Original instructions

PULSED HEAT CONTROLLER

MR-130B EU

OPERATION MANUAL

AMADA

Y04OM1168030-08

Thank you for purchasing our Pulsed Heat Controller **MR-130B**.

- This operation manual explains its method of operation and precautions for use.
- Before using, read this operation manual carefully; after reading, save it in a proper place where you can easily access.

Contents

1. Special Precautions

(1) Safety Precautions

Before using, read "Safety Precautions" carefully to understand the correct method of use.

- These precautions are shown for safe use of our products and for prevention of damage or injury to operators or others. Be sure to read each of them, since all of them are important for safety.
- The meaning of the words and symbols is as follows.

⚠ DANGER

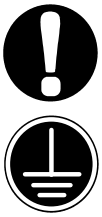
Denotes operations and practices that may imminently result in serious injury or loss of life if not correctly followed.

⚠ WARNING

Denotes operations and practices that may result in serious injury or loss of life if not correctly followed.

⚠ CAUTION

Denotes operations and practices that may result in personal injury or damage to the Controller, if not correctly followed.

	These symbols denote "prohibition". They are warnings about actions out of the scope of the warranty of the product.
	These symbols denote actions which operators must take.
	Each symbol with a triangle denotes that the content gives notice of DANGER, WARNING or CAUTION to the operator.

⚠ DANGER

Do not touch the inside of the Controller unnecessarily

Since very high voltages are applied to the interior of this Controller, it is very dangerous to touch it unnecessarily.

Never disassemble, repair or modify the Controller

These actions can cause electric shock and fire. Consult us or your distributor for inspection and repair.

Never burn, destroy, cut, crush or chemically decompose the Controller

This product incorporates parts containing gallium arsenide (GaAs).

⚠ WARNING

Ground this Controller
If the Controller is not grounded, you may get an electric shock when there is trouble, or when electricity leaks.

Apply Single-phase, 180–264 V AC power supply
Application of a voltage out of the specified range can cause fire and electric shock.

Using circuit breaker
Without a circuit breaker, it may cause fire or electric shock.

Connect the specified cables securely
Cables of insufficient current capacities and loose connections can cause fire and electric shock.

Do not damage the power cable and connecting cables
Do not tread on, twist or tense any cable. The power cable and connecting cables may be broken, and that can cause electric shock and fire.
If any part needs to be repaired or replaced, consult us or your distributor.

Stop the operation if any trouble occurs
Continuous operation after occurrence of a trouble such as burning smell, abnormal sound, abnormal heat, smoke, etc. can cause electric shock and fire. If such a trouble occurs, immediately consult us or your distributor.

Persons with pacemakers must stay clear of the welding machine
A person who uses a pacemaker must not approach the welding machine or walk around the welding shop while the welding machine is in operation, without being permitted by his/her doctor. The welding machine generates a magnetic field and has effects on the operation of the pacemaker while it is turned on.

Protective gear must be worn
Put on protective gear such as protective gloves, long-sleeve jacket, leather apron, etc. Surface flash and expulsion can burn the skin if they touch the skin.

Wear protective glasses
If you look at the flash directly during welding, your eyes may be damaged.
If any surface flash and expulsion gets in your eye, you may lose your eyesight

Do not touch Thermode
To prevent burns, keep hands and fingers away from Thermode during welding.

Do not touch soldered parts, Thermodes or their surroundings immediately after soldering
Parts and thermodes immediately after joining or soldering are very hot. Touching them may burn the skin.

⚠ CAUTION

Do not splash water on the Controller

Water splashed over the electric parts can cause electric shock and short circuits.

Use proper tools (wire strippers, pressure wire connectors, etc) for termination of the connecting cables

Do not cut the conductor of wire. A flaw on it can cause fire and electric shock.

Install the Controller on firm and level surface

If the Controller falls or drops, injury may result.

Do not place a water container on the Controller

If water spills, insulation will deteriorate, and this may cause electric leak and fire.

Keep combustible matter away from the Controller

Surface flash and expulsion can ignite combustible matter. If it is impossible to remove all combustible matter, cover them with non-combustible material.

Do not cover the Controller with a blanket, cloth, etc.

If such a cover is used, it may be overheated and burn.

Do not use this Controller for purposes other than welding

Use of this Controller in a manner other than specified can cause electric shock and fire.

Keep a fire extinguisher nearby

Keep a fire extinguisher in the welding shop in case of fire.

Maintain and inspect the Controller periodically

Maintain and inspect the Controller periodically, and repair any damage nearby before starting operation.

(2) Precautions for Handling

- When transporting or moving the Controller, do not lay it down. Also, handle the Controller with care so as not to make an impact such as drop on it. Moving the Controller by hand must be done by at least two people.

- Install this Controller on a firm and level surface. If it is inclined, malfunction may result.

- Do not install this Controller in the following:
  - Damp places where humidity is higher than 93%,
  - Hot or cold places where temperatures are above 40°C or below 15°C,
  - Places near a high noise source,
  - Places where chemicals are handled,
  - Places where water will be condensed,
  - Dusty places, and
  - Places at an altitude above 1000 meters.

- Clean the outside of the Controller with a soft, dry cloth or one wet with a little water. If it is very dirty, use diluted neutral detergent or alcohol. Do not use paint thinner, benzine, etc., since they can discolor or deform the Controller.

- Do not put a screw, a coin, etc., in the Controller, since they can cause a malfunction.

- Operate the Controller according to the method described in this operation manual.

- Operate the switches and buttons carefully by hand. If they are operated roughly or with the tip of a screwdriver, a pen, etc., this will cause malfunction or damage.

- The Controller is not equipped with auxiliary power such as an outlet for lighting.

- The welding head and the secondary cable for connecting the welding head with the Controller are separately needed to use the Controller.

- The I/O signal line to start the Controller is not attached. Prepare the line for wiring to the connectors.

(3) On Disposal

This product incorporates parts containing gallium arsenide (GaAs). At the time of disposal, separate it from general industrial waste or domestic waste and carry out the disposal in accordance with applicable laws and regulations.

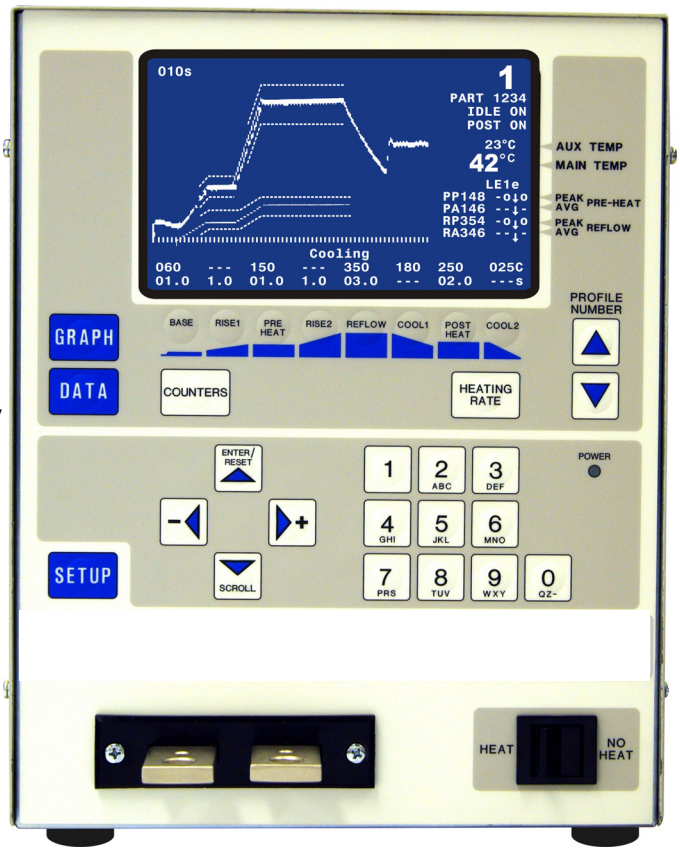
2. Description

I. Features

(1) Overview

For the rest of this manual, the **MR-130B Pulsed Heat Controller** will simply be referred to as ***the Control***.

If you have questions about custom items in your Control that are not covered in this manual, contact us.



The Control is a power supply designed for reflow soldering or heat sealing electronic interconnections using a precisely controlled temperature profile.

The design of the Control is directed toward compactness, reliability, safety and simplicity, and ease of repair.

