USER'S MANUAL **990-351**
Revision E **July 2007**

OPERATOR MANUAL

FOR THE

STA SERIES
AC CONTROLS

(Software Version 3.0)

Model Number

STA-100A **STA-200A**

STA-400A **STA-600A**

STA-800A

Revision Record

Revision	EO	Date	Basis of Revision
A	19123	12/01	Initial Release
B	19373	7/02	Addition of technical upgrades and features and inclusion of other STA models.
C	19557	11/02	Inclusion of all STA Controls, and software upgrade to version 3.0.
D	20369	3/05	Updated technical information.
E	21467	7/07	Updated Schematics.

CONTACT US

Thank you for purchasing a Miyachi Unitek STA Series AC Control. This unit is a component of a larger resistance welding system. Upon receipt, please inspect it thoroughly for shipping damage ***before*** you install it. If there is any damage, contact the shipping company immediately to file a claim, and notify Unitek Miyachi at:

Unitek Miyachi
1820 South Myrtle Avenue
P.O. Box 5033
Monrovia, CA 91017-7133

Telephone:	**(626) 303-5676**
FAX:	**(626) 358-8048**
e-mail:	**info@unitekmiyachi.com**

Unitek Miyachi is not responsible for any losses due to improper use of this product. The contents of this manual are subject to change without notice. If you have any questions, find any errors/omissions, or if you have suggestions for improving this manual, please contact us.

About This Equipment

The Control consists of a cabinet which contains the AC Main Timer Board, SCR Driver Board, Control Panel Assembly, valve and power transformers; SCR assemblies and snubbers and surge resistors. Unless ordered otherwise, STA-200 through STA-800 Controls contain a circuit breaker that disconnects when the front panel is opened. Four tabs on the rear surface provide convenient mounting of the unit. The Control provides the user with all of the controls for establishing all weld modes and timing.

Control options include a Valve Expansion Board, communication capability, voltage monitoring, electronic pressure regulator control, force monitoring and either primary current sensor or input connector(s) for secondary current sensor(s). WeldLab software to extract and analyze weld data is also available.

We have made every effort to ensure that the information in this manual is accurate and adequate.

Should questions arise, or if you have suggestions for improvement of this manual, please contact us at the above location/numbers.

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SAFETY NOTES

This instruction manual describes how to operate, maintain and service STA Series AC Controls, and provides instructions relating to their SAFE use.

For SAFETY, and to effectively take advantage of the full capabilities of the workstation, please read these instructions before attempting to use the workstation.

Procedures other than those described in this manual or not performed as prescribed in it, may expose personnel to electrical hazards.

After reading this manual, retain it for future reference when any questions arise regarding the proper and SAFE operation of the unit.

Please note the following conventions used in this manual:

WARNING: Comments marked this way warn the reader of actions, which, if not followed, might result in immediate death or serious injury.

CAUTION: Comments marked this way warn the reader of actions which, if not followed, might result in either damage to the equipment, or injury to the individual if subject to long-term exposure to the indicated hazard.

WARNINGS

HIGH VOLTAGE is used in the operation of this equipment.

DEATH ON CONTACT may result if personnel fail to observe the safety precautions labeled on the equipment and noted in this manual.

WHEN WELDING **always** wear safety glasses.

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CHAPTER 1
DESCRIPTION

Section I: Features

Overview

For the rest of this manual, **STA Series Single-Phase AC welding Controls** will simply be referred to as "the Control." The STA Series has a wide variety of options, some are installed at the time of purchase, some may be added later. In addition, the operating controls and LCD display screen on STA-200A through STA-800A Controls may be installed on the front or side of the Control, depending on your space requirements. As a result, each Control is essentially "custom-built" to your specifications even though it is assembled using standard Unitek Miyachi components.

This manual describes the most common or "typical" components and options. If you have questions about custom items in your Control that are not covered in this manual, contact Unitek Miyachi using the phone, e-mail, or mailing information in the front of this manual.

Standard Features

- Operates on 50Hz or 60Hz, self-detecting, no adjustments needed.
- Multiple pulse capability.
- Controlled current ramps.
- 300, 600, 1200, 1800, or 2200 amp SCRs with constant current control.
- Water-cooling of the 600A and larger SCR assemblies.
- Programming features with LCD display.
- Programmable for spot, repeat, successive, or chaining modes.
- Continuous seam weld and roll spot seam welding capabilities.
- Programmable for 64 welding schedules.
- Valve drivers for up to four user-programmable valves are included in the basic unit.
- Supports air-actuated Retraction Valves.

Optional Features

- A circuit breaker that removes power to the Control when the door is opened (STA-200 through STA-800).
- A Communications card that allows remote data collection and remote programming of the Control.
- A Cascade Board Option that allows a Control to operate multiple SCRs. Depending upon the model, up to 8 SCRs can be cascade fired.

- A Valve Expansion Option to increase user-programmable valve-driver capability to 12 valves.
- A Voltage Monitor Option that allows you to compare results against high and low limits, and monitor either peak or average voltage. This feature allows you to select when the voltage is monitored, either during both weld periods (excluding up/downslope) or during the last cycle of each weld only, which is useful for welding to a specific resistance.
- A Force Control (Force Output) Option that can control up to 8 separate (user supplied) electronic pressure regulators. Force is programmed in pounds using front panel controls. The Control makes calculations to create accurate air pressure. Calibration is a simple 2-step procedure using front panel controls.
- A Pressure Control Option (Force Input) that uses differential pressure sensors is available for up to eight channels. You may use this feature in a Force-Firing function (welds only when correct pressure is reached), or as a pressure monitor to see if air pressure is in the desired range. Force firing can reduce cycle time by eliminating the need to program squeeze time, and it assures that every weld is made at the optimum force.

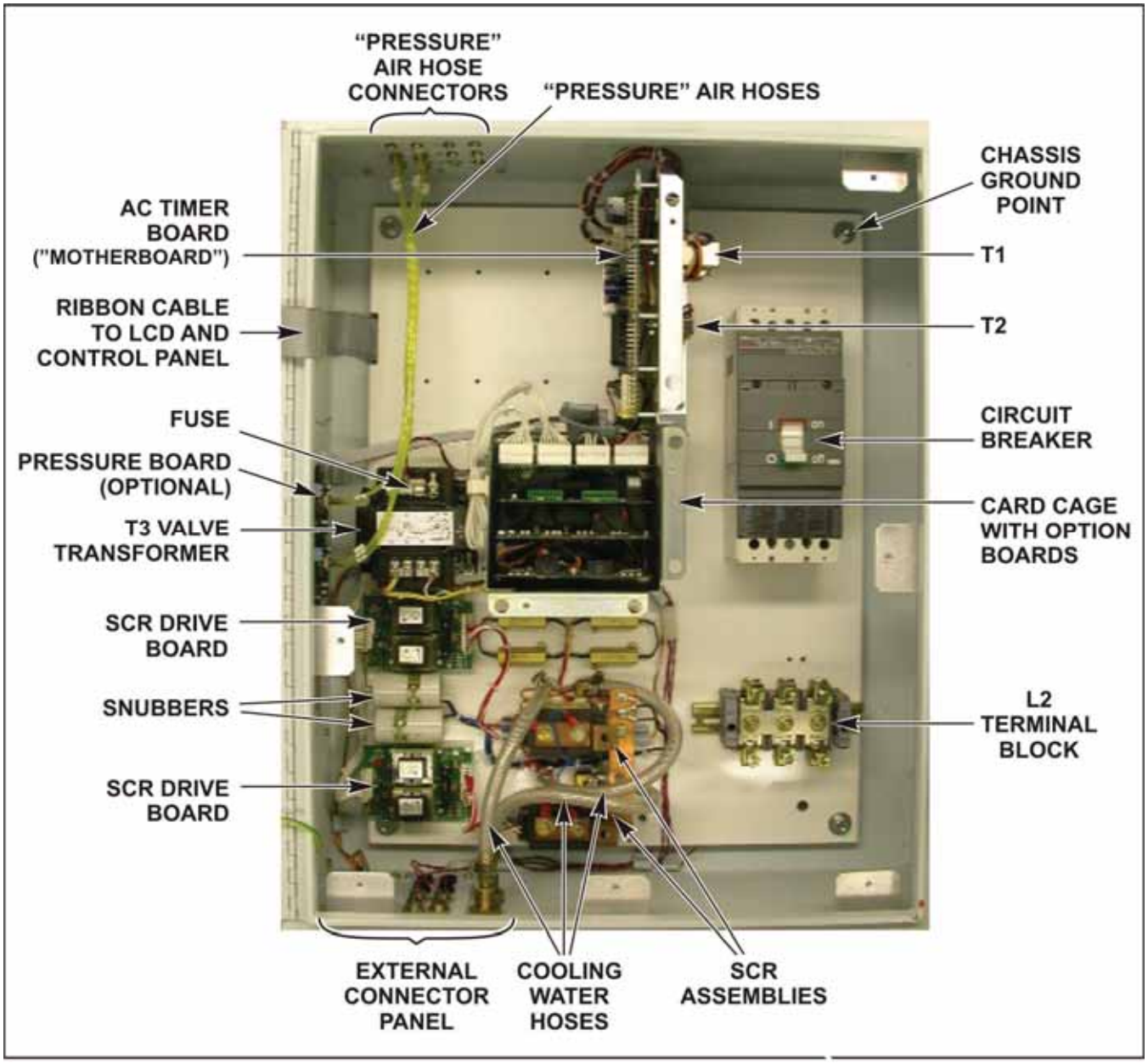
  High, **low** and **Firing Force** limits are programmed in pounds using front panel controls. Calibration is a simple 2-step procedure using front panel controls. Calibration correlates the pounds desired to the equivalent air pressure. This feature will check the air pressure for up to 5 seconds at the start of the squeeze delay period. If the force is within limits, the weld will continue. Otherwise, the weld will be aborted and an alarm will be triggered. If the pressure was out of limits at the end of a weld an alarm will be triggered.

  NOTE: This feature ***requires*** presence of the Force Control (Force Output) board, but does not require usage of the Force Output feature in order for Force Input to be functional.

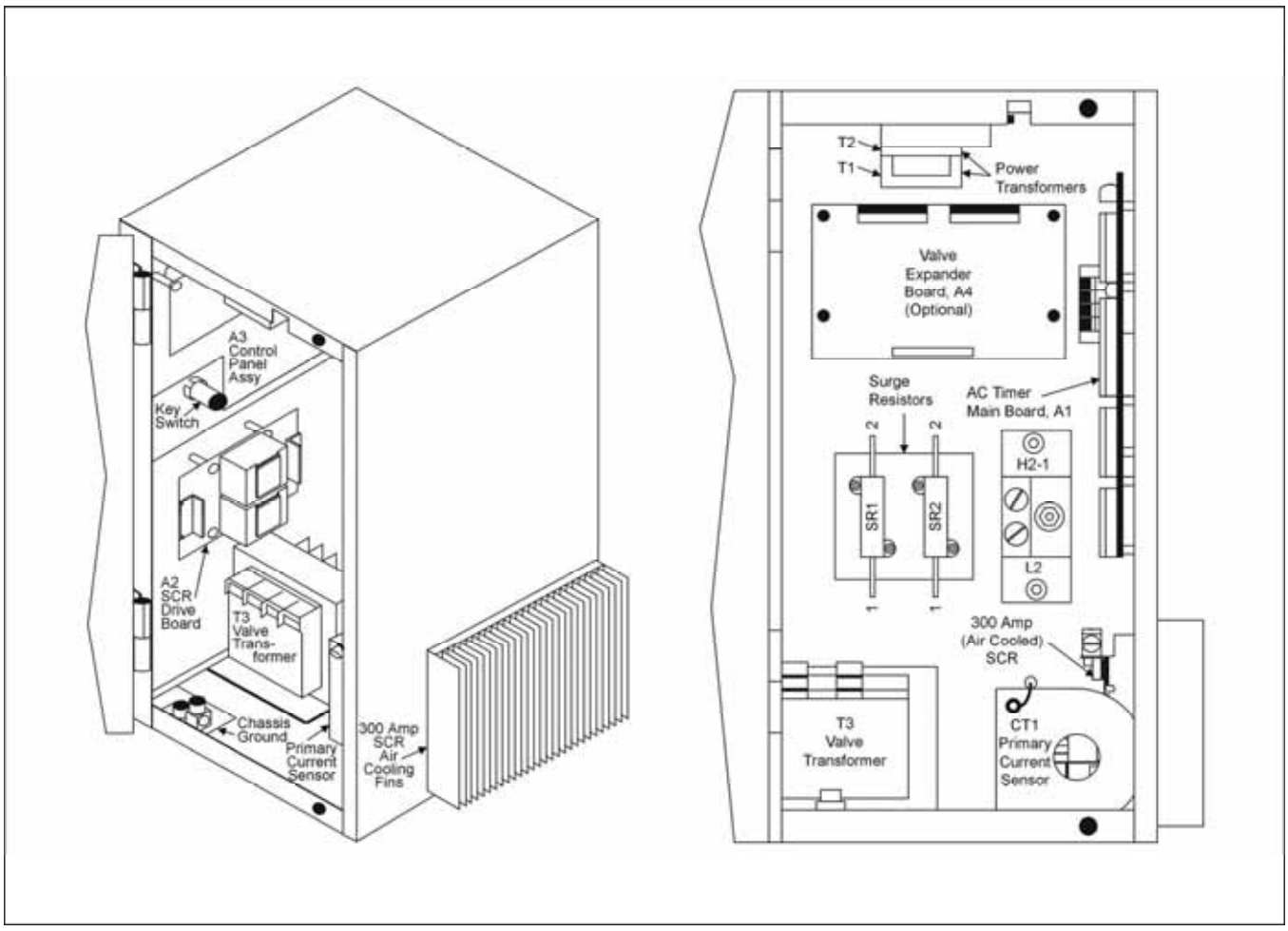
Section II: Major Components

Major Components

The following illustrations show a "typical" Control. Your Control may be different due to options that have been installed or to the physical configuration. For example, the LCD Display and operating controls can be factory-installed on the front or on the side of the Control. Dimensions and weight for each model are listed in *Appendix A, Technical Specifications*.



STA-200A through STA-800A Series Major Components (Typical)



STA-100A Series Major Components (Typical)

Front Panel Controls and Indicators

All controls and indicators are located on the control panel shown below. The Control Panel Assembly is normally mounted on the access panel, but can also be mounted on the left-hand side of the box on STA-200A through STA-800A Controls.

STA Series Controls and Indicators

LCD Display White on blue 40 x 8 LCD display provides information for programming and monitoring the unit.

Ready Red LED indicator lights when the Control is ready to weld.

Error Red LED indicator lights when a control error or weld error has occurred.

Weld Green LED indicator lights when weld is occurring.

Start Red LED indicator lights to indicate receipt of a start signal.

Program/Save Pressing this pushbutton switch toggles the Control between Program Mode and Run Mode. (In the Run Mode, entered data is saved; hence the name on the switch.) When in the Program Mode, the green LED on the pushbutton switch lights and the operator may enter program information using the **DATA** and **CURSOR** pushbutton switches. When in this mode, the Control will not accept a Start signal.

At the completion of making Schedule Program changes, pressing the **PROGRAM/SAVE** switch again, saves all program changes and places the Control into Run mode. During **Run Mode**, the **DATA ON/OFF** pushbutton switch will be disabled, preventing the operator from modifying programs.

Weld ON/OFF When the **WELD ON/OFF** entry (in the **Extended System Values** screen) is set to **LOCAL**, pressing this pushbutton switch will enable or disable the flow of weld current. The green LED lights when current is enabled. When current is disabled, the Control can still sequence through its program and fire valves, but current will not flow.

- Data +
ON | OFF This is a two-position pushbutton switch. When the Control is in the **Program** Mode, pressing this pushbutton switch will allow the operator to change the program settings. Holding the switch down (in either position) will scroll the values in the selected direction.

When the Control is in the Run mode, the **WELD ON/OFF** switch is set to **OFF**, and the cursor is at the schedule number position, the operator can use this key to scroll through the schedules.

Cursor This is a four-position, momentary-action pushbutton switch. Pressing this pushbutton switch will allow the operator to move the cursor around the display.

Left and Right Arrows < > – In general, the right arrow will move the cursor from left to right, then to the left-hand field of the next line down, across that line, and so on. Upon reaching the bottom, right-hand field, the cursor will "roll over" to the top, left-hand field. The left arrow works in the reverse direction. Whichever arrow is pressed, when the cursor enters a field, it will automatically position itself at the rightmost position of a numeric field or the leftmost position of an **ON/OFF** or alphabetic field.

When in a numeric field, successively pressing the left arrow will move the cursor successively to the next higher order digit or, when the highest order number for that field is reached, to the previous field.

Up and Down Arrows ∨ ∧ – These arrows will move the cursor to the field above or below the current field whose rightmost digit is closest to the current position of the cursor. Holding any cursor pushbutton down will cause the cursor to rapidly move in the appropriate direction, eventually rolling over from the last field to the first, or vice-versa.

While in Program Mode, when the cursor is in any position of a digit field, pressing the + or – key of the **DATA** pushbutton will cause the digit in that position to increment or decrement by one digit.

Schedule When the **WELD ON/OFF** pushbutton switch is set to **OFF**, pressing this pushbutton switch will cause the current Schedule number's screen to be displayed. The cursor shall be at the unit digit of the Schedule #. If the Schedule # is changed, that specific schedule will be displayed. See Chapter 3 for details of this screen.

Valves When the **WELD ON/OFF** pushbutton switch is set to **OFF**, pressing this pushbutton switch will cause the Valve screen to appear on the display. See Chapter 3 for details of this screen.

Modes When the **WELD ON/OFF** pushbutton switch is set to **OFF**, pressing this pushbutton switch will cause the Mode screen to appear on the display. See Chapter 3 for details of this screen.

Reset Pressing this pushbutton switch will reset the Control after a major error signal is received. (Major errors are **Emergency Stop, Over-temperature, No Current, Mode Change Error, End of Stepper Function, Weld1 or Weld2 Conduction High, Weld1 or Weld2 Current High, Full Wave Conduction, Illegal Schedule Number,** or **SCR shorted**.) Pressing this pushbutton also resets minor errors if auto reset is turned **OFF**. See *Chapter 3, Using STA Series Control Functions, Section VIII*.

Monitor When the **WELD ON/OFF** pushbutton switch is set to **OFF**, pressing this pushbutton switch will cause the Monitor screen to appear on the display. See *Chapter 3* for details of this screen.

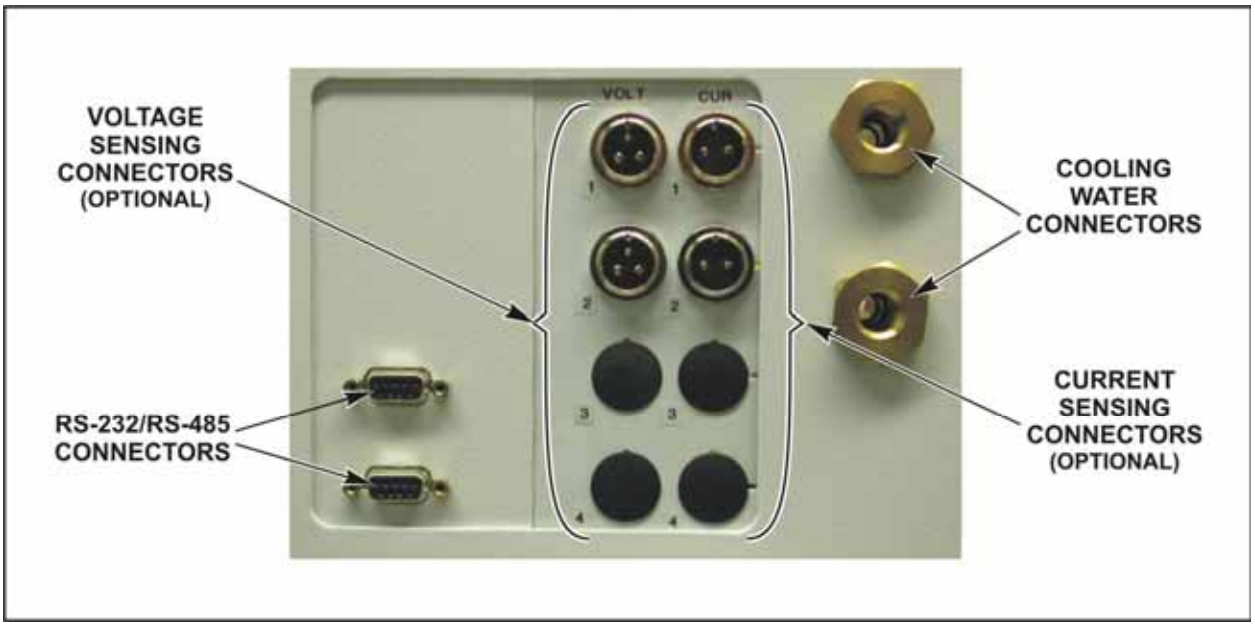
Stepper When the **WELD ON/OFF** pushbutton switch is set to **OFF**, pressing this pushbutton switch will cause the **Stepper** screen to appear on the display. See *Chapter 3* for details of this screen.

This screen allows information to be programmed to compensate for gradual degradation of the weld electrodes by adjusting power to compensate for that degradation. Power can be adjusted either up or down.

Programming Lock This optional key lock prevents any change in the program when it is locked.

External Connectors

External connectors for Voltage Sensing, Current Sensing, Data & Communications (RS-232 or RS-485), and cooling water for the SCRs are on a panel that can be mounted on the top, bottom, or sides of the Control.

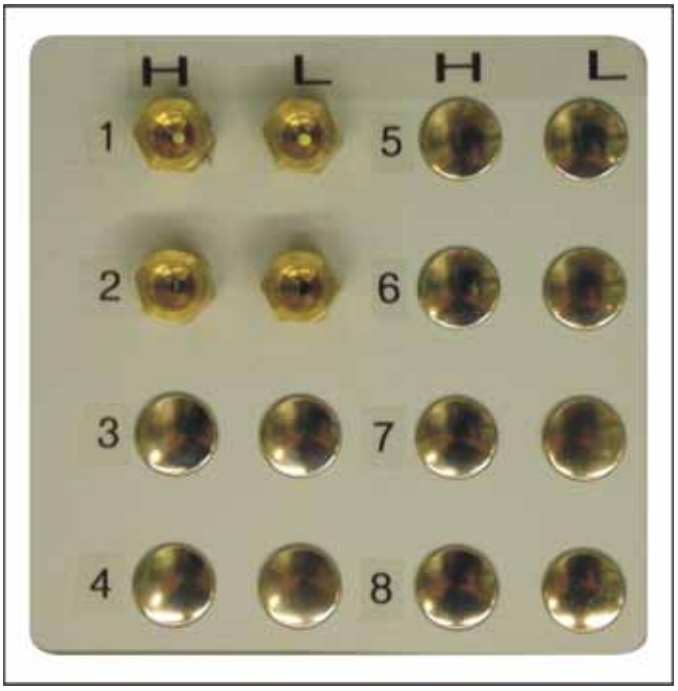


Cylinder Air Hose Connections

If your Control uses Force Control, the air hoses for the Differential Pressure Sensors are located on a panel on the top of the Control.

In the example on the right, this Control is equipped with HIGH and LOW fittings for channels 1 and 2.

Standard ¼ NPT female fittings are supplied by the factory, but the customer must supply air connections and hoses in order to connect the Control to the HIGH and LOW connections on the weld head(s). The HIGH fitting should be connected to the top (high-pressure side) of the cylinder that supplies welding force. The LOW fitting is connected to the bottom (low-pressure side) of that same cylinder. Make the connection to the weldhead as close to the cylinder as possible in order to get accurate readings.



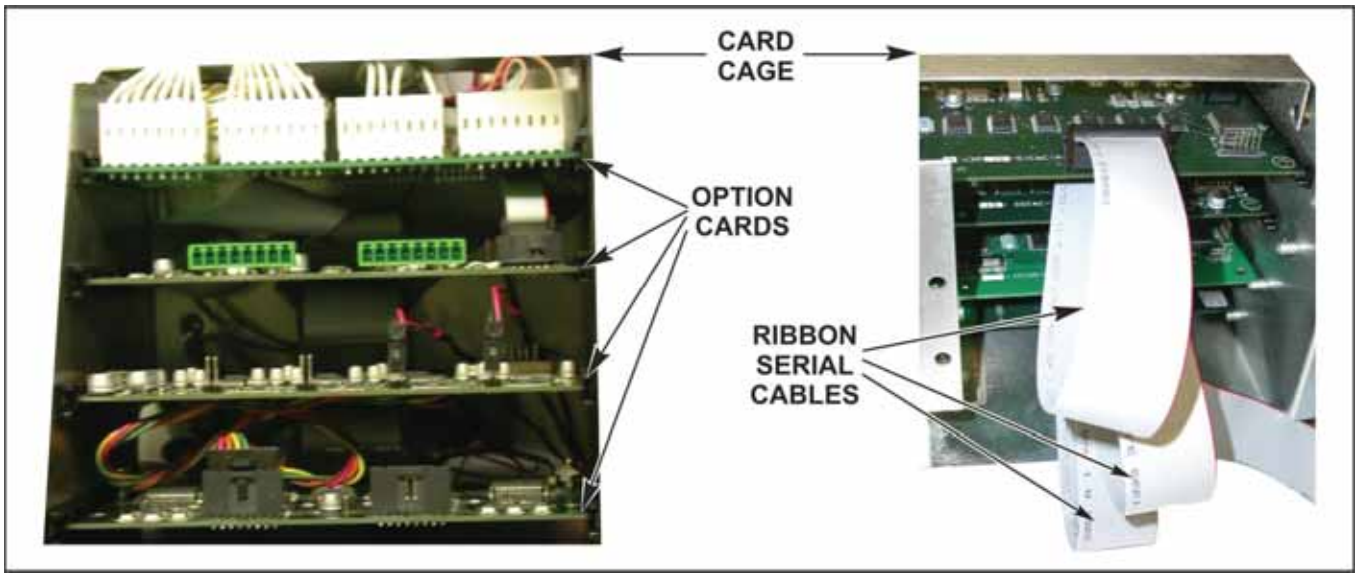
Internal Access

Access to the internal components is obtained by opening the door, which is secured with a screw-operated latch. There are no operator adjustments inside of the unit, so the door should not need to be opened except for initial installation (electrical connections) and for repair of components.

NOTE: If your unit is equipped with a circuit breaker, that breaker ***must*** be de-energized to open the door and access the components.

Option Cards

Printed circuit boards ("cards") for STA Series options can be installed in each Control. The STA-100 has a card cage that can accept three option cards. The larger STA-200, -400, and –600 models each have a card cage that can accept four option cards. The STA-800 has two card cages. Option boards can be inserted into a card cage in any order. No installation hardware is required, the cards merely slide into slots. A ribbon cable connects each of the option cards together, with the last output cable connected to the buss connector on the motherboard.



Electrical Connections

The user must provide access holes for electrical connections (power and control). If the optional secondary current sensing has been ordered, the Control will have the appropriate input connector(s) are factory-installed in the bottom of the Control cabinet.

CHAPTER 2
INSTALLATION AND SETUP

Section I: Planning for Installation

Environmental Factors

We recommend that you install the Control in a well-ventilated area that is free from excessive dust, weld expulsion, acids, corrosive gasses, salt, moisture, oil, coolant, and contaminants. Allow adequate space around the unit for power and signal cabling runs, water-cooling hose connections, and full length of open front door. Electrical and signal connections may be made from either the top or bottom of the Control.

The Control is designed to work in the following ambient conditions:

Temperature:	32-104°F (0-40°C)
Humidity:	0% to 95%, non-condensing
Maximum altitude	9800 ft. (3000 m)

Space and Mounting Requirements

Outline drawings of the STA Controls, including dimensions for the mounting holes, are included in *Appendix A, Technical Specifications.*

Power Requirements

Power requirements are: 230 or 460 VAC (nominal), single phase, 50/60 Hz. (See Appendix A, Technical Specifications, for exact ranges.) Other voltages are available upon request.

NOTE: The Control is a component of a larger resistance welding system. Please review the complete system requirements in order to install this component in compliance with all applicable codes and requirements. The external disconnect device must be rated no less than 115 percent of the full load current. If the Control does not have an internal circuit breaker, an external power control (ON/OFF switch or contactor) must be provided at the junction box that feeds power to the Control.

Cooling Water Requirements

See *Appendix A, Technical Specifications*, for SCR cooling water requirements. The connections to the SCR are made with ¼-18 NPT fittings through the bottom of the Control cabinet.

Section II: Control Set-up

Unpacking

Unpack the Control from its shipping box. The box also contains a Ship Kit with the components itemized on a packing list within the kit.

NOTE: Carefully save and store packing materials for future storage or shipment of the Control.

Installation

Installation consists of mounting the unit, making power and signal connections, and making cooling water connections.

CAUTION: Protect electronic components from metal shards when drilling pilot holes and punching holes. Be sure all metallic shards are removed from the Control after punching holes.

Mounting the Control

The STA-100 is small and is commonly used standing on a bench, but can be machine-mounted using the detachable mounting tabs shipped with the Control. All other STA Series Controls are designed for wall or machine mounting using four mounting tabs, two with mounting holes, two with mounting slots. Mount the unit with the display towards the top.

As each installation is different, no mounting hardware is provided for the cabinet. The holes on the mounting tabs are 0.44-inch diameter, and are designed for 7/16 screws or bolts. You will need to provide the appropriate screws or bolts, flat and lock washers, and nuts.

Loosely install the two lower mounting screws. Slide the Control bottom (slotted) tabs into the two lower mounting screws. With one person holding the Control in place, have a second person install the two upper mounting screws then tighten the two lower mounting screws.

Mounting Holes

Connecting Electrical Power

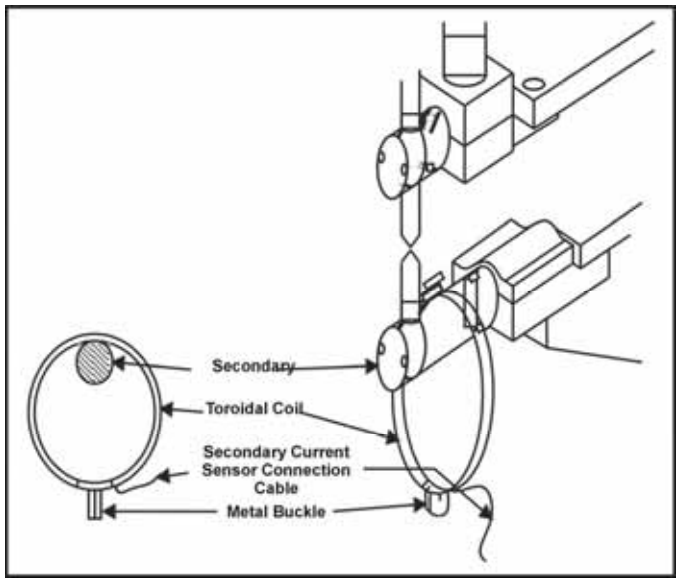
For installation instructions, see *Appendix B, Electrical and Data Connections*.

Secondary Current Sensing

If you ordered Secondary Current sensing, toroidal coil(s) were shipped with the Control, along with cable(s) that attach to the connector(s) on the bottom of the Control box. Place the toroidal coil(s) on the secondary of each weld transformer.

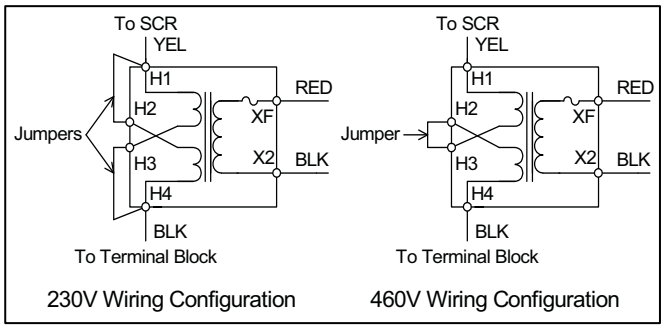
NOTES For MB-400K and MB-800K Coils:

- Make sure that the metal buckle on the toroidal coil is as far away from the secondary as possible.
- For most accurate measurement, do not distort the shape of the toroidal coil.



Placement of Secondary Current Coils

NOTE: Unless otherwise ordered, Controls are shipped with the Valve Transformer T3 connected for 460V configuration. If you re-configure the unit for 230 V, you must change the jumpers as shown on the right.



