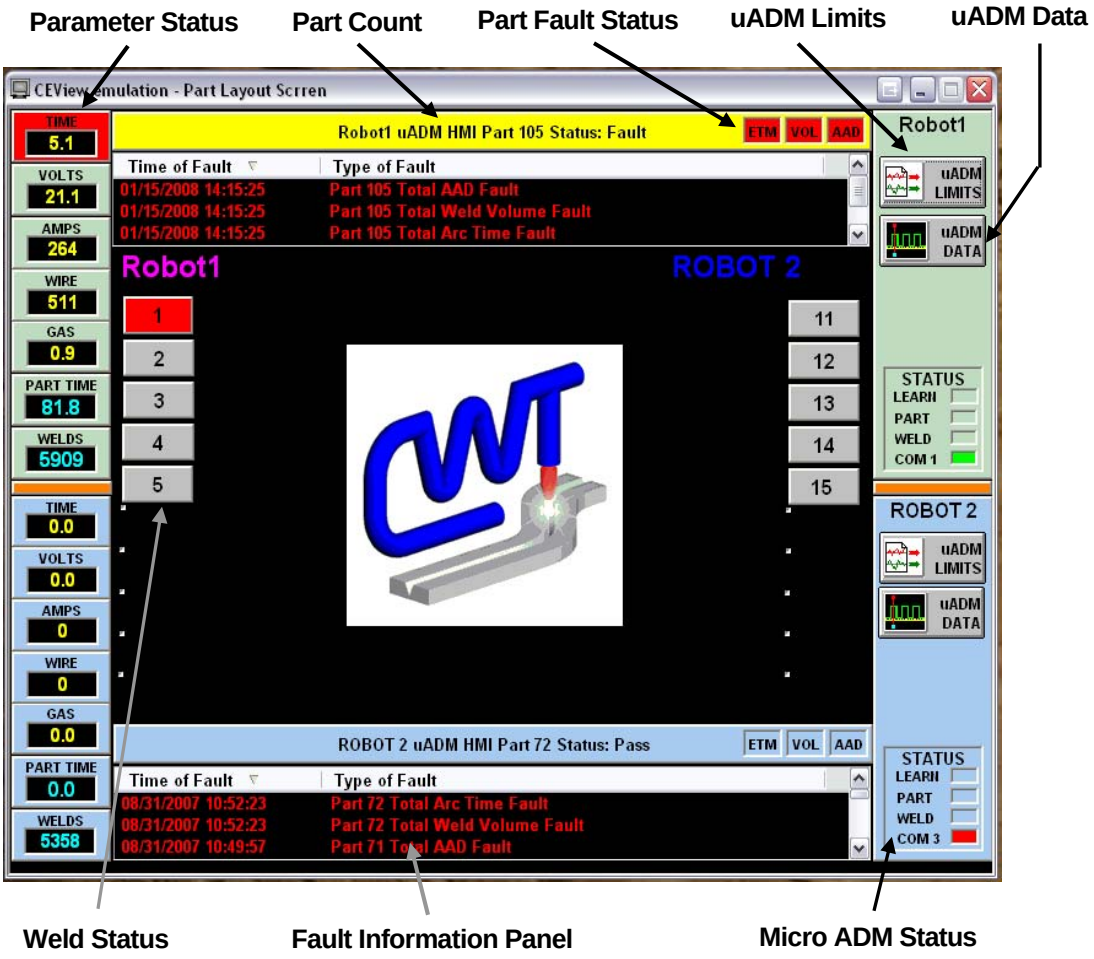



**Figure 2 – Default Screen**

***NOTE: Only use approved pen stylus or tip of finger on the TOUCH SCREEN of the WPM™. Use of abrasive items will scratch the screen and possibly damage the touch screen.***

**PARAMETER STATUS WINDOWS:**

***NOTE: The TIME, VOLT, AMPS, WIRE and GAS Parameter Windows will display the following Parameter Fault COLOR INDICATION:***

- ***RED = Parameter Fault***

**TIME**: Displays a running ARC timer during a Weld. Displays the TOTAL ARC time for a Weld after the ARC is OFF.

**VOLTS**: Displays the WELD VOLTS recorded during a Weld. Displays the Average Volts recorded after the Weld ARC is OFF.

**AMPS**: Displays the WELD AMPS recorded during a Weld. Displays the Average AMPS recorded after the Weld ARC is OFF.

**WIRE**: Displays the WIRE FEED SPEED recorded during a Weld. Displays the Average WIRE FEED SPEED recorded after the Weld ARC is OFF.

**GAS**: Displays the GAS recorded during a Weld. Displays the Average GAS recorded after the Weld ARC is OFF.

**PART TIME**: Total time from PART ACTIVE INPUT ON until PART ACTIVE INPUT OFF triggered by setting and dropping the PART INPUT to the Micro ADM.

**WELDS**: Displays TOTAL Number of welds from 0:00 hrs to 24:00 hrs each day. Counter automatically resets at start of each day or at Power Up of the system.