The operator is coached by visual displays on a Liquid Crystal Display (LCD) screen if out-of-range entries are made, or when out of limits or alarm/error conditions occur.

Up to 63 heat profiles (the records containing the joining parameters to be used during the joining cycles) can be programmed, stored, and recalled for use.

Reflow soldering is a multi-step metal joining process where: Two solder-coated parts are brought into intimate contact, using a preset force.

- The temperature of the two parts is raised to a preheat temperature for a preset time to activate the pre-applied flux. The flux removes the surface oxides from the solder-plated parts.
- The temperature is then raised to the reflow temperature for a pre-set time to melt the solder between the parts.
- Cooling is then initiated to allow the solder to solidify.
- Upon reaching the pre-set cool temperature, the reflow head can be retracted, removing force from the parts.

Heat sealing or ACF Final Bonding is a multi-step process that creates an electrical conductive adhesive bond between two items. These items are typically flexible and rigid circuit boards, glass panel displays, and flex foils.

- With an applied force, two parts are brought together with an adhesive foil, flex, or paste in between them. The temperature then may be raised to a preheat temperature as a step toward the final sealing temperature.
- The temperature is then raised to the sealing temperature. A plastic deformation of the adhesive material occurs creating a conductive interface between the two items.
- Cooling and curing of the adhesive occurs while the applied force is maintained to stabilize the joint.

The Control has several features which detect temperatures outside of process requirements:

1) **Peak Temperature Limits:** Upper and lower temperatures can be set for the peak temperature during the Preheat and Reflow process cycles.
2) **Average Temperature Limits:** Upper and lower temperatures can be set for the average temperature during the Preheat and Reflow process cycles.
3) **Envelope Limits:** Upper and lower boundaries can be established for the Rise to Preheat, Preheat, Rise to Reflow and Reflow process cycles.
4) **Maximum Process Temperature:** A maximum temperature, which applies at any time during Controller operation, can be set. The Control will then abort the process and stop heat to the thermode if the temperature is ever reached.

(2) Models

The Control has a front panel with controls and a display for operator control of the Control.

Model	Version	Secondary Voltage	AC Input Voltage	Output Heating Capability
MR-130B-00-00	Standard	3.81V (Fast) 1.9V (Medium) 1.27V (Slow) 0.95V (Very Slow)	180 – 264 V AC	4 kVA For thermodes up to 4” (100 mm) long
MR-130B-00-01	Standard	7.62V (Fast) 3.8V (Medium) 2.54V (Slow) 1.90V (Very Slow)	180 – 264 V AC	4 kVA For thermodes up to 4” (100 mm) long
MR-130B-00-02	Standard	3.81V (Fast) 1.9V (Medium) 1.27V (Slow) 0.95V (Very Slow)	180 – 264 V AC	2 kVA For thermodes up to 2.3” (60 mm) long
MR-130B-00-03	Standard	7.62V (Fast) 3.8V (Medium) 2.54V (Slow) 1.90V (Very Slow)	180 – 264 V AC	2 kVA For thermodes up to 2.3” (60 mm) long

(3) Heads, Thermodes and Accessories

For details of solder reflow and heat seal heads, thermodes and accessories available from us, please contact us.

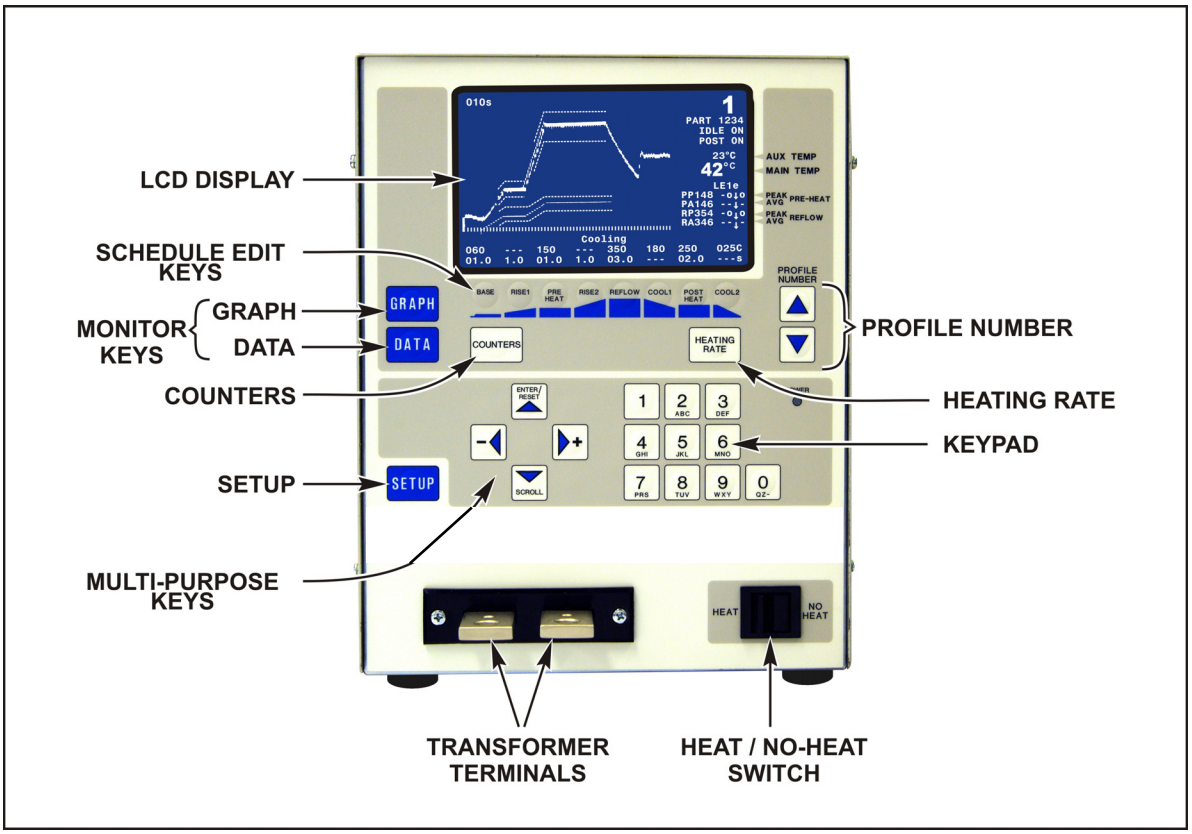
The Thermode, Thermode-chip, Heater-chip, Heater-element, Heater-plate, Heater-cool is also called.

Accessory list

Part Number	Description	Quantity
160-116	Bolt, Cap, Hex Head, M6, 25,4l	2
160-117	Bolt, Cap, Hex Head, M8, 25mml	2
4-39005-01	Cord,3x#14,8ft,1conn End	1
4-38703-01	Plug Set	1
4-38758-01	Thermocouple Cable Assembly, K Type	1
465-206	Nut, M8, Hex, Machine	2
465-214	Machine Nut Hex M6x1.0p	2
755-063	Washer(3/8~,Brass,Small T	4
755-322	Flat Washer, M6	4
755-321	Split Lock Washer	2
755-335	Spring Lock Washer, M8	2
AS1168489	English and Japanese Operation manual CD-ROM	1

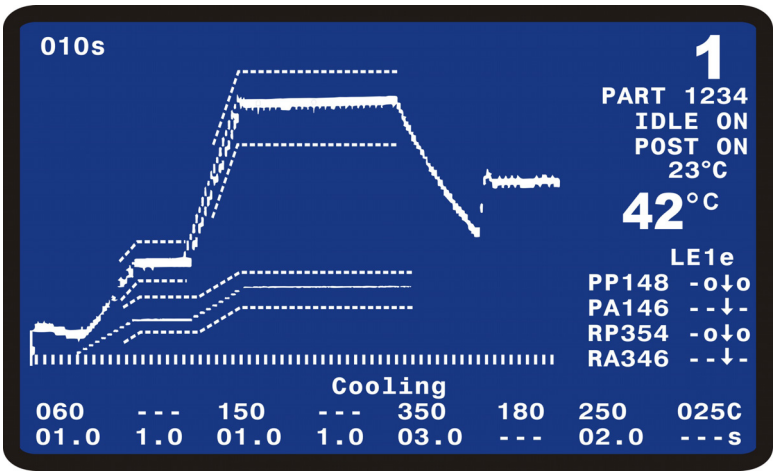
II. Controls and Indicators

(1) Front Panel



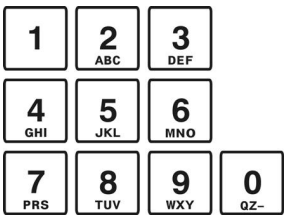
(2) Display (LCD)

The LCD on the front panel displays both graphic and alphanumeric data depending on the function chosen by the Operator.