Valve Transformer Wiring Connections

Cooling Water Hose Connections

Connect the water, specified in *Appendix A, Technical Specifications*, using water hoses and ¼-18 NPT fittings.

Input/Output Signal Connections

Connect the input/output (I/O) signals as shown in the *Appendix B, Electrical And Data Connections*.

CHAPTER 3
USING STA SERIES CONTROL FUNCTIONS

Section I: Overview

To ensure accurate, consistent welds, the Control delivers extremely precise pulses of energy to the weld head. Each pulse is comprised of weld-time and weld-energy values pre-programmed by the user. The Control with optional primary or secondary current coils is a closed-loop welding control using internal or external sensors to measure the weld-energy delivered to the weld head. Weld-energy feedback instantly goes to the Control's logic circuits that actively correct the pulse to compensate for any variation in part resistance. The Control also has several monitor functions that give you remarkable control over the welding and production process. Together, these features ensure precise, consistent welds, higher productivity, a lower rejection rate, and longer electrode life.

The Control contains internal software that gives you a great deal of flexibility in the setup and use of your welding system. The Control software displays various menu screens on the LCD, each containing prompts telling you which of the Control's front panel controls to use in order to customize operating parameters, set the Control for use in an automated welding system, and program communication settings if you are using the optional Communication capability.

This chapter describes Control functions in the following sections based on the LCD screens:

- Schedule Screen
- Valves Screen
- Monitor Screen
- Monitor Counts Screen
- Mode Screen
- Linked Schedules Screen
- System Wide Values Screens (3)
- System Valve Status Screen
- Force Calibration Screen
- Stepper Screen

Before programming the Control, you must be familiar with the **location** and **function** of the LCD and front panel controls. If you need more information on these controls, see *Chapter 1, Description*.

Chapter 4, Operating Instructions, contains the step-by-step instructions on how to program each of the functions above.

Section II: Schedule Screen

The **SCHEDULE** screen consists of the following settings shown on the right.

```
SCHEDULE  # 01
SQD  SQZ  UP1  W1  DN1  CO  UP2  W2  DN2  HLD OFF
 00   00   00   00  00   00  00   00  00   00  00
                060%              000%
CH=F1     FORCE=0150Lb     ElecValve=01     SCR=1
IMPULSE=01        COPY TO # 00     PLUS 00 ↵
SCR          1
VALVES 1   2   3   4
```

SCHEDULE # - The schedule number is programmable from **00** to **63**; the default is **00** on initial operation. Changing the schedule number will automatically display that schedule on the screen.

Pressing the **PROGRAM/SAVE** pushbutton toggles between the **Program** and **Run** Modes. Placing the system in the **Run Mode** automatically saves the currently displayed values for the schedule.

If any changes have been made in any data field, the system will prevent the operator from changing to a different schedule until the changes have been accepted or rejected. The operator will get the following message:

```
MODIFIED SCHEDULE NOT SAVED.
PRESSING THE PROGRAM/SAVE KEY SAVES
   MODIFICATIONS, THEN PRESS DESIRED
   SCREEN BUTTON AFTER SAVING.
OR PRESS PLUS OR MINUS KEY TO LOSE
  MODIFICATIONS
```

Links – If the schedule is part of a linked sequence, the upper-right corner of the screen will show the links as a set of three 2-digit numbers.

```
SCHEDULE  # 01                                07<03>05
SQD  SQZ  UP1  W1  DN1  CO  UP2  W2  DN2  HLD OFF
 00   00   00   00  00   00  00   00  00   00  00
                60%               000%
CH=F1     FORCE=0150Lb     ElecValve=01     SCR=1
IMPULSE=01        COPY TO # 00     PLUS 00 ↵
SCR          1
VALVES 1   2   3   4
```

1) First number: **Previous** schedule
2) Second number: **Current** schedule being used (shown in brackets **< >**).
3) Third number: **Subsequent** schedules in the link.

In the example shown above (**07<03>05**), **07** is the previous schedule used, **03** is the current schedule being used, and **05** will be the next schedule used. If the current schedule is the *first* of the link, the first 2-digits will be " **– –** ". Similarly, if it is the last of the link, the last 2-digits will be " **– –** ".

NOTE: Each of the following weld sequence settings are programmable from **00** to **99** cycles. The default is **00** for all values except **W1** and **W2**, whose defaults are **01**.

SQD – Squeeze delay is that period between receipt of the start signal (FS1 or FS1/FS2) and the start of the SQZ (squeeze) time. It allows the electrodes to move to the parts and build up force.

SQZ – The squeeze time is the delay from the receipt of the start signal (or the end of SQD) until UP times begin (weld power is not necessarily applied). It allows the system to settle and any mechanical motion or ringing to stop before welding begins.

UP1 – This is the upslope time for weld 1 of the sequence.

W1 – This is the weld 1 time of the sequence.

DN1 – This is the downslope time for weld 1 of the sequence.

CO – This is the cool time between weld 1 downslope and weld 2 upslope in the sequence.

UP2 – This is the upslope time for weld 2 of the sequence. (See **IMPULSE**)

W2 – This is the weld 2 time of the sequence.

DN2 – This is the downslope time for final weld 2 of the sequence. (See **IMPULSE**)

HLD – This is the hold time (the time the valve is held on) after the **DN2** ends. (See **IMPULSE**)

OFF – This is the off time at the end of the weld cycle. The electrode valve is turned off at the beginning of hold (**HLD**) time. All other valves are turned off at the conclusion of **OFF** time.

NOTE: Some of the items in the **SCHEDULE** screen will differ depending on the Control's operating **MODE** (described in *Section VI, Mode Screen*).

CURRENT SETTING – The current settings are presented directly below the **W1** and **W2** settings. When **CONTROL MODE** is set to **%HEAT**, the percentage of the available power is programmable from **000%** to **100%**. The minimum conduction angle is 20 degrees of power at a power factor of 1.0. As the power factor decreases, the minimum conduction angle may increase. When **CONTROL MODE** is set to **PRI C.C.** or **SEC. C.C.**, the current setting is programmable from **00.0kA** to **80.0 kA**. for best results, this value should be between 20% and 95% of the full current. (Control may operate beyond this range, but not within accuracy and regulation specifications.)

CH – Force Output Channel selected. Settings include **NONE** (the Force option is not installed), and **F1-F8** (The output for SCR 1 goes through F1, SCR 2 through F2 and so on). The **F1-F8** option allows the Control to operate up to 8 independent electronic pressure regulators.

FORCE – Force output (in lbs.) for the Force Output Board (electronic pressure regulator). See the appendix for details on how to calibrate this option. This is the electronic pressure regulator output only. This valve should be set to match the **FIRE=** firing force in the Monitor Screen. See Section IV: Monitor Screen for programming limits on the force input option.

NOTE: The following six functions are identical for all three operational modes.

ElecValve – This number indicates the valve that is associated with the welding electrode in the selected schedule. It's associated SCR appears to the right.

SCR # – When there are multiple SCRs, the number presented represents the SCR that will be fired for that schedule. It is programmable in the **System Wide Values** screen (below) from 1 to the number of SCRs in the control (maximum of 8); the default is 1.

IMPULSE – This number is the quantity of Weld 2 operations. It is generally used in applications such as stitch welding, which involves a series of spaced spot welds, similar to a sewing stitch. Impulse is programmable from **01** to **25** times, with a default of **01**. If there are more than one Weld 2 operations, the programmed **UP2** time applies only to the first pulse and the programmed **DN2** time applies only to the last pulse, after which the **HLD** and **OFF** times occur. The time between each Weld 2 pulse is determined by the programmed **CO** time.

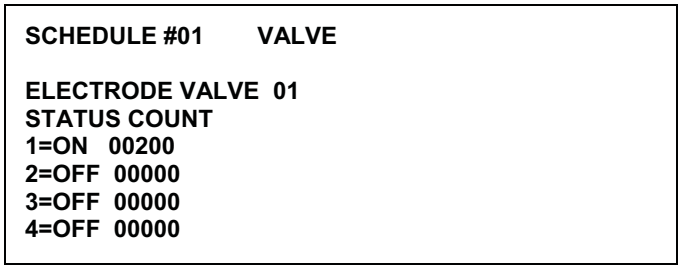
COPY TO # – Copying a schedule —this includes all functions such as valves, etc.—to another schedule is done by changing the schedule number to the (new) desired schedule number. (It is assumed that the new schedule is not already in use). By placing the cursor on the ↵ symbol next to **COPY TO #,** entering the number of schedules beyond this **COPY TO #,** and pressing the **DATA +** pushbutton, the original schedule will be copied to the new schedule(s).

For example, **COPY TO 10 PLUS 02** will copy the current schedule to schedules **10, 11** and **12**. The following message will be displayed:

SCHEDULES HAVE BEEN COPIED
PRESS ANY SCREEN KEY TO CONTINUE
I.E. SCHEDULE, VALVES, MODES,
OR MONITOR

Section III: Valves Screen

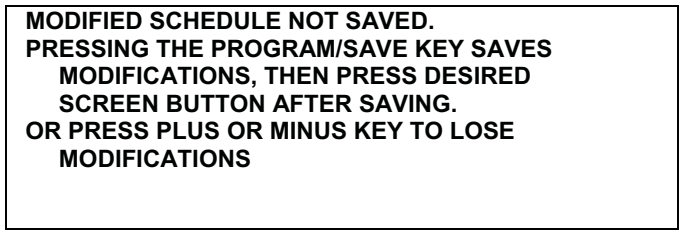
The Valve screen is used to program which valves will turn on during a welding schedule. (See *Appendix D, System Timing* for details.) The standard unit has four valves, and an additional eight valves can be added for a total of twelve. The screen will show entries for the correct number of valves in that particular unit. The **Valves** screen consists of the settings shown above.



SCHEDULE # - The schedule number is used to select the program number that will control the valves. Entering a schedule number will automatically display the associated valve data for that schedule. The schedule is programmable from **00** to **63**.

Pressing the **PROGRAM/SAVE** pushbutton toggles between the **Program** and **Run Modes**. Placing the system in the Run Mode automatically saves the currently displayed values for the schedule.

If any changes have been made in any data field, the system will prevent the operator from changing to a different schedule until the changes have been accepted or rejected. The operator will get the following message:



ELECTRODE VALVE – This item displays the electrode valve number which is used with this schedule. The valve is selected using the Schedule screen.

STATUS – Valves are scheduled either **ON** or **OFF**. If set to **ON**, a valve will turn on at the start of the squeeze delay (**SQD**). (See *Appendix D, System Timing* for details.)

COUNT –This is a display-only field and allows the operator to view the weld count used in the **Stepper** function.

Section IV: Monitor Screen

Press the **MONITOR** button on the Control Panel to get the **MONITOR** Screen.

NOTES:

- These **W1** and **W2** values are the results of the weld. ➔
- These **W1** and **W2** values are the limits that were programmed ***before*** the weld. ➔

```
SCHEDULE #00          MONITOR
      CURR(KA)        COND      VOLTS          FORCE (LBS)
W1    00.0            000°      0.00           START  END
W2    00.0            000°      0.00           0000   0000
      LO    HI        HI        LO    HI       LO     HI
W1    N/A   N/A       N/A       0.00  0.00     0000   0000
W2    N/A   N/A       N/A       0.00  0.00     FIRE =  0000
                                                Counts ↵
```

CURR – Displays the average weld current for **Weld 1 (W1)** and **Weld 2 (W2)** during the previous weld. This data is not programmable. A primary or secondary current coil is required to collect this data.

COND - Displays the conduction (**COND**) angle for **Weld 1 (W1)** and **Weld 2 (W2).** This data is not programmable.

VOLTS – Displays the voltage measured from the last weld if the optional voltage card has been installed. See Section VIII details on System Valves Screen 3 for instruction on how to program this reading for peak or RMS readings over the whole weld period or for the last cycle only.

FORCE(LBS) - Displays the force in lbs. at the start of the squeeze period and at the end of the weld. This reading and the associated limits require the optional force input card to be installed.

LO – This field sets the low limit for the associated parameter. Current is programmable from **50%** to **100%** for W1 and W2. A setting of **100%** is equivalent to the low monitor being **OFF**. This limit is not applicable in **Percent Heat Primary** and **Percent Heat Secondary** modes. The Voltage is programmable from 0.1 to 9.9V. A setting of 0.00 is equivalent to the low monitor being off. Force is programmable from 1 to 9999 lbs. This setting is a programmable force-firing switch. When the force reaches this limit (and stays within a HI limit if programmed) the weld will continue (e.g. Squeeze Delay and Squeeze could both be set to 1 cycle and the lower force limit will trigger the weld, thus shortening cycle times). A setting of 0000 is equivalent to the low monitor being off. See Chapter 4 Section V for a list of associated error messages.

HI – This field sets the high limit for the associated parameter. Current is programmable from **100%** to **150%**. A setting of **100%** is equivalent to the high monitor being **OFF**. This limit is not applicable in **Percent Heat Primary** and **Percent Heat Secondary** modes. The conduction angle limit is programmable from **000** to **180** (degrees) in primary constant current and secondary constant current modes. This limit is not applicable in **Percent Heat Primary** and **Percent Heat Secondary** modes. Setting the limit to **180** degrees turns this limit **OFF.** Voltage is programmable from 0.1 to 9.9V. A setting of 0.00 is equivalent to the high monitor being off. Force is programmable from 1 to 9999 lbs. A setting of 0000 is equivalent to the high monitor being off. See Chapter 4 Section V for a list of associated error messages.

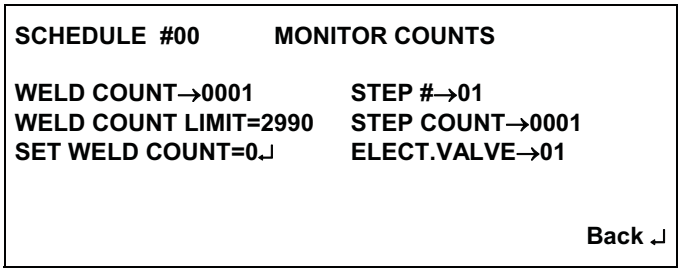
FIRE = This field requires installation of the differential pressure input. When this option is installed, this field sets the force at which the weldhead will fire. The weld force setting in the schedule screen should match this value. The actual weld force measured by the control must be greater than this value and less that a **HI** limit (if programmed) for the weld to proceed. In order to prevent pressure spikes from inadvertently triggering the weld, an initial good reading is followed by a 4 cycle delay after which the pressure is again checked against the limits. If both readings are within the acceptable range, the weld will proceed. If not, the Control will wait for about 5 seconds for acceptable pressure readings. If acceptable readings are not reached within that period, a minor error will be recorded.

Counts ↵ -- This control takes you to the **MONITOR COUNTS** screen.

Section V: Monitor Counts Screen

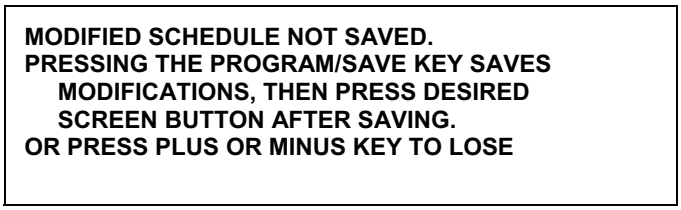
To get the **MONITOR COUNTS** Screen, press the **MONITOR** button on the Control Panel, go to COUNTS at the bottom of the screen, highlight the ↵ symbol and press the Data + key.

The **MONITOR COUNTS** screen consists of the following settings and readouts shown on the right.



SCHEDULE # - The schedule number is used to select a particular schedule whose associated monitor data is to be displayed. The schedule is programmable from **00** to **63**, the default being the last schedule saved. Pressing the **PROGRAM/SAVE** pushbutton toggles between the **Program** and **Run Modes**. Placing the system in the **Run Mode** automatically saves the currently displayed values for the schedule.

If any changes have been made in any data field, the system will prevent the operator from changing to a different schedule until the changes have been accepted or rejected. The operator will get the following message:.



If no data field has been changed, the software will allow control buttons on the panel to function. Entering a new **SCHEDULE #** shall cause the Control to switch to that new schedule and display it on the screen.

WELD COUNT – Displays the total number of welds for the schedule. This data is not programmable.

WELD COUNT LIMIT – Programmable from **0000** to **9999** with the default being **0000**, which sets the weld count limit to **OFF**. When the **WELD COUNT** reaches this user programmed number, an error signal is transmitted from the Fault output and a fault message screen **WELD COUNT REACHED WELD COUNT LIMIT** is displayed. (See Error Messages in Chapter 4.)

SET WELD COUNT = 0 – Placing the cursor at the ↵ symbol and pressing the plus key, sets the weld count of a schedule to zero.

STEP # -- Displays what step the schedule is on. This data is not programmable. When the Stepper is off, **00** is displayed. When the **Stepper** is reset, this value updates after the following weld.

STEP COUNT – Displays the current weld count of the step. This data is not programmable. When the Stepper is off, **0000** is displayed.

ELECT. VALVE – This item displays the electrode valve number used with this schedule. The valve is selected using the **Schedule** screen.

Section VI: Mode Screen

Press the **MODE** button on the Control Panel to get this screen.

The **MODE** screen is used to set up various parameters used in welding. The **Weld Mode** screen consists of the settings shown on the right.

```
SCHEDULE  # 01              MODE

START=MAINTAINED
WELD MODE=SPOT WELD
LINKED SCHED ↵
GO TO SYSTEM VALUES SCREEN      1  ↵
GO TO SYSTEM VALUES SCREEN      2  ↵
GO TO SYSTEM VALUES SCREEN      3  ↵
```

SCHEDULE # - The schedule number is used to select the schedule for making parameter settings. Entering a particular schedule number will cause the previously selected parameters for that schedule to be displayed. The schedule is programmable from **00** to **63**.

The **PROGRAM/SAVE** pushbutton toggles between the **Program** and **Run Modes**. Placing the system in the **Run Mode** automatically saves the currently displayed values for the schedule.

If any changes have been made in any data field, the system will prevent the operator from changing to a different schedule until the changes have been accepted or rejected. The operator will get the following message:

```
MODIFIED SCHEDULE NOT SAVED.
PRESSING THE PROGRAM/SAVE KEY SAVES
   MODIFICATIONS, THEN PRESS DESIRED
   SCREEN BUTTON AFTER SAVING.
OR PRESS PLUS OR MINUS KEY TO LOSE
  MODIFICATIONS
```

If no data field has been changed, the software shall allow control buttons on the panel to function. Entering a new **SCHEDULE #** shall cause the Control to switch to that new schedule and display it on the screen.

START – This control determines how the Control reacts to an external **Start** signal. A different type of start signal can be set for each schedule. It can be set for **PULSED, LATCHED, MAINTAINED**, or will appear as **SEAM** if the unit is a seam welder.

- If set for **PULSED**, the **Start** signal need only be held until **Squeeze Delay** (**SQD**) is completed.
- If set for **LATCHED**, the **Start** signal need only be held until **Squeeze** (**SQZ**) is completed. If **SQZ** is used, and the **Start** signal is interrupted before **W1** or **W2** begins, the control will abort the schedule being fired.
- If set for **MAINTAINED**, the **Start** signal must be maintained throughout the entire process from **SQZ** to **Hold** (**HO**) or the process will abort. When in **SEAM START** mode, the weld can be aborted during **SQD** time by releasing the **Start** signal. If the **Start** signal is held beyond the end of **SQD** time, the seam schedule will begin by initiating **SQZ, UP1**, and **W1**, (if so programmed). The **CO, UP2**, and **W2** sequence will then be repeated until the **Start** signal is released. When the **Start** signal is released, **CO, UP2**, and **W2** will run to completion and the schedule will conclude with **HO** and **OFF** times. (See *Appendix D, System Timing* for details.)

WELD MODE – This control selects one of six welding modes:

- **Spot Weld Mode** – This is the basic default weld.
- **Repeat Mode** – When this mode is being used, the entire weld cycle from **Squeeze** through **OFF** is repeated as long as the start signal is present. **Squeeze Delay** occurs only for the first weld cycle. The **OFF** time between repetitions is set by the program, but it will be a minimum of one cycle (even if "**0**" cycle is selected).
- **Successive Mode –** This mode sequences through a series of previously selected and linked weld schedules. Each schedule begins with the presence of a separate Start signal. There is a pause between each schedule until a new Start signal is received. To set up a succession, select the first desired schedule, then turn Successive Mode ON at the Mode screen. Repeat the procedure for subsequent schedules in the succession. Then link the schedules together in the correct sequence. (See Section VII: Linked Schedules Screen for this procedure.)

  The **Successive Mode** can be started at any schedule in the linked sequence. To start in any schedule in a link, press the **DATA+/-** keys to select the first schedule to be fired. Press the **PROGRAM/SAVE** key to save this schedule as the beginning of the sequence. Each subsequent **Start** signal will then cause the next schedule in the linked sequence to be selected. At the end of the sequence, the weld sequence stops and awaits another start signal. The control returns to the *first schedule fired in that succession* whether or not that schedule is the first one in the **link**. For instance, if schedules **01** through **06** are set up in the link, but the weld operation is started with schedule **03**, after completing schedule **06**, the control will return to schedule **03** rather than schedule **01**.

  During welding in **Successive Mode**, the screen displays the currently active schedule.
- **Chaining Mode –** When in the Chaining Mode the operation sequences through a series of linked weld schedules with the presence of only a single Start signal. Unlike the Successive Mode, it does not pause between schedules.

  To set up a sequence, select the first desired schedule, then turn **Chaining Mode ON**. Repeat the procedure for subsequent schedules in the sequence. Then link the schedules together in the correct sequence. (See Section VII: Linked Schedules Screen for this procedure.).

  The **Chaining Mode** can be started at any schedule in the link sequence by selecting that schedule with the display (using the **DATA +/–** key followed by the **Program/Save** key**)** and applying a **Start** signal. The control returns to the *first schedule fired in that chain* (whether or not that schedule is the first one in the link.). For instance, if schedules **01** through **06** are set up in the chain, but the **Program/Save** key is pressed and the weld operation is started with schedule **03**, after the completing schedule **06**, the control will return to schedule **03** rather than schedule **01**.

  NOTE: During welding in **Chaining Mode**, the **Monitor** screen does not display monitoring results. At the completion of the chain, monitor results may be viewed for each weld **if WELD ON/OFF** is turned **OFF** and the **DATA +/-** key is used to increment / decrement the schedule number.

- **CONT SEAM MODE** (optional) **-** The continuous seam mode repeats the weld cycle from **COOL** through **WELD2** as long as the start signal is present. See Appendix D for a graphical representation of this weld mode.
- **ROLL SPOT MODE** (optional) - The roll spot seam mode repeats the weld cycle from **SQUEEZE** through **OFF** as long as the start signal is present. See Appendix D for a graphical representation of this weld mode.

LINKED SCHED ↵ -- Placing the cursor at the ↵ symbol, and pressing the **DATA+** key will cause the Linked Schedule screen to be displayed.

Section VII: Linked Schedules Screen

To get this screen, go to the **MODE** screen, highlight **LINKED SCHED. ↵,** and press the **DATA +** button on the Control Panel.

This screen shows all linked schedules, their current weld counts, weld modes, and an error notification if the same schedule is used more than once. It allows changes and additions to be made as shown on the right.

SCHD	CURR WELD CNT	WELD MODE	
01. 02	0025	SUCC	ERROR
02. --			
03. 05	0300	REPT	
04. 08	0010	SPOT	
05. 10	0045	CHAIN	
06. --			
07. 02	0025	SUCC	ERROR

NOTE: Linking is not enabled when binary schedule select is enabled or when **Continuous Seam** or **Roll Spot Weld** modes are selected at the **System Wide Value Screen #1.**

Each link shall be a series of schedule numbers separated by a schedule number of **--** ***before*** the first number in the link and ***after*** the last number. In the example above, schedule **05** is linked to **08**, which is linked to **10**.

If a schedule number is used more than once, it shall have a **ERROR** printed to the right. In the above example schedule **02** has been entered twice. The reason for this is that if this schedule number starts a linked sequence, the system will not know which link to use.

Reference Number – This left-hand column of figures, labeled **01., 02., 03.,** and so on up to **64.,** provides a reference for the operator's convenience. Pressing the up or down key shall scroll through all reference numbers, rolling over from largest to smallest and vice versa.

SCHD – This column represents the schedule number linked in this reference position. It is programmable from **00** to **63**.

CURR WELD CNT – This column shall be non programmable. It displays the current number of weld counts for the schedule.

WELD MODE – This column shall be non programmable. It displays the weld mode for the last saved schedule set up in the **WELD MODE** field of the **Mode** screen.

ERROR – This notification shall be displayed when a schedule number is repeated in the list. If it is desirable to use the same schedule in two different link sequences, copy the schedule and assign it a different schedule number.

Section VIII: System Values Screens

System Values Screen 1

To get this screen, go to the **MODE** screen, highlight **System Values Screen 1** ↵, and press the **DATA +** button on the Control Panel.

NOTE: Some values are detected and displayed by the Control. They can not be changed by the operator.

SYSTEM VALUES SCREEN 1	
FULL CURR=10KA	COIL=01X
MAX # OF SCR=1	CONTRAST +/-
TURNS RATIO=053: 1	NUM VALVES=04
CNTRL MODE=%HEAT SEC.	VALVES STATUS ↵
BIN. SCHED. SELECT=OFF	MODE=SPOT
FIRING SWITCH=ONE STAGE	More ↵

FULL CURR. – The full current (**FULL CURR.)** is programmable from **05 kA** to **80 kA**. For proper operation, this value must be at the current obtained when the unit is fired with a 180E conduction angle into the secondary circuit that will be used for welding. If the transformer taps are changed, this value must be adjusted.

MAX # OF SCR – Denotes the number of SCRs available in the Control. The factory-set default is **4**, so this must be changed to the appropriate number.

TURNS RATIO – This adjusts the transformer turns ratio for the constant current, and is programmable from **001:1** to **200:1**.

CNTRL MODE – Control Mode (**CNTRL MODE**) allows the operator to set the control mode of operation. Selections are pre-set by the factory and depend on the type of current sensing coil (if any) installed.

- **%HEAT SEC –** Percent Heat Secondary
- **SEC. C.C.** – Secondary Constant Current

OR

- **%HEAT PRI –** Percent Heat Primary
- **PRI. C.C.** – Primary Constant Current

By placing the cursor at the first character of the **CNTRL MODE** selection and using the **DATA +/–** pushbutton, the operator can toggle between the modes that are applicable to that machine. %HEAT works for all machines. SEC. CC requires a secondary current coil. PRI CC requires a primary current coil. Selecting any one of these modes will automatically turn the other modes off. The Control is shipped in the **% HEAT** mode as the default.

BIN. SCHED. SELECT – Binary Schedule Select (**BIN. SCHED. SELECT**) determines whether or not the binary schedule select input is active. That is, it enables or disables the ability for the Control to be slaved to a separate Programmable Logic Controller (PLC) or other device with BCD capability. There are only two options, **OFF** or **ON**; the default is **OFF**. If **OFF**, the binary inputs are ignored and the Control defaults to that which is presented on the control panel. If **ON**, the binary select input is active and an external device controls which schedule is used. Linking is disabled if Binary Schedule Select is ON.

FIRING SWITCH – Selects either two stage or single stage firing switch.

COIL –This Control has no option; it is set for **1X**.

CONTRAST+/– – By placing the cursor at the first character of this field and using the **DATA +/–** pushbutton, the operator can increase or decrease the contrast of the LCD screen.

NUM VALVES – This control will select the number of valves in the system. It is pre-set to either 4 or 12, depending on the valve option implemented in this unit.

VALVES STATUS – This control allows the operator to select the **Valve Status** screen, discussed in Section IX.

MODE – This control allows the selection of weld modes - Spot Weld and the optional Roll Spot or Continuous Seam Weld Functions. The unit is shipped as ordered.

MORE – Brings up **System Values Screen 2**.

System Values Screen 2

87° DELAY - This control turns the **87° Delay** Mode ON or OFF. This mode is used with Hypersil transformers to limit the firing of the SCR to 87° on the first half cycle thereby preventing saturation of the transformer. The default setting is ON.

SYSTEM VALUES SCREEN 2	
87° DELAY=ON	AUTO RESET=OFF
END OUTPUT=ON	ERROR OUTPUT=ON
STEP END OUTPUT=ON	SET DEFAULTS ↵
WELD ON/OFF=LOCAL	MASTER CNTL=LOCAL
LOW LINE ALARM=ON	UNIT ADDRESS=01
	Screen 1 ↵ More ↵

END OUTPUT – This control turns on and off the **End Output** signal (that signal that indicates the completion of the weld cycle). It is programmable as either **ON** or **OFF** by placing the cursor at the first character of the parameter's value and using the **DATA +/–** key to toggle between the two states.

STEP END OUTPUT – This control turns on and off the **Step End Output** signal (that signal that indicates the completion of a stepper). It is programmable as either **ON** or **OFF** by placing the cursor at the first character of the parameter's value and using the **DATA +/–** key to toggle between the two states. In the **ON** state, the **Step End Output** signal remains active until a **Reset** signal is received, the operator presses the **RESET** button, or the **Step Reset** signal is received. In the **OFF** state the **Step End Output** signal remains inactive. If the **Reset** key is pressed on the front panel or an external **Reset** is received, the error will return after the next weld. If the unit receives an external **Step Reset** signal, the step counters are cleared and the error does not occur until the step counts are again reached.

WELD ON/OFF – This control determines whether the **WELD ON/OFF** button on the Control Panel or the remote **NW1** signal will control the flow of welding current. The default is **LOCAL**, which places control on the pushbutton switch. If **REMOTE** is selected, control is placed under the **NW1** signal. In either case, the control NOT selected is locked out.

When set to **REMOTE**, saving any changes to the schedule or settings on the front panel will set the Control to the **Weld Off** state. This input must then be opened and re-closed to set the **Weld On** state.

LOW LINE ALARM – this control determines whether the **Low Line Voltage Alarm** is active.

AUTO RESET – This control determines how the Control reacts to an internal minor error signal. When **AUTO RESET** is **OFF**, an error signal will prevent the Control from reacting to the next **Start** signal and will inhibit an **End** signal output from the Control.

- When **AUTO RESET** is **ON**, the error signal will light the Error LED indicator but this error signal will be reset by the next **Start** signal. If the **ERROR OUTPUT** function is turned on, a Fault output will occur.
- If **AUTO RESET** is **OFF**, the error signal must be overridden by the operator pressing the **RESET** button on the control panel, or by the application of an **Error Reset** signal to the I/O connector. If **ERROR OUTPUT** function is turned on, a Fault output will occur. This is the default setting.

ERROR OUTPUT – This control turns on and off the **Error Output** signal. It is programmable as either **ON** or **OFF** by placing the cursor at the first character of the parameter's value and using the **DATA +/–** key to toggle between the two states. The default is **ON**. In the **ON** state, the **Error Output** signal remains on either until an **Error Reset** signal occurs or, in the case of a minor error, until the next **Start** signal or an **Error Reset** signal occurs. In the **OFF** state the **Error Output** signal remains **OFF**.

SET DEFAULTS – Placing the cursor over the ↵ symbol next to **SET DEFAULTS** and pressing the **DATA +** pushbutton will cause the factory-set defaults to be restored to the software.

MASTER CNTL – This selects the device that will be able to change the programming on the unit. If **LOCAL** is selected, (the default) the operator will be able to program the unit normally through the buttons on the unit's panel. If **HOST** is set, the buttons on the panel will be able to display but not change any values; only the host device will have the ability to program the unit, through the communications software. The only exception is that **MASTER CNTL** itself may be changed to **LOCAL** using the panel buttons, even though it has been previously set to **HOST**.

UNIT ADDRESS – This sets the unit's RS-485 address. Each control on a single RS-485 loop must have a unique unit address. Allowable values are **01 – 30**, default is **01**.

Screen 1 ↵ – Highlight Screen 1 and push the **DATA +** button to return to **System Values Screen 1**.

More ↵ – Highlight **MORE** to go to **System Values Screen 3.**

System Values Screen 3

RETRACTION – This switches the Electrode Retraction mode between **MAINTAINED** and **PULSED**. The **MAINTAINED** mode causes the retraction output to follow the input switch. When the switch is closed, power is supplied to the retraction output. This is the non-retracted state. Welding is allowed in this state.

SYSTEM VALUES SCREEN 3

RETRACTION=MAINTAINED	**DIFF.PRESSURE=ON**
PRESSURE SWITCH=OFF	**BACK PRESSURE=10**
FORCE CALIBRATION ↵	
OUTPUT FORCE=F1	
MONITORED VOLTS=RMS	
MONITORED TIME=W1/W2	**Screen 2 ↵**

Welding is not allowed when the weldhead is retracted. The **PULSED** mode requires the input switch to be toggled before the output changes state. Welding is not allowed when the weldhead is retracted.

