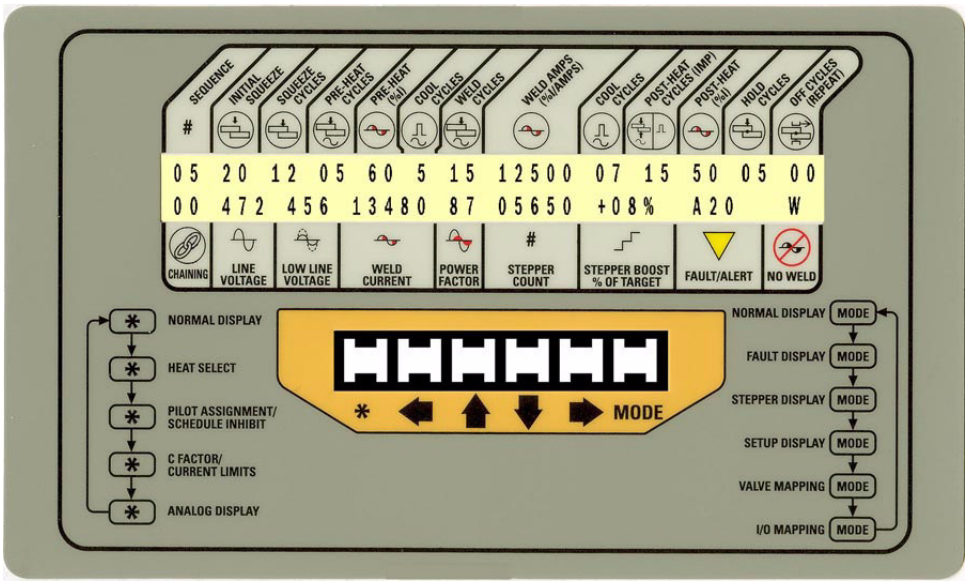
MedWeld T2200

Resistance Weld Control



Technical Reference

for Software Program #T02200 & #T02209

Revision 03

Modified: 6/1/04

Part No. M-030061

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http://www.weldtechcorp.com

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Table of Contents

Getting Started

If You Need Help . . .

Welding Technology Corp. (WTC)

WTC is committed to quality products, service and support. Our service department maintains an assistance hotline to assist with applications or troubleshooting during normal business hours.

By Phone or Fax:

To arrange for field service or warranty repair, call one of these numbers:

Industrial Technical Service (ITS)	**Voice:**	**(248) 477-3900**
	Fax:	**(248) 477-8897**

The ITS telephone number offers 24-hour service, seven days a week. Before calling, make a note of any fault conditions, applicable software and hardware revision numbers. Record the part number of the enclosure (on the serial tag on the inside or front door of the enclosure). Also note the sequence of events leading to the problem, and the drawing numbers of the schematics you received with the enclosure. For your convenience, fill out the "Problem Report Form" on page -ix.

By E-mail:

When an immediate response is not critical, contact WTC at the following e-mail addresses:

welding-sales@weldtechcorp.com	**Sales/Marketing Comments**
welding-support@weldtechcorp.com	**Technical Support**

WTC's technical support will respond within 24 hours, Monday through Friday, to your e-mail requests. Please include your name, company name, location, product part and serial number and a description of the problem with your request. Be sure to indicate how you want us to respond, and include applicable phone and fax numbers with your e-mail address.

On the Web:

Visit our Web site at: **www.weldtechcorp.com**.

Safety Dangers

Danger!

FAILURE TO OBSERVE SAFETY MEASURES MAY RESULT IN DEATH, SEVERE BODILY INJURY OR SERIOUS DAMAGE TO PROPERTY.

Danger!

LETHAL voltages are present when applying power to the weld control. Exposure to high voltage WILL CAUSE SEVERE ELECTRICAL BURNS, INTERNAL INJURIES and/or DEATH.

Refer all necessary service on this machine ONLY to qualified maintenance personnel. Follow proper lock-out procedures.

Danger!

NEVER drill into the control cabinet without properly protecting internal components from metal debris and removing power. Failure to observe this requirement may cause a potential EXPLOSION HAZARD.

Danger!

Always ensure proper flow rate, temperature and chemistry of cooling water. Obstructed or insufficient flow of cooling water may damage welding transformers, SCRs or MFDC inverters. Refer to “Cooling Water Requirements” on page -v for more details.

Danger!

NEVER remove circuit boards or unplug connectors with power applied. Be certain to REMOVE power BEFORE servicing, installing or removing circuit boards.

Caution for Lifting Weights Above 45 lb.:
When lifting any weight exceeding 20 kg (~45 pounds), use a two-man lift or assisted lift.

Symbols Used in This Manual

Danger! and **WARNING!** messages indicate high-voltage hazards in weld controls, SCRs, MFDC inverters and weld monitoring equipment.

Danger!

This symbol will be used wherever failure to observe safety measures may result in death, severe bodily injury or serious damage to property.

WARNING!

This symbol will be used wherever insufficient or lacking compliance with instructions may result in personal injury.

Caution: and **NOTE:** messages indicate the following:

Caution:
This symbol denotes when insufficient or lacking compliance with the instructions may damage equipment or files.

NOTE: *This convention informs the user about special features, or where to find more information.*

Revision History

Revision	Release Date	Comments
1	11/25/02	Released as T02200-00-01.
2	5/19/03	Manual revision for version T02200-00-01.
3	5/04/04	Revision to include updates to software and Anti tie down functionality.

For more details on the changes to this manual, contact WTC's technical support department.

How to Use this Manual

This manual is designed as a reference guide. Use it as you would a dictionary. See the Table of Contents to locate the instructions or information you require. For additional details, you are referred to the appropriate sections and page numbers.

The Table of Contents lists each section and subsection. In these sections, descriptive subheadings indicate the information provided. Simply flip to the page number and subheading indicated.

Detailed procedures describe the steps required to perform each programming task. Other descriptions explain the procedures for installation, initialization and troubleshooting, along with explanations of the hardware and each weld function.

Software Updates

WTC reserves the right to make substitutions or changes as required to the hardware or software described in this manual.

This manual may be periodically updated to reflect software changes that will affect operation of the equipment described. Request copies of the latest updates by completing the "Comments for Feedback Form" on page -xi, or by visiting WTC's Web site:

http://www.weldtechcorp.com.

Cooling Water Requirements

Specifications on the Web

The specifications for cooling water are subject to change. For the latest specifications, go to the WTC Web site: **http://www.weldtechcorp.com/documentation/index.html**.

Cooling Water Specifications

The cooling water provided must comply with chemical and physical specifications as stated in the Resistance Welder Manufacturers' Association ***Bulletin 5–005.05***:

- Maximum temperature not to exceed 104° F. (40° C.), or fall below the dew point of ambient air at about 70° F. (21° C.).
- Maximum pressure not to exceed 90 PSIG
- pH maintained between 7.0 and 8.0
- Maximum chloride content 20 parts per million (PPM)
- Maximum nitrate content 10 PPM
- Maximum sulfate content 100 PPM
- Maximum suspended solids content 100 PPM, non-abrasive
- Maximum total (suspended and dissolved) solids content 250 PPM
- Maximum calcium carbonate content 250 PPM
- Resistivity less than 2,000 ohms/cm at 25° C. (500 µSiemens)
- The hose used must be NO LESS THAN 18 in. long across the power voltages.

NOTES:

Water that is safe for drinking is generally sufficient for cooling water, provided it is filtered to eliminate sand and rust particles. In addition, water temperature must NOT *fall more than 2° C. below the temperature of the surrounding air.*

WTC does NOT *recommend adding any additives to the cooling water.*

Water Flow Rate

In general, the SCRs require a MINIMUM flow rate of 0.5 gallon (2 liters) per minute. The recommended maximum is 1.0 gal (4 l.) per minute. Larger SCRs (2,100 A. or greater) may require a higher flow rate. Consult WTC for more information.

SCRs with Hose Running Between Tangs at 480 VAC.

The following warning applies ONLY to SCRs which have the water cooling hose running between tangs at 480 VAC (non-isolated).

WARNING!

REMOVE POWER from the SCR if the cooling water is not flowing and the resistivity of the water is less than 2,000 ohms/cm @ 25° C, or conductivity is greater than 500 μSiemens @ 25° C.

If water circulation stops (in hosing between tangs) or is interrupted while the power is on, leakage current through the water in the hose between the SCR tangs will cause gas bubbles to form. Current will arc across these voids, weakening or destroying the hose. Putting the water into circulation again develops pressure in the cooling circuit, consequently causing the hose to rupture. ***Therefore, WTC does* NOT *recommend the use of water savers with these SCRs.***

When magnetic contactors are used, they remove power from the SCR module and prevent destruction of the hose.

Hoses

If a cooling hose (for non-isolated SCRs) needs replacing, use a certified non-electrically conductive hose. Its inside diameter must NOT exceed 3/8". The hose between SCR tangs must be *at least* 18 inches long across the power voltages, where the SCR tangs are directly cooled.

Working with Static-Sensitive Devices

ESD Costs!

Electrostatic discharge (ESD) can ignite flammable materials and damage electronic components. Static electricity can attract contaminants in clean environments or cause products to stick together. Other costs of ESD-damaged electronic devices are in their replacement and production down time. Associated costs of repair and rework, shipping, labor and overhead can be significant. Reducing losses to ESD and static electricity is an ABSOLUTE NECESSITY.

Observe the following warnings AT ALL TIMES:

Danger!

NEVER use the personnel grounding system described below when working with voltages above 220 VAC.

Personnel Grounding

Before touching any Electrostatic Discharge Sensitive (ESDS) devices or circuit boards, put on and wear an Electrostatic Discharge (ESD) wrist strap. Ground this strap through a one megohm (1 MΩ) resistor.

Handling or Moving ESDS Devices

Handle all circuit boards by their edges ONLY. NEVER touch the traces or edge pad connectors.

Transport, store and ship ESDS devices and circuit boards in a static shielding container. An acceptable container is either a static shielding bag or a static shielding tote. To be effective, either type of container MUST be closed.

NOTE: *Use* **ONLY** *static-shielding containers for transporting ESDS devices or circuit boards.*

Workstation Requirements

If diagnostics are required, move the circuit board to an approved ESD workstation. A static-safe workstation must include a grounded ESD mat, wrist strap and cord. The measured static voltage at a workstation MUST NOT exceed 50 volts.

Contact Information

For detailed information about ESD precautions, contact

ESD Association

Voice: 315–339–6937
Fax: 315–339–6793

Web: www.esda.org
e-mail: info@esda.org

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WTC specifically does not authorize duplication of the software stored in the EEPROM, distribution media (magnetic or CD-ROM) or in print form, without prior written authorization and payment of royalty fees.

Patents

This product contains intellectual property owned or licensed by WTC, excluding (but not limited to) one or more of the following U. S. patents:

4,388,515	4,399,511	4,459,456	4,459,457	4,463,244	4,973,815
4,493,040	4,513,363	4,516,008	4,721,840	4,733,045	6,130,396
4,804,819	4,831,229	4,849,873	4,851,635	4,885,451	6,215,086
4,973,419	4,945,201	5,128,507	5,276,308	5,347,105	6,225,590
5,386,096	5,424,506	5,440,092	5,449,887	5,471,028	6,342,686
5,483,035	5,589,088	5,667,704	5,757,176	5,793,243	6,359,566

Other patents, U. S. or foreign, may be issued or pending.

The software and documentation associated with this product are protected by copyrights owned by WTC. Trademarks have been adopted and used on all or part of this product.

Problem Report Form

Fax this form at (248) 477-8897.

Plant Name and Location: _____

Phone: _____

Your Name: _____ **Date:** _____

Time: _____

Program # (Timer power-up message): _____–___–___ ___/___/___

Part #: _____

Fault code display. When a fault or error occurs, the MedWeld T2200 displays a two-character status code. Indicate each code that is displayed:

_____

_____

Description of the problem: _____

_____

_____

_____

_____

_____

Sequence of events leading to the problem: _____

_____

_____

_____

_____

_____

Drawing number(s) of schematic(s) shipped with the Product ###:

_____

_____

_____

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Your Feedback Welcome Here!

We welcome your feedback on the accuracy and usefulness of this manual. Our Training and Documentation staff will review your comments and implement the required corrections in future updates.

For specific comments, fill in the Comments for Feedback form below. Fax it at (248) 477-8897.

Comments for Feedback Form

Your Name: _____ **Date:** _____ **Time:** ___

Company Name: _____ **Phone:** _____

Company Address: _____

City: _____ **State:** _____ **ZIP:** _____

Program/Revision #: _____

# of Manuals at your site: _____

Document Number/Name: _____

Your comments: _____

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Product Registration Form

Direct this form to the attention of Industrial Technical Services. Fax this form at (248) 477-8897.

Plant Name and Location: _____

Phone: _____

Your Name: _____

Date: _____ **Time:** _____

Program # (Timer power-up message): _____–___–____ ___/___/___

Part #: _____

Product Name: _____

Product Series: _____

How did you hear about WTC (for example, trade show, trade publication, from colleagues, sales call, etc.)?

_____

_____

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MedWeld T2200 Overview 1

The WTC MedWeld T2200 is a single-phase resistance welding control. Programmed commands instruct the processor to send firing signals to a SCR (silicon-controlled rectifier) contactor. In turn, the contactor sends high-voltage, low-amperage primary current to a welding transformer. Finally, the transformer delivers low-voltage, high-amperage secondary weld current to the electrodes.

Software Features

The MedWeld T2200 control can store

- Up to 63 independent weld schedules,
- Six linear stepper profiles and
- A list of programmable setup parameters which define the operating environment.

The 63 weld schedules have a fixed sequence of functions. Other features enhance programming flexibility:

- Chaining or successive initiation of schedules,
- Ability to program each weld pilot to initiate specific weld schedules, valve, transformer turns ratio and stepper program,
- Ability to define their order of initiation,
- Several options to program weld current by automatic voltage compensation (AVC), or automatic current compensation (ACC) and
- The ability to define a weld impulse.

Programming the control is through a 2-line by 40-character LCD (liquid crystal display) window and six programming keys. The following section describes these interface features.

User Interface Features

View status messages and programming information from the LCD window. This shows all of the values programmed for a weld schedule. You can also see operating status of the control at a glance.

The keypad has six keys: Four directional arrows (LEFT, RIGHT, UP and DOWN), asterisk (*) and a MODE key, [MODE] .

Selecting a Value

Six programming keys are located under the display window. Use them to

- Select between the display modes,
- See or change the values programmed for each weld schedule or
- Change setup parameters (controlling basic control operation).

To select a value, first use the LEFT/RIGHT keys to move the cursor (a blinking block) to the value you want to change.

If the cursor skips over a value, you CANNOT change it. For example, the second line of the **Normal/Programming** display shows control status. You CANNOT move the cursor to these status values with the arrow keys.

Changing a Value

To change a programmable value, use the LEFT and RIGHT keys as needed to move the cursor to the value to modify. Then,

- To increase the value, press UP or
- To decrease the value, press DOWN.

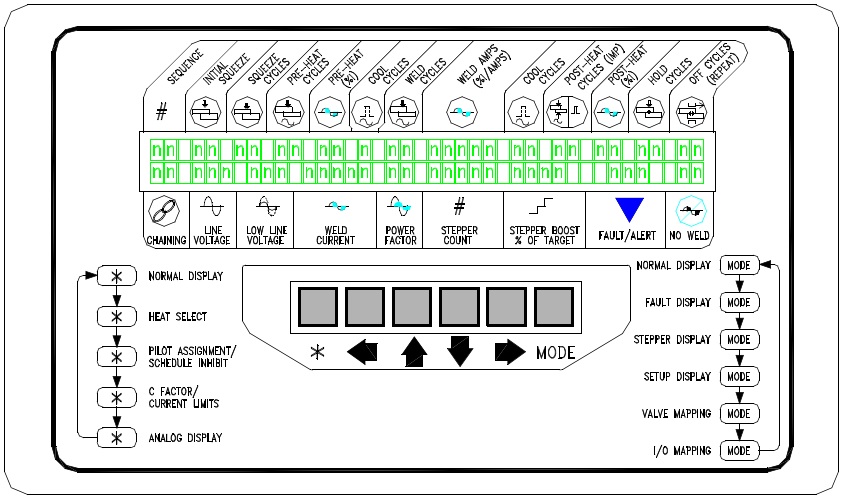
Also, use these keys to scroll through a list, or to toggle between selections such as **ON** and **OFF**.

Programming Keypad

The control uses the international welding symbols to depict the weld schedule and identify control status data on the **Normal/ Programming** display. It also symbolizes the timing sequence of the weld schedule, showing when the weld valve(s) activate and de-activate during the schedule, and when weld current is supplied to the work piece. The international symbols are described in “Welding Icons” on page 1-4.

MedWeld T2200 Front Panel

On the front panel of the MedWeld T2200 are the programming keys, LCD window and international welding icons:



Description of Programming Keys

Detailed descriptions of each key appear with the procedures described in this manual. This table summarizes the function of each key:

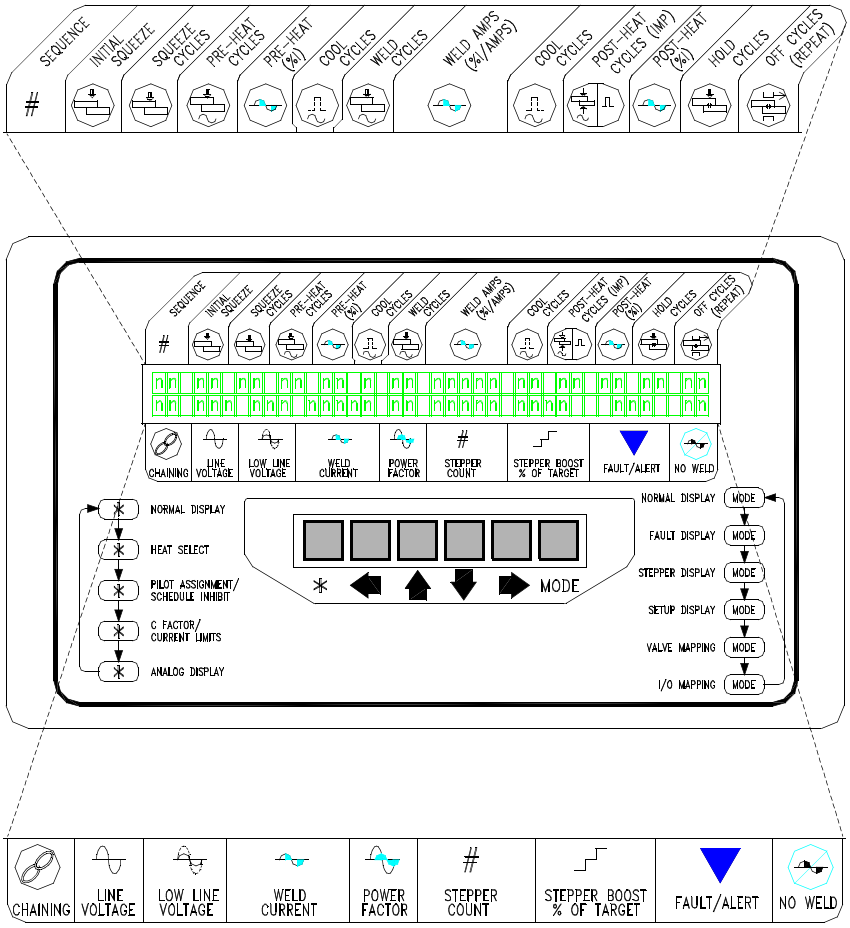
Key	Key Name	Definition
*	Asterisk	Use this key to switch between displays within a program mode. (For example, from the Normal / Programming display, this key selects the **Heat Select**, **Pilot Assignment/Schedule Inhibit**, **C-Factor/ Current Limits** and **Analog** Display modes.)
▲	UP Arrow	Press this key to increase a number, select an option or move the cursor **UP** through a list of options.
▶	RIGHT Arrow	Press this key to move the cursor to the **RIGHT**. (In the Setup Mode, this key is used to edit a setup parameter value.)
◀	LEFT Arrow	Press this key to move the cursor to the **LEFT**.
▼	DOWN Arrow	With this key, - Decrease a number, - Select an option or - Move the cursor **DOWN** through a list of options.
MODE	MODE	Press this key to select one of the six programming modes: - Normal, - Fault Display (*available only when there are active fault or alert conditions*), - Stepper Display - Setup Parameters Display, - Valve Mapping Display and - I/O Mapping Display.

Welding Icons

Icons on the face plate represent

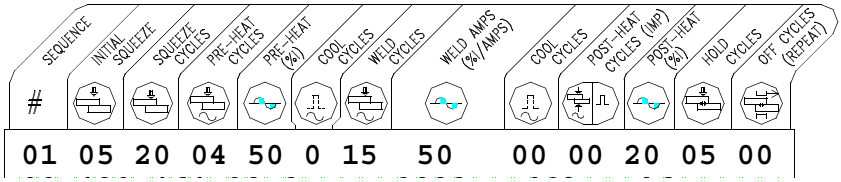
- Programmable values in the fixed weld schedule (on the top line) and
- The weld control status information (bottom line)

The icons appear below, highlighted in enlarged inset views. Certain icons appear more than once, representing the same information in a different function. i.e. Pre-Heat (%) and Weld Amps (%/Amps)

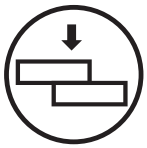


Weld Schedule Icons

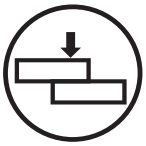
NOTE: *The functions assigned to the fixed weld schedule change, based on the type of firing selected in the* **Heat Select** *display. For example, selecting* IMPULSE *welding for post-heat does* NOT *display the post-heat current value. The number under the post-weld Cycle Time icon actually denotes the number of weld impulses (consisting of heat cycles and cool cycles) provided by the control. These features are described in detail in "The Heat Select Display" on page 2-8.*



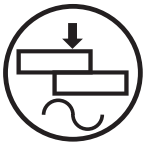
Descriptions of the icons follow:



Initial Squeeze: A Squeeze time at the start of a repeated sequence **or** the only squeeze time in a single sequence. Initial Squeeze time is used to permit an initial movement of electrodes through their preliminary starting distance. Initial Squeeze time should be greater then the subsequent Squeeze times in a portable gun repeated sequence.



Squeeze Cycle Time: The number of cycles to wait for the weld gun to fully close and build up pressure between the electrode tips.



Pre-heat Cycle Time: The number of cycles to provide pre-weld heat to the work piece. For more information, see page 2-9 and page 3-3.

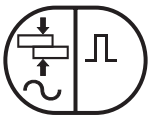
Pre-heat: The amount of current to apply during the weld cycles. For more information see page 2-9 and page 3-3.

Cool Cycle Time: The number of cycles to wait for the weld tips to cool between the pre-heat and weld cycles.

Weld Cycle Time: The length of time in number of cycles that weld current is applied to the work piece. For more information see “Weld Options” on page 2-10 and “Programming the WELD Cycle Time” on page 3-4.

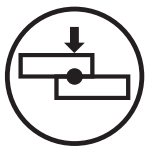
Weld: The amount of weld current to provide during the weld cycles. For more information, see “Weld Options” on page 2-10 and “Programming the WELD Cycle Time” on page 3-4.

Cool Cycle Time: The number of cycles to wait to allow the work piece to cool between the weld and post-weld heat cycles.

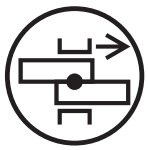


Post-heat Cycle Time: The number of cycles or impulses to supply post-weld current to the work piece. For more information, see “Post-Heat Options” on page 2-10 and “Programming POST-HEAT Cycle Time” on page 3-5.

Post-heat: The amount of current to supply during the post-weld cycles. Not used if Post-Heat firing mode is set to impulse. For more information see “Post-Heat Options” on page 2-10 and “Programming the POST-HEAT Current” on page 3-6.



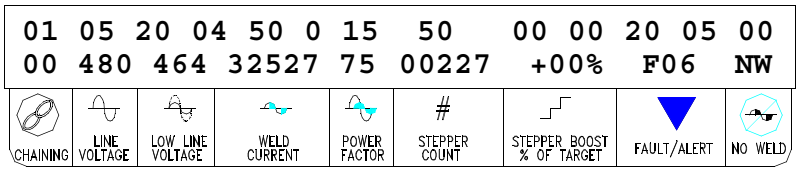
Hold Cycle Time: The number of cycles to wait before turning off the weld valves and releasing the work piece. Hold time is not executed in a chained sequence unless it is the last schedule in the chain. For more information, see page 3-6.



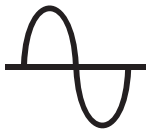
Off Cycle Time: The number of cycles when the electrodes are off the work piece before the schedule is repeated. (If this value is set to **0**, the schedule will NOT repeat.) Off time is not executed in a chained sequence unless it is the last schedule in the chain. For more information refer to “Programming the OFF Cycle Time” on page 3-7.

Weld Status Symbols

This section describes the symbols representing the status information (provided on the lower line of the display). Most of these fields show data only, but two of the fields are programmable. These two exceptions are the **Chaining** and **Weld/No Weld** fields.



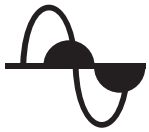
Chaining: The chaining feature adds weld functions to a schedule by “chaining” one weld schedule to another schedule. Chaining allow an operator to perform more complex tasks by using multiple weld functions from different schedules. The number shown in this area on the display (1 - 63) is the schedule that is “chained” to the schedule you are viewing. (**0** means that the schedule is not chained.)



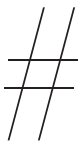
Line Voltage: This shows the present line voltage, as read from the control side of the circuit breaker. This is an RMS (Root Mean Square) value that is updated once a second.

Low Line Voltage: The lowest line voltage read during any single cycle of the last weld. This is an RMS (Root Mean Square) value.

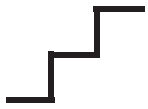
Weld Current: Weld current is calculated as the average secondary current of the last weld. This value is accurate ONLY if the transformer turns ratio has been correctly programmed in the setup parameters. Refer to “The Valve Mapping Display” on page 2-22.



Power Factor: Power factor is the ratio of watts to volts-amperes. The weld control calculates and updates power factor each time a weld is initiated.



Stepper Count: This icon indicates the total weld count. This number is incremented after the weld schedule is completed if the stepper is active.



Stepper Boost: This is the amount of heat being added by the linear stepper of the weld control. This value is based on the boost/adder programmed in the stepper profile and the current stepper weld count. (Refer to “Programming the Stepper Profile” on page 6-4.)

Fault/Alert: If the MedWeld T2200 detects any fault or alert conditions, an error code will flash in this area. The code **F***nn* indicates Faults; **A***nn* denotes alert conditions and **I***nn* shows critical internal faults. If more than one condition is detected, the display will scroll through the active conditions.

To select the Fault Display (i.e. view the condition detected by the control), press the MODE key. Then use the * key to reset the fault/alerts from the Fault Display screen. The control will return to the Normal/ Programming Display after the fault is reset.

Weld/No Weld: This is the other programmable field on the status line. The Weld / No Weld displayed in this field shows the operator whether weld current is enabled or disabled in the software. To set Weld / No Weld, move the cursor to this field to select either condition: **W** (to enable weld current) or **NW** (to disable weld current when a schedule is initiated).

NOTE: *This does NOT indicate whether weld current was **actually** provided during the last weld. It is a programmable software NO WELD, and merely indicates when weld current is **enabled**. An external Weld / No Weld input will NOT change the display status. The software and the external Weld/NoWeld inputs must both be in WELD to enable or disable weld current when an initiate occurs. For more information see page 5-6.*

Installation

To install the MedWeld T2200 control, follow these steps:

1. Connect the inputs and outputs. Refer to the wiring diagrams shipped with the control.
2. Hook up the SCR cooling water. (Refer to “Problem Report Form” on page x for the recommended water flow rate, temperature and chemical specifications.)
3. Connect the incoming line voltage into the contactor cabinet at terminals L1 and L2. The control will operate on 600, 480 and 240 VAC at 50 or 60 Hz with a simple jumper change on the control

transformer 1T. The control is normally shipped jumpered for 480VAC.

NOTE: ***For 380 VAC operation 1T and control fuses MUST be changed***.

4. Ensure that the enclosure is properly grounded.

Cooling Methods for Controls/Inverters

The high-power current switches used in WTC resistance welding controls require cooling. Cooling utilizes either air or water flow.

Air Cooling

Air cooling employs large heatsink fins on the outside of the welding control cabinet (on the back or one of the sides). Higher-power applications may add one or more electric fans to increase the heat flow from the heatsink.

When installing an air-cooled welding control, it is CRITICAL to allow room around the heatsink (and the fans) for air to flow. A space of 2 inches (50 mm) between the heatsink fins and a wall or another cabinet is generally adequate. Items which could be damaged by air temperatures above 120° F. (50° C.) should not be located above air-cooled welding control cabinets or near the fan outlets.

The cooling fans on most welding controls are thermostatically controlled and turn on only as needed. In applications where the welding current or the welding duty cycle is very low, the fans may never turn on at all.

The heatsink fins MUST be kept clear of dust, dirt and debris. Check the fan(s) at least twice a year for proper operation. If an air-cooled control gives an overtemperature fault, inspect the heatsink and the fan(s).

Water Cooling

Water cooling uses water flow through a copper or aluminum heatsink plate. This heatsink plate is fastened to the high-power current switches to draw heat away from the SCR. Depending on the control configuration, the load resistors may also be fastened to the heatsink plate.

The heatsink plate is either directly bolted to the current switch (non-isolated) or is separated from the current switch with an electrical insulator (isolated). Almost all resistance welding controls with an SCR or inverter current rating of 1200 A. or below use the isolated cooling method. For SCR current ratings of 1500 A. and more, the non-isolated cooling method is used.

The non-isolated cooling method has two special requirements:

1. The water hoses going to the copper heatsink(s) must be made of a non-electrically conductive material. The hoses must be at least 19 inches (500 mm) long.

2. The water flow must NEVER be stopped while power is applied to the SCR. If the control is equipped with an isolation contactor, water flow MUST be present whenever the isolation contactor is pulled in.

NOTE: *Failure to observe these requirements will result in water leaks!*

WTC's warranty does not cover damage due to improper cooling water hookup or leaks caused by misuse.

Other than these two special requirements, the water requirements for isolated and non-isolated cooling are very similar.

The amount of cooling water needed (flow rate) is determined by the circuit breaker size of the welding control and by the number of water flow circuits in the cabinet. For controls with a 400 A. or smaller circuit breaker, a water flow of between 0.5 and 1.0 gallon per minute (2 to 4 liters / minute) is recommended per water flow circuit. Water flow above 1 gallon / minute (4 liters / minute) is not recommended because it can cause erosion of the water passages in the copper heatsink.

For welding controls equipped with 600 A. or larger circuit breakers, a water flow of between 1 and 1.5 gallons / minute (4 to 6 liters / minute) is recommended per water flow circuit. Water flow above 1.5 gallons / minute (6 liters / minute) is not recommended because it can cause erosion of the water passages in the copper heatsink.

Where water pressures are high, the use of water flow regulators is recommended.

To avoid condensation, the temperature of the cooling water should be no cooler than 5° F. (3° C.) below ambient air temperature.

WTC does not recommend any additives to the cooling water for its welding controls. Ordinary drinking water from a public utility is suitable. If water treatment chemicals must be used in a closed-loop cooling system, AVOID CHEMICALS WHICH ATTACK ALUMINUM. Refer to the cooling water composition requirements, below. Always filter or screen cooling water to eliminate sand or rust particles which can clog water flow regulators or erode water passages. WTC's warranty does NOT cover damage due to corrosive cooling water, or to cooling water which causes heatsink erosion because of sand and rust particles.

Connecting Inputs and Outputs

As wired at the factory, the MedWeld T2200 provides 16 user inputs (24 VDC / 24 VAC / 120 VAC) and 10 dry-contact outputs. The inputs and outputs are located on the control's I/O board.

Two 1 Amp. fuses are located above the 24 VDC connector on the programming/display board. These fuses limit power to the control processor and the inputs. Fusing for the outputs is at 1FU inside the control cabinet.

The following tables list the location of the inputs and outputs at the I/O board connector.

Caution:
To avoid possible noise interference, maintain a **minimum** distance between the I/O wires and the high-voltage wires of 15 cm (6 inches).

Inputs

Program T02200 has 16 inputs. The inputs in group 1 (which include inputs numbered 1-8) are on a 10-pin Phoenix connector, labeled **J3**. Inputs in the second group 9-15 are on **J4**, a 10-pin Phoenix connector. Three local inputs are on the Programmer/Display board 1PD, **J10**. The pinouts of these connectors and their correspondence with the data received by the weld timer from the 821 I/O board are programmed in the I/O Mapping Mode. (For the labels and abbreviations of the inputs, see "Table 1: Input Functions and Abbreviations" on page 4-7.)

To activate an input, either 24 VDC, 24 VAC or 120 VAC is applied between the input and its common. Activating an input makes its corresponding bit "**1**." De-activating an input makes its corresponding bit "**0**."

This following table describes the Standard Group #1 input pins and data correspondence (connector J3, 12-pin Phoenix of the 821 I/O board):

Abbreviation	Input Name	Pin	Signal Name
-		J3-1	+24 VDC Initiate signal source
BS1	Binary Select 1/ Pilot 1	J3-2,	Input 1, Group 1
BS2	Binary Select 2/ Pilot 2	J3-3	Input 2, Group 1
BS3	Binary Select 4/ Pilot 3	J3-4	Input 3, Group 1
BS4	Binary Select 8/ Pilot 4	J3-5	Input 4, Group 1
BS5	Binary Select 16/ Pilot 5	J3-6	Input 5, Group 1
INT	Weld Initiate	J3-7	Input 6, Group 1
WNW	Weld No Weld	J3-8	Input 7, Group 1
-	Spare	J3-9	Spare
-	Input AC/.DC Common	J3-10	Group 1 common
-		J3-11	24 VDC common
-		J3-12	24 VDC common

This table describes the Standard Group #2 input pins and data correspondence (connector J4, 10-pin Phoenix):

Abbreviation	Input Name	Pin	Signal Name
-	-	J4-1	*No connection*
FR	Fault Reset	J4-2	Input 9, Group 2
PS	Pressure Switch	J4-3	Input 10, Group 2
2ND	Second Stage	J4-4	Input 11, Group 2
RP1	Retract Pilot #1	J4-5	Input 12, Group 2
-	Spare	J4-6	Input 13, Group 2
TROT	Transformer Overtemp.	J4-7	Input 14, Group 2
-	*Reserved*	J4-8	Input 15, Group 2
HSEC	Heat Display Security	J4-9	Input 16, Group 2
-	Input AC / DC Common	J4-10	Input AC / DC Common

1PD Local Inputs

The following table lists the local inputs defined for 1PD, the Programmer/Display board:

Abbreviation	Input Name	J10 Pin(s)
CS	Control Stop	12, 13
MC NC	MC Auxiliary N. C. Contacts	6, 7
1SW	SCR Thermo Switch	8, 9

NOTE: *To verify your specific I/O configuration, refer to the I/O wiring diagrams supplied with your control.*

For instructions on changing the I/O configuration, refer to "The IO Mapping Display" on page 2-25.

Outputs

This table describes the output pins and data correspondence (connector J5, 17-pin):

Abbreviation	Output Name	J5 Pin	Signal Name
-	Output VAC/VDC Source	J5-1	Group 1 common
BV1	Valve #1/Binary Valve #1	J5-2	OUT 1
BV2	Valve #2/Binary Valve #2	J5-3	OUT 2
BV4	Valve #3/Binary Valve #4	J5-4	OUT 3
BV8	Valve #4/Binary Valve #8	J5-5	OUT 4
-	Output VAC/VDC Source	J5-6	VAC/VDC Source
FLT	Fault	J5-7	OUT 5
ALT	Alert.	J5-8	OUT 6
WCMP	Weld Complete	J5-9	OUT 7
EOH	End Of Hold	J5-10	OUT 8
-	-	J5-11	OUT 9, NC
-	Output VAC/VDC Source	J5-12	OUT 9, VAC/VDC Source
RV1	Retract Valve 1/ Ohma Block 1	J5-13	OUT 9, NO
-	-	J5-14	OUT 10, NC
	Output 10, VAC Source	J5-15	OUT 10, VAC Source
	Forge Valve, N. O.	J5-16	OUT 10, NO
		J5-17	*No connection*

1PD Local Outputs

The following table lists the local outputs defined for 1PD, the Programmer/Display board:

Abbreviation	Output Name	J10 Pin(s)
MC	MC Coil	4, 5
ST	Shunt Trip	2, 3

NOTES: *To verify your specific I/O configuration, refer to the I/O wiring diagrams supplied with your control.*

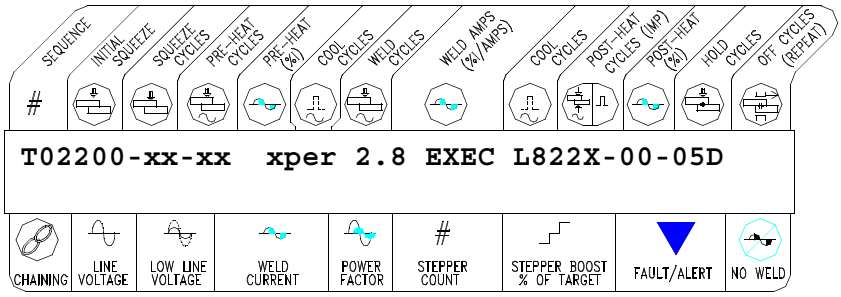
For instructions on changing the I/O configuration, refer to "The IO Mapping Display" on page 2-25.

Anti Tie Down Optional Equipment

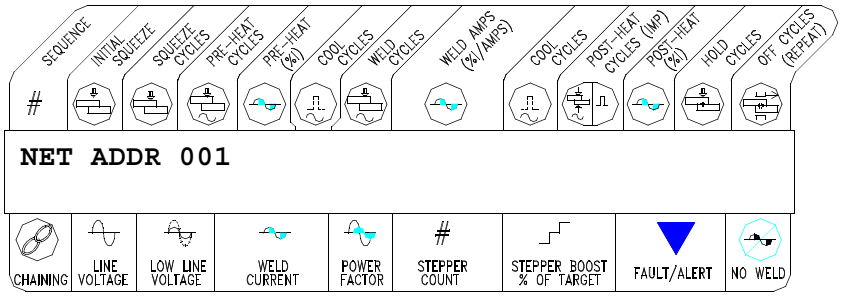
If your control is equipped with the optional anti tie down feature, the T2200 you receive will include an 824 I/O board instead of the 821 I/O board and an 8333 daughter board and software T02209. For detailed information on Anti Tie Down, please see page 7-18.

Powering Up the Control

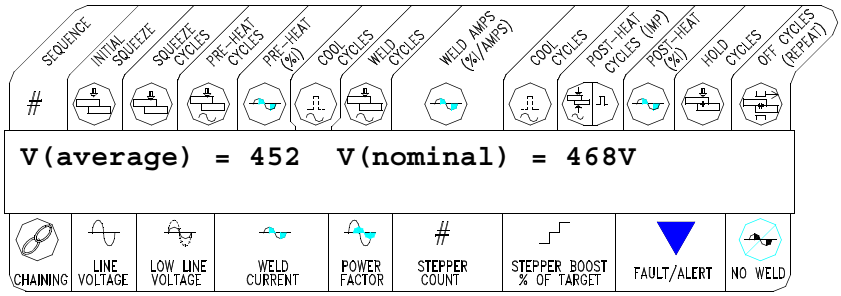
Powering up the MedWeld T2200 resets the outputs to their “normal” state and checks memory integrity. The first screen briefly shows the program number, software version and revision level:



After a few seconds, the next screen briefly displays the MedLAN address assigned to the control on the network, as in this example:



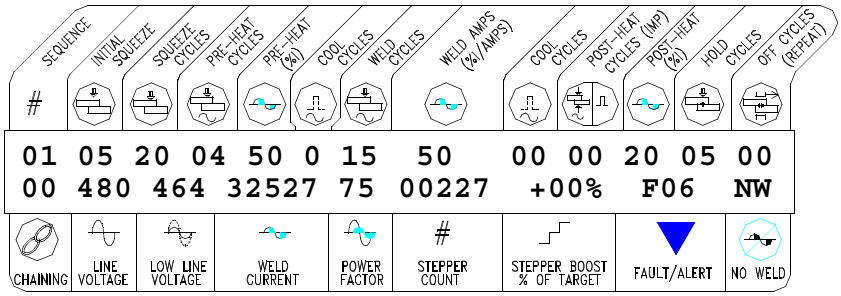
A third display appears briefly at power-up ONLY if the setup parameters select automatic nominal line voltage (NOMINAL LINE VOLTAGE is set to 000). This display is similar to the one shown here:



This indicates the nominal voltage that the control selected, based on the average voltage detected on the weld bus. **V(average)** is the average voltage detected. **V(nominal)** is the nominal line voltage selected by the control.

NOTE: *This feature may be disabled by setting the “Nominal Line Voltage” in Setup Parameters to any value greater then zero. See page 5-13.*

At the end of the power-up cycle, the **Normal/Programming** display appears showing the weld schedule and control status. (See “The Normal/Programming Mode” on page 2-4 for a complete description of this display.)