NOTE: These screens, their functions and displays are described in *Chapter 4, Using Programming Functions*.

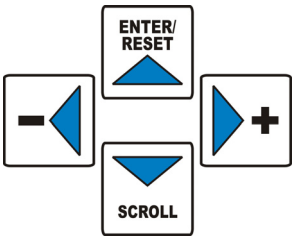
(3) Numerical Keypad



The keypad allows you to edit the numeric values of the display screens.

The keypad also allows you to enter in the alphanumeric schedule reference which is displayed on the graphic screen.

(4) Cursor Keys



The cursor keys allow you to move the editing cursor up, down and sideways. You use the ▲ (Up) and ▼ (Down) keys to select multiple pages in a single menu or setup screen. You use the ◄ (Left) and ► (Right) keys to decrease or increase a numeric field value. After changing the temperature or time parameters using the keypad, the ▲ (Up) key will save your change. The ▲ (Up) key will also clear alarm messages and the **ALARM** and **OUT OF LIMITS** of relay state.

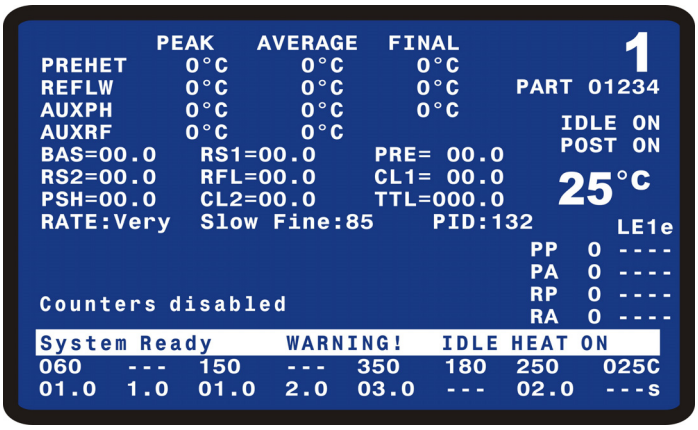
(5) GRAPH Key

This key displays the graphic screen for editing the heat profile parameters with the keypad or cursor keys. After editing the heat profile parameters, pressing the **GRAPH** key saves the new parameters to the heat profile noted on the display. Pressing the **GRAPH** key while in the setup, counter, or heating rate menus returns the Control to the graphic display mode.

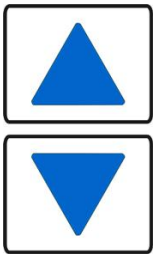
(6) DATA Key

The **DATA** key brings up the data screen to the display.

The data screen reports the most recent heat cycle parameters in numerical format: time, temperature, duty cycle, and counter status (when enabled). You may initiate the **HEAT** cycle while the **DATA** screen (rather than the graphic screen) is displayed.



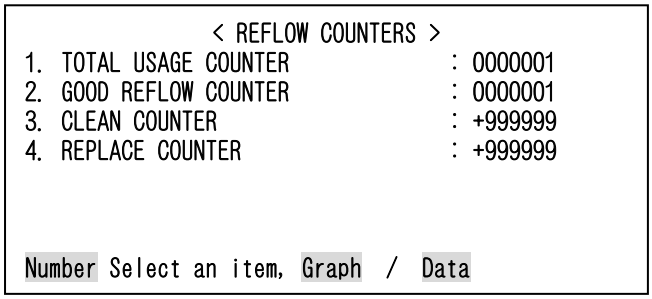
(7) PROFILE NUMBER ▲▼ Keys



With the graphics screen on the display, these keys will increment/decrement the heat profile number on the graphics screen. With the data screen on the display, pressing either **PROFILE NUMBER** key returns the graphics screen to the display; the keys will then increment/decrement the profile number on the screen. The **PROFILE NUMBER** up/down keys are disabled when any screen other than the graphic screen or data screen is on the display.
The number of possible heat profiles than can be stored ranges from 1 to 63.

(8) COUNTERS Key

This key brings up the **REFLOW COUNTERS** screen.
This screen provides a menu of selections for setting the thermode cleaning and thermode replacement counters, and choosing responses to the counter settings.



(9) DATA EDIT Keys

The Schedule Edit Keys allow you to edit the time and temperature parameters of the heat profile on the graphic display. The **BASE**, **RISE1**, **PREHEAT**, **RISE2**, **REFLOW**, **COOL1**, **POSTHEAT** and **COOL2** keys are vertically aligned with the profile heating states as displayed on the graphic screen. When these keys are repeatedly pressed, the input capability switches back and forth between time and temperature.

These keys are ***only*** active when the graphic screen is displayed.

(10) HEATING RATE Key

The **HEATING RATE** key brings up the **MANUAL TUNING** screen. This screen allows you to go to the **SET COARSE HEATING RATE** and **SET FINE HEATING RATE** heating rate capability to match the heat generating capability of the thermode to minimize the temperature overshoot and undershoot.

```
< MANUAL TUNING >
1. Set Coarse Heating Rate : MEDIUM
2. Set Fine Heating Rate   : 85%


Number Select an item, Graph / Data
```

```
< SET COARSE HEATING RATE >
1. Very Slow
2. Slow
3. Medium
4. Fast


Number Select an item, Graph / Data
```

```
< SET FINE HEATING RATE >
SET FINE HEATING RATE   :   85%

0  10  20  30  40  50  60  70  80  90

◄ ► Adjust, ▲Page, Graph / Data
```

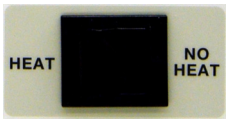
(11) SETUP Key

This key brings up the **SETUP MENU** screen.

The **SETUP MENU** screen provides a menu of operating characteristics for the Control.

```
                < SETUP MENU >
1. HARDWARE SETUP
2. COMMUNICATIONS
3. REFLOW SETUP
4. SYSTEM SECURITY
5. COPY PROFILE
6. SET TO DEFAULTS
7. LANGUAGE
8. I/O STATUS



Number Select an item, Graph  /  Data
```

(12) HEAT/NO HEAT Switch



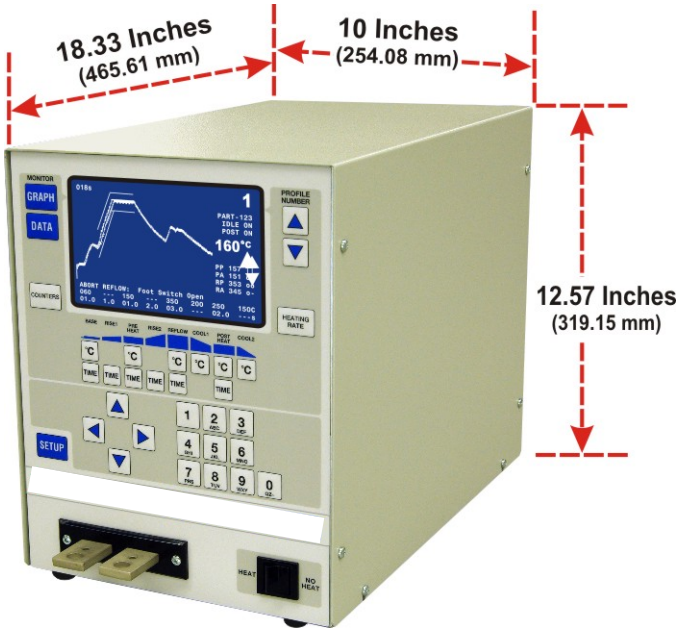
When this switch is in the **HEAT** position, the programmed profile can initiate heating energy.
When you set the switch to the **NO HEAT** position, no heating current can flow. This function is required to adjust a new thermode to the workpieces prior to initiating a heating cycle.