**PART FAULT STATUS WINDOWS:**

**ETM**: Displays a PASS/FAIL indication of the PART Total ELAPSE TIME. GREEN = PASS, RED = FAIL.

**VOL**: Provides a PASS/FAIL indication of the Total VOLUME of material applied for a PART. GREEN = PASS, RED = FAIL.

**AAD**: Provides a PASS/FAIL indication of the Total WORK APPLIED during a PART. GREEN = PASS, RED = FAIL.

**PART COUNT WINDOW:**

Displays TOTAL Number of PARTS from 0:00 hrs to 24:00 hrs each day. Counter automatically resets at start of each day or at Power UP of the system.

**WELD STATUS WINDOWS:**

The Weld Status Window provides an indication of the Weld being performed.

A **YELLOW** window indicates that the ARC is ACTIVE.

A **GREEN** Window indicates that the WELD PASSED Limit testing.

A **RED** WINDOW indicates that the WELD FAILED Limit testing.

During the Micro ADM **LEARN** Process the WPM will provide a Weld Status Window for up to 10 WELDS per PART for two Micro ADM's (DEFAULT MAIN SCREEN CONFIGURATION).

A Weld Status Windows will appear on the screen for each weld after the first part is completed during the LEARN PROCESS.

If more that 10 welds per PART/Micro ADM are needed the customer will have to request a custom display.

To access the **Weld Data Trend Analysis Graph**, tap/click on the Weld Status Window for the desired weld (see Figure?).

**FAULT INFORMATION PANEL:**

The Fault Information Panel provides the **DATE** and **Time** of a Fault as well as the **PART Number** (incremental Part counter reset at the start each day [24 hour period]) and **TYPE of Fault** that occurred.

The Fault Level displayed is selected using the uADM Limits Window (see Figure 3 for more information).

**Micro ADM (uADM) LIMITS BUTTON:**

This button enables the user to access the uADM Limits and Configuration Screen (see Figure 3 for screen information).

**Micro ADM (uADM) DATA BUTTON:**

This button enables the user to access the WELD DATA Graph Function (see Figure 5 for WELD DATA Graph screen information).

**Micro ADM (uADM) STATUS PANEL:**

The uADM STATUS Panel provides information on the uADM LEARN, PART, WELD (ARC) Active and Communications status.

A **YELLOW** Status window indicates that the **LEARN**, **PART** Input and **WELD** (ARC) are active.

If the **COM** Window is **GREEN** that indicates communication has been established with uADM.

If the **COM** Window is **RED** that indicates that the WPM™ can not communicate with the uADM. Perform Communication Troubleshooting procedures in Chapter 5.

## 3.2 Micro ADM (uADM) LIMITS AND CONFIGURATION SCREEN:

To access this screen double click the **uADM LIMITS** button located in the Upper Right Corner of the Main Screen.

The uADM Limits and Configuration Screen enables the user to:

- View the calculated LEARNED MEAN Values for a weld

- Set Minimum and Maximum GRAPH PARAMETER values for the graph displayed in the uADM DATA Screen (see Figure 5)
- EDIT and SEND changes to the uADM Configuration and Sensor Limits for testing
- Select and set the uADM Modes
- Input User Identification Name for Torch/uADM(Displayed on Main Screen)
- Select Fault Level for Faults Displayed in the Fault Information Panel of the Main Screen
- Input User E-Mail Address for Fault Notification E-Mail or Text Message