NOTE: *This example is for reference only. The values you see will vary, based on your control’s software.*

After power-up, the display will show the weld pilot assignment of Schedule #01 upon default. Refer to “The Pilot Assignments/Schedule Inhibit Display” on page 2-13.

Once the Normal/Programming screen appears the operator can program weld schedules, or provide a WELD PILOT input to initiate a weld schedule. (Refer to the procedure in page 2-13.)

The Autonominal Function

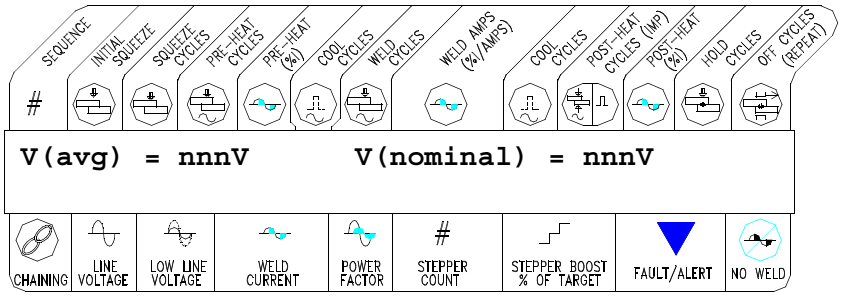
An Autonominal feature averages the bus voltage over 15 cycles when the control is powered on. This allows the weld control to properly select an operating voltage based upon incoming power to help reduce setup time. The function then compares the average voltage with the ranges listed in a pre-set table. Finally, it selects one of the five auto nominal voltages in the right-hand column of this table.

This Autonominal value is only used (and the Autonominal screen only appears) when setting the nominal voltage in the setup parameters to **000 V**.

NOTE: *This feature may be disabled by setting the “Nominal Line Voltage” in the setup parameters to any value greater then zero. See page 5-13.*

The Autonominal Screen

Powering-up the control first displays the program version and the retract setup parameters. Next, this screen appears:



The Autonominal feature uses these voltage ranges:

Range	Voltage
000 – 140	117 (Derated 120 V. bus)
141 – 264	215 (Derated 220 V. bus)
265 – 420	371 (Derated 380 V. bus)
421 – 520	468 (Derated 480 V. bus)
521 – 999	575 (Derated 600 V. bus)

Providing MedLAN Connections

MedLAN (WTC's Local Area Network) is a proprietary communications protocol. It defines how devices on the network communicate with each other.

The MedWeld T2200 has two MedLAN ports. One is a local port only; the second is a network port. The timer's address on the local port is always set to **00**. When connected to the local port, the user can program a network address (from **00** to **29**) that will identify the timer on its network port.

NOTE: *The MedLAN address identifies each weld control's location on the network. Therefore, each weld control's address must be programmed* BEFORE *communication over the MedLAN channel is possible.*

Networking takes place over the MedLAN channel. Use a WTC data entry device (DEP-100S or *WebView*) for network communications.

For the MedLAN network, you MUST program the MedLAN address for each control on the network. Program the address through the **Advance Display Options** menu, or with the **Network Addr** screen on the DEP via the local port. Refer to page 2-29.

NOTE: *In some configurations, a connector is provided on the door of the*

enclosure for convenience in connecting the DEP-100S. This port is internally wired to the local port of the weld processor card.

This must be done before you can use a MedLAN network port. If you do not program a MedLAN address, communication errors may result.

MedLAN and DEP-100S Connections on Network Port

The network connection requires a WTC Network Power Pack for power to the DEP-100S programming device on the network port.

A Brad-Harrison, 3-pin bulkhead connector is located at the top right corner of the Network Power Pack. This connector provides external 110/220 VAC power. The DEP-100S then plugs into the connector on the face of the Network Power Pack.

The MedLAN cable connection originates at the 6-pin connector on the bottom of the network power pack. This cable runs to the 3-pin MedLAN connector (J2) on the T2200 weld processor card in the control.

For network configurations, the MedLAN cable connection is daisy-chained to the other controls on the network.

MedLAN Wiring Specifications

The MedLAN interface is an optically-isolated, RS–485 connection. The interface is a 3-position, removable Phoenix connector with a pin spacing of 5 mm.

Cable Requirements

WTC recommends using Belden #9463 cable or equivalent. The following tables list the cable pinouts.

MedLAN Connector (on the Network Power Pack):

Designator	Pin #	Function	Wire Color (BELDEN #9463)
MDP2	6	+ 24 V.	
MDPS	5	Shield	
MDP1	4	Com	
MDL2 *	3	MedLAN Line 2	Clear
MDLS *	2	Line Shield	
MDL1 *	1	MedLAN Line 1	Blue

* Some versions of the control use a 6-pin MedLAN connector with all the positions connected as listed here. Other versions use a 3-pin MedLAN connector. It uses only these three pins as noted with an asterisk (*****).

MedLAN Connector (on the weld processor card):

Designator	Pin #	Function	Wire Color (BELDEN #9463)
MDL2	3	MedLan Line 2	Clear
MDLS	2	Line Shield	
MDL1	1	MedLAN Line 1	Blue

WARNING!

NEVER connect any of the communication ports to the MDP- power wires. Damage to the ports or other internal components may result.

Designator	Function
MDL1 - MedLAN Line 1	This is the TX/RX + line of the RS–485 signal. Attach it to the blue wire of the cable.
MDL2 - MedLAN Line 2	This is the TX/RX – line of the RS–485 signal. Attach it to the clear or white wire of the cable.
Shield	Connect the shield to the drain wire of the cable.

Cable Routing Requirements

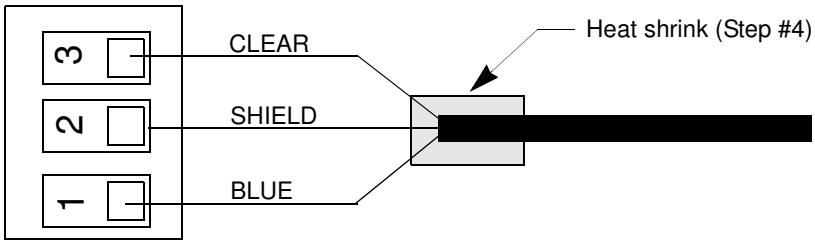
Wire the MedLAN network ONLY in a “daisy-chain” method. NEVER use “stub” wiring.

The maximum total length of the MedLAN network cable is 3,000 feet. Up to 30 weld controls may be connected to a single MedLAN network.

The MedLAN cable wire ends terminate into MTSB (Phoenix) connectors. Terminate the cable with this procedure:

1. Strip the cable jacket to 1 inch.
2. Remove foil shield strands outside the foil.
3. Cover the shield with heat shrink.
4. Cover the cable insulation end with one inch of heat-shrink tubing.
5. Strip 1/4 inch of insulation off each wire.

6. Install wires in each connector as shown in Figure below.
7. Torque the terminal screws to 5 in.-lb. Terminating the MedLAN cable



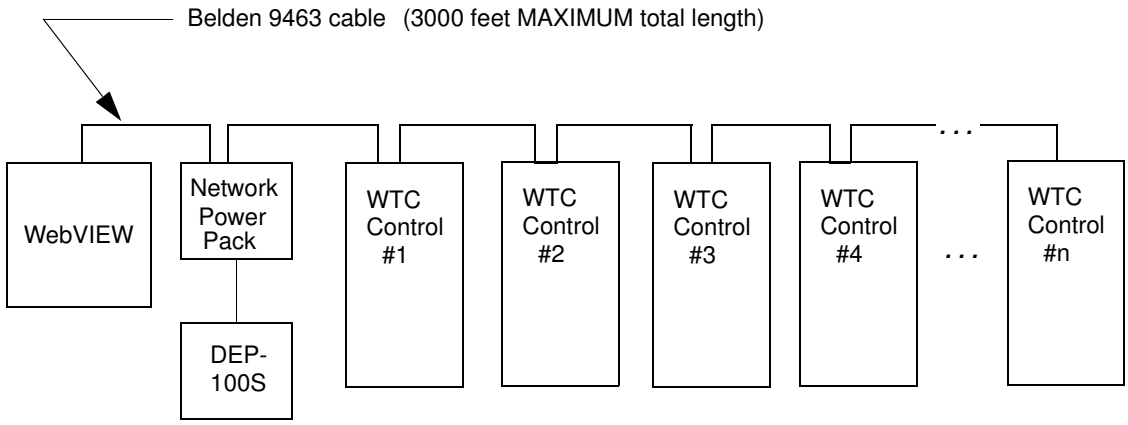
You must provide strain relief at the MedLAN cable entry and exit points at the weld control enclosure. If the enclosure requires drilling entry/exit holes, exercise cautions to assure that no metal shavings are left inside the control.

WARNING!

Be certain to cover all components to protect them from metal shavings. Metal debris (from drilling into the cabinet) can cause catastrophic failure. The WTC warranty does NOT cover damage caused by metal debris.

Physically separate the MedLAN cable from wiring greater than 50 volts. If the MedLAN cable must cross this wiring, it must do so at a 90° angle.

The figure below illustrates the recommended MedLan wiring configuration.



NOTE: *This diagram shows a MedLan Network using the DEP-100S, the DEP-100S is optional equipment on all T2200 weld controls.*

Setting the Weld Processor MedLAN Address

The MedWeld T2200 uses MedLAN (WTC's proprietary Local Area Network) to create a communications network between devices. You must set the MedLAN address for each device before connecting to and powering up the network.

Set the MedLAN address, either directly through the keypad of the T2200 under the **Advance Display Options** menu, or via the DEP-100S (DEP). When using the DEP, program the MedLAN address for each individual weld control, through the DEP local port only (not the network port). Refer to the next section, Network Address below.

NOTE: *For the steps required to set the address via the DEP-100S, refer to the manual provided with the DEP-100S programming device.*

Network Address

The MedWeld T2200 can communicate with multiple weld devices on a LAN (local area network).

The ***network address*** is the MedLAN address of the weld control. Editing the network address sets the control's MedLAN address. With multiple weld controls connected to the network, WTC's WebView (or DEP100S) can identify and single out a particular weld control.

NOTE: *The MedLAN address identifies each weld control's location on the network. Therefore, you must program each weld control's address* BEFORE *communication over the MedLAN channel is possible.*

To set the network address, follow these steps:

1. Open (or return to) the **Normal/Programming** display mode.
2. Simultaneously press and hold the MODE and * keys for 2 seconds. This presents the **Advance Display Options** menu.
3. Scroll down this menu with the DOWN key. Repeat as needed to move the cursor to the option, **10 Network Address**.
4. At this menu option, press the RIGHT key.
5. With the UP and DOWN keys, change the MedLAN address to the desired value for your control. The range is **00 - 29**.
6. Press the RIGHT key to accept the entered value.
7. Exit the **Advance Display Options** menu and return to the **Normal/Programming** display mode.

Programming the Weld Processor

The weld processor provides multiple functions for defining weld schedules. It also lets you configure the device to meet your application requirements by programming setup parameters. The control also provides two programmable steppers to compensate for lost current density over the life of the electrodes.

All of these features are programmable from several different programming devices:

- The T2200 LCD Display, which is built into the weld control or kit purchased from WTC.
- Plug the DEP-100S programming device into the connector on the enclosure door or on the weld processor module or the WTC Network Power Pack.
- WTC's ***WebView*** program lets you remotely view or modify the program running in a MedWeld control. *WebView* operates through a standard Web browser.

For more complete information, refer to the manual provided with each programming device.

Display Modes 2

Selecting Display Modes and Options

The MedWeld T2200 control has nine display modes. To select from them, use the MODE key. Pressing it each time changes the display mode.

Menus and Options

Program #T02200 includes these modes and displays:

1. **Normal/Programming** Mode
   - **Fault** Mode (only if any faults or alerts occur),
2. **Heat Select** display and
3. **Pilot Assignment/Schedule Inhibit** display,
4. **C-Factor** display.* (Pressing MODE from this screen returns to the **Normal/Programming** mode.)
5. **Stepper Status** Mode*, which presents these options *only* ***if the stepper display is enabled***:
   - * **Stepper Status** display or
   - * **Stepper Reset** display.
6. **Setup** display,
7. **Valve Mapping** display,
8. **I/O Mapping** display and
9. **Analog** display.

Pressing the * key toggles between the options (if enabled) within those modes that include these options.

NOTE: ** denotes that when enabling the* **Advance Display Options** *program, its menu list can mask the screen already displayed. Refer to page 2-29.*

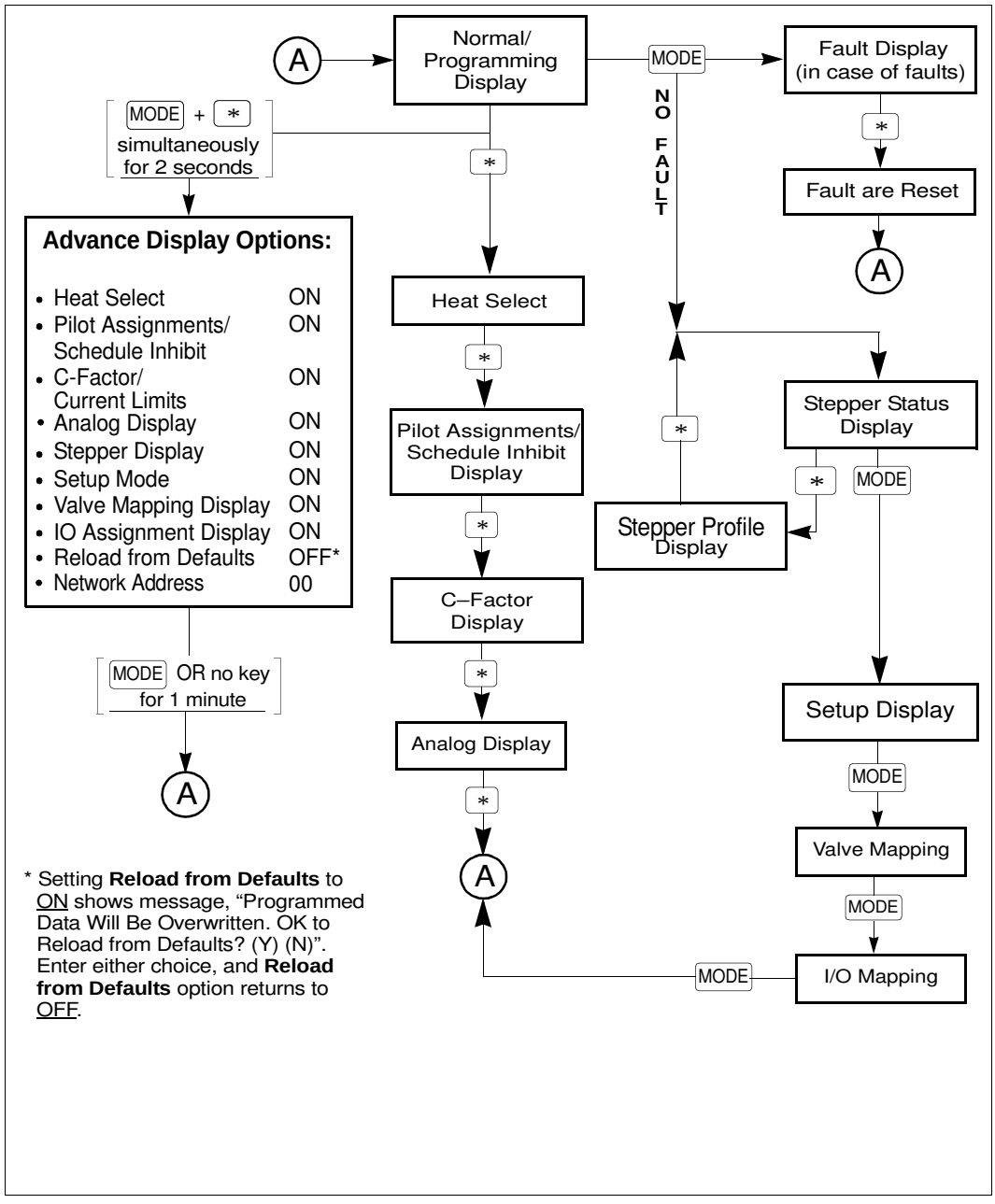
Press MODE at any time to show the **Fault** mode (if any fault or alert conditions were detected), the **Stepper Status** mode, the **Setup** mode or back to the **Normal/Programming** mode.

NOTE: *When no faults or alerts are present, pressing the* MODE *key from the* **Normal/Programming** *display will go directly to the* **Stepper Status** *mode, skipping over the* **Fault** *display*

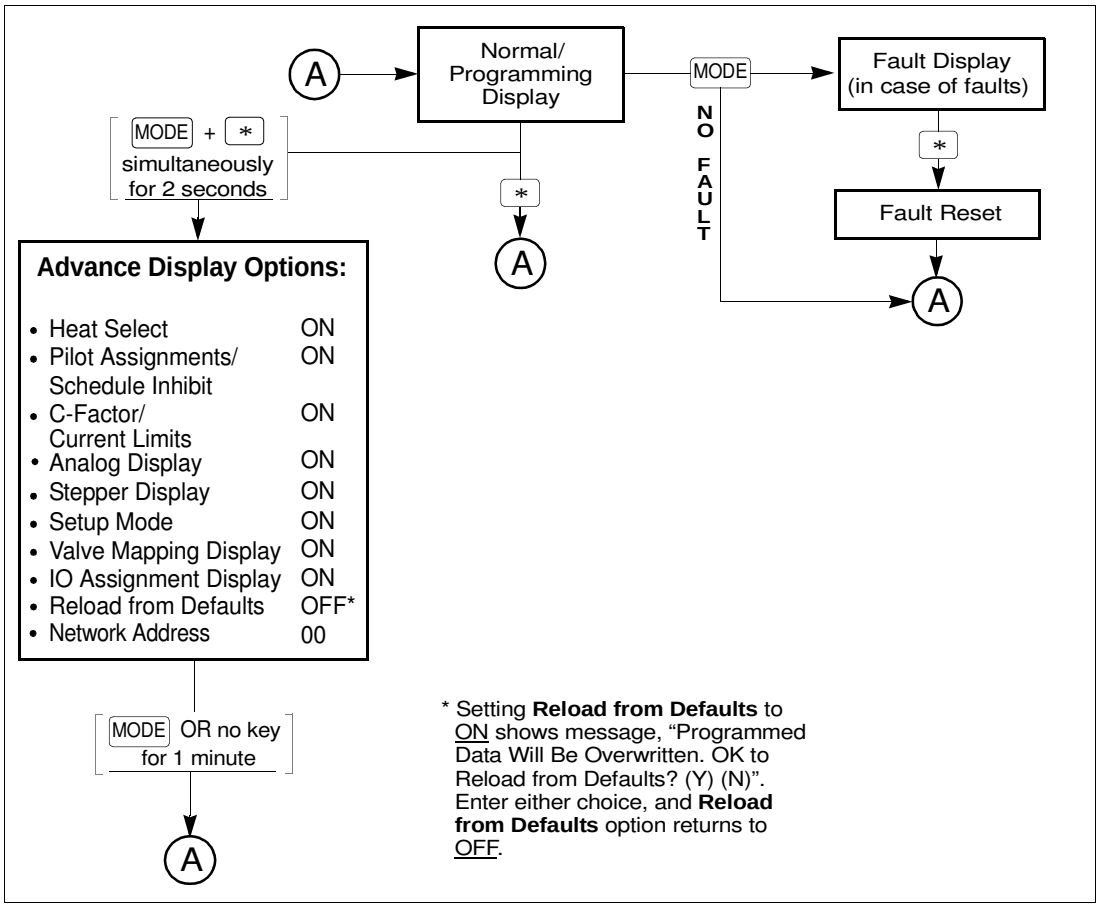
Available Displays in #T02200

The available displays depend on whether they are programmed as ON or OFF in the **Advance Display Options** *menu. Figure 2 illustrates the display modes and options of program #T02200 when all the displays are ON. See page 2-29 for more information.*

FIGURE 1:



Turning OFF all the items in the **Advance Display Options** menu enables only the modes and displays depicted here:



Moving Through Modes and Displays

To advance to the next mode, press the MODE key. This displays the next mode in the schedule, but does not scroll through all screens. To scroll, you must release the MODE key.

To advance to the next display, press the * key. This presents the next screen in the schedule, but does not scroll through all screens. To scroll, you must release the * key.

Program #T02200 includes an **Advance Display Options** menu. Use it to let certain users access certain screens (but not others) at your option. See page page 2-29 for more information. To open this menu from the **Normal/Programming** mode, simultaneously press and hold the MODE and * keys for 2 seconds.

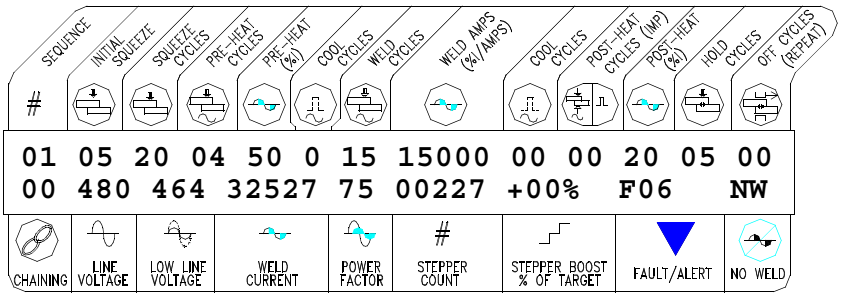
To exit this menu, press the MODE key. Alternately, if no key is pressed within 1 minute, the control returns to the **Normal/Programming** mode.

The MODE Key

Use the **MODE** key to access various displays in the T2200. To present each display screen, briefly press the MODE key. The first display is the **Normal/Programming** mode, described next.

The Normal/Programming Mode

After the initialization messages on power-up, the **Normal/ Programming** mode display appears (as shown here):



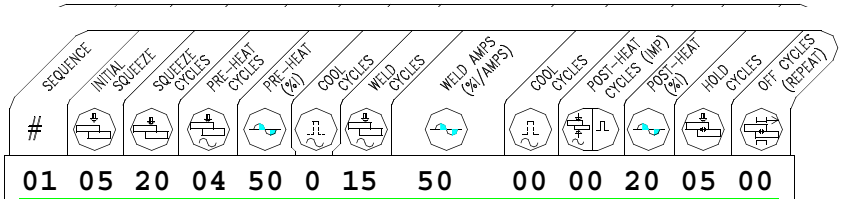
Use this display to program weld schedules and view the status of the last weld. On this screen,

- The upper line indicates the weld schedule. You can change the values on this line. For further details, refer to “Weld Schedule Information” on page 2-5.
- The lower line is the weld data collected the last time this weld schedule was initiated. You can change ONLY the **Chaining** and **WELD/NO WELD** status. For detailed information about this line, see “Weld Data” on page 2-7.

For more information, refer to “Programming Weld Schedules” on page 3-1.

The Normal/ Programming Screen

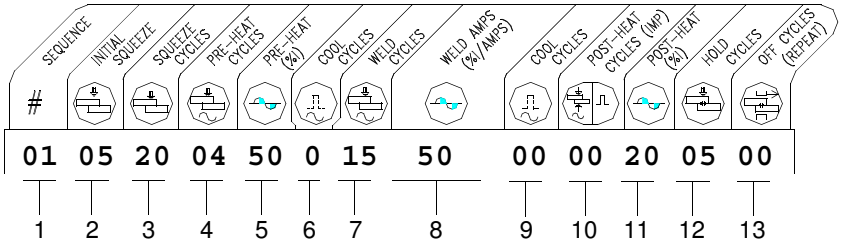
The upper line of the **Normal/Programming** screen displays information about the present weld schedule:



Program values on the Weld Schedule information line by using the arrow keys. With the LEFT and RIGHT keys, move the flashing cursor to the field you want to change. After selecting the item, use the UP and/ or DOWN keys as needed to increase or decrease the value displayed.

Weld Schedule Information

The upper line in the **Normal/Programming** screen displays the Weld Schedule information. This table describes each field in the line. Field numbers 1 – 13 in the diagram correspond to numbers 1 – 13 in the **Field No.** column of the table shown below and on the next page. An example of this screen appears here



Field No.	Function	Description
1	SCHEDULE NUMBER	This field allows an operator to select a weld schedule to view or edit. After initiating a weld, this field will display weld data from the last schedule fired. Refer to page 2-13 for more information on pilot assignments and schedule inhibit.
2	INITIAL SQUEEZE	The cycle time for initial gun closure. This cycle time is NOT repeated when the control is in REPEAT mode, or for the second schedule in a chain of schedules.
3	SQUEEZE	The cycle time for the gun to fully close and build up pressure.

Field No.	Function	Description
4	PRE-HEAT Time	The cycle time for the pre-heat pulse. *****
5	PRE-HEAT Current	The amount of energy for the pre-heat pulse (set either as AVC mode or slope).***†**
6	COOL	The number of delay cycles between the pre-weld and weld functions. *****
7	WELD Time	The time for the weld pulse, in cycles.
8	WELD Current	The amount of energy for the weld pulse. Specify the firing mode as AVC, AVC seam, Amperes of ACC or ACC seam.*****
9	COOL	The number of delay cycles between the weld and post-weld functions.
10	POST-HEAT Time	This is the cycle time for the post-heat pulse. †
11	POST-HEAT Current	The amount of energy for the post-heat pulse. Set the firing mode as AVC, slope or impulse. ***†**
12	HOLD	Cycles of hold time after the weld pulse. ‡
13	OFF	The number of cycles during which the electrodes are off the work before the schedule is repeated. **Note:** If the off time is set to zero, the control will NOT repeat the schedule. ‡

Special Notes About this Table

Certain conditions apply to the functions listed in the preceding table, according to these notations:

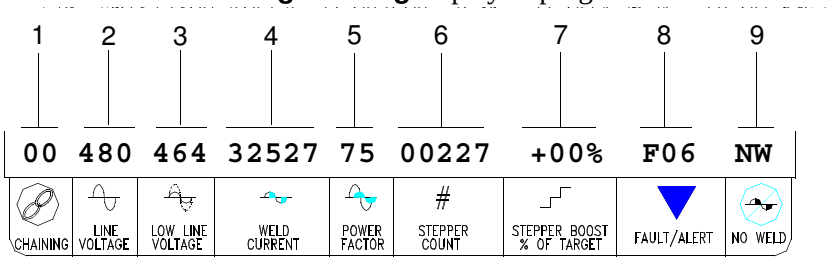
***** The function assigned to this field may change, based on the firing mode selected (in the **Heat Select** display). See “The Heat Select Display” on page 2-8 for more information.

† If this schedule will chain to another schedule, as described in “Chaining Schedules” on page 3-9. This function is NOT executed until the control reaches the last schedule in the chain.

‡ If this schedule was chained to another (the chain started with a different schedule), this function is NOT executed. It executes only during the schedule at the end of the chain.

Weld Data

This is the **Normal / Programming** display in program #T02200:



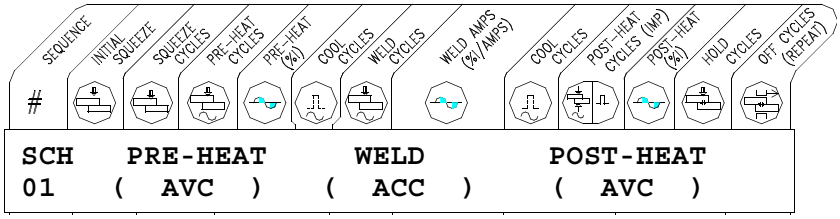
The fields in the lower line of the screen have these meanings:

Field No.	Function	Description
1	Chained-to Schedule #	This field is normally set to **00**. 00 indicates that the weld control will repeat the schedule shown in the field Schedule Number. Otherwise, it shows the number of the weld schedule that is "chained to" after the post-heat function in the present schedule. Refer to page 3-9.
2	Line Voltage	The averaged line voltage actually read during the last weld.
3	Low Line Voltage	The lowest line voltage actually read during the last weld.
4	Average Secondary Current	The averaged value of secondary current applied to the last weld. (primary current times transformer turns ratio). See page 2-20 for more information.
5	Power Factor	Due to the inductive nature of the secondary loop, current lags voltage. Power factor = cosine of the phase angle.
6	# Stepper Count	The number of welds in the presently-selected step. This tells the control the weld number in this step over which to linearly increase the amount of boost programmed in the BOOST field.
7	Stepper Boost	Set the amount of stepper boost to apply, in the %I firing mode. It is in the form **±nn** percentage of the target (maximum available) current.
8	Fault display	This field denotes a two-digit code **Axx** for an active alert occurrence, or **Fxx** for an active fault. Refer to "The Fault/Alert Display Mode" on page 2-17 for more information.
9	Weld / No Weld status	This field indicates the control's operating mode: **W** for Weld mode, and **NW** for No Weld mode. See "Selecting Weld/No Weld Status" on page 3-11 for more information.

The Heat Select Display

The **Heat Select** display sets the type of firing heat to provide to each weld function in the selected schedule. Open the Heat Select Display from the **Normal/Programming** mode by pressing * , repeating as needed to display the **Heat Select** option.

A screen like this example will appear:



NOTE: *If this screen does not appear, it might be turned OFF in the Advance Display Options Screen. Simultaneously press and hold the* MODE *and * keys for 2 seconds. This presents the* **Advance Display Options** *menu.*

Define pre-heat, weld and post-heat firing types separately. In the example above, the firing heat for the pre-heat cycles for schedule #1 is ***AVC*** (Automatic Voltage Compensation). The weld cycles for schedule #1 will use ***Automatic Current Compensation*** (ACC), and the post-weld cycles for schedule #1 are specified as AVC (Automatic Voltage Compensation).

Navigating the Heat Select Display

On entering the **Heat Select** display, the cursor is on the schedule number. To select the weld schedule you want to program, use the UP and/or DOWN keys as needed.

When the desired schedule appears, use the LEFT and RIGHT keys as needed to move the cursor to the **PRE-HEAT**, **WELD** or **POST-HEAT** fields. Then use the UP and/or DOWN keys to scroll through the list of options available for that function.

After selecting the correct options for a schedule, either move the cursor back to the schedule number (to select another schedule); or move to another display (with the MODE or * key).

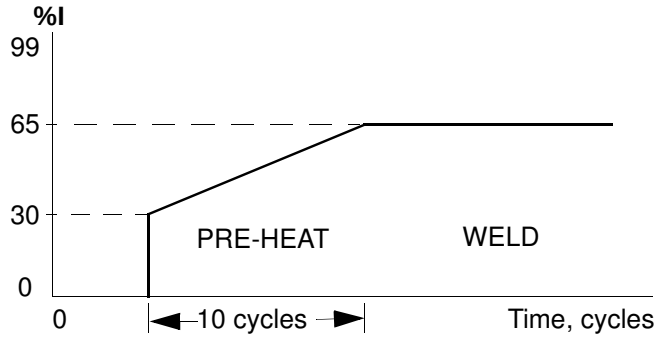
NOTE: *Changes to the weld types do not take effect until you exit the* **Heat Select** *display. Exit the Heat Select Display by pressing either the* MODE *or * key. These changes* WILL *affect the data in the selected weld schedule. Be certain to return to the* **Normal/Programming** *display to verify the weld data* BEFORE *attempting to initiate a weld with that schedule.*

The pre-heat, weld and post-heat functions each have a different list of heat options. Each is described in the sections that follow.

Pre-Heat Options

With the cursor on the **PRE-HEAT** field, use the UP and DOWN keys to scroll through the two pre-weld options: **AVC** and **SLOPE.**

Slope Selecting this option tells the control, during the pre-weld function, to ramp the heat from the amount specified in the pre-heat function to the amount of weld heat over the number of pre-heat cycles. For example, setting the pre-heat to 30 %I, pre-heat cycles to 10 and the weld heat to 65 %I ramps the weld heat from 30% to 65% heat over 10 pre-heat cycles. This does NOT affect the weld function. The following graph illustrates this example:



Note: The Slope pre-heat option can be selected only if the AVC option is selected for the weld function. For more information, see “Weld Options” on page 2-10.

AVC This specifies Automatic Voltage Compensation (AVC). The control applies consistent weld heat, despite changes in the primary line voltage. When programming using AVC, program firing heat as a percentage of the maximum available current, with a range of 20% to 99%.

The control monitors the primary voltage, using a programmed nominal line voltage to determine when to compensate for voltage swings on the weld bus.

(For example, when entering **30** for the pre-heat function, the MedWeld T2200 will provide 30% of the maximum available current of the Nominal Voltage waveform to the weld.) For more information see page 5-13.

NOTE: *When changing firing modes, the appropriate function in the weld schedule is reset to the minimum heat: 20% for AVC.* ***Make certain to return to the*** **Normal / Programming** ***mode to verify the heat values after exiting the*** **Heat Select** ***display.***

Weld Options

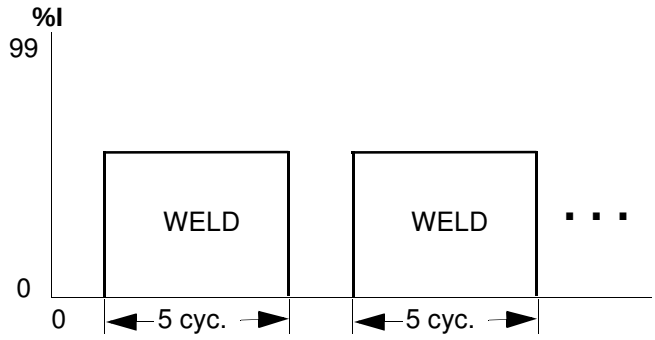
Four heat options are available for the weld function: **AVC**, **ACC**, **AVC Seam** and **ACC Seam**.

AVC Automatic Voltage Compensation, as described above. For this option, program a percent of maximum available current.

ACC Automatic Current Compensation, as described above. For this option, program the desired secondary current to apply to the work piece.

ACC SEAM
AVC SEAM With these options, select seam welding using either AVC or ACC firing mode. For either option, the control repeats the weld function until the initiate is removed.

For example, if you programmed 5 weld cycles, the control welds to the next multiple of 5 cycles after the initiate is removed, as shown here:



NOTE: *For seam weld applications which requires some cool time between each weld pulse, set the Post Heat option to "IMPULSE". This will provide an impulse type seam weld where each impulse can be divided into heat and cool cycles. For more information see "Programming a Seam Impulse Weld" on page 3-8.*

When the control is in ACC mode, it uses the primary current times the transformer turns ratio to regulate to the secondary current programmed. For more information see page 2-23.

Post-Heat Options

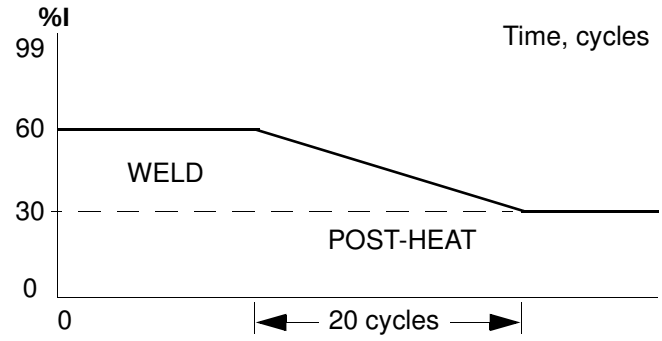
After moving the cursor to the **POST-HEAT** field, use the UP and DOWN keys to scroll through the three options: **SLOPE**, **AVC** and **IMPULSE**.

NOTE: *The option you select may change the values programmed for the selected weld schedule. AVC resets the heat to the minimum of 20%. ACC resets the heat to 0 A. Impulse removes the post-heat cycles value and*

selects impulse welding. ***Be certain to return to the*** **Normal / Programming** ***mode to view the weld schedule after making any changes in the*** **Heat Select** ***display.***

These are the post-heat options: Changes you make to the firing modes:

Slope Selecting this option tells the control to ramp the heat from the amount specified in the weld function to the amount of post-heat energy over the number of post-heat cycles. For example, setting the weld function heat at 60% of maximum, post-heat to 30 and the post-heat cycles to 20, the control will post- slope the heat from the weld current (60%) down to 30% over 20 cycles. This option does not affect the weld function.



NOTE: *The Slope Post-heat option can be selected only if the AVC option is selected for the weld function. For more information see "Weld Options" on page 2-10.*

AVC This specifies Automatic Voltage Compensation (AVC). The control applies consistent weld heat, despite changes in the primary line voltage. When programming using AVC, program firing heat as a percentage of the maximum available current, with a range of 20% to 99%.

The control monitors the primary voltage, using a programmed nominal line voltage to determine when to compensate for voltage swings on the weld bus.

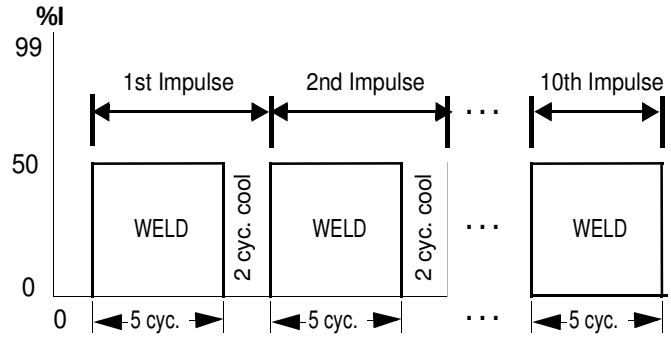
(For example, when entering **30** for the pre-heat function, the MedWeld T2200 will provide 30% of the maximum available current of the Nominal Voltage waveform to the weld.) For more information see page 5-13.

NOTE: *When changing firing modes, the appropriate function in the weld schedule is reset to the minimum heat: 20% for AVC.* ***Make certain to return to the*** **Normal/ Programming** ***mode to verify the heat values after exiting the*** **Heat Select** ***display.***

Impulse This option does not actually provide post-weld heat. It lets you program pulsation for the weld function. Pulsation permits specifying the number of impulses the control will perform. (An ***impulse*** is the combination of weld cycles and cool cycles.)

Selecting the impulse mode for post-heat tells the control that the heat and cool cycles programmed for the weld function constitute one impulse. The number of impulses programmed is the number of times the heat and cool cycles will be repeated.

For example, if the weld heat is 50% for 5 cycles, the cool cycles are set to 2 and post-heat cycle time is 10, the control will deliver 10 impulses. Each impulse will have 5 cycles of heat, followed by 2 cool cycles. Graphically, the impulse looks like this:



NOTE: *The final impulse in the sequence does not include cool time.*

Changes you make to the firing mode do not take effect until you exit the **Heat Select** display. If the firing mode has been changed, be certain to verify the weld schedule values BEFORE attempting to initiate a weld schedule.

The Pilot Assignments/Schedule Inhibit Display

The **Pilot Assignments/Schedule Inhibit** display instructs the MedWeld T2200 about which weld schedule to initiate when it receives a WELD PILOT input.

The display you see will vary according to the pilot type chosen: either ***Binary*** or ***Discrete***.

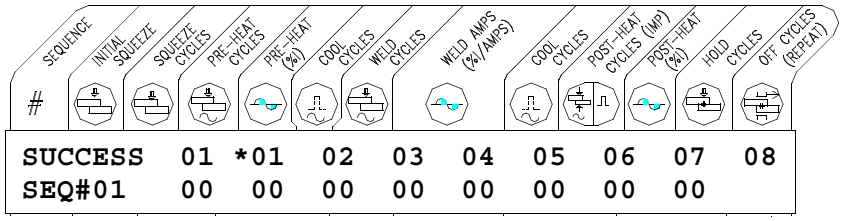
- When programmed as Discrete, the pilot assignment is in Successive mode.
- When programmed as Binary, the pilot assignment is in Schedule Inhibit mode.

Access this display from the **Normal/Programming** mode. To do this, press * (repeating as needed to display the **Pilot Assignments/ Schedule Inhibit** option).

Successive Mode

If this display does not appear, it is turned off in the **Advance Display Options** menu. Refer to page 2-29 for more details.

When pilots are programmed discrete, the **Pilot Assignments/ Schedule Inhibit** display is similar to this example:



NOTE: *The* **Pilot Assignments/Schedule Inhibit** *screen will not appear if this option is turned* OFF *in the* **Advance Display Options** *menu.*

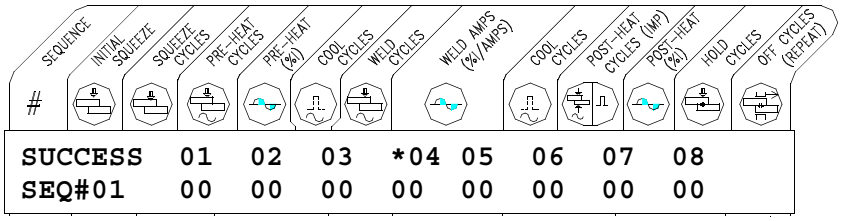
The cursor is located on the **WELD PILOT** number selected: **1**, **2**, **3**, **4**, **5** or **6**. To select the pilot you want to see, use the UP and DOWN keys. Then press RIGHT to move the cursor to the first field on the assignment list.

This is the schedule that will be initiated the ***first*** time the control receives the WELD PILOT input selected. The second field shows the weld schedule that will be initiated the ***second*** time the control receives the input.

The asterisk (*****) on the display indicates the next schedule that will be initiated when the appropriate pilot becomes active.