Pressure Switch = This turns the **Pressure Switch** function **ON** and **OFF**. When this function is turned ON, a weld will not proceed until both the footswitch input and the pressure switch inputs are closed. If this input does not close in approximately 5 seconds, the unit gives a "Pressure Switch Alarm" on the screen and a fault output.

NOTE: This is for an external pressure switch on the weldhead. Normally this is **OFF**. Turn **ON** only when using an external pressure switch on the weldhead.

Force Calibration = This accesses the **Force Calibration** screen. Instructions for using this screen are in *Appendix H, Force Control Option.*

Output Force = This turns the Output Force function to Channels **F1-F8**, or **OFF**. **F1-F8** means the output for SCR 1 goes through F1, SCR 2 is associated with F2 and so on. The **F1-F8** option allows the control to operate up to 8 independent electronic pressure regulators.

Monitored Volts = This switches the voltage monitoring mode between **PEAK** and **RMS** (Average).

Monitored Time = This switches the weld monitoring time between **W1/W2** (Weld 1 and Weld 2) or **Last Cycle Only**. This setting applies to the voltage monitoring option only. Selecting **W1/W2** causes the unit to monitor the voltage during the **W1** period and the **W2** period, ignoring any upslope and downslope. Selecting **Last Cycle Only** causes the control to look only at the last cycle in the **W1** and **W2** periods.

DIFF PRESSURE = This turns the force input functions (differential pressure) **ON** and **OFF.** When this function is turned on, actual force readings from each weld will be displayed on the monitor screen. High, low and firing force limits can be programmed in the monitor screen, and welding will not proceed until the actual value is within those limits.

Back Pressure = Using the ∧ ∨ keys, you can increment/decrement the Back Pressure (in psi). Back Pressure is the pressure that is sent by the electronic pressure regulator to the bottom of a weld head's air cylinder when a schedule is not operating. The psi setting for this parameter will only be accurate if the electronic pressure regulator has the association of 0-10VDC = 0-100psi.

Screen 2 ↵ -- Returns you to **SYSTEM VALUES SCREEN2.**

Section IX: System Valve Status Screen

To get this screen, go to the **SYSTEM VALUES SCREEN 1**, highlight **VALVES STATUS.** ↵, and press the **DATA +** button on the Control Panel.

The **System Valve Status** screen allows the operator to view the weld count used in the **Stepper** function. The number displayed is the total count of welds performed on each valve by all schedules. The operator can set this count to zero by placing the cursor at the ↵ symbol and pressing the **DATA +** key. The operator can also select the SCR to be associated with each valve for the weld count used in the Stepper function. Note that this setting does not control which SCR is to be fired in a weld schedule; that is done on the **Schedule** screen.

The number of valves displayed on the screen will be either **4** or **12**, depending on the option selected in **System Wide Values** screen 1.

SYSTEM VALVE STATUS

VALVE	CNT	RESET	SCR
1	00200	↵	1
2	00000	↵	N/A
3	00000	↵	N/A
4	00000	↵	N/A

VALVE – This column displays the valve numbers. These numbers are non-programmable.

CNT – This column displays the total count of welding operations associated with the electrode valve / SCR combination.

RESET - Placing the cursor at the ↵ symbol and pressing the **DATA +** key will cause the **CNT** number to reset to zero.

SCR – This column indicates the SCR used with each valve. It can be programmed from 1 to the maximum number of SCRs selected at the **System Wide Values** screen. If desired, it can also be programmed to **N/A** (not applicable).

Section X: Force Calibration Screen

To get to this screen, go to the **SYSTEM VALUES SCREEN 3**, highlight **FORCE CALIBRATION ↵,** and press the **DATA +** button on the Control Panel.

The **FORCE CALIBRATION** screen allows the operator to calibrate the pressure used in both the **FORCE** and **PRESSURE** (Differential Pressure) functions. Complete Calibration instructions are in *Appendix H, Force Control Option.*

F1 through **F8** are the Channels (**F** = "Force") to calibrate. **F1** is associated with SCR 1, **F2** with SCR 2 and so on.

Lo-Psi is highlighted to calibrate Low Pressure.

Hi-Psi is highlighted to calibrate High Pressure.

000 * FORCE CALIBRATION ***
Psi (All Force Entries in Pounds)**

Channel #	Lo-Psi	Hi-Psi	Valve #	Channel #	Lo-Psi	Hi-Psi	Valve #
F1	0000	0001	1	F5	0000	0001	N/A
F2	0000	0001	2	F6	0000	0001	N/A
F3	0000	0001	N/A	F7	0000	0001	N/A
F4	0000	0001	N/A	F8	0000	0001	N/A

The Valve # must be programmed with the valve that is being turned on to create the weld force.

The PSI value at the top left of the screen indicates the actual differential pressure across the weldhead cylinder for the active channel if the force input option is installed.

Section XI. Stepper Screen

The **Stepper** screen allows information to be programmed to maintain weld results despite gradual degradation of the weld electrodes. This is done by adjusting power to compensate for the electrode degradation. The **Stepper** screen is shown on the right.

VALVE NUM=01
SCR #1 STEPPER=OFF

	COUNT	HEAT%	COUNT	HEAT%
1	0000	FIXED	6 0000	100%
2	0200	105%	7 0000	100%
3	0500	110%	8 0000	100%
4	0750	120%	9 0000	100%
5	0850	130%	10 0000	100%

Note: This screen cannot be accessed if the control's weld mode is set to **%HEAT PRIMARY** or **%HEAT SECONDARY.**

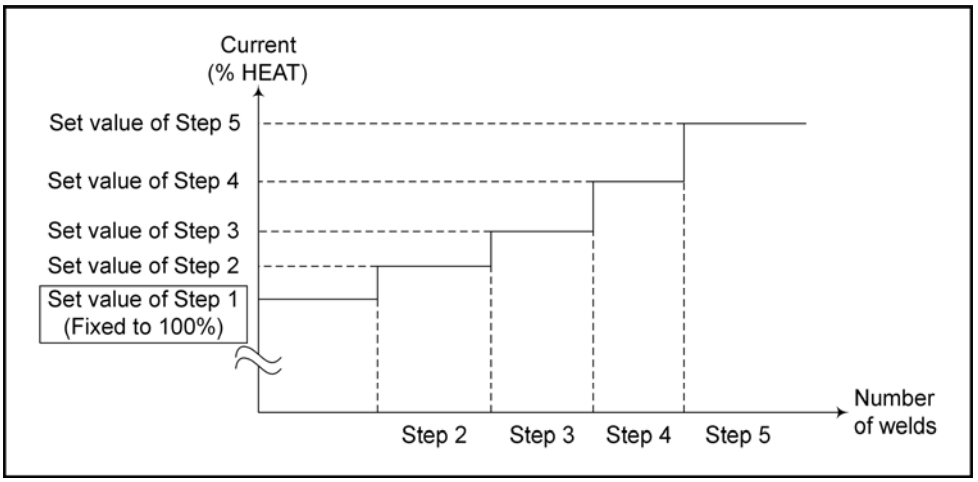
VALVE NUM - The **Valve Number (VALVE NUM)** is used to select a particular valve stepper schedule to be displayed. The schedule is programmable from **01** to **04** or **01** to **12** depending on the valve option selected on the **System Wide Values** screen.

SCR# – This display-only field shows the SCR number associated with the selected valve. The association is programmed on the **System Valve Status** screen.

STEPPER – This control turns the **Stepper ON** or **OFF**. The default is **OFF**.

COUNT - This control sets the weld count for each step, and is programmable from **0000** to **9999**. When the count is set to **0000** the step is considered off or at the end of a step. There are 10 steps available to increment/decrement **Heat%.**

HEAT% -- This control sets the percent of heat change for each step relative to the base weld current set in the schedule. The first field is non-programmable and its value is displayed as "FIXED," representing 100% of the weld current set in the schedule. All other fields are programmable from 50% to 200%. If the setting is 100%, the weld current will be that set in the schedule.



Example of Stepper Function

CHAPTER 4
OPERATING INSTRUCTIONS

Section I: Introduction

Overview

This Chapter tells you how to turn the Control ON, use menu screens to customize operating parameters, match the Control to your welding system, and how to operate the Control. This chapter is divided into the following sections:

- Introduction
- Preparing for Operation
- Setup Messages
- Operation
- Programming Weld Schedules
- Operational Messages
- Shutdown

Before operating the Control, you ***must*** be familiar with the following:

- The principles of resistance welding and the use of programmed weld schedules.
- The **location** and **function** of Controls and Indicators. For more information, see *Chapter 1* of this manual.
- How to **select** and **use** the Control functions for your specific welding applications. For more information, see *Chapter 3, Using STA Series Control Functions*.

General Operator Safety

WARNINGS

- To prevent blindness or eye injury, ***wear safety goggles at all times during welding***.
- ***Be careful of moving parts.*** You can be injured by moving parts during welding.
- Do ***not*** wear loose clothing or jewelry around moving parts. They could get caught and cause injury.

Section II: Preparing for Operation

Turning the Equipment ON

Depending on the customer's purchase, the Control may have an internal circuit breaker or power may be applied from the junction box that feeds power to the Control.

When power is first applied, the system performs an internal self-test. At the completion of that test, all LEDs are turned on briefly and introductory screens appear on the Control Panel for several seconds, beginning with the screen on the right.

Control Panel with Introductory Screen and Indicators

During the power-up cycle, the Control will briefly display the version of the software installed in the Control. If you ever need to contact Unitek Miyachi for technical assistance, Customer Support will need to know which version ("Release") number of the software is installed.

STA SERIES RESISTANCE WELDING SYSTEM

UNITEK MIYACHI CORP.
MONROVIA, CALIFORNIA

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RELEASE 3.0 Rev G

The Control will then display which Option cards are installed in the Control as shown on the right.

If an unknown card is present, the system will stop, prevent further operation, and display the following message:

***** INSTALLED BOARDS *****

DETECTED SINGLE CASCADE CARD
DETECTED SINGLE COMMUNICATION CARD
DETECTED SINGLE VOLTAGE CARD
DETECTED PRESSURE MONITOR CARD

ERROR! DETECTED UNKNOWN OPTION CARD

After the startup screens, the **Schedule** screen appears. All values on the screen will be the values on the Control at time of last power-off.

Pre-Operational Setup

NOTES:

- If your unit is equipped with a **PROGRAMMING** lock, the key must be inserted and turned to the ON position before any program changes can be made.
- If your weldhead does not have a retraction switch to control this function, a jumper must be installed between RETR and RETC inputs on the main board.
- During set-up, the following symbols indicate which values are controllable, and which are presented for information only. The symbols are screen-specific; a value that can be controlled on one screen may be informational on another screen.
- **=** are values that can be set by the operator.
- **➜** are values provided for information only and cannot be changed by the operator
- Following this section is a display of information and error screens, which you might encounter during set-up.

Section III: Setup Messages

You may receive one of the following messages during set-up of the Control. The message tells you what corrective action should be taken. If you cannot correct the action by performing these instructions, contact your Unitek Miyachi representative.

SCHEDULE 01 WELD 1 CURRENT LESS THAN 20% OF SYSTEM FULL CURRENT.
TO ACCEPT, PRESS PROGRAM/SAVE KEY, THEN. DESIRED SCREEN BUTTON AFTER SAVING.
OR ENTER THE SYSTEM VALUES SCREEN AND CHECK FULL CURR. W1 CURRENT MUST BE MORE THAN 20% OF THIS. ADJUST W1 ON THE SCHEDULE SCREEN ACCORDINGLY.

SYSTEM VALUE FOR FULL CURRENT FAILS VALIDITY CHECK.
FULL CURRENT DIVIDED BY TURNS RATIO MUST FALL WITHIN A 50 TO 1500 AMP RANGE.
ON SYSTEM VALUES SCREEN, CHECK THAT THE TURNS RATIO IS VALID. IF SO, THE FULL CURR VALUE MUST BE BROUGHT WITHIN ACCEPTABLE LIMITS.

SCHEDULE 01 WELD 1 CURRENT GREATER THAN SYSTEM FULL CURRENT.

ENTER THE SYSTEM VALUES SCREEN AND CHECK FULL CURR. WELD 1 CURRENT MUST BE LESS THAN THIS. ADJUST W1 ON THE SCHEDULE SCREEN ACCORDINGLY.

SCHEDULE 01 WELD 1 CURR. PLUS STEP CURR. GREATER THAN SYSTEM FULL CURRENT

ENTER THE SYSTEM VALUES SCREEN AND CHECK FULL CURR. WELD 1 STEP CURRENT MUST BE LESS THAN THIS.
STEP CURRENT IS THE PRESENT STEP NUM'S HEAT % TIMES WELD 1 CURRENT.

SCHEDULE 01 WELD 2 CURRENT LESS THAN 20% OF SYSTEM FULL CURRENT.
TO ACCEPT, PRESS PROGRAM/SAVE KEY, THEN DESIRED SCREEN BUTTON AFTER SAVING.
OR ENTER THE SYSTEM VALUES SCREEN AND CHECK FULL CURR. W2 CURRENT MUST BE MORE THAN 20% OF THIS. ADJUST W2 ON THE SCHEDULE SCREEN ACCORDINGLY.

SCHEDULE 01 W1 AND W2 TIMES ARE SET TO ZERO

PRESS PROGRAM/SAVE KEY TO ACCEPT, THEN DESIRED SCREEN BUTTON AFTER SAVING.
OR PRESS SCHEDULE KEY TO VIEW OR CHANGE THESE TIMES

MODIFIED SCHEDULE NOT SAVED.
PRESSING THE PROGRAM/SAVE KEY SAVES MODIFICATIONS, THEN PRESS DESIRED SCREEN BUTTON AFTER SAVING.
OR PRESS PLUS OR MINUS KEY TO LOSE MODIFICATIONS

SCHEDULE 01 WELD 2 CURRENT GREATER THAN SYSTEM FULL CURRENT.

ENTER THE SYSTEM VALUES SCREEN AND CHECK FULL CURR. WELD 2 CURRENT MUST BE LESS THAN THIS. ADJUST W2 ON THE SCHEDULE SCREEN ACCORDINGLY.

SCHEDULE 01 WELD 2 CURR. PLUS STEP CURR. GREATER THAN SYSTEM FULL CURRENT

ENTER THE SYSTEM VALUES SCREEN AND CHECK FULL CURR. WELD 2 STEP CURRENT MUST BE LESS THAN THIS.
STEP CURRENT IS THE PRESENT STEP NUM'S HEAT % TIMES WELD 2 CURRENT.

SCHEDULE 01
BAD SCR NUMBER IN SCHEDULE TO BE WELDED.

SELECT CORRECT SCR NUMBER ON SCHEDULE SCREEN AND PRESS RESET TO CONTINUE.

Programmed value for FORCE fails a validity check.
The FORCE value on the SCHEDULE screen Must be greater than the FORCE LO and less than the FORCE HI values on the MONITOR screen. Also, FORCE must be equal to or greater than the MONITOR screen FORCE FIRING value.

Section IV: Operation

1 Turn power ON, either from the internal circuit breaker or the external, customer-supplied circuit breaker or power contactor.

2 After waiting for the internal self-test, and presentation of the introductory screens, the Control Panel will present the Schedule Screen. During this period, all LEDs will light briefly as an indication that they are working.

3 Select the appropriate schedule for your welding procedure.

4 During welding operation, you may monitor the operation of the Control through the various screens described in *Chapter 3, Using STA Series Controls*, but you cannot modify the schedules. If your unit has a PROGRAMMING lock, you will be unable to change the schedules unless programming is turned ON.

5 In **Roll Spot Mode** (optional), the motor (connected to the valve designated as **the Motormove Valve** in the schedule) moves only during **OFF** time. All other valves are held through the **OFF** time. If **OFF** time is set to 0, the motor will not move.

NOTE: Some motors require several cycles before motion begins.

6 In Continuous **Seam Weld Mode** (optional), changing the **Binary Schedule** inputs (with **Binary Select Enabled**) will cause the Control to change schedules. There is a delay of up to 70 milliseconds for switch debounce and 5 cycles for the Control to re-compute the parameters of the new schedule. During this time, the previous schedule will continue to operate. The Control will then start at the beginning of **COOL** time in the second schedule.

7 In **% Heat Mode**, the conduction angle depends on both the user-programmed **% Heat** and the power factor of the secondary circuit. Changes in that power factor can result in changes of the measured conduction angle even though there are no programmed changes to the **% Heat**.

Spot Welds

1 To change the information in the schedule screen the control must be in **PROGRAM** mode. From the schedule screen press the **PROGRAM/SAVE** button so that the red **READY** indicator is off and the green **PROGRAM** indicator is on.

2 To select the schedule you desire, press the schedule button, then select the schedule number using the **DATA +** or **–** buttons.

3 To change weld schedule data, press > to scroll through and enter the time (in cycles) desired for **SQD, SQZ, UP1, W1, DN1, CO, UP2, W2, DN2, HO** and **OFF**. As described above, in each field, use the + or – keys to change the time desired. See *Appendix D, System Timing* for a graphical representation of each of these periods.

4 Press > again and enter the weld current or percent heat desired for **W1**. See the description of the system wide values screen for more information on the %heat and constant current weld modes.

5 Press > and enter the weld current or percent heat desired for **W2**.

6 Press > to move to the **ELECTRODE VALVE** and **SCR** selection. Use the + or – keys to select the desired electrode valve and SCR. See the description of the system valve status screen for more information on assigning electrode valves to SCRs.

7 To select the valve on/off settings, press the **VALVES** button located below the main screen, to go to the valves screen.

8 Press V to toggle through the available valves. Use the + or – keys to turn each valve on **ON** or **OFF** in that schedule.

9 Use the **MONITOR** screen to set welding limits (see *Chapter 3, Section IV*).

10 To save the information that was just modified press the **PROGRAM/SAVE** button. The message *****SAVING***** will flash briefly on the top of the screen.

11 If operating in **LOCAL MODE**, press the **WELD ON/OFF** button to put the control into the ready to weld mode. The green LED in the **WELD ON/OFF** button will turn ON.

12 Actuate the Start signal to begin welding.

Continuous Seam Weld (Optional on all STA Models)

1 To change the information in the schedule screen the control must be in **PROGRAM**. From the schedule screen, press the **PROGRAM/SAVE** button so that the red **READY** indicator is off and the green **PROGRAM** indicator is on.

2 From the schedule screen press ^ once to select the **SHOW SYSTEM VALUES** field. Press the + button to show the system wide values screen.

3 Press ^ to go to the **MODE** field. Press the + key as needed to select **CONT SEAM.**

4 To select the schedule you desire, press the **SCHEDULE** button, then select the schedule number using the **DATA+/-** buttons.

5 To change weld schedule data, press > to scroll through and enter the time (in cycles) desired for **SQD, SQZ, UP1, W1, CO, UP2, W2, HO** and **OFF**. In each field, use the **+** or **–** keys to change the time desired. See *Appendix D, System Timing* for a graphical representation of each of these periods.

6 Press > again and enter the weld current or percent heat desired for **W1**. See the description of the system wide values screen for more information on the %heat and constant current weld modes.

7 Press > and enter the weld current or percent heat desired for **W2**.

8 Press > to move to the **MOTORMOVE VALVE** and **SCR** selection. Use the **+** or **–** keys to select the desired motormove valve and SCR. See the description of the system valve status screen for more information on assigning electrode valves to SCRs.

9 Press v to toggle through the available valves. Use the **+** or **–** keys to turn each valve on or off in that schedule.

10 To select the valve ON/OFF settings, press the **VALVES** button located below the main screen, to go to the valves screen.

11 Use the **MONITOR** screen to set welding limits (see *Chapter 3, Section IV*).

12 To save the information that was just modified, press the **PROGRAM/SAVE** button. The message *****SAVING***** will flash briefly on the top of the screen.

13 If operating in **LOCAL MODE**, press the **WELD ON/OFF** button to put the control into the ready mode.

14 Actuate the **START** signal to begin welding.

Cascading (Requires Multiple SCRs)

1 To change the information in the schedule screen the control must be in **PROGRAM**. From the schedule screen press the **PROGRAM/SAVE** button so that the red **READY** indicator is OFF and the green **PROGRAM** indicator is ON.

2 From the **MODE** screen, highlight the **SYSTEM VALUES 1** screen, then press the **DATA +/-** key.

3 Press V to select the **MAX # OF SCR=** field. Use the **+** key to input the number of SCRs in the control.

4 Use < > to select the **VALVES STATUS** field. Press the + key to display the **System Valve Status** screen. Use > to select the **SCR** field for the first valve. Use the + or – key to select which SCR should be tied to this electrode valve. Use V to select the SCR field for each of the remaining electrode valves. Use the + or – keys to select the SCR that is associated with each electrode valve. You may also select **N/A**.

5 To select the schedule you desire, return back to the main schedule screen by pressing the **Schedule** button then select the schedule number using the **+** or **–** (**ON** or **OFF**) keys.

6 To change the weld schedule data, press > to scroll through and enter the time (in cycles) desired for **SQD, SQZ, UP1, W1, DN1, CO, UP2, W2, DN2, HO** and **OFF**. In each field, use the + or – keys to change the time desired. See *Appendix D, System Timing* for a graphical representation of each of these periods.

7 Press > again and enter the weld current or percent heat desired for **W1**. See the description of the **SYSTEM VALUES SCREEN 1** for more information on the %heat and constant current weld modes.

8 Press > and enter the weld current or percent heat desired for **W2**.

9 Press > to move to the **ElectroValve** and **SCR** selection. Use the **+** or **–** keys to select the desired electrode valve and SCR.

10 To select the valve **ON/OFF** position, press the **VALVES** button located below the main screen, to go to the valve screen.

11 Press V to toggle through the available valves. Use the **+** or **–** keys to turn each valve on or off in that schedule.

12 Use the **MONITOR** screen to set welding limits (see *Chapter 3, Using STA Series Control Functions, Section IV*).

13 Press the **MODES** button to display the modes screen. Push V twice to select the **WELD MODE** field. Press the **DATA +/-** key as required to select the **SUCCESSIVE** or **CHAINING** weld mode. Use **SUCCESSIVE** when the intention is to stop welding between each schedule, remove, and reactivate the **Start** signal to resume welding with the next schedule in the sequence. Use **CHAINING** when the intention is to fire all the linked schedules in sequence with one input of the Start signal.

14 Press the **SCHEDULE** button to redisplay the schedule screen.

15 If you desire multiple copies of a specific schedule to be included in the Linked program, press V to go to the **COPY TO # xx PLUS yy** field. Enter the number of the schedule you want to copy to in place of the **XX** above. If you want to make more than one copy, enter the number of additional copies in the **PLUS** yy field above. (For example, **COPY TO 10 PLUS 02** will copy the current schedule to schedules **10, 11** and **12**). Move the cursor to the (↵) field. Press the + button to make the copies. **SCHEDULES HAVE BEEN COPIED** …will be displayed.

16 Press the **SCHEDULE** button to redisplay the schedule screen. Press the **PROGRAM/SAVE** button to save the schedule. The message ***** SAVING ***** will flash briefly on the top of the screen. Go to each of the schedules copied above, and in each of those schedules, press V as required to select the **ELECTRODE VALVE=XX AND SCR # Y** field. Then use the + or – keys to enter the number of SCR that you wish to fire in that schedule. The valve status can be changed in each schedule by pressing the **VALVE** button and making the desired changes. Press the **PROGRAM/SAVE** button after each schedule to save the data in that schedule.

17 Press the **MODES** button to select the modes screen. Press V to select the **LINKED SCHED** field. Press the + key to select the linked schedule screen.

18 In the linked schedule screen, use the **+** or **–** keys to select the first schedule you wish to fire in this cascade.

19 Press V to select the **SCHD** field in the next line. Use the **+** or **–** keys to select the second schedule that will be fired in this cascade. Repeat this process until all schedules for this cascade have been entered. Push the **PROGRAM/SAVE** button to save the schedule. The message ***** SAVING ***** will flash briefly on the top of the screen.

20 Press the **SCHEDULE** button to go to the schedule screen. Use the **+** or **–** keys to select the first schedule that will be fired in this cascade. Press **PROGRAM/SAVE** to put the unit into program mode. Press **PROGRAM/SAVE** again. This sets the first schedule in the chain. To help the user follow which schedules are Linked together, Unitek Miyachi has provided an easy to understand Help-Link. The **Help**-Link is located in the upper right-hand corner of the **SCHEDULE** screen and displays the schedules that are Linked to the schedule that is displayed. In the upper right hand corner of the screen you will notice that the schedule you are in will be displayed in the center, between the schedules that are Linked both prior and after your displayed schedule. For example: **01 < 02 > 03**

21 If operating in **Local Mode**, press the **WELD ON/OFF** button to put the control into the ready to weld mode. The green LED on the **WELD ON/OFF** button will be on if the unit is ready to fire.

22 Actuate the **Start** signal to begin welding.

Section V: Operational Messages

You may receive one of the following error messages during set-up or operation of the Control. The message tells you what corrective action should be taken. If you cannot correct the action by performing these instructions, contact your Unitek Miyachi representative. Major errors require pressing the **RESET** button or giving a signal to the **RESET** input to clear the error. If **AUTO RESET** is turned **ON**, minor errors can be cleared by the next **START** signal. If **AUTO RESET** is turned **OFF**, minor errors must be cleared by pressing the **RESET** button or giving a signal to the **RESET** input. See Chapter 3, Section VIII for more information on **AUTO RESET.**

Major Run-Time Error Messages

```
********** EMERGENCY STOP **********

THE SYSTEM HAS ENCOUNTERED A SERIOUS
CONDITION, POSSIBLY INVOLVING A
SAFETY HAZARD.  CLEAR THE CONDITION
AND PRESS THE RESET BUTTON TO REBOOT.
```

```
                OVERTEMP ALARM:

CHECK THERMOSTAT CIRCUIT

PRESS RESET TO RESUME WELDING
```

NOTE: If an external weld transformer thermostat is connected into the circuit **OVERTEMP ALARM** will be displayed if the external transformer thermostat opens. as shown in *Appendix K, Circuit Modification for External Transformer Thermostat,*

```
NO CURRENT. VERIFY THAT THERE IS:
1.  ENOUGH WELD FORCE   6.  FULL CURR SET
2.  NO COIL BREAKAGE IN RANGE
3.  INTACT COIL CABLE       7.  CORRECT SCR
4.  GOOD COIL CABLE UNIT POWER
    CONNECTION
5.  ENOUGH SQZ TIME
PRESS RESET BUTTON TO RESUME WELDING.
```

```
SCHEDULE 01
WELD 2 CURRENT EXCEEDED HIGH LIMIT.
  1. REPROGRAM WELD 2 CURRENT.
  2. INCREASE WELD TRANSFORMER RATIO.
  3. INCREASE W2 HIGH LIMIT AT THE
     MONITOR SCREEN.

PRESS RESET BUTTON TO RESUME WELDING.
```

```
SCHEDULE 01
WELD 1 CURRENT EXCEEDED HIGH LIMIT.
  1. REPROGRAM WELD 1 CURRENT.
  2. INCREASE WELD TRANSFORMER RATIO.
  3. INCREASE W1 HIGH LIMIT AT THE
     MONITOR SCREEN.

PRESS RESET BUTTON TO RESUME WELDING.
```

```
SCHEDULE 01
WELD 1 CONDUCTION ANGLE EXCEEDED LIMIT.
  PRESS RESET BUTTON TO RESUME WELDING.
  IF PROBLEM CONTINUES, INCREASE THE W1
     COND. LIMIT AT THE MONITOR SCREEN.

PRESS RESET BUTTON TO RESUME WELDING.
```

```
SCHEDULE 01
WELD 2 CONDUCTION ANGLE EXCEEDED LIMIT.
    PRESS RESET BUTTON TO RESUME WELDING.
    IF PROBLEM CONTINUES, INCREASE THE W2
       COND. LIMIT AT THE MONITOR SCREEN.

PRESS RESET BUTTON TO RESUME WELDING.
```

```
CONDUCTION ANGLE REACHED FULL PHASE
    (180 DEGREES)

    REDUCE % HEAT SETTING

  PRESS RESET BUTTON TO RESUME WELDING.
```

```
SCHEDULE 01
    EXCEEDED STEPPER SCHEDULE LIMIT.
    1. SERVICE ELECTRODES, RESET VALVE
       COUNT FOR THE ASSOCIATED VALVE.
    2. CHANGE TO A SCHEDULE WITH GREATER
       STEPPER COUNTS.
    3. PUSH RESET TO CONTINUE WITH THIS
      SCHEDULE (AND REDISPLAY THIS MSG).
```

```
   ** IMPROPER SCHEDULE NUMBER DETECTED **

FOUND AN OUT OF RANGE SCHEDULE NUMBER.
  VALID NUMBERS ARE 00 – 63.


PRESS THE RESET KEY AND CONTINUE.
```

```
CHANGED FROM RUN MODE TO PROGRAM MODE
  IN THE MIDDLE OF A WELD, OR TURNED
  OFF WELD CURRENT DURING A WELD. WELD
  WAS ABORTED.

PRESS RESET BUTTON, THEN RESTART THE
  WELD FROM THE BEGINNING.
```

Minor Run-Time Error Messages

```
SCHEDULE 01
WELD 1 CURRENT BELOW LOW LIMIT.
    1. REPROGRAM WELD 1 CURRENT.
    2. DECREASE WELD TRANSFORMER RATIO.
    3. DECREASE W1 LOW LIMIT AT THE
    MONITOR SCREEN.

PRESS RESET BUTTON TO RESUME WELDING
```

```
SCHEDULE 01
WELD 2 CURRENT BELOW LOW LIMIT.
    1. REPROGRAM WELD 2 CURRENT.
    2. DECREASE WELD TRANSFORMER RATIO.
    3. DECREASE W2 LOW LIMIT AT THE
         MONITOR SCREEN.

PRESS RESET BUTTON TO RESUME WELDING.
```

```
SCHEDULE 01
REACHED THE LAST STEP COUNT FOR
CURRENT STEP. THE NEXT WELD WILL
MODIFY WELDING CURRENT USING THE
PERCENTAGE FACTOR SPECIFIED IN THE NEXT STEP
OF THE CURRENT STEPPER
SCHEDULE.
PRESS RESET BUTTON TO RESUME WELDING.
```

```
WELD COUNT REACHED WELD COUNT LIMIT.
IMPLEMENT USER DEFINED PROCEDURE FOR
THIS CONDITION.

AT THE MONITOR SCREEN:
1.      SET WELD COUNT=0  OR
2.      INCREASE WELD COUNT LIMIT.
```

***** LOW LINE VOLTAGE *****

***** ADVISORY MESSAGE ONLY *****

LOW LINE VOLTAGE WAS DETECTED. CHECK LINE VOLTAGE AND PRESS RESET KEY TO CONTINUE.

***** HIGH LINE VOLTAGE *****

***** ADVISORY MESSAGE ONLY *****

HIGH LINE VOLTAGE WAS DETECTED. CHECK LINE VOLTAGE AND PRESS RESET KEY TO CONTINUE

***** SCALE CURRENT ERROR *****

SCALED CURRENT WAS GREATER THAN MAX.

PRESS RESET KEY TO CONTINUE

Section VI: Shutdown

Emergency Shutdown

In an emergency, you may perform an emergency shutdown by hitting the **Emergency Stop Switch**. Weld power will be immediately shut down, the valve outputs will turn off, and you will get the emergency shutdown message on the Control.

********** EMERGENCY STOP **********

THE SYSTEM HAS ENCOUNTERED A SERIOUS CONDITION, POSSIBLY INVOLVING A SAFETY HAZARD. CLEAR THE CONDITION AND PRESS THE RESET BUTTON TO REBOOT.

After clearing the emergency condition, you ***must***:

- Assure that **FS1** and **FS2** signals are open,
- Reset the emergency shutdown switch.
- Rest the Control either by pressing the front panel **RESET** switch or providing an external reset signal.
- The Control will re-boot following the **RESET** signal. Set the Control to the desired schedule.

Normal Shutdown

Turn off power from the external, customer-supplied circuit breaker or power contactor.

CHAPTER 5
MAINTENANCE

Section I: Precautions

WARNING

Never attempt to repair the Control with power applied. ***DEATH may result from contact with lethal voltages inside the Control***.

Turn power to the unit OFF ***before*** starting maintenance work. Tag (and preferably lock) the switch so that power is ***not*** accidentally restored.