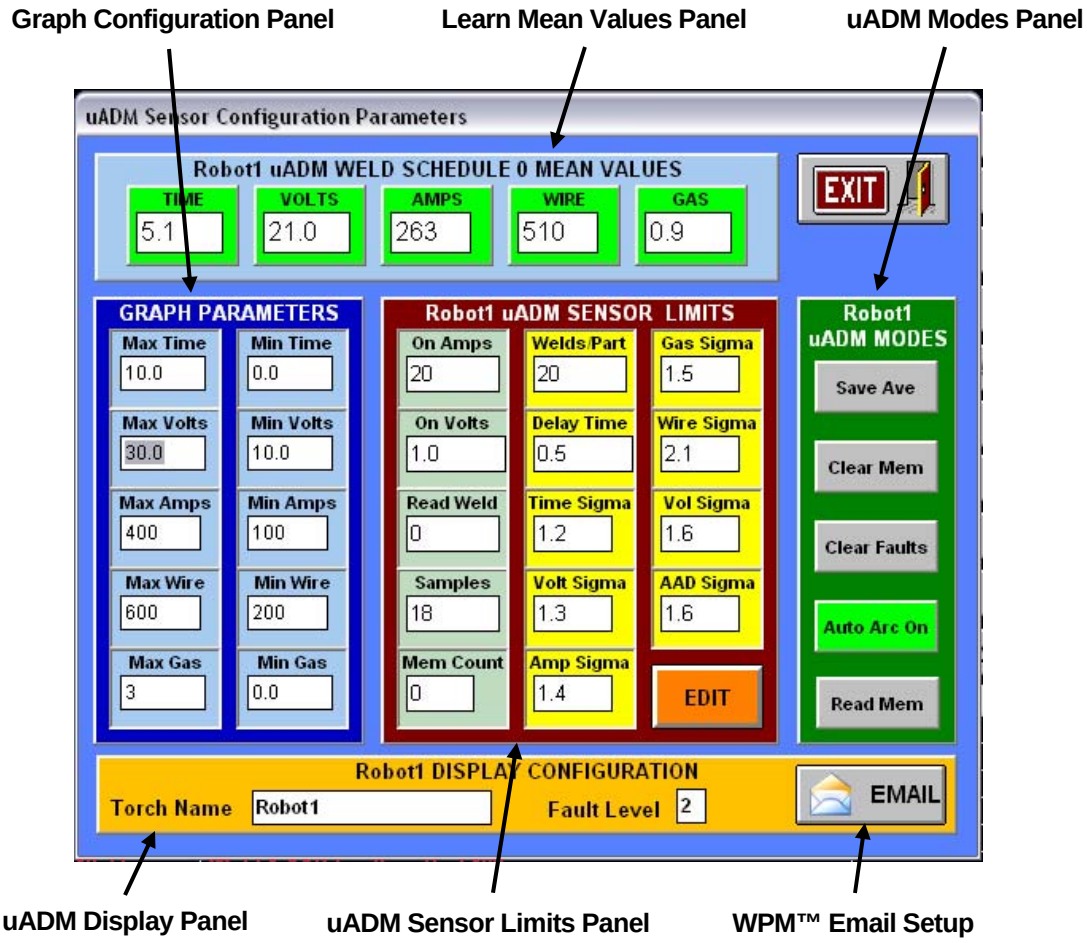



**FIGURE 3 – uADM LIMITS SCREEN**

**GRAPH CONFIGURATION PANEL:**

The GRAPH Configuration Panel enable the user to select the Minimum and Maximum values viewable for each parameter displayed on the GRAPH when the uADM DATA Button on the MAIN SCREEN is selected (see Figure 5 – uADM DATA GRAPH).

**LEARNED MEAN VALUES PANEL:**

The Learned Mean Values Panel displays the Averaged Mean values for each Parameter as calculated by the uADM during the LEARN process.

These values are generated during the LEARN Sequence. Testing Limits are generated using the user defined Sigma Limits values located in the uADM SENSOR LIMITS PANEL and the Parameter Mean values from the Learned Welds.

*NOTE: A Sigma Value change sent to the uADM will generate a re-calculation of the Testing Limits within the uADM.*

**uADM MODES PANEL:**

- GREEN BUTTON = ON
- GRAY BUTTON = OFF

**Save Ave Button:** When selected the uADM will save the Averaged Weld Data from each weld. This function is not required when the WPM™ is connected to the uADM.

The Default Setting is **OFF**.

*Note: The WPM™ automatically saves the averaged weld data for each weld.*

**Clear Mem Button:** When selected the uADM Memory will be cleared of all saved weld data. The Button will momentarily turn YELLOW then back to GRAY to indicate the memory is cleared. (Will not clear LEARNED Weld Schedule Values)

**Clear Faults Button:** When Selected the Saved Fault Data in the uADM Memory will be cleared.

*Note: The WPM™ automatically saves all Faulted data for each weld.*

**Auto ARC On Button:** When selected the uADM will automatically determine that the ARC is active based on the user set On Amps and On Volts values entered in the uADM Sensor Limits Panel of this screen.

Default value is **ON**.

*Note: If the Auto ARC On Button is set to **OFF** the uADM will not log data until the REMOTE ARC ON INPUT is set high (see uADM Manual, Chapter 6, Remote I/O).*

**Read Mem Button:** When selected the WPM™ will read the Saved weld data from the uADM.

Default value is **OFF**.

*Note: When the WPM™ has a continuous connection to the uADM it automatically saves all weld data.*

**uADM DISPLAY PANEL:**

The uADM Display Panel contains the Torch (or uADM) user defined name text entry box and the Fault Level Selection box.

**Torch/uADM Name Box:** When the user enters a Name in this box it will be displayed on the MAIN SCREEN.

**Fault Level Box:** The user can select 3 different levels of Faults displayed in the Fault Information Panel on the Main Screen (see Figure 2).

Those Levels are:

- Level 1 = Fault Information for Parameter, Weld and Part will be displayed
- Level 2 = Fault Information for Weld and Part will be displayed
- Level 3 = Fault Information for the Part will be displayed.

The WPM™ saves all levels of Fault Data but displays only the Level selected by the User. If the User changes the Fault Level, the WPM™ will update the Fault Information Panel to reflect the new level selected.

**EMAIL Button:** When selected the EMAIL Setup window will appear(see Figure 4 – EMAIL SETUP).

**uADM SENSOR LIMITS PANEL:**

The Sensor Limits Panel enables the user to change the uADM Configuration and Sigma Values. All values in this Panel are User defined.

To Change any of the values in this Panel the user must first click the **EDIT** Button.

After the required changes are completed the user must click the **SEND** to transmit the new values to the uADM.

Changing the Sigma values will change the Upper Control Limit (UCL) and Lower Control Limit (LCL) for the Parameter being tested. A Larger Sigma value will broaden the UCL and LCL. If the Sigma value is increased too much the UCL and LCL may be to the point that a suspect weld will receive a PASS indication. A Smaller Sigma value will narrow the UCL and LCL. If the Sigma value is decreased too much the UCL and LCL may be to the point that you may receive nuance faults for valid welds.

**On Amps Window:** This value is the Minimum ARC AMPS required for an ARC ON condition. The uADM must sense this value or above for a valid ON Condition.

Default value is 20.

**On Volts Window:** This value is the Minimum ARC Volts required for an ARC ON condition. The uADM must sense this value or above for a valid ON Condition.

Default value is 5.