The control moves through the assignment list, initiating the appropriate schedule each time it receives an initiate input, until it encounters a field containing a zero. When it reaches zero, it returns to the schedule in the first field on the assignment list.

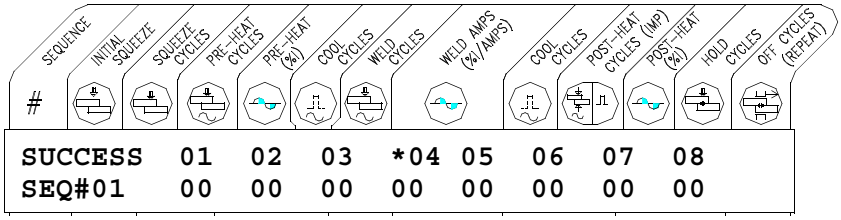
In this example, the control will execute schedules 01 through 08 in the order shown, then return to schedule 01.



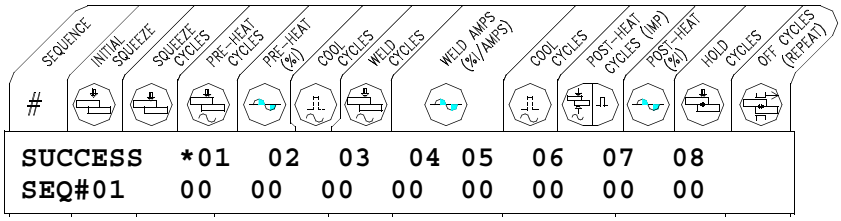
NOTE: *To disable the assignment list (always initiate the same schedule), set the first value to the schedule number desired. Set the second number in the assignment list to zero.*

Pilot Assignment Reset on Power-up

The next schedule to be initiated for each pilot on the **Pilot Assignments** display is automatically set back to the first field (the first schedule in the array) when cycling power to the control. (For example, before cycling power, the control was set to execute the schedule in array location #4. This is Schedule #4:



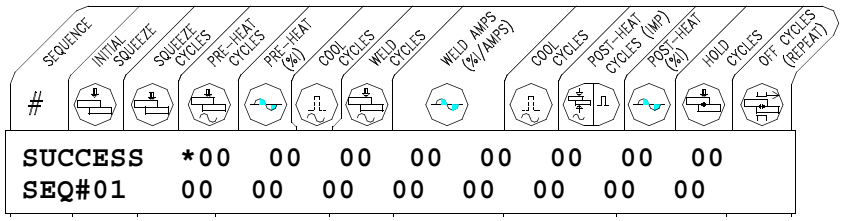
After cycling power, the control is now set to execute the schedule in array location #1 (Schedule #1 in this example).



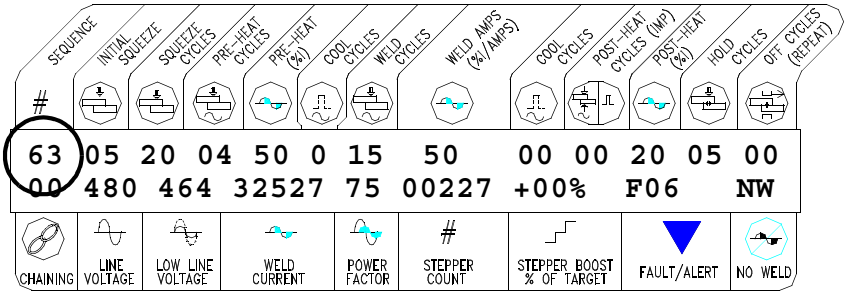
Programming the Pilot Assignment

To program the pilot assignment list, first position the cursor on the appropriate field. Next, use the UP and DOWN keys to select the schedule number desired, 1 – 63. Then press RIGHT to move to the next field on the list. With this display, initiate a list of up to 16 schedules for each pilot.

NOTE: *In the* **Pilot Assignments** *screen, program the first cell as* **00**. *The control will then initiate the schedule that appears in the* **Normal/ Programming** *display (as shown below).*

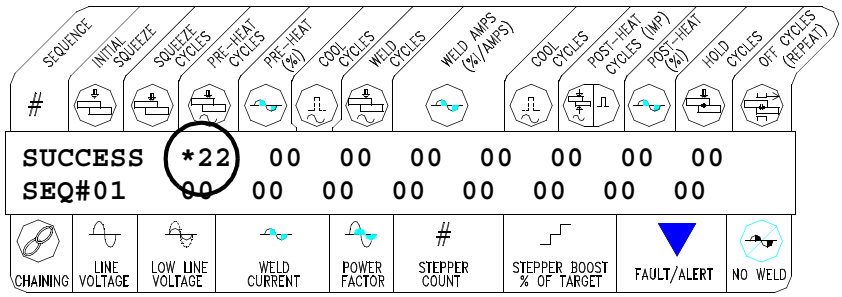


Changing the sequence number in the normal display mode will change the schedule executed by all pilots assigned to **00**. For example, pilot assignment (SEQ#1) has all **0**s in each cell (as shown above). The normal display shows **SEQ# 63** (as shown below). Pilot 1 will initiate Schedule #63. PILOT 1 will continue to initiate Schdule #63 until **SEQ#** in the normal display is changed to another number. For more details, see pages 2-4 to 2-7..



Selecting a Specific Schedule

To initiate a successive sequence at a particular weld schedule, first position the cursor in the first array of the successive sequence schedule assignment (as shown below). Pressing the * key sets the value and next weld initiated will use schedule #22.



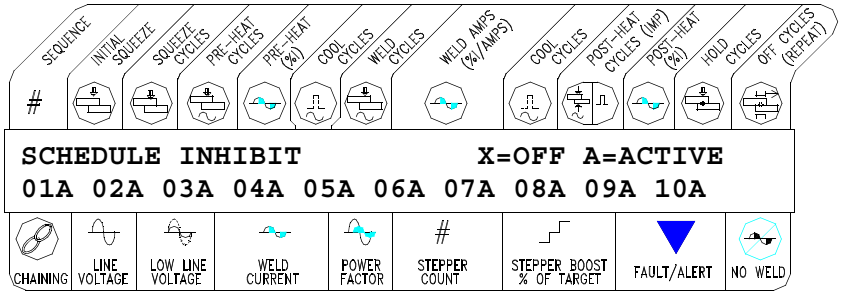
To Return to the Normal/Programming Display

When you finish assigning the desired schedules, use the LEFT and RIGHT keys as needed to move the cursor to the sequence number (**SEQ#**). Then press * until the Normal/Programming Display appears.

Or, press the MODE key to change to the **Fault** mode (if any fault or alert conditions are active). Then press * once, to clear all faults/alerts and return to the Normal/Programming display mode.

Schedule Inhibit Mode

The **Pilot Assignments/Schedule Inhibit** display looks like this example when programming the pilots as Binary:



This example shows Schedules #1 - 10 active. To inhibit a schedule, place the cursor using LEFT and RIGHT over the desired schedule. Then press UP or DOWN, changing any **A,** which means active schedules with ***x,*** which means OFF. The first space (next to **01**) is a cursor space, where the UP and DOWN keys will display the next group of 10 schedules. If programmed as a binary pilot of that number, it will not initiate the schedule.

Using the C-Factor and Current Limits

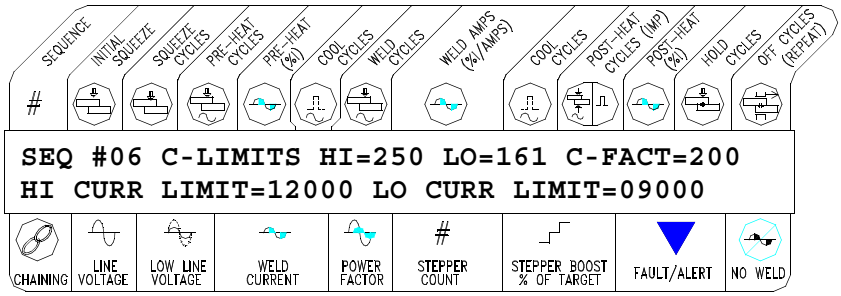
You may view and program the high and low limits of the secondary current for each schedule. You can also see the C-Factor reported for the last weld, and review or modify its high and low limits.

"C-Factor" on page 7-1 provides a detailed explanation of C-Factor, checking and reviewing the current limits, and examples of increasing and decreasing C-Factor.

C-Factor

You can review the C-Factor reported for the last weld, or program its high and low limits. Do this in the **C-Factor/Current Limits Display** menu.

If this option is turned ON, selecting it will present a screen like this example:



NOTE: *This screen will not be shown if the screen is turned* OFF *in the* **Advance Display Options** *menu. Refer to "The Advance Display Options Menu" on page 2-29.*

The upper line shows the high and low C-Factor limits set for schedule **nn**. (Refer to "C-Factor" on page 7-1.) **C-FACT=nnn** denotes the C-Factor value reported for the last weld. Both the high limit **HI=nnn** and low limit **LO=nnn** can range from 000 to 999. The high and low default values are 999 and 000, respectively. Use the LEFT and RIGHT keys to move the cursor to the desired field, then change these values as needed with the UP and DOWN keys.

Current Limits

The lower line indicates the high and low limits of secondary current, in A. **HI CURR LIMIT=nnnn0** has a default of **99990**. **LO CURR LIMIT= nnnn0** has a default of **00000**.

Changing Current Limits

Every welding schedule has high and low limits on secondary current. Either read or modify the current limit values as desired. Scroll among the values in this screen with the LEFT and RIGHT keys. To increase a value, press UP and to decrease a value, press DOWN. To enter a new value after changing it, press the * key.

Two setup parameters define the Fault or Alert status of the high and low current limits. Refer to page 5-3 for more details.

The Fault/Alert Display Mode

The **Fault/Alert** display mode indicates which fault or alert condition(s) occurred during the last weld schedule initiated. Use this mode to review these fault conditions and reset them.

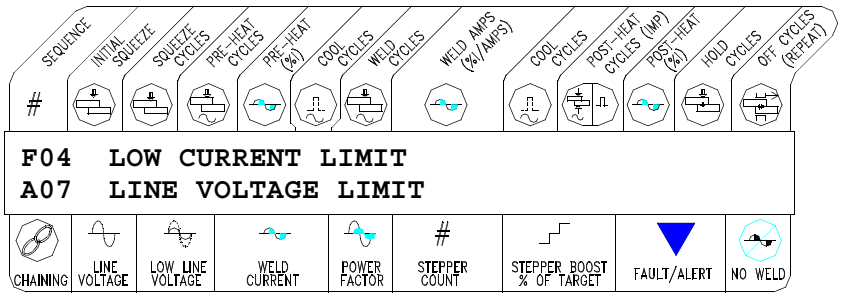
NOTE: *This mode is available* ONLY *if there are active fault or alert conditions. (The* **Normal/Programming** *display will show data in the* **fault** *or* **alert**

field. If no active faults or alerts exist, pressing MODE *goes directly to the* **Stepper Status** *mode.)*

On detecting a condition you define as either a fault or an alert in the setup parameters, the control flashes one or more error codes in the lower-right corner of the **Normal/Programming** mode display. If the control detected two or more faults, the codes will scroll across the lower-right corner of the screen.

Opening the Fault/ Alert Display

To enter the **Fault/Alert** display mode (only if faults or alerts are present), press the MODE key from the **Normal/Programming** display. Then, a description of the fault and/or alert conditions similar to this one will appear:



Fault Descriptions

Following each fault or alert code number is a description for each active fault or alert condition. Refer to “Fault Codes” on page 3 in Appendix A for a complete list of fault and alert conditions with their corresponding code numbers.

F means fault conditions (for example, **F04**). **A** denotes conditions defined as an alert (as in **A07**). The letter **I** (**I02**) indicates one of three internal fault conditions (such as a memory error). If the status is defined as NONE, this appears on the display as **Nxx**.

At this point, you can

- Display additional Fault or Alert messages (if more than two are active). Scroll through them with the UP and DOWN keys.
- Go to the **Stepper Status** mode by pressing MODE or
- Press * to reset the fault and alert conditions. This clears the reported condition(s) and returns to the normal display.

NOTE: *How the control reacts to a fault condition depends on the setting of the* Initiation On Fault *setup parameter. If a fault is detected and this setup parameter is set to* **INHIBIT**, *the control will* NOT *initiate another schedule until the fault has been reset. If set to* **ALLOW**, *the control resets the fault and initiates the schedule. (A fault is cleared by initiating.)*

******Initiation is never inhibited by an active alert condition.******

Resetting Faults

To reset fault and alert conditions, press the * key from the **Fault/Alert** display. The control clears the reported condition(s) and returns to the **Normal/Programming** display. The fault display disappears and the **Fault/Alert** field now becomes blank.

Another way to reset faults or alerts is by using the external input programmed to fault reset. For a Fault Reset input assignment, see “The IO Mapping Display” on page 2-25.

Only after resetting a fault will the control accept a weld initiate (except if the Initiation On Fault setup parameter is set to **ALLOW**, then the fault is automatically cleared by the next initiate). See page 5-9 for more information.

Displaying Internal Faults

The MedWeld T2200 can also display three internal faults:

I01 SHORTED CONTACTOR

The control detected that the SCR was ON (closed) when the control is not firing to supply high voltage to the weld transformer. This also generates the FAULT/ALERT output.

I02 EPROM ERROR

The control processor detected a failure in the EPROMs which contain the operating program. The processor board must be replaced. Contact WTC’s service department for assistance.

I03 RAM DATA ERROR

The processor detected an error in the contents of RAM used to store the programmable settings. If this condition occurs, you must reload the default settings from defaults. To do this, go to the **Normal/Programming** display. Simultaneously press and hold the MODE and * keys until the **Advance Display Options** menu appears. Then press DOWN and scroll to the **RELOAD FROM DEFAULTS** line (shown below). Then press RIGHT, and UP or DOWN as needed to select On, and then YES:

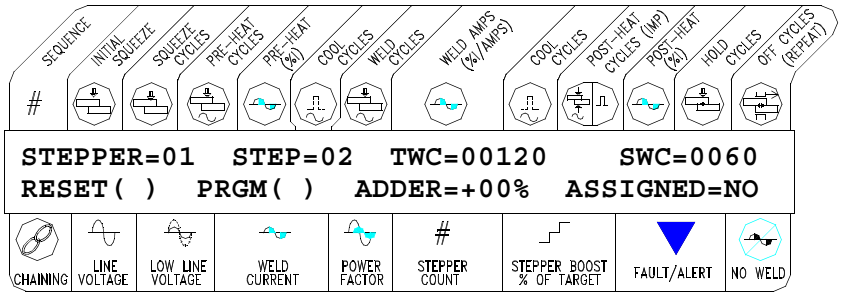
09 RELOAD FROM DEFAULTS (OFF)

NOTE: **Be certain to record the appropriate setup parameters and all other programmable settings before reloading the defaults.**

Stepper Display Mode

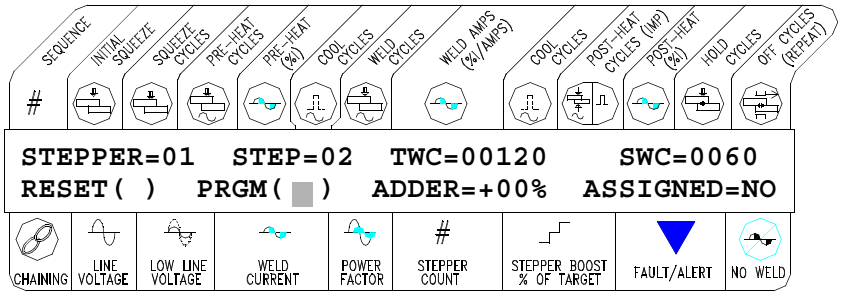
The MedWeld T2200 includes six independent ***linear steppers***. They are typically programmed to add more heat to each weld, to help compensate for “mushrooming” of the electrode tips.

The **Stepper Display** mode provides two displays. The first of these is the **Stepper Status** display (below):

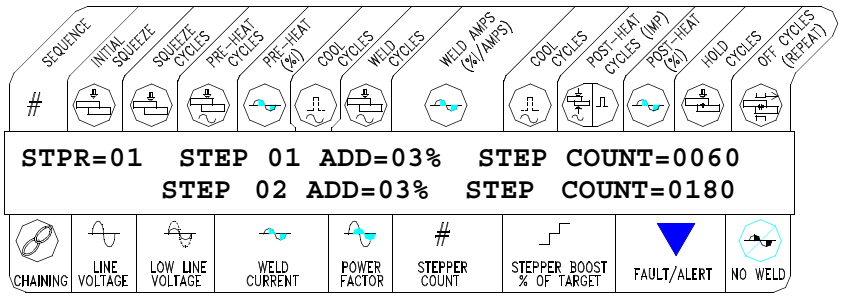


The **Stepper Status** shows the present status of the stepper program such as the current step, total weld count and step weld count. For full details on accessing and programming in this mode, refer to “Programming Steppers” on page 6-1.

To program a stepper, the operator will need to move to the **Stepper Profile** screen, to do so place the cursor in the PRGM( ) area and press the UP or DOWN arrow (as shown below).



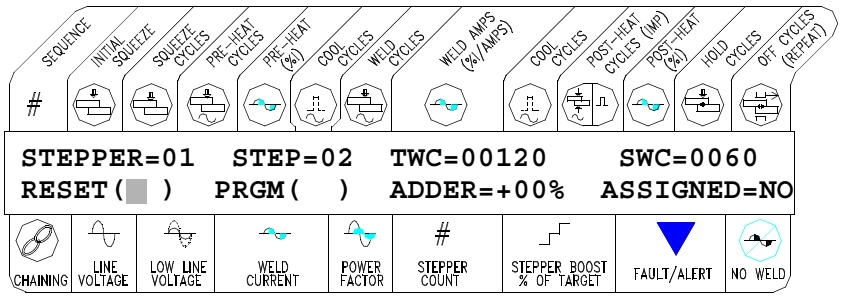
Once in the **Stepper Profile** screen (shown below) the operator will be able to view or program each individual step, the amount of current to add, adjust the number of counts per step, and create stepper groups.



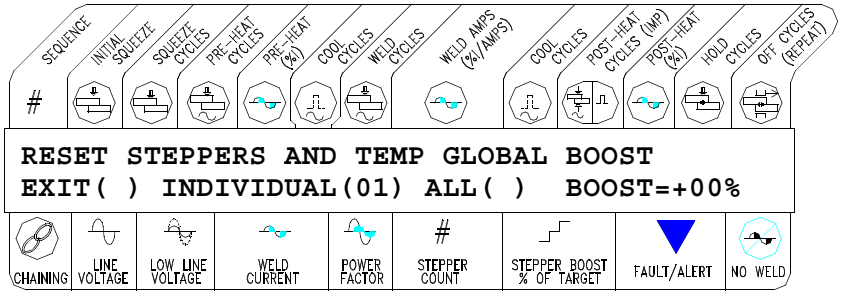
Pressing * will move the operator to the **Stepper Status** screen. For further information on programming, see “The Stepper Status Mode” on page 6-2.

Resetting a Stepper Program

To reset one or all of the steppers or adjust global boost, the operator will need to move to the **Stepper Profile Reset** screen. Pressing LEFT or RIGHT will place the cursor in the RESET( ) area, then pressing the UP or DOWN arrow in the area shown below.



This will take you to the **Stepper Profile Reset** screen (shown below) and allow the operator to reset one or all of the steppers and also adjust global boosts user can navigate this screen by using the LEFT and RIGHT arrow buttons and change a setting by using the UP and DOWN arrow buttons.



Another method to resetting a stepper is to assign an external input to **STEPPER RESET**, and reset all steppers with the input. For more information see “The IO Mapping Display” on page 2-25.

Setup Mode

The T2200 includes a list of ***setup parameters***. The setup parameters let the operator customize the control to meet the specific requirements or application. A **Fault Display** mode lets you see and reset which fault or alert condition(s) occurred during the last weld schedule initiated.

For full details on accessing and programming the setup parameters, see “Other parameters define the hardware and nominal range limits on weld current. To view the setup parameters (or modify those that are programmable), use the Setup Display Mode.Selecting the Setup Mode” on page 5-1.

The Valve Mapping Display

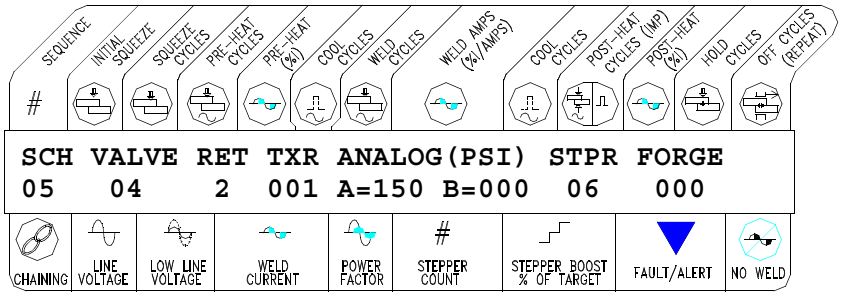
The weld schedules are fixed. You cannot insert or delete functions in a schedule. However, you can use the Advance Display option called ***Valve Mapping*** to specify which valves each welding schedule is to control.

To access the **Valve Mapping Display**, press MODE . With the LEFT and RIGHT keys, move the cursor over to the desired field. Increment or decrement the number to show the desired valve.

Turning on the **Valve Mapping** Display

To open the **Valve Mapping** option, follow these steps:

1. Open (or return to) the **Normal/Programming** mode.
2. Simultaneously press and hold the MODE and * keys for 2 seconds. The **Advance Display Options** menu appears.
3. Press the DOWN key (repeating as needed) to scroll to the **06 Valve Mapping** option.
4. Press RIGHT to select the **Valve Mapping** field.
5. Press either UP or DOWN as needed to turn ON the display of valve mapping.
6. Return to the **Normal/Programming** mode, either by waiting 1 minute, or by pressing MODE and repeating as needed until you see a screen like the example shown here:



Use the **Valve Mapping** option to view or modify the assignment of valves for a particular schedule.

Move the cursor over to the appropriate field by using LEFT and RIGHT. With the UP or DOWN keys, increment or decrement to set the desired valve number. Next, set the transformer turns ratio. Then program the Retract valve number, and Pressure valve number for discrete, or set the pressure in PSI for analog pressure type. Then assign the appropriate stepper number. Finally, set the length of delay time for the Forge valve. See the explanations below for more information.

Data appears on this screen as follows:

SCH — The number of the desired weld schedule. Set it in the range **00 - 63**.

VALVE — The valve number. Set it in the range **0 - 63** if setting the valve mode in Binary mode; or **0 - 6** if programming in Discrete mode. In either mode, programming 00 will not turn on any output valve.

RET — The number of the Retract valve. Set it to **0**, **1** or **2**. Programming **00** will not turn on any Retract valve.

TXR — The turns ratio of the welding transformer. This is the ratio of Secondary current/Primary current. Secondary current = Primary current x turns ratio. Program in the range **001** - **255**. The default is **001** (which will display primary current).
Note: When the control is in either ACC or ACC Seam mode, it uses Primary current x turns ratio to regulate the secondary current. Therefore, the turns ration MUST be set correctly to achieve the programmed secondary current. For more information, see “Weld Options” on page 2-10.

Note: Select the pressure type for your application (either **ANALOG** or **PRESSURE SELECT**) in the I/O map. These options are described below.

ANALOG

OR

PRESSURE

This sets the pressure in PSI for Ports A and B. Set this value to **0 - 150** PSI.
Note: Be sure to set the Maximum line pressure, static analog 1 and 2 output pressure in the setup parameters. For more details, see page 5-15 and page 5-15.

This selects the PRESSURE SELECT valve output turned on. Select valve **1**, **2**, **3** or **4**. **Note:** You must assign the PRESSURE SELECT outputs in the I/O map. Refer to page 4-16 for more details.
Programming **00** will not turn on any pressure select output valve.

STPR — The desired stepper assignment. The range is **0 - 6**.

FORGE — The interval of Forge delay time to apply, in cycles. The range is **0 - 999** cycles.

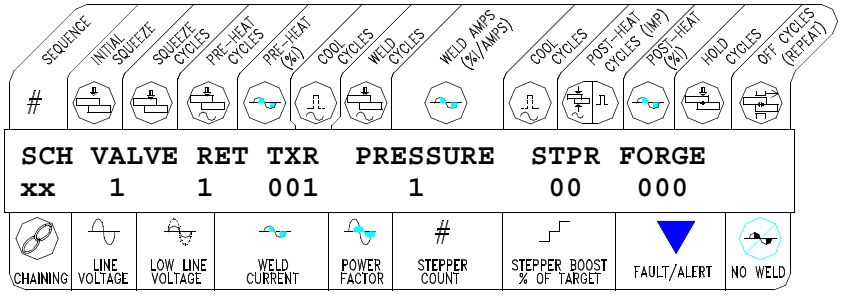
WARNING!

Be certain that the Forge valve delay time is less than the weld plus hold times. Otherwise, the Forge valve will not turn on.

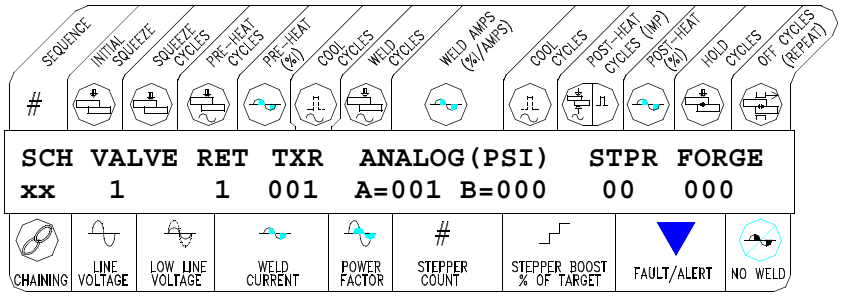
The example on page 2-19 sets Schedule #05 to control valve #04. The transformer turns ratio is 1:1. Pressure for analog port A is 150 PSI; Port DOWN is off (000). Stepper #6 is assigned, and the Forge delay time is 000 cycles (i. e., no forge delay).

Default Valving for All Schedules

The MedWeld T2200 has a default valve mapping that applies to all 63 weld schedules. It looks like this:



xx is the schedule number, 0 - 63. The above example appears if the pressure type (in **IO Mapping**) is set to ***Pressure Select***. If the pressure type is set to ***Analog***, this screen will appear:



If the I/O feature is not activated, it does not appear in the **Valve Mapping** display. Limits on these parameters are based on what has been mapped in I/O. For example, mapping Valves 1, 2 and 3 makes the range **0 - 3 only**.

The IO Mapping Display

The **IO Mapping Display** has two modes: ***Normal*** and ***Program***. Normal mode is view-only; it does not allow making any changes. This mode appears ONLY if it is turned on from the **Advance Display Options** menu. Refer to page 2-29.

In the **IO Mapping Display** mode, you may review and/or modify which I/O point corresponds to each input or output on the 821 I/O board. (Refer to page 4-1.) You may also reload from any of six factory- or OEM-programmed defaults. In this mode, no other display modes can be viewed.

As normally shipped from the factory, default Schedule #3 is installed. Refer to Appendix A for the listings of default I/O mappings.

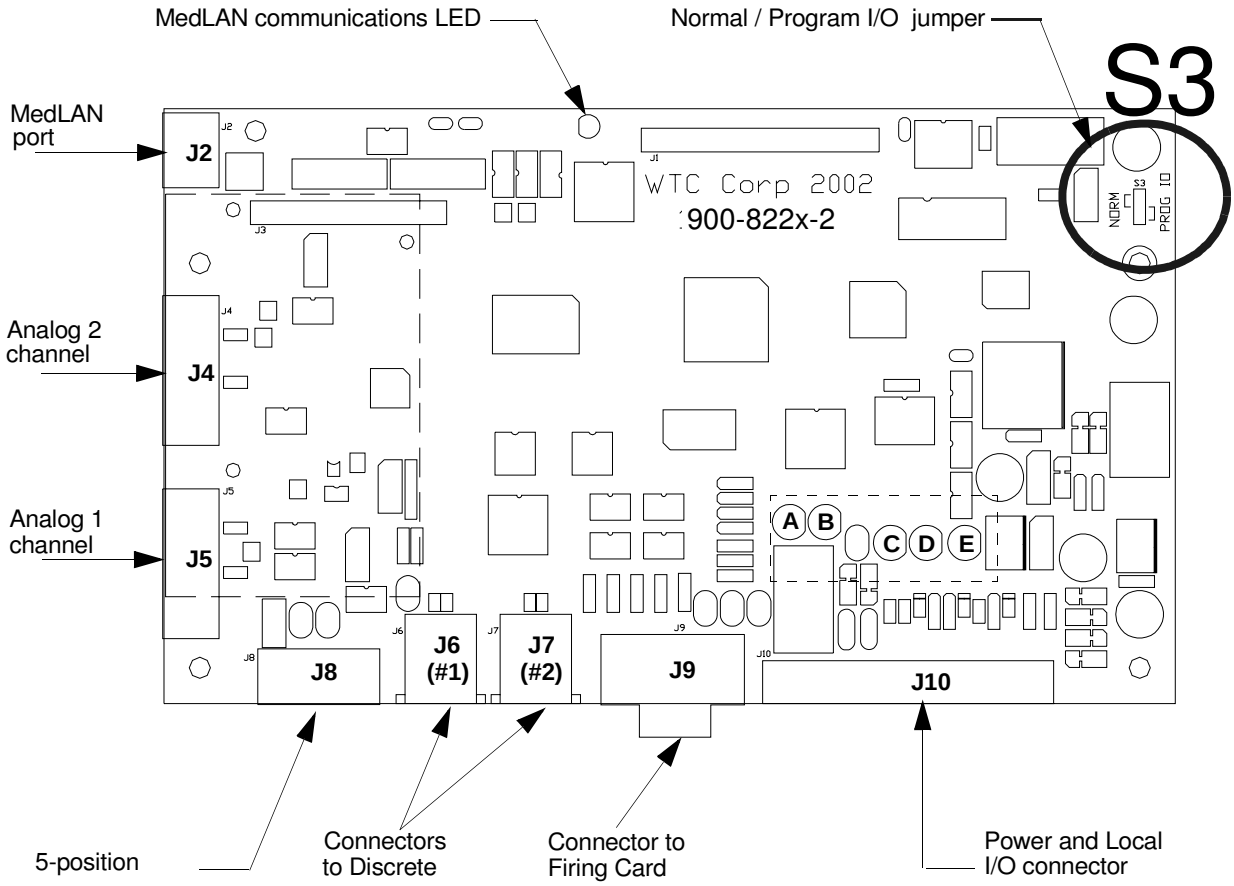
Programming the I/O Map

To enter the **/ IO Mapping** Program mode, follow the procedure listed below.

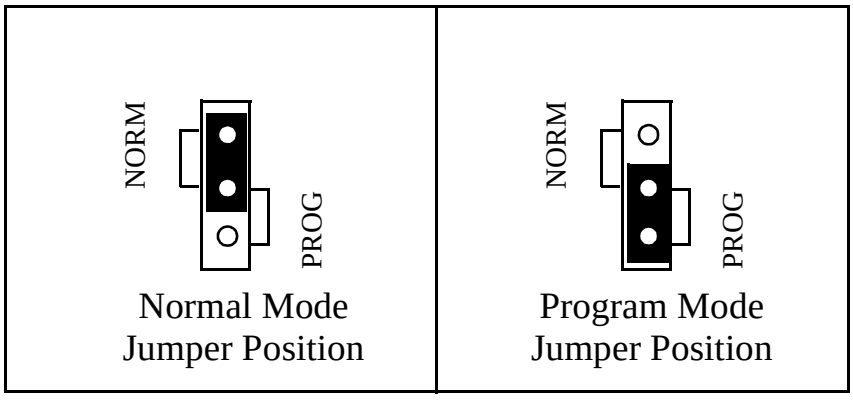
NOTE: *In **Program** mode, power-up always enters in programming the I/O mapping. In **Normal** mode, power-up always enters the* **Normal/ Programming** *display mode.*

1. Turn OFF power to the control.

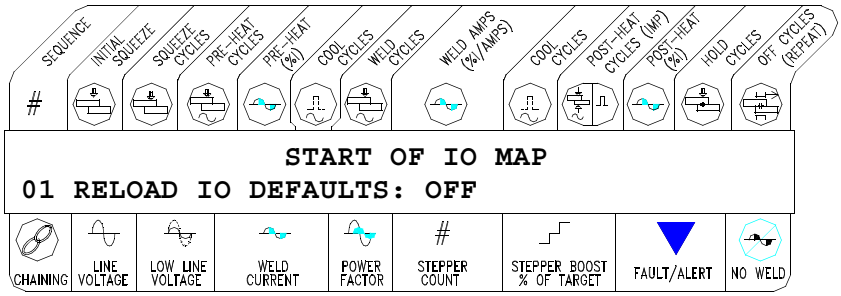
2. Locate jumper **S3** on the back of the programmer/display board. Set **S3** to **PROG** (for Program mode).



NOTE: *If jumper is not replaced properly or becomes lost the control will be in normal mode until the jumper is replaced.*



3. Turn ON power to the control. This screen appears in about 5 seconds:



4. Press the UP or DOWN key to scan through the I/O map.
5. At the desired line, press the RIGHT arrow to move the cursor to the setting field.
6. Press UP or DOWN as needed to change setting for each line of the I/O map.
7. Press LEFT to return the cursor to the I/O map number.
8. Repeat this process to set each I/O point in turn.
9. Turn power OFF.
10. Set jumper S3 to **NORM** (for Normal mode).
11. Turn power to the control back ON.
12. To view the I/O settings (you CANNOT program them here), press MODE as needed to present the **I/O Mapping** menu.

NOTE: *You can view the* **I/O Mapping** *display from the Normal mode ONLY if it is turned on from the* **Advance Display Options** *menu. Refer to page 2-29 for further details.*

WARNING!

For the changes to take effect, the control must be cycled OFF. Set the jumper to *NORMAL*, then turn power back ON.

Reloading I/O From I/O Default Settings

The six I/O defaults are listed on “Default Mapping of I/O Points” on page 6 of Appendix A.

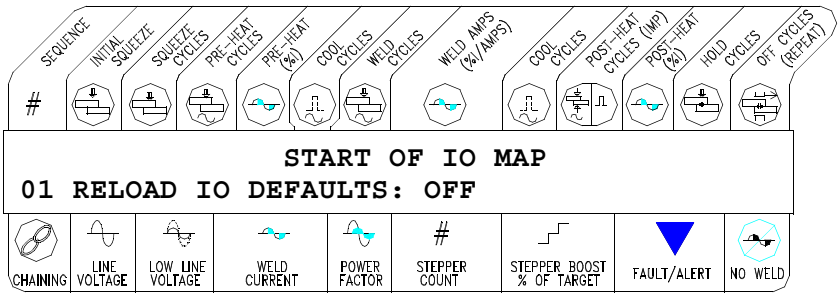
In the **Reload I/O Defaults** screen, you may choose from six factory-installed settings. For a list of the possible I/O mapping, refer to “I/O Definitions” on page 4-1.

Resetting the Defaults

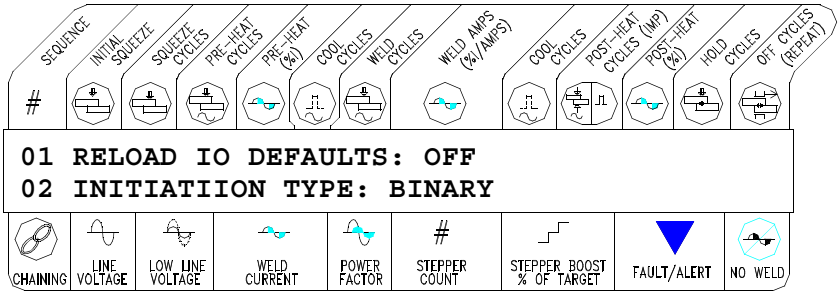
At any time after modifying any I/O map(s), you can restore them to the default values originally installed at the factory. The **Reload I/O Defaults** option lets you reset every programmable I/O map to the original factory (default) setting(s).

To reset the factory defaults, follow this procedure:

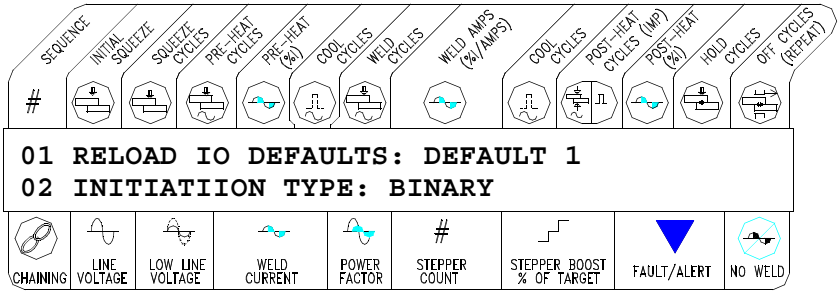
1. Repeat Steps 1 - 4 in “Programming the I/O Map” on page 2-25, until you see this screen:



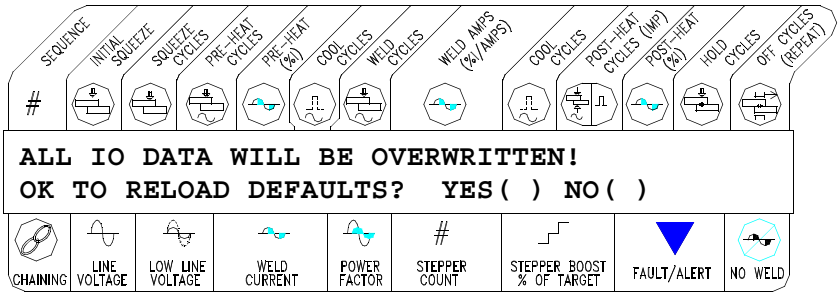
2. Select option **01 Reload I/O Assignments** by pressing the DOWN arrow, then press the RIGHT arrow, to move the cursor to **OFF**:



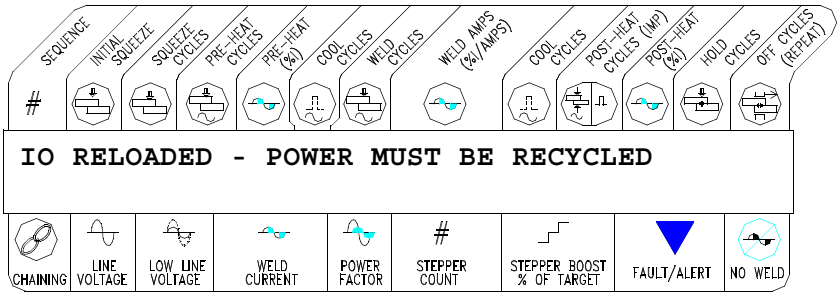
3. Press either UP or DOWN to select the desired default (see below).



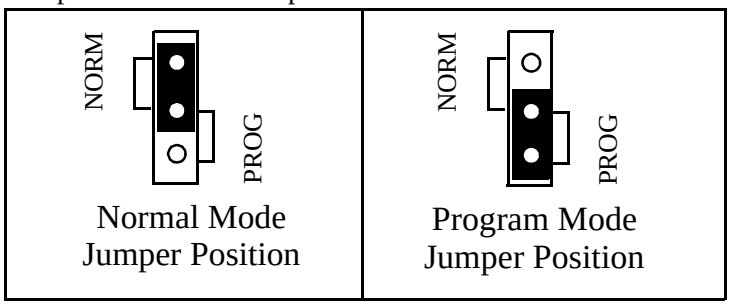
4. Once a default is found pressing LEFT or RIGHT will select the current default shown and a screen requesting confirmation appears:



5. To cancel, move the cursor to the **NO** field and press either UP or DOWN. To proceed, move the cursor to the **YES** field and press UP or DOWN. This screen now appears for a few seconds if the defaults reload successfully:



6. Turn power to the control OFF. Set jumper S3 to the NORM position. Then turn power back ON.



The **Advance Display Options** Menu

The T02200 software includes an **Advance Display Options** menu. With it, select the screens you wish to enable or disable. This menu limits the access users have to only the screens that are turned on, while prohibiting access to all other screens that are turned off at your option.

Accessing the ADVANCE DISPLAY OPTIONS Menu

From the **Normal/Programming** display, simultaneously press and hold the MODE and * keys for 2 seconds. This presents the following series of screens:

START OF ADVANCE DISPLAY OPTIONS

01	**HEAT SELECT:**	(ON / OFF)
02	**PILOT ASSIGNMENTS/SCHEDULE INHIBIT:**	(ON / OFF)
03	**C-FACTOR/CURRENT LIMITS:**	(ON / OFF)
04	**ANALOG DISPLAY:**	(ON / OFF)
05	**STEPPER DISPLAY:**	(ON / OFF)
06	**SETUP DISPLAY:**	(ON / OFF)
07	**VALVE MAPPING DISPLAY:**	(ON / OFF)
08	**IO ASSIGNMENT DISPLAY:**	(ON / OFF)
09	**RELOAD FROM DEFAULTS:**	(ON / OFF)
10	**NETWORK ADDRESS:**	(00 - 29)

END OF ADVANCE DISPLAY OPTIONS

Each screen shows two successive lines from this list.