Precautions

- Read through the entire specific instructions, including all caution and warning messages, ***before*** starting any maintenance procedure.
- Other than as indicated in *Appendix K, Circuit Modification for External Transformer Thermostat,* do ***not*** modify the unit without prior written approval from Unitek Miyachi Corporation.
- Use the appropriate tools for terminating the connecting cables, being careful not to nick the wire conductors.
- ***Never*** use paint thinner, benzene or acetone to clean the exterior of the Control. Use a dry cloth or, if it is heavily soiled, use a cloth moistened with a mild detergent or alcohol.

Section II: General Information

General Maintenance Procedures

1 Open the door by rotating (CCW) the front panel screw securing the door.

2 Rotate or pull the circuit breaker handle and open the door.

3 Repair is by replacement of components. Find the specific item(s) you want to repair or upgrade in *Section III, Standard Components Replacement* or *Section IV, Optional Components Replacement*, then follow the procedures listed.

Cooling Maintenance-Water Draining

CAUTION: To protect the equipment (SCR and hoses) the water should be drained at any time when there is a chance that it might freeze. The water should also be drained and the hoses and SCR cooling chamber flushed any time you believe that there is a build-up of sediment that might decrease the water flow and cause the unit to overheat.

Fuse Replacement

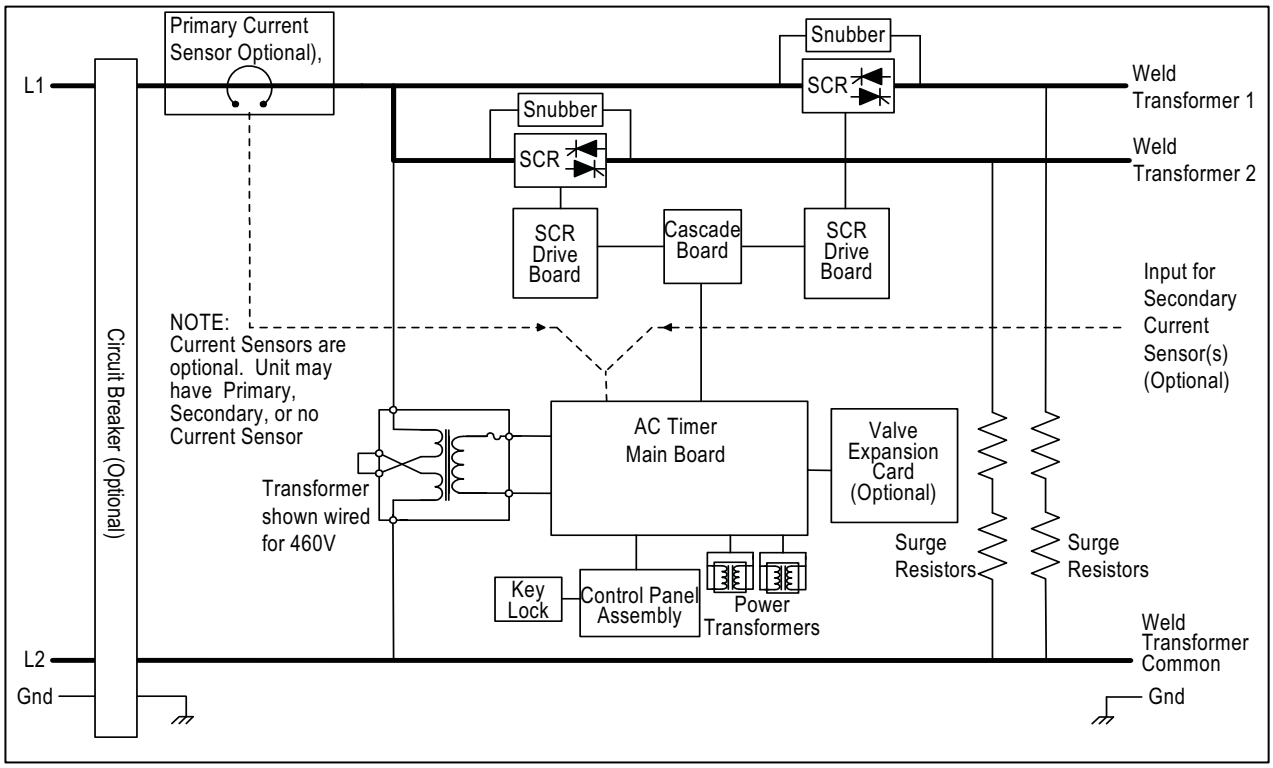
The Control contains a fuse, mounted on the load side of the Valve Transformer. Before replacing the fuse, determine what caused it to fail and make appropriate repairs. The fuse size will depend on which transformer has been ordered. See table 4-1 for appropriate fuse selection.

Valve Transformer Fuse Selection

Transformer Rating	Fuse Size	Part Number
115VAC, 150 VA	2A	FNM-2
115VAC, 250 VA	3A	FNM-3
115VAC, 500 VA	6A	FNM-6
24VAC, 150 VA	10A	FNM-10
24VAC, 250 VA	15A	FNM-150
24VAC, 500 VA	30A	FNM-30

Principles of Operation

Input power (L1 and L2) enters the Control. L1 is applied through the (optional) circuit breaker and (optional) primary current sensor to the SCRs and the valve transformer.



Simplified Block Diagram

Your Control may have Primary Current sensing, Secondary Current sensing, or no current sensing. The valve transformer is wired and jumpered based on the input voltage. The output of the transformer is applied to the AC Timer Main Board for application to the valves.

Two chassis-mounted power transformers break down the input voltage to the various voltages required in the main board and the Control.

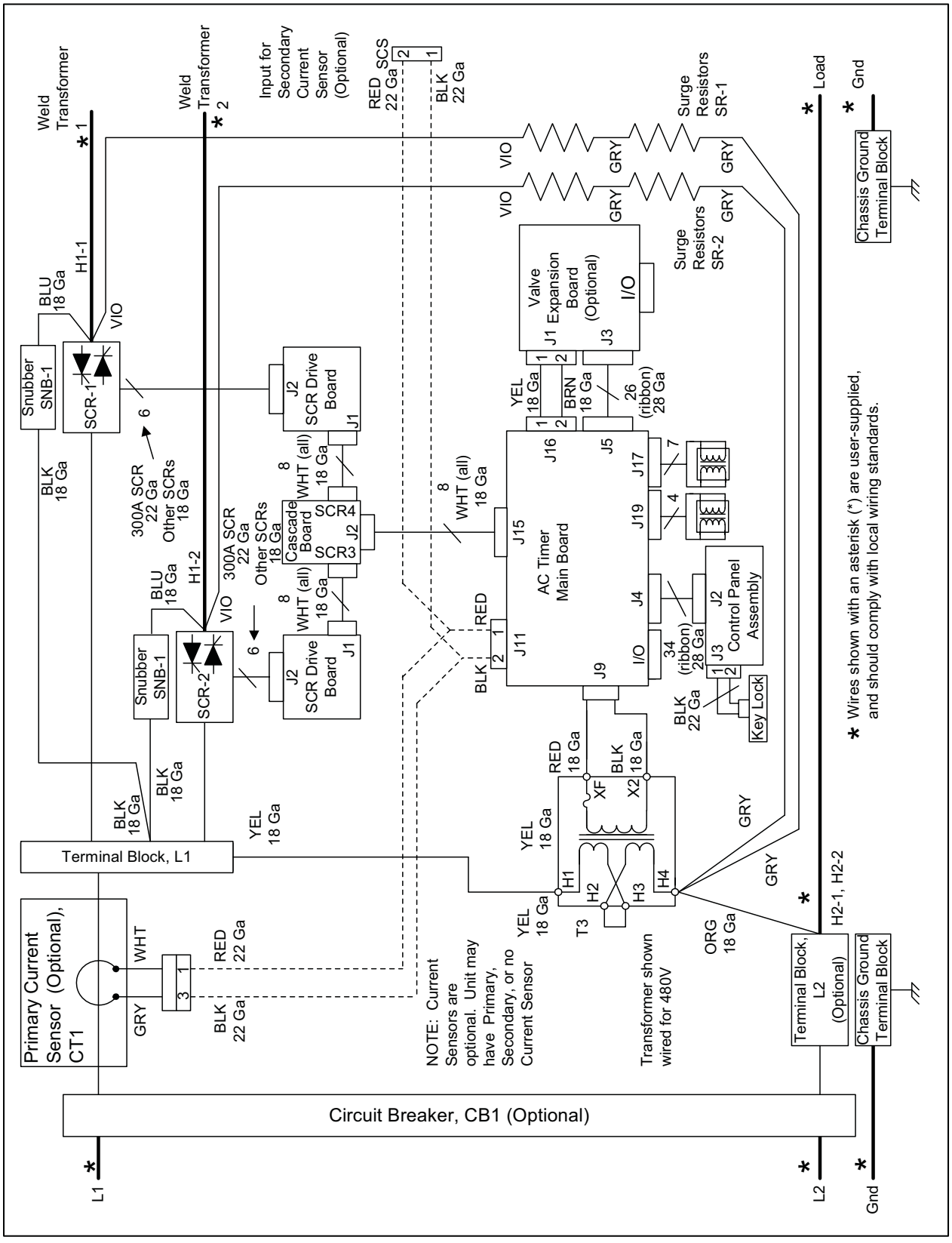
The main board receives signals from the Control Panel Assembly and/or external input signals, applied directly to the main board through the I/O connectors. These signals, along with various feedback signals from the primary or secondary current sensor(s), control the entire operation of the unit. This board has the basic controls for the operation of four user-programmable valves. If more valves are required, an optional Valve Expansion Card can be added to control the additional valves.

An optional key lock, mounted on the front panel, can be used to prevent programming changes.

At the appropriate timing, as determined by the control and feedback signals, the main board provides a control signal to the Cascade Board, which at the appropriate time passes the signal to SCR Drive Boards. If there is only one SCR, the signal goes directly from the Main Board to the SCR Driver. The SCR Driver Board, in turn, causes the SCRs to switch the input voltage (L1) across the two surge resistors to the weld transformers. The snubber across the SCR assembly cancels inductive-kickback from the weld transformers.

Wiring Diagram

The diagram on page 5-4 shows the point-to-point wiring, which will assist you in performing continuity checks on the Control or rewiring it after a repair.



STA Series Control Wiring Diagram

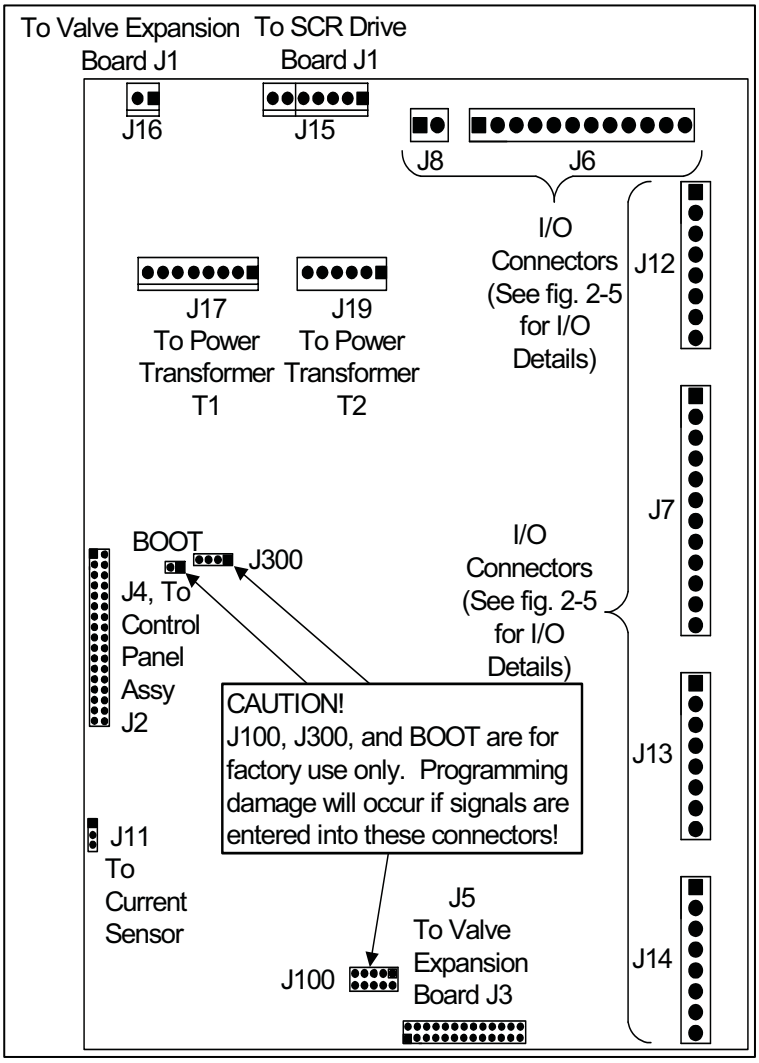
Section III. Standard Components Replacement

AC Timer Main Board

1 Disconnect the following cable connectors from the indicated headers on the circuit board:

- Two wire cable from the valve transformer T3 connected to J9.
- Eight wire connector from SCR Drive Board or Cascade Board connected to J15.
- Thirty-four wire ribbon cable connector from Control Panel Assembly connected to J4.
- Seven-wire cable (eight-pin connector) from power transformer to J17 and four-wire cable (six pin connector) from power transformer to J19.

2 Disconnect the six, I/O plugable terminal strips from the board (J6, J7, J8, J12, J13, and J14). See *Appendix B, Electrical and Data Connections* for a detailed listing of I/O signals.



AC Timer Main Board Connector Locations

3 If present, disconnect the following optional cable connectors from the indicated headers on the circuit board:

- Two-wire cable from the primary current sensor or the secondary current sensor connector connected to J11.
- Two-wire cable from the Valve Expansion Card connected to J16 and the 26-wire ribbon cable from the same circuit board connected to J5.

4 Remove the nine 6-32x3/8 Phillips head screws and nine #6 flat nylon washers that secure the circuit board to the Control and remove the board.

5 Install or re-install the circuit board with nine 6-32x3/8 Phillips head screws and nine #6 flat nylon washers, being careful not to over-tighten the screws and damage the circuit board.

6 If present, reconnect the following optional cable connectors to the indicated headers on the circuit board:

- Two-wire cable from the primary current sensor or secondary current sensor connector connected to J11.
- Two-wire cable from the Valve Expansion Card to J16 and the 26-wire ribbon cable from the same circuit board to J5.

7 Reconnect the six I/O plugable terminal strips to the board (J6, J7, J8, J12, J13, and J14). See *Appendix B, Electrical and Data Connections* for a detailed listing of I/O signals.

NOTE: If you are installing a new circuit board, be sure to connect the pullup connector to the +24V connector or to whatever other power source it had been previously connected.

8 Reconnect the following cable connectors to the indicated headers on the circuit board:

- Two-wire cable from the valve transformer T3, connected to J9.
- Eight-wire connector from SCR Drive Board or Cascade Board to J15.
- Thirty-four-wire ribbon cable from Control Panel Assembly to J4.
- Four-wire cable (six-pin connector) from power transformer to J19 and seven-wire cable (eight pin connector) from power transformer to J17.

Power Transformer T1

1 Disconnect the transformer cable connector from AC Timer Main Board connector J17.

2 While supporting the transformer with one hand, remove the two screws and lock washers.

3 Install re-install the transformer by supporting it with one hand while attaching it to the side of the card cage with two screws and lock washers.

4 Reconnect the transformer cable connector to AC Timer Main Board connector J17.

Power Transformer T2

1 Disconnect the transformer cable connector from AC Timer Main Board connector J19.

2 While supporting the transformer with one hand, remove the two screws and internal tooth lock washers.

3 Install or re-install the transformer by supporting it with one hand while attaching it to the side of the card cage with the two screws and internal tooth lock washers.

4 Reconnect the transformer cable connector to AC Timer Main Board connector J19.

Valve Transformer, T3

1 Remove the following four wires from the transformer terminals: H1 (yellow), H4 (orange and gray), XF (red), and X2 (black).

2 While supporting the transformer, remove the four 10-32 x 3/8 Phillips head screws, #10 split lock washers, and #10 flat washers that secure the transformer to the Control and remove it.

3 Install or re-install the transformer with four 10-32 x 3/8 Phillips head screws, #10 split lock washers, and #10 flat washers.

NOTE: If you are installing a new transformer, be sure to reconnect the jumper(s) in the same configuration as previously connected. See the **Wiring Diagram** on page 5-4 for specific connections for different voltage inputs.

4 Connect the following wires to the indicated terminals and tighten the screws: yellow to H1, orange and gray to H4, red to XF, and black to X2. Be sure to install the proper fuse, as shown in *Section V, Parts List*.

Surge Resistors

1 To replace a surge resistor assembly, disconnect the violet wire from the SCR and the gray wire from Valve Transformer terminal H4.

2 Remove the four screws and lock washers that attach the surge resistor assembly to the Control.

3 Install or re-install the surge resistor assembly by attaching the assembly to the Control with four screws and lock washers.

4 Reconnect the violet wire to the SCR and the gray wire to Valve Transformer terminal H4.

Snubber

1 Disconnect the blue wire from the SCR and the black wire from copper bus bar L1.

2 Loosen the clamp screw that secures the snubber and remove it.

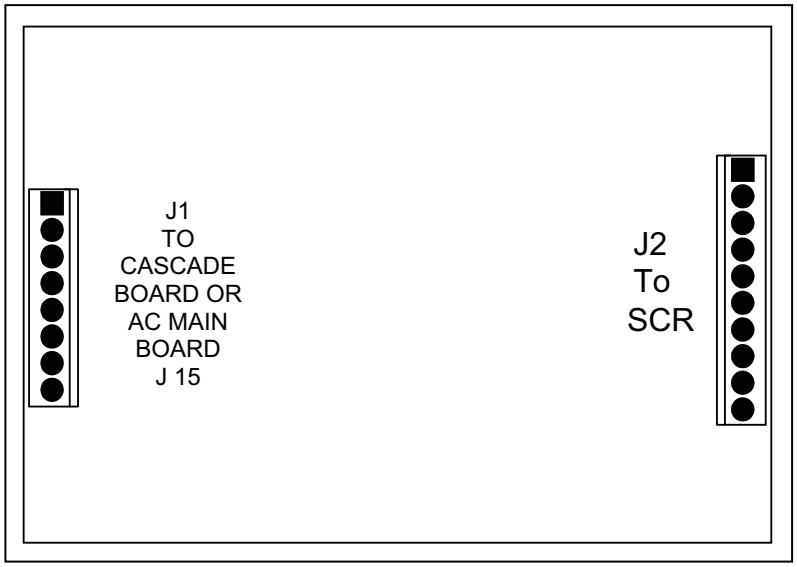
3 Install or re-install the snubber by slipping it into the clamp and tightening the clamp screw.

4 Reconnect the black wire to copper bus bar L1 and the blue wire to the SCR.

SCR Drive Board

1 To replace the SCR Drive Board, disconnect the following cable connectors from the indicated headers on the circuit:

- Six-wire cable (ten-pin connector) from the SCR connected to J2.
- Eight-wire cable connector from AC Timer Main Board or Cascade Board to J1.



SCR Drive Board Connector Locations

4 Remove the four 6-32x3/8 Phillips head screws, spring lock washers, and flat washers that secure the circuit board to the Control and remove the board.

5 Install or re-install the circuit board with the four 6-32x3/8 socket head screws, spring lock washers, and flat washers, being careful not to over-tighten the screws and damage the circuit board.

6 Reconnect the following cable connectors to the indicated headers on the circuit board:

- Six-wire cable (ten pin connector) from the SCR to J2.
- Eight-wire cable from AC Timer Main Board to J1 or Cascade Board.

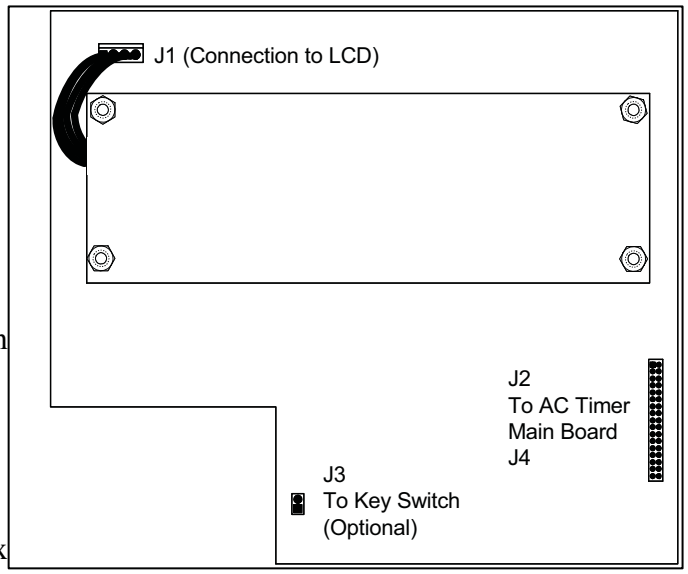
Control Panel Assembly

1 To replace the Control Panel Assembly Remove the four screws securing the protective cover plate over the Control Panel Assembly and remove the plate.

2 Disconnect the following cable connectors from the indicated headers on the circuit board:

- Thirty-four-wire ribbon cable connector from the AC Timer Main Board, connected to J2.
- (Optional) 2 wire cable connector from control panel key switch to J3.

3 Remove the four standoffs and 4-40 hex nuts that secure the assembly to the Control and remove the assembly.



Control Panel Assembly Connector Locations

3 Install or re-install the circuit board with four 4-40 hex nuts and standoffs.

4 Reconnect the following cable connectors to the indicated headers on the assembly:

a Thirty-four-wire ribbon cable connector from the AC Timer Main Board to J2.

b (Optional) two-wire cable connector from control panel key switch to J3.

5 Install the protective cover plate over the Control Panel Assembly with four screws.

Section IV. Optional Components Replacement

NOTE: Each of the following options is described in a separate *Appendix*. Each *Appendix* contains descriptions, maintenance procedures, and other information. (See *Table of Contents*.)

Optional Primary Current Sensor

1 To replace the primary current sensor, disconnect the two-wire (white and gray) connector from the mating connector of the two-wire (black and red) jumper cable (which is connected to the AC Timer Main Board connector J1).

2 Disconnect the orange cable from the circuit breaker by loosening the Allen head screw in the circuit breaker.

3 While holding the current sensor, remove the 10-32 screws and size 10 lock washers that secure it to the back plate.

4 Slide the current sensor from the orange cable.

5 Install or re-install the primary current sensor by sliding the sensor onto the orange cable from L1 bus bar.

6 Connect the orange cable to the circuit breaker (if equipped).

7 Attach the current sensor to the Control with 10-32 screws and number 10 washers.

8 Reconnect the two-wire (white and gray) connector from the mating connector of the two-wire (black and red) cable.

Optional Secondary Current Sensor Connector

1 To replace the secondary current sensor connector, disconnect the two-wire (black and red) cable connector from the AC Timer Main Board connector J11.

2 Remove the attaching hardware (nut and washer) from the inside bottom of the Control.

3 Install or re-install the connector assembly by attaching it to the bottom of the Control with the attaching hardware (nut and washer) supplied with the assembly.

4 Reconnect the two-wire (black and red) cable connector to the AC Timer Main Board connector J11.

Optional Key Lock

1 To replace the key lock, disconnect the two-wire cable from connector J3 of the Control Panel Assembly.

2 Unscrew the nut on the rear of the switch.

3 Install a new key lock (or re-install the old one if it is being used) by sliding it into the double "D" hole in the Control and securing from inside with the nut that comes with the switch.

4 Reconnect the two-wire cable to connector J3 of the Control Panel Assembly.

Optional SCR Assembly, 600,1200, 1800, and 2200 Amp

NOTE: The only difference in the removal/replacement instructions for the 600A and 1200A SCR assemblies is the attaching hardware. The 600A requires two 10-32 x 1.5 Phillips pan head mounting screws and #10 internal tooth washers; the 1200A and 1800A SCRs each require four 10-32 x 1.0 Phillips pan head mounting screws and #10 internal tooth washers.

1 Turn the water supply to the cooling water hoses going to the SCR assembly OFF.

NOTE: Place a container beneath the Control to catch water draining from the SCR assembly and the cooling water hoses.

2 Disconnect the cooling water hoses from the SCR assembly on the bottom of the Control. Allow all of the water to drain from the SCR assembly.

CAUTION: In the following steps, be careful not to damage the wires attached to the L1 terminal.

3 Remove the bolts, lock washers and flat washers securing L1 bus bar to the SCRs (or SCR and insulator), and remove L1.

4 Disconnect the cable connector from the SCR Drive Board connector J2.

5 Remove the screws and lock washers attaching the assembly to the Control.

6 Install or re-install the SCR by attaching it to the Control with the screws and lock washers.

7 Reconnect the cable connector to the SCR Drive Board connector J2.

8 Reinstall L1 to the SCRs (or SCR and insulator) with the bolts lock washers and flat washers removed in step 3.

9 Reconnect the cooling water hoses to the SCR assembly on the bottom of the Control.

10 Turn on the water supply to the cooling hoses going to the SCR assembly. Check for leaks.

Section V. Spare Parts

Below is a list of frequently required spare parts, which can be obtained by contacting your Miyachi representative. Additional parts are available by contacting Unitek Miyachi using the phone, e-mail, or mailing information in the front of this manual.

Spare Parts Kit # 4-35732-01

Item	Part Number
AC Timer Main Board A1	4-35255-01
Control Panel Assembly, A3	4-35259-01
Fuse, 2A, SB (FNM-2)	330-130
Fuse, 3A, SB (FNM-3)	330-141
Fuse, 10A, SB (FNM-10)	330-142
Fuse, 15A, SB (FNM-15)	330-117
Cascade Board	4-35858-01
Valve Expansion Board	4-35268-01
Snubber	These part numbers will vary, depending on your Model and Serial Number. Please be sure to have those numbers handy when you call us.
SCR Drive Board	
SCR	
Primary Coil	
Secondary Coil	
Circuit Breaker	
Transformers T1, T2, T3	
Water Hose	

NOTE: Contact Unitek Miyachi for replacement cooling hose. Use of other hoses may result in damage to the Control.

Section VI. Repair

If you have problems with your unit that you cannot resolve, please contact our service department at the address, phone number, or e-mail address indicated in the Foreword of this manual.

Section VII. Storage and Shipment

Preparation for Storage or Shipment

WARNING: Be sure ***all*** power is removed from the Control before disconnecting input (LINE) cables.

1 Open the Control door and disconnect all line and load wires.

2 Disconnect all signal wires

3 If a secondary current sensor is used, disconnect the signal cable from the connector(s) on the bottom of the Control.

4 If SCR is water-cooled, turn off water source and disconnect the water hoses to the Control. Using shop air, dry out the water-cooling chamber of the SCR

5 Remove the Control from its mounting location.

Packing for Storage or Shipment

Repack the Control into the original packing materials and packing box in which you originally received the unit.

APPENDIX A
TECHNICAL SPECIFICATIONS

Specifications

Model	Size	Weight	Maximum Number of SCRs
STA-100	18" H x 10" W x 10" D (457mm x 254mm x 25.4mm)	35-50 lbs (depends on options)	1
STA-200	30" H x 25.4" W x 12" D (762mm x 645mm x 305mm)	110-140 lbs (depends on options)	2
STA-400	36" H x 31.4" W x 12 " D (914mm x 797mm x 305mm)	130-160 lbs (depends on options)	4
STA-600	42" H x 31.4" W x 12" D (1067mm x 797 mm x 335mm)	140-170 lbs (depends on options)	6
STA-800	60" H x 37.4" W x 12" D (1524mm x 950mm x 305mm)	160-220 lbs (depends on options)	8

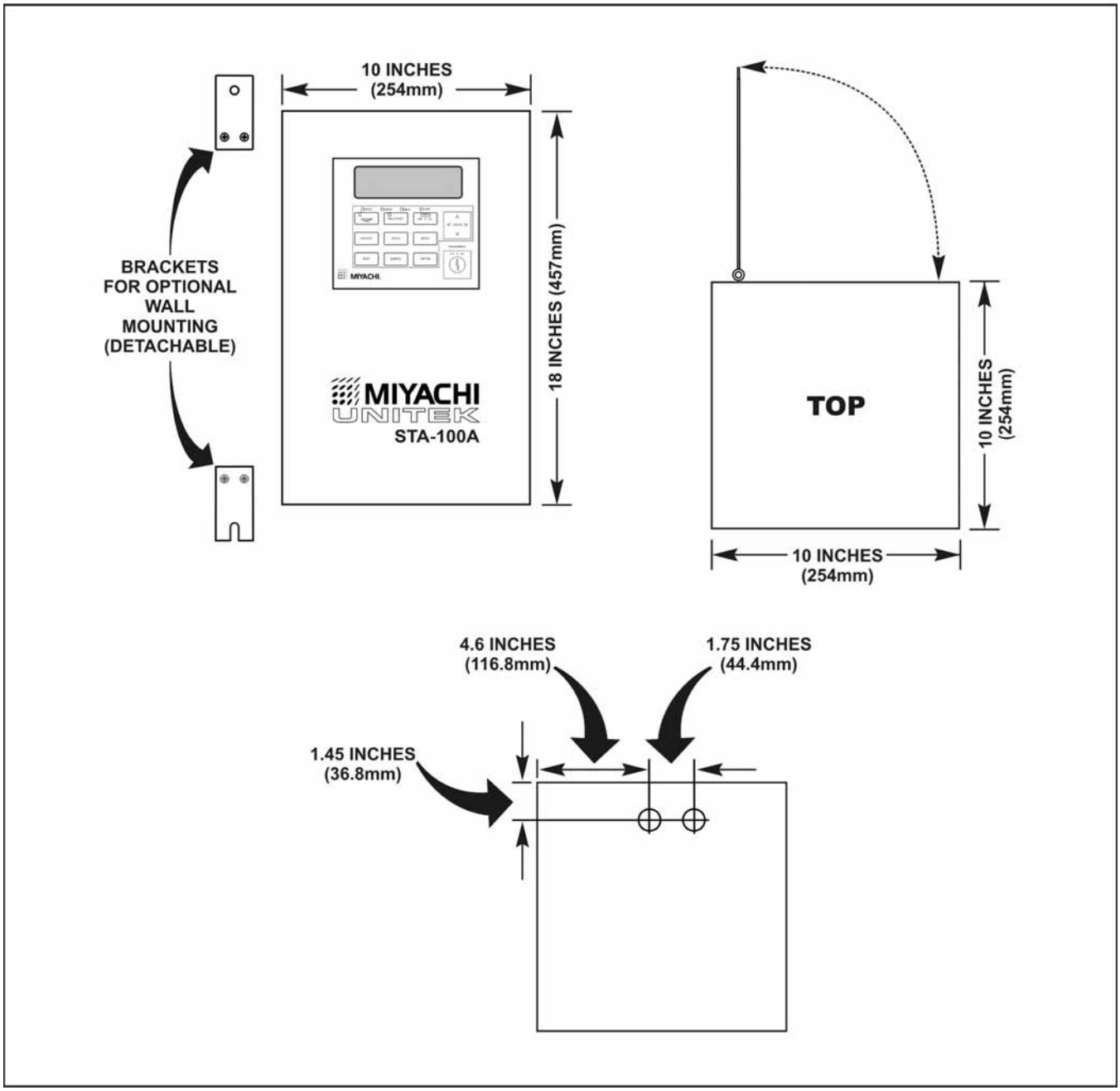
ITEMS	SPECIFICATIONS
Environmental Ambient Temperature Relative Humidity Maximum altitude	 32 – 104ºF (0 – 40ºC) 0% to 95% non condensing 9800 ft. (3000 m)
Electrical Requirements	201 to 270 VAC or 402 to 540 VAC, 60 Hz, single-phase External disconnected device shall be rated no less than 115% of full-current load.
Cooling Water Requirements	In accordance with RWMA Bulletin 5-005.04: 1.2 gallons/minute (4.5 liter/minute), minimum; 90 psi (621 kPa) maximum; 104°F (40°C) maximum. In addition: ▪ Water temperature should be no less than existing dew point for ambient air (approximately 70°F (21°C)); ▪ Water shall have a pH of 7.0 – 8.0; ▪ Maximum impurity contents shall be: ▪ Chloride 20 ppm; ▪ Nitrate 10 ppm; ▪ Sulfate 100 ppm; ▪ Solids 250 ppm; ▪ Calcium carbonate ppm. In addition, for the 2200A SCR, the cooling water must always be flowing when voltage is supplied to the SCR.