***Note: The uADM must have the Minimum value of both Volts and Amps to start logging and testing data.***

**Read Weld Window:** When the user places a Weld Number in this box and clicks the Read Mem Button in the uADM MODES Panel, the WPM™ will read and save the requested weld.

Default value is 0.

**Samples Window:** The Samples Box displays the number of raw weld data samples averaged together to give one data point. If a 0 (Zero) is entered into this box the uADM will collect 0(Zero) data points.

Default value is 18.

**Mem Count Window:** This box displays the total number of Saved Weld Averages stored in Memory.

Default value is 0

**Welds/Parts Window:** This box contains the number of welds per part recorded by the uADM during the LEARN process. Setting this number to 0(Zero) will clear the Learn Flag in the uADM.

Setting this value to the number of Welds used to learn the Part will set the LEARN Flag in the uADM.

**Delay Time Window:** This value is used to Delay the ARC ON output at the start of a weld to prevent an ARC On/ARC Off/ARC On type condition.

Default value is 0.5 seconds

**Time Sigma Window:** This value sets the Sigma Deviation Value for the Time Parameter Limits Calculation.

Default value is 2.1

**Volt Sigma Window:** This value sets the Sigma Deviation Value for the Volt Parameter Limits Calculation.

Default value is 2.1

**Amp Sigma Window:** This value sets the Sigma Deviation Value for the Amp Parameter Limits Calculation.

Default value is 2.1

**Gas Sigma Window:** This value sets the Sigma Deviation Value for the Gas Parameter Limits Calculation.

Default value is 2.1

**Wire Sigma Window:** This value sets the Sigma Deviation Value for the Wire Parameter Limits Calculation.

Default value is 2.1

**Vol Sigma Window:** This value sets the Sigma Deviation Value for the Total Volume Parameter Limits Calculation.

Default value is 2.7

**AAD Sigma Window:** This value sets the Sigma Deviation Value for the Applied ARC Density (AAD) Parameter Limits Calculation.

Default value is 2.7

## 3.3 EMAIL SET UP SCREEN:

When the EMAIL Button is selected the EMAIL Setup screen will be displayed. In this screen the user can enter an e-mail address to provide e-mail or text message notification of a FAULT condition from a uADM.

The Setup information for this screen should be provided by your local IT manager.

After the information is entered perform a TEST by selecting the TEST Button.

If you do not receive a Success notification contact your IT Manager.

If a Success indication is received place a check in the Enable Email box.

The WPM™ will generate an e-mail notification, by Fault Level Selected (Level 1, 2, or 3), for each fault received.

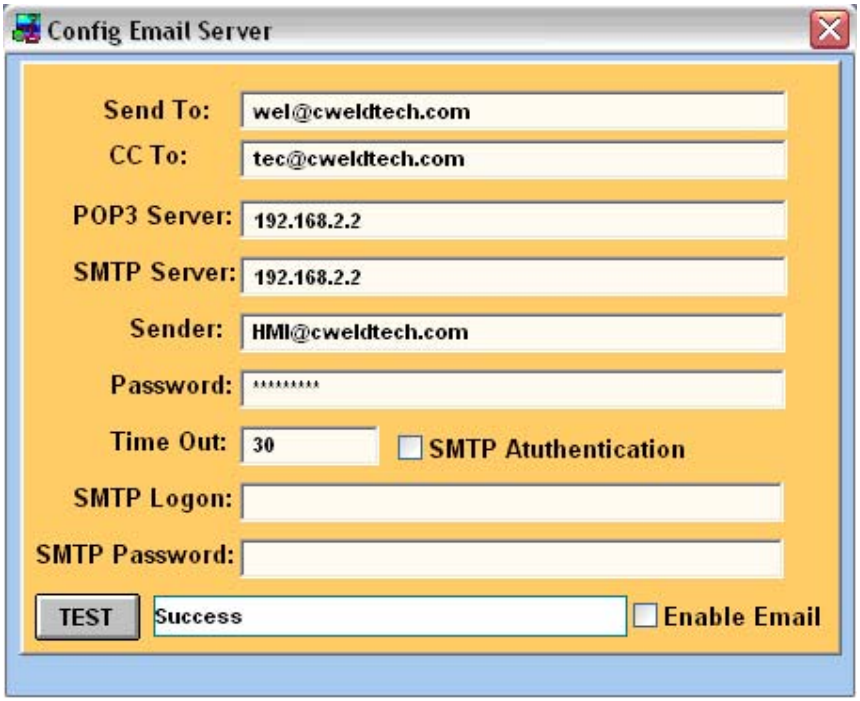



Figure 4 – E-mail Setup Screen

## 3.4 Micro ADM (uADM) WELD DATA GRAPH SCREEN:

When the uADM DATA Button on the MAIN Screen is selected the Weld Data Graph Screen will open. At the end of the weld the RUN time Parameter and DATA will be displayed on the Graph.