3. Installation and Setup

I. Planning for Installation

(1) Space Requirements

Dimensions (including all projections from the housing, but ***excluding*** cabling):



Weight: 60 pounds (27.2 kg)

- Install the Control in a well-ventilated area that is free from excessive dust, acids, corrosive gases, salt and moisture.
- Allow sufficient clearance around both sides and back of the Control for power and signal cabling runs, and to ensure adequate inflow and exhaust of air for the cooling system.
- Allow ample workspace around the Control so that it will not be jostled or struck while in use.
- The work surface must be level, stable, free from vibration, and capable of supporting the combined weight of the total joining system.
- There are no sources of high-frequency energy close by.
- There can be strong magnetic fields around the cables connected between the thermode and the Control. To avoid movement, secure the cables in cases of strong magnetic fields.

(2) Utilities

Input power requirements for the Control are as listed below.

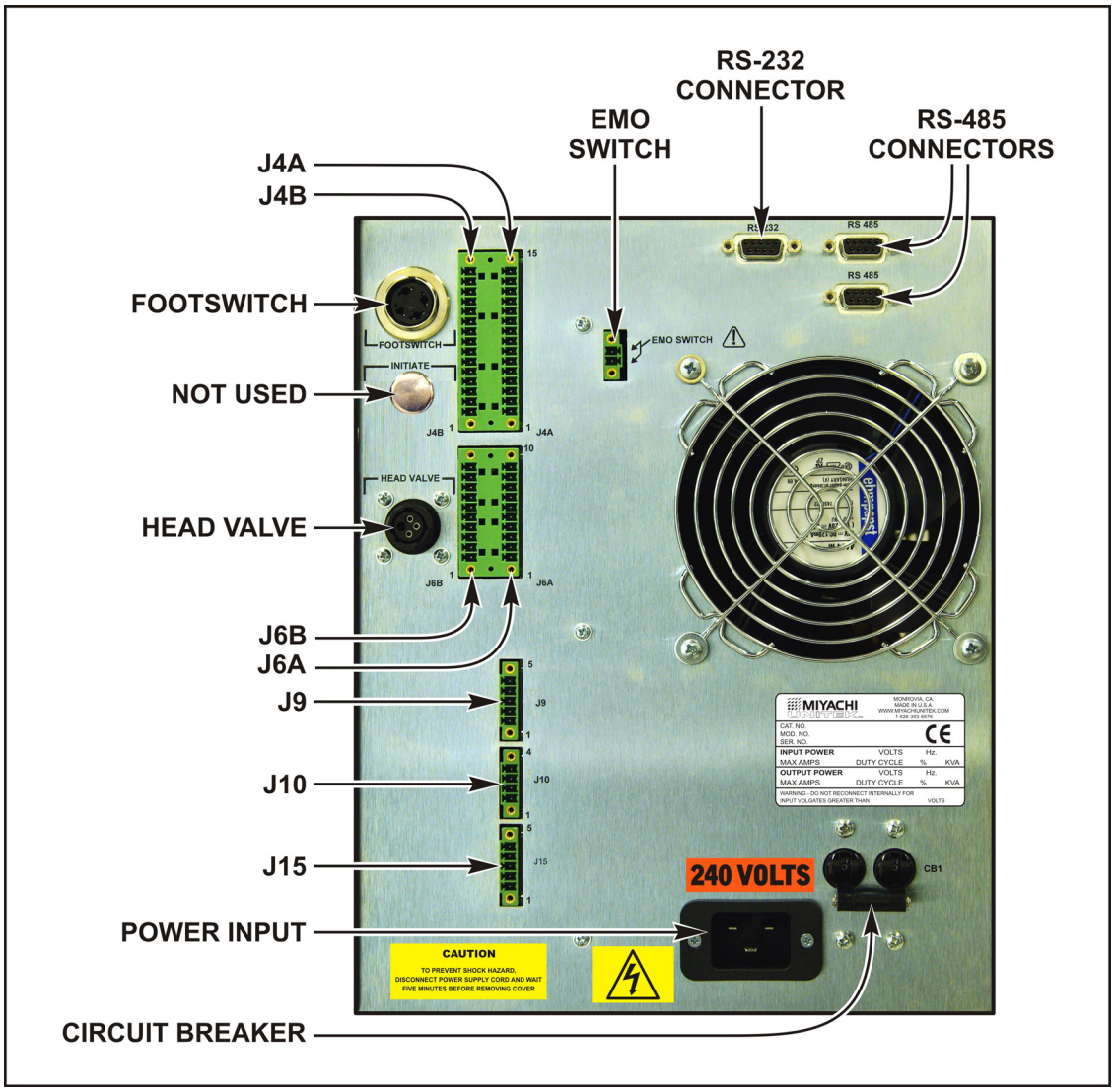
Controller Model	Input Voltage, 50 or 60 Hz, Single Phase (Vrms)	Circuit Breaker Rating (Amps)
MR-130B-**-**	180 – 264 V AC	15

II. Connections To External Equipment

(1) Overview

All connections, other than the transformer cable connections, between the Control and external equipment are made through the rear panel. The transformer cable connections from the reflow soldering or heat seal head are made at the transformer cable terminals on the front panel.

NOTE: If you require compressed air, cover gas, and cooling water service for the reflow soldering or heat seal head, please refer to the head manufacturer's user's manual for service specifications.



(2) Input Power Connections

⚠CAUTION

Be sure that the source power is appropriate for your Control model.

Connect the Control power cable to a single-phase, 50/60 Hz power source.

The nominal voltage range for each model is set at the factory: either 180 to 264 V AC.

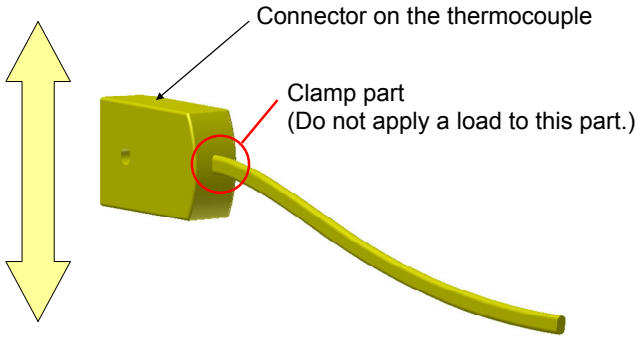
(3) Controller to Head Connection

To connect the Control to the reflow soldering or heat seal head, refer to the head manufacturer's manual as you follow the instructions below.

1. Connect the reflow soldering or heat seal head thermocouple cable, referenced in this manual as **MAIN** thermocouple, to terminal block **J9** on the rear panel. Connect a second thermocouple, referenced in this manual as **AUXILIARY** thermocouple, to terminal block **J15** on the rear panel.

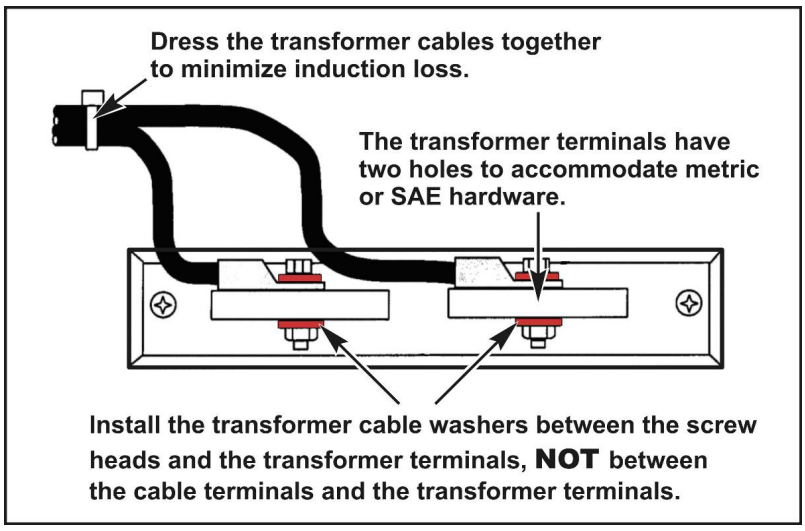
   NOTES:

   - The connector is keyed so that it cannot be installed improperly.
   - Do ***not*** run thermocouple cables next to the power cables (together) in order to reduce noise pickup.
   - If you are using two individual thermocouple wires, they ***must*** be twisted together in order to reduce noise pickup.
   - The Control will ***not*** respond to an initiation signal until the thermocouple is properly connected. The LCD will display an error message if the thermocouple is not connected.
   - When fixing the connector on the thermocouple to the head, make sure that a load is not applied to the clamp part during a up-and-down motion of the head. Otherwise it may cause a break in the cable.