APPENDIX A: TECHNICAL SPECIFICATIONS

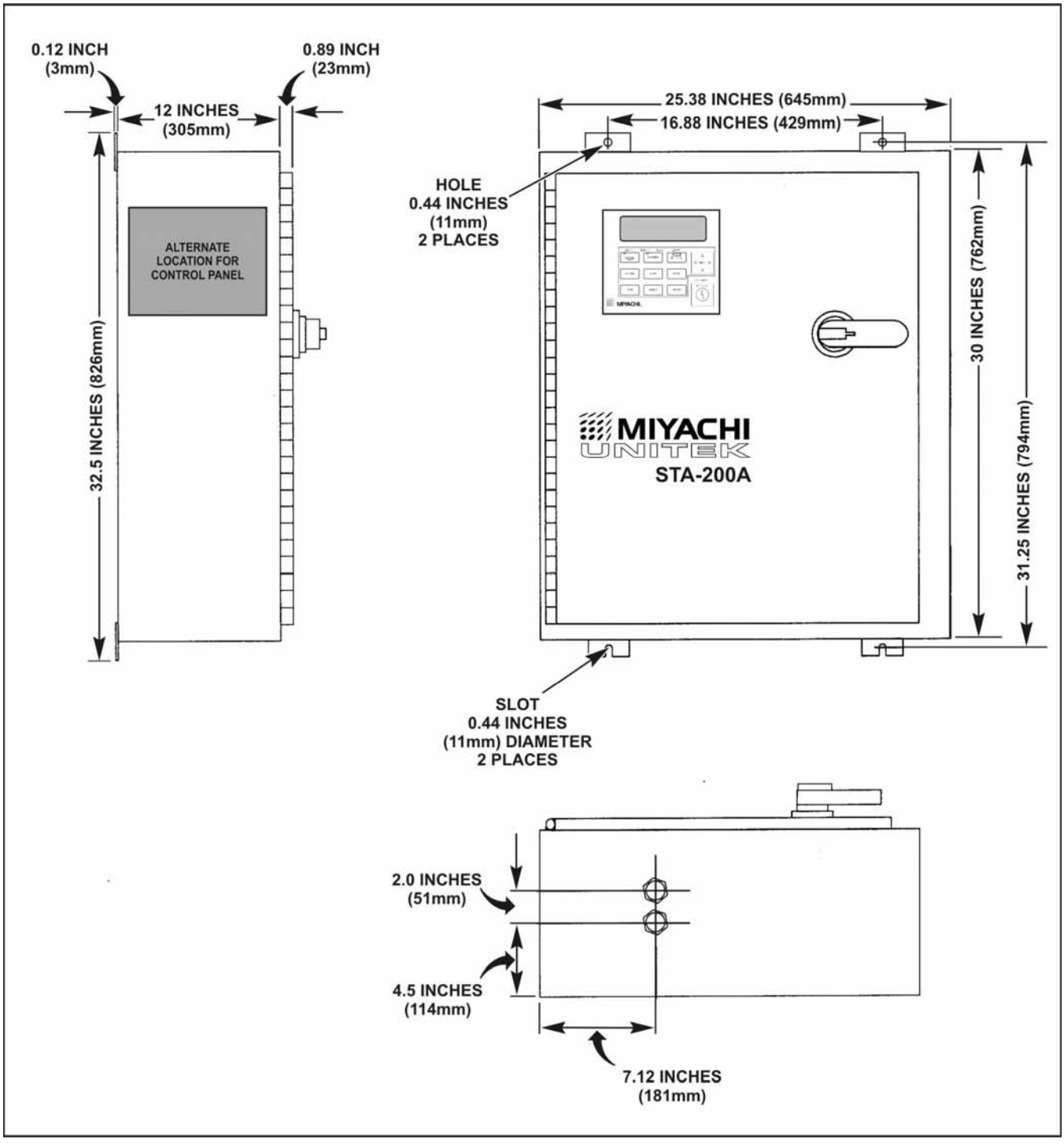
ITEMS	SPECIFICATIONS
Output Power	
Valve power	Four user-programmable valve outputs (standard); Eight additional user-programmable valve outputs (optional). 115 VAC (24 VAC optional) at 150 VA (standard) or 250 VA or 500 VA (optional)
Output Signals	Five outputs, triac, 1 A, 125 VAC max. Functions are under program control.
Conditions for all Modes	
Load Power Factor Applicable Set Point Ranges	30-70%, fixed impedance 20-95% of current at 180° conduction angle. (Unit will operate outside these ranges, but accuracy and regulation specifications will not apply.)
Regulation	
Percent Heat Mode Control Speed Accuracy	Responds by end of second cycle to input voltage fluctuations. ±3% of set point for fluctuation of ±10% of power source voltage
Constant Current – Primary Monitor Control Algorithm *Initial Responding Speed *Voltage regulation *Resistive load regulation *Inductive load regulation	Internal current transformer Whole cycle (symmetrical) by cycle Set point current ±10% after 4 cycles ±2% of set point for +10, –15% AC voltage fluctuation ±2% of set point for ±15% load resistance fluctuation ±2% of set point for ±15% load induction fluctuation
Constant Current – Secondary Monitor Control Algorithm *Initial Responding Speed *Voltage regulation *Resistive load regulation *Inductive load regulation *Average Current Accuracy	External Rowgowski Coil (Torroidal Coil) Half cycle by half cycle Set point current ±10% after 2 cycles ±2% of set point for +10, –15% AC voltage fluctuation ±2% of set point for ±15% load resistance fluctuation ±2% of set point for ±15% load induction fluctuation ±1% of set point of full scale after initial response
*For welds between 20% and 95% of full current	

Outline Drawings

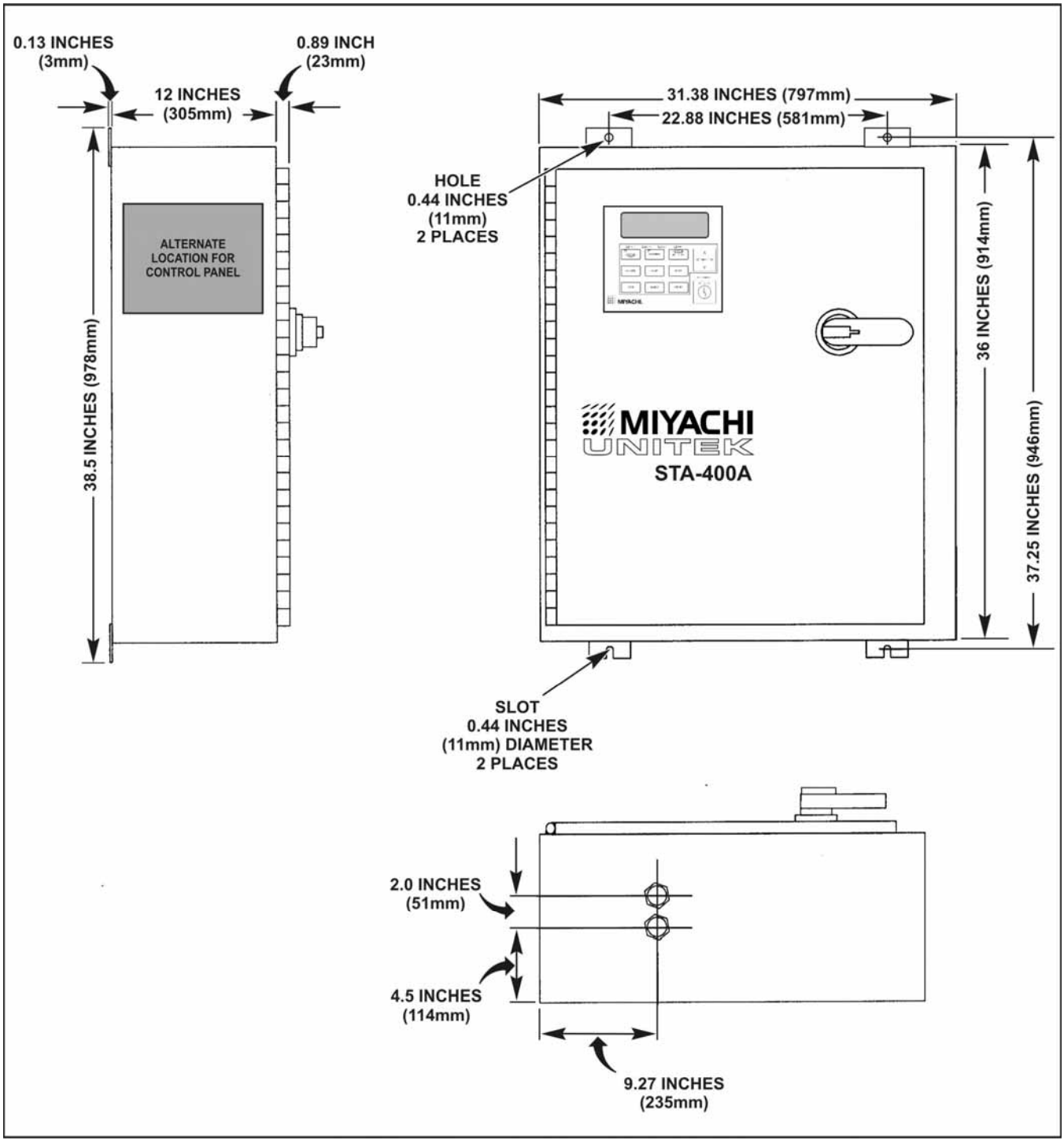
NOTE: Measurements are in inches (mm).



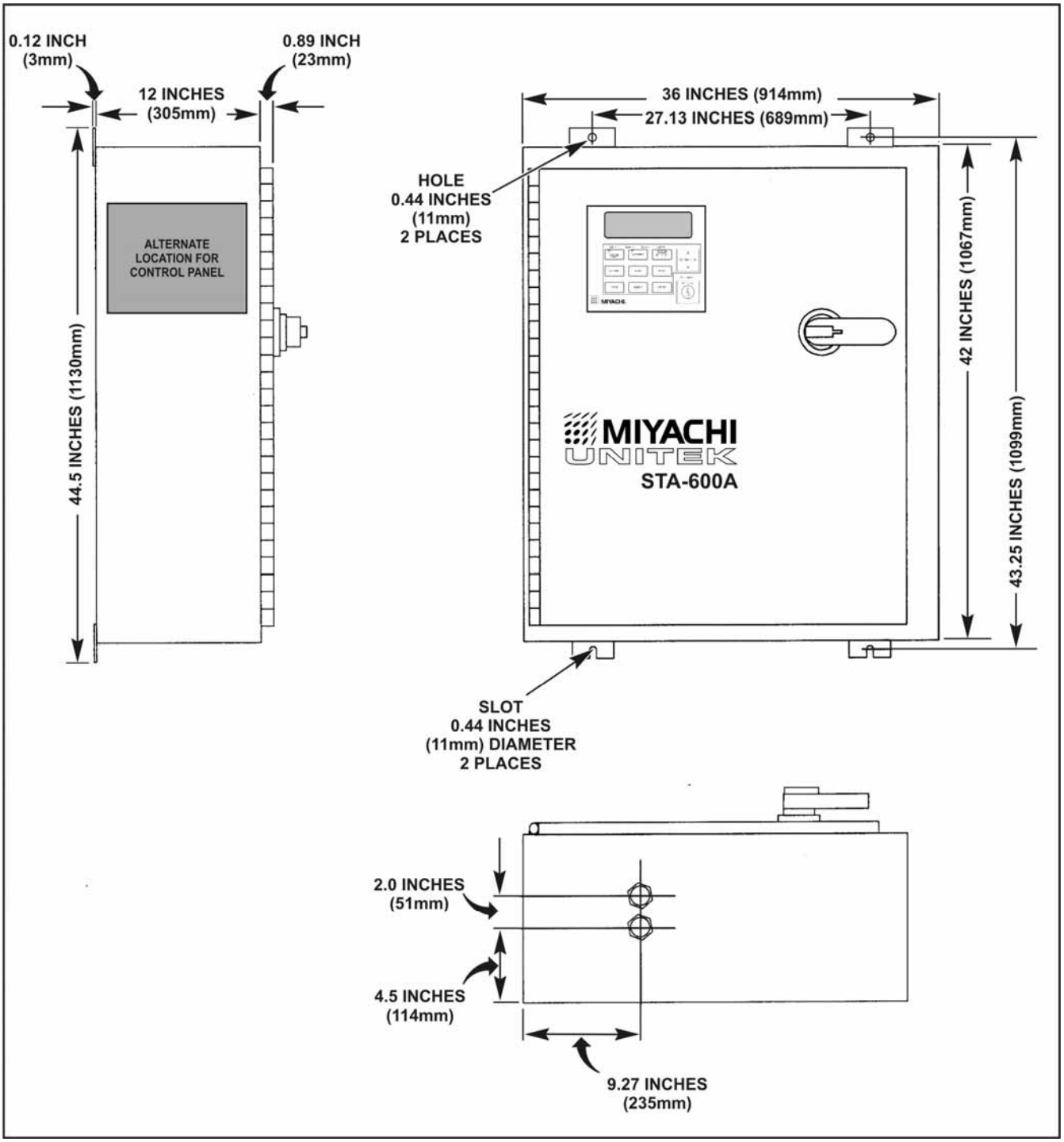
STA-100A AC Control



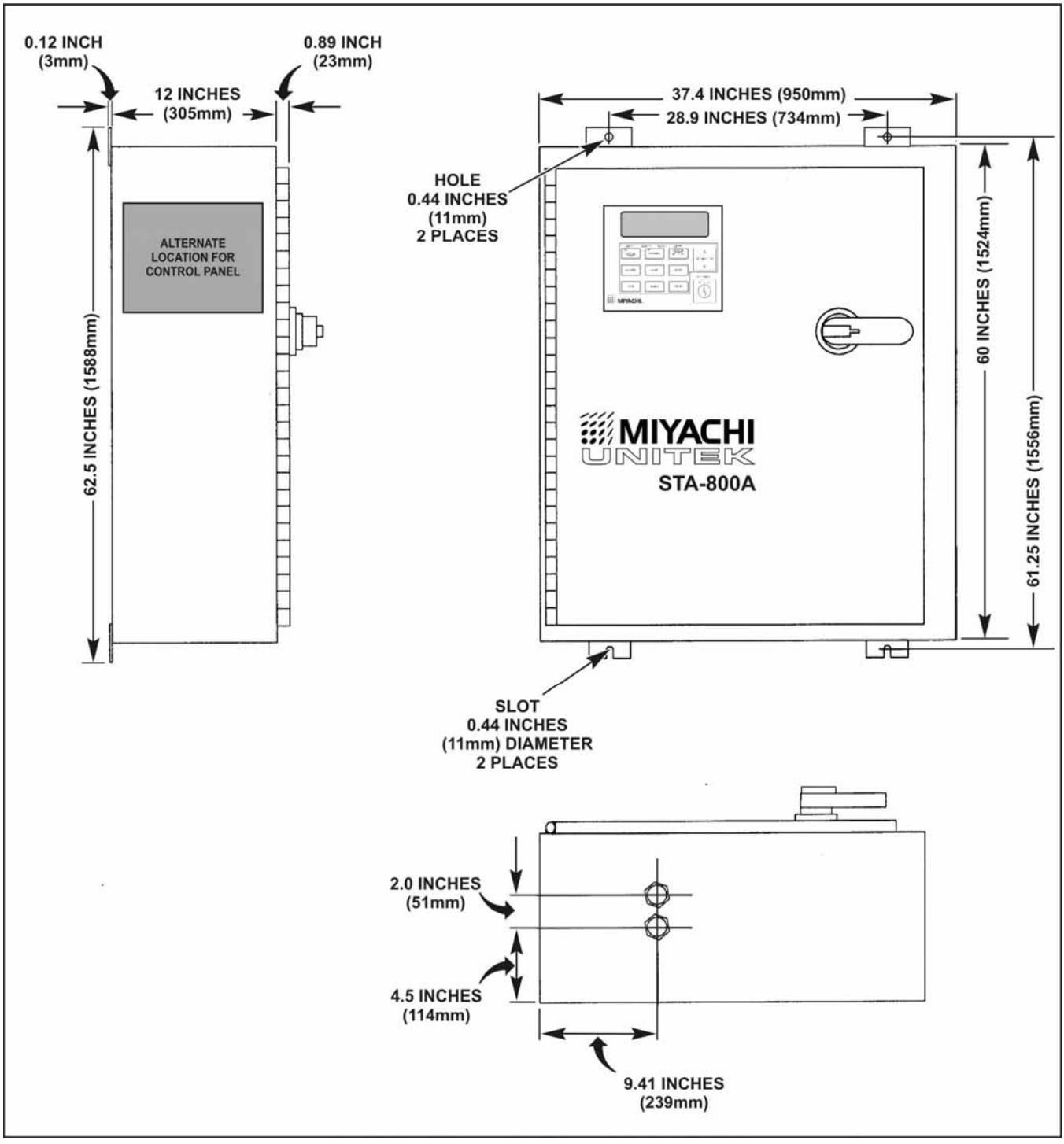
STA-200A AC Control Outline Drawing



STA-400A AC Control



STA-600A AC Control



STA-800A AC Control

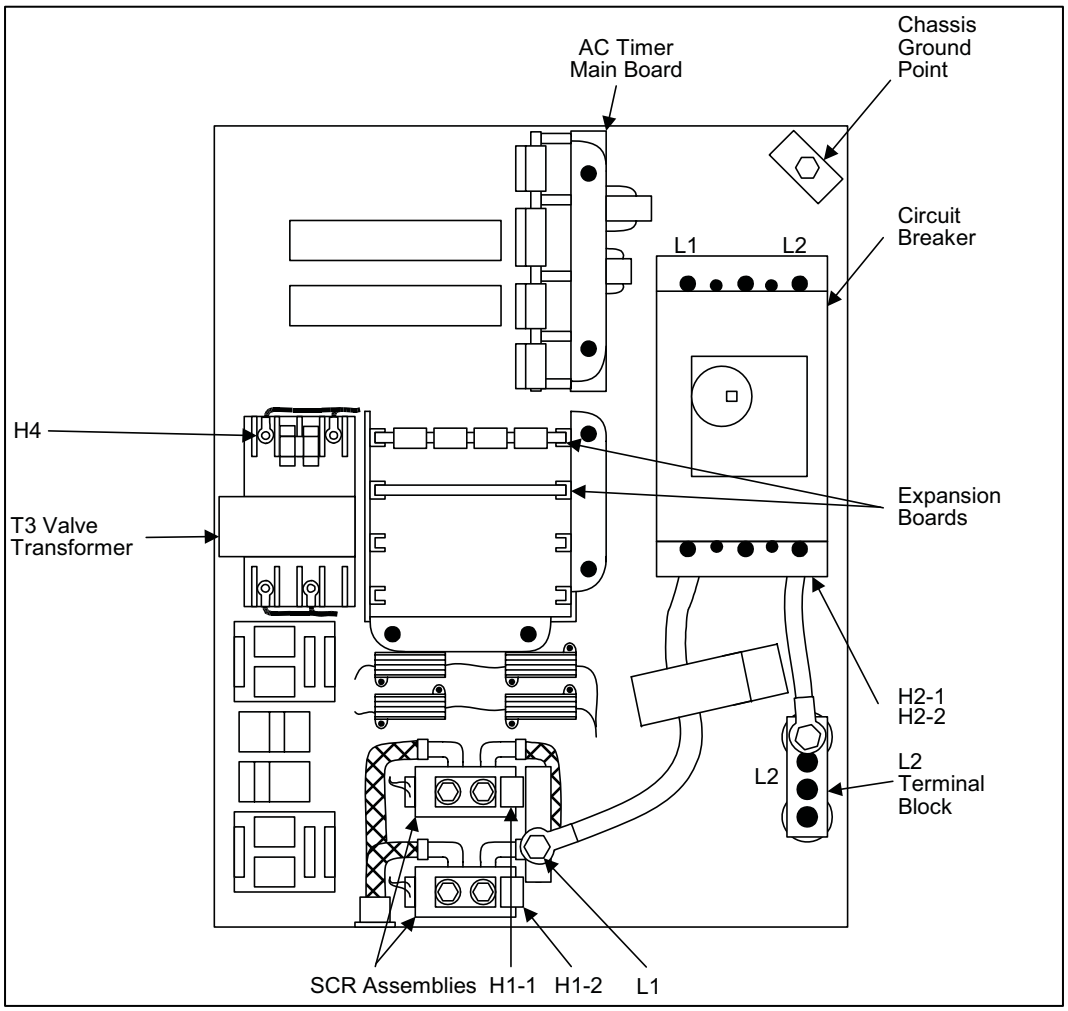
APPENDIX B
ELECTRICAL AND DATA CONNECTIONS

Section I. Electrical Connections

WARNING: The installer must make electrical connections in accordance to all applicable codes.

NOTES:

- Make sure you are familiar with the Control's internal components and where they are located (see *Chapter 1, Description*).
- Make sure you know where the power connection points are. (See Page B-2*, Electrical Power Connections*.)
- Make sure you know the appropriate circuit breaker rating for your control. (See *Appendix C, SCR, Wire Gauge, and Circuit Breaker Selection*.)
- Make sure you know how to make the **Emergency Stop** connections.
- Power and signal connections are made through the customer-provided punch-out holes in the Control.



Typical Electrical Power Connections

1 Connect the control to the weld transformer using the appropriate wire gauge for your requirements.

2 Connect one side of each weld transformer primary to H1-1 and H1-2, respectively.

3 Connect the other side of each weld transformer primary together and to H2-1 and H2-2 or the optional Terminal Block L2.

NOTE: If the Control is not equipped with an L2 terminal block, connect H2-1 and H2-2 to the incoming L2 line and connect an 18 gauge wire from there to H4 of the valve transformer.

4 Connect the Control to the appropriate power source (230 V or 460 V) using the appropriate wire gauge for your power requirements. (See Appendix C.)

5 Connect the power source wires to L1 and L2 of the circuit breaker and to chassis ground.

NOTE: If your unit was ordered without a circuit breaker, connect the wires to L1 of the SCR assemblies, optional terminal block L2, and ground. If you do *not* have terminal block L2, connect the incoming L2 wire to H2-1 and H2-2, and connect an 18-gauge wire from there to H4 of the valve transformer.

Section II. Input/Output Signal Connections

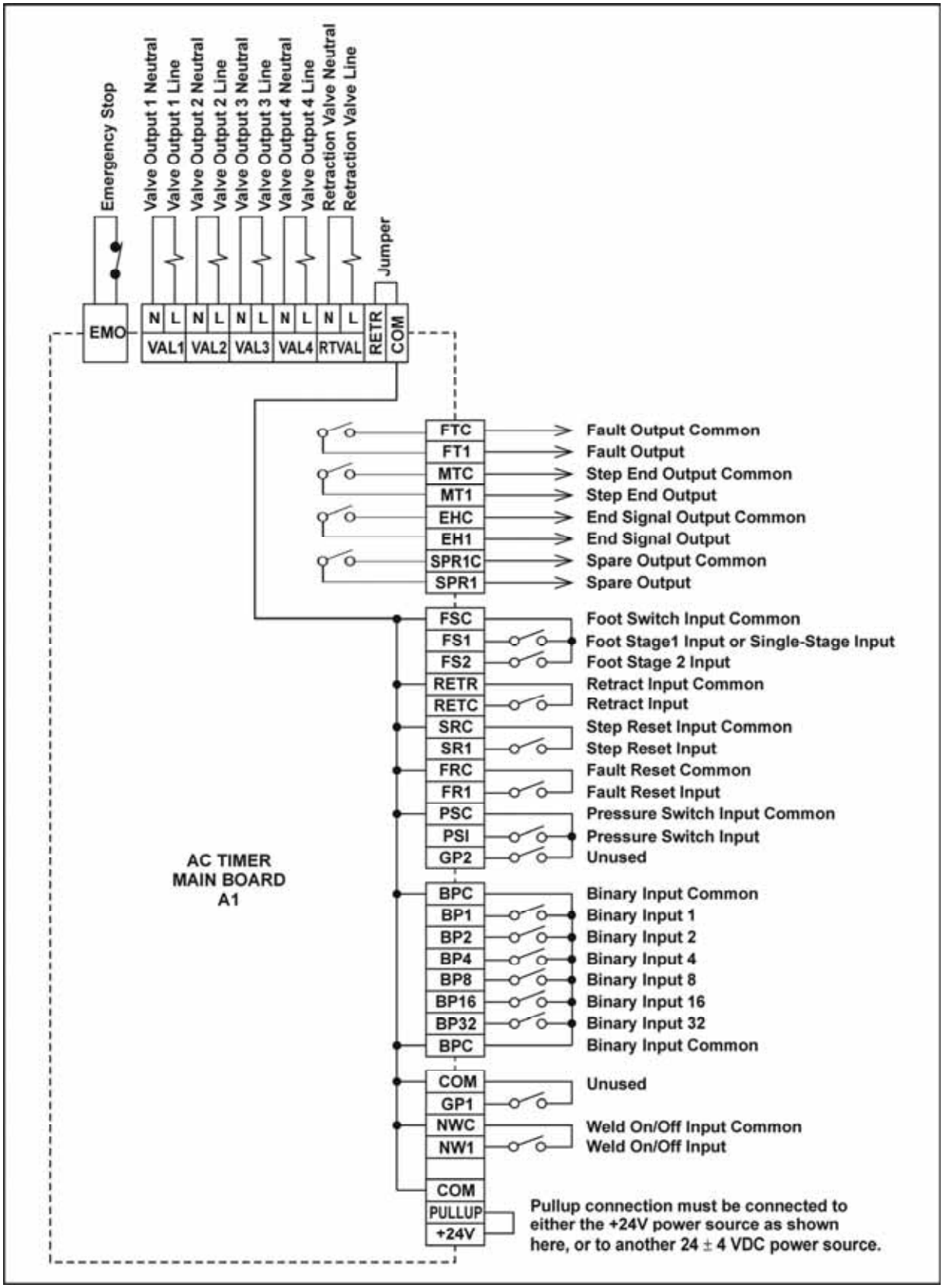
Connect the input/output (I/O) signals as shown in the connection diagram on the following page (B-4), *Input/Output Control Signals*.

With the exception of the valve outputs, all output signals are isolated contact relays. Valve outputs may be either 115 VAC (standard) or 24 VAC.

Input signals are referenced to either an internal or external 24 VDC power supply.

NOTES:

- If you have an optional Valve Expansion Board, also make the output connections to that board, as shown on page B-7.
- Descriptions of these signals follow each diagram.



Input/Output Control Signals

Input/Output Signal Descriptions

EMO – Emergency Stop

A disconnect signal from an external Emergency Stop switch, across these two pins will cause an immediate termination of the welding operation. Control power remains on. When the emergency stop switch is released and the reset button is pressed, the Control will automatically re-boot and then be ready for operation.

VAL1, N & L through VAL4, N & L – Valve Output 1 Neutral and Line through Valve Output 4 Neutral and Line

Output signals to drive up to four valves. (If more valves are needed, a Valve Expander Board is required.) Each set of connections provides 115 VAC (standard) or 24 VAC (optional) power to the valve solenoid connected across those connections.

RTVAL, N & L – Retraction Valve Output Neutral and Line

Output signals to drive the retraction valve. Provides 115 VAC (standard) or 24 VAC (optional) power to the valve solenoid connected across those connections.

RETR – Retraction Input

The input to control the status of the retraction valve output. This may be either a fixed or pulsed input. See Chapter 3 for the software selection of how this input operates. If a retraction input is not supplied, a jumper should be installed between **RETR** and **RETC**.

FT1/FTC – Fault Output

An output signal indicating an error has occurred. The **ERROR OUTPUT** setting, set on the **Weld Mode** screen, determines whether this signal will be sent.

MT1/MTC – Step End Output

Output signal indication stepper is completed. Once this output is on, the unit can no longer be fired and the error must be cleared. If the front panel **RESET** button or external **Fault Reset** is initiated at the end of the stepper, the fault will clear and the unit may be fired one more time. After firing one more time, the fault will re-appear. To clear the step counters, use the **Step Reset** input. After clearing with **Step Reset**, the unit will once again start counting at the first programmed step count.

EH1/EHC – End Signal Output

Output signal indicating completion of the weld schedule sequence. In **Chain Sequence**, **EH1** occurs after all schedules have fired. **EH1** is 40-70 ms in duration. If the Start signal is held beyond the end of the schedule, **EH1** will stay on until either **Start** switch (**FS1** or **FS2**) is turned off.

SPR1/SPR1C – Weld On/Off Status

This output indicates the NW1 status. (See **NW1**) When the output is closed, the unit is ready to weld.

NOTE: These outputs are isolated contact relays that are closed when active.

FS1 – Foot Switch Stage 1 Input

The first level of a two-level foot switch or a single level foot switch is connected to this connector. (A single level foot switch MUST also be connected to FS2) This signal will switch the valve driver on, causing the electrode(s) of the weld head to apply force to the work pieces and start the squeeze delay period. In the case of a single level footswitch, the weld schedule will continue to its completion; no

further input is required. In the case of a two-level footswitch, the valves will be activated on the first level, and the schedule will commence from the beginning on the second level.

FS2 – Foot Switch Stage 2 Input

This signal starts the weld schedule. **FS1** turns on selected valves only.

SR1 – Step Reset Input

Input signal that, with the presence of a step end signal, will set the stepper back to **0000** and the step number back to **01**. This input will also clear the fault output when step end occurs.

FR1 – Fault Reset Input

Input signal that resets a fault condition and clears the fault output. After an **EMO** (**Emergency Stop**), a fault reset input will re-boot the system.

IN1 – General Purpose Input 1

Unused

PS1 – Pressure switch input

When the pressure switch input is enabled in software (see Chapter 3) this input must close for the schedule to progress from squeeze delay to squeeze. If this input does not close within approximately 5 seconds, the error message **PRESSURE SWITCH ALARM** appears on the display and a fault output occurs.

IN2 – General Purpose Input 2

Unused

BP1, BP2, BP4, BP8, BP16, BP32 – Binary Input 1, 2, 4, 8, 16, 32

These are the binary inputs for weld schedule selection. See *Appendix D* for the I/O Binary Input schedule. There are two **Binary Input Common** (**BPC**) connections associated with these signals.

TT1 – Unused

Unused

NW1 – Weld On/Off Input

When the **WELD ON/OFF** control (in the **Extended System Values** screen) is set to **LOCAL**, this signal locks out the **WELD ON/OFF** input and enables the pushbutton switch on the Control Panel.

When the **WELD ON/OFF** control is set to **REMOTE**, the following occurs: If the input is closed, the Control will function normally. If the input is open, the Control will operate through the programmed sequence, but will not activate the SCR; no weld will occur.

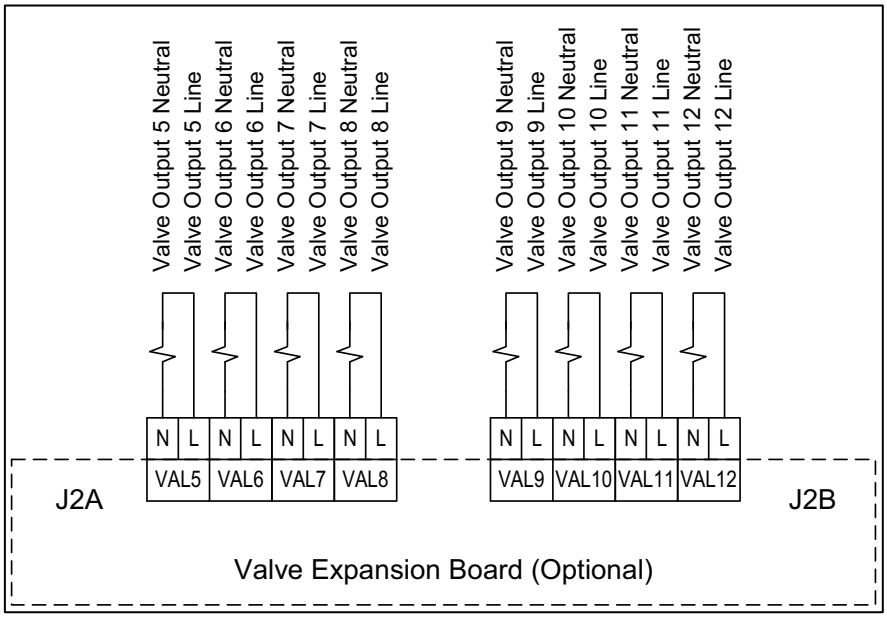
When set to **REMOTE**, saving any changes to the schedule or settings on the front panel will set the Control to the **Weld Off** state. This input must then be opened and re-closed to set the **Weld On** state.