To Set the Minimum and Maximum values for the individual Graphs go to the GRAPH Configuration Panel located in the uADM Configuration and Limits Screen (Figure 3)

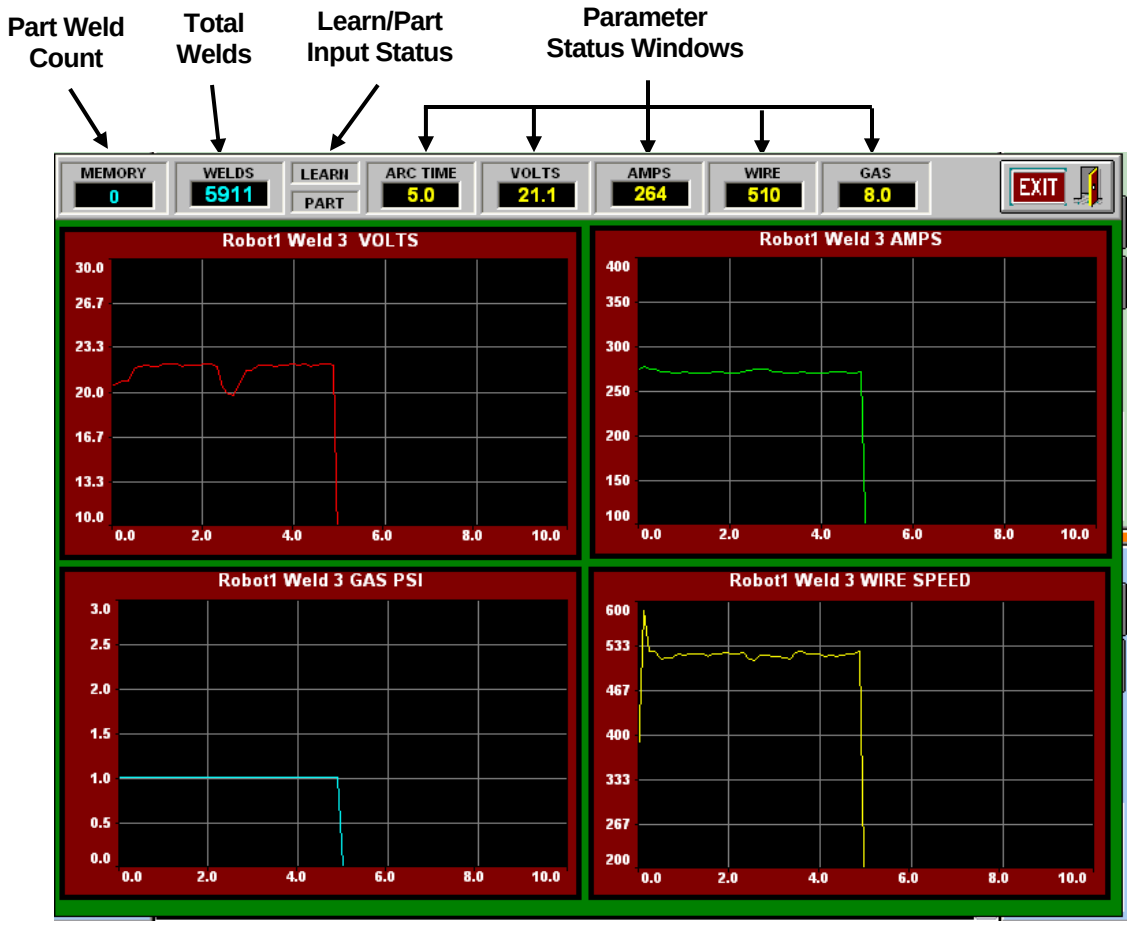



Figure 5 – Weld Data Graph Screen

**Part Weld Count Window:** This window displays the Part Weld Number for the Data displayed in the Parameter Status windows.

**Total Welds Window:** This window displays the Total Welds sense last reset.

**Learn/Part Input Status Window:** Displays the status of the LEARN and/or PART Input to the uADM. If the Input is ACTIVE the window will be YELLOW.

**Parameter Status Windows:** These windows display the Weld Run Time Data during a weld and the Average Weld Data after the weld. The Window will also gives an indication for a Parameter Fault. RED = Parameter Fault

## 3.5 Micro ADM (uADM) WELD DATA TREND SCREEN:

To view the Graphed Trend Data for a weld, tap/click on the Weld Status Window located on the Main Screen.