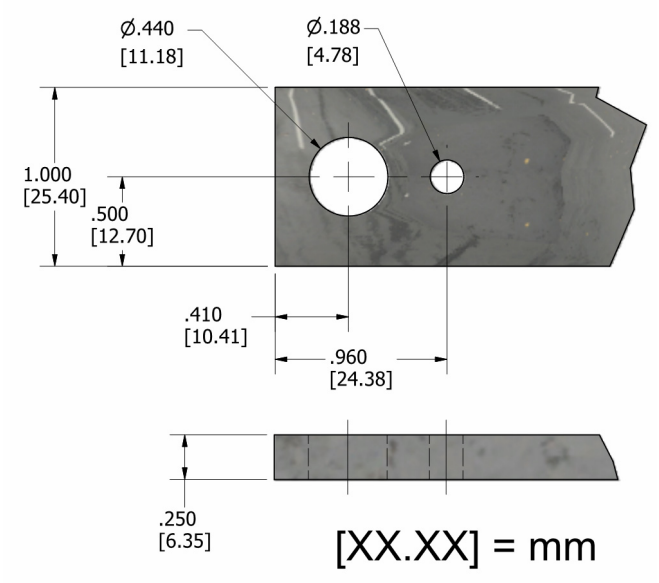


2. Plug the green **CONTROL INPUT JUMPER** plug (marked **P4B**) into connector **J4B** on the rear panel.
3. Connect the data interface connectors on the rear panel to the PLC using the Phoenix-type connector, J6A/J6B.

4. If you are working in a CE standards environment using an Emergency Stop Switch, it ***must*** be connected across pins 1 and 2 of the **EMO SWITCH** connector. If you are ***not*** using an Emergency Stop Switch, you ***must*** install the EMO jumper plug on the **EMO SWITCH** connector. This plug shorts Pins 1 and 2, labeled **EMO SWITCH** on the rear panel. See *Chapter 9, Electrical and Data Connections* for details.
5. Connect the two transformer cables from the head to the transformer terminals on the remote transformer.

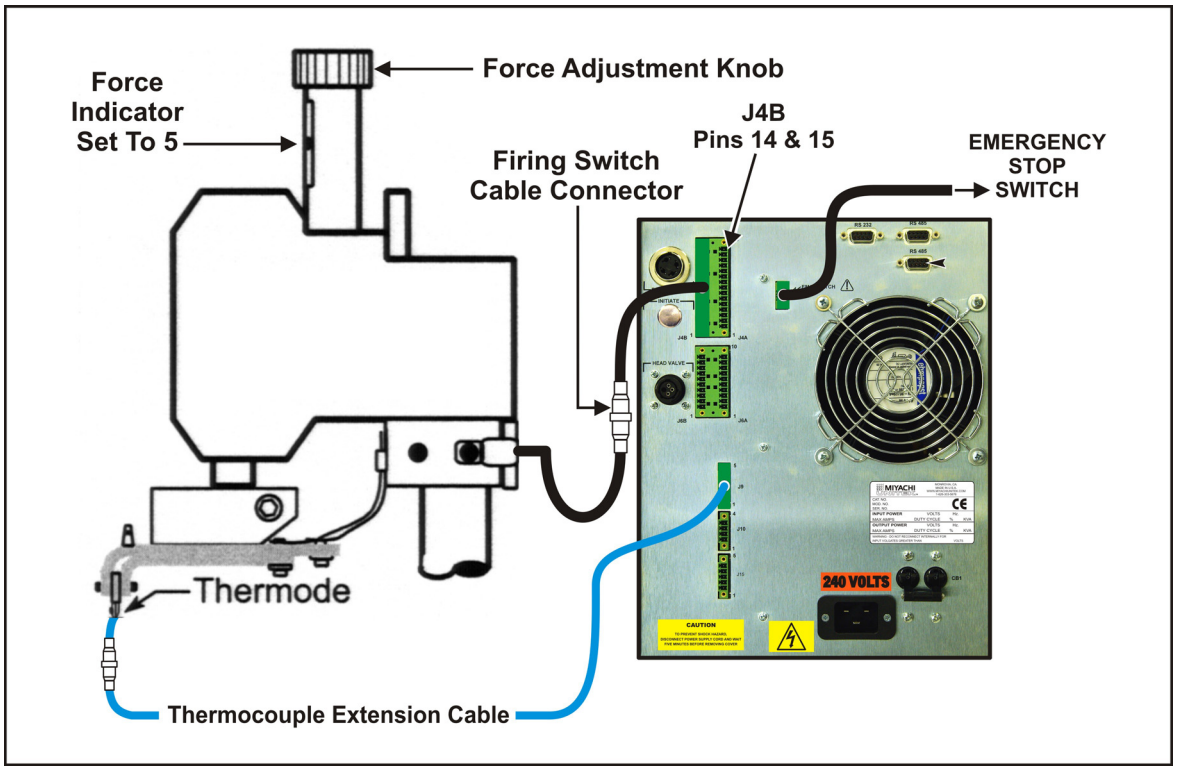


Transformer Terminal Dimensions



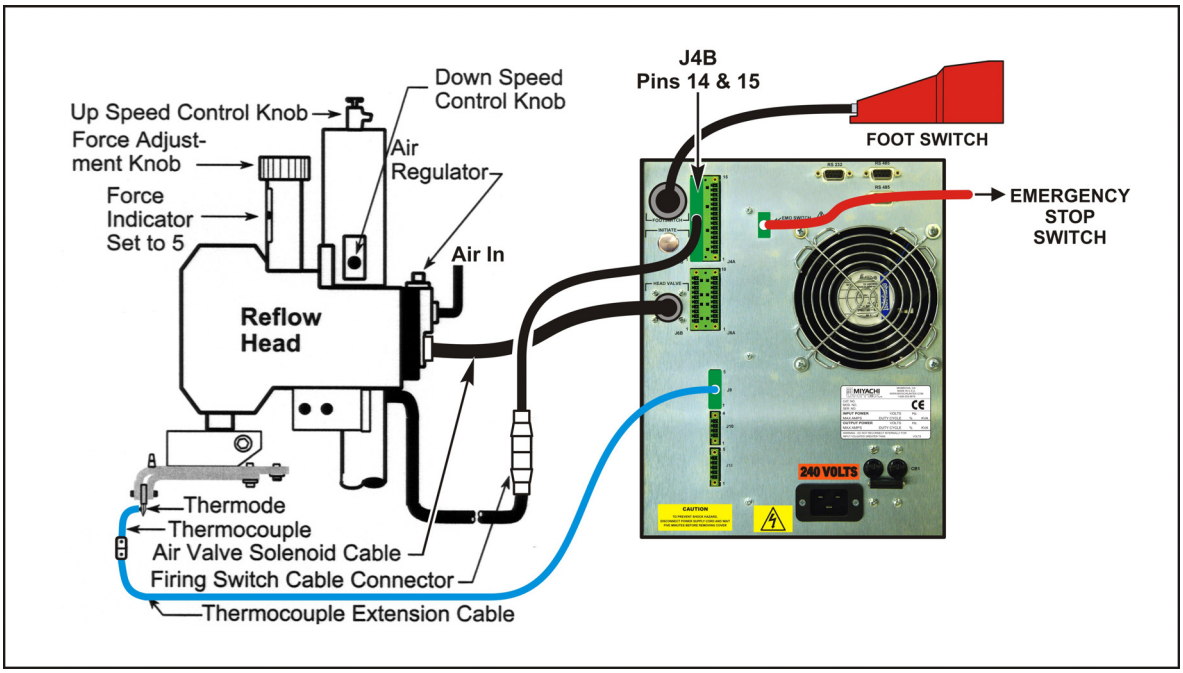
III. Equipment Setup

(1) Force Fired, Mechanically Actuated Head



1. Adjust the reflow soldering head force adjustment knob to produce 5 units of force, as displayed on the force indicator index.
2. Connect the reflow soldering head firing switch cable connector to the **Control J4B** pins **14** and **15**.
3. Set the **HEAT/NO HEAT** switch on the Control front panel to the **NO HEAT** position. In this position, the Control cannot deliver heating energy to the thermode.
4. Set the circuit breaker on the rear panel of the Control to the ON position. The default graphic screen will display. You will use this screen to enter heating parameters.