PULLUP – Pullup Voltage

This input provides the pull-up voltage for the I/O bus. It is normally connected to the adjacent +24V source (see **+24V**, below), but can be connected to any power source between +20V and +28V.

+24V – Provides output source of **+24V** power that may be used for the pull-up voltage. Do ***not*** use this voltage to power external devices or the control may be damaged.

Optional Valve Expansion Board



Valve Expansion Board Output Signals

VAL5, N & L through VAL12, N & L – Valve Output 5 Neutral and Line through Valve Output 12 Neutral and Line

Output signals to drive up to eight additional valves. Each set of connections provides 115 VAC (standard) or 24 VAC (optional) power to the valve solenoid connected across those connections. Output is limited to 1 amp per channel.

APPENDIX C
SCR, WIRE GAUGE, AND CIRCUIT BREAKER SELECTION

Basis for SCR, Wire Gauge, and Circuit Breaker Selection

- SCR size is determined as the larger size needed to support
  a) machine rated kVA
  b) machine demand kVA
- The maximum demand current an SCR can handle is conservatively assumed equal to 2.5 X rated current (at the 50% duty cycle).
- Maximum machine kVA ratings (50% duty cycle) for a given SCR allows for a 300% safety factor.
- Input wire gauge must meet two criteria:
  a) Less than or equal to 5% of the voltage drop with 100 feet of mains wiring at maximum demand current, and
  b) Ampacity must be larger than effective 100% RMS current based on NEC table.
- Circuit breaker is determined by
  a) Trip current being the lowest specified unit at least 1.25 times the maximum RMS current, normalized to 100% of the duty cycle.
  b) Trip characteristics are determined by maximum demand current and weld duration.
- Wire gauge determination assumes 90°C, 600V insulation.

SCR Selection

SCR Current Rating		240V				480V			
SCR 100% DC Current Rating	SCR 50% DC 30-Cycle Weld Current Rating (A)	Max kVA 50%	Equivalent Continuous Current (A)	Max kVA Demand	Max Current Demand (A)	Max kVA 50%	Equivalent Continuous Current (A)	Max kVA Demand	Max Current Demand (A)
300	470	35	103	85	354	70	103	170	354
600	1100	85	250	220	916	170	250	440	916
1200	1800	130	383	300	1250	250	383	600	1250
1800	2500	200	590	500	2083	400	590	1000	2083
2200	3200	250	736	583	2430	500	736	1166	2430

Wire Gauge

For specific wire gauge needed to support ampacity, use the Equivalent Continuous Current and refer to NFPA 70 National Electric Code table 310-16. The table for 90°C insulated copper wire at 30°C ambient temperature is reproduced here for reference only.

Wire Gauge Requirements

Ampacity	AWG Wire Gauge
55	8
75	6
95	4
110	3
130	2
150	1
170	0

Ampacity	AWG Wire Gauge
195	2/0
225	3/0
260	4/0
290	250
320	300
350	350
380	400

Ampacity	AWG Wire Gauge
430	500
475	600
520	700
535	750
555	800
585	900
615	1000

Table C-3. Wire Gauge Based on Ampacity.

240V AC Mains

Rated kVA	240	AWG
10	29	8
15	44	8
20	59	6
30	88	6
50	147	1
75	221	3/0
100	295	250
150	442	2x4/0
175	516	2x250
200	589	2x300
250	737	2x500
300	884	*
350	1031	*
400	1179	*
500	1473	*

480V AC Mains

Rated kVA	480	AWG
10	15	8
15	22	8
20	29	8
30	44	8
50	74	6
75	110	2
100	147	1
125	184	2/0
150	221	3/0
160	236	4/0
175	258	250
200	295	300
250	368	400
300	442	2x4/0
350	516	2x250
400	589	2x300
500	737	2x400
600	884	2x500
700	1031	*
800	1179	*
900	1326	*
1000	1473	*
1200	1768	*

Wire Gauges Based on Demand (kVA)

For wire gauge needed to support a maximum of 5% voltage drop, consult table C-4. The information herein is based on NFPA70 National Electric Code table 9 in Chapter 9. The calculations are based on a 30% power factor and 100 foot power cable run.

Wire Gauge Based on Demand 240V AC Mains

Demand kVA	240	Max Zw	Max Rw	Max XLw	AWG (Cu)
10	42	2.880E-01	8.640E-01	2.758E+00	8
15	63	1.920E-01	5.760E-01	1.839E+00	6
20	83	1.440E-01	4.320E-01	1.379E+00	4
30	125	9.600E-02	2.880E-01	9.195E-01	3
50	208	5.760E-02	1.728E-01	5.517E-01	1
75	313	3.840E-02	1.152E-01	3.678E-01	2/0
100	417	2.880E-02	8.640E-02	2.758E-01	3/0
150	625	1.920E-02	5.760E-02	1.839E-01	250
175	729	1.646E-02	4.937E-02	1.576E-01	300
200	833	1.440E-02	4.320E-02	1.379E-01	350
250	1042	1.152E-02	3.456E-02	1.103E-01	400
300	1250	9.600E-03	2.880E-02	9.195E-02	2x250
350	1458	8.229E-03	2.469E-02	7.881E-02	2x300
400	1667	7.200E-03	2.160E-02	6.896E-02	2x350
500	2083	5.760E-03	1.728E-02	5.517E-02	2x500

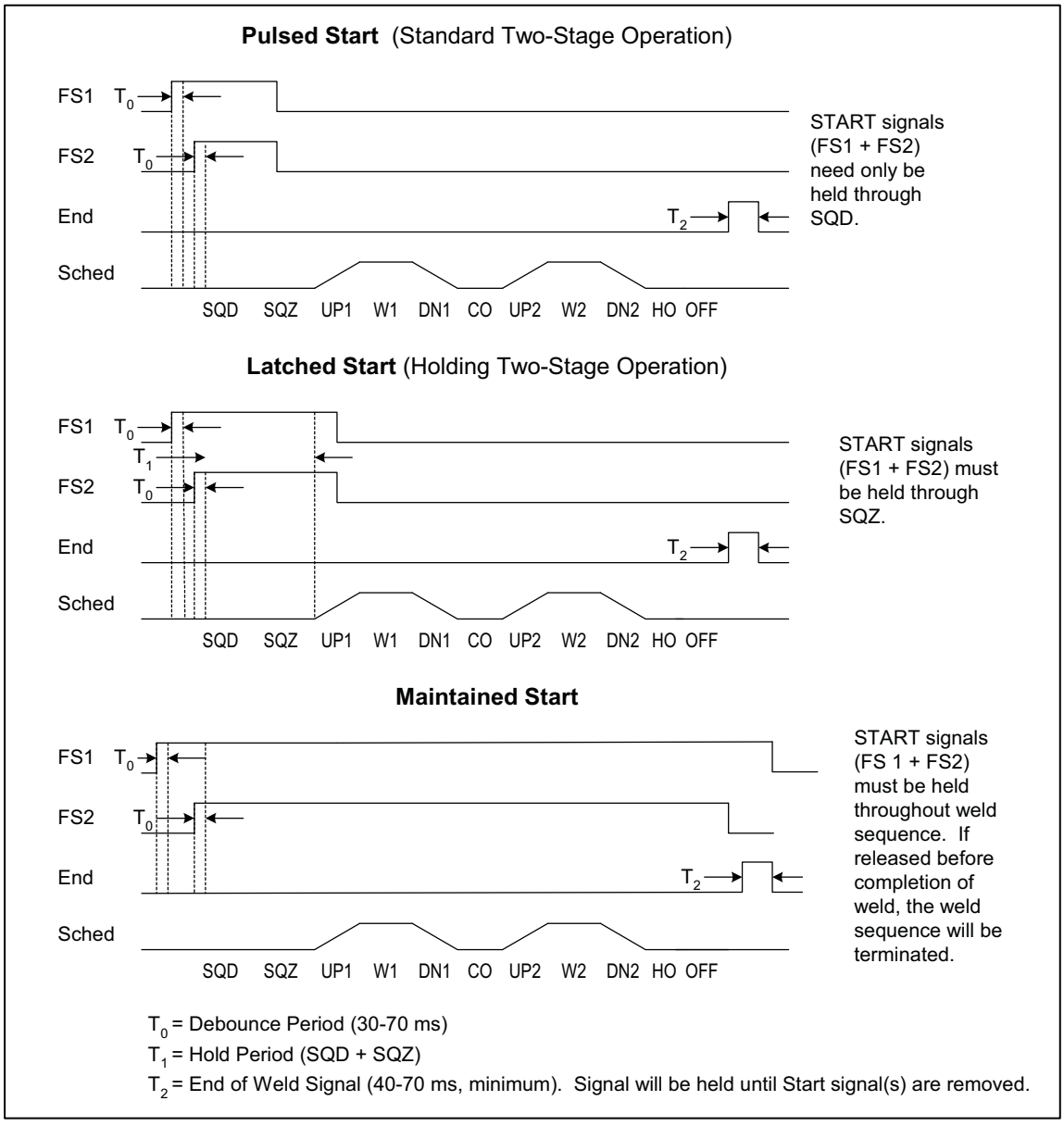
Wire Gauge Based on Demand 480V AC Mains

Demand kVA	480	Max Z	R	XL	AWG (Cu)
10	21	1.152E+00	3.456E+00	1.103E+01	14
15	31	7.680E-01	2.304E+00	7.356E+00	12
20	42	5.760E-01	1.728E+00	5.517E+00	10
30	63	3.840E-01	1.152E+00	3.678E+00	8
50	104	2.304E-01	6.912E-01	2.207E+00	6
75	156	1.536E-01	4.608E-01	1.471E+00	4
100	208	1.152E-01	3.456E-01	1.103E+00	4
150	313	7.680E-02	2.304E-01	7.356E-01	2
160	333	7.200E-02	2.160E-01	6.896E-01	2
175	365	6.583E-02	1.975E-01	6.305E-01	1
200	417	5.760E-02	1.728E-01	5.517E-01	1
250	521	4.608E-02	1.382E-01	4.414E-01	1/0
300	625	3.840E-02	1.152E-01	3.678E-01	2/0
350	729	3.291E-02	9.874E-02	3.153E-01	3/0
400	833	2.880E-02	8.640E-02	2.758E-01	3/0
500	1042	2.304E-02	6.912E-02	2.207E-01	4/0
600	1250	1.920E-02	5.760E-02	1.839E-01	250
700	1458	1.646E-02	4.937E-02	1.576E-01	350
800	1667	1.440E-02	4.320E-02	1.379E-01	400
900	1875	1.280E-02	3.840E-02	1.226E-01	500
1000	2083	1.152E-02	3.456E-02	1.103E-01	2x250
1200	2500	9.600E-03	2.880E-02	9.195E-02	2x300

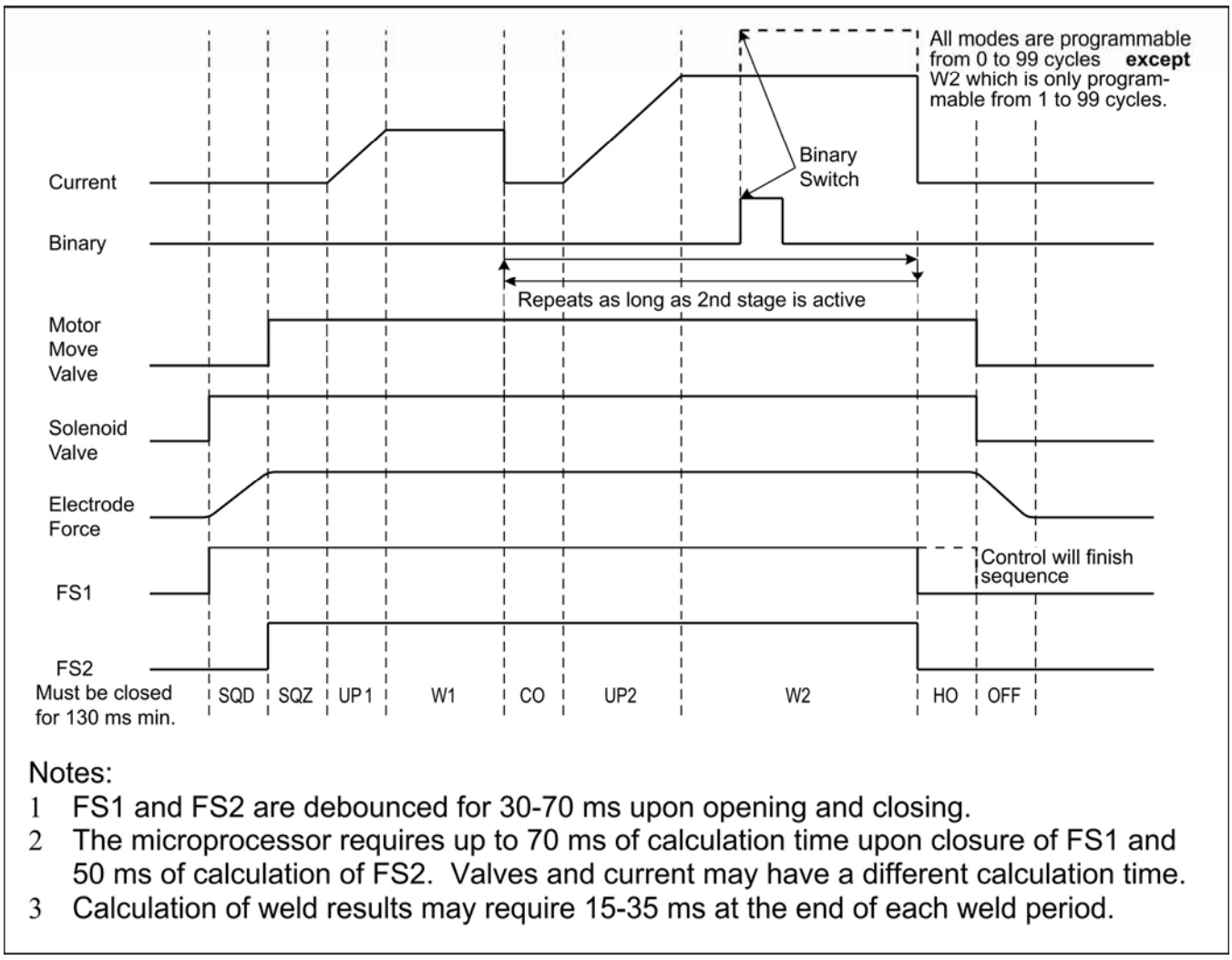
APPENDIX D
SYSTEM TIMING

Input and Output Timing Signals

Figure B-1 shows the timing signals for the pulsed, latched, and maintained start signals. Table B-1 is the binary input for the schedules.



Pulsed, Latched, and Maintained Start Signals



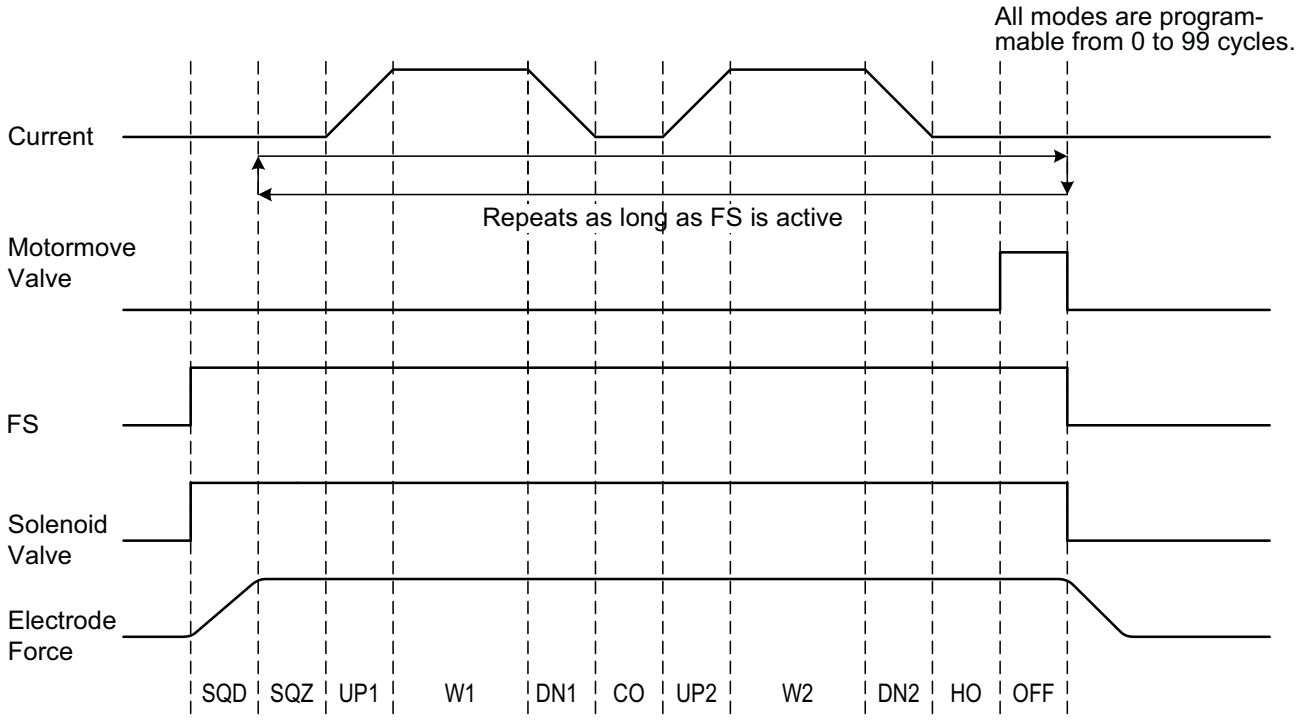
Notes:

1 FS1 and FS2 are debounced for 30-70 ms upon opening and closing.

2 The microprocessor requires up to 70 ms of calculation time upon closure of FS1 and 50 ms of calculation of FS2. Valves and current may have a different calculation time.

3 Calculation of weld results may require 15-35 ms at the end of each weld period.

Continuous Seam Weld

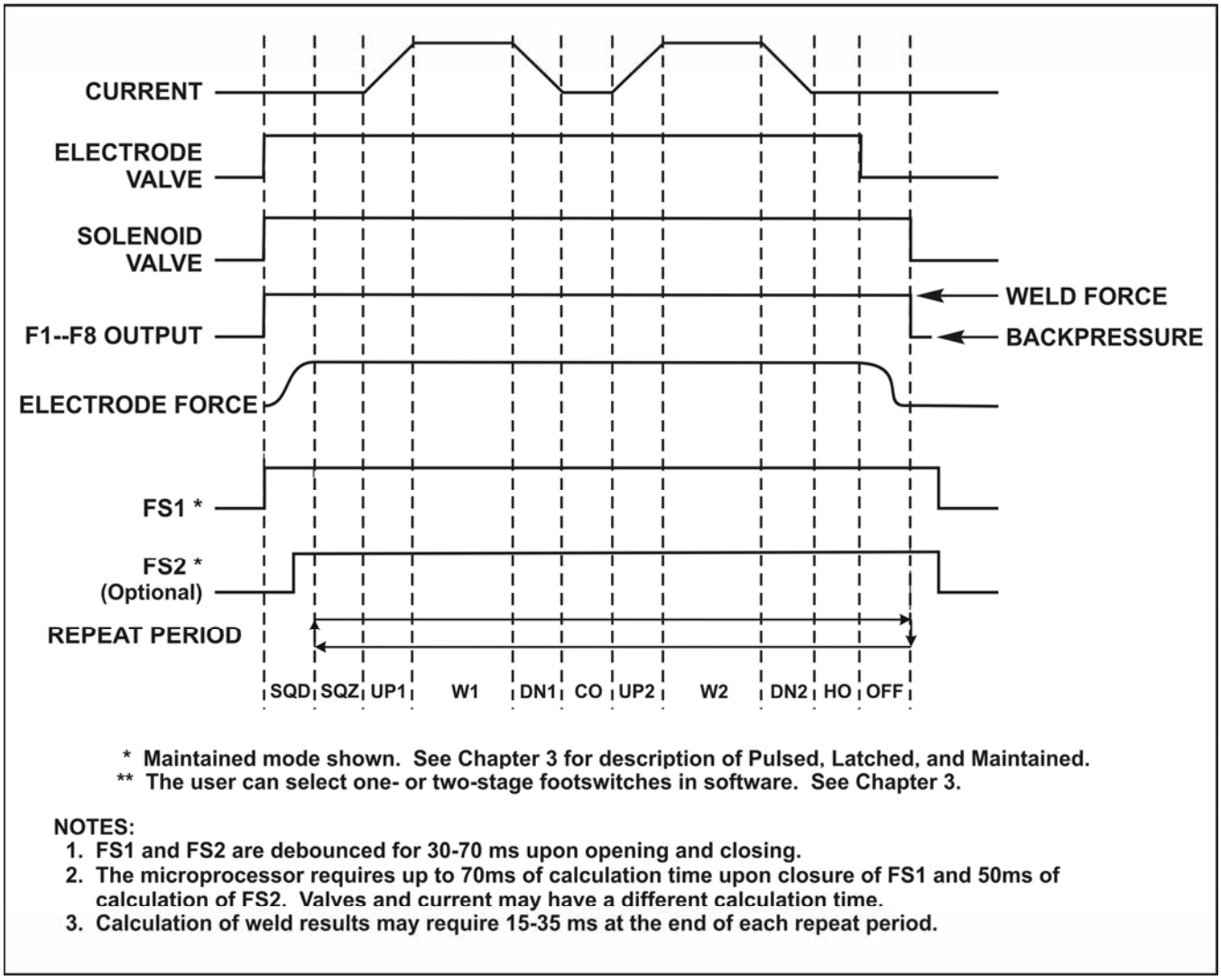


Notes:

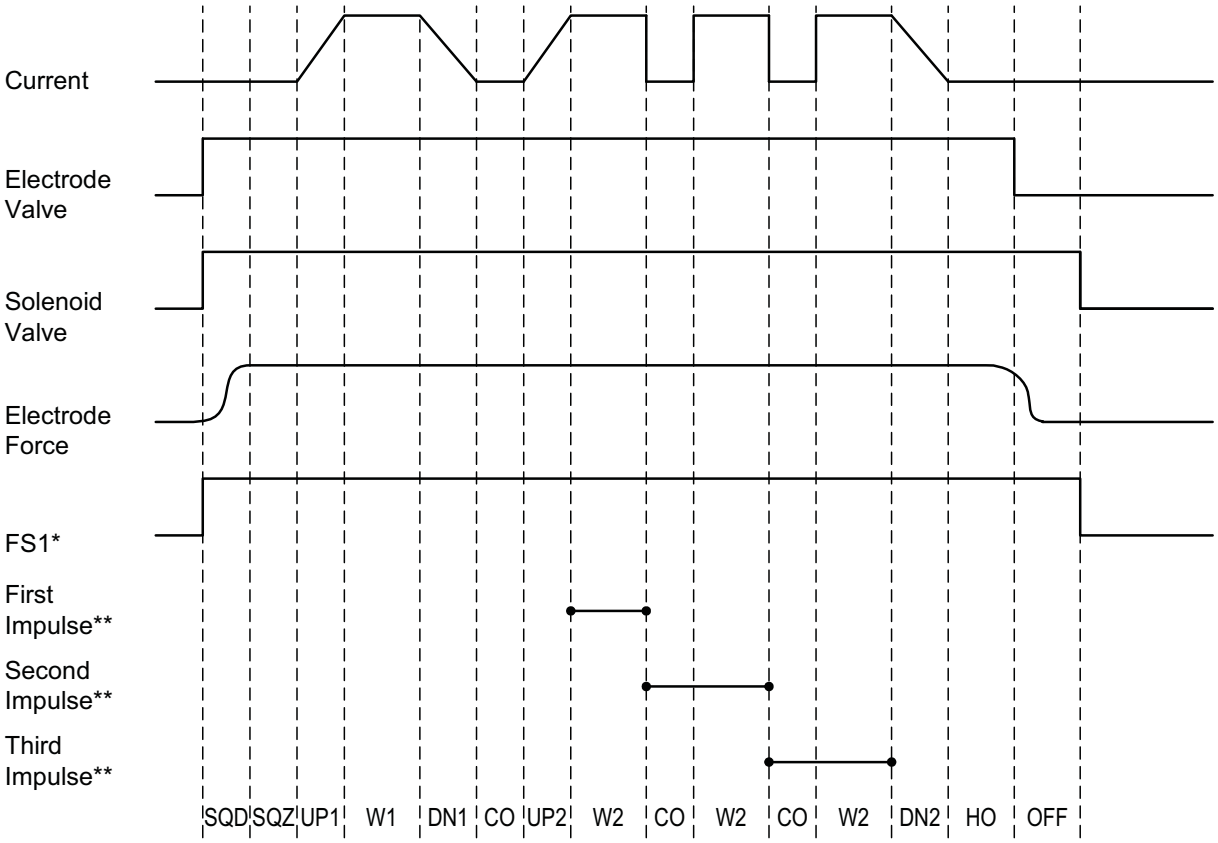
1 FS1 and FS2 are debounced for 30-70 ms upon opening and closing.

2 The microprocessor requires up to 70 ms of calculation time upon closure of FS1 and 50 ms of calculation of FS2. Valves and current may have a different calculation time.

Roll Spot Seam Weld



Spot Welding



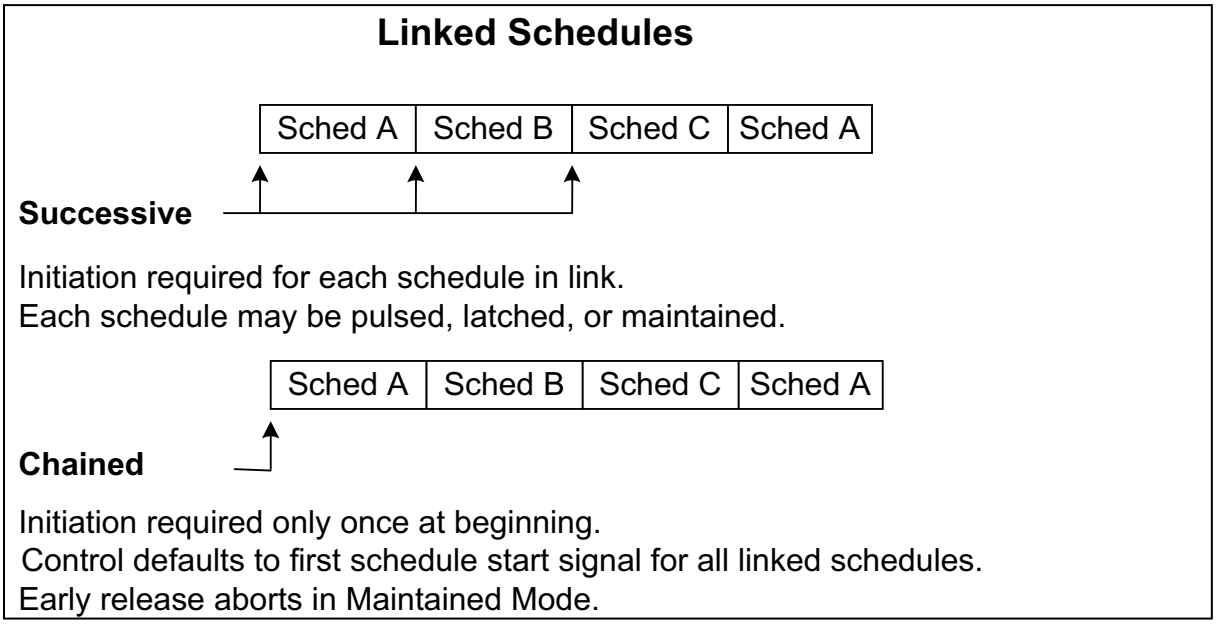
*See Chapter 3 for description of Maintained, Pulsed, and Latched modes. One-stage footswitch shown.
**The first impulse is a W2 period only. The second and following impulses are a CO period followed by a W2 period.

Notes:

1 FS1 and FS2 are debounced for 30-70 ms upon opening and closing.

2 The microprocessor requires up to 70 ms of calculation time upon closure of FS1 and 50 ms of calculation of FS2. Valves and current may have a different calculation time.

Spot Welding with 3 Impulses



Linked Schedules

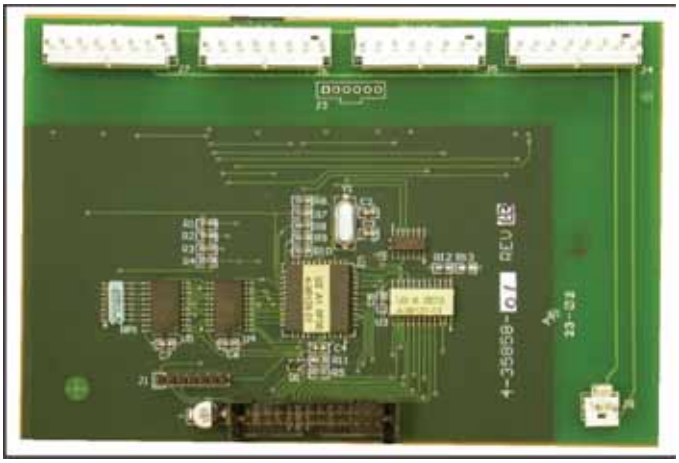
Table B-1. I/O Binary Input

Weld Schedule	I/O Binary Input					
	Schedule 1	Schedule 2	Schedule 4	Schedule 8	Schedule 16	Schedule 32
Schedule 00						
Schedule 01	•					
Schedule 02		•				
Schedule 03	•	•				
Schedule 04			•			
Schedule 05	•		•			
Schedule 06		•	•			
Schedule 07	•	•	•			
Schedule 08				•		
Schedule 09	•			•		
Schedule 10		•		•		
Schedule 11	•	•		•		
Schedule 12			•	•		
Schedule 13	•		•	•		
Schedule 14		•	•	•		
Schedule 15	•	•	•	•		
Schedule 16					•	
Schedule 17	•				•	
Schedule 18		•			•	
Schedule 19	•	•			•	
Schedule 20			•		•	
Schedule 21	•		•		•	
Schedule 22		•	•		•	
Schedule 23	•	•	•		•	
Schedule 24				•	•	
Schedule 25	•			•	•	
Schedule 26		•		•	•	
Schedule 27	•	•		•	•	
Schedule 28			•	•	•	
Schedule 29	•		•	•	•	
Schedule 30		•	•	•	•	
Schedule 31	•	•	•	•	•	
Schedule 32						•
Schedule 33	•					•
Schedule 34		•				•
Schedule 35	•	•				•
Schedule 36			•			•
Schedule 37	•		•			•
Schedule 38		•	•			•
Schedule 39	•	•	•			•
Schedule 40				•		•
Schedule 41	•			•		•
Schedule 42		•		•		•
Schedule 43	•	•		•		•
Schedule 44			•	•		•
Schedule 45	•		•	•		•
Schedule 46		•	•	•		•
Schedule 47	•	•	•	•		•
Schedule 48					•	•
Schedule 49	•				•	•
Schedule 50		•			•	•
Schedule 51	•	•			•	•
Schedule 52			•		•	•
Schedule 53	•		•		•	•
Schedule 54		•	•		•	•
Schedule 55	•	•	•		•	•
Schedule 56				•	•	•
Schedule 57	•			•	•	•
Schedule 58		•		•	•	•
Schedule 59	•	•		•	•	•
Schedule 60			•	•	•	•
Schedule 61	•		•	•	•	•
Schedule 62		•	•	•	•	•
Schedule 63	•	•	•	•	•	•

APPENDIX E
CASCADE BOARD OPTION

Description

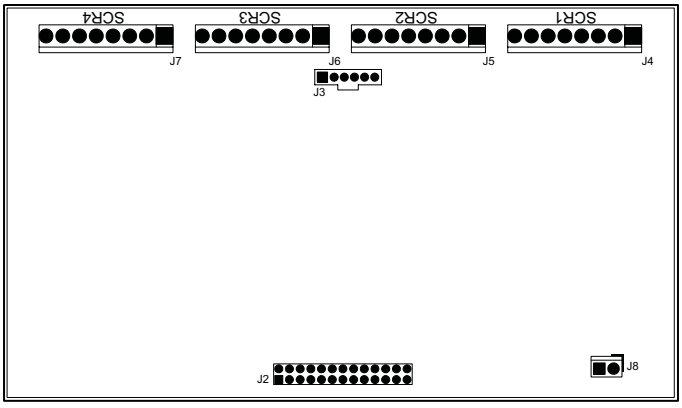
The Cascade Board gives the Control the ability to operate up to four SCRs instead of just one. The STA-600 and STA-800 use two Cascade Boards in order to operate up to six and eight SCRs respectively.