Options of the Advance Display Menu

Each numbered menu item signifies a screen or mode that you can choose to enable (or disable), as described in this table:

01	**Heat Select**	Select and/or program the pre-heat, weld and post-heat options for firing in Automatic Current (or Voltage) Mode. See page 2-8.
02	**Pilot Assignments/ Schedule Inhibit**	The Pilot Assignments item instructs the control which schedule to initiate when it receives each WELD PILOT input. See “The Pilot Assignments/ Schedule Inhibit Display” on page 2-13.
03	**C-Factor / Current Limits**	View or set the high and low C-Factor limits, and read the C-Factor measured for each weld. View or modify the High and Low Current limits. For additional details, see “Using the C-Factor and Current Limits” on page 7-1.
04	**Analog Display**	The Analog Display allows the user to set the analog pressure for the electrodes on the weld gun for each individual weld schedule.
05	**Stepper Display**	View or modify the status of steppers, the present weld count and the amount of “boost” applied to each weld. (See “The Stepper Status Mode” on page 6-2.)
06	**Setup Mode**	Define the control’s operating environment by using programmable setup parameters. Refer to “Setup Parameters and Faults” on page 5-1.
07	**Valve Mapping Display**	Use this option to specify which valves each welding schedule is to control. Refer to “The Valve Mapping Display” on page 2-22 for more details.

08	**IO Mapping Display**	Review which I/O point corresponds to each input or output name. Refer to “The IO Mapping Display” on page 2-25.
09	**Reload from Defaults**	This reloads the control, resetting every programmable value to the original factory-installed settings. See “Reloading I/O From I/O Default Settings” on page 2-27.
10	**Network Address**	In this screen, view or modify the MedLAN address assigned to a weld device on the network. Refer to “Network Address” on page 1-20 for more details.

Selecting from the **Advance Display** Options

Each item (except **Network Address**) has either of two settings to the right: **ON ( )** or **OFF ( )**. A flashing bar shows each item as ON or OFF. You can scroll among displays, turn a display ON or turn it OFF.

To toggle the state of a display, first scroll down the list. Press UP or DOWN as needed to select the desired item. Then press the RIGHT key to shift the cursor to the new status (ON or OFF). To toggle the present state to the other state, press the UP or DOWN key.

Turning a menu option ON displays its respective screen when you scan the menu with the * and/or MODE keys. Setting a menu option OFF disables the display of its respective screen. (However, functionality of these menu items remains active, regardless of whether their displays are turned ON or OFF.)

This capability can be used for security. For example, to set up and certify a tool (welder), you may want to turn on all available displays to permit making programming changes, to accommodate your particular application’s requirements. Then, after making the desired programming changes, turn off any displays that you wish to hide from unauthorized personnel. This limits access and/or changing the display(s) of your choice.

Default Settings in This Menu

As shipped from the factory, the **Advance Display Options** menu has the **Pilot Assignments, Stepper Display** and **Reload From Defaults** items set to OFF. **Network Address** defaults to **001**. All the other menu items default to ON.

Exiting the Menu

To exit the **Advance Display Options** menu, either

- Momentarily press the MODE key, or
- Do NOT touch any key for 1 minute. The control automatically exits the menu and returns to the **Normal/Programming** mode.

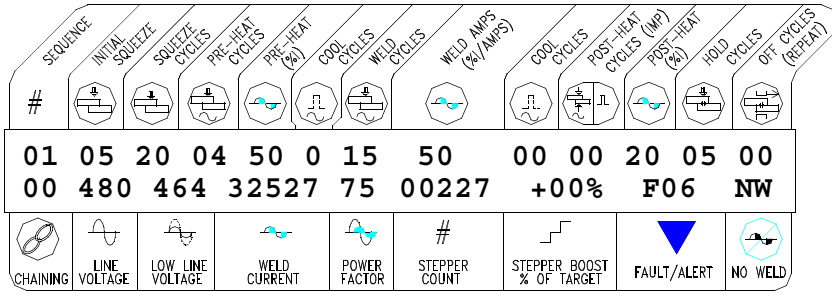
Programming Weld Schedules 3

This chapter explains how to program weld schedules with the MedWeld T2200 control. The principal aspects of this are

- Entering the **Normal/Programming** mode,
- Reading and understanding Weld Status data,
- “Chaining” multiple weld schedules,
- Setting the Weld/No Weld status of the control,
- Initiating a weld schedule,
- Programming a seam weld and
- Programming a seam impulse weld.

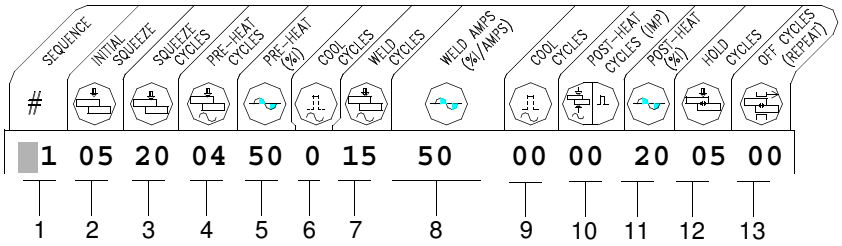
Working in the Normal/Programming Mode

You program weld schedules in the **Normal/Programming** mode. At power-up, the control displays three start-up initialization screens, then presents the **Normal/Programming** screen. You can also open (or return to) this screen from any other mode or screen. To do this, press the MODE key (repeating as needed). A screen like this example will appear:



Selecting a Weld Schedule

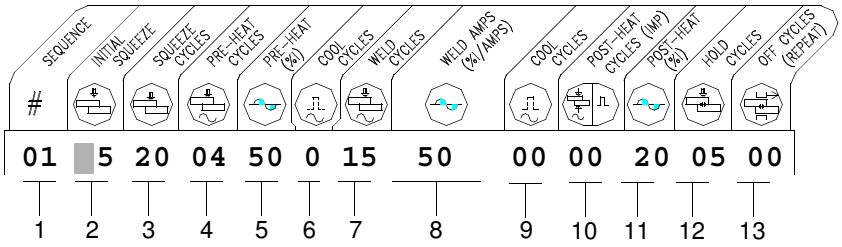
Select a weld schedule by following the steps on the next page:



1. If the cursor is not on field **(1)** in the diagram above, press the LEFT or RIGHT key to move it there.
2. Select the schedule to view or edit by pressing UP or DOWN.

Programming Initial Squeeze Cycle Time

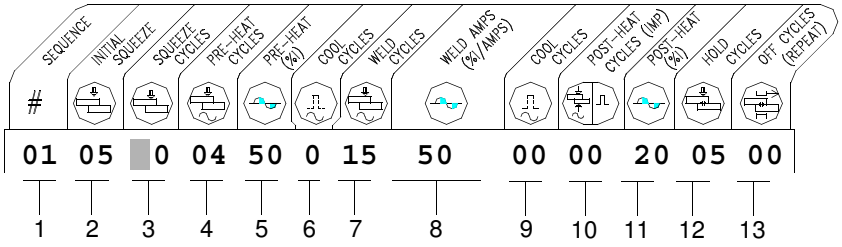
Program the Initial Squeeze cycle time by following the steps below.



1. If the cursor is not on field **(2)** in the diagram above, press the LEFT or RIGHT key to move it there.
2. Press UP to increase the number, or DOWN to decrease it.

Programming Squeeze Cycle Time

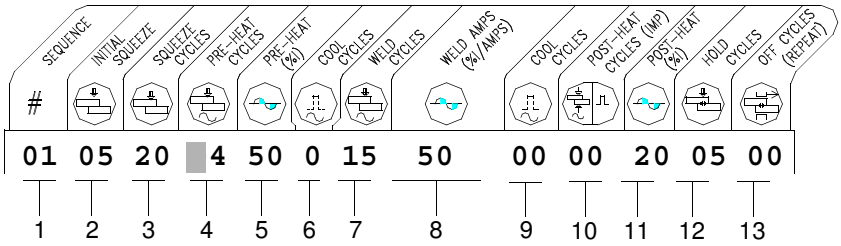
To program the Squeeze cycle time, follow the steps below.



1. If the cursor is not on field **(3)** in the diagram above, press the LEFT or RIGHT key to move it there.
2. Press UP to increase the number, or DOWN to decrease it.

Programming PRE-HEAT Cycle Time

Program the PRE-HEAT Pulse cycle time by following these steps:

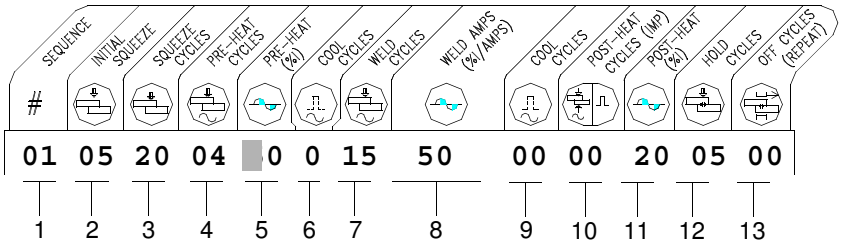


1. If the cursor is not on field **(4)** in the diagram above, press the LEFT or RIGHT key to move it there.
2. Press UP to increase the number, or DOWN to decrease it.

NOTE: *This value is the number of pre-heat cycles in AVC, and slope cycles when programmed to* SLOPE *in the* **Heat Select** *mode. For more information, refer to page 2-8.*

Programming the PRE-HEAT Current

Set the PRE-HEAT current by following these steps:

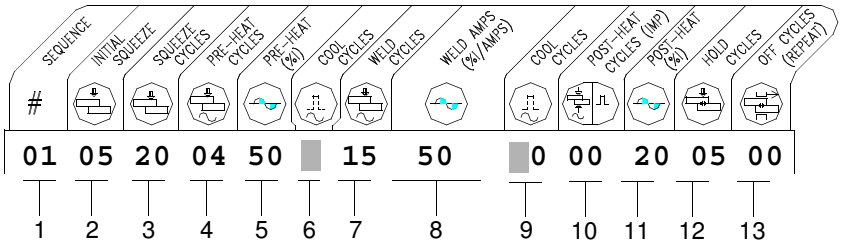


1. If the cursor is not on field **(5)** in the diagram above, press the LEFT or RIGHT key to move it there.
2. Press UP to increase the number, or DOWN to decrease it.

NOTE: *The firing mode (selected in the* **Heat Select** *display) will affect how current is executed. With AVC, program weld heat as a percentage of maximum available primary current. In slope firing, this value specifies the initial level of heat. Any changes made in the* **Heat Select** *display will reset the current values to their minimum values: 20% for AVC. Refer to "Pre-Heat Options" on page 2-9.*

Programming the COOL Cycle Time

Two cool cycles (fields #6 and #9) are programmable. To program the COOL cycle times, follow these steps:



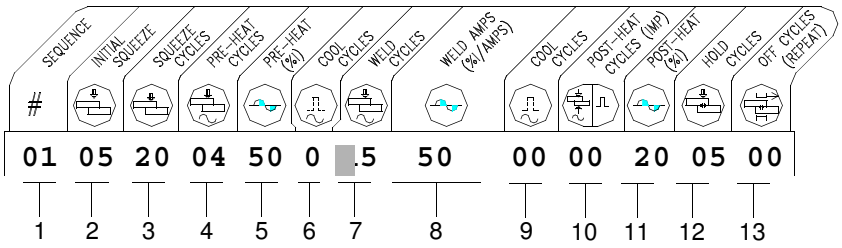
1. If the cursor is not on either field **(6)** or **(9)** in the diagram above, press the LEFT or RIGHT key to move it there. Note that the second COOL time in field **(9)** is programmable in two digits, **0 - 99** cycles.

NOTE: *The second cool time (field 9) represents the length of cool time used to define an impulse weld if post-heat is set to Impulse). Refer to page 2-12 for additional information.*

2. Press UP to increase the number, or DOWN to decrease it.

Programming the WELD Cycle Time

Program the WELD Cycle time by following the steps below:



1. If the cursor is not on field **(7)** in the diagram above, press the LEFT or RIGHT key to move it there.

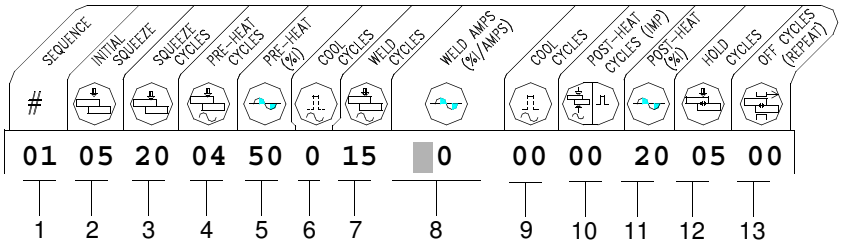
NOTE: *This value represents the number of heat cycles used to define an impulse weld if post-heat is set to Impulse). Refer to "Programming POST-HEAT Cycle Time" on page 3-5 for additional information.*

2. Press UP to increase the number, or DOWN to decrease it.

NOTE: *Either seam firing mode will repeat this value. When selecting either AVC or ACC Seam welding, the control will repeat the weld function or impulse as long as the weld pilot is active. The control will* NOT *proceed to the next function in the schedule until the pilot is removed. For more details, see "Weld Options" on page 2-10.*

Programming the WELD Current

Set the WELD current by following the steps below.



1. If the cursor is not on field **(8)** in the diagram above, press the LEFT or RIGHT key to move it there.

NOTES: *When either ACC firing mode is selected in the* **Heat Select** *display, this field shows a value up to 5 digits long (i. e.,* 10000*). The range is 0 - 99990 A. in ACC.*

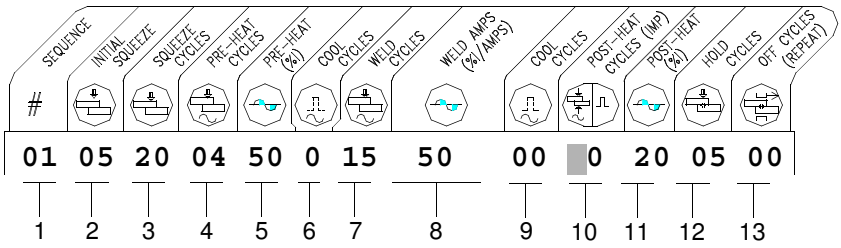
If either AVC firing mode is selected in the **Heat Select** *display, this field shows a value up to 2 digits long (i. e.,* 30*). The range is 20 - 99 %I. in AVC.*

2. Press UP to increase the number, or DOWN to decrease it.

NOTE: *Remember: The firing mode you select in the* **Heat Select** *display will determine the weld heat. The possible firing modes are ACC, AVC, ACC Seam and AVC Seam. Making any changes to the settings will reset the current to its minimum acceptable value: 20% for AVC, or 00000 A. for ACC.*

Programming POST-HEAT Cycle Time

Program the POST-HEAT cycle time by following the steps below.



1. If the cursor is not on field **(10)** in the diagram above, press the LEFT or RIGHT key to move it there.

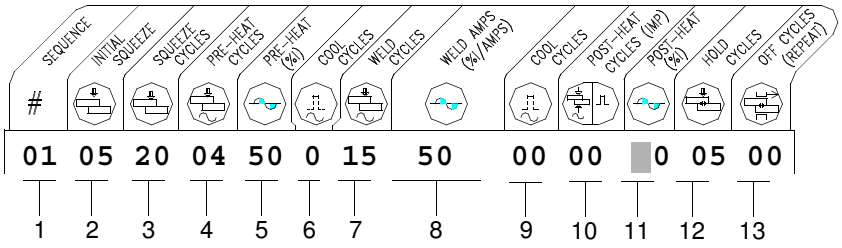
2. Press UP to increase the number, or DOWN to decrease it.

NOTE: *This value signifies the number of post-heat cycles (*AVC*), the number of post-slope cycles (*Slope*) or the number of weld impulses (*Impulse*). The option depends on which firing mode is programmed in the Heat Select display. See "Post-Heat Options" on page 2-10.*

If the post-weld function is set to Impulse in the **Heat Select** display, use the steps above to enter the number of times the control will repeat the weld impulse (heat cycles and cool cycles) specified by the WELD (7) and COOL (9) values programmed.

Programming the POST-HEAT Current

Program the POST-HEAT current by following the steps below.

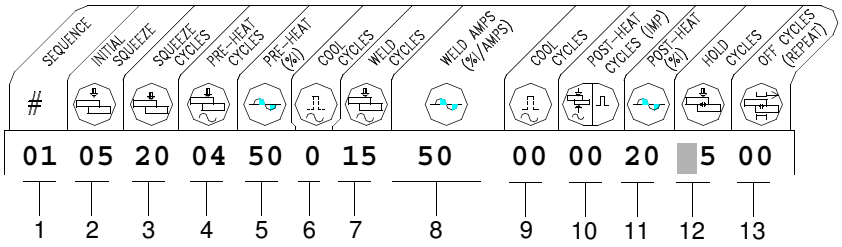


1. If the cursor is not on field **(11)** in the diagram above, press the LEFT or RIGHT key to move it there. The possible firing modes in post-heat are AVC, slope or impulse.
2. Press UP to increase the number, or DOWN to decrease it.

NOTE: *When selecting Impulse for the post-heat firing mode in the* **Heat Select** *Display, this value is not used, the display is blank and the cursor will skip over this value.)*

Programming the HOLD Cycle Time

Program the HOLD Cycle time by following the steps below.

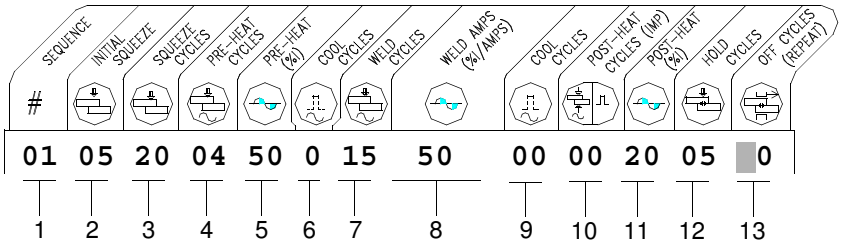


1. If the cursor is not on field **(12)** in the diagram above, press the LEFT or RIGHT key to move it there.
2. Press UP to increase the number, or DOWN to decrease it. The range is 0 - 99 cycles.

NOTE: *If the weld schedule is "chained" to another schedule, this function is not executed. (Only the Hold and Off cycles in the last schedule in the chain will execute.) For further details, see "Chaining Schedules" on page 3-9.*

Programming the OFF Cycle Time

To program the OFF cycle time, follow these steps:



1. If the cursor is not on field **(13)** in the diagram above, press the LEFT or RIGHT key to move it there.
2. Press UP to increase the number, or DOWN to decrease it.

NOTES:

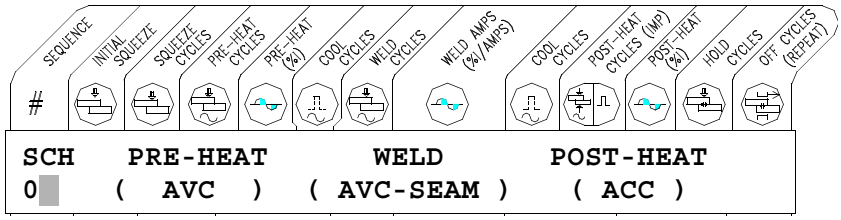
If this weld schedule chains to another schedule, this function is not executed unless this is the LAST *schedule in the chain.*

Repeat will start at the Squeeze function of the first schedule in the chain. In this case, the control will repeat all of the schedules in the chain, until the pilot is turned off. Refer to "Chaining Schedules" on page 3-9.

Programming a Seam Weld

Note: The **Heat Select** display must be turned ON to change to a seam weld mode. Refer to "The Advance Display Options Menu" on page 2-29 for more details.

1. Press * to view or modify the **Heat Select** display. See the following example:



2. With the the UP or DOWN keys, select the desired weld schedule.
3. Use the LEFT or RIGHT keys to move the cursor to **WELD**.
4. Set the WELD function to a seam weld using the UP and DOWN keys. Set the WELD function to either AVC-SEAM, or ACC-SEAM.

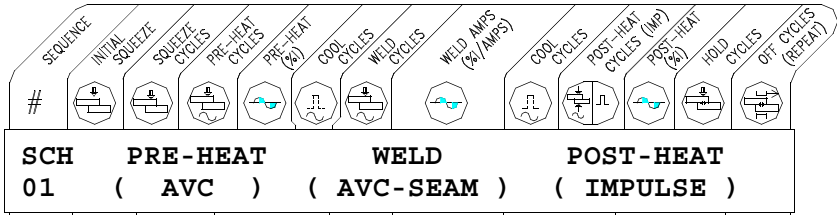
For more information, see "Weld Options" on page 2-10.

WELD TIMING and **CURRENT** will repeat until the pilot is made NOT TRUE. To prevent welding after the initiate is removed, follow Steps 1 - 4 listed above.

Programming a Seam Impulse Weld

Program a seam impulse weld by setting the WELD function to SEAM and setting the POST-HEAT function to IMPULSE using Steps 1 - 4 in “Programming a Seam Weld” on page 3-7.

1. Use the LEFT or RIGHT keys to select the **POST-HEAT** mode.
2. Use the UP and DOWN keys to select the **IMPULSE POST-HEAT** mode. Now this screen will appear:



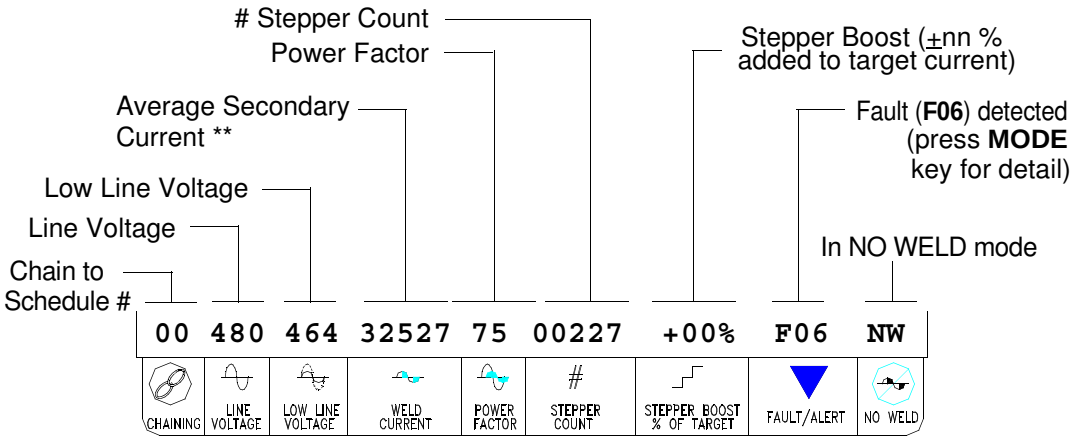
The control is now set up for a seam impulse weld.

3. Press * or MODE to return to the **Normal/Programming** display.
4. Press LEFT or RIGHT to select weld and cool cycles (heat and cool cycles for each impulse). Then press UP or DOWN to set the desired values.
5. Press LEFT or RIGHT to select post-heat cycles (impulses). Then press UP or DOWN to set the number of impulses required. This is the number of times the control will repeat the heat/cool pattern (impulse) pattern set in Step 4.
6. Press the LEFT or RIGHT key to select weld A. (%I). Then press UP or DOWN to set the desired heat. The range is 10 - 99990 A. for ACC, and 20 - 99 %I for AVC.

For further information about Impulse welding, see “Post-Heat Options” on page 2-10.

About the Weld Status Data

The bottom row of the screen displays the weld status data that the control collected when the displayed schedule was last initiated. The status information only shows the data collected (except for the first (chain-to sequence #) and last (Weld/No Weld switch) fields). It is NOT programmable.



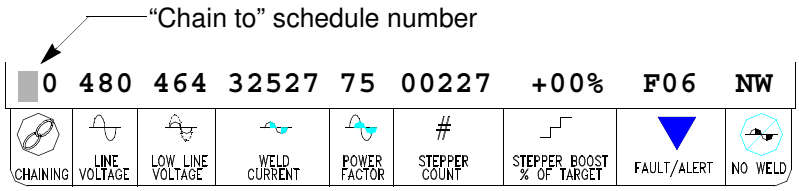
** The secondary current displayed is the primary current x the transformer turns ratio. Consequently, the turns ratio MUST be set correctly to display the correct value of secondary current. For more information, see TXR in the “The Valve Mapping Display” on page 2-22.

This display is updated after each weld. You CANNOT move the cursor to these fields. You can modify ONLY the first and last fields on this line, to select the WELD/NO WELD status and to instruct the control to chain to another weld schedule. These are described in the following sections.

Chaining Schedules

The first field on the lower line of the display lets you instruct the control to “chain” the presently-selected weld schedule to another schedule. This chaining capability permits adding more weld functions to a weld schedule.

The **Chain command** field, highlighted in the figure on the next page, is normally set to **00**. Otherwise, it shows the number of the weld schedule that is “chained to,” which will be executed after the post-heat function in the present schedule.



Chaining enhances flexibility and welding power within a weld schedule. Use it to add to the control's fixed weld schedule (pre-heat, weld and post-heat). Welding at multiple currents and other, more complex operations become possible.

When the MedWeld T2200 starts a chain schedule, it executes each function in the first schedule of the chain—until it completes the post-heat function. Then, instead of going to the hold cycles and off cycle time, it jumps directly to the weld schedule that it is "chained" to. The control then executes the next schedule in the chain.

NOTE: *The control will execute the initialization functions (initial squeeze, squeeze and pre-weld) for the new weld schedule. It then checks whether it is chained to a third schedule.*

Only the last schedule in a chain executes the HOLD *and* OFF CYCLE *functions. If it* IS *chained to another weld schedule, it again skips the* HOLD *and* OFF cycles*, and jumps to the new schedule.*

Theoretically, the MedWeld T2200 can execute all 63 schedules as part of a chain. (The last schedule in any chain is the schedule where the **Chain command** field is set to zero.) However, few practical applications will require such complexity. Normally, a chain will consist of only two or three schedules.

It is also possible to instruct the control to repeat a weld schedule chain, by setting the off cycles in the last schedule of the chain to a value other than zero. During the off cycles, the control processes any weld fault(s) that occurred.

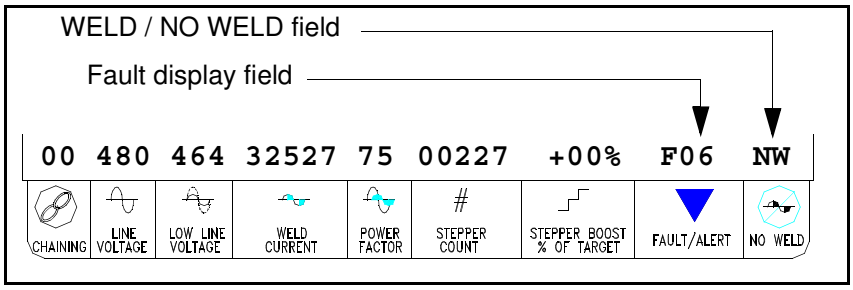
This allows the control to stop any automated processes when a fault occurs. Again, chaining is not a typical application.

NOTE: *A schedule can be used only* ONCE *within a chain. Attempting to use it more than once generates a* CHAINED SEQUENCE ERROR *fault.*

For example, Schedule 1 is chained to Schedule 2, which is chained to Schedule 3. This is a permissible chain. However, Schedule 1 chained to Schedule 2 chained to Schedule 1 generates a CHAINED SEQUENCE ERROR *fault.*

Selecting WELD/NO WELD Status

The other programmable field on the lower line of the display is the **WELD/NO WELD** field.



This field shows the presently-selected status. It also allows for changing the presently-selected mode:

- **WELD** mode enables firing pulses to the welding transformer primary.
- In **NO WELD**, the control cycles but does NOT supply weld current to the work piece.

NOTES: *This indicator only shows the Weld/No Weld status of the software switch. It does* NOT *reflect the status of the external* WELD/NO WELD *input on the I/O card, if it is mapped to an external input in the* **I/O Mapping** *display. To determine if the external* WELD/NO WELD *input is used, check your* **I/O Mapping** *display. Refer to "The IO Mapping Display" on page 2-25.*

If the control is in NO WELD, *(because it was disabled on the* **Normal/ Programming** *display and/or disabled with the external* WELD/NO WELD *input), the control will cycle in* NO WELD. *It will show the* SYSTEM COOLING/NO WELD *fault in the fault display area, field (13 of the* **Normal/Programming** *display). Refer to "15 SYSTEM COOLING: (FAULT / ALERT)" on page 5-5 for a detailed description of this fault condition.*

To change to the presently-selected mode, follow these steps from the **Normal/Programming** mode:

- To move the cursor to the **WELD/NO WELD** field on the **Normal/ Programming** screen, press the LEFT or RIGHT key.
- To select **WELD**, press UP. To select **NO WELD**, press DOWN.
- To select the **Fault** or **Stepper Status** modes, press MODE ; or use the Lifter RIGHT key to continue programming tasks.

Initiating a Weld Schedule

The MedWeld T2200 uses the six WELD PILOT inputs and/or the WELD INITIATE input if the Binary initiation type is selected in the **I/O Mapping** display to determine which schedule to initiate when you provide a WELD PILOT input.

The I/O map, together with the Pilot Assignment/Schedule Inhibit programs, determine how the control responds to the pilot inputs. If the Initiation Type in the I/O map is set to Binary, verify that the WELD INITIATE input is mapped to the appropriate input. Without this input, the control will NOT initiate a weld schedule.

(The **Pilot Assignments/Schedule Inhibit** display is described in "The Pilot Assignments/Schedule Inhibit Display" on page 2-13. It informs the control about which schedule to initiate when it receives each WELD PILOT input.)

When WELD PILOT Input #1, #2, #3, #4, #5 or #6 becomes active, the control scans the appropriate pilot assignment list and initiates the schedule indicated by an asterisk. When it completes the selected schedule, the control updates the weld status data (on the **Normal/Programming** display). The asterisk on the **Pilot Assignment** display moves to the next programmed schedule.

To set up a weld schedule, follow this procedure:

1. Verify that all the screens in the **Advance Display Options** menu are enabled. To do this, simultaneously press and hold the MODE and * keys for 2 seconds. The **Advance Display Options** menu appears. Scroll through all the items. Toggle as needed to set all the menu items to ON.
2. Select the schedule to edit from the **Normal/Programming** mode.
3. Press * to define the firing heat for the pre-heat, weld and post-heat cycles (in the **Heat Select** display).
4. Enter the High and Low current limits, the C-Factor High and Low limits. Refer to "C-Factor" on page 7-1
5. Press * to assign the schedule to a weld pilot (and, indirectly, the stepper to control the schedule).
6. Program the linear stepper assigned to the weld schedule. If not using the stepper, turn it to OFF. (Press MODE until you enter the **Stepper Status** mode.)
7. Return to the **Normal/Programming** mode to verify all of the values programmed.

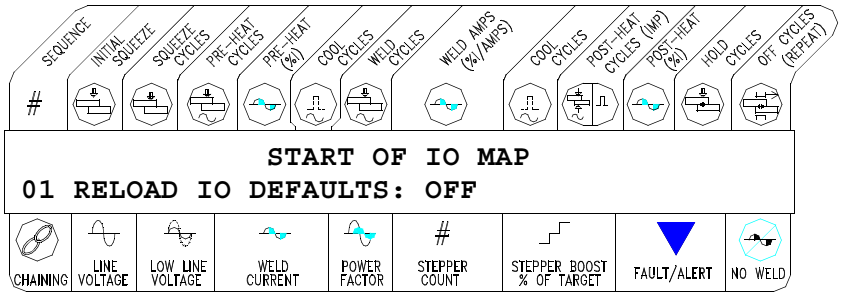
8. When you finish programming the control settings, enter the **Advance Display Options** menu.

9. Turn all the menu options OFF.

   This prevents the control from displaying menus and options that are no longer required. It effectively locks out access to programming displays by unauthorized users.

NOTE: *At power-up (or when cycling power to the control), the pilot assignment is always reset to the first schedule in the Pilot Assignment list.*

The beginning of the I/O mapping looks like this:



Scan through the listing by using the UP and DOWN keys as needed.

I/O Definitions 4

This chapter describes the 821 I/O board. It also defines the inputs to the MedWeld T2200, and the outputs that it provides.

The 821 I/O Board

The 821 I/O board serves to add more I/O capability to the T2200 welding control. The 821's main features are:

- 16 inputs
- 10 outputs
- Inputs can operate with any voltage between 16 V and 120 V, AC or DC
- Outputs are electromechanical relays to switch up to 5 A. at 240 VAC.

Introduction

The 821 I/O board has 16 inputs and 10 outputs. It operates at either 50 or 60 Hz line frequency.

In the standard configuration, the inputs operate on 24 VDC. Power to activate the inputs is supplied from the I/O board. With voltage from an external supply, any voltage between 16 VDC and 180 VDC, or 16 VAC and 120 VAC can activate the inputs. No jumpers or user setup are required; the 821 adjusts itself automatically to the correct operating voltage.

The ten outputs are electromechanical relay contacts with a current rating of 5 A. at 30 VDC, 120 VAC or 250 VAC. Eight relay outputs are normally-open, closed when activated. The other two outputs are SPDT. Either normally-open or normally-closed contacts can be used.

The connection between the 821 board and the weld timer is via a standard 8-pin modular connector, similar to a Category 5 Ethernet connector. A standard Category 5 cable can connect the I/O board to the weld timer. The weld timer supplies all power for the circuitry on the board. A maximum cable length of 10 m (~33 feet) can be used. All connectors on the board are different, to reduce connection mistakes.

The 821 I/O board “intelligently” measures the voltages at the input pins and adjusts the load resistances and logic thresholds to accommodate the detected voltages. Any input voltage less than 140 VAC or 180 VDC will not damage the board. A minimum 16 VAC or 15 VDC (either polarity) is required to activate an input. An input will not be activated by any current of less than 2 mA., regardless of nominal input voltage. Recommended nominal input voltages are 24 VAC, 24 VDC or 120 VAC.

A light emitting diode (LED) indicates the status of each input. If an input is ON, the LED lights brightly. If the input is OFF, the LED glows very dimly or it will be OFF. A dim or OFF LED means that some small amount of current is being applied to the input. If driving the inputs by 120 VAC from the solid-state outputs of a programmable controller, some leakage current through the outputs can be expected. If the voltage applied to the 821 board inputs is below 10 VAC, they will not be activated.

If a DC voltage is used to activate an input, the LED for that input lights red if the voltage is positive relative to the input common, or green if the voltage is negative relative to the input common. If using AC to activate an input, the associated LED will glow yellow-orange.

For each group of inputs, a green LED indicates which voltage level the inputs are operating on. If the inputs are in low-voltage mode (24 V AC/DC nominal), this LED will light. If the inputs are in high-voltage mode (120 V AC/DC nominal), this LED will be OFF. On power-up, the green LED will light (24 V mode) until a high-voltage signal is applied to any input.

DC Operation

When operating on 24 VDC nominal, the inputs are guaranteed to activate at any voltage above 14 VDC (with a current draw of ~7 mA.). They are guaranteed to not activate at any voltage below 5 VDC (current draw at 2 mA.). An input can tolerate up to 40 VDC continuously. An input will not be damaged by up to 30 VAC continuous, or by negative voltages up to 40 VDC.

Connector J3 provides 24 VDC power to activate the inputs. Pin 1 is +24 VDC. Pins 11 and 12 are the negative terminal of the 24 VDC power. This power source is protected with a 0.5 A. fuse.

With 24 VDC, response time to a valid input signal is 8 msec., plus any time delay overhead on the part of the weld timer.

AC Operation

No changes to any components on the circuit board are necessary to support AC input voltages between 16 VAC and 36 VAC, or between 85 VAC and 140 VAC. You can activate the inputs by applying external AC to the desired input terminal.

NOTE: *The internal 24 VDC initiate power source* MUST *be disconnected.*

Within each group of 8 inputs, the initiate voltage must be the same for the entire group. It is possible to operate one group of inputs at 120 VAC and the other at 24 VDC.

When operating at 24 VAC, the minimum voltage at which an input is guaranteed to activate is 16 VAC, 50 or 60 Hz. The maximum voltage guaranteed to NOT activate an input is 5 VAC, 50 or 60 Hz. At 24 VAC, the current draw of the input is ~12 mA.

At voltages between 85 and 140 VAC, the minimum voltage at which an input is guaranteed to activate is 80 VAC, 50 or 60 Hz. The maximum voltage guaranteed to NOT activate an input is 20 VAC, 50 or 60 Hz. At 120 VAC, the input draws ~12 mA current. At 20 VAC, an input draws ~1 mA. If an input is driven by a solid-state relay output with a leakage current of 2 mA. OR LESS, the leakage current will not activate the input.

When operating with an AC input signal, the response time of an input to recognize a valid signal is 10 msec.

The inputs are isolated from ground and can be operated from an ungrounded power source. Each group of 8 inputs is isolated from the other group of 8 inputs so it is possible to operate one group of inputs from a grounded 24 VDC power source and the other from an ungrounded 120 VAC power source.

When operating the inputs with an external power source, nothing should be connected to the +24 VDC power source on the input connector.

Inputs

To activate an input, either 24 VDC, 24 VAC or 120 VAC is applied between the input and its common. Activating an input sets the corresponding bit as “1”. If an input is not activated, the corresponding bit is “0”.

The 16 inputs are divided into two groups of 8. Group 1 inputs are on a 12-pin Phoenix connector labeled **J3**. Group 2 inputs are on a 10-pin Phoenix connector, **J4**. The connectors’ pinouts and their correspondence with the data received by the weld timer from the 821 I/O board are listed in the following two tables.

Group 1 Input Pins and Data Correspondence. (J3, 12-pin Phoenix)

PIN	Signal Name	Corresponding Bit
J3-1	+24 VDC initiate signal source	N/A
J3-2	Input 1, Group 1	Bit 0 (LSB) in byte 2
J3-3	Input 2, Group 1	Bit 1 in byte 2
J3-4	Input 3, Group 1	Bit 2 in byte 2
J3-5	Input 4, Group 1	Bit 3 in byte 2
J3-6	Input 5, Group 1	Bit 4 in byte 2
J3-7	Input 6, Group 1	Bit 5 in byte 2
J3-8	Input 7, Group 1	Bit 6 in byte 2
J3-9	Input 8, Group 1	Bit 7 in byte 2
J3-10	Group 1 common	N/A
J3-11	24 VDC initiate signal source common	N/A
J3-12	24 VDC initiate signal source common	N/A

Group 2 input Pins and Data Correspondence (J4, 10-pin Phoenix)

PIN	Signal Name	Corresponding Bit
J4-1	No connection	
J4-2	Input 1, Group 2	Bit 0 (LSB) in byte 3
J4-3	Input 2, Group 2	Bit 1 in byte 3
J4-4	Input 3, Group 2	Bit 2 in byte 3
J4-5	Input 4, Group 2	Bit 3 in byte 3
J4-6	Input 5, Group 2	Bit 4 in byte 3
J4-7	Input 6, Group 2	Bit 5 in byte 3
J4-8	Input 7, Group 2	Bit 6 in byte 3
J4-9	Input 8, Group 2	Bit 7 in byte 3
J4-10	Group 2 common	N/A

Outputs

The ten outputs of the 821 board are electromechanical relays, rated to switch up to 5 Amp at 120 VAC or 2 Amp at 250 VAC. A 17-position Phoenix-type pluggable connector labeled **J5** is used for the output signals.

Eight outputs are SPST (normally-open only), arranged in two groups of four. The two SPDT relays are separate. Each group of four relays has a single common connection. The other two relays have all three poles brought out separately so they can be connected in a normally-open or normally-closed configuration independent of the other 8 relays. The timer's software determines which output is used for which purpose.

The 821 board provides no fuses for any of the outputs.

The response time of the relays is 15 millisecond maximum to activate or de-activate.

All the relays come out on a 17-pin Phoenix connector. The pinouts of this connector and the correspondence with the data sent from the weld timer to the 821 I/O board are listed below.

J5 Output Pinouts and Corresponding Bits

PIN	Signal name:	Controlled by:
J5-1	Group 1 Common	N/A
J5-2	Relay 1, Group 1	Closed to pin 1 if bit 0 in byte 2 = “1”
J5-3	Relay 2, Group 1	Closed to pin 1 if bit 1 in byte 2 = “1”
J5-4	Relay 3, Group 1	Closed to pin 1 if bit 2 in byte 2 = “1”
J5-5	Relay 4, Group 1	Closed to pin 1 if bit 3 in byte 2 = “1”
J5-6	Group 2 Common	N/A
J5-7	Relay 1, Group 2	Closed to pin 6 if bit 0 in byte 3 = “1”
J5-8	Relay 2, Group 2	Closed to pin 6 if bit 1 in byte 3 = “1”
J5-9	Relay 3, Group 2	Closed to pin 6 if bit 2 in byte 3 = “1”
J5-10	Relay 4, Group 2	Closed to pin 6 if bit 3 in byte 3 = “1”
J5-11	Relay 5, Group 1 SPDT-NC	Closed to pin 12 if bit 4 in byte 2 = “0”
J5-12	Relay 5, Group 1 Common	N/A
J5-13	Relay 5, Group 1 SPDT-NO	Closed to pin 12 if bit 4 in byte 2 = “1”
J5-14	Relay 5, Group 2 SPDT-NC	Closed to pin 15 if bit 4 in byte 3 = “0”
J5-15	Relay 5, Group 2 Common	N/A
J5-16	Relay 5, Group 2 SPDT-NO	Closed to pin 15 if bit 4 in byte 3 = “1”
J5-17	No connection	

Interface to the Weld Timer

The cable connecting the weld timer and 821 board has eight conductors and is implemented with 8-pin modular connectors. To limit voltage drop and crosstalk, the maximum recommended cable length is 10 meters (33 ft.). The weld timer has two connectors, to connect up to two 821 boards.