(2) Force Fired, Air Actuated Head



1. Adjust the head force adjustment knob to produce **5** units of force, as displayed on the force indicator index.
2. Connect the head firing switch cable connector to the **Control J4B** pins **14** and **15**.
3. Connect the Foot Switch to the **Foot Switch** connector on the Control rear panel.
4. Using the air-head manufacturer's user manual for reference, connect the head air valve solenoid cable connector to the Control **HEAD VALVE** connector.

NOTE: This connector supplies 24 V DC.

5. Connect a properly filtered air line to the air inlet fitting on the head. Use 0.25 inch O.D. by 0.17 inch I.D. plastic hose with a rated burst pressure of 250 psi. Limit the length of the air line to less than 40 in. (1 m) or thermode motion will be very slow.

NOTE: Use a lubricator ***only*** with automated installations.

6. Turn on the air system and check for leaks.
7. Set the **HEAT/NO HEAT** switch on the Control front panel to the **NO HEAT** position. In this position, the Control can ***not*** deliver heating energy to the thermode, but it ***will*** automatically control the head.
8. Set the circuit breaker on the rear panel of the Control to the ON position. The default graphic screen will display. You will use this screen to enter heating parameters.

9. Turn the air regulator clockwise to produce **10 psi** on the air regulator pressure gauge.
10. Press the foot switch down to close the first level, and hold the foot switch at the first level. The thermode should descend to the parts.
11. If the parts are properly positioned under the thermode, press the foot switch to the second (bottom) level. The Control should begin a process cycle without applying heat and the head should immediately retract. If the head ***does*** retract, go to Step 13. If the head does ***not*** retract, go to Step 12.
12. Increase air pressure in **5 psi increments** and repeat Steps 10 and 11 until the thermode automatically retracts at the end of the process cycle.
13. Press the foot switch to actuate to the first level. The thermode should descend smoothly to the surface of the parts. When it reaches the parts, release the foot switch and go to Step 15. If it does not descend ***smoothly***, go to Step 14.
14. Adjust the head down speed control knob and repeat Step 13 until the thermode descends smoothly.
15. Press the foot switch to actuate the first level and set the thermode on the parts. Release the foot switch and verify that thermode does ***not*** impact during retraction. If it ***does*** impact during retraction, go to Step 16.
16. Repeat Step 15, adjusting the Head Up Speed Control Knob until the thermode does ***not*** impact at the UP position.

4. Using Programming Functions

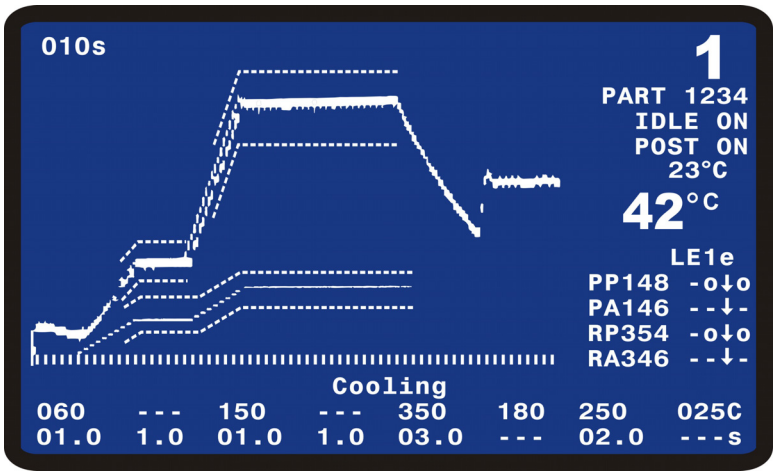
(1) Overview

To ensure accurate, consistent soldering, the Control delivers extremely precise pulses of energy to the reflow head. Each pulse is comprised of time and energy values that you pre-program. *Chapter 2, Description* told you *where* the Controls and Indicators are located. This chapter describes *how to use* them in order to program the precise temperature profiles needed for reflow soldering, heat sealing or other processes.

(2) Front Panel Display

The LCD on the front panel displays both the graphic and numeric heat profile information before a heating cycle. It also shows the results of a heating cycle following its completion. The display has several functions, depending on the active mode of the Control.

The LCD display shows both graphic and alpha-numeric data. For the rest of this manual screens containing both graphic and alpha-numeric data will be shown in **color** like the screen below.



(3) Screen Navigation and Menu Selection

```
          < SCHEDULE SETUP, page 1 of 5 >
1.  ENABLE PEAK AND AVG LIMITS    :     OFF
2.  PREHT PEAK TIME DELAY         :    01.0 SEC
3.  PREHT AVG TIME DELAY          :    01.0 SEC
4.  PREHT PEAK HI TEMP LIMIT      :    +030 ° C
5.  PREHT PEAK LO TEMP LIMIT      :    -030 ° C
6.  PREHT AVG HI TEMP LIMIT       :    +030 ° C
7.  PREHT AVG LO TEMP LIMIT       :    -030 ° C
8.  REFLOW PEAK HI TEMP LIMIT     :    +030 ° C
9.  REFLOW PEAK LO TEMP LIMIT     :    -030 ° C
0.  REFLOW AVG HI TEMP LIMIT      :    +030 ° C
<.  REFLOW AVG LO TEMP LIMIT      :    -030 ° C

Number Select,  ▼▲ Page, Graph  /  Data
```

Refer to the bottom line of the display. The contents are prompts (instructions) for editing and exiting the screen. You will find operation-specific instructions like these on every menu screen. The highlighted word or symbol indicates the key you must press to perform the operation listed next to the highlighted word or symbol.

For the rest of this manual screens containing only alpha-numeric data will be shown in **black & white** like the screen below.

In general, there are three kinds of instructions on the bottom line of the screen. For and example, refer to the **Schedule Setup**, **Page 1 of 5** screen:

The instruction on the left side of the screen briefly describes the appropriate response for the options on the current screen. For example, to select the **PREHT PEAK HI TEMP LIMIT** function on this screen, you would press the **4** key.

- The next instruction is usually a page up or page down instruction. For example, press the ▼ key to scroll to the **SCHEDULE SETUP, Page 2 of 5** screen. Press the ▲ key to step backwards through the screen sequence.
- The instruction on the right is an “escape” function, returning the Control to its **Ready** mode in the graphics or data display screens. For example, pressing the **GRAPH** key to returns you to the graphic display.

①Run Mode

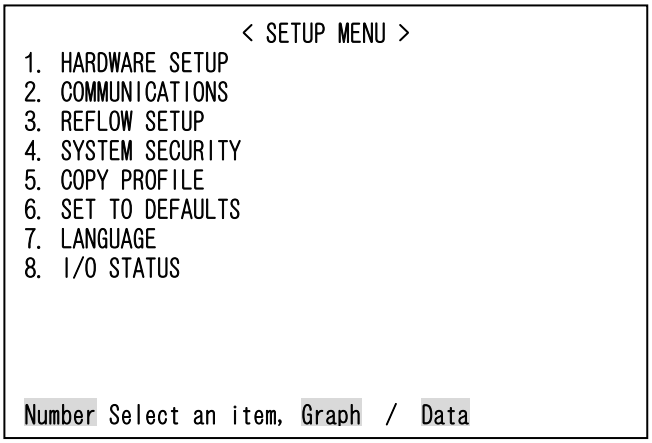
Press the **GRAPH** or **DATA** key to enter the **RUN** mode. With the graphic screen on the display:

The Control can run processes when either the **GRAPH** or **DATA** screens are displayed. These screens display actual temperature, process cycle state, process results, and status and error messages.

②Setup Mode

Press the **SETUP** key to enter the setup mode. In the setup mode, the display presents system setup options for you to select.

For details, refer to *SETUP Key* later in this chapter.



(4) GRAPH Key

Pressing the **GRAPH** key when any screen is displayed except for the Graph and Schedule Setup Screens, will change the display to the **GRAPH** screen. Pressing the **GRAPH** key when the Graph or Schedule Setup Screens are displayed will rotate the screen display through the **GRAPH** and two **Schedule Setup** screens.