Cascade Board

Maintenance/Replacement

1. Disconnect the 26-pin ribbon cable connector from the AC Timer Main Board connected to J2.
2. Disconnect the 8-wire cable connector from each of the SCR Driver Boards connected to J4 (SCR1) through J7 (SCR4) as required.
3. Disconnect the 2-wire power connector from J8.
4. Slide the card out of the card cage.
5. Install or re-install the circuit board by sliding it into the card cage.
6. Reconnect the 26-pin ribbon cable connector from the AC Timer Main Board to J2
7. Reconnect the 8-wire cable connectors from each of the SCR Driver Boards to J4 through J7 as required.
8. Reconnect the 2-wire power connector to J8.
9. Slide the board into the card cage.

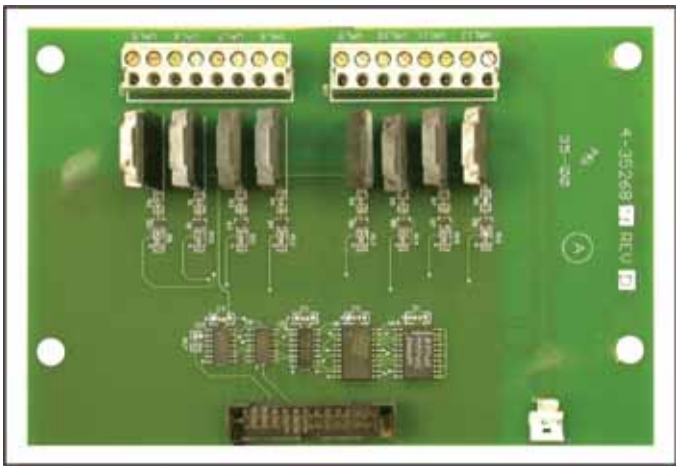


Cascade Board Connector Locations

APPENDIX F
VALVE EXPANSION BOARD OPTION

Description

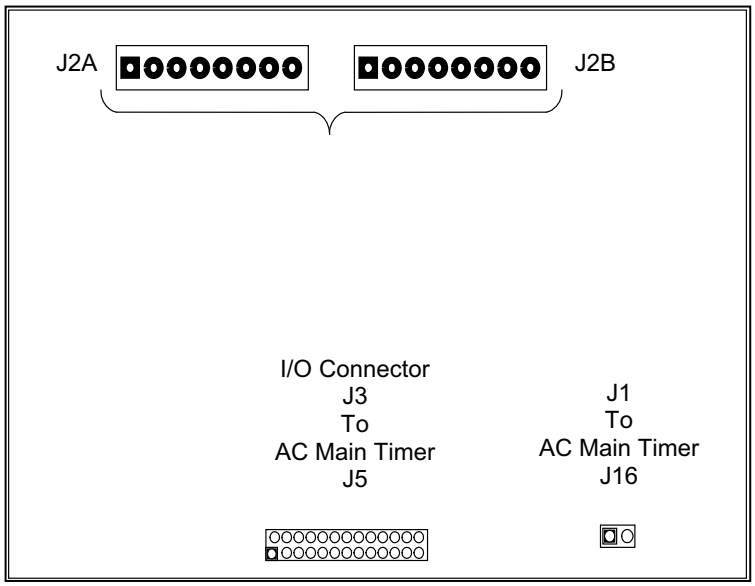
The Valve Expansion Board gives the Control the ability to drive up to eight additional valves. Each set of connections provides 115 VAC (standard) or 24 VAC (optional) power to the valve solenoid connected across those connections.



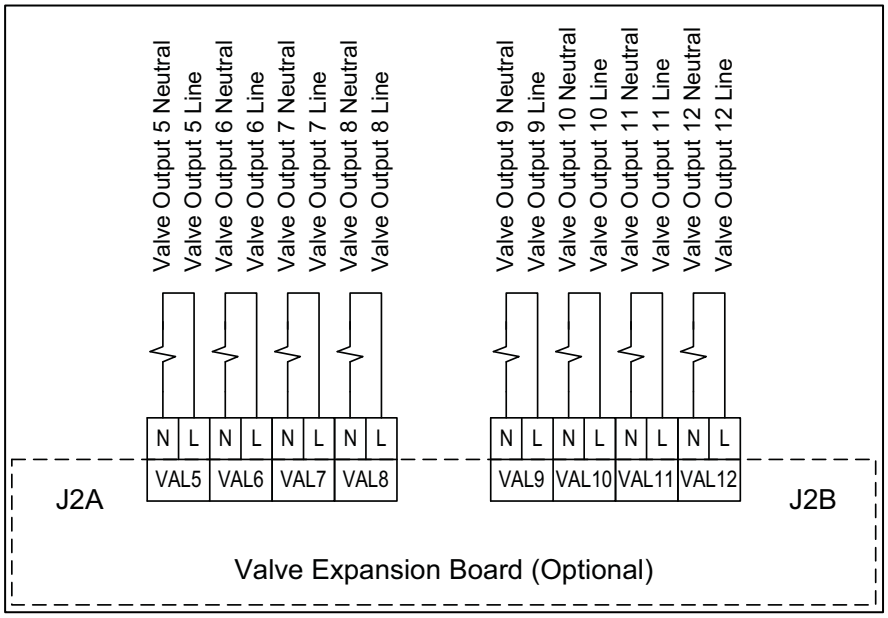
Valve Expansion Board

Maintenance/Replacement

1. Disconnect the 26-pin ribbon cable connector from the AC Timer Main Board connected to J3.
2. Disconnect the 2-wire cable connector from the AC Timer Main Board connected to J1.
3. Mark and disconnect the I/O plugable terminal strips from the board (J2A and J2B). See the next illustration (Valve Expansion Board Output Signals) for a detailed listing of signals.
4. Slide the card out of the card cage.



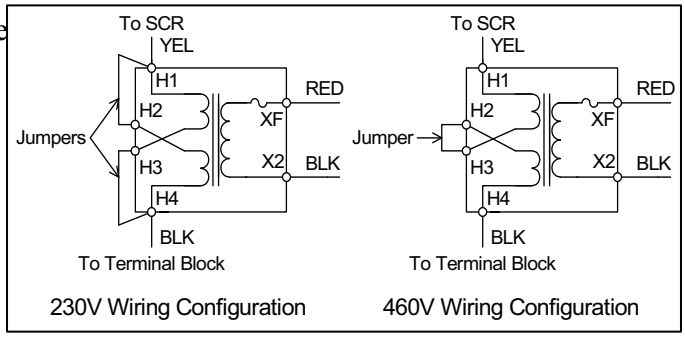
Valve Expansion Board Connector Locations



Valve Expansion Board Output Signals

NOTES:

- VAL5, N & L through VAL12, N & L – Valve Output 5 Neutral and Line through Valve Output 12 Neutral and Line.
- Unless otherwise ordered, Controls are shipped with the Valve Transformer T3 connected for 460V configuration. If you re-configure the unit for 230 V, you must change the jumpers as shown on the right.



Valve Transformer Wiring Connections

5 Reconnect the 26-wire ribbon cable connector from the AC Timer Main Board to J3

6 Reconnect the 2-wire cable connector from the AC Timer Main Board to J1.

7 Reconnect the I/O plugable terminal strips to the board (J2A and J2B).

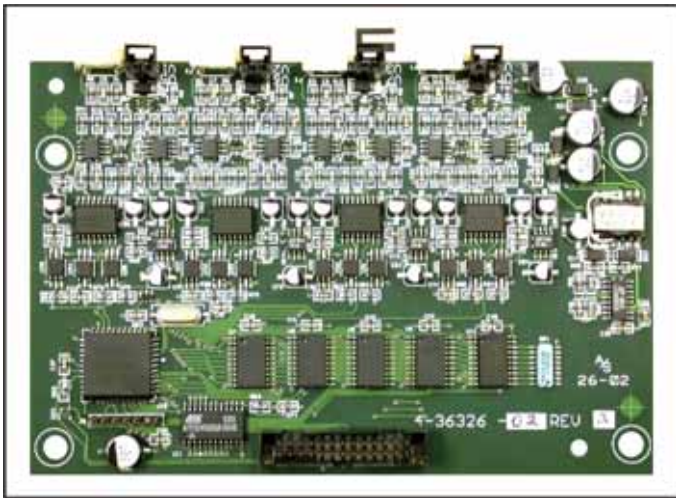
8 Slide the card into the card cage.

APPENDIX G
VOLTAGE MONITOR BOARD OPTION

Description

The Voltage Board gives the Control the ability to compare weld voltage against pre-programmed high and low limits. This board allows you to monitor either peak or average (RMS) voltage.

You can also select *when* the voltage is monitored, either during both weld periods (excluding up/downslope) or during the last cycle only. When doing a constant current weld, the last cycle voltage monitoring is useful for calculating the specific resistance of the part at the end of the weld.



Voltage Monitor Board

Specifications

Voltage Measurement Range:	.10 to 9.99 volts
Accuracy:	+/- 2% of full scale

Operation

Voltage Monitor functions are described in *Chapter 3,Using STA Series Control Functions.*

Maintenance/Replacement

1 Disconnect the serial cable connector (26-pin ribbon cable) connected to J10 on the Voltage Board.

2 Disconnect the voltage sensing cables from V1 through V4 on the Voltage Board as required.

3 Slide the card out of the card cage.

4 Reconnect the voltage sensing cables to V1 through V4 on the Voltage Board as required.

5 Reconnect the serial cable connector (26-pin ribbon cable) to J10 on the Voltage Board.

6 Install or re-install the circuit board by sliding it into the card cage.

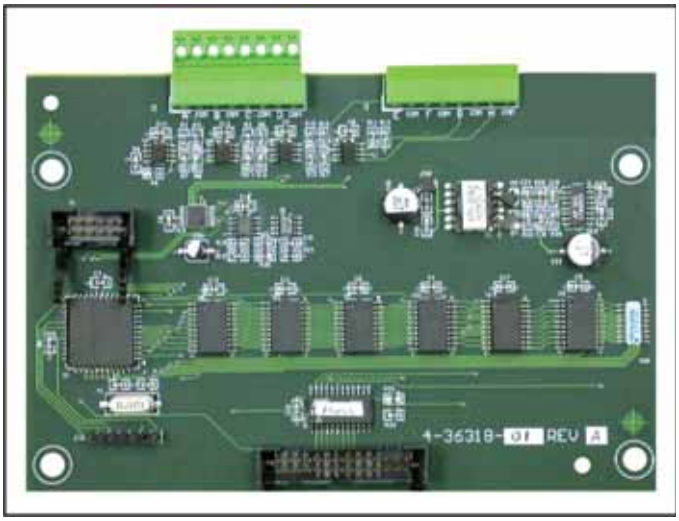
APPENDIX H
FORCE CONTROL OPTION

Description

The Force Control (Force Output) Option can control up to 8 electronic pressure regulators.

Output Force is programmed in lbs using front panel controls. Once the Operator programs the Output Force, the Control converts this to the correct voltage to be sent to the electronic pressure regulator in order to get the desired force.

Calibration is a simple 2-step procedure using front panel controls.



Force Board

Operation

Descriptions of how to program and use the Force Control functions are located in *Chapter 3, Using STA Series Control Functions.* For accurate back pressure readings, the electronic pressure regulator attached to this board must be set to have an association of 0-10V = 0-100 psi.

Calibration

CAUTION: If the electronic pressure regulator is set to have an association of 0-10V = 0-100 psi, Lo psi during calibration will be about 30 psi and Hi psi will be about 80 psi. Make sure the force gauge used can withstand the force of the weldhead at 80 psi.

SYSTEM VALUES SCREEN 3

RETRACTION=MAINTAINEDDIFF.PRESSURE=ON
PRESSURE SWITCH=OFFBACK PRESSURE=10
FORCE CALIBRATION ↵
OUTPUT FORCE=F1
MONITORED VOLTS=RMS
MONITORED TIME=W1/W2SCREEN 2 ↵

1 From the **SYSTEM VALUES SCREEN 3**, set **OUTPUT FORCE = F1-F8**.

2 Go to **FORCE CALIBRATION**, highlight the ↵ symbol and press **DATA +** to enter the screen.

Operation

1 Use the ∧ ∨ < > buttons on the Control panel to highlight the valve number for the channel to be calibrated. Press **PROGRAM/SAVE** to put the unit into program mode. Input the valve number that supplies air to the head to be calibrated.

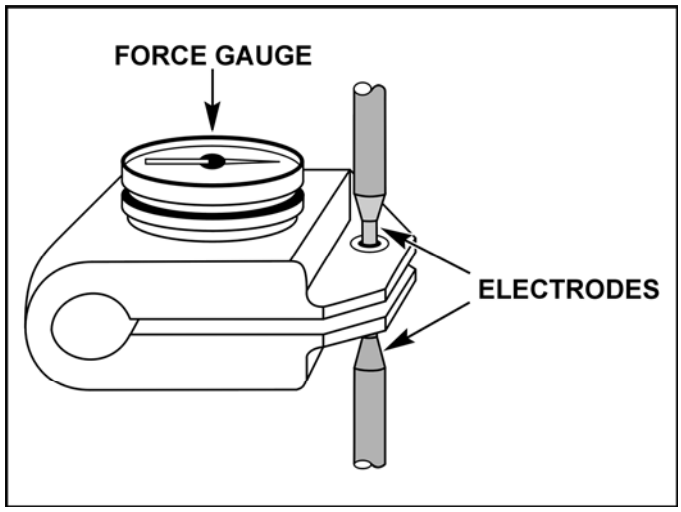
000 Psi	*** FORCE CALIBRATION *** (All Force Entries in Pounds)					
Channel #	Lo-Psi	Hi-Psi	Valve #	Channel #	Lo-Psi	Hi-Psi	Valve #
F1	0000	0001	1	F5	0000	0001	N/A
F2	0000	0001	2	F6	0000	0001	N/A
F3	0000	0001	N/A	F7	0000	0001	N/A
F4	0000	0001	N/A	F8	0000	0001	N/A

2 Move the cursor to "Lo-Psi."

3 Place a force gauge between the electrodes.

4 Press the **WELD ON** button on the Control Panel to close the electrodes.

NOTE: In **FORCE CALIBRATION** mode, the Control will ***not*** send weld current to the electrodes.



5 Let the force stabilize, then check the force on the force gauge. Press the **WELD ON** button to release the weldhead. Enter the number of pounds under **Lo-Psi** on the LCD screen.

6 Select "Hi-Psi" on the control.

7 Place a force gauge between the electrodes.

8 Press the **WELD ON** button on the Control Panel to close the electrodes.

9 Let the force stabilize, then check the force on the force gauge. Press the **WELD ON** button to release the weldhead. Enter the number of pounds under **Hi-Psi** on the LCD screen. Press the Program/Save button to save this information. Calibration for this Channel is now complete.

000 Psi	*** FORCE CALIBRATION *** (All Force Entries in Pounds)					
Channel #	Lo-Psi	Hi-Psi	Valve #	Channel #	Lo-Psi	Hi-Psi	Valve #
F1	0119	0364	1	F5	0000	0001	N/A
F2	0000	0001	2	F6	0000	0001	N/A
F3	0000	0001	N/A	F7	0000	0001	N/A
F4	0000	0001	N/A	F8	0000	0001	N/A

Example: As shown on the right, Low Pressure was **119 lbs**, High Pressure was **364 lbs.**

10 Repeat Steps 3-10 to calibrate other channels.

Maintenance/Replacement

1 Disconnect the serial cable connector (26-pin ribbon cable) connected to J10 on the Force Board.

2 Disconnect the force input cables from J1 and the force output cables from J2 and J3 on the Force Output Board as required.

3 Slide the card out of the card cage.

4 Reconnect the force input cables from J1 and the force output cables from J2 and J3 on the Force Output Board as required.

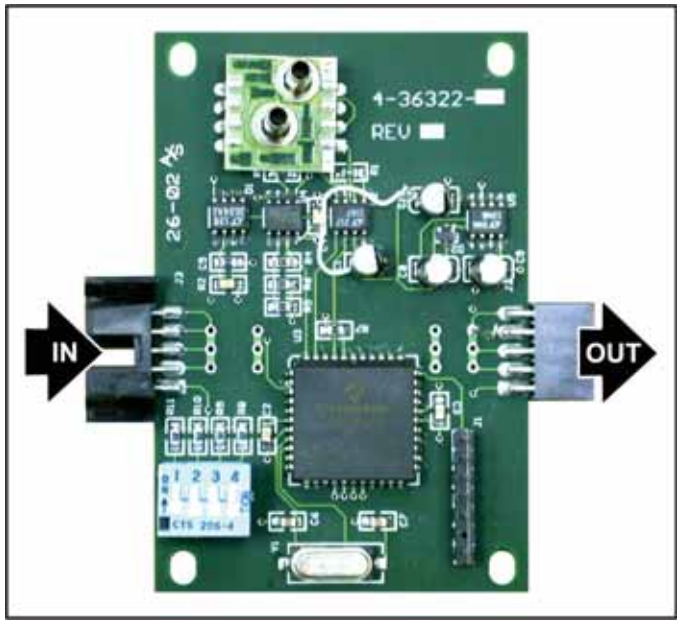
5 Reconnect the serial cable connector (26-pin ribbon cable) to J10 on the Force Board.

6 Install or re-install the circuit board by sliding it into the card cage.

APPENDIX I
PRESSURE MONITORING OPTION

Description

The Pressure Control Option (Force Input) uses differential pressure sensors on up to eight channels. You may use this feature in a Force-Firing function (welds only when correct pressure is reached), or as a pressure monitor to see if air pressure reached (or exceeded) the desired range. Setting high and low limits can reduce cycle time by reducing the programmed squeeze time to 1 cycle.



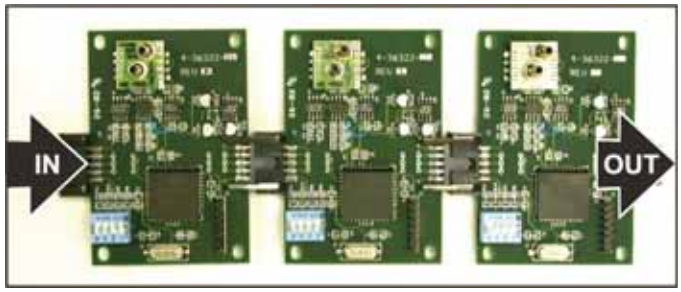
Pressure Board

NOTE: Some configurations of pneumatic components produce pressure spikes when the solenoids are energized. This is most common when there is significant friction in the cylinder. The control has a 4 cycle delay to catch this condition. The weld proceeds only if the pressure is within limits at the start and end of this period. This is sufficient for most weldheads. In some extreme cases, a few cycles of squeeze delay time may be needed in order to prevent premature triggering due to the pressure spikes.

The Pressure Control Option will trigger an alarm if correct pressure is ***not*** reached within 5 seconds. If there is too much or too little pressure at the ***start*** of a weld, the Control will prevent welding until the problem is fixed.

If the pressure was too high at the ***end*** of a weld, the Control will give an alarm. High and low pressure limits are programmed in lbs using front panel controls. Calibration is a simple 2-step procedure using front panel controls.

NOTE: This feature comes with the Force Control (Force Output) Board because the Pressure Boards plug into the Force Board. The Force Output features may or may not be used in conjunction with Pressure Monitoring features.



Linked Pressure Boards

Pressure Boards are plugged into J1 on the Force Board using a ribbon cable. As shown on the right, multiple Pressure Boards may be plugged into each other, *then* plugged into the ribbon cable because the signal passes through all the boards.

Channel Number Setup

Each Pressure Board is manually assigned to a specific channel at the factory using the dipswitch on each board. If you are replacing a Pressure Board(s), you will have to set each one to a different channel. Find the **CHANNEL** you want in the table below, then turn the dipswitches ON or OFF as indicated.

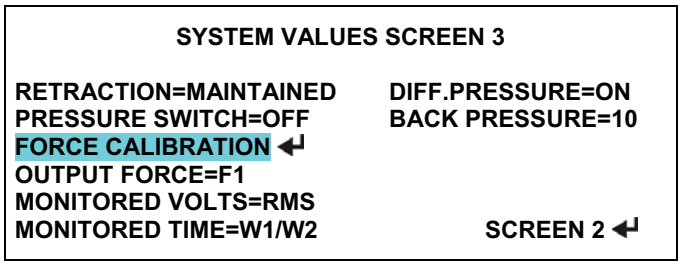
NOTE: It's easier to tag the board with the new channel number until you install it than it is to remember the new channel number solely by dipswitch settings.

CHANNEL	DIPSWITCH			
	#1	#2	#3	#4
1	ON	ON	ON	ON
2	OFF	ON	ON	ON
3	ON	OFF	ON	ON
4	OFF	OFF	ON	ON
5	ON	ON	OFF	ON
6	OFF	ON	OFF	ON
7	ON	OFF	OFF	ON
8	OFF	OFF	OFF	ON

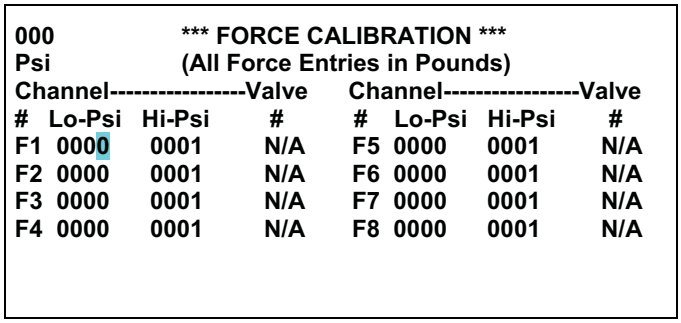
After the channel number is set, you may plug the board into other Pressure Boards ***in any sequence.*** The channel number is fixed and will not change until it is reprogrammed.

Calibration

1. From the **SYSTEM VALUES SCREEN 3**, turn **DIFF. PRESSURE ON.**
2. Go to **FORCE CALIBRATION**, highlight the ↵ symbol and press **DATA +** to enter the screen.

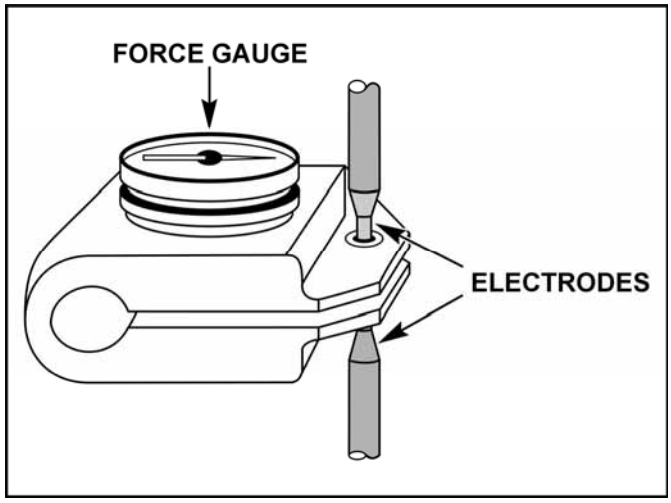


3. Use the ∧ ∨ < > buttons on the Control panel to highlight the valve number for the channel to be calibrated. Press **PROGRAM/SAVE** to put the unit into program mode. Input the valve number that supplies air to the head to be calibrated.
4. Move the cursor to **Lo-Psi.**



5 Place a force gauge between the electrodes.

6 If the force output option is installed, press the **WELD ON** button on the Control Panel to close the electrodes.



NOTE: In **FORCE CALIBRATION** mode, the Control will ***not*** send weld current to the electrodes.

7 If the force output option is not installed, press the **WELD ON** button to close the electrodes. Set the air pressure to approximately 30 psi. Use the psi of the screen to adjust the air pressure..

8 Let the force stabilize, then check the force on the force gauge.

9 Press the **WELD ON** button to release the weldhead. Enter the number of pounds under **Lo-Psi** on the LCD screen.

10 Select **Hi-Psi** on the control.

11 Place a force gauge between the electrodes.

12 If the Force Output Option is installed, press the **WELD ON** button on the Control Panel to close the electrodes.

If the force output option is not installed, press the WELD On button to close the electrodes. Set the air pressure to approximately 80 psi. Use the psi indicator in the upper left corner of the screen to adjust the air pressure.

13 Let the force stabilize, then check the force on the force gauge.

14 Press the **WELD ON** button to release the weldhead. Enter the number of pounds under **Hi-Psi** on the LCD screen.

000 ***** FORCE CALIBRATION *****
Psi **(All Force Entries in Pounds)**

Channel	Lo-Psi	Hi-Psi	Valve #	Channel	Lo-Psi	Hi-Psi	Valve #
F1	0119	0364	N/A	F5	0000	0001	N/A
F2	0000	0001	N/A	F6	0000	0001	N/A
F3	0000	0001	N/A	F7	0000	0001	N/A
F4	0000	0001	N/A	F8	0000	0001	N/A

15 Press the **PROGRAM/SAVE** button to save this information. Calibration for this Channel is now complete.

16 **Example:** As shown above on the right, Low Pressure was **119 lbs.**, High Pressure was **364 lbs**. Repeat Steps 3-13 to calibrate other channels.

Maintenance/Replacement

1 Label the air hoses from the Pressure Board(s) you want to remove. Note the location on the board and label them appropriately. Hoses cannot be switched! Remove the hoses.

2 Unplug the Pressure Board(s) from the Force Board. If you are using multiple Pressure Boards, disconnect them in order to remove/replace/install specific boards.

NOTE: If you are using a ***new*** board, verify that it has been set for the correct channel.

3 Install the air hoses on the Pressure Board that were removed in Step 1.

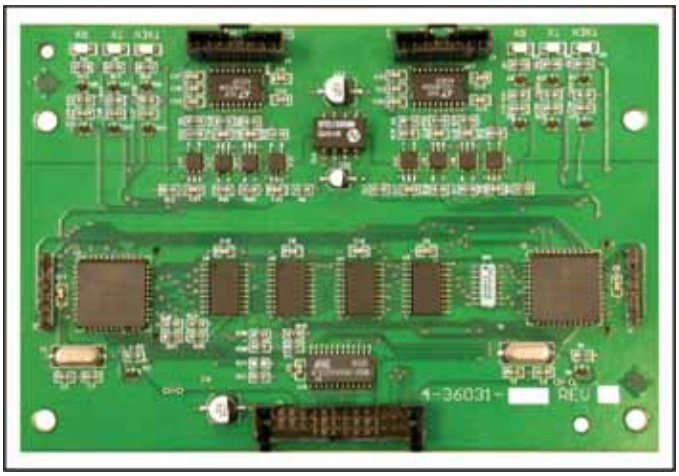
4 Install the new Pressure Board(s) either by plugging into the Force Board, or mounted separately and connected with a ribbon cable.

APPENDIX J
COMMUNICATIONS OPTION

Section I. Description

An optional circuit card gives the Control the ability to communicate with a host computer or with automation control systems. The communications option uses either RS-232 to connect one control to one host or RS-485 multi-drop architecture to connect up to 30 controls to one host on a single channel. Miyachi's *Weldlab* software allows you to connect a single or multiple Controls to a computer in order to:

- Compile, store, view, and print weld history data for detailed analysis.
- Check the status of the Control(s).
- Remotely program weld schedules on the Control(s).
- Remotely program menu items on the Control(s).



Serial Communications Board

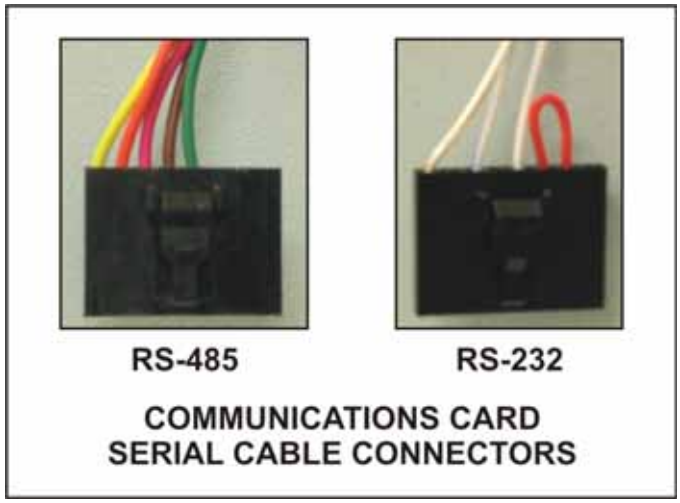
Remote Programming

Most users will find the *Weldlab* software functions sufficient for collecting and using weld history information and remote schedule programming. However, advanced users may wish to perform additional programming for custom welding applications. The codes needed to perform remote programming are listed in *Section II. Communications Protocol and Commands*. Using these codes, users can write customized software for controlling all functions of the welding control and interfacing the unit to automation control systems.

RS-485 / RS-232 Operation

The STA Communications Option card can be used for RS-232 or RS-485 protocol. The wiring of the external 9-pin connector is determined by the internal serial connector supplied at time of purchase. The connectors shown on the right are from the cables that go between the external 9-pin connector on the Control and the Communications Board.

When the 5-pin cable is used, the external 9-pin connector is set for RS-485 operation. When the 3-pin + jumper cable is used, the 9-pin connector is set for RS-232 operation.



COMMUNICATIONS CARD
SERIAL CABLE CONNECTORS

Host settings

Baud Rate38.4k
Data bits8
Stop bit1
ParityNone

NOTE: The host must be able to support 38.4 kbaud communications without interruptions or dropped bits. The computer hardware and operating system needed to achieve that level of performance depends upon the RS-485 adapter (or converter box) used. For a microprocessor-based conversion (such as the Edgeport USB converter from Inside Outside Networks), the host computer should be at least a Pentium II-233 running Windows 98, Windows ME, Windows 2000, Windows XP or Windows NT 4.0. For a hardware-based converter without an internal microprocessor (such as the Telebyte model 285), the host computer should be at least a Pentium III-550 running Windows 98, Windows ME, Windows 2000, Windows XP or Windows NT 4.0.

For RS-485 communication, care must be taken not to exceed the capacity of each channel. The product of:

(total number welds per second on all welders on that channel)
times
(total number of bytes exchanged per weld)
times
(8 bits per byte)

must in all cases remain less than the theoretical maximum capacity of the channel – 38,400 bits per second. This capacity is not an issue on RS-232 channels.

A good guideline is that on a line free of electrical noise, the number calculated above must remain less that 70% of the theoretical maximum capacity (26,880 bytes per second). Electrical noise on the communications lines will further reduce this capacity. Shielded cables are recommended.

Several commands require the Control to be in **HOST** mode for the Control to accept them. Those commands include the **REPORT** command and all **SET** commands. See the **MASTER CNTL** command in *Chapter 3, Using STA Series Control Functions* and the **REMOTE** command in the next Section for more information.

Section II. Communications Protocol and Commands

Communication External Protocol

Each external command will be formatted as follows:

<soh> <@> <cmd> <cnt> <data> <cksum> <eot>.

Definition of Command Elements

<soh>	1 BYTE	The data packet will start with a **SOH** (start of header **0x01**) character .
<@>	2 BYTES	This is the address of the unit to which data is requested converted into ASCII decimal numbers. **("01" - "30").**
<cmd>	2 BYTES	This is a two character ASCII string denoting the command. **(i.e. "IA")**.
<cnt>	2 BYTES	This is a count of data bytes to follow, converted into a ASCII HEX number. **("00" - "FF").**
<data>	n BYTES	his is optional **BINARY** data. Multiple binary byte ordering **[MSB][…][LSB]**.
<cksum>	2 BYTES	This is a two charter ASCII HEX string calculated from the sum of all fields except **<soh>, <cksum>,** and **<eot>**. Then masked with **0xFF.**
<eot>	1 BYTE	This terminates the transmission. (End transmit **0x04**).

Unit Responses To External Commands

Errors or Unsupported Commands

The STA will respond with a Negative Acknowledge <**NAK**> (0x15) when an error in checksum is encountered. The host will return a Negative Acknowledge <**NAK**> in response to any command that is not supported.

<soh> <@> <**NAK**> <err> <cksum> <eot>

Where <err> = '1' NO <SOH>
'2' BAD checksum
'3' Unrecognized command
'4' Timeout
'5' HC16 is Busy
'6' Data Bad
'7' Input timeout
'8' Output timeout

Valid Commands

A valid command will return ***either*** data ***or*** **<ACK> (0x06)**.