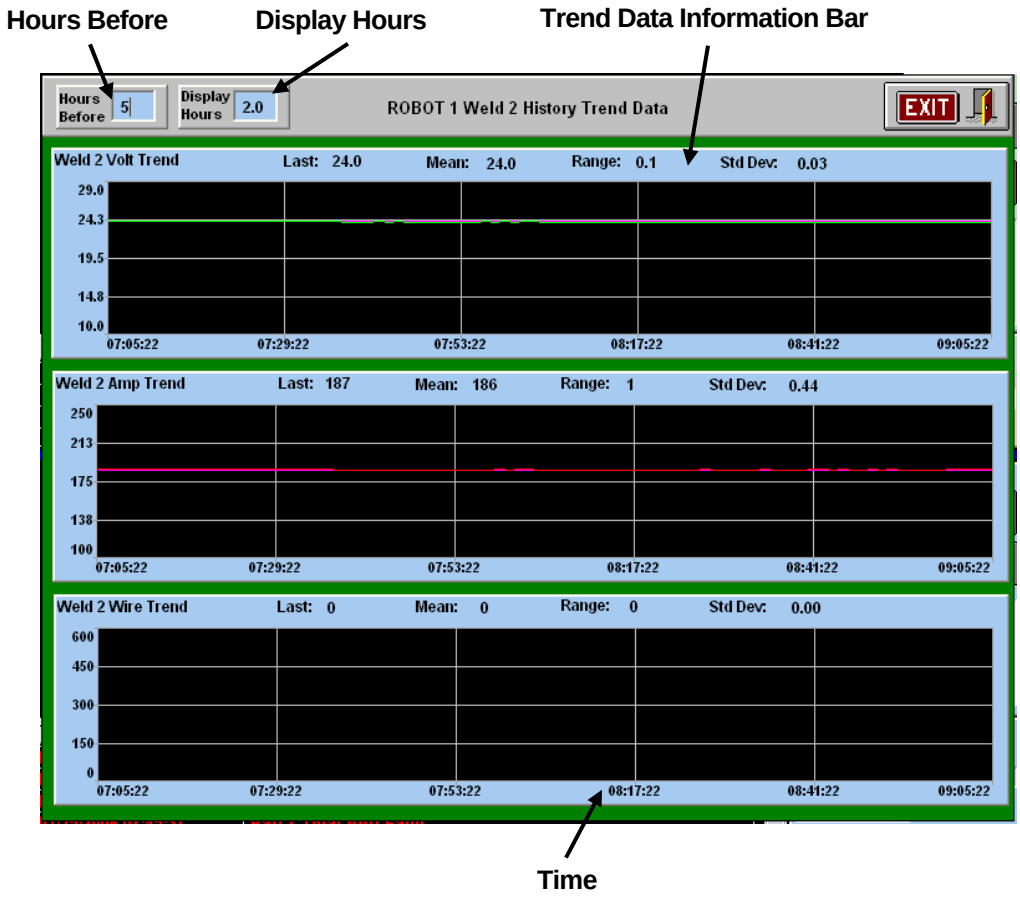



Figure 6 – WELD TREND DATA GRAPH

**Hours Before Window:** To view TREND Data from the past 12 hours tap the window and enter the desired time.

**Display Hours Window:** To change the total hours of TREND Data on the GRAPH DISPLAY, tap the window and enter the desired time (Maximum of 5 Hours).

*NOTE: The Maximum number of hours that can be viewed on with the Trend Data Graph function is 17 hours (5 Display Hours and 12 Before Hours)*

**Trend Data Information Bar:** The Trend Data Information Bar displays:

- The Weld Number and Weld Parameter associated with the Displayed data
- The Last Data Value posted to the Graph
- The Mean Value for the Parameter
- The Range of Change for the Parameter

- The Standard Deviation of the Parameter.

**Time Bar:** Displays the Time divisions for the Graph. Based on the setting of the Display Hours.

# 4.0 TROUBLESHOOTING

This section contains basic troubleshooting procedures for the WPM™. For problems not addressed in this section please contact the customer service representative at the telephone or e-mail address listed below.

Service Telephone Number: (713) 462-2118

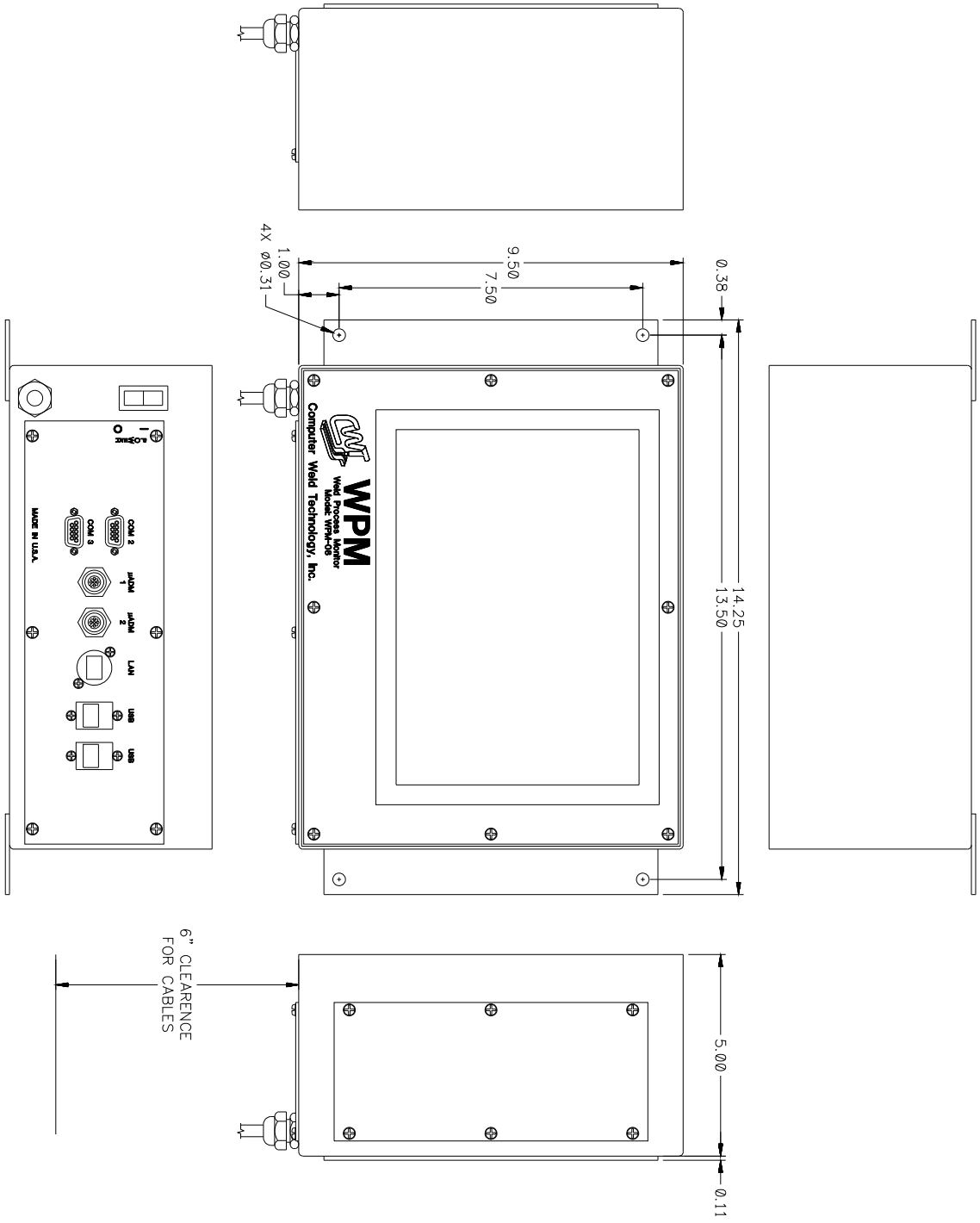
E-mail – Go to www.cweldtech.com and click on the SUPPORT/TECHNICAL and complete the form.