The board receives 24 VDC nominal from the weld timer. The maximum allowable power voltage is 40 VDC, and the minimum is 16 VDC. The board will function properly at any voltage between these extremes.

The worst-case current draw, assuming all inputs and outputs are ON simultaneously, is about 300 mA at 24 VDC. In normal operation, the current will be under 150 mA.

The signal interface between the weld timer and the I/O board is a standard, self-clocked SPI interface. This means the data transfer rate is determined by the clock, which is supplied from the weld timer. The interface supports commands from the timer to the 821 board as well as the transfer of normal I/O information.

Programming/Test Connector

A 6-pin RJ-11 connector on the 821 board is designated **J1**. J1 allows programming the embedded microprocessor and performing the circuit board functional test. This connector interfaces to a Microchip ICD module (Microchip Technology Inc. p/n DV164002) with a 6-conductor modular cable, similar to the type used for telephones.

Installation and Operation

The 821 I/O board mounts with six standoffs to a flat panel. For proper cooling and spacing for voltages, standoffs should be at least 10 mm (3/8 in.) long. The board can be mounted in any orientation.

The 821 I/O board will operate properly at any temperature between -10 and +40° C. Relative humidity above 90% will cause corrosion of the connectors and eventual failure.

When mounted with steel standoffs to a steel panel at least 2 mm thick, the board will withstand vibration up to 2 G and shock up to 10 G.

As with any device containing digital circuitry, take precautions to protect the 821 I/O board from static electricity before and during its installation into a welding control. Once installed, the board is quite insensitive to static electricity and no special protection measures are required.

I/O Mapping List

Tables 1 and 2 on the following page list the possible functions that may be programmed for each I/O point in the I/O map. For more information, refer to “The IO Mapping Display” on page 2-25.

Table 1: Input Functions and Abbreviations

BINARY SELECT 1 / Pilot 1	BS1
BINARY SELECT 2 / Pilot 2	BS2
BINARY SELECT 4 / Pilot 3	BS4
BINARY SELECT 8 / Pilot 4	BS8
BINARY SELECT 16 / Pilot 5	BS16
BINARY SELECT 32 / Pilot 6	BS32
WELD INITIATE	INT
WELD / NO WELD	WLD
ISOLATION CONTACTOR SAVER	CSVR
STEPPER RESET	SR
FAULT RESET	FR
TIP DRESS RESET	TIPD
PRESSURE SWITCH Input	PS1
2ND STAGE Input	2ND
RETRACT PILOT 1	RP1
RETRACT PILOT 2	RP2
TRANSFORMER OVERTEMP Input	TROT
NO STROKE NO WELD Input	NSNW
PROGRAM SECURITY Input	PSEC
HEAT DISPLAY SECURITY Input	HSEC
NONE	

Table 2: Output Functions and Abbreviations

VALVE1 / BINARY VALVE 1	BV1
VALVE2 / BINARY VALVE 2	BV2
VALVE3 / BINARY VALVE 4	BV4
VALVE4 / BINARY VALVE 8	BV8
VALVE5 / BINARY VALVE 16	BV16
VALVE6 / BINARY VALVE 32	BV32
INTENSIFICATION VALVE Output	INTV
WELD IN PROGRESS / INIT ACK	IACK
NO FAULT Output	FLT
ALERT Output	ALT
STEPPERS ARE RESET	SAR
WELD COMPLETE	WCPL
READY TO WELD	RTW
END OF STEPPER	EOS
STEPPER APPROACHING MAX	SAM
WATER SAVER Output	WSV
RETRACT 1 / OHMA BLOCK 1	RV1
RETRACT 2 / OHMA BLOCK 2	RV2

END OF HOLD Output . . . . . EOH
PRESSURE SELECT 1 . . . . . PS1
PRESSURE SELECT 2 . . . . . PS2
PRESSURE SELECT 3 . . . . . PS3
PRESSURE SELECT 4 . . . . . PS4
WELD / NO WELD . . . . . WNWO
WELD / NO WELD MISMATCH Output . . . . . WM
FORGE . . . . . FRGV
ADVANCE 1 VALVE VLV1
ADVANCE 2 VALVE VLV2
NONE

I/O Map Definitions

01 RELOAD FROM DEFAULTS: (OFF / DEFAULT 1-6)

Six I/O default maps are available to choose from. Refer to “Default I/O Mappings for Program T02200” on page 4-18.

02 INITIATION TYPE: (BINARY / DISCRETE)

Initiation is of two types: ***Binary*** and ***Discrete***.

- **Binary:** In this type, up to six inputs can be used to select which schedule to initiate. BINARY SELECT inputs 1 - 32 can select up to 63 schedules. When using two or more BINARY SELECT inputs in combination, the inputs must be turned on PRIOR to the WELD ENABLE input. In this mode, the control requires at least one BINARY SELECT input combined with the WELD INITIATE input in order to initiate a weld schedule.

Binary initiation sets the desired schedule number as the total of all the weighted values of BINARY SELECT inputs for that schedule number. For example, BS1 + BS2 will initiate Sequence #03 (because 1 + 2 = 3). BS1 + BS3 + BS4 + BS6 initiates Sequence #45 (because 1 + 4 + 8 + 32 = 45), etc., AND the WELD INITIATE input is true for that binary combination.

Failure to map the WELD INITIATE input means the control CANNOT initiate any weld schedule.

Any one, more or all 63 schedules can be inhibited in the **Pilot Assignments/Schedule Inhibit** display mode. Turn on this display from the **Advance Display Options** menu. See page 2-29 for more information. For more details on editing in or viewing **Pilot Assignments/Schedule Inhibit** display, refer to page 2-13.

- **Discrete:** In this mode, the control does NOT use the WELD INITIATE input. If two or more pilots are turned on simultaneously, the control will NOT initiate, and will generate a WELD PILOT fault/alert.

  Up to six individual pilot inputs can be used as a discrete input to initiate a sequence. In this mode, the **Pilot Assignments/ Schedule Inhibit** display controls which sequence will be initiated by all six pilot inputs.

  Each pilot input can initiate up to 16 different combinations of weld schedules in succession, or initiate the same sequence each time the same pilot is turned on.

  The schedule that a pilot input initiates may also be controlled by the schedule number selected from the **Normal/ Programming** display mode if the **Pilot Assignments/Schedule Inhibit** display has 00s programmed in all fields. For more information, see “The Pilot Assignments/Schedule Inhibit Display” on page 2-13.

03 VALVE TYPE: (BINARY / DISCRETE)

Valve outputs may be output in two ways: ***Binary*** or ***Discrete***. The type is set in I/O map **03 Valve Type**.

- When set ***Binary***, the output is the weighted value of the binary outputs. For example, 1 = BV1; 2 = BV2, 3 = BV1 + BV2 (because 1 + 2 = 3); 5 = BV4 + BV1 (1 + 4 = 5); etc.
- When set ***Discrete***, only one of the six possible valves will be output for the sequence.

Valve initiation is of two types: ***Binary*** and ***Discrete***.

- **Binary:** In this mode, the control can turn on all six valve outputs in any combination, depending on the binary valve number programmed in the **Valve Mapping** display (see page 2-22). This also depends on how many output valves are set up in the **I/O Mapping** display. Refer to page 2-25 for more information.
- **Discrete:** In this mode, the control will only turn on one of the six valve outputs at a time in any weld schedule initiated, depending on what valve number is programmed in the Valve Mapping display. See page 2-22 for further information.

NOTE: *Selecting AIR/OIL in the Cylinder Type setup parameter will disable the valve outputs.*

04 PRESSURE TYPE: (PRESSURE SELECT / ANALOG)

PRESSURE SELECT enables 1 - 4 PRESSURE SELECT outputs that may be mapped to outputs 1 - 10. ANALOG enables the two analog outputs, A and B. For more information, refer to “Default Valving for All Schedules” on page 2-24.

05 INITIATION MODE: (BEAT / NON BEAT)

This parameter instructs the control on how to respond if the weld initiate drops out during the weld sequence. The default setting is **NON BEAT**. The possible settings are

- When selecting ***BEAT***, the WELD PILOT input must be held active until the control executes the pre-heat function. If this input is de-activated before the pre-heat function executes, the control generates the BEAT MODE fault and aborts the schedule.
- When selecting ***NON BEAT***, the control does not require the WELD PILOT input to be held active.

06 ISOLATION CONTACTOR: (DISABLED / ENABLED)

Enabling the isolation contactor engages the program that checks the state of the isolation contactor, via the auxiliary contactor contacts and coil connected to **J10** on the programmer/display board.

07 INPUT 1
08 INPUT 2
09 INPUT 3
10 INPUT 4
11 INPUT 5
12 INPUT 6
13 INPUT 7
14 INPUT 8
15 INPUT 9
16 INPUT 10
17 INPUT 11
18 INPUT 12
19 INPUT 13
20 INPUT 14
21 INPUT 15
22 INPUT 16

The following describes the input functions assignable to the 16 inputs listed above. At the right of each input label, abbreviations are as they appear on the DEP-100S (Data Entry Panel).

BINARY SELECT 1 / PILOT 1	**BS1**
BINARY SELECT 2 / PILOT 2	**BS2**

BINARY SELECT 4 / PILOT 3 **BS4**
BINARY SELECT 8 / PILOT 4 **BS8**
BINARY SELECT 16 / PILOT 5 **BS16**
BINARY SELECT 32 / PILOT 6 **BS32**

Determine the schedule(s) to assign to a weld pilot by using the **Pilot Assignments/Schedule Inhibit** display. See “The Pilot Assignments/Schedule Inhibit Display” on page 2-13 for more details.

WELD INITIATE INT

When this input is activated, the weld control executes the schedule that was selected by the BINARY SELECT inputs.

WELD / NO WELD WLD

This is a Weld input to the control. With this input closed (HIGH), the control is in Weld mode. If this input is open, the control is in No Weld mode.

With this input open (No Weld mode), the control will turn on the NO WELD output (if programmed), no weld current will flow and the NO WELD fault is issued.

ISOLATION CONTACTOR SAVER CSVR

This input tells the weld processor to enable the isolation contactor delay timer. The delay timer (programmed in the setup parameters, as described on page 5-11), holds the isolation contactor closed after a weld schedule is completed, to prevent it from dropping out between welds.

If this input is active at the end of a schedule, the weld processor will hold the isolation contactor closed for the amount of time programmed.

If this input is not active, the isolation contactor will drop out at the end of the weld schedule. However, if this input drops out during the delay time, the remaining time on the delay timer is aborted and the isolation contactor is immediately opened.

STEPPER RESET SR

This input will reset all the steppers to Step 1 and the weld count to 0.

FAULT RESET FR

This input allows the control to remotely reset all faults.

TIP DRESS TIPD

This input moves the stepper to the beginning of the second step in the stepper profile.

PRESSURE SWITCH PS

If the weld schedule contains the function WAIT nnn CY FOR PRESSURE SWITCH, and this input does not become active in the number of cycles specified, the control generates a PRESSURE SWITCH fault and continues with the schedule.

The control aborts the weld schedule and generates a PRESSURE SWITCH fault if the weld initiate is removed while the control is waiting in the function WAIT FOR PRESSURE SWITCH.

2ND STAGE 2ND

The function of this input depends on the setting of the Second Stage Input setup parameter:

- If set to ***2ND STAGE***, this input must be active when the control executes Function #68 (WAIT FOR SECOND STAGE). The control will wait for this input to become active, and issues a SECOND STAGE fault if the initiate is removed while it is waiting. This lets you tell the control to wait for a second condition to become true before continuing with a weld schedule.

RETRACT #1 RP1
RETRACT #2 RP2

This input changes the state of the RETRACT VALVE #1 (or #2) output. How this output reacts to the RETRACT input depends on the settings established for the Retract Mode and Retract Cylinder setup parameters.

- When set to ***UNLATCHED***, the RETRACT VALVE output follows the state of the RETRACT input. The valve output is active while the input is active.
- When setting ***LATCHED*** retract mode, the RETRACT input changes the state of the RETRACT VALVE output. The first pulse from the input activates the valve output. The second pulse from the input de-activates the output.
- With NONE selected, the control ignores the RETRACT input.

The Retract Cylinder setup parameter defines the retract cylinder as either AIR-NORMAL, or AIR-INVERTED, AIR/OIL-NORMALLY-OPEN or AIR/OIL-NORMALLY-CLOSED.

- AIR-NORMAL indicates that the output is turned **OFF** to close the gun.
- AIR-INVERTED indicates that the output is turned **ON** to close the gun.
- AIR/OIL-NORMALLY OPEN indicates that the output is turned **OFF** to close the gun.
- AIR/OIL-NORMALLY CLOSED indicates that the output is turned **ON** to close the gun.

TRANSFORMER OVERTEMP TROT

This input tells the state of the cooling system. It is provided as an external welding transformer over-temperature switch. If not using this input, jumper it HIGH.

If this input is not active when the control receives a schedule initiate, a SYSTEM COOLING Fault will be generated, and the NO FAULT Output will be de-energized.

NO STROKE/NO WELD NSNW

When this input is active, the control is in No Stroke/No Weld. This tells the weld control to cycle without supplying current and without turning on the valves. This input affects the weld valves only. It does not affect any other outputs.

PROGRAM SECURITY PSEC

If this input is not jumpered, only data under the Stepper Status Mode and Heat Display Mode can be changed.

This input is used in conjunction with the HEAT DISPLAY SECURITY input, only data under the Stepper Display Mode can be changed.

HEAT DISPLAY SECURITY HSEC

This input must be used in conjunction with the PROGRAM MODE SECURITY input. If this input is not active (not jumpered), NO changes can be made to any of the programmable data except under the Stepper Status Mode.

Table 1: Security Jumper Position

	Control is LOCKED	Control is Fully Programmable	Only Heat Display is Programmable	Control is Fully Programmable
Program Security	**No Jumper**	**Jumpered**	**No Jumper**	**Jumpered**
Heat Security	**No Jumper**	**No Jumper**	**Jumpered**	**Jumpered**

NONE
NO INPUT ASSIGNMENT

23 OUTPUT 1
24 OUTPUT 2
25 OUTPUT 3
26 OUTPUT 4
27 OUTPUT 5
28 OUTPUT 6
29 OUTPUT 7
30 OUTPUT 8
31 OUTPUT 9
32 OUTPUT 10

Below are the functions that the T2200 outputs may be mapped to. At the right of the output labels are abbreviations as they appear on the DEP-100S (Data Entry Panel).

VALVE 1 / BINARY VALVE1	**BV1**
VALVE 2 / BINARY VALVE2	**BV2**
VALVE 3 / BINARY VALVE4	**BV4**
VALVE 4 / BINARY VALVE8	**BV8**
VALVE 5 / BINARY VALVE16	**BV16**
VALVE 6 / BINARY VALVE32	**BV32**

INTENSIFICATION VALVE **INTV**

This output energizes the TURN ON INTENSIFY VALVE some time after the gun closes and builds up initial pressure.

WELD IN PROGRESS / INIT ACK **IACK**

This output indicates that the control is executing a schedule.

NO FAULT **FLT**

This output is normally ON (to indicate that no fault conditions exist). If the control shuts down as the result of a fault condition, this output will be turned OFF.

ALERT **ALT**

This output is normally OFF. It turns ON to indicate an alert condition. Alert conditions are usually less serious than faults and are normally used to warn the operator that maintenance is required.

STEPPERS ARE RESET **SAR**

This input will reset all the steppers to Step 1 and the weld count to 0.

WELD COMPLETE WCPL

This output is turned ON and OFF by the weld control in response to Functions #50 and #51.

READY TO WELD RTW

When active, this output indicates that the control is ready to weld and will pass current if

- The control is in Weld Mode,
- NO faults exist,
- The CONTROL STOP input is HIGH,
- The WCU is synchronized with the line voltage,
- System cooling is provided:
  - The SCR OVER TEMP input is closed
  - On DIO/RWC1-P2 controls only: The TRANSFORMER OVER TEMP input is closed.

When this output is activated, the **RTW** LED on the WTC weld processor will light.

END OF STEPPER EOS

This output is active when the stepper completes the final weld in Step #5 of the profile. The program now issues the END OF STEPPER fault. Electrode maintenance is required.

STEPPER APPROACHING MAX SAM

For linear steppers, this output will activate when the control reaches the start of the last step in the stepper profile.

WATER SAVER WSV

The Water Saver valve is used to save cooling water. This valve is energized at the start of a weld schedule. The valve turns OFF 180 sec (3 minutes) after a sequence ends.

RETRACT / OHMA BLOCK 1 RV1
RETRACT / OHMA BLOCK 2 RV2

These outputs respond to the on/off status of the RETRACT VALVE 1 and 2 PILOT inputs, based on the Retract Mode setup parameter. Refer to page 4-17 for more details.

END OF HOLD EOH

This output turns ON after the control completes the number of HOLD CYCLES programmed. The output remains active for the

number of OFF CYCLES programmed. (For example, setting OFF CYCLES to 08 cycles holds this output active for 8 cycles.)

By disabling the OFF CYCLES (programming for 0 cycles), this output remains on for five cycles before it is turned off. The output remains on for a default interval of five cycles.

PRESSURE SELECT 1 **PS1**
PRESSURE SELECT 2 **PS2**
PRESSURE SELECT 3 **PS3**
PRESSURE SELECT 4 **PS4**

These outputs are activated or de-activated when the T2200 executes functions #56 (TURN ON PRESSURE SELECT #n) and #57 (TURN OFF PRESSURE SELECT #n).

WELD/NO WELD **WNWO**

When the WELD/NO WELD input is opened, it energizes this output (to indicate that the control is in No Weld Mode). If a valid weld initiate is received while the control is in No Weld Mode, the weld schedule will schedule normally, but weld current WILL NOT FLOW.

WELD / NO WELD MISMATCH **WM**

This output is active to indicate that the control is in Weld Mode and the data entry device is in No Weld Mode.

FORGE **FRGV**

This output is programmable. It is controlled by Functions #75 and #76 in a weld schedule.

ADVANCE 1 VALVE **VLV1**
ADVANCE 2 VALVE **VLV2**

These outputs are activated or de-activated when the T2200 executes Function #54 (TURN ON WELD VALVE #n) or Function #55 (TURN OFF WELD VALVE #n).

NOTE: *Valves #1 and #2 are shared outputs. They function as the two Advance (Fluid) valves when enabling Ohma (air-over-oil) cylinder operation for the processor.*

NONE
NO OUTPUT ASSIGNMENT

RETRACT 1 / OHMA BLOCK 1

The control activates or de-activates this output in response to the RETRACT input. The action of the output depends on how retract is defined in the Retract Mode setup parameter.

- When set to ***UNLATCHED***, the RETRACT VALVE output follows the state of the RETRACT input. The valve output is active while the input is active.
- When set to ***LATCHED*** retract mode, the RETRACT input changes the state of the RETRACT VALVE output. The first pulse from the input activates the valve output. The second pulse from the input de-activates the output.
- When you select ***NONE***, the control ignores the RETRACT input.

The Retract Cylinder setup parameter also controls this output.

- When set to ***AIR-NORMAL***, the RETRACT output is ***activated***, to indicate that the control is in retract.
- When set to ***AIR-INVERTED***, the RETRACT output becomes ***inactive***, to indicate that the control is in retract.

Caution:

As a safety feature, the control ignores any changes made to the Retract setup parameters until you reset the control (by cycling power). It also displays the currently-selected status of the Retract setup parameters on power-up.

Default I/O Mappings for Program T02200

T02200 includes six default mappings of the I/O points.

Default #1

START OF IO MAP
01 RELOAD IO DEFAULTS
02 INITIATION TYPE: DISCRETE
03 VALVE TYPE: BINARY
04 PRESSURE ANALOG/PRESSURE SELECT: PRESSURE
05 INITIATION MODE: NON BEAT / BEAT
06 ISO CONTACTOR: ENABLED / DISABLED
07 INPUT 01: BINARY 1 / PILOT 1
08 INPUT 02: BINARY 2 / PILOT 2
09 INPUT 03: BINARY 4 / PILOT 4
10 INPUT 04: BINARY 8 / PILOT 8
11 INPUT 05: WELD INITIATE
12 INPUT 06: WELD/NO WELD
13 INPUT 07: STEPPER RESET
14 INPUT 08: FAULT RESET
15 INPUT 09: PRESSURE SWITCH
16 INPUT 10: 2ND STAGE
17 INPUT 11: RETRACT 1
18 INPUT 12: RETRACT 2
19 INPUT 13: XFORMER OVERTEMP
20 INPUT 14: PROGRAM SECURITY
21 INPUT 15: HEAT SECURITY
22 INPUT 16: TIP DRESS RESET
23 OUTPUT 01: VALVE 1
24 OUTPUT 02: VALVE 2
25 OUTPUT 03: OHMA INTENSIFY
26 OUTPUT 04: PRESSURE SEL 1
27 OUTPUT 05: PRESSURE SEL 2
28 OUTPUT 06: RETRACT VALVE 1
29 OUTPUT 07: RETRACT VALVE 2
30 OUTPUT 08: WELD/NO WELD OUT
31 OUTPUT 09: NO FAULT
32 OUTPUT 10: ALERT
33 END OF I/O MAP

Default #2

01 START OF IO MAP
02 INPUT MODE: BINARY
03 OUTPUT MODE: DISCRETE
04 PRESSURE ANALOG/PRESSURE SELECT: PRESSURE
05 INPUT MODE: NON BEAT
06 ISO CONTACTOR CHECKING: YES
07 INPUT 01: BINARY 1
08 INPUT 02: BINARY 2
09 INPUT 03: BINARY 4
10 INPUT 04: BINARY 8
11 INPUT 05: WELD INITIATE
12 INPUT 06: WELD/NO WELD
13 INPUT 07: STEPPER RESET
14 INPUT 08: FAULT RESET
15 INPUT 09: PRESSURE SWITCH
16 INPUT 10: 2ND STAGE
17 INPUT 11: RETRACT 1
18 INPUT 12: RETRACT 2
19 INPUT 13: XFORMER OVERTEMP
20 INPUT 14: PROGRAM SECURITY
21 INPUT 15: HEAT SECURITY
22 INPUT 16: TIP DRESS RESET
23 OUTPUT 01: VALVE 1
24 OUTPUT 02: VALVE 2
25 OUTPUT 03: OHMA INTENSIFY
26 OUTPUT 04: PRESSURE SEL 1
27 OUTPUT 05: PRESSURE SEL 2
28 OUTPUT 06: RETRACT VALVE 1
29 OUTPUT 07: RETRACT VALVE 2
30 OUTPUT 08: WELD/NO WELD OUT
31 OUTPUT 09: NO FAULT
32 OUTPUT 10: ALERT
33 END OF I/O MAP

Default #3

01 START OF IO MAP
02 INPUT MODE: BINARY
03 OUTPUT MODE: DISCRETE
04 PRESSURE ANALOG/PRESSURE SELECT: PRESSURE
05 INPUT MODE: NON BEAT
06 ISO CONTACTOR CHECKING: NO
07 INPUT 01: BINARY 1
08 INPUT 02: BINARY 2
09 INPUT 03: BINARY 4
10 INPUT 04: BINARY 8
11 INPUT 05: BINARY 16
12 INPUT 06: BINARY 32
13 INPUT 07: WELD INITIATE
14 INPUT 08: WELD/NO WELD
15 INPUT 09: FAULT RESET
16 INPUT 10: PRESSURE SWITCH
17 INPUT 11: 2ND STAGE
18 INPUT 12: RETRACT 1
19 INPUT 13: XFORMER OVERTEMP
20 INPUT 14: PROGRAM SECURITY
21 INPUT 15: HEAT SECURITY
22 INPUT 16: NONE
23 OUTPUT 01: VALVE 1
24 OUTPUT 02: VALVE 2
25 OUTPUT 03: VALVE 3
26 OUTPUT 04: VALVE 4
27 OUTPUT 05: WATER SAVER
28 OUTPUT 06: WELD/NO WELD OUT
29 OUTPUT 07: RETRACT VALVE 1
30 OUTPUT 08: END OF HOLD
31 OUTPUT 09: NO FAULT
32 OUTPUT 10: FORGE VALVE
33 END OF I/O MAP

Default #4

01 START OF IO MAP
02 INPUT MODE: BINARY
03 OUTPUT MODE: DISCRETE
04 PRESSURE ANALOG/PRESSURE SELECT: PRESSURE
05 INPUT MODE: NON BEAT
06 ISO CONTACTOR CHECKING: YES
07 INPUT 01: BINARY 1
08 INPUT 02: BINARY 2
09 INPUT 03: BINARY 4
10 INPUT 04: BINARY 8
11 INPUT 05: BINARY 16
12 INPUT 06: BINARY 32
13 INPUT 07: WELD INITIATE
14 INPUT 08: WELD/NO WELD
15 INPUT 09: FAULT RESET
16 INPUT 10: PRESSURE SWITCH
17 INPUT 11: 2ND STAGE
18 INPUT 12: RETRACT 1
19 INPUT 13: XFORMER OVERTEMP
20 INPUT 14: PROGRAM SECURITY
21 INPUT 15: HEAT SECURITY
22 INPUT 16: NONE
23 OUTPUT 01: VALVE 1
24 OUTPUT 02: VALVE 2
25 OUTPUT 03: VALVE 3
26 OUTPUT 04: VALVE 4
27 OUTPUT 05: WATER SAVER
28 OUTPUT 06: WELD/NO WELD OUT
29 OUTPUT 07: RETRACT VALVE 1
30 OUTPUT 08: END OF HOLD
31 OUTPUT 09: NO FAULT
32 OUTPUT 10: FORGE VALVE
33 END OF I/O MAP

Default #5

01 START OF IO MAP
02 INPUT MODE: DISCRETE
03 OUTPUT MODE: DISCRETE
04 PRESSURE ANALOG/PRESSURE SELECT: PRESSURE
05 INPUT MODE: NON BEAT
06 ISO CONTACTOR CHECKING: NO
07 INPUT 01: PILOT 1
08 INPUT 02: PILOT 2
09 INPUT 03: PILOT 3
10 INPUT 04: PILOT 4
11 INPUT 05: PILOT 5
12 INPUT 06: PILOT 6
13 INPUT 07: WELD INITIATE
14 INPUT 08: WELD/NO WELD
15 INPUT 09: FAULT RESET
16 INPUT 10: PRESSURE SWITCH
17 INPUT 11: 2ND STAGE
18 INPUT 12: RETRACT 1
19 INPUT 13: XFORMER OVERTEMP
20 INPUT 14: PROGRAM SECURITY
21 INPUT 15: HEAT SECURITY
22 INPUT 16: NONE
23 OUTPUT 01: VALVE 1
24 OUTPUT 02: VALVE 2
25 OUTPUT 03: VALVE 3
26 OUTPUT 04: VALVE 4
27 OUTPUT 05: WATER SAVER
28 OUTPUT 06: WELD/NO WELD OUT
29 OUTPUT 07: RETRACT VALVE 1
30 OUTPUT 08: END OF HOLD
31 OUTPUT 09: NO FAULT
32 OUTPUT 10: FORGE VALVE
33 END OF I/O MAP

Default #6

01 START OF IO MAP
02 INPUT MODE: DISCRETE
03 OUTPUT MODE: DISCRETE
04 PRESSURE ANALOG/PRESSURE SELECT: PRESSURE
05 INPUT MODE: NON BEAT
06 ISO CONTACTOR CHECKING: YES
07 INPUT 01: PILOT 1
08 INPUT 02: PILOT 2
09 INPUT 03: PILOT 3
10 INPUT 04: PILOT 4
11 INPUT 05: PILOT 5
12 INPUT 06: PILOT 6
13 INPUT 07: WELD INITIATE
14 INPUT 08: WELD/NO WELD
15 INPUT 09: FAULT RESET
16 INPUT 10: PRESSURE SWITCH
17 INPUT 11: 2ND STAGE
18 INPUT 12: RETRACT 1
19 INPUT 13: XFORMER OVERTEMP
20 INPUT 14: PROGRAM SECURITY
21 INPUT 15: HEAT SECURITY
22 INPUT 16: NONE
23 OUTPUT 01: VALVE 1
24 OUTPUT 02: VALVE 2
25 OUTPUT 03: VALVE 3
26 OUTPUT 04: VALVE 4
27 OUTPUT 05: WATER SAVER
28 OUTPUT 06: WELD/NO WELD OUT
29 OUTPUT 07: RETRACT VALVE 1
30 OUTPUT 08: END OF HOLD
31 OUTPUT 09: NO FAULT
32 OUTPUT 10: FORGE VALVE
33 END OF I/O MAP

DEP-100S Abbreviations

The DEP-100S provides an I/O Status display to help troubleshoot the I/O. This display shows the state of each input and output provided by your control.

Status indications are either a **0** or a **1**. Zero indicates the input or output is *inactive.* One indicates that the input or output is *active*.

The following tables list the abbreviations used to represent the I/O for DeviceNet or RIO at the DEP-100S Programming Device.

Input Abbreviations

On the LCD panel of the T2200 or DEP-100S, the inputs appear with these abbreviations:

BINARY SELECT 1 / Pilot 1	BS1
BINARY SELECT 2 / Pilot 2	BS2
BINARY SELECT 4 / Pilot 3	BS4
BINARY SELECT 8 / Pilot 4	BS8
BINARY SELECT 16 / Pilot 5	BS16
BINARY SELECT 32 / Pilot 6	BS32
WELD INITIATE	INT
WELD / NO WELD	WLD
ISOLATION CONTACTOR SAVER	CSVR
STEPPER RESET	SR
FAULT RESET	FR
TIP DRESS RESET	TIPD
PRESSURE SWITCH Input	PS1
2ND STAGE Input	2ND
RETRACT PILOT 1	RP1
RETRACT PILOT 2	RP2
TRANSFORMER OVERTEMP Input	TROT
NO STROKE NO WELD Input	NSNW
PROGRAM SECURITY Input	PSEC
HEAT DISPLAY SECURITY Input	HSEC

Output Abbreviations

On the LCD panel of the T2200 or DEP-100S, the outputs appear with these abbreviations:

VALVE1 / BINARY VALVE 1	BV1
VALVE2 / BINARY VALVE 2	BV2
VALVE3 / BINARY VALVE 4	BV4
VALVE4 / BINARY VALVE 8	BV8
VALVE5 / BINARY VALVE 16	BV16
VALVE6 / BINARY VALVE 32	BV32
INTENSIFICATION VALVE Output	INTV
WELD IN PROGRESS / INIT ACK	IACK
NO FAULT Output	FLT
ALERT Output	ALT

STEPPERS ARE RESET . . . . . SAR
WELD COMPLETE . . . . . WCPL
READY TO WELD . . . . . RTW
END OF STEPPER . . . . . EOS
STEPPER APPROACHING MAX . . . . . SAM
WATER SAVER Output . . . . . WSV
RETRACT 1 / OHMA BLOCK 1 . . . . . RV1
RETRACT 2 / OHMA BLOCK 2 . . . . . RV2
END OF HOLD Output . . . . . EOH
PRESSURE SELECT 1 . . . . . PS1
PRESSURE SELECT 2 . . . . . PS2
PRESSURE SELECT 3 . . . . . PS3
PRESSURE SELECT 4 . . . . . PS4
WELD / NO WELD . . . . . WNWO
WELD / NO WELD MISMATCH Output . . . . . WM
FORGE . . . . . FRGV
ADVANCE 1 VALVE VLV1
ADVANCE 2 VALVE VLV2

Setup Parameters and Faults 5

This chapter describes the setup parameters and faults provided for the MedWeld T2200.

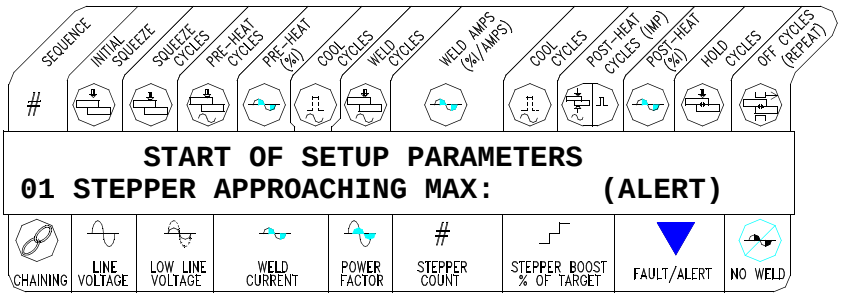
The control includes a set of defined ***setup parameters***. They let you customize the control to meet your specific requirements. Some parameters define the hardware environment (such as the type of retract, pressure cylinder or transformer being used). Others tell the control how to respond to certain error conditions.

- On detecting a condition defined as a ***Fault***, the control activates the FAULT/ALERT output. The Initiation On Fault setup parameter permits specifying that the control either ALLOW or INHIBIT the operator to initiate a new schedule when this output is active.
- When responding to an error condition defined as an ***Alert***, the control flashes the FAULT/ALERT output. Alert conditions do NOT inhibit initiation.

Other parameters define the hardware and nominal range limits on weld current. To view the setup parameters (or modify those that are programmable), use the **Setup** Display Mode.Selecting the Setup Mode

In the setup mode, you define the operating environment for the MedWeld T2200. To access this mode, follow these steps:

1. Open (or return to) the **Normal/Programming** display mode.
2. Press the MODE key, repeating as needed until this screen appears:



NOTE: *On first entering the* **Setup** *mode after turning off the control, the display will show the first setup parameter in the list. Otherwise, the control*

returns to the point in the list of setup parameters where you left off (the last time you used the **Setup** *mode).*

Using the Setup Parameters

Some setup parameters define the severity of control error conditions. Others identify the hardware environment (such as the retract type and transformer type) to the control.

The setup parameters are described in this section. This lists the options available for each parameter and the weld control default (factory) settings.

Moving Through the Setup Parameters

The MedWeld T2200 displays each parameter in the order shown in the following section. The parameter number also appears, indicating where you are located in the list. To move through the list, press the UP or DOWN key. At the last parameter in the list, the display wraps back to parameter #01.

Changing a Parameter Value

To change the value of a setup parameter, follow these steps:

1. Press UP or DOWN as needed to scroll through the parameter list until you see the parameter to modify.
2. With the desired parameter displayed, press RIGHT. The cursor moves to highlight the present setting for this parameter.
3. Press UP or DOWN to either
   - Scroll through the list of options (such as FAULT/ALERT or PEAK/AVERAGE); or
   - Increase or decrease a numerical value.
4. When the correct setting appears, press LEFT or RIGHT to move the cursor back to the beginning of the line.
5. Then, either
   - Select another parameter by pressing UP or DOWN and repeating Steps 1 – 3, or
   - Go to a different display mode by pressing MODE .

Descriptions of Setup Parameters

This section describes the setup parameters and their possible values (or ranges of values):

----------START OF SETUP PARAMETERS----------

01 STEPPER APPROACHING MAX: (FAULT / ALERT / NONE)

This defines the severity of the condition when a stepper reaches Step 5 of the profile. This condition warns that electrode maintenance is required.

02 END OF STEPPER: (FAULT / ALERT / NONE)

The control generates this condition when the stepper has completed the last weld in Step 5. At this point, the electrodes require dressing or replacing. To clear the condition, you must reset the stepper.

03 HIGH CURRENT LIMIT: nnnnn (FAULT / ALERT / NONE)
04 LOW CURRENT LIMIT: nnnnn (FAULT / ALERT / NONE)

These setup parameters specify the range of acceptable secondary current. If the secondary current exceeds the High Current Limit (or falls below the Low Current Limit) setup parameter, the control issues a HIGH (or LOW) CURRENT LIMIT fault condition.

05 HIGH C-FACTOR LIMIT: (FAULT / ALERT / NONE)
06 LOW C-FACTOR LIMIT: (FAULT / ALERT / NONE)

These two conditions indicate that the actual C-Factor read during the weld either exceeded or fell below the values programmed in the C-Factor function (C-FACTOR LIMIT: HI=nnn LOW=nnn).

The low limit is helpful in detecting cable and connection deterioration. The upper limit can detect secondary bridges and shunting paths. (Refer to “Low C-Factor Limit” on page 7-4 and “High C-Factor Limit” on page 7-4 for more information.)

07 HALF CYCLE: (FAULT / ALERT / NONE)

This condition occurs if the MedWeld T2200 detects conduction on one half-cycle, followed by a half-cycle with no conduction. This suggests a possible firing fault.

08 VOLTAGE COMPENSATION LIMIT: (FAULT / ALERT / NONE)

This condition indicates that the control was unable to compensate for a large swing in line voltage.The default setting is **NONE**. This fault is generated when the weld function uses the AVC (Automatic Voltage Compensation) firing mode (see “The Heat Select Display” on page 2-8).

09 INSUFFICIENT LINE VOLTAGE: (FAULT / ALERT / NONE)

This condition results when the control did not receive the minimum voltage required to perform a weld. The default setting of this parameter is **NONE**. Two setup parameters set the minimum voltage: Wait For Line Voltage and Line Voltage Wait Time.

For example, set Wait For Line Voltage to 480 V. and Line Voltage Wait Time to 050 cycles. Then this fault indicates that the control waited 50 cycles for the line voltage to reach 480 V. Since the line voltage failed to reach this value, the control completes the weld schedule and generates this fault.

10 EXTENDED WELD: (FAULT / ALERT / NONE)

The control generates this condition if it detected a LOW CURRENT LIMIT fault and rewelded, but then detected low current while rewelding. The default setting is **FAULT**. This condition serves to prevent the control from entering an endless loop, and continuously rewelding when sufficient secondary current is not available.

11 CURRENT COMPENSATION: (FAULT / ALERT / NONE)

If the control detects that it did not provide the specified amount of secondary current to a weld function, it generates this condition. The default setting is **ALERT**. This fault is similar to setup parameter #06 (Voltage Compensation), but results when selecting the ACC firing mode in the **Heat Select** display.

12 NO ZERO CROSSING SYNC: [FAULT]

This condition indicates that the control is unable to synchronize its voltage zero-crossing signal with the incoming line voltage. This can also occur if no line voltage is present. The control CANNOT execute a weld schedule when this condition is present. (**Note:** This parameter always assumes the Fault condition. It is NOT programmable.)

NOTE: *The NO ZERO CROSSING SYNC parameter always assumes the Fault condition and is NOT programmable. Setup parameters that are not programmable will NOT show up in the SETUP PARAMETERS DISPLAY even if the SHOW / HIDE feature is set to SHOW.*

13 LOW BATTERY: (FAULT / ALERT)

A battery backup maintains the integrity of RAM while the MedWeld T2200 is powered down. If voltage from this battery falls below a specified value, the control generates this fault. To clear it, replace the battery within 30 to 60 days.

The default setting of this parameter is **ALERT**.

14 WELD PILOT: (FAULT / ALERT / NONE)

The default setting of this parameter is **NONE**. This error condition can have any of three causes:

- Both WELD PILOT inputs are active at the same time,
- An operator resetting the faults while the WELD PILOT input is still active or
- When removing the initiate while the control is waiting for the SECOND STAGE input to become active.

15 SYSTEM COOLING: (FAULT / ALERT)

This fault means that weld current could not be provided during the weld functions of the previous schedule. The default setting is **FAULT**.

This fault occurs when the SYSTEM COOLING input (1PD J10-9) is not active. When the control attempts to initiate a weld schedule, the thermostat on the SCRs opens, due to excessive temperature. Flow of cooling water may be insufficient or blocked.

16 SECOND STAGE: (FAULT / ALERT / NONE)

This condition is generated if the control receives only one of the two inputs required to initiate a weld (Second Stage and Weld Pilot). This condition is also generated if the weld control detects a delay of more than 15 cycles between these inputs. The default setting is **NONE**.

For safety, the control requires no more than a 15-cycle delay between the two initiate inputs (SECOND STAGE and the WELD PILOT) becoming active.

Both inputs MUST remain active until the control begins executing the preheat function. If the inputs are not activated within **3** cycles of each other, OR either input dropped out before the preheat function is started, the control aborts the weld schedule and generates this fault condition.

17 CHAINED SEQUENCE: (FAULT / ALERT)

This condition results if the same schedule appears more than once in a chain. The default setting is **FAULT**. For background on chaining, refer to “Chaining Schedules” on page 3-9.

18 RETRACT PILOT: (FAULT / ALERT)

The function VERIFY CYLINDER #n IS OUT OF RETRACT tells the control to confirm that the selected cylinder is out of retract. If the cylinder is NOT out of retract, the control will abort the schedule and generate this fault.

19 BEAT MODE: (FAULT / ALERT / NONE)

If the Initiation setup parameter selects the BEAT type of initiation, the control expects that the WELD PILOT input will remain active at least until the preheat function is executed. The default setting is **ALERT**.

This fault is generated only when selecting BEAT mode, AND the weld pilot drops out early (before the PREHEAT function executes). In this case, the control aborts the schedule.