<soh> <@> <ACK> <cksum> <eot>

Data will be returned with the following structure:

<soh> <@> <cmd> <cnt> <data> <cksum> <eot>

Host Originated Command Set

These are commands sent by the host computer, via the RS-485/RS-232 port to the STA.

NAME	COMMAND	DATA		SIZE
TYPE	"TY" Read	none		0 Bytes
REPORT	"RR" Read	Retransmission = 0x0FF		1 Byte
RESET	"RX" Set	Reset an Error and Returns	STATUS	0 Bytes
REMOTE	"RM" Set	0=Local, 1=Remote		1 Byte
LOAD	"LR" Read	none		0 Bytes
	"LS" Set	The schedule # to become active		1 Byte
COUNTER	"CS" Set	Schedule # to Reset the Counter		1 Byte
COPY	"CP" Set	Source schedule #		1 Byte
		Destination schedule #		1 Byte
		Count past		1 Byte
				3 Bytes Total
TIME CLK	"RT" Set	<data>=0 Reset Time Clock		1 Byte
	"RT" Read	<data>=1 Read Time Offset		1 Byte
LINK	"KR" Read	none		0 Bytes
	"KS" Set	SCHEDULE #, SCHEDULE #,…		64 Bytes

NAME	COMMAND	DATA		SIZE
SCHEDULE	"DR" Read	Schedule #		1 Byte
SCHEDULE	"DS" Set	SCHEDULE #		1 Byte
		SQD #	(Squeeze Delay)	2 Bytes
		SQZ #	(Squeeze Time)	2 Bytes
		UP1 #	(Up Slope Time)	2 Bytes
		WELD1 #	(Weld Time),	2 Bytes
		DOWN1 #	(Down Slope Time)	2 Bytes
		COOL #	(Cool Time)	2 Bytes
		UP2 #	(Up Slope Time)	2 Bytes
		DOWN2 #	(Down Slope Time)	2 Bytes
		HOLD #	(Hold Time)	2 Bytes
		OFF #	(Off Time)	2 Bytes
		% HEAT #1	(0-100%)	2 Bytes
		% HEAT #2	(0-100%)	2 Bytes
		CURRENT #1	(Energy 0-80.0kA), See **NOTE [1]**	2 Bytes
		CURRENT #2	(Energy 0-80.0kA), See **NOTE [1]**	2 Bytes
		IMPULSE	(0-25)	1 Byte
		FORCE,	(0-9999)	2 Bytes
		FORCE CHANNEL	(1-8)	1 Byte
				35 Bytes Total

NOTE [1]: 1000 = 10.0kA

NAME	COMMAND	DATA			SIZE
MONITOR	"MR" Read	Read Schedule #			1 Byte
MONITOR	"MS" Set	Set SCHEDULE #			1 Bytes
		HIGH1C #	High current #1%		2 Bytes
		HIGH2C #	High current #2%		2 Bytes
		LOW1C #	Low current #1%		2 Bytes
		LOW2C #	Low current #2%		2 Bytes
		ANGLE LIMIT 1	Conduction limit #1		1 Byte
		ANGLE LIMIT 2	Conduction limit #2		1 Byte
		LIMIT #	Weld Count limit		2 Bytes
		START	start value		1 Byte
		MODE	weld mode		1 Byte
		LOP	Low Pressure Limit	(0-9999)	2 Bytes
		HIP	High Pressure Limit		2 Bytes
		VOLTHIW1	W1 High Volt Limit	(0.00-9.99)	2 Bytes
		VOLTLOW1	W1 Low Volt Limit		2 Bytes
		VOLTHIW2	W2 High Volt Limit		2 Bytes
		VOLTLOW2	W2 Low Volt Limit		2 Bytes
					27 Bytes Total

---

start value:	MAINTAINED = 0
or	PULSED = 1
or	LATCHED = 2
or	SEAM =3

---

weld mode:	SPOT = 0
or	REPEAT = 1
or	SUCCESSIVE = 2
or	CHAINING = 3

NAME	COMMAND	DATA	SIZE		
STEPPER	"ER" Read	Valve #			1 Byte
STEPPER	"ES" Set	VALVE #			1 Byte
		STEPPER	{ON=1 | OFF=0}		1 Byte
		STEP 1 COUNT #	100%		3 Bytes
		STEP 2 COUNT #	#%		3 Bytes
		STEP 3 COUNT #	#%		3 Bytes
		STEP 4 COUNT #	#%		3 Bytes
		STEP 5 COUNT #	#%		3 Bytes
		STEP 6 COUNT #	#%		3 Bytes
		STEP 7 COUNT #	#%		3 Bytes
		STEP 8 COUNT #	#%		3 Bytes
		STEP 9 COUNT #	#%		3 Bytes
		STEP 10 COUNT #	#%		3 Bytes
			(0-9999)	(50-200)	32 Bytes Total
		NOTE: COUNT# = 2 Bytes #% = 1 Byte			
VALVE	"VR" Read	Schedule #			1 Byte
VALVE	"VS" Set	SCHEDULE #			1 Byte
		ELECTRODE VALVE #			1 Byte
		VALVE 1	{ON=1 | OFF=0}		1 Byte
		VALVE 2	{ON=1 | OFF=0}		1 Byte
		VALVE 3	{ON=1 | OFF=0}		1 Byte
		VALVE 4	{ON=1 | OFF=0}		1 Byte
		VALVE 5	{ON=1 | OFF=0}		1 Byte
		VALVE 6	{ON=1 | OFF=0}		1 Byte
		VALVE 7	{ON=1 | OFF=0}		1 Byte
		VALVE 8	{ON=1 | OFF=0}		1 Byte
		VALVE 9	{ON=1 | OFF=0}		1 Byte
		VALVE 10	{ON=1 | OFF=0}		1 Byte
		VALVE 11	{ON=1 | OFF=0}		1 Byte
		VALVE 12	{ON=1 | OFF=0}		1 Byte
					14 Bytes Total

NAME	COMMAND	DATA			SIZE
SCR's	"UR" Read	none			0 Bytes
SCR's	"US" Set	Valve 1	SCR#	Count	5 Bytes
		Valve 2	SCR#	Count	5 Bytes
		Valve 3	SCR#	Count	5 Bytes
		Valve 4	SCR#	Count	5 Bytes
		Valve 5	SCR#	Count	5 Bytes
		Valve 6	SCR#	Count	5 Bytes
		Valve 7	SCR#	Count	5 Bytes
		Valve 8	SCR#	Count	5 Bytes
		Valve 9	SCR#	Count	5 Bytes
		Valve 10	SCR#	Count	5 Bytes
		Valve 11	SCR#	Count	5 Bytes
		Valve 12	SCR#	Count	5 Bytes
			(1-8)	(0-99999)	60 Bytes Total

NOTE: SCR# = 1 Byte
COUNT = 4 Bytes

NAME	COMMAND	DATA		SIZE
SYSTEM	"YR" Read	none		0 Bytes
SYSTEM	"YS" Set	MAX VALVES #		1 Byte
		MAX SCRS		1 Byte
		TURNS RATIO	(1:1 - 200:1)	1 Byte
		87 DEGREE DELAY	{ON=1 | OFF=0}	1 Byte
		RESET	{ON=1 | OFF=0}	1 Byte
		END OUTPUT	{ON=1 | OFF=0}	1 Byte
		ERROR OUTPUT	{ON=1 | OFF=0}	1 Byte
		STEP END OUTPUT	{ON=1 | OFF=0} 1 Byte	
		BINARY SCHEDULE	{ON=1 | OFF=0}	1 Byte
		FULL CURRENT #	(5kA - 80kA), See **NOTE [1]**	1 Byte
		CONTROL MODE	control mode	1 Byte
		FIRING SWITCH	{0=2Stage, 1= 1Stage}	1 Byte
		SEAM WELD	seam mode	1 Byte
		WELD ON/OFF	{ LOCAL=0 | REMOTE=1}	1 Byte
		LOW LINE ALARM	{ON=1 | OFF=0}	1 Byte
		Master Control	{0=Local, 1=Host}	1 Byte
		RETRACTION (0=MAINTAINED, 1=PULSED)		1 Byte
		DIFF. PRESSURE	{ON | OFF}	1 Byte
		PRESSURE SWITCH	{ON | OFF}	1 Byte
		OUTPUT FORCE	(0=OFF, 1=F1, 2=F1-F8)	1 Byte
		MONITORED VOLTS	(0=PEAK, 1=RMS)	1 Byte
		MONITORED TIME	(0=W1/W2, 1=LAST CYCLE)	1 Byte
		BACK PRESSURE	(0-30)	1 Byte
		Always 0		1 Byte
		Always 0		1 Byte
				25 Bytes Total

---

control mode:	Primary C. Current = 0	
or	Secondary C. Current = 1	
or	% Heat = 2	
or	% Heat Secondary = 3	

---

seam mode:	Spot = 0	
or	Continuous Seam = 1	
or	Roll Spot = 2	(Seam welding is an optional feature)

NOTE [1]: 1000 = 10.0kA

NAME	COMMAND	DATA		SIZE
FORCE	"PR" Read	None		0 Bytes
FORCE	"PS" Set	P1 MIN CALIBRATE #,	(0-9999)	2 Bytes
		P1 MAX CALIBRATE #,		2 Bytes
		P2 MIN CALIBRATE #,		2 Bytes
		P2 MAX CALIBRATE #,		2 Bytes
		P3 MIN CALIBRATE #,		2 Bytes
		P3 MAX CALIBRATE #,		2 Bytes
		P4 MIN CALIBRATE #,		2 Bytes
		P4 MAX CALIBRATE #,		2 Bytes
		P5 MIN CALIBRATE #,		2 Bytes
		P5 MAX CALIBRATE #,		2 Bytes
		P6 MIN CALIBRATE #,		2 Bytes
		P6 MAX CALIBRATE #,		2 Bytes
		P7 MIN CALIBRATE #,		2 Bytes
		P7 MAX CALIBRATE #,		2 Bytes
		P8 MIN CALIBRATE #,		2 Bytes
		P8 MAX CALIBRATE #,		2 Bytes
		P1 ASSOCIATED VALVE #,	(0=n/a, 1-12)	1 Byte
		P2 ASSOCIATED VALVE #,		1 Byte
		P3 ASSOCIATED VALVE #,		1 Byte
		P4 ASSOCIATED VALVE #,		1 Byte
		P5 ASSOCIATED VALVE #,		1 Byte
		P6 ASSOCIATED VALVE #,		1 Byte
		P7 ASSOCIATED VALVE #,		1 Byte
		P8 ASSOCIATED VALVE #,		1 Byte
				40 Bytes Total

STA Originated Response Command Set

These are commands returned by the STA, via the RS-485/RS-232 port.

NAME	COMMAND	DATA	SIZE
TYPE	"TY" Read	"STA", Release # and Revision # Example: "STA 01.21 AB"	12 Bytes
COUNT	"CT" Read	#Reports Stored	1 Byte
COUNTER	"CS" Set	<ACK> **OR** <NAK>	0 Bytes
COPY	"CP" Set	<ACK> **OR** <NAK>	0 Bytes
LOAD	"LR" Read	The active schedule #	1 Byte
	"LS" Set	<ACK> **OR** <NAK>	0 Byte
TIME CLK	"RT" Read	Read Time Offset in cycles since power-up or reset	4 Bytes
	"RT" Set	<ACK> **OR** <NAK>	0 Bytes
LINK	"KS" Set	<ACK> **OR** <NAK>	0 Bytes
	"KR" Read	SCHEDULE #, SCHEDULE #,…	64 Bytes

NAME	COMMAND	DATA		SIZE
REPORT	"RR" Read	Schedule #		1 Byte
		Status		4 Bytes
		1st pulse Current		2 Bytes
		1st pulse Pressure		2 Bytes
		1st pulse Angle		2 Bytes
		2nd pulse Current		2 Bytes
		2nd pulseVoltage		2 Bytes
		2nd pulsePressure		2 Bytes
		2nd pulse Angle		2 Bytes
		Weld Number		2 Bytes
		On Step number		1 Bytes
		Stepper Count		2 Bytes
		Time Count Offset	(in cycles since power-up or reset)	4 Bytes
		Total number of reports = <cnt> /		30 Bytes Total
SCHEDULE	"DS" Set	<ACK> **OR** <NAK>		0 Bytes
SCHEDULE	"DR" Read	SCHEDULE #		1 Byte
		SQD #	(Squeeze Delay)	2 Bytes
		SQZ #	(Squeeze Time)	2 Bytes
		UP1 #	(Up Slope Time)	2 Bytes
		WELD1 #	(Weld Time)	2 Bytes
		DOWN1 #	(Down Slope Time)	2 Bytes
		COOL #	(Cool Time)	2 Bytes
		UP2 #	(Up Slope Time)	2 Bytes
		WELD2 #	(Weld Time)	2 Bytes
		DOWN2 #	(Down Slope Time)	2 Bytes
		HOLD #	(Hold Time)	2 Bytes
		OFF #	(Off Time)	2 Bytes
		% HEAT #1	(0-100%)	2 Bytes
		% HEAT #2	(0-100%)	2 Bytes
		CURRENT #1	(Energy 0-80.0kA), See **NOTE [1]**	2 Bytes
		CURRENT #2	(Energy 0-80.0kA), See **NOTE [1]**	2 Bytes
		IMPULSE	(0-25)	1 Byte
		FORCE,	(0-9999)	2 Bytes
		FORCE CHANNEL	(1-8)	1 Byte
				35 Bytes Total

NOTE [1]: 8000 = 80.0kA

NAME	COMMAND	DATA			SIZE
MONITOR	"MS" Set	<ACK> **OR** <NAK>			0 Bytes
MONITOR	"MR" Read	SCHEDULE #			1 Byte
		HIGH1C #	High current #1 %		2 Bytes
		LOW1C #	Low current #1 %		2 Bytes
		HIGH2C #	High current #1 %		2 Bytes
		LOW2C #	Low current #1 %		2 Bytes
		ANGLE LIMIT 1	Conduction limit #1		1 Byte
		ANGLE LIMIT 2	Conduction limit #2		1 Byte
		LIMIT #	Weld count limit		2 Bytes
		START	start value		1 Byte
		MODE	weld mode		1 Byte
		LOP,	Low Pressure Limit	(0-9999)	2 Bytes
		HIP,	High Pressure Limit		2 Bytes
		VOLTHIW1	W1 High Volt Limit	(0.00-9.99)	2 Bytes
		VOLTLOW1	W1 Low Volt Limit		2 Bytes
		VOLTHIW2	W2 High Volt Limit		2 Bytes
		VOLTLOW2	W2 Low Volt Limit		2 Bytes
					27 Bytes Total
	weld mode:	SPOT = 0			
	or	REPEAT = 1			
	or	SUCCESSIVE = 2			
	or	CHANING = 3			
	start value:	MAINTAINED = 0			
	or	PULSED = 1			
	or	LATCHED = 2			
	or	SEAM = 3			
STATUS	"TS" Read	Last Major Error (see below)			2 Byte
		Last Minor Error (see below)			2 Byte
		Schedule, Monitor, or Valve changed			
		0=No Change, Schedule #+1 if changed			1 Byte
		Stepper, 0=No change, Valve # if changed			1 Byte
		Link Array 0=No change, 1=change			1 Byte
		Active screen number			1 Byte
		Active screen value			1 Byte
					9 Bytes Total

Major Error Bit Pattern – the following bits are set to 1 when their associated error condition exists.

Bit 0 Emergency Stop
Bit 1 Over temperature
Bit 2 No current
Bit 3 Mode change error
Bit 4 Shorted SCR
Bit 5 Weld 1 current high
Bit 6 Weld 2 current high
Bit 7 Weld 1 conduction angle high
Bit 8 Weld 2 conduction angle high
Bit 9 Step end reached
Bit 10 Full conduction angle reached
Bit 11 Schedule number error

Minor Error Bit Pattern - the following bits are set to 1 when their associated error condition exists.

Bit 0 Weld 1 current low
Bit 1 Weld 2 current low
Bit 2 Step count too high
Bit 3 Setup error
Bit 4 Weld end reached
Bit 6 Low line voltage
Bit 7 High line voltage
Bit 8 Current scaling incorrect
Bit 9 Initial force too high
Bit 10 Initial force too low
Bit 11 Final force too high
Bit 12 Final force too low

Active Screen Number

1. Run screen
2. Stepper screen
3. Weld mode screen
4. % heat monitor screen
5. Valve screen for 12 valves
6. Not used
7. Program screen for constant current modes
8. System values screen
9. Linked schedules screen
10. Not used
11. Not used

Active Screen Number (Continued)

12. Duplicate starting schedules in link lists screen
13. Schedule programming screen
14. Not used
15. Hidden screen
16. Copy schedule screen
17. System valve screen – 4 valve option
18. System valve screen – 12 valve option
19. Full current error screen
20. Weld 1 current greater than full current error screen
21. Weld 2 current greater than full current error screen
22. Weld 1 current less than 20% of full current screen
23. Weld 2 current less than 20% of full current screen
24. Weld monitor screen – constant current modes
25. Valve screen – 4 valves
26. Weld monitor programming screen
27. Weld 1 current plus stepper value exceeds full current screen
28. Weld 2 current plus stepper value exceeds full current screen
29. Emergency Stop screen
30. Thermostat over temperature screen
31. No current error screen
32. Full wave conduction angles reached error screen
33. Mode change error screen
34. Weld 1 current too high
35. Weld 2 current too high
36. Weld 1 current too low
37. Weld 2 current too low
38. Weld 1 conduction angle too high
39. Weld 2 conduction angle too high
40. Step count too high error screen
41. Modified schedule not saved error screen
42. Duplicate SCR number assigned error screen
43. Weld count reached limit error screen
44. Stepper end reached error screen
45. Not used
46. Simplified schedule screen
47. Simple %heat screen
48. Not used
49. Seam weld in primary current control screen
50. Seam weld in %heat mode screen

Active Screen Number (Continued)

51. Seam weld simplified schedule screen – constant current modes
52. Seam weld simplified schedule screen – %heat modes
53. SCR shorted screen
54. List of boards installed screen
55. Low line voltage screen
56. High line voltage screen
57. Current scaling error
58. Not used
59. Continuous seam weld enabled mode screen
60. Roll spot weld enabled mode screen
61. Schedule number error screen
62. System values continuation screen
63. Schedule W1 and W2 times set to 0 error screen
64. Pixel test info screen
65. Not used
66. Not used
67. Second hidden screen
68. Incorrect SCR number detected screen
69. Pressure switch error
70. Force calibration screen
71. System boot-up screen

NAME	COMMAND	DATA		SIZE
STEPPER	"ES" Set	<ACK> **OR** <NAK>		0 Bytes
STEPPER	"ER" Read	VALVE #		1 Byte
		STEPPER	{ON=1 | OFF=0}	1 Byte
		STEP 1 COUNT #	100%	3 Bytes
		STEP 2 COUNT #	#%	3 Bytes
		STEP 3 COUNT #	#%	3 Bytes
		STEP 4 COUNT #	#%	3 Bytes
		STEP 5 COUNT #	#%	3 Bytes
		STEP 6 COUNT #	#%	3 Bytes
		STEP 7 COUNT #	#%	3 Bytes
		STEP 8 COUNT #	#%	3 Bytes
		STEP 9 COUNT #	#%	3 Bytes
		STEP 10 COUNT #	#%	3 Bytes
			(0-9999) (50-200)	33 Bytes Total
		NOTE: COUNT# = 2 Bytes #% = 1 Byte		
VALVE	"VS" Set	<ACK> **OR** <NAK>		0 Bytes
VALVE	"VR" Read	SCHEDULE #		1 Byte
		ELECTRODE VALVE #		1 Byte
		VALVE 1	{ON=1 | OFF=0}	1 Byte
		VALVE 2	{ON=1 | OFF=0}	1 Byte
		VALVE 3	{ON=1 | OFF=0}	1 Byte
		VALVE 4	{ON=1 | OFF=0}	1 Byte
		VALVE 5	{ON=1 | OFF=0}	1 Byte
		VALVE 6	{ON=1 | OFF=0}	1 Byte
		VALVE 7	{ON=1 | OFF=0}	1 Byte
		VALVE 8	{ON=1 | OFF=0}	1 Byte
		VALVE 9	{ON=1 | OFF=0}	1 Byte
		VALVE 10	{ON=1 | OFF=0}	1 Byte
		VALVE 11	{ON=1 | OFF=0}	1 Byte
		VALVE 12	{ON=1 | OFF=0}	1 Byte
				14 Bytes Total
SCR's	"UR" Read	<ACK> **OR** <NAK>		0 Bytes
SCR's	"US" Set	Valve 1	SCR # Count	5 Bytes
		Valve 2	SCR # Count	5 Bytes
		Valve 3	SCR # Count	5 Bytes
		Valve 4	SCR # Count	5 Bytes
		Valve 5	SCR # Count	5 Bytes
		Valve 6	SCR # Count	5 Bytes
		Valve 7	SCR # Count	5 Bytes
		Valve 8	SCR # Count	5 Bytes
		Valve 9	SCR # Count	5 Bytes
		Valve 10	SCR # Count	5 Bytes
		Valve 11	SCR # Count	5 Bytes
		Valve 12	SCR # Count	5 Bytes
		(1-8)	(0-99999)	60 Bytes Total

NAME	COMMAND	DATA		SIZE
SYSTEM	"YS" Set	<ACK> **OR** <NAK>		0 Bytes
SYSTEM	"YR" Read	MAX VALVES #		1 Byte
		MAX SCRS		1 Byte
		TURNS RATIO	(1:1 - 200:1)	1 Byte
		87 DEGREE DELAY	{ ON=1 | OFF=0}	1 Byte
		RESET	{ ON=1 | OFF=0}	1 Byte
		END OUTPUT	{ ON=1 | OFF=0}	1 Byte
		ERROR OUTPUT	{ ON=1 | OFF=0}	1 Byte
		STEP END OUTPUT	{ ON=1 | OFF=0}	1 Byte
		BINARY SCHEDULE	{ ON=1 | OFF=0}	1 Byte
		FULL CURRENT #	(5kA - 80kA)	1 Byte
		CONTROL MODE	control mode	1 Byte
		FIRING SWITCH	{0=2Stage, 1= 1Stage}	1 Byte
		SEAM WELD	seam mode	1 Byte
		WELD ON/OFF	{ LOCAL=0 | REMOTE=1}	1 Byte
		LOW LINE ALARM	{ ON=1 | OFF=0}	1 Byte
		MASTER CONTROL	{0=Local, 1=Host}	1 Byte
		RETRACTION	(0=MAINTAINED, 1=PULSED)	1 Byte
		DIFF. PRESSURE	{ON | OFF}	1 Byte
		PRESSURE SWITCH	{ON | OFF}	1 Byte
		OUTPUT FORCE	(0=OFF, 1=F1, 2=F1-F8)	1 Byte
		MONITORED VOLTS	(0=PEAK, 1=RMS)	1 Byte
		MONITORED TIME	(0=W1/W2, 1=LAST CYCLE)	1 Byte
		BACK PRESSURE	(0-30)	1 Byte
		COIL TYPE	(0=NONE, 1=PRI, 2=SEC)	1 Byte
		FREQ	{0=60hz, 1=50hz}	1 Byte
				17 Bytes Total

---

control mode: Primary C. Current = 0
or % Heat Primary = 1,
or Secondary C. Current = 2
or % Heat Secondary = 3
or % Heat = 4

---

seam mode: Spot = 0
or Continuous Seam = 1
or Roll Spot = 2

NAME	COMMAND	DATA		SIZE
FORCE	"PS" Set	<ACK **OR** NAK>		0 Bytes
FORCE	"PR" Read	P1 MIN CALIBRATE #,	(0-9999)	2 Bytes
		P1 MAX CALIBRATE #,		2 Bytes
		P2 MIN CALIBRATE #,		2 Bytes
		P2 MAX CALIBRATE #,		2 Bytes
		P3 MIN CALIBRATE #,		2 Bytes
		P3 MAX CALIBRATE #,		2 Bytes
		P4 MIN CALIBRATE #,		2 Bytes
		P4 MAX CALIBRATE #,		2 Bytes
		P5 MIN CALIBRATE #,		2 Bytes
		P5 MAX CALIBRATE #,		2 Bytes
		P6 MIN CALIBRATE #,		2 Bytes
		P6 MAX CALIBRATE #,		2 Bytes
		P7 MIN CALIBRATE #,		2 Bytes
		P7 MAX CALIBRATE #,		2 Bytes
		P8 MIN CALIBRATE #,		2 Bytes
		P8 MAX CALIBRATE #,		2 Bytes
		P1 ASSOCIATED VALVE #,	(0=n/a, 1-12)	1 Byte
		P2 ASSOCIATED VALVE #,		1 Byte
		P3 ASSOCIATED VALVE #,		1 Byte
		P4 ASSOCIATED VALVE #,		1 Byte
		P5 ASSOCIATED VALVE #,		1 Byte
		P6 ASSOCIATED VALVE #,		1 Byte
		P7 ASSOCIATED VALVE #,		1 Byte
		P8 ASSOCIATED VALVE #,		1 Byte
				40 Bytes Total

Remove/Replace the Communications Board

1 Disconnect the twenty-six pin ribbon cable connector from the AC Timer Main Board connected to J2.

2 Disconnect the serial cable connector (coming from the external 9-pin connector) from J3.

3 Slide the card out of the card cage.

4 Install or re-install the circuit board by sliding it into the card cage.

5 Reconnect the 26-pin ribbon cable connector from the AC Timer Main Board to (coming from the external 9-pin connector)

6 Reconnect the serial cable connector (coming from the external 9-pin connector) to J3.

7 Slide the board into the card cage.

APPENDIX K
CIRCUIT MODIFICATION FOR EXTERNAL TRANSFORMER THERMOSTAT

External Transformer Thermostat Connection

The following procedure will enable you to connect an external transformer thermostat to the Control such that it will monitor that thermostat the same as the SCR thermostat.

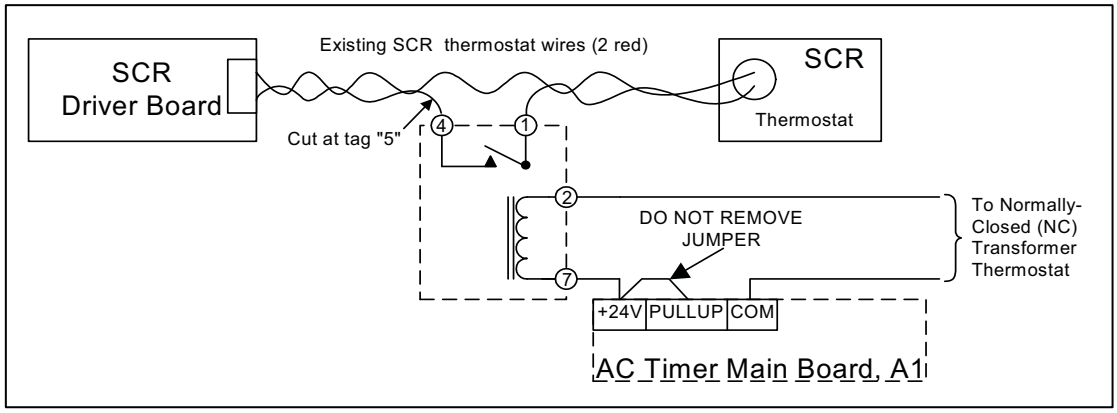
WARNING: Lethal voltages are present in the unit. Disconnect power before making this modification.

Required Parts:

- 1 relay, 24VDC, 75mA maximum coil current, octal base (Recommended: *Grainger* 1A485)
- 1 octal relay socket (Recommended: *Grainger* 5X852)
- Miscellaneous wire, tape, insulation, and mounting hardware, as needed

1 Determine a location in the Control cabinet for mounting the relay. This location should be away from the high voltage terminals.

2 Mount the relay socket and perform the following wiring procedure:



a) On one of the SCR thermostats, locate the red wire tagged "**5**."

b) Cut the wire and splice on two extension wires long enough to reach the relay socket Connect these wires to the socket terminals for the **NO** and **COM** terminals of the relay.

c) Connect a wire from one of the socket terminals for the relay coil to the **+24VDC** terminal on connector **J14** of the **AC Timer Main Board, A1**. Do not remove the existing jumper already on this terminal.

d) Connect the external transformer thermostat to the **COM** terminal on connector **J14** of the **AC Timer Main Board, A1**, and the socket terminal for the other side of the relay coil.

3 Carefully check all wiring and plug the relay into the relay socket.

APPENDIX L
DEFAULT INITIALIZATIONS

The Table below lists the settings that are initially loaded into the Control software. Note that some of these settings may not still be so set when you receive your equipment. During final testing in our Quality Assurance department certain settings, such as **Control Mode**, may be altered to test the equipment with the options you have ordered.

NOTE: Selecting **SET DEFAULTS** in the **Extended System Wide Values** screen, ***will*** set all settings to those shown in table E-1. This may require you to reset certain settings, such as **Control Mode**, to allow the Control to operate as you ordered it.

Default Initializations

Setting Name	Screen Indication (May vary between screens)	Default
Current Schedule Number	SCHEDULE #	00
Linking		All schedules are unlinked
SCHEDULE Initialization		
Squeeze Delay Time	SQD	0
Squeeze Time	SQZ	0
UP 1 Time	UP1	0
Weld 1 Time	W1	1
Down 1 Time	DN1	0
Cool Time	CO	0
Up 2 Time	UP2	0
Weld 2 Time	W2	1
Down 2 Time	DN2	0
Hold Time	HLD	0
OFF Time	OFF	0
Weld 1 Current		00.0
Weld 2 Current		00.0
Weld Valve	ELECTRODE VALVE	01
SCR Number	SCR #	1
Impulse	IMPULSE	01
Detailed Schedule Screen		Detailed

APPENDIX L. DEFAULT INITIALIZATIONS

Setting Name	Screen Indication (May vary between screens)	Default
SYSTEM WIDE VALUES Initialization		
Full Current	FULL CURR.	10
Maximum Number of SCRs	MAX # OF SCR	1
Turns Ratio	TURNS RATIO	053:1
Control Mode	CNTRL MODE	%HEAT
Binary Schedule Selected	BIN. SCHED. SELECT	OFF
Firing Switch	FIRING SWITCH	TWO STAGE
Coil	COIL	01
Contrast	CONTRAST	0X3C00 (Value not seen by user)
Number of Valves	NUM VALVES	04
Weld Mode Status	MODE	SPOT
87° Delay	87° DELAY	ON
End Output	END OUTPUT	ON
Step End	STEP END	ON
Weld On/Off	WELD ON/OFF	LOCAL
Low Line Alarm	LOW LINE VOLTAGE ALARM	ON
Auto Reset	AUTO RESET	OFF
Error Output	ERROR OUTPUT	ON
SYSTEM VALVE STATUS Initialization		
Valve Count (All)	CNT	00000
Valve 1 SCR	SCR	1
All Others Valves	SCR	N/A
MODE Initialization		
Weld Mode	WELD MODE	SPOT WELD
MONITOR Initialization		
Weld Count Limit	WELD COUNT LIMIT	99999
Weld Count	SET WELD COUNT	0
Weld 1 Current	W1 - CURR	00.0
Weld 1 High Current Limit	W1 - HIGH	150
Weld 1 Low Current Limit	W1 - LOW	50
Weld 1 Conduction Angle Limit	W1 – COND. LIMIT	180
Weld 2 Current	W2 - CURR	00.0

Setting Name	Screen Indication (May vary between screens)	Default
MONITOR Initialization (Continued)		
Weld 2 High Current Limit	W2 - HIGH	150
Weld 2 Low Current Limit	W2 - LOW	50
Weld 2 Conduction Angle Limit	W2 – COND. LIMIT	180
STEPPER Initialization		
Stepper	STEPPER	OFF
Step 1 Count	COUNT	250
Step 2 Count	COUNT	400
Step 3 Count	COUNT	600
Step 4 Count	COUNT	800
Step 5 Count	COUNT	1000
Step 6 Count	COUNT	1200
Step 7 Count	COUNT	1400
Step 8 Count	COUNT	1600
Step 9 Count	COUNT	1800
Step 10 Count	COUNT	2000
Step 1 Heat %	HEAT%	FIXED (100%)
Step 2 Heat %	HEAT%	90%
Step 3 Heat %	HEAT%	100%
Step 4 Heat %	HEAT%	105%
Step 5 Heat %	HEAT%	110%
Step 6 Heat %	HEAT%	120%
Step 7 Heat %	HEAT%	125%
Step 8 Heat %	HEAT%	125%
Step 9 Heat %	HEAT%	125%
Step 10 Heat %	HEAT%	125%

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