| SYMTOM | DIAGNOSIS |
|---|---|
| **No Power to WPM**<br><br>**No Power to Micro ADM** | 1. Verify AC power source.<br><br>2. Disconnect power plug from power source. Remove and check 12/5 VDC Power Supply Fuse. Replace if defective. If fuse blows after replacement contact CWT service representative.<br><br>3. Verify that the WPM Power Connector from the 12/5 VDC Power Supply is plugged into the back of the WPM.<br><br>4. Disconnect power plug from power source. Remove and check 24 VDC Power Supply Fuse. Replace if defective. If fuse blows after replacement contact CWT service representative. |
| **WPM will not Auto Boot to Main Screen** | 1. Remove power from the WPM.<br><br>2. Wait 30 seconds.<br><br>3. Apply Power to the WPM.<br><br>4. If WPM Main Screen is not displayed after boot up contact CWT Service representative. |
| **WPM will not Communicate with Micro ADM (RED COM indication on WPM Main Screen)** | 1. Verify Micro ADM NODE Selection set to NODE 1 (see Micro ADM Manual)<br><br>2. Verify that the 24 and 5 VDC Power LED's for the Micro ADM are illuminated. If not verify that the I/O cable is connected to the WPM and the Micro ADM.<br><br>3. Disconnect the REMOTE I/O Cable from the Micro ADM. If the 24 and 5 VDC LED's illuminate and Communications are established with the Micro ADM, verify connection of User REMOTE I/O (see Micro ADM Manual)<br><br>4. If the Micro ADM Power LED's are illuminated and communication can not be established Switch the WPM Power to OFF and remove the eight screws securing the front panel. Tilt the panel so you can see the two RS-232/RS-484 Converter modules located in the bottom of the enclosure. Apply Power to the WPM by setting the Switch to ON and |