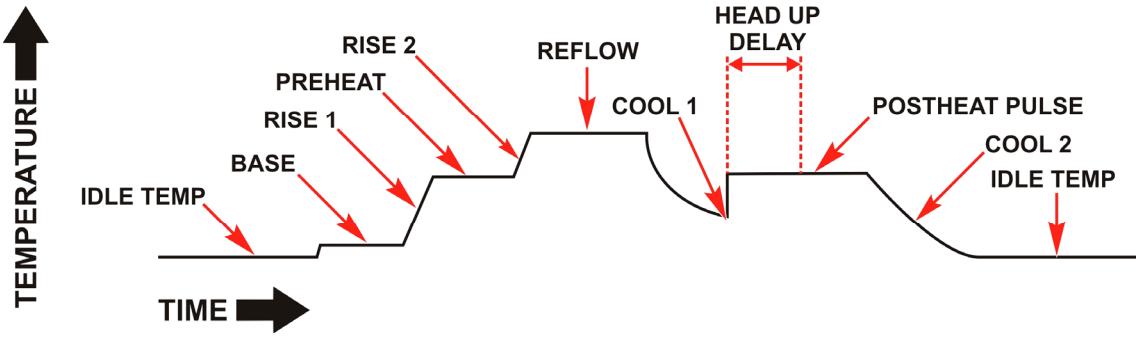
Graph Schedule Profile

The screen shown above displays the default profile settings.

The profile temperature and time parameters are edited while the **GRAPH** screen is displayed.
For a complete description of the information displayed on the **GRAPH** screen, refer to *Chapter 5, Operating Instructions.*

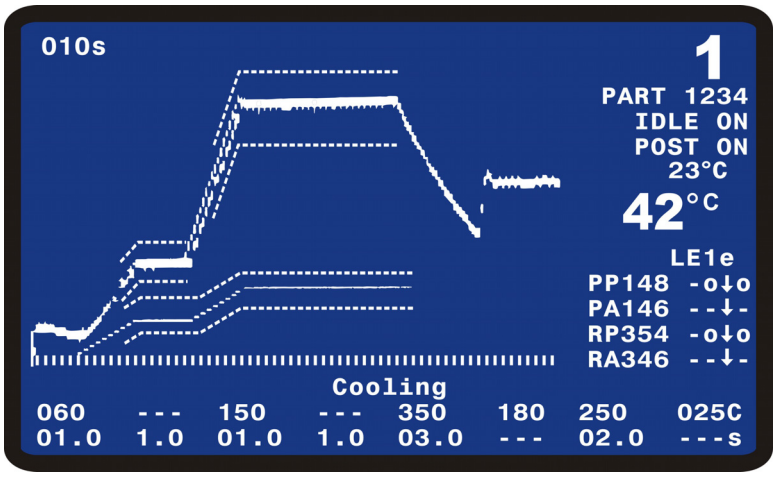
(5) Process Cycles

The Control provides for up to eight programmable process cycles as shown in the following diagram:



The user can include a process cycle in a Profile by assigning the desired process cycle a time of greater than 0 seconds.

The Control requires that every Profile have at least one process cycle, **Reflow**, with a time of at least 0.1 seconds.



①Base

You can use **Baseheat** to provide a consistent temperature starting point for the process. The temperature for this state is displayed as 60°C (note the Celsius units at the right hand side of the screen) and time as 01.0 seconds (note the seconds units at the right hand side of the screen). **Baseheat** can be set from 25° to 300°C and 0 to 99.9 seconds. When it is set to 00.0 seconds, the **Baseheat** state is omitted.

②Rise1

You can use **Rise1** to reduce the temperature overshoot at the beginning of **Preheat**. **Rise1** is shown as being set for 1.0 seconds. It can be set from 0 to 9.9 seconds. When it is set to 0.0 seconds, the **Rise1** state is omitted.

③Preheat

You can use **Preheat** to activate flux for removing solder oxides between solder plated parts. You can also use **Preheat** to reduce warping on large thermodes by decreasing the temperature difference between **Preheat** and **Reflow** periods.

The temperature for this state is displayed as 150°C and the time is 01.0 seconds. **Preheat** can be set from 60° to 500°C and from 0 to 99.9 seconds. When it is set to 00.0 seconds, the **Preheat** state is omitted from the heat profile.

④Rise2

You use **Rise2** to reduce the thermode warping caused by rapidly heating from the **Preheat** setting to the **Reflow** setting. **Rise2** is shown as being set for 1.0 seconds. It can be set from 0 to 9.9 seconds. When it is set to 0.0 seconds, the **Rise2** state is omitted.

⑤Reflow

You use the **Reflow** period to actually melt the solder for a reflow solder joint, or set thermoplastic or thermoset conductive adhesives for a heat-seal joint.

NOTE: The **Reflow** temperature will always be higher than the actual melting point of the solder or heat seal adhesives due to heat losses in both the thermode and parts.

Reflow is shown as having a time length of 3.0 seconds and a set-point temperature of 350°C. Time can be set for 0.1 to 99.9 seconds. Set-point temperature can be set from 60° to 600°C. **Reflow** can also be set in an extended temperature range up to 999°C.

⑥Cool1

You use **Cool1** to ensure that a solder joint or heat seal adhesive has solidified. An air actuated reflow soldering head or a heat seal head retracts the thermode from the parts upon reaching the **Cool1** temperature. The **Cool1** parameter shows 180°C. Set-point temperature can be set from 25° to 300°C. The **Cool1** time is not controlled.

⑦Postheat

You can use **Postheat** to provide a higher temperature for when the thermode will be lifted off the process part. This feature provides a reduction in contaminant buildup on the thermode.

Postheat is shown as having a time of 2.0 seconds and a set-point temperature of 250°C. Time can be set for 0 to 99.9 seconds. When it is set to 00.0 seconds, the **Postheat** state is omitted. Set-point temperature can be set from 25° to 600°C.

⑧Cool2

You use **Cool2** to establish a temperature for the end of process. The **Cool2** parameter shows 150°C. Set-point temperature can be set from 25° to 300°C. The **Cool2** time is not controlled.

(6) Profile Description and Programming

The parameters contained in each profile are viewed and edited in two areas. The last two lines of the **GRAPH** screen contain the temperature and time settings for each process cycle. The two **Schedule Setup** screens contain error limits, temperature envelopes, process and display parameters.

①Temperature and Time Parameters

The temperature and time values are edited with the keys located on the front panel just below the display. For detailed information on entering the temperature and time settings for a profile, refer to *Chapter 5, Operating Instructions, Section V.*

②Schedule Setup Parameters

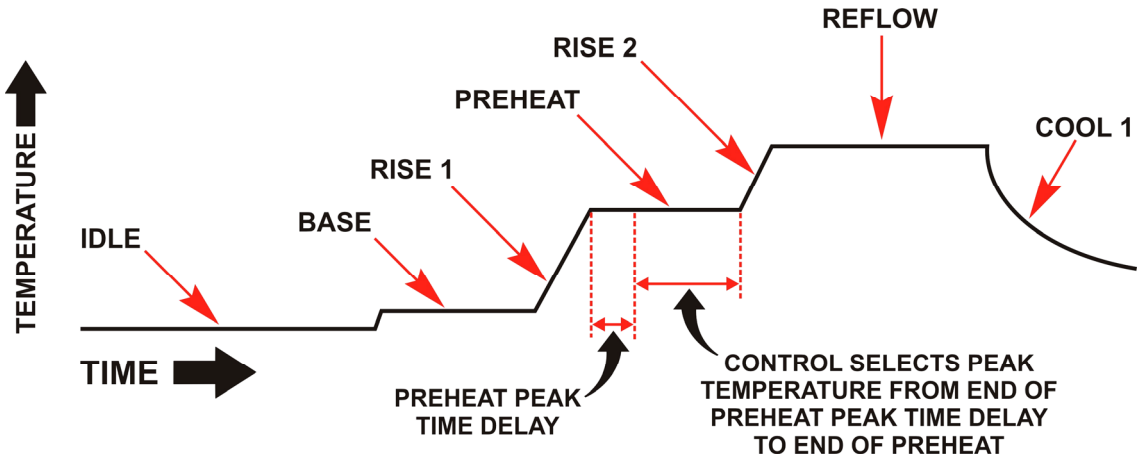
The **Schedule Setup** screens are accessed by pressing the **GRAPH** key.

Pressing the **GRAPH** key when the Graph screen is displayed will change the display to the **Schedule Setup, Page 1 of 5**. This screen contains parameters for the **Main** thermocouple and the temperature the Control is controlling.

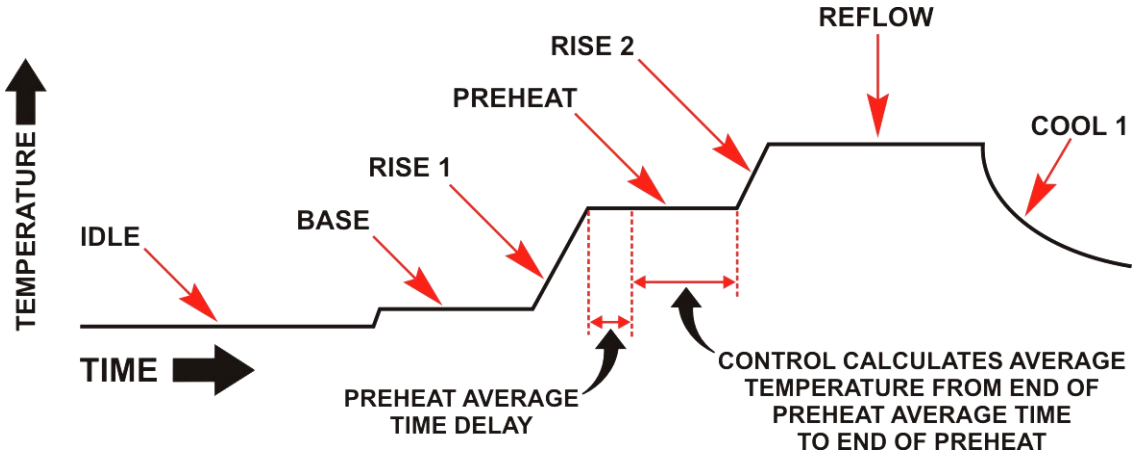
```
< SCHEDULE SETUP, Page 1 of 5 >

1.  ENABLE PEAK AND AVG LIMITS    :     OFF
2.  PREHT PEAK TIME DELAY         :     01.0 SEC
3.  PREHT AVG TIME DELAY          :     01.0 SEC
4.  PREHT PEAK HI TEMP LIMIT      :    +030 °C
5.  PREHT PEAK LO TEMP LIMIT      :    -030 °C
6.  PREHT AVG HI TEMP LIMIT       :    +030 °C
7.  PREHT AVG LO TEMP LIMIT       :    -030 °C
8.  REFLOW PEAK HI TEMP LIMIT     :    +030 °C
9.  REFLOW PEAK LO TEMP LIMIT     :    -030 °C
0.  REFLOW AVG HI TEMP LIMIT      :    +030 °C
<.  REFLOW AVG LO TEMP LIMIT      :    -030 °C
Number Select,  ▼▲Page,  Graph  /  Data
```

Press the **1** key to toggle **ENABLE PEAK AND AVG LIMITS** to between **ON** and **OFF**. If set to **ON**, then the Control will monitor temperatures and trigger an alarm if the peak and/or average temperature is outside the set limits. If set to **OFF**, the Control will not monitor any peak or average temperatures.

Item 2 on the menu, **PREHT PEAK TIME DELAY**, allows the operator to set the Control to ignore the first part of the Preheat process cycle when selecting the peak Preheat temperature. This parameter can be set from 0 to 99.9 seconds. If this parameter is set equal to or greater than the Preheat Time, then the Control will not evaluate any peak temperature error, and will use 0°C as the Preheat Peak Temperature for display and communication.



Item 3 on the menu, **PREHT AVG TIME DELAY**, allows the operator to set the Control to ignore the first part of the Preheat process cycle when calculating the average Preheat temperature. This parameter can be set from 0 to 99.9 seconds. If this parameter is set equal to or greater than the Preheat Time, then the Control will not evaluate any average temperature error, and will use 0°C as the Preheat Average Temperature for display and communication.



Press the **4** through **<** keys to edit the high and low limits for the peak and average temperatures. The number entered will be the difference between the profile set temperature and the limit.

```
PREHT PEAK HI TEMP LIMIT          :  +030

After edit ▲ Page to accept new value


Number Change,  ◂ ▸  Adjust,  Graph  /  Data
```

For example, if the Preheat set temperature is 150°C, and the peak temperature for the process should not exceed 180°C, then the user should enter 30°C in the **PREHT PEAK HI TEMP LIMIT** field. Use the numeric keys on the front panel to enter a number and then press the ▲, **GRAPH** or **DATA** keys to save the value.

```
          < SCHEDULE SETUP, Page 2 of 5 >

 1.  PREHEAT ENVELOPE LIMITS      :     ON
 2.  REFLOW ENVELOPE LIMITS       :     ON
 3.  RISE1 TIME DELAY             :      1.0 SEC
 4.  RISE2 TIME DELAY             :      1.0 SEC
 5.  PREHEAT HIGH TEMP LIMIT      :    +050 °C
 6.  PREHEAT LOW TEMP LIMIT       :    -050 °C
 7.  REFLOW HIGH TEMP LIMIT       :    +050 °C
 8.  REFLOW LOW TEMP LIMIT        :    -050 °C
 9.  GRAPH TIME SPAN              :     018  SEC
 0.  HEAD UP DELAY                :     00.0 SEC
 <.  IDLE TEMPERATURE             :     025 °C
 >.  SCHEDULE REFERENCE           :
Number Select,  ▼▲Page,  Graph  /  Data
```

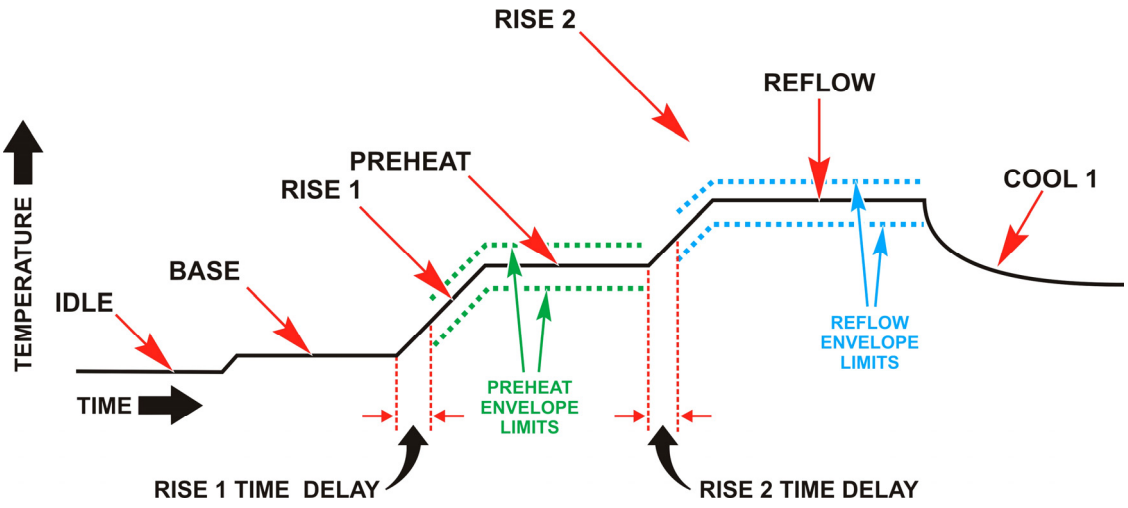
Pressing the **GRAPH** key when the **Schedule Setup, Page 1 of 5** screen is displayed will change the display to the **Schedule Setup, Page 2 of 5**.

Press the **1** key to toggle **PREHEAT ENVELOPE LIMITS** to between **ON** and **OFF**.

If set to **ON**, then the Control will monitor temperatures and trigger an alarm and messages if the temperature at any point is outside the user set Preheat Envelope Limits.

If set to **OFF**, the Control will ***not*** monitor or display any temperature envelopes for Preheat.

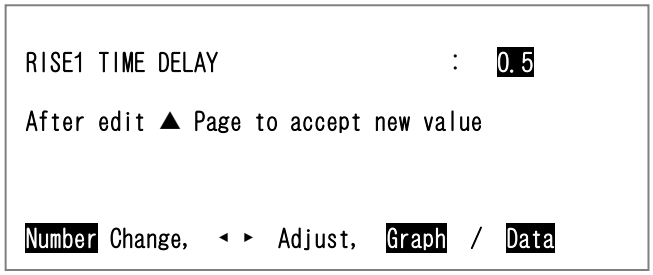
Press the **2** key to toggle **REFLOW ENVELOPE LIMITS** to between **ON** and **OFF**. If set to **ON**, then the Control will monitor temperatures and trigger an alarm if the temperature at any point is outside the user set Reflow Envelope Limits. If set to **OFF**, the Control will not monitor or display any temperature envelopes for Reflow.