If selecting NON-BEAT initiation, the control does not require that the WELD PILOT input remain active. (When selecting this type of initiation, this fault condition cannot be generated.)

20 NO WELD (FAULT / ALERT)

This fault occurs if the control moves from Weld mode into No Weld Mode while sequencing. This fault is also generated if the control receives a weld initiate while in No Weld mode.

The two types of Weld/No Weld switches are:

- The software Weld/No Weld switch accessible from the **Normal/Programming** display, and
- An external Weld/No Weld input on the I/O board, if it is mapped to an external input in the **I/O Mapping** display.

If either switch is in No Weld mode, this fault/alert will be generated. Be aware that the software Weld/No Weld switch from the **Normal/Programming** display reflects only the status of the software switch. It does NOT reflect the status of the external hardware switch (if used). For more information, refer to “Weld Schedule Icons” on page 1-5 and “Selecting Weld/No Weld Status” on page 3-11.

21 HEAT CYCLE LIMIT: [FAULT]

The control generates this fault on detecting that the number of consecutive weld cycles where conduction occurred exceeded the limit set in the Heat Cycle Limit setup parameter. On detecting this condition, the control also times out the remainder of the weld schedule in No Weld.

Seam welding applications often require long periods of conduction. For seam welding, set this parameter to zero to disable the cycle limit.

22 I/O FAILURE: (FAULT)

This parameter is NOT programmable.

NOTE: *Setup parameters that are non-programmable will NOT show up in the SETUP PARAMETERS DISPLAY, even if the SHOW / HIDE feature is set to SHOW.*

23 ISO OFF WHEN NEEDED (FAULT)

The isolation contactor was not pulled in when required by the weld schedule. This parameter is NOT programmable.

NOTE: *Setup parameters that are non-programmable will NOT show up in the SETUP PARAMETERS DISPLAY, even if the SHOW / HIDE feature is set to SHOW.*

This fault is generated when the control detects that the isolation contactor is open when it is trying to execute a weld function. (The contactor must be closed to provide weld current.)

On detecting this condition, the control schedules in No Weld and generates this fault condition. If the control is in No Weld mode, it does not generate a fault.

24 CONTROL STOP (FAULT)

This fault is generated if the CONTROL STOP input (normally high) goes low during the execution of a weld schedule, or if the CONTROL STOP input is not active when the control receives a weld initiate.

25 PRESSURE NOT ACHIEVED (FAULT)

This fault occurs when the proportional valve pressure (programmed by functions #08, #13 or #14), was not achieved within the number of cycles programmed in Function #09 (WAIT nn CY FOR PRESSURE ACHIEVED).

If the sequence contains more than one valve pressure setting, the processor will only monitor the last pressure function contained in the sequence.

This parameter is permanently set to the FAULT condition. You CANNOT program it.

NOTE: *This parameter is permanently set to the FAULT condition. You CANNOT program it. Setup parameters that are non-programmable will NOT show up in the SETUP PARAMETERS DISPLAY, even if the SHOW / HIDE feature is set to SHOW.*

26 ISO CNTR ERR - BRKR TRIPPED (FAULT)

This fault is generated when the control signals to open the isolation contactor (to cut off weld current) but the isolation contactor did NOT open. It can also occur if the isolation contactor is pulled in when a weld initiate is not present.

This parameter permanently assumes the FAULT setting. You CANNOT change it.

27 PRESSURE SWITCH: (FAULT / ALERT / NONE)

This fault is generated when the PRESSURE SWITCH input is still open after squeeze time. If set to NONE, only the "WAIT FOR PRESSURE SWITCH" message is generated, and no fault/alert.

28 SECONDARY CURRENT COIL/BOARD: (FAULT)

This fault will occur under the following conditions:

- If an error occurred while attempting to initialize or configure the SCIB due to a malfunction on the SCIB board or an improper connection to the weld timer.
- If an error occurred during the secondary current calibration process due to an improper connection to the secondary current coil.
- If an error occurred during the secondary calibration process due to a loss of primary power (no zero-crossing synchronization).
- If an error occurred during the secondary calibration process due to a missing current range jumper on the SCIB board.

29 SHOW / HIDE NON SETUPS (SHOW / HIDE)

The SHOW / HIDE NON SETUPS feature is used to hide the unused list items from the SETUP PARAMETERS DISPLAY. The default factory setting is set to SHOW. If the operator can not find a particular setup parameter, they should check to be certain that line 29: SHOW / HIDE NON SETUPS is set to SHOW.

NOTE: *Setup parameters that are non-programmable will NOT show up in the SETUP PARAMETERS DISPLAY, even if the SHOW / HIDE feature is set to SHOW.*

30 INITIATION ON FAULT: (ALLOW / INHIBIT)

This parameter tells the control how to respond to any active fault condition(s) when receiving a weld initiate. The default setting is **ALLOW**. The possible settings are

- ***INHIBIT*** tells the control to disregard the initiate until the faults have been reset;
- ***ALLOW*** has the control reset any active fault conditions when receiving an initiate, and to initiate the schedule.

31 INDEX PILOT ASSIGN ON REPEAT: (YES / NO)

This parameter tells the control how to respond when it is in repeat mode. It can either repeat on the present weld schedule, or index to the next schedule on the pilot assignment list. The default setting is **NO**. Operation is as follows:

- **If *NO*:** Setting this parameter to ***NO*** puts the control in standard repeat mode. In this mode, the control repeats a particular schedule (or chain of schedules) if OFFTIME is programmed at the end of the schedule (or chain). The pilot assignment will not change until the pilot is dropped and then re-asserted. At that time, the pilot assignment will index to the next location and execute the appropriate schedule.
- **If *YES*:** When set to ***YES***, the control will use the pilot assignment in conjunction with repeat mode. On executing a schedule with OFF time programmed, the control indexes the pilot assignment, fetches the next schedule and executes it. This process continues until a schedule is reached in which no OFF time is programmed, or when the end of the pilot assignment array is reached. At this point, the control will stop and require another initiate to continue welding.

NOTE: *Removing power to the control will reset the pilot assignment. It is reset to the first schedule in the pilot assignment list.*

32 SUCCESSIVE SEQUENCING (YES / NO)

The Successive feature may be allowed, or blocked.

33 TRANSFORMER: (AC WOUND / AC STACKED / DC WOUND / DC STACKED);

This parameter specifies the type of transformer being used. The default setting is **AC WOUND**. The possible settings are

- When selecting ***AC STACKED CORE*** or ***DC STACKED CORE***, the first half-cycle of each pulse fires completely as required by the weld schedule.

- If selecting ***AC WOUND*** or ***DC WOUND***, the control uses delayed firing to prevent damage to wound-core transformers.

Selecting between AC and DC also affects how the control performs voltage or current compensation. AC calculations are based on the actual current read. For DC transformers, the control uses a special algorithm to approximate the current.

Caution:
These options are provided for maximum flexibility across applications. Be certain to check the setup parameter settings to confirm that the transformer type matches your configuration BEFORE attempting to initiate a weld schedule, to prevent possible damage to equipment.

34 CURRENT LIMIT MODE: (PEAK / AVERAGE)

This parameter specifies which method to use during current limit processing. The default setting is **AVERAGE**. The possible settings are

- When set to ***PEAK***, this fault is generated if the High or Low Current Limit (as programmed in the setup parameters or in the Stepper Display) is exceeded during any ***one*** cycle of a weld schedule.
- When set to ***AVERAGE***, the control adds the current read during each cycle and divides by the total number of cycles to determine the average current.

If the average current exceeds the HIGH CURRENT LIMIT or falls below the LOW CURRENT LIMIT set in the setup parameters (or the stepper profile current limits), the control generates a HIGH (or LOW) CURRENT LIMIT fault.

35 CURRENT MONITOR MODE: (PRIMARY / SECONDARY)

Select either primary or secondary current monitoring. If selecting secondary current monitoring, a Secondary Current Interface board (SCIB) and secondary

36 EXTENDED WELD: (DISABLED / ENABLED)

This setup parameter tells the control how to respond on detecting insufficient secondary current applied to the previous weld. The default setting is **DISABLED.** The possible settings are

- ***ENABLED*** tells the control to allow automatic rewelding.
- ***DISABLED*** prevents the control from rewelding, despite insufficient current. The control only generates a LOW CURRENT fault condition.

37 HEAT CYCLE LIMIT (0=SEAM): nn(00 - 99)

This counter defines the maximum number of consecutive cycles of heat conduction. After nine consecutive cycles without conduction, the counter resets. The default setting is **SEAM**.

Seam welding applications frequently require more than 99 cycles of conduction. For such applications, disable this parameter by setting the value to **0**.

38 HALF CYCLING FIRING (DISABLE) (ENABLE)

When half cycling is enabled, heat cycle timing is in half- cycles.

39 ISOLATION CONTACTOR DELAY (SEC) (5 Seconds by Default)

This parameter tells the control how long to hold the isolation contactor pulled in after the function TURN OFF ISOLATION CONTACTOR executes. This is designed to prevent wear on the isolation contactor caused by dropping in and out between welds.

When the ISOLATION CONTACTOR SAVER input is available and set LOW, it disables this delay timer.

40 ANALOG OUTPUT (VOLTAGE) (CURRENT LOOP)

This parameter sets the output to either voltage or current loop output.

41 INITIATION FROM RETRACT (INHIBIT) (ALLOW)

This parameter either inhibits or allows sequence initiation in Retract mode.

42 RETRACT MODE: (LATCHED / UNLATCHED)

This parameter tells the control how to respond on receiving the RETRACT input:

- ***UNLATCHED*** tells the control to let the RETRACT output follow the state of the RETRACT input. (When the input is on, the output is on. When the input is off, the output is off.)
- ***LATCHED*** tells the control to change the state of the RETRACT output when the input is briefly turned on and then off (pulsed).

Caution:

As a safety feature, the control ignores any changes made to the retract setup parameters until you reset the control (by cycling power). It always displays the currently-selected status of the Retract setup parameters on power-up.

When changing the Retract Mode setup parameter between LATCHED or UNLATCHED, you must toggle the RETRACT PILOT input state before initiating the next weld schedule. (This will activate the RETRACT VALVE output.)

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43 RETRACT CYLINDER: (AIR-NORMAL)/ AIR-INVERTED / AIR/OIL-NO / AIR/OIL-NC)

This setup parameter defines the type of gun cylinder to use. This definition determines how several weld functions operate, the configuration of outputs and the operation of retract. The settings are

- ***AIR-NORMAL:*** Select this type of cylinder when the machine uses an air-only cylinder AND the RETRACT output is turned OFF to close the gun.
- ***AIR-INVERTED:*** Select this type when the machine uses an air-only cylinder AND the RETRACT output is turned ON to close the gun.
- ***AIR/OIL - NO:*** Select this type of cylinder when you are using an air-over-oil cylinder with a Blocking Valve that is normally open (**NO**).
- ***AIR/OIL - NC:*** Select this type of cylinder when you are using an air-over-oil cylinder with a normally-closed (NC) Blocking Valve.

Caution:
As a safety feature, the control ignores any changes made to the retract setup parameters until you reset the control (by cycling power). It always displays the currently-selected status of this setup parameter on power-up.

44 DATA COLLECTION SAMPLE SIZE: (1 - 99)

This sets the number of samples taken for SPC reporting.

45 DATA COLLECTION SAMPLE FREQUENCY: (1 - 9999)

This parameter sets how often the SPC sample is taken.

46 GUN #1 CLOSE TO PRE-BLOCK POS (CY/2): nnn (000)
47 GUN #2 CLOSE TO PRE-BLOCK POS (CY/2): nnn (000)

This parameter sets the length of time to allow for Gun #1 (or Gun #2) to move from the full-open position to the partially-closed position. **nnn** is the time, in cycles.

48 GUN #1 ADVANCE STOP TIME (CY/2): nnn (000)
49 GUN #2 ADVANCE STOP TIME (CY/2): nnn (000)

This parameter programs the dynamic brake time for Gun #1 (or Gun #2). **nnn** is the dynamic brake time, in cycles

50 GUN #1 OPEN FROM BLOCK POS (CY/2): nnn (000)
51 GUN #2 OPEN FROM BLOCK POS (CY/2): nnn (000)

This sets the length of time to allow for Gun #1 (or Gun #2) to move from the partially-closed position to the full-open position. **nnn** is the time, in cycles.

52 GUN #1 OPEN TO BLOCK POS (CYC): nnn (000)
53 GUN #2 OPEN TO BLOCK POS (CYC): nnn (000)

This is the length of time to allow for Gun #1 (or Gun #2) to move from the fully-closed position to the partially-closed position. **nnn** is the time, in cycles.

54 NOMINAL LINE VOLTAGE: (000 - 650)

This sets the nominal line voltage needed for welding heat control using AVC (Automatic Voltage Compensation). For more details, see page 1-15. Enter a nominal line voltage directly; or use the value that the control calculates automatically on power-up. The default setting is **000** V.

To enter a nominal line voltage directly, enter a value in the range **001** to **650** (i.e., 1 to 650 VAC) for NOMINAL LINE VOLTAGE. This value changes ONLY if you change it explicitly, or reload from defaults.

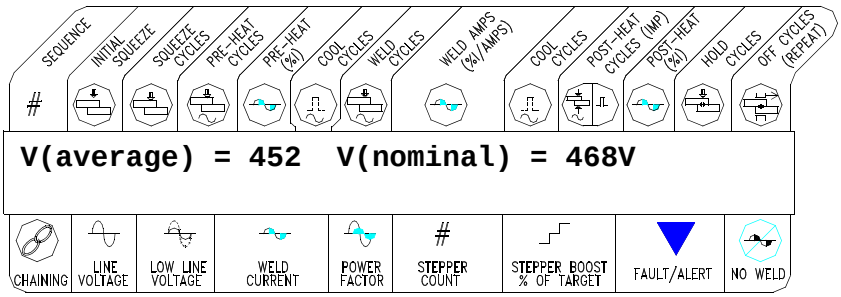
To use the nominal line voltage that the control automatically calculates on power-up, enter **000** for the NOMINAL LINE VOLTAGE. Note that **000** does NOT mean 0 V. If you enter “000”, the control re-calculates nominal line voltage every time at power-up, as follows:

At power-up, the control averages the bus voltage over 15 cycles. It sets nominal voltage to one of the five values listed in the right-hand column of the table below. The setting will depend on which range (from the left-hand column) the voltage falls within:

Range	Voltage
000 - 140	117 (Derated 120 V. bus)
141 - 264	215 (Derated 220 V. bus)
265 - 420	371 (Derated 380 V. bus)
421 - 520	468 (Derated 480 V. bus)
521 - 999	575 (Derated 600 V. bus)

To check the calculated nominal line voltage setting, cycle power and watch the message display as the control powers up. If setting NOMINAL LINE VOLTAGE to 000, the third of three initialization displays shows the average voltage and the calculated nominal line voltage.

The following example shows a calculated average line voltage of 452 V and a nominal line voltage of 468 V:



NOTE: *This Autonominal value is only used (and the Autonominal screen only appears) when setting* NOMINAL LINE VOLTAGE *in the setup*

parameters to **000** *V. Any value greater than 0 will be used as the AVC set point and will disable the Autonominal feature.*

55 WAIT FOR LINE VOLTAGE: nnn (000 - 650)

This setup parameter sets the minimum value of line voltage that the control must obtain before being allowed to continue with the weld schedule. The default setting is **000** V.

This setup parameter works with the **LINE VOLTAGE WAIT TIME (CYC):** parameter.

56 LINE VOLTAGE WAIT TIME (CYC): nnn (000 - 999)

This setup parameter specifies the maximum number of cycles that the control can delay the weld schedule, to allow the voltage to exceed the programmed minimum value. The default setting is **000** cycles.

This setup parameter works with the **WAIT FOR LINE VOLTAGE:** parameter (above).

After the programmed number of cycles, the control issues a LINE VOLTAGE LIMIT fault and continues with the weld schedule.

57 MAXIMUM LINE PRESSURE (PSI) (000 - 150)

This parameter setting is required for pressure control.

58 STATIC ANALOG 1 OUT VALVE (000 - 150)

59 STATIC ANALOG 2 OUT VALVE (000 - 150)

These two parameters set the PRESSURE output in PSI while at rest, not in sequence.

The following parameter supports operation of the Secondary Current Interface Board (SCIB):

60 SECONDARY CURRENT COIL FACTOR (X1000): (0-9999)

Program T2200 supports secondary current monitoring through a secondary current coil. Use this setup parameter when monitoring secondary current as an adjustment to accommodate for secondary current sensing coils of different sensitivities. Setting this parameter to 1000 will result in accurate secondary current readings for coils of 0.477 mHy mutual inductance (150 mV/kA @ 50 Hz, or 180

mV/kA @ 60 Hz). Setting this parameter ***above*** 1,000 will increase the reading. Setting ***below*** 1,000 will decrease the reading.

----------END OF SETUP PARAMETERS----------

Setup Parameter Defaults

This section lists the setup parameters as they appear in numerical order, along with their assumed defaults.

No.	Parameter	Default
01	STEPPER APPROACHING MAX	**(ALERT)**
02	END OF STEPPER	**(FAULT)**
03	HIGH CURRENT LIMIT	**(FAULT)**
04	LOW CURRENT LIMIT	**(FAULT)**
05	HIGH C-FACTOR LIMIT	**(FAULT)**
06	LOW C-FACTOR LIMIT	**(FAULT)**
07	HALF CYCLE	**(FAULT)**
08	VOLTAGE COMPENSATION	**(ALERT)**
09	LINE VOLTAGE	**(ALERT)**
10	EXTENDED WELD	**(ALERT)**
11	CURRENT COMPENSATION	**(ALERT)**
12	NO ZERO CROSSING SYNC *	**(FAULT)**
13	LOW BATTERY	**(ALERT)**
14	WELD PILOT	**(ALERT)**
15	SYSTEM COOLING	**(FAULT)**
16	SECOND STAGE	**(NONE)**
17	CHAINED SEQUENCE	**(FAULT)**
18	RETRACT PILOT	**(ALERT)**
19	BEAT MODE	**(ALERT)**
20	NO WELD	**(FAULT)**
21	HEAT CYCLE LIMIT	**(FAULT)**
22	I/O FAILURE	**(FAULT) ***
23	ISO OFF WHEN NEEDED	**(FAULT) ***
24	CONTROL STOP	**(FAULT) ***
25	PRESSURE NOT ACHIEVED	**(FAULT) ***
26	ISO CNTR ERR - BRKR TRIPPED	**FAULT) ***
27	PRESSURE SWITCH	**(ALERT)**
28	INITIATION ON FAULT	**(ALLOW)**
29	INDEX PILOT ASSIGN ON REPEAT:	**(NO)**
30	SUCCESSIVE SEQUENCING	**(NO)**
31	TRANSFORMER:	**(AC WOUND)**
32	CURRENT LIMIT MODE:	**(AVERAGE)**
33	EXTENDED WELD:	**(DISABLED)**
34	HEAT CYCLE LIMIT (0=SEAM): nn	**(SEAM)**

No.	Parameter	Default
35	HALF CYCLING FIRING	**(ENABLE)**
36	ISOLATION CONTACTOR DELAY (SEC)	**(05)**
37	ANALOG OUTPUT	**(VOLTAGE)**
38	INITIATION FROM RETRACT	**(ALLOW)**
39	RETRACT MODE:	**(LATCHED)**
40	RETRACT CYLINDER:	**(AIR-NORMAL)**
41	DATA COLLECTION SAMPLE SIZE:	**(05)**
42	DATA COLLECTION SAMPLE FREQUENCY:	**(0100)**
43	GUN #1 CLOSE TO PRE-BLOCK POS (CY/2): nnn	**(000)**
44	GUN #1 ADVANCE STOP TIME (CY/2): nnn	**(000)**
45	GUN #1 OPEN FROM BLOCK POS (CY/2): nnn	**(000)**
46	GUN #1 OPEN TO BLOCK POS (CYC): nnn	**(000)**
47	GUN #2 CLOSE TO PRE-BLOCK POS (CY/2): nnn	**(000)**
48	GUN #2 ADVANCE STOP TIME (CY/2): nnn	**(000)**
49	GUN #2 OPEN FROM BLOCK POS (CY/2): nnn	**(000)**
50	GUN #2 OPEN TO BLOCK POS (CYC): nnn	**(000)**
51	NOMINAL LINE VOLTAGE:	**(000)** †
52	WAIT FOR LINE VOLTAGE: nnn	**(000)**
53	LINE VOLTAGE WAIT TIME (CYC): nnn	**(000)**
54	MAXIMUM LINE PRESSURE (PSI)	**(000)**
55	STATIC ANALOG 1 OUT VALVE	**(000)**
56	STATIC ANALOG 2 OUT VALVE	**(000)**

NOTES: *Annotations for certain parameters signify the following:*

* *This parameter permanently assumes the* FAULT *setting. You* CANNOT *change it.*

† *When set to* **000**, *the control automatically calculates the nominal line voltage at power-up.*

Internal Fault Codes

Program T02200 has the following internal fault codes:

I01 SHORTED CONTACTOR:
I02 EPROM ERROR:
I03 RAM DATA ERROR:

Programming Steppers 6

The MedWeld T2200 includes six independent ***linear steppers***. They ensure consistent heat to each weld, despite mushrooming and alloying of the electrode tips.

Each stepper tracks the number of welds initiated by each WELD PILOT input. The stepper gradually increases the heat supplied to the weld at several programmable set points. Steppers are assigned to a schedule under the **Valve Mapping** display.

How Linear Steppers Work

Heat is added to the weld in several "***steps***." Each step supplies additional weld current in a linear fashion over a programmed number of welds. It is the amount of stepper "boost," or the amount of current the stepper adds to the weld function. When the stepper reaches the last programmed set point (the last weld in the last step), the electrodes must be dressed or replaced, and the stepper reset.

The operator programs the stepper based on experience with the welding process and resulting electrode deterioration. The best stepper settings are the result of trial and error.

For example, you might program a step to add 3% current after 100 welds. The stepper will add current in these steps:

1. 1% current increase after 33 welds
2. 2% current increase after 66 welds
3. 3% by the 100th weld. This 3% increase of current is added to the value of current already programmed to the control.

The **Stepper Status** display shows the stepper boost (**BST**) in two ways:

- As a percent of maximum available primary current (for AVC welding) and

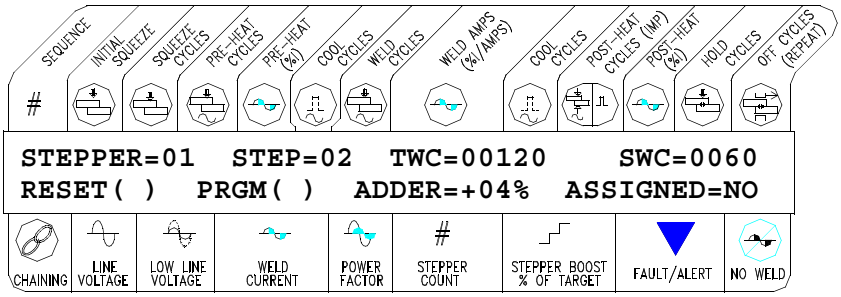
- As a percent of the target current (for ACC welding).

As the amount of stepper boost increases (in the latter steps of the profile), you must expand the window of acceptable secondary current, to avoid generating HIGH and LOW CURRENT LIMIT faults.

The Stepper Status Mode

If no fault conditions are active, pressing MODE ONCE from the **Normal/Programming** mode opens the **Stepper Status** screen. If faults and/or alert conditions are active, press MODE again.

This is an example of the **Stepper Status** display:

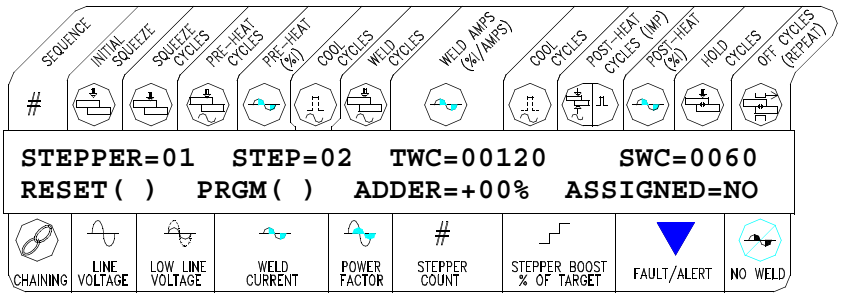


Use this mode to

- View the status of the steppers, including the total weld count and step weld count
- View if a stepper is assigned to a schedule
- Quickly move to the STEPPER RESET screen, which lets an operator reset an individual or all steppers and adjust temporary global boost percentage.
- Quicly move to the STEPPER PROGRAM screen, which allows an operator to program variables to the stepper. The STEPPER PROGRAM screen permits the operator to assign stepper groups, adjust the step count and the amount of current to add per step.

Viewing the Status of a Stepper

The **Stepper Status** display shows the following values:



The fields in this display signify the following data:

STEPPER The selected stepper. The MedWeld T2200 has six steppers (1 – 6). Each stepper contains five steps.

STEP The step (1 – 5) the stepper is presently executing.

TWC TOTAL WELD COUNT: The number of welds executed by the selected stepper since the stepper was reset.

SWC STEP WELD COUNT: The weld number being executed during the present step.

ADDER ADDER: This is the percentage of target current that the stepper is adding to the weld function.

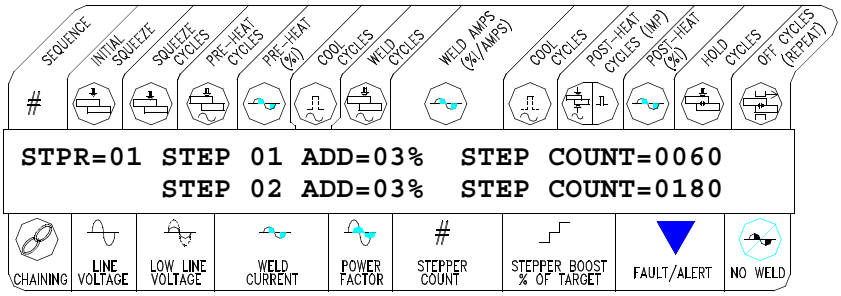
ASSIGNED The ASSIGNED field shows the operator if the current stepper has been assigned to a weld schedule or not. Steppers are assigned to a weld schedule though the VALVE MAPPING DISPLAY.

To modify the programmable settings, move the cursor to the stepper status value. Then use the UP and DOWN keys to increase or decrease the setting, or change the option selected. For example, turn the selected stepper on or off by pressing the UP or DOWN key to toggle the value.

NOTE: *To move to a different mode, press the* MODE *key once. This presents the* **Setup** *display, described on "Other parameters define the hardware and nominal range limits on weld current. To view the setup parameters (or modify those that are programmable), use the* Setup *Display Mode.Selecting the Setup Mode" on page 5-1.*

The Stepper Profile Display

Highlight PRGM( ) from the **Stepper Status** display to program the stepper profile. The **Stepper Profile** display shown below now appears:



The control offers six independent steppers. Each stepper has five steps. Assign a stepper program to a schedule with a valve in the **Valve Mapping** screen, under **STPR**.

The fields in this display describe the following information:

STPR — The presently-selected stepper (1 – 6). To select the stepper to edit, press the UP or DOWN key.

STEP — Indicates which step (1 – 5) you are editing. Select the step to edit using the UP or DOWN key.

ADD — The amount of "boost" to **add** during the ***present*** step when the control is performing AVC welding. When welding in ACC mode, boost is the percent of current to add.

STEP COUNT — The number of welds in the presently-selected step. This tells the control the weld number in this step over which to linearly increase the amount of boost programmed in the **BST(%I)** field. To change the number of welds in this step. use the UP and DOWN keys.

Programming the Stepper Profile

You can program new values for each of the five steps in the stepper profile from the **Stepper Profile** display. To do this, follow this procedure:

1. With the cursor under the **STPR** (Stepper) field, press UP or DOWN to select the Stepper number, **1 - 6**.
2. Press RIGHT to move the cursor under **STEP**. Use either the UP or DOWN key to select which step you want to edit, from 1 – 5.

3. Press RIGHT to move the cursor to the boost value. This is the percent amount of heat to **add** to the selected step, based on the weld count. **ADD=03%** programs the boost as a percent of primary current added, for AVC. When welding in ACC mode, **BST ACC** programs the percent secondary current in A being added to the selected step.
4. Press UP or DOWN as needed to increase or decrease the boost.
5. Press RIGHT to move the cursor to the weld count, **STP CNT**. Now press the UP or DOWN key to select the weld count for this step of the stepper. (This is the number of welds over which to linearly increase the weld heat by the boost value.)

Default Linear Stepper Profile

As shipped from the factory, program T02200 uses this linear stepper profile by default:

STEP 1 - 3% HEAT OR 0100 AMPS IN 0060 WELDS
STEP 2 - 3% HEAT OR 0100 AMPS IN 0180 WELDS
STEP 3 - 3% HEAT OR 0100 AMPS IN 0300 WELDS
STEP 4 - 3% HEAT OR 0100 AMPS IN 0600 WELDS
STEP 5 - 3% HEAT OR 0100 AMPS IN 0800 WELDS

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Advanced Software Features 7

This chapter describes some of the advanced features of the MedWeld T2200 control.

C-Factor

This section describes the concept of ***C-Factor***. It covers reviewing C-Factor, determining high and low current limits, examples of increasing and decreasing C-Factor and calculating high and low C-Factor limits.

Using the C-Factor and Current Limits

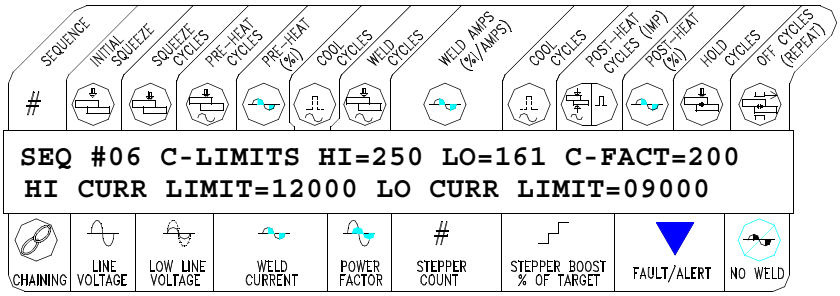
You may view the high and low limits of the secondary current attained in the last weld. You can also see the C-Factor reported for the last weld, and review or modify its high and low limits.

This section is a detailed explanation of C-Factor, checking and reviewing the current limits, and examples of increasing and decreasing C-Factor.

Reviewing C-Factor

You can review the C-Factor reported for the last weld, or program its high and low limits. Do this in the **C-Factor** option of the **Advance Display Options** menu.

If this option is turned ON, selecting it will present a screen like this example:



NOTE: *This screen will not be shown if the screen is turned* OFF *in the* **Advance**

Display Options *menu. Refer to "Selecting from the Advance Display Options" on page 2-31.*

The upper line shows the high and low C-Factor limits set for sequence **nn**. (Refer to "Low C-Factor Limit" on page 7-4.) **C-FACT=nnn** denotes the C-Factor value reported for the last weld.

Both the high limit **HI=nnn** and low limit **LO=nnn** can range from 000 to 999. The high and low default values are 999 and 000, respectively. Change these values as needed with the UP and DOWNkeys.

Current Limits

The lower line indicates the high and low limits of secondary current, in A. **HI CURR LIMIT=nnnn0** has a default of **99990**. **LO CURR LIMIT= nnnn0** has a default of **00000**.

About C-Factor

C-Factor is the value of current obtained for each *change* in percentage of the maximum secondary current delivered. C-Factor equals 1% of the total available current during a weld.

The C-Factor can be used in various ways:

- It can be used as a conversion factor between %I values and the actual value of current that would be produced.
- A change in C-Factor will indicate changes in the welding environment.

The MedWeld T2200 calculates the actual C-Factor after every weld. The processor calculates C-Factor by dividing the average secondary current during the weld by the %I fired. C-Factor is

$$\text{C-Factor} = I_{pri} \times \frac{n}{\%I} \times \frac{V_{nominal}}{V_{line}} = \frac{I_{sec}}{\%I} \times \frac{V_{nominal}}{V_{line}}$$

where ***n*** = transformer turns ratio.

The C-Factor varies with changing conditions in the secondary. Decreasing C-Factor indicates that the total capacity of the system is decreasing. This is evident when the tool current pathways become more resistive. This, in turn, results in deterioration in the secondary circuit. (Two examples of this are cable wear and deterioration of connections.)

Example of Decreasing C-Factor

In an application of shunts in a fixture indexing gun, the guns will pull on the cable. These forces cause strands of wire in the cable to break. As fewer conducting strands remain, the current pathway will decrease, increasing the resistance. This, in turn, will decrease the C-Factor.

This is illustrated by the following data:

- The control is firing the following weld function:
  WELD 10 CYC 10000 A.
- The control required 53% initially to achieve the 10,000 A. Over time, the control actually requires 60% to achieve the desired 10,000 A.
- The initial C-Factor = 10,000 A. / 53% = 189.
- Final C-Factor = 10,000 A. / 60% = 167.

Conversely, where C-Factor increases, the total capacity of the system is increasing. This increase in C-Factor is associated with shorting or shunting conditions in the welding environment.

When shorting or shunting arises, less resistance is seen because the full current is not passing through the entire welding circuit.

This is a concern. If the full current is not passing through the weld point, a weld below the desired current will occur. Depending on the amount of shunting, the weld nugget may possibly fail to be formed.

Example of Increasing C-Factor

In this example, a robot uses a kickless cable. The robot's motions cause the cable to twist. As a result, individual wires within the cable will rub against each other.

This action will eventually cause the cable insulation to break down. When this breakdown occurs, the current will start to shunt between wires within the kickless cable.

As the shunting grows, the current at the weld will diminish, and the current pathway will actually increase. This, in turn, will increase the C-Factor.

This is illustrated by the following data:

- The weld control is firing the following function:
  WELD 10 CYC 65% I.
- The control initially sees 12,450 A.
- After the shorting condition occurs, the control may see 14,300 A.
- Initial C-Factor = 12,450 A. / 65% = 192.
- Final C-Factor = 14,300 A. / 65% = 220.

C-Factor can be used to alert the maintenance staff of a welder's deteriorating secondary circuit. You can establish upper and lower C-Factor limits that correspond to a current threshold, to meet the needs of the welding process.

When the weld processor detects that the high or low C-Factor limits were exceeded, it activates the HIGH or LOW C-FACTOR LIMIT condition (which can be defined as either a Fault or an Alert in the setup parameters).

- Low C-Factor is a monitoring condition and usually defined as an ALERT.
- High C-Factor is a welding quality issue, and usually defined as a FAULT.

Low C-Factor Limit

The low C-factor limit detects cable and connection deterioration.

Determining a Low Limit

In another example, a weld schedule requires 14,000 A. at the end of a stepper program. However, you do not want to exceed 90% of the tool's maximum current capacity.

The lowest full-current capacity of the tool should be 15,555 A. (14000/ 90 = 155.555). This makes the low C-Factor limit 155.

High C-Factor Limit

The high C-factor limit can detect secondary shunting paths.

Determining a High Limit

For example, a spot weld requires 10,000 A. The maximum current achievable is 20,000 A. Then the C-Factor is 200.

However, if shunting conditions are simulated and the welds become substandard at C-Factor of 230, then the High C-Factor limit can be set to 230.

Data Collection Capabilities

With ***SPC*** (Statistical Process Control) ***Indexing***, the control collects weld data in temporary storage bins. This data can be collected either in controlled intervals or continuously (in special situations such as tear-down).

Analyzing the collected weld data can help recognize certain welding trends such as changes in resistance of the work piece, primary current and line voltage. You can then use the WTC WebView to retrieve and analyze the stored data.

NOTE: *This function does* NOT *tell the control to collect weld data. It only assigns a data storage bin number. Refer to the Data Collection Sample Size and Data Collection Sample Frequency setup parameters described on page 5-13 for instructions on how to specify data collection.*

The SPC Indexing function tells the control to start collecting weld data for all welds. This function should follow the SPC Offset function in the weld schedule because it is still necessary to assign a starting bin number.

Weld data collection continues until the control executes another schedule containing this function (without the offset function), to reset the global data collection process.

This function *overrides* the global Data Collection Sample Size and Data Collection Sample Frequency setup parameters. These are described next.

Caution:

DO NOT use this function in a normal production run. It is intended for special situations (such as tear-down) which require continuous data collection.

SPC Setup Parameters

DATA COLLECTION SAMPLE SIZE: 05 (1–99)
DATA COLLECTION SAMPLE FREQUENCY:0100(1–9999)

These two parameters set a global command which allows the weld control to sample data for analysis at controlled intervals.

The sample size is the amount of weld data collected for analysis (number of consecutive welds, per bin). The sample frequency is the total number of welds per bin, where data was collected (the samples are taken from).

For example, by setting the Data Collection Sample Size parameter to 2 and the Data Collection Sample Frequency parameter to 8, the

control will collect weld data for 2 consecutive welds (in bin #1), and flag the XWSS to retrieve the data. It will then collect data for 6 more cycles (without flagging XWSS) before starting the process again.

The following example table is for Bin #1 ONLY.

Sample/ Frequency	WCU Process	WIS/WSS Process
1/8	Data flagged for retrieval	Data uploaded
2/8	Data flagged for retrieval	Data uploaded
3/8	Data collected	Data ignored
4/8	Data collected	Data ignored
5/8	Data collected	Data ignored
6/8	Data collected	Data ignored
7/8	Data collected	Data ignored
8/8	Data collected	Data ignored
1/8	Data flagged for retrieval	Data uploaded
2/8	Data flagged for retrieval	Data uploaded
3/8	Data collected	Data ignored
4/8	Data collected	Data ignored
5/8	Data collected	Data ignored
6/8	Data collected	Data ignored
7/8	Data collected	Data ignored
8/8	Data collected	Data ignored

NOTE: *Weld Data Collection is bin dependent. Each bin has its own independent counter and is uploaded to XWSS separately.*

Retract Cylinder Features

This section describes in detail how the retract operation is used to provide support for air-only and air-over-oil cylinders. It also describes how the operation of retract is affected by certain functions and programmable setup parameters. These parameters control the operation of

- The Retract Mode setup parameter,
- The Retract Cylinder Type setup parameter and
- The INITIATE FROM RETRACT function.

NOTE: *Selecting* AIR-NORMAL *in the* Retract Cylinder Type *setup parameter*

disables the outputs associated with the air-over-oil cylinder. These outputs control the Advance, Intensify and Blocking valves. They do NOT *turn on when the* AIR-NORMAL *cylinder is selected.*

Air-Over-Oil Setup Procedure

To set the Retract Cylinder Type setup parameter to operate an Ohma type (air-over-oil) cylinder, follow these steps:

1. Enter the **I/O Mapping** display mode. Here, set the outputs for the **Advance** and **Intensify** valves.
2. If a blocking valve is required in the **I/O Mapping** display, assign RETRACT/OHMA BLOCK to an output.
3. Set the Retract Cylinder Type setup parameter to either AIR/OIL N.O. or AIR/OIL N.C.
4. In the **I/O Mapping** display mode, set the **RET** field to either 1 or 2 valves.
5. Turn power off and back on to accept the changes.

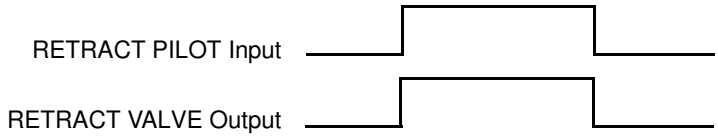
WARNING!

For safety, the MedWeld T2200 ignores any changes to these parameter settings until power is removed from the control. The control checks the status of these parameters only at power-up.

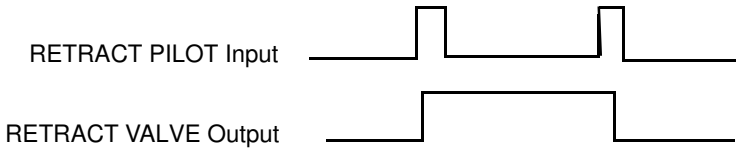
Retract Mode Setup Parameter

The Retract Mode setup parameter determines how the control responds to the presence of an active RETRACT PILOT input. This parameter is described in detail on page 5-6.

- ***UNLATCHED*** tells the control to let the output for the Retract valve (or Blocking valve, for air-over-oil cylinders) follow the state of the RETRACT PILOT input. The output will be active while the input is active.



- ***LATCHED*** tells the control to change the state of the output each time it receives a pulse from the RETRACT PILOT input. The control expects a brief pulse from the input, such as from a pushbutton.



NOTE: *When selecting* LATCHED *retract, it may be necessary to toggle the state of the* RETRACT PILOT *input at power-up (to change the state of the* RETRACT VALVE *output). This will be required if the control powers up in the incorrect retract state, or if status of the* RETRACT PILOT *input changes while the control is in a C-Stop condition (the* CONTROL STOP *input is* LOW*).*

Retract Cylinder Type

This setup parameter defines the type of gun cylinder the control application is using. The parameter defines the retract operation, as shown below:

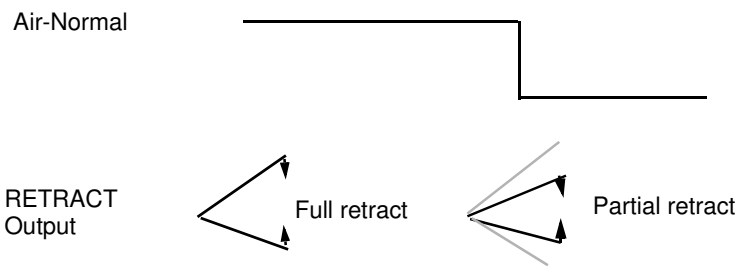
Air-Normal Cylinders

When using air-normal cylinders, two valves control the weld gun. These are the Weld valve and the Retract valve.