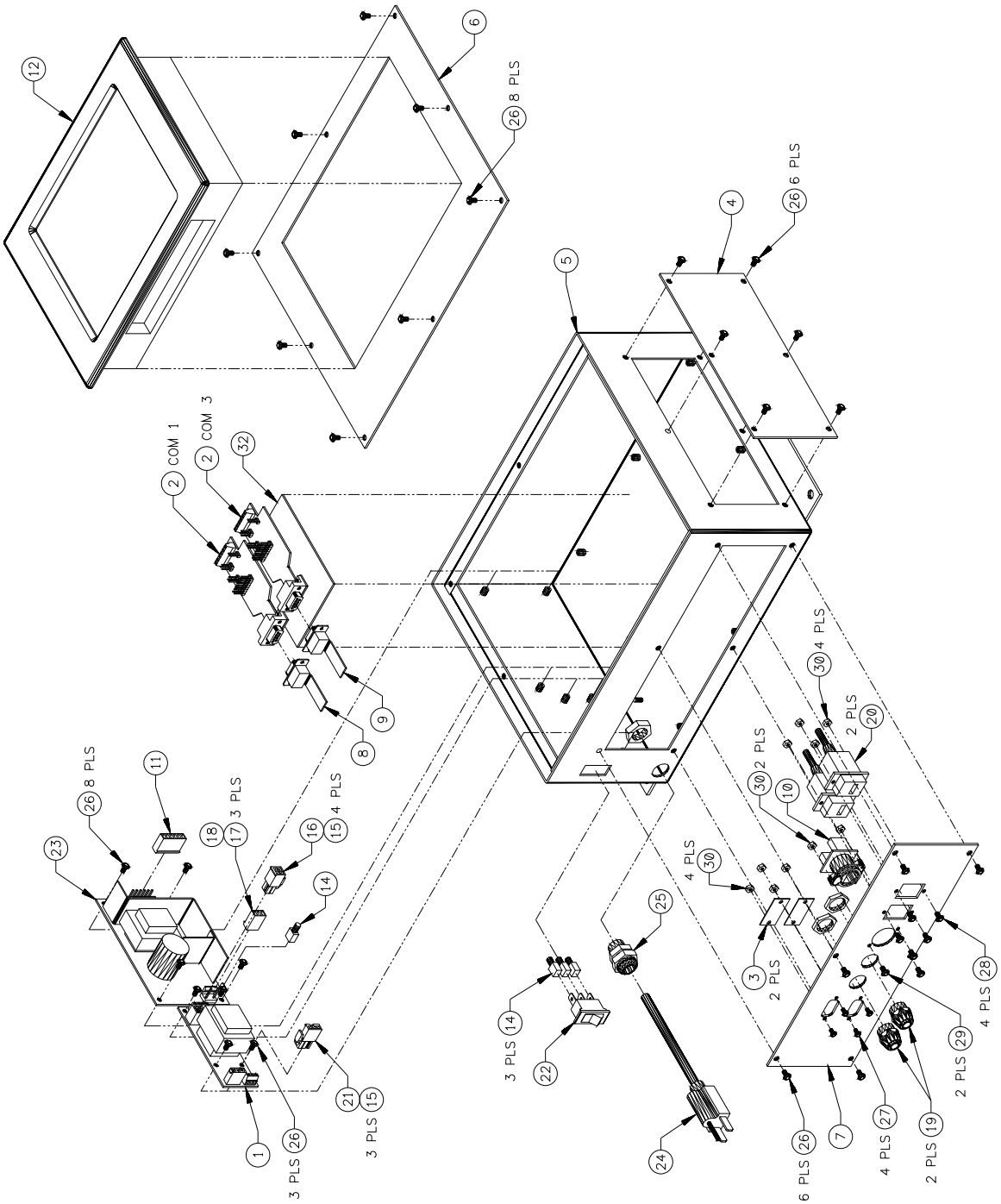
| | |
|---|---|
| | observe that the RS-232/RS-485 Converter PWR, TD and RD LED's illuminate. If they do not Illuminate contact a CWT service representative. |
| **NO LEARN, PART or A/B Select INPUT** | 1. Verify connection of User REMOTE I/O (see Micro ADM Manual)<br>2. Verify that the REMOTE I/O Cable is connected to the Micro ADM<br>3. Contact CWT service representative. |
| **Can not Access the Additional Screens for the WPM** | 1. Remove power from the WPM.<br>2. Wait 30 seconds.<br>3. Apply Power to the WPM.<br>4. If you still can not access Additional Screens contact CWT service representative |
| | |

For any problems not covered in this section, Please contact a CWT Service Representative.

# 5.0 MOUNTING DIMENSIONS



# 6.0 SYSTEM ASSEMBLY DRAWINGS



| ITEM | QTY | PART NO | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | A5A0135 | PCB Assy., 20 VDC Isolated Power Supply |
| 2 | 2 | C5A5009 | PCB Assy., RS-485 Isolated Converter |
| 3 | 2 | S2M5012 | Cover, D-Shell |
| 4 | 1 | S3E5081 | Cover, Large Blank |
| 5 | 1 | S3E5092 | Enclosure, 12" X 9-1/2" X 5" |
| 6 | 1 | S3E5094 | Cover, WPM-08 Front |
| 7 | 1 | S3E5095 | Cover, WPM-08 Bottom |
| 8 | 1 | S3W5134 | Cable, WPM-08 COM1 |
| 9 | 1 | S3W5135 | Cable, WPM-08 COM3 |
| 10 | 1 | S3W5136 | Cable, WPM-08 LAN |
| 11 | 1 | S3W5137 | Cable, WPM-08 HMI Power |
| 12 | 1 | S2A5142 | HMI Assy., 8" Windows CE Modified |
| 13 | 2 | X3P5257 | Lug, Locking Ring Terminal - HH Smith #1412-6 |
| 14 | 4 | X3P5419 | Terminal, Female Coupler |
| 15 | 7 | X3P5702 | Contact, Socket 18-22 AWG |
| 16 | 1 | X3P5706 | Connector, Plug Housing 4 Circuit |
| 17 | 2 | X3P5719 | Terminal, Crimp |
| 18 | 1 | X3P5720 | Connector, Housing 3 Circuit |
| 19 | 2 | X3P5804 | Connector, RCPT 5 Circuit Female |
| 20 | 2 | X3P5862 | Connector, Bulkhead USB |
| 21 | 1 | X3P5875 | Connector, RCPT Housing 3 Circuit |
| 22 | 1 | X3S5078 | Switch, Rocker 110 VAC |
| 23 | 1 | X3T5065 | Supply, Power Triple |
| 24 | 1 | X3W5022 | Cord, Power 18 AWG 6'7" |
| 25 | 1 | X3Z5106 | Relief, Strain |
| 26 | 28 | | #6-32 X 1/4" Long Pan Head Screw w/ Internal Lock Washer |
| 27 | 4 | | #4-40 X 1/4" Long Pan Head Screw |
| 28 | 4 | | #4-40 X 3/8" Long Pan Head Screw |
| 29 | 2 | | #4-40 X ½" Long Pan Head Screw |
| 30 | 10 | | #4-40 Jam Nut |
| 31 | 1 | | #6-32 Hex Nut |
| 32 | 1 | | Tape, Double Face |

Part