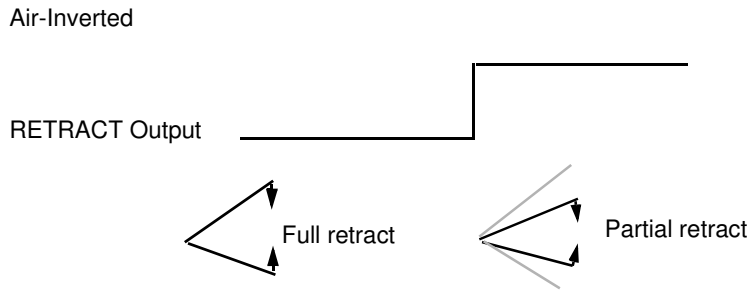
- The **Retract** valve allows the gun to close to a set gap position. A spring or a second return valve usually returns the gun to the full-open position.
- The **Weld** valve closes the gun under the welding air pressure.

Air-normal cylinders are identified as shown below in the Cylinder Type setup parameter:

- **AIR-NORMAL** informs the control that the gun is an air-only cylinder using “normal” retract. The output is turned OFF to close the gun.



- **AIR-INVERTED** indicates an air-only cylinder, but the output is turned ON to close the gun.



NOTE: *Selecting* AIR-NORMAL *in the* Retract Cylinder Type *setup parameter disables the outputs associated with the air-over-oil cylinder. These outputs control the Advance, Intensify and Blocking valves. They do* NOT *turn on when the* AIR-NORMAL *cylinder is selected.*

The following sections detail the retract operation under a variety of combinations of parameter settings. The Retract Mode setup parameter is described on page 5-11.

Description of the Ohma™ (Air-Over-Oil) Cylinder

The Ohma™ cylinder design uses three stages and two pistons. It has two air stages (a ***Return*** stage and an ***Intensify*** stage), and an oil (***Advance***) stage. Their operation is as follows:

1. The first stage (air) is the ***Return Cylinder stage***. Air enters the Return stage through the cylinder's Return port, adding back pressure on the working piston. This pressure slows or stops the extend stroke of the working piston. (If pressure remains, it also retracts the piston.) The Return port connects to the back side of the Advance valve.

    - When the Advance valve is at rest (OFF), the Return port receives line pressure from the valve manifold. This is marked **Return Air In Port** (**RET. AIR IN**).
    - When this valve is ON, the Return port is allowed to equalize to atmospheric pressure through the Advance Valve Exhaust port.

2. The second stage is the oil (***Advance Cylinder)*** stage. Oil enters the Advance stage through the cylinder's Advance port, causing the working piston to extend. When the Intensify piston moves into this stage (closing the Advance port), this piston displaces an equal volume of oil. This displaced oil cannot exit the stage through the advance port. As a result, it adds more force to the main piston, increasing the welding pressure.

The Advance port is connected to the oil reservoir. The Advance valve pressurizes the oil reservoir.

- When the Advance Valve is at rest, the oil reservoir equalizes to atmospheric pressure through the Advance Valve Exhaust port.
- When the Advance Valve is ON, the Advance port gets line pressure from the valve manifold. This is marked **Return Air In Port** (**RET. AIR IN**). The Blocking valve is on the oil line between the Advance port and oil reservoir. This valve serves to hold the working piston in position between the fully-extended and fully-retracted positions.

Caution:
DO NOT use the Blocking valve to slow or stop the working piston.

By engaging this valve before adequate back pressure builds in the return stage, the gun's weight will pull a small amount of oil (in the hose between the Advance port and the Blocking Valve) into the Advance stage. The reduced diameter of the hose lets the working piston keep extending until the back pressure equals the pressure in the Advance stage *plus* the force on the piston due to the gun's weight. After enough back pressure develops, the hose returns to normal diameter, thus accepting the oil that it had previously lost.

This allows the gun to return nearly to the position where the blocking valve was engaged. This overshoot increases with longer runs of hose and heavier welding guns. Since pressure has not built up in both the Return and Advance stages, the seal between them may leak. This causes a layer of compressible gas to form in the Advance stage.

The larger the gas layer is, the spongier and less-responsively the cylinder will operate.

3. The third stage (air) is the ***Intensify Cylinder*** stage. Air enters this stage through the cylinder's Intensify port, adding more pressure to the main piston. To do this, the Intensify piston moves into the Advance stage. The piston closes the Advance port, increasing the pressure in the Advance stage. Since oil is not compressible, it is directly added to the working piston, thus adding pressure to the welding electrodes. The Intensify port is connected to the Intensification Valve. When the Intensification valve is at rest, the Intensify port is vented to atmospheric pressure through the Intensification valve's exhaust port.

   When the Intensification Valve, however, is in the on state, the Intensify port is pressurized with line pressure through the valve manifold (Intensification Air In, marked **INT. AIR IN**).

Cycle of Movements

The operating cycle of the Ohma™ cylinder has four motions:

- Low Pressure Advance,
- Power Stroke,
- Return Stroke and
- Dynamic Braking.

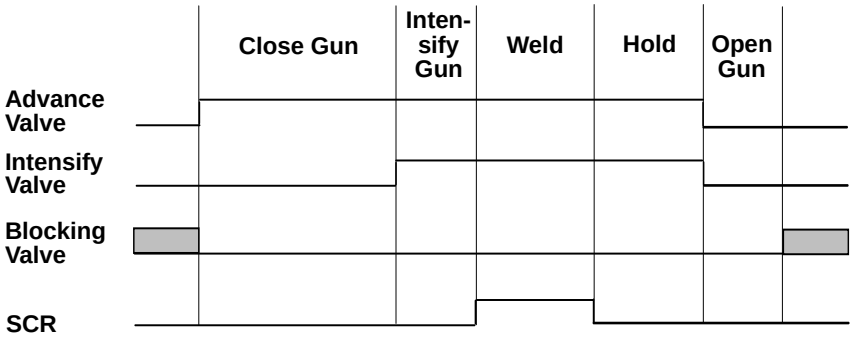
1. The first motion is ***Low Pressure Advance***. This extends the cylinder. The extend stroke includes bringing the welding electrodes in contact with the work piece, moving to the partial retract gun position, etc. During this stroke, the valves operate as follows:
   - The Advance Valve turns ON, to apply line pressure to the oil reservoir and to remove the back pressure being applied through the Return port.
   - The Blocking valve is OPEN, allowing oil to enter the Advance port.
   - The Intensify valve is OFF, allowing the oil to enter the Advance port.
2. The second motion is a ***Power Advance***. The power advance applies high (welding) pressure to the electrodes after they contact the work piece surface. If the cylinder has not fully traveled, this stops the working piston from extending any further, locking the gun in position. The valves operate during the power advance as follows:
   - The Intensify Valve turns ON, to apply line pressure to the Intensification port. This advances the Intensification piston and blocks the Advance port. Pressure during the Advance stage also increases.
   - The Advance valve is activated to vent the return port to atmospheric pressure.
   - The Blocking valve is open to allow free flow of oil.
3. The third motion is the ***Return Stroke***. The return stroke is used for opening the welding electrodes to the partial-retract or fully-open positions. The valves operate to return the gun to the open position as follows:
   - The Advance Valve is at rest. This applies line pressure to the Return port, and removes pressure from the reservoir.
   - The Blocking valve is OPEN. This allows oil to return to the reservoir.

- The Intensify valve is OFF. This allows the oil to exit the Advance Port.

4. The fourth motion is the ***Advance Stop*** operation. The working piston cannot stop instantly. The cylinder must go through a controlled stop sequence (see the Caution note, above). This is used when the cylinder must be held anywhere between the fully-open of fully-closed position. During the Advance Stop motion, the valves operate as follows:

   - The Advance Valve is OFF. This applies line pressure to the Return port, and removes pressure from the reservoir. This creates a back pressure in the cylinder, causing the cylinder to slow and eventually stop.
   - The Blocking valve remains OPEN until the cylinder comes to rest. The Blocking valve now closes, to inhibit the cylinder from retracting. If the Blocking valve stays OFF too long, the cylinder will retract. This extra time is used to overcome the gravitational force pulling the working piston forward due to the mass of the upper gun arm.
   - The Intensify Valve remains OFF, allowing the oil to flow as required.

I/O Timing Diagrams—Sequence Timing:



Close Gun Time:

- From Full Open: ***Close Gun*** time is defined by the setup parameters **Close to Pre-Block Time** + **Advance Stop Time** + the function **TURN ON ADVANCE VALVE TIME**.
- From Partial Open: ***Close Gun*** time is defined in the function **TURN ON ADVANCE VALVE TIME**.

Intensify Gun Time: Is defined by the weld function **TURN ON INTENSIFICATION VALVE**.

Open Gun *Time:*

- To Full Open: ***Open Gun*** time is defined by the setup parameter **Open From Block Time** + (if using Function #17, the setup parameter Gun #n Open to Block POS or, if using Function #18, **TURN OFF INT/ADV VALVE TIME**.)
- To Partial Open: ***Open Gun*** time is defined by (if using Function #17, the setup parameter Gun #n Open to Block POS or, if using Function #18, **TURN OFF INT/ADV VALVE TIME**.)

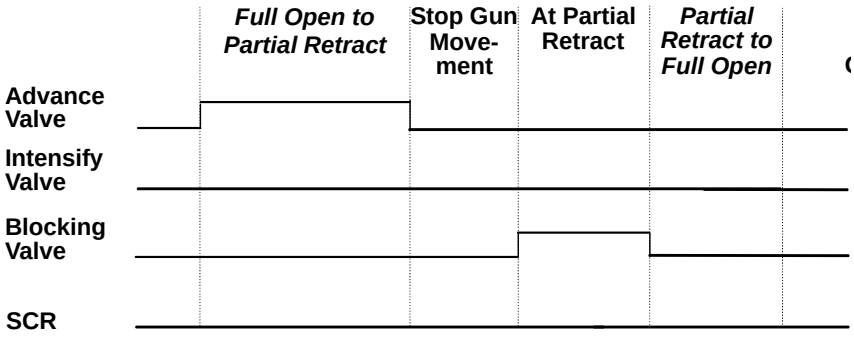
The BLOCKING VALVE output is active ONLY while the cylinder is being held between fully-open and fully-closed.

- If the Retract Pilot setup parameter is in ***unlatched*** mode, the control will return to the partial retract position IF, at the function TURN ON INTENSIFY/ADVANCE VALVE, the Retract Pilot is HIGH. When the Retract Pilot is LOW, it will return to the fully-open position.

- If the Retract Pilot setup parameter is in ***latched*** mode, the control will return to the position it started the weld sequence from. If the control does not know what position it is in, it returns from the

fully-closed to the partial retract position. An example of this is using the opening option before the control welds. See I/O Timing Diagram for After Closing Movement And Before Weld Operation.

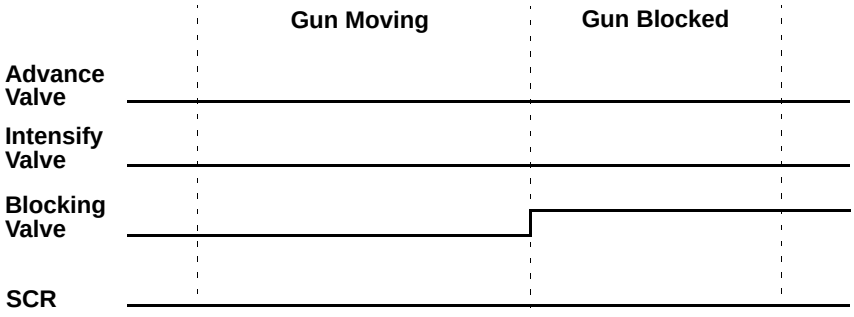
Closing Retract Operation



Full Open to Partial Retract Time: is defined by the Close to Pre-Block Time + Advance Stop Time setup parameters.

Partial Retract to Full Open Time: is defined in the Open From Block time + Advance Stop Time setup parameters.

Open to Blocked Position



The **Gun Moving** interval is defined by:

For the Close to Partial Retract position, the setup parameter Open to Blocked Position.

Example Schedule: Air-Over-Oil Cylinder Operation

This schedule is an example of operation when using an air-over-oil cylinder:

```
    START OF SCHEDULE
82  LINEAR STEPPER #00 ASSIGNED (0=OFF)
```

```
80   VERIFY CYLINDER #n IS OUT OF RETRACT
62   REPEAT (AT NEXT FUNCTION)
15   TURN ON ADVANCE VALVE #1 SQZ 20 CY
16   TURN ON INTENSIFY VALVE SQZ 10 CY
01   SQUEEZE 00 CYCLES
24   PREWELD 00 CY 30%I
02   COOL 10 CYCLES
20   WELD 10 CYCLES 50%I
03   HOLD 05 CYCLES
17   TURN OFF INTENSIFY/ADV VALVE #1
04   OFF 10 CYCLES
```

The example schedule provides the following:

- Function #82 assigns the schedule to the proper stepper profile.
- Function #80 is used to prevent the control from executing a weld schedule while the gun is in the full-retract position. If the gun is not in the partial retract position, the control will generate the RETRACT PILOT fault as a result of Function #80.

NOTE: *Program the* RETRACT PILOT *fault as an* ALERT *condition in the setup parameters, so that the operator can place the valve in the partial retract position and re-initiate the weld schedule.*

If this condition is defined as a FAULT, *the control will require a fault reset before it can continue. (An exception is when the* Initiation On Fault *setup parameter is set to* ALLOW, *as described on page 5-9.)*

- If the weld schedule does NOT contain this function, the control lets you execute a sequence with the gun in the full retract position. If firing the control from full retract, the Extend Sqz From Retract (CY/2) setup parameter is added to the time the gun is closed under only hydraulic pressure.

NOTE: *These functions are enabled* ONLY *when setting the* Cylinder Type *setup parameter to* AIR-OVER-OIL. *The outputs controlling the Advance, Intensify and Blocking valves do* NOT *turn on when selecting air-only cylinders.*

- The TURN ON ADVANCE VALVE function contains the time the gun will close under hydraulic pressure: (20 cycles in this example).
- The function TURN ON INTENSIFY VALVE contains the time the gun will close and build up pressure under air pressure (10 cycles in our example).
- The next two functions define the weld and hold time.

- Finally, the control turns off the Advance and Intensify valves for the time set in the setup parameter Blocking Valve #n Delay (CY/2). When firing the control from the full retract position, the setup parameter Extend Sqz From Retract (CY/2) value is added to the value of Blocking Valve #n Delay. This allows the gun to return to the prior position.

Initiation From Retract

The processor also provides a function which you can place in a weld schedule to tell the control to check whether the selected cylinder is out of retract. The function (VERIFY CYLINDER #n IS OUT OF RETRACT) will abort the schedule and generate a RETRACT PILOT fault if the cylinder is NOT in the partial retract position.

NOTE: *Program the* RETRACT PILOT *fault as an* ALERT *condition in the setup parameters. This enables the operator to place the valve in the partial retract position and re-initiate the weld schedule.*

If this condition is defined as a FAULT*, the control will require a fault reset before it can continue. (An exception is when the* Initiation On Fault *setup parameter is set to* ALLOW*, as described on page 5-9.)*

If the weld schedule does NOT contain this function, the control will allow you to execute a sequence with the gun in the full retract position. When the control is fired from full retract, the Extend Sqz From Retract (CY/2) setup parameter is added to the time the gun is closed under only hydraulic pressure.

New (Inverted) Retract Operation

Inverted retract operation in this program varies according to these modes:

- ***Unlatched mode* (Air-only and Ohma cylinders)*:*** The HIGH state of the RETRACT PILOT input(s) now indicates the partially-closed position. The LOW state indicates the full-open position.
- ***Latched mode* (Air-Normal cylinders):** The HIGH state of the RETRACT VALVE now indicates the partially-closed position. The LOW state indicates the full-open position.
- ***Latched mode* (Air-Inverted cylinders):** The LOW state of the RETRACT VALVE(s) now indicates the partially closed position. The HIGH state indicates the full-open position.

New Retract Setup Parameters and Functions

Program #T02200 also supports these functions and setup parameters defining retract operation according to weld gun and length of opening/closing time:

GUN #1 CLOSE TO PRE-BLOCK POS(CY/2): nnn

This function sets the length of time to allow for Gun #1 to move from the full-open position to the partially-closed position. **nnn** is the time, in half-cycles.

GUN #1 ADVANCE STOP TIME (CY/2): nnn

This function programs the dynamic brake time for Gun #1. **nnn** is the dynamic brake time, in half-cycles.

GUN #1 OPEN FROM BLOCK POS (CY/2): nnn

This sets the length of time to allow for Gun #1 to move from the partially-closed position to the full-open position. **nnn** is the time, in half-cycles.

GUN #1 OPEN TO BLOCK POS (CY/2): nnn

This is the length of time to allow for Gun #1 to move from the fully-closed position to the partially-closed position. **nnn** is the time, in half-cycles.

GUN #2 CLOSE TO PRE-BLOCK POS(CY/2): nnn

This is the length of time to allow Gun #2 to move from the full-open position to the partially-closed position. **nnn** is the time, in half-cycles.

GUN #2 ADVANCE STOP TIME (CY/2): nnn

This function programs the dynamic brake time for Gun #2. **nnn** is the time, in half-cycles.

GUN #2 OPEN FROM BLOCK POS (CY/2): nnn

This function sets the length of time to allow for Gun #2 to move from the partially-closed position to the full-open position. **nnn** is the time, in half-cycles.

GUN #2 OPEN TO BLOCK POS (CY/2): nnn

This sets the length of time to allow for Gun #2 to move from the fully-closed position to the partially-closed position. **nnn** is the time, in half-cycles.

TURN OFF INT/ADV VALVE #n OPEN nnn CY/2

This function opens the specified Intensify/Advance valve. **nnn** sets the open time, in half-cycles. Operation varies according to the mode being set, as follows:

- ***Unlatched mode:*** The TURN OFF INT/ADV VALVE #n sequence functions check the state of the RETRACT PILOT input to find out if the cylinder should return to the full-open or partially-closed position. If the RETRACT PILOT input is HIGH in this function, the cylinder will return to the partially-closed position. (This interval is defined as the Open time.) If this input is LOW, the cylinder will return to the full-open position.
- ***Latched mode:*** The TURN OFF INT/ADV VALVE #n sequence functions check the prior state of the retract to find out if the cylinder should return to the full-open or partially-closed position.

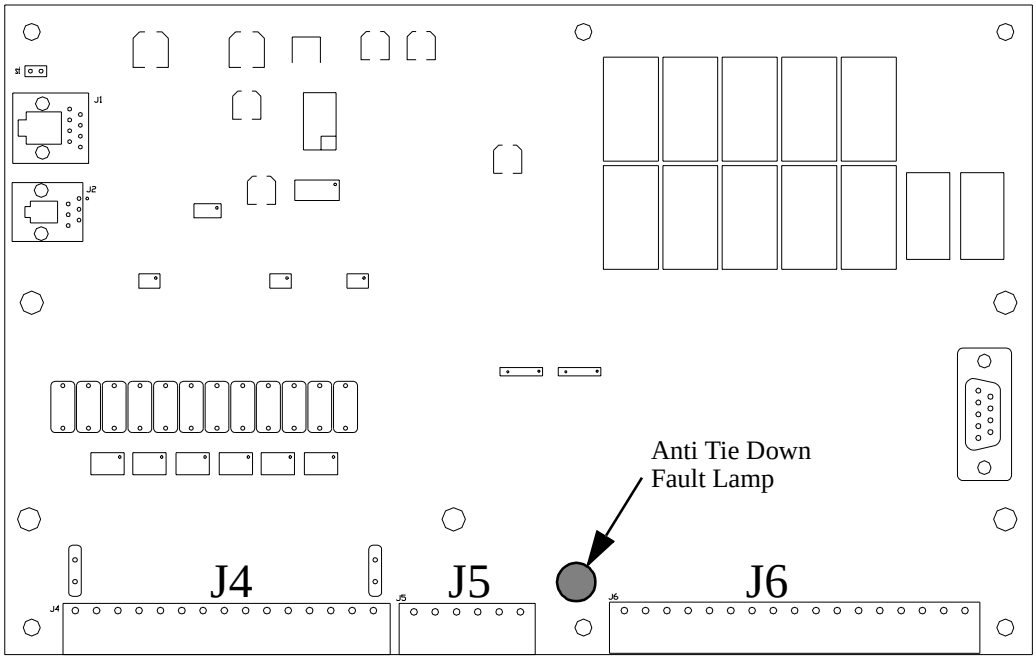
Anti Tie Down Feature

The T2200 offers the option to include an anti tie down safety feature for manually-operated welding machines using software T02209. Anti tie down is operated via palm buttons, which require the operator to depress two buttons within 1/3 of a second of each other to initiate a weld. As a safety feature, the I/O board also requires that the operator keep both hands on the palm buttons and that the buttons are held down until the detection of weld current.

The optional anti tie down feature includes:

- Softare T02209
- 824 I/O Board
- and 8333 Daughter Board

The 824 board (shown below) provides four special inputs for a pair of



anti tie down palm buttons. A pilot controlled relay (PCR) is associated with the anti tie down inputs so that it is impossible to turn on any of the weld valve outputs (at J6 pins 2,3,4 or 5) unless both palm buttons are pressed.

Table 1: J5 Inputs

Pin	Signal Name
J5-1	Left Palm Button Common
J5-2	Left Palm Button Normally Closed
J5-3	Left Palm Button Normally Open
J5-4	Right Palm Button Common
J5-5	Right Palm Button Normally Closed
J5-6	Right Palm Button Normally Open

Upon power-up, the 824 I/O board checks to be sure that both inputs associated with the normally-closed contacts of the palm buttons (Pins 2 and 5 of J5) are activated. If both normally-closed palm button inputs are activated and both normally-open palm button inputs (Pins 3 and 4 of J5) are NOT activated at power-up, the 824 I/O board starts normal operation.

Anti Tie Down Operation

In the anti tie down system, power to the weld valve circuit (The relay outputs at J6 pins 2, 3, 4, and 5) is shut off with the PCR and a weld sequence cannot be started unless one palm button (doesn't matter which) is pressed 20 to 500 milliseconds before the other one. If both palm buttons are not pressed down, one 20 to 500 milliseconds before the other, an anti tie down fault results. The welding control does not start a weld sequence and no power is applied to any of the weld valves to make the welding machine move.

As the welding sequence starts and the welding machine moves to close the welding electrodes, both palm buttons must be held down until the weld timer detects that at least 20% of the desired welding current (if in constant current mode) or 20% of the average current of the previous weld (if in AVC mode) has been reached. Since welding current cannot flow until the welding electrodes are closed, this assures that the operator has both hands on the palm buttons, and out of harm's way until the welding machine has completed the motion to close the welding electrodes onto the part to be welded. If the palm buttons are released before welding current starts, power is immediately removed from the weld valve circuit, the welding electrodes open and the weld sequence is aborted. An appropriate alert or fault is generated within the weld timer.

NOTE: *If the control is in NO WELD mode, both hands must still remain on the palm buttons to complete the weld sequence.*

The minimum 20 millisecond delay between the two palm button inputs is designed to prevent defeat of the safety system by wiring a single palm button in place of the two. If the palm buttons are pressed simultaneously or not within 500 milliseconds of each other, no weld sequence is started and no power is applied to the weld valve circuit. The OK/FAULT (D36) LED on the 824 I/O board will light RED to indicate an anti tie down fault. This LED will continue to light RED until both pushbuttons are released and pressed down again in the correct timing relationship.

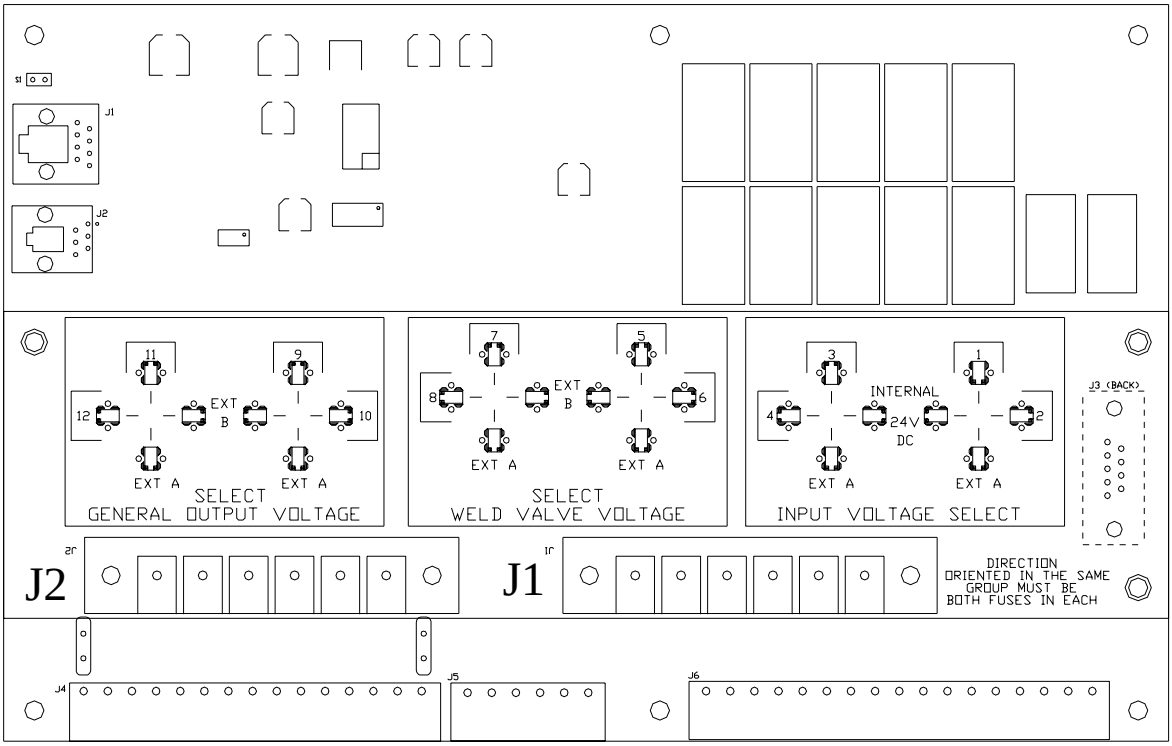
The four anti tie down inputs are activated by a positive DC voltage which is supplied from terminal strip J5. The minimum voltage to guarantee a valid input is +16VDC and the maximum allowable voltage is +40VDC. The input circuit current draw at a nominal +24VDC is approximately 10 milliamperes per input. The anti tie down inputs should only be activated by the +24VDC source for anti tie down on the J5 terminal strip and the anti tie down palm buttons should only be connected as shown in Figure 3. There is no requirement for special cable for the anti tie down palm buttons, although local safety rules may dictate a specific wire color. With #16 wire, the length of the wires between the palm buttons and the 824 I/O board can be up to 100 meters. The +24VDC source for the anti tie down inputs is protected against short-circuit to ground. Shorting it to ground will not permanently damage anything but it will cause an anti tie down fault, which stops the control from welding. The four anti tie down inputs are not isolated with respect to ground and care should taken to avoid connecting any terminal of the anti tie down connector to ground or

another voltage circuit. For obvious reasons of operator safety, the wiring for the anti tie down palm buttons should be routed separately from any high voltage circuits.

In order to operate in anti tie down mode, the weld timer must also be in anti tie down mode. If there is a mismatch in anti tie down mode between the weld timer and the 824 I/O board, the welding control will stay in the idle state, and an appropriate error message will be displayed by the weld timer.

824 I/O Board Voltage Overview

The 824 I/O board can operate with up to three different voltages on its inputs and outputs at the same time. For example, the inputs (Sequence Select, Pressure switch, etc.) can be operated at 24VDC, the Group 1 outputs (weld valves) can be operated at 120VAC, and all the remaining outputs can be operated at 24VAC.



To accomplish this, a “daughter” circuit board is fastened to the top of the 824 I/O board. This daughter board has two 6-position terminal strips (J1 and J2) and a set of fuse sites on the circuit board. The daughter board is sized and positioned so it sits completely on top of the 824 I/O board and consumes no additional panel space. The daughter board can also be mounted separately from the 824 I/O board if so desired.

The terminal strips on the daughter board serve as a tie point for I/O voltages to eliminate the need for another terminal strip in the weld control. The terminal strips have clamp plates under the screws. Two #12 wires or four #16 wires can be accomodated at each terminal. The connections of the J1 and J2 terminal strips are shown below.

I/O Voltage Configuration

Two different external I/O voltages (A and B) can be connected to J2. Voltages A and B can be AC or DC at any voltage less than 250V. These voltages can be completely isolated from each other and from ground.

On terminal strips J1 & J2, the following terminals are connected together through the circuit board; no external jumpers are required:

1.Terminals J1-1 and J1-2 are connected together

2.Terminals J1-4, J1-5, and J1-6 are connected together

3.Terminals J2-5 and J2-6 are connected together

The purpose of connecting these terminals together is to provide tie points for wiring.

Once the I/O voltages have been connected to J1 & J2, the selection of which I/O voltage is used for which input or output is made with standard 5mm by 20mm fuses.

Table 2: J1 & J2 Pinout

Pin	Signal Name
J1-1	I/O Voltage A+ (Hot)
J1-2	I/O Voltage A- (Neutral)
J1-3	I/O Voltage B+ (Hot)
J1-4	I/O Voltage B- (Neutral)
J1-5	Common (Neutral) for general outputs (at J6 pins 7,8,9 and10)
J1-6	Common (Neutral) for general outputs (at J6 pins 7,8,9 and10)
J2-1	Common (Neutral) for general outputs (at J5 pins 2,3,4 and 5)
J2-2	Common (Neutral) for general outputs (at J5 pins 2,3,4 and 5)
J2-3	Cabinet (Safety) Ground
J2-4	Initiate Voltage Source (for inputs at J4 pins 2,3,4,5,6,7,8,9,10,11,12 and 13)
J2-5	Initiate Voltage Source (for inputs at J4 pins 2,3,4,5,6,7,8,9,10,11,12 and 13)
J2-6	Initiate Voltage Source (for inputs at J4 pins 2,3,4,5,6,7,8,9,10,11,12 and 13)

For the inputs, two input voltages are possible. The inputs can be activated by either the 24VDC unregulated internal power of the 824 I/O board, or by external I/O voltage A. The selection of voltage is made by where a pair of standard 5 by 20 mm fuses is installed in a fuseholder site on the daughter board.

Table 3: J4 Pinout

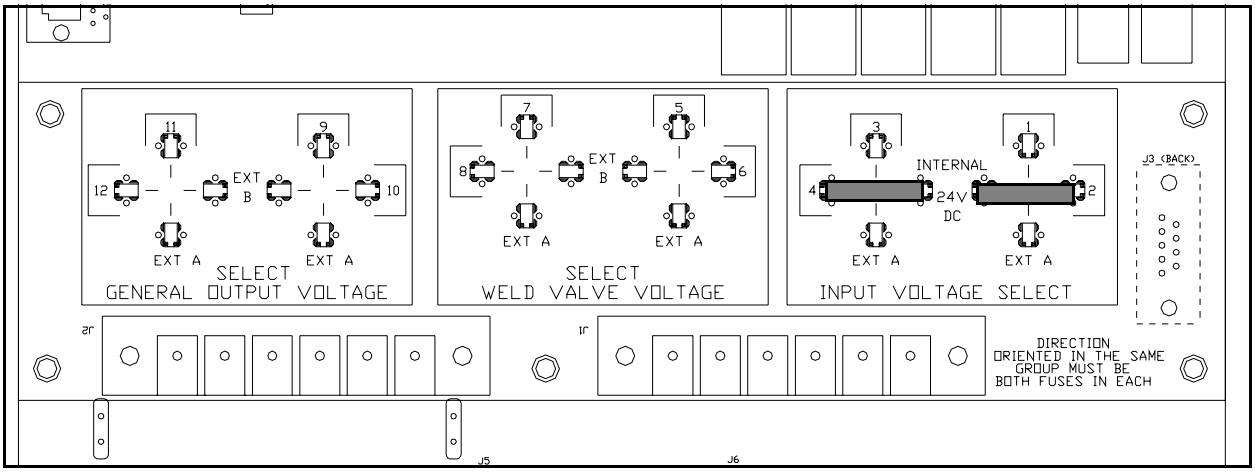
Pin	Signal Name
J4-1	+24VDC fused internal voltage source
J4-2	Input 1
J4-3	Input 2
J4-4	Input 3
J4-5	Input 4
J4-6	Input 5
J4-7	Input 6
J4-8	Input 7
J4-9	Input 8
J4-10	Input 9
J4-11	Input 10
J4-12	Input 11
J4-13	Input 12
J4-14	Input Common
J4-15	Logic Ground (fused)

Table 4: J6 Pinout

Pin	Signal Name
J6-1	Group 1 Common
J6-2	Relay 1, Group 1 (Weld Valve #1)
J6-3	Relay 2, Group 1 (Weld Valve #2)
J6-4	Relay 3, Group 1 (Weld Valve #3)
J6-5	Relay 4, Group 1 (Weld Valve #4)
J6-6	Group 2 Common
J6-7	Relay 1, Group 2
J6-8	Relay 2, Group 2
J6-9	Relay 3, Group 2
J6-10	Relay 4, Group 2
J6-11	Relay 5, Group 1 SPDT-NC
J6-12	Relay 5, Group 1 Common
J6-13	Relay 5, Group 1 SPDT-NO
J6-14	Relay 5, Group 2 SPDT-NC
J6-15	Relay 5, Group 2 Common
J6-16	Relay 5, Group 2 SPDT-NO
J6-17	Test Point

Example For Setting Input Voltage

If the voltage source for the inputs is to be supplied from the internal +24VDC from the 824 I/O board, two fuses should be installed in 24VDC (Horizontal) positions. For the voltage source from I/O voltage A, two fuses should be installed in the A (Vertical) positions, which are marked EXT A on the Daughter board. For the inputs, a 5-amp fast-blow fuse should be used.



Setting Output Voltages

In a similar way, positioning of fuses is used to select between either voltage source A (Vertical fuse location) or voltage source B (Horizontal fuse location) the weld valve outputs (J6 pins 2, 3, 4, and 5) and the general outputs (J6 pins 7, 8, 9 and 10). For the outputs, a 5-amp fast-blow fuse should be used.

With this arrangement, mixing of output voltages is possible. For example, the four weld valve outputs could be configured for 120 VAC, and the other group of four general outputs could be configured for 24VAC.

The two separate relay outputs with both normally-open and normally-closed contacts are electrically completely isolated from anything else on the 824 I/O and can be wired to any voltage source of 250 VAC or less.

CONNECTION TO THE WELD TIMER

The connection to the weld timer is provided by an 8-pin RJ-45 modular jack on the 824 I/O board and a standard Category 5 jumper cable back to the weld timer. Power and signals travel on this cable. The maximum allowable length of cable between the weld timer and the 824 I/O board is 10 meters (about 30 feet). To avoid noise-induced malfunctions, the cable between the 824 I/O board and the weld timer should be routed away from any wires carrying voltage greater than 24V. If the cable is routed from one cabinet to another, it should go through its own conduit or separate opening between the cabinets.

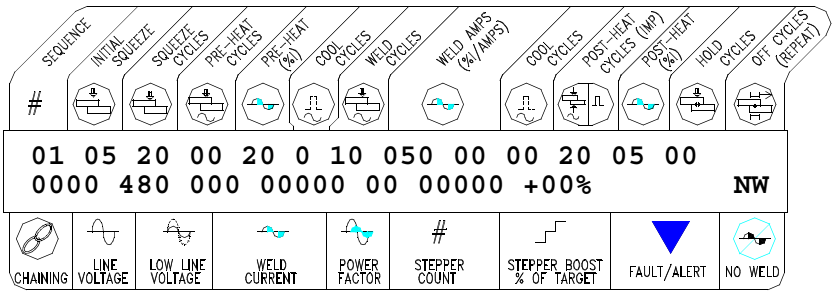
The 821 weld timer board is equipped with two RJ-45 modular jacks to handle two 824 I/O boards.

Appendix A: System Defaults

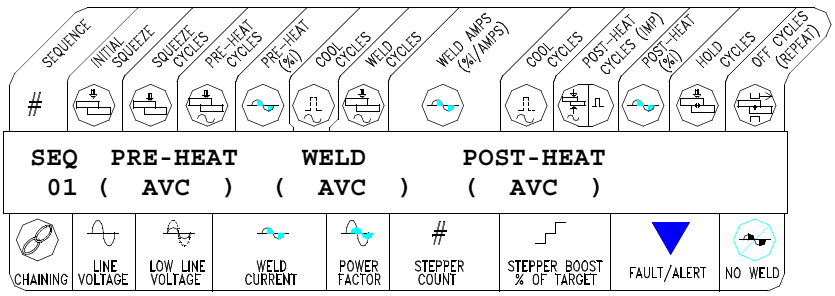
Appendix A describes the weld schedule, setup parameter defaults and the manual stepper defaults. It also lists functions with associated function codes, the default weld schedule and fault codes.

Default Weld Schedule

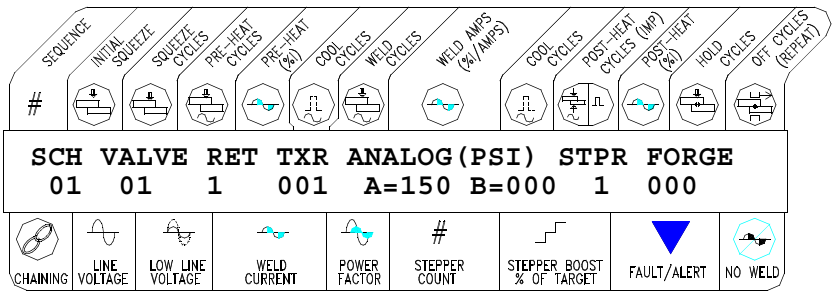
This is an example (for reference only) of the default **Normal/ Programming** screen:



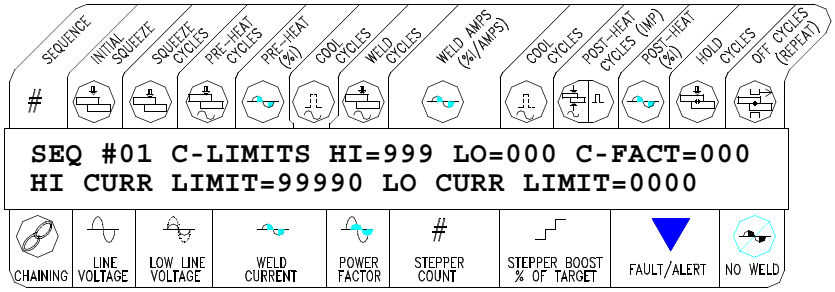
This is the default **Heat Select** screen:



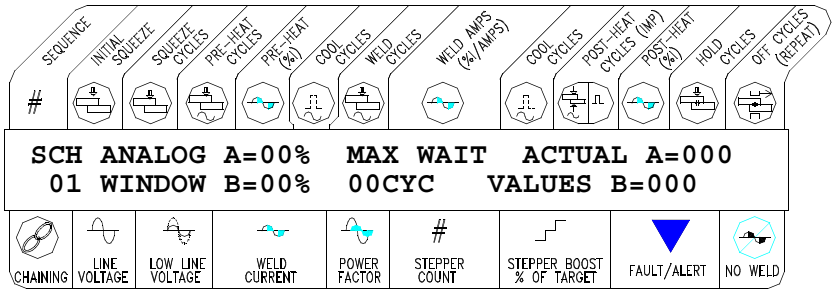
This is the default **Valve Mapping** screen:



This is the default **C-Factor Display** screen:



This is the default **Analog Display** screen:



Default Linear Stepper Profile

Following is the default linear stepper profile for T02200:

STEP 1 - 3% HEAT OR 0100 AMPS IN 0060 WELDS
STEP 2 - 3% HEAT OR 0100 AMPS IN 0180 WELDS
STEP 3 - 3% HEAT OR 0100 AMPS IN 0300 WELDS
STEP 4 - 3% HEAT OR 0100 AMPS IN 0600 WELDS
STEP 5 - 3% HEAT OR 0100 AMPS IN 0800 WELDS

Fault Codes

When a fault occurs, the MedWeld T2200 displays a fault code in the lower-right corner of the **Normal / Programming** mode display. The following table lists the fault defined for each code when running program #T02200.

Fault Code	Definition
01	STEPPER APPROACHING MAX:
02	END OF STEPPER:
03	HIGH CURRENT LIMIT:
04	LOW CURRENT LIMIT:
05	HIGH C-FACTOR LIMIT:
06	LOW C-FACTOR LIMIT:
07	HALF CYCLE:
08	VOLTAGE COMPENSATION LIMIT:
09	LINE VOLTAGE:
10	EXTENDED WELD:
11	CURRENT COMPENSATION:
12	NO ZERO CROSSING SYNC:
13	LOW BATTERY:
14	WELD PILOT
15	SYSTEM COOLING:
16	SECOND STAGE:
17	CHAINED SEQUENCE:
18	RETRACT PILOT
19	BEAT MODE
20	NO WELD
21	HEAT CYCLE LIMIT:
22	I/O FAILURE:
23	ISO OFF WHEN NEEDED
24	CONTROL STOP
25	PRESSURE NOT ACHIEVED
26	ISO CNTR ERR - BRKR TRIPPED:
27	PRESSURE SWITCH:
I01	SHORTED SCR (Internal)
I02	EPROM ERROR (Internal)
I03	RAM ERROR (Internal)

Setup Parameter Defaults

Program T02200 includes a number of setup parameters. Some setup parameters define the severity of control error conditions. Others identify the hardware environment (such as the types of retract and transformer being used) to the control.

The following table lists the setup parameters and the control's default (factory-installed) settings.

No.	Parameter	Default
01	STEPPER APPROACHING MAX	**(ALERT)**
02	END OF STEPPER	**(FAULT)**
03	HIGH CURRENT LIMIT	**(FAULT)**
04	LOW CURRENT LIMIT	**(FAULT)**
05	HIGH C-FACTOR LIMIT	**(FAULT)**
06	LOW C-FACTOR LIMIT	**(FAULT)**
07	HALF CYCLE	**(FAULT)**
08	VOLTAGE COMPENSATION	**(ALERT)**
09	LINE VOLTAGE	**(ALERT)**
10	EXTENDED WELD	**(ALERT)**
11	CURRENT COMPENSATION	**(ALERT)**
12	NO ZERO CROSSING SYNC *	**(FAULT)**
13	LOW BATTERY	**(ALERT)**
14	WELD PILOT	**(ALERT)**
15	SYSTEM COOLING	**(FAULT)**
16	SECOND STAGE	**(ALERT)**
17	CHAINED SEQUENCE	**(ALERT)**
18	RETRACT PILOT	**(ALERT)**
19	BEAT MODE	**(ALERT)**
20	NO WELD	**(ALERT)**
21	HEAT CYCLE LIMIT	**(FAULT)**
22	I/O FAILURE	**(FAULT) ***
23	ISO OFF WHEN NEEDED	**(FAULT) ***
24	CONTROL STOP	**(FAULT) ***
25	PRESSURE NOT ACHIEVED	**(FAULT) ***
26	ISO CNTR ERR - BRKR TRIPPED	**FAULT) ***
27	PRESSURE SWITCH	**(ALERT)**
28	INITIATION ON FAULT	**(INHIBIT)**
29	INDEX PILOT ASSIGN ON REPEAT:	**(NO)**
30	SUCCESSIVE SEQUENCING	**(NO)**
31	TRANSFORMER:	**(AC WOUND)**
32	CURRENT LIMIT MODE:	**(AVERAGE)**
33	EXTENDED WELD:	**(DISABLED)**
34	HEAT CYCLE LIMIT (0=SEAM): nn	**(SEAM)**
35	HALF CYCLING FIRING	**(ENABLE)**
36	ISOLATION CONTACTOR DELAY (SEC)	**(05)**
37	ANALOG OUTPUT	**(VOLTAGE)**
38	INITIATION FROM RETRACT	**(ALLOW)**
39	RETRACT MODE:	**(LATCHED)**
40	RETRACT CYLINDER:	**(AIR-NORMAL)**
41	DATA COLLECTION SAMPLE SIZE:	**(05)**
42	DATA COLLECTION SAMPLE FREQUENCY:	**(0100)**

No.	Parameter	Default
43	GUN #1 CLOSE TO PRE-BLOCK POS (CY/2): nnn	**(000)**
44	GUN #1 ADVANCE STOP TIME (CY/2): nnn	**(000)**
45	GUN #1 OPEN FROM BLOCK POS (CY/2): nnn	**(000)**
46	GUN #1 OPEN TO BLOCK POS (CYC): nnn	**(000)**
47	GUN #2 CLOSE TO PRE-BLOCK POS (CY/2): nnn	**(000)**
48	GUN #2 ADVANCE STOP TIME (CY/2): nnn	**(000)**
49	GUN #2 OPEN FROM BLOCK POS (CY/2): nnn	**(000)**
50	GUN #2 OPEN TO BLOCK POS (CYC): nnn	**(000)**
51	NOMINAL LINE VOLTAGE:	**(000)**
52	WAIT FOR LINE VOLTAGE: nnn	**(000)**
53	LINE VOLTAGE WAIT TIME (CYC): nnn	**(000)**
54	MAXIMUM LINE PRESSURE (PSI)	**(100)**
55	STATIC ANALOG 1 OUT VALVE	**(075)**
56	STATIC ANALOG 2 OUT VALVE	**(075)**

***** denotes that this parameter is NOT programmable.

Default Mapping of I/O Points

Program #T02200 permits assigning any desired mapping of I/O points with their corresponding settings. This section lists the six default mappings of I/O points:

Default #1

START OF IO MAP
01 RELOAD IO DEFAULTS
02 INITIATION TYPE: DISCRETE
03 VALVE TYPE: BINARY
04 PRESSURE ANALOG/PRESSURE SELECT: PRESSURE
05 INITIATION MODE: NON BEAT / BEAT
06 ISO CONTACTOR: ENABLED / DISABLED
07 INPUT 01: BINARY 1 / PILOT 1
08 INPUT 02: BINARY 2 / PILOT 2
09 INPUT 03: BINARY 4 / PILOT 4
10 INPUT 04: BINARY 8 / PILOT 8
11 INPUT 05: WELD INITIATE
12 INPUT 06: WELD/NO WELD
13 INPUT 07: STEPPER RESET
14 INPUT 08: FAULT RESET
15 INPUT 09: PRESSURE SWITCH
16 INPUT 10: 2ND STAGE
17 INPUT 11: RETRACT 1
18 INPUT 12: RETRACT 2
19 INPUT 13: XFORMER OVERTEMP
20 INPUT 14: PROGRAM SECURITY
21 INPUT 15: HEAT SECURITY
22 INPUT 16: TIP DRESS RESET
23 OUTPUT 01: VALVE 1
24 OUTPUT 02: VALVE 2
25 OUTPUT 03: OHMA INTENSIFY
26 OUTPUT 04: PRESSURE SEL 1
27 OUTPUT 05: PRESSURE SEL 2
28 OUTPUT 06: RETRACT VALVE 1
29 OUTPUT 07: RETRACT VALVE 2
30 OUTPUT 08: WELD/NO WELD OUT
31 OUTPUT 09: NO FAULT
32 OUTPUT 10: ALERT
33 END OF I/O MAP

Default #2

01 START OF IO MAP
02 INPUT MODE: BINARY
03 OUTPUT MODE: DISCRETE
04 PRESSURE ANALOG/PRESSURE SELECT: PRESSURE
05 INPUT MODE: NON BEAT
06 ISO CONTACTOR CHECKING: YES
07 INPUT 01: BINARY 1
08 INPUT 02: BINARY 2
09 INPUT 03: BINARY 4
10 INPUT 04: BINARY 8
11 INPUT 05: WELD INITIATE
12 INPUT 06: WELD/NO WELD
13 INPUT 07: STEPPER RESET
14 INPUT 08: FAULT RESET
15 INPUT 09: PRESSURE SWITCH
16 INPUT 10: 2ND STAGE
17 INPUT 11: RETRACT 1
18 INPUT 12: RETRACT 2
19 INPUT 13: XFORMER OVERTEMP
20 INPUT 14: PROGRAM SECURITY
21 INPUT 15: HEAT SECURITY
22 INPUT 16: TIP DRESS RESET
23 OUTPUT 01: VALVE 1
24 OUTPUT 02: VALVE 2
25 OUTPUT 03: OHMA INTENSIFY
26 OUTPUT 04: PRESSURE SEL 1
27 OUTPUT 05: PRESSURE SEL 2
28 OUTPUT 06: RETRACT VALVE 1
29 OUTPUT 07: RETRACT VALVE 2
30 OUTPUT 08: WELD/NO WELD OUT
31 OUTPUT 09: NO FAULT
32 OUTPUT 10: ALERT
33 END OF I/O MAP

Default #3

01 START OF IO MAP
02 INPUT MODE: BINARY
03 OUTPUT MODE: DISCRETE
04 PRESSURE ANALOG/PRESSURE SELECT: PRESSURE
05 INPUT MODE: NON BEAT
06 ISO CONTACTOR CHECKING: NO
07 INPUT 01: BINARY 1
08 INPUT 02: BINARY 2
09 INPUT 03: BINARY 4
10 INPUT 04: BINARY 8
11 INPUT 05: BINARY 16
12 INPUT 06: BINARY 32
13 INPUT 07: WELD INITIATE
14 INPUT 08: WELD/NO WELD
15 INPUT 09: FAULT RESET
16 INPUT 10: PRESSURE SWITCH
17 INPUT 11: 2ND STAGE
18 INPUT 12: RETRACT 1
19 INPUT 13: XFORMER OVERTEMP
20 INPUT 14: PROGRAM SECURITY
21 INPUT 15: HEAT SECURITY
22 INPUT 16: NONE
23 OUTPUT 01: VALVE 1
24 OUTPUT 02: VALVE 2
25 OUTPUT 03: VALVE 3
26 OUTPUT 04: VALVE 4
27 OUTPUT 05: WATER SAVER
28 OUTPUT 06: WELD/NO WELD OUT
29 OUTPUT 07: RETRACT VALVE 1
30 OUTPUT 08: END OF HOLD
31 OUTPUT 09: NO FAULT
32 OUTPUT 10: FORGE VALVE
33 END OF I/O MAP

Default #4

01 START OF IO MAP
02 INPUT MODE: BINARY
03 OUTPUT MODE: DISCRETE
04 PRESSURE ANALOG/PRESSURE SELECT: PRESSURE
05 INPUT MODE: NON BEAT
06 ISO CONTACTOR CHECKING: YES
07 INPUT 01: BINARY 1
08 INPUT 02: BINARY 2
09 INPUT 03: BINARY 4
10 INPUT 04: BINARY 8
11 INPUT 05: BINARY 16
12 INPUT 06: BINARY 32
13 INPUT 07: WELD INITIATE
14 INPUT 08: WELD/NO WELD
15 INPUT 09: FAULT RESET
16 INPUT 10: PRESSURE SWITCH
17 INPUT 11: 2ND STAGE
18 INPUT 12: RETRACT 1
19 INPUT 13: XFORMER OVERTEMP
20 INPUT 14: PROGRAM SECURITY
21 INPUT 15: HEAT SECURITY
22 INPUT 16: NONE
23 OUTPUT 01: VALVE 1
24 OUTPUT 02: VALVE 2
25 OUTPUT 03: VALVE 3
26 OUTPUT 04: VALVE 4
27 OUTPUT 05: WATER SAVER
28 OUTPUT 06: WELD/NO WELD OUT
29 OUTPUT 07: RETRACT VALVE 1
30 OUTPUT 08: END OF HOLD
31 OUTPUT 09: NO FAULT
32 OUTPUT 10: FORGE VALVE
33 END OF I/O MAP

Default #5

01 START OF IO MAP
02 INPUT MODE: DISCRETE
03 OUTPUT MODE: DISCRETE
04 PRESSURE ANALOG/PRESSURE SELECT: PRESSURE
05 INPUT MODE: NON BEAT
06 ISO CONTACTOR CHECKING: NO
07 INPUT 01: PILOT 1
08 INPUT 02: PILOT 2
09 INPUT 03: PILOT 3
10 INPUT 04: PILOT 4
11 INPUT 05: PILOT 5
12 INPUT 06: PILOT 6
13 INPUT 07: WELD INITIATE
14 INPUT 08: WELD/NO WELD
15 INPUT 09: FAULT RESET
16 INPUT 10: PRESSURE SWITCH
17 INPUT 11: 2ND STAGE
18 INPUT 12: RETRACT 1
19 INPUT 13: XFORMER OVERTEMP
20 INPUT 14: PROGRAM SECURITY
21 INPUT 15: HEAT SECURITY
22 INPUT 16: NONE
23 OUTPUT 01: VALVE 1
24 OUTPUT 02: VALVE 2
25 OUTPUT 03: VALVE 3
26 OUTPUT 04: VALVE 4
27 OUTPUT 05: WATER SAVER
28 OUTPUT 06: WELD/NO WELD OUT
29 OUTPUT 07: RETRACT VALVE 1
30 OUTPUT 08: END OF HOLD
31 OUTPUT 09: NO FAULT
32 OUTPUT 10: FORGE VALVE
33 END OF I/O MAP

Default #6

01 START OF IO MAP
02 INPUT MODE: DISCRETE
03 OUTPUT MODE: DISCRETE
04 PRESSURE ANALOG/PRESSURE SELECT: PRESSURE
05 INPUT MODE: NON BEAT
06 ISO CONTACTOR CHECKING: YES
07 INPUT 01: PILOT 1
08 INPUT 02: PILOT 2
09 INPUT 03: PILOT 3
10 INPUT 04: PILOT 4
11 INPUT 05: PILOT 5
12 INPUT 06: PILOT 6
13 INPUT 07: WELD INITIATE
14 INPUT 08: WELD/NO WELD
15 INPUT 09: FAULT RESET
16 INPUT 10: PRESSURE SWITCH
17 INPUT 11: 2ND STAGE
18 INPUT 12: RETRACT 1
19 INPUT 13: XFORMER OVERTEMP
20 INPUT 14: PROGRAM SECURITY
21 INPUT 15: HEAT SECURITY
22 INPUT 16: NONE
23 OUTPUT 01: VALVE 1
24 OUTPUT 02: VALVE 2
25 OUTPUT 03: VALVE 3
26 OUTPUT 04: VALVE 4
27 OUTPUT 05: WATER SAVER
28 OUTPUT 06: WELD/NO WELD OUT
29 OUTPUT 07: RETRACT VALVE 1
30 OUTPUT 08: END OF HOLD
31 OUTPUT 09: NO FAULT
32 OUTPUT 10: FORGE VALVE
33 END OF I/O MAP

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Appendix B: Drawings

This Appendix contains the schematics and drawings required to hook up, configure and operate the MedWeld T2200 control. These drawings are:

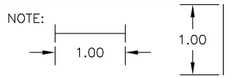
Drawing No.	Title
DM-011967-01	Assembly--Chassis, T2200 Layout
DM-011970-01	T2200-SL-1=1200-0002 Layout
DW-011562-01	T2200 Series Wiring Diagram, Sheet 1 of 2
DW-011562-02	T2200 Series Wiring Diagram, Sheet 2 of 2

NOTE for On-line Viewing:

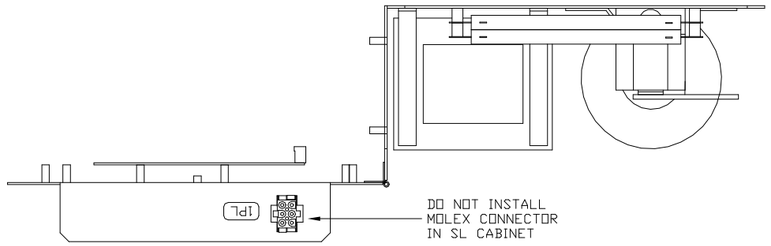
If you are viewing this manual in Adobe *Acrobat* or *Acrobat Reader*, the numbers highlighted in blue are active links. In the document window, first position the hand cursor over the desired number. It now becomes a pointing hand cursor. Left-click once. The selected drawing will appear in a new window.

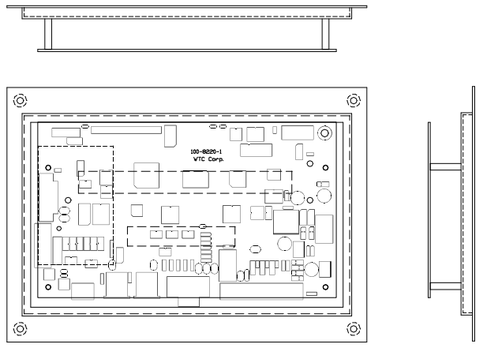
FOR WTC PRODUCTION USE ONLY

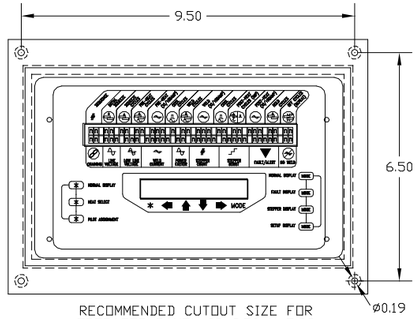
NOTE:



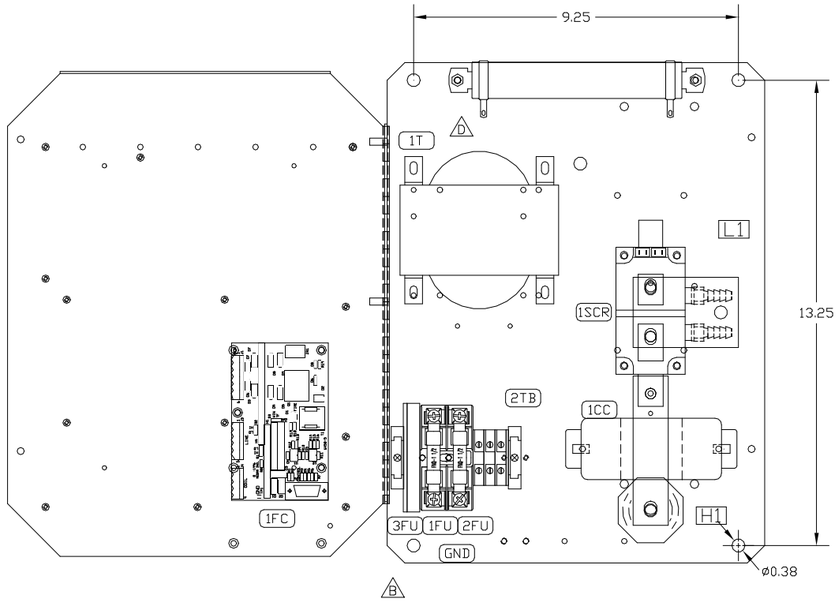
IN ORDER FOR WTC PERSONNEL TO SCALE THIS DRAWING FOR LAYOUT PURPOSES, THE LINES DIMENSIONED ABOVE MUST PHYSICALLY MEASURE 1 INCH. THE SCALE VALUE IS SHOWN ELSEWHERE ON THIS SHEET.

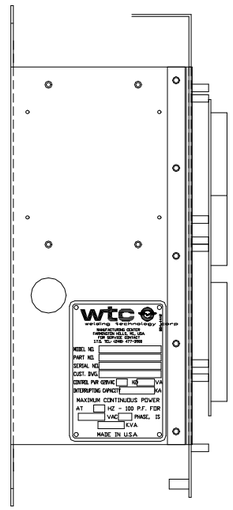


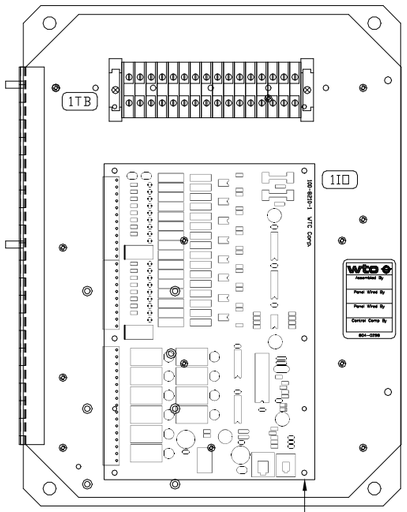




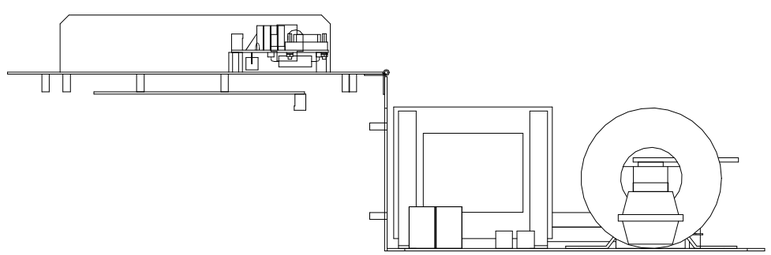
RECOMMENDED CUTOUT SIZE FOR
OPERATOR PANEL IS 9.50 X 5.88







MOUNT USING 8-32 X 3/4 STANDOFFS



ACTIVE LAYERS
ALL

REV	DESCRIPTION	DATE	BY	AUTHORITY	BY
E	UPDATED DECALS	04/06/04	WD	ENG	ENG
D	MOVED F3 FOR PLUG CLEARANCE/1T SHIFTED UP	07/11/03	ERK	CR03-R164	BKJ
C	MOUNTING DIMENSIONS ADDED	05/13/03	DW	ENG	BKJ
B	2TB REVISED/FUSES REVISED	04/10/03	DW	CR 03-R061	CCB
A	RELEASED TO PRODUCTION			ENG	

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[redacted]

MECHANICAL TOLERANCES:
0.00X ±0.005
0.0X ±0.015
0.X ±0.03

ANGLES ±1/2°
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. IF REQUIRED, METRIC ARE SHOWN IN BRACKETS [mm]. BREAK & DEBURR ALL SHARP EDGES.

PROJECTION: THIRD ANGLE

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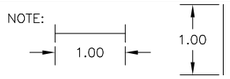
ASSY-CHASSIS, T2200 LAYOUT	DRAWN BY: DJW	07/09/02
	REQ'D BY:	
	SCALE: 1/2	SIZE: D
CUSTOMER:	SALES ORDER NO.:	

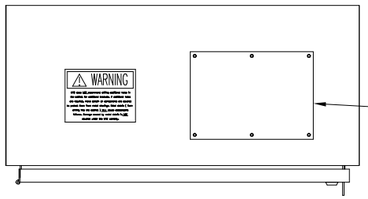
PART NO.	SHEET	DRAWING NO.	REV.
830-0587	1 OF 1	DM-011967-01	E

FOR WTC PRODUCTION USE ONLY

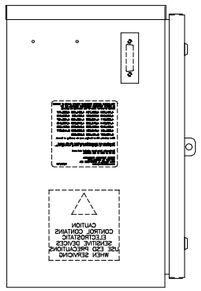
NOTE:

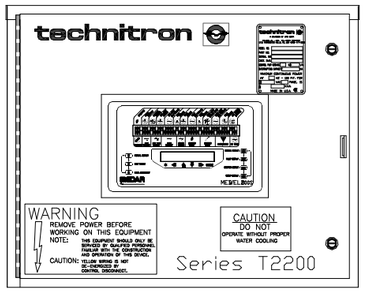


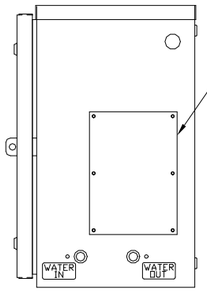
IN ORDER FOR WTC PERSONNEL TO SCALE THIS DRAWING FOR LAYOUT PURPOSES, THE LINES DIMENSIONED ABOVE MUST PHYSICALLY MEASURE 1 INCH. THE SCALE VALUE IS SHOWN ELSEWHERE ON THIS SHEET.

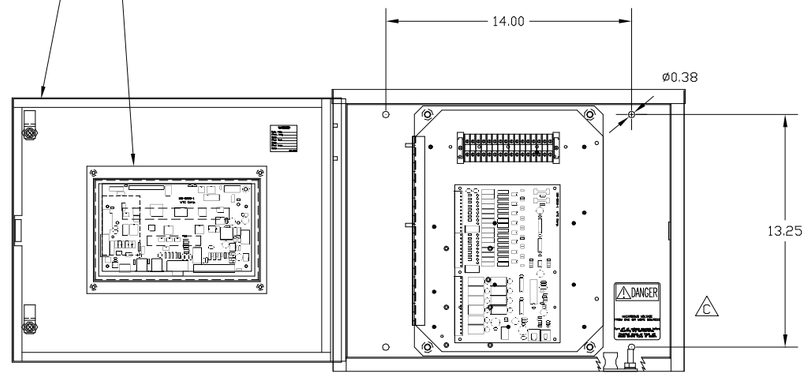


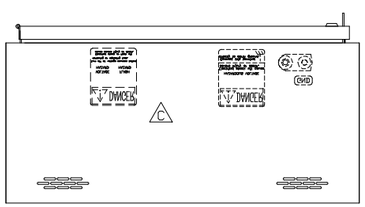
GASKET ADDED TO DOOR AND COVERPLATES











REV	DESCRIPTION	DATE	BY	AUTHORITY	BY
C	FIXED DECALS	05/17/04	WD	ENG	ENG
B	CHANGED PART # TO VARIOUS	8/01/03	WD	ENG	ENG
A	RELEASED TO PRODUCTION			ENG	

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[redacted]

MECHANICAL TOLERANCES:	ANGLES ±1/2'	PROJECTION
0.00X ±0.005	UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE	
0.0X ±0.015	IN INCHES. IF REQUIRED, METRIC ARE SHOWN IN	
0.X ±0.03	BRACKETS [mm]. BREAK & DEBURR ALL SHARP EDGES.	THIRD ANGLE

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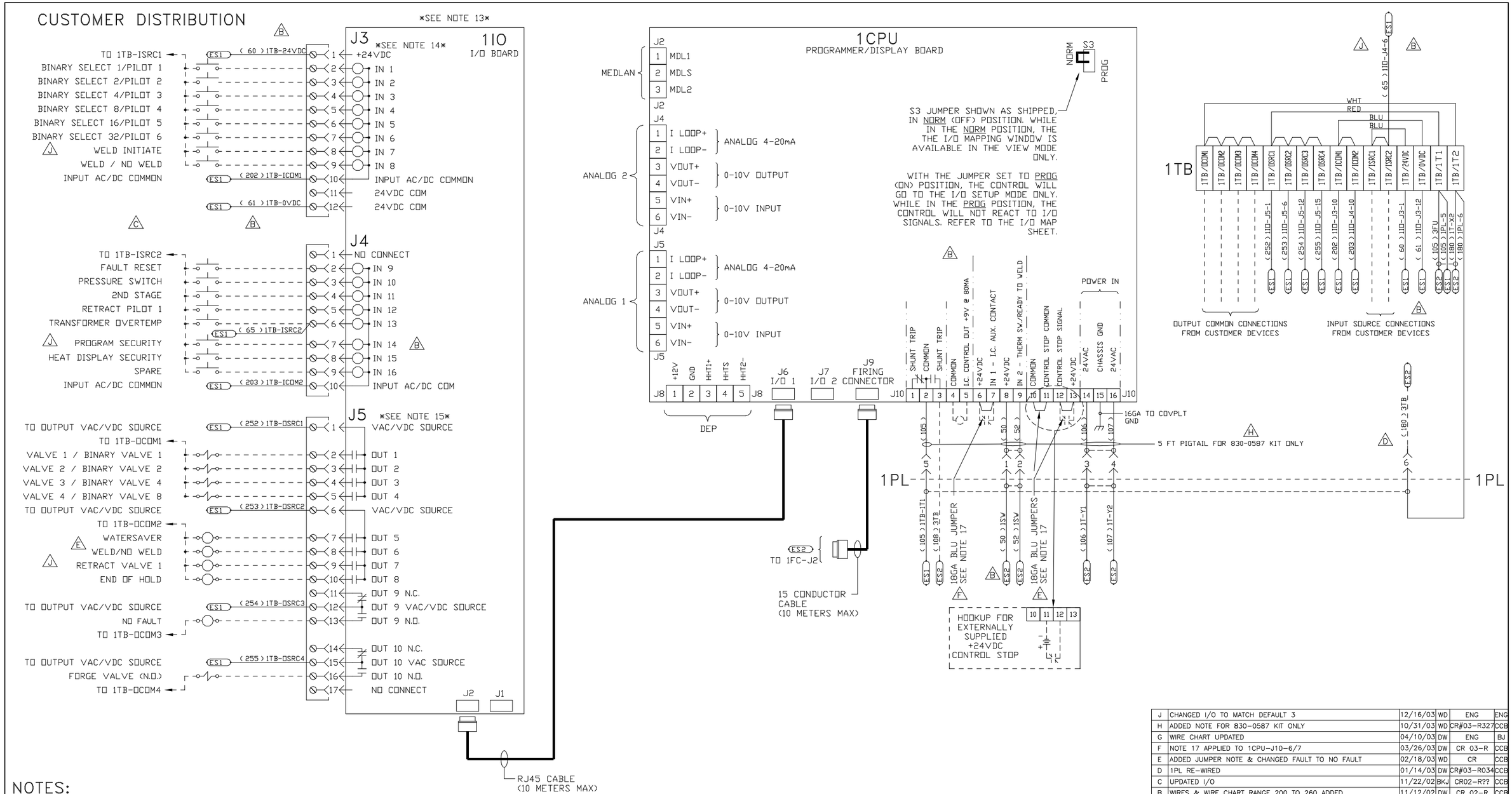
ACTIVE LAYERS
BORDER-TITLE
MA1
PANEL

T2200-SL-1=1200-0002 LAYOUT	DRAWN BY: DJW	07/09/02
	REQ'D BY:	
	SCALE: 1/4	SIZE: D
CUSTOMER:	SALES ORDER NO.:	

PART NO.	SHEET	DRAWING NO.	REV.
VARIOUS	1 OF 1	DM-011970-01	C



NOTES:

1.) (XX) WIRE NUMBER
2.) SNUBBER
3.) TWISTED WIRE PAIR
4.) CHASSIS GROUND
5.) CUSTOMER RESPONSIBILITY
6.) MOV
7.) WIRE NUMBER/GAUGE CHART

WIRE NUMBERS	COLOR/GAUGE
1 THRU 49	RESERVED FOR CUSTOMER
50 THRU 99	— BLUE, 18GA
100 THRU 179	— RED, 16GA
180 THRU 199	— WHITE, 16GA
200 THRU 260	— YELLOW, 16GA
1L1, 1L2, 1L1A, 1L2A, H1	— BLACK, 16GA

8.) WIRE (1L1A) IS CONNECTED TO THE TRANSFORMER LEAD NEAREST THE CUSTOMER LINE VOLTAGE.

9.) DUE TO TRANSFORMER AVAILABILITY, '1T' MAY NOT BE WIRED AS SHOWN IN THIS INSTANCE, REFER TO THE HOOK-UP DIAGRAM FOUND ON EACH INDIVIDUAL XFMR.

10.) THIS DWG IS INTENDED TO SHOW POINT TO POINT WIRE DESTINATIONS. WHILE THE TERMINAL DESIGNATORS ARE CORRECT, THE PHYSICAL REPRESENTATION MAY NOT BE. REFER TO THE COMPONENTS IN THE ENCLOSURE TO FIND THE ACTUAL TERMINAL ORIENTATIONS.

11.) (ESXX) CONNECTION TO OTHER SHEET

12.) (?) REVISION INDICATOR

13.) I/O BOARD INPUT LED REFERENCE:
YELLOW AC
RED DC (POSITIVE LOGIC)
GREEN DC (NEGATIVE LOGIC)

14.) I/O BOARD INPUT SOURCE CAN BE 24VDC OR 120VAC. NO ADJUSTMENTS ARE REQUIRED FOR THESE VOLTAGES.

15.) I/O BOARD OUTPUTS CAN SWITCH 5 AMPS MAX AT 24VDC/24VAC/120VAC OR 2 AMPS MAX AT 240VAC.

16.) IF CIRCUIT BREAKER IS NOT PRESENT, CUSTOMER IS RESPONSIBLE FOR TERMINATING THE 1L2 WIRE. A 36IN LEAD IS SUPPLIED.

17.) PROCESSOR BOARD CONNECTOR J10 – REMOVE BLUE JUMPERS IF EXTERNAL CONTACT IS DESIRED.

REV	DESCRIPTION	DATE	BY	AUTHORITY	BY
J	CHANGED I/O TO MATCH DEFAULT 3	12/16/03	WD	ENG	ENG
H	ADDED NOTE FOR 830-0587 KIT ONLY	10/31/03	WD	CR#03-R327	CCB
G	WIRE CHART UPDATED	04/10/03	DW	ENG	BJ
F	NOTE 17 APPLIED TO 1CPU-J10-6/7	03/26/03	DW	CR 03-R	CCB
E	ADDED JUMPER NOTE & CHANGED FAULT TO NO FAULT	02/18/03	WD	CR	CCB
D	1PL RE-WIRED	01/14/03	DW	CR#03-R034	CCB
C	UPDATED I/O	11/22/02	BKJ	CR02-R??	CCB
B	WIRES & WIRE CHART RANGE 200 TO 260 ADDED	11/12/02	DW	CR 02-R	CCB
A	RELEASED TO PRODUCTION			ENG	

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DO NOT SCALE DRAWING

MECHANICAL TOLERANCES:
0.00X ±0.005
0.0X ±0.01
0.X ±0.03
ANGLES ±1/2°
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. IF REQUIRED, METRIC ARE SHOWN IN BRACKETS [mm]. BREAK & DEBURR ALL SHARP EDGES.
PROJECTION: THIRD ANGLE

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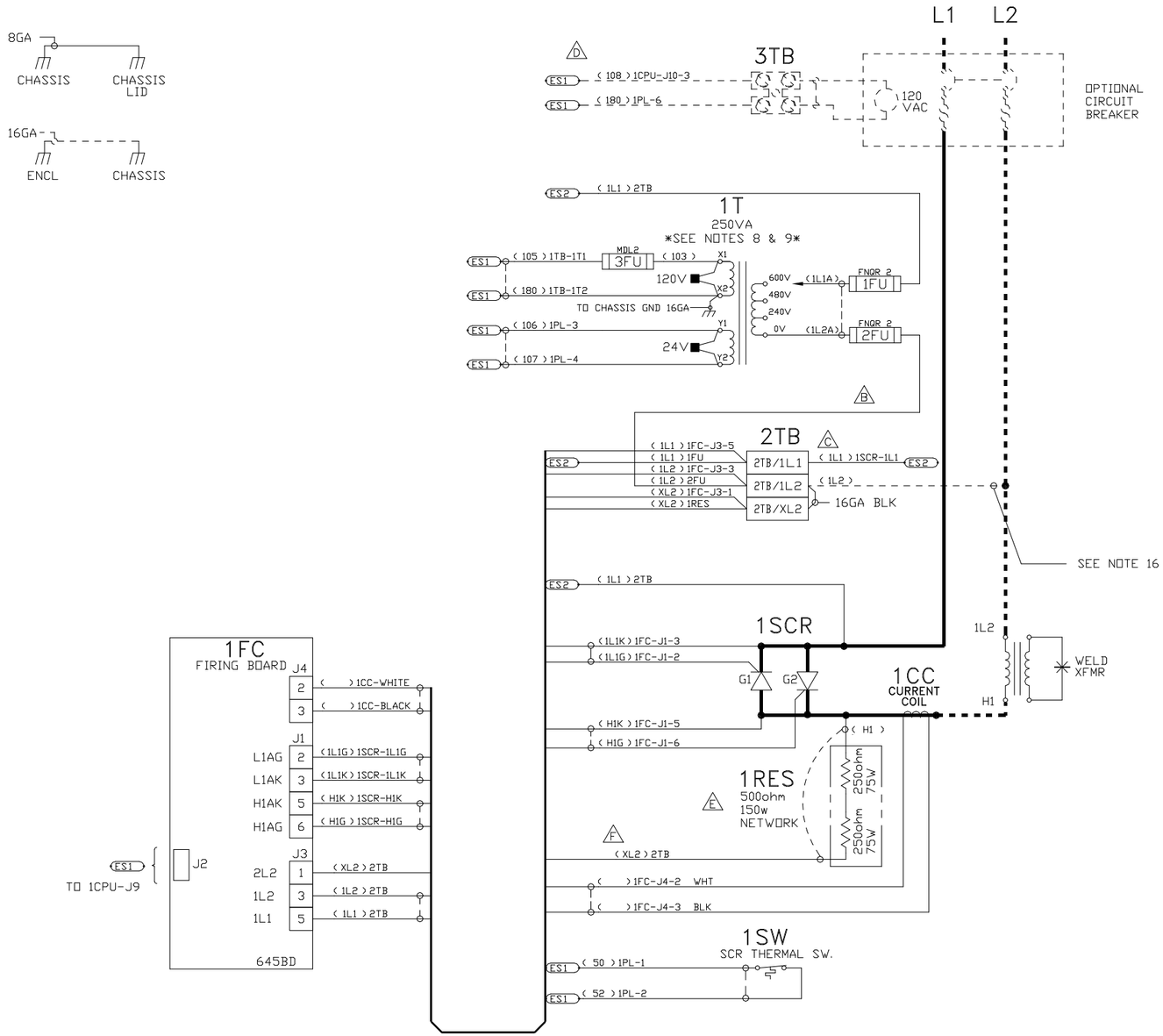
FARMINGTON HILLS, MI 48335

T2200 SERIES
WIRING DIAGRAM

DRAWN BY: DJW 07/08/02
REQ'D BY:
SCALE: NONE SIZE: D
CUSTOMER:
SALES ORDER NO.:

PART NO.	SHEET	DRAWING NO.	REV.
VARIOUS	1 OF 2	DW-011562-01	J



NOTES:

1.) (XX) WIRE NUMBER
2.) SNUBBER
3.) TWISTED WIRE PAIR
4.) CHASSIS GROUND
5.) CUSTOMER RESPONSIBILITY
6.) MOV
7.) WIRE NUMBER/GAUGE CHART

WIRE NUMBERS	COLOR/GAUGE
1 THRU 49	RESERVED FOR CUSTOMER
50 THRU 99	— BLUE, 18GA
100 THRU 179	— RED, 16GA
180 THRU 199	— WHITE, 16GA
200 THRU 260	— YELLOW, 16GA
1L1, 1L2, 1L1A, 1L2A, H1 XL2	— BLACK, 16GA

8.) WIRE (1L1A) IS CONNECTED TO THE TRANSFORMER LEAD NEAREST THE CUSTOMER LINE VOLTAGE.

9.) DUE TO TRANSFORMER AVAILABILITY, '1T' MAY NOT BE WIRED AS SHOWN IN THIS INSTANCE, REFER TO THE HOOK-UP DIAGRAM FOUND ON EACH INDIVIDUAL XFMR.

10.) THIS DWG IS INTENDED TO SHOW POINT TO POINT WIRE DESTINATIONS. WHILE THE TERMINAL DESIGNATORS ARE CORRECT, THE PHYSICAL REPRESENTATION MAY NOT BE. REFER TO THE COMPONENTS IN THE ENCLOSURE TO FIND THE ACTUAL TERMINAL ORIENTATIONS.

11.) (ESXX) CONNECTION TO OTHER SHEET

12.) △? REVISION INDICATOR

13.) I/O BOARD INPUT LED REFERENCE:
YELLOW AC
RED DC (POSITIVE LOGIC)
GREEN DC (NEGATIVE LOGIC)

14.) I/O BOARD INPUT SOURCE CAN BE 24VDC OR 120VAC. NO ADJUSTMENTS ARE REQUIRED FOR THESE VOLTAGES.

15.) I/O BOARD OUTPUTS CAN SWITCH 5 AMPS MAX AT 24VDC/24VAC/120VAC OR 2 AMPS MAX AT 240VAC.

16.) IF CIRCUIT BREAKER IS NOT PRESENT, CUSTOMER IS RESPONSIBLE FOR TERMINATING THE 1L2 WIRE. A 36IN LEAD IS SUPPLIED.

17.) PROCESSOR BOARD CONNECTOR J10 – REMOVE BLUE JUMPER IF EXTERNAL CONTACT IS DESIRED.

ACTIVE LAYERS
BORDER–TITLE
ES2

REV	DESCRIPTION	DATE	BY	AUTHORITY	BY
F	CHANGED WIRE LABEL & CHART	5/12/03	WD	ECN#03-037	CCB
E	LOAD RESISTOR WIRING CORRECTED	04/25/03	DW	CR 03-R202	CCB
D	CHANGED 1PD LABEL TO 1CPU	04/16/03	WD	ENG	BJ
C	480 WIRING REVISED FOR I.C. OPTION	04/10/03	DW	ECN#03-037	CCB
B	CORRECTED WIRE DESIGNATION	11/22/02	BKJ	ECN#02-R	CCB
A	RELEASED TO PRODUCTION			ENG	

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DO NOT SCALE DRAWING

MECHANICAL TOLERANCES:
0.00X ±0.005
0.0X ±0.015
0.X ±0.03

ANGLES ±1/2°
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. IF REQUIRED, METRIC ARE SHOWN IN BRACKETS [mm]. BREAK & DEBURR ALL SHARP EDGES.

PROJECTION: THIRD ANGLE

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24775 CRESTVIEW COURT
FARMINGTON HILLS, MI 48335

T2200 SERIES
WIRING DIAGRAM

DRAWN BY: DJW 07/08/02
REQ'D BY:
SCALE: NONE SIZE: D
CUSTOMER:
SALES ORDER NO.:

PART NO.	SHEET	DRAWING NO.	REV.
VARIOUS	2 OF 2	DW-011562-02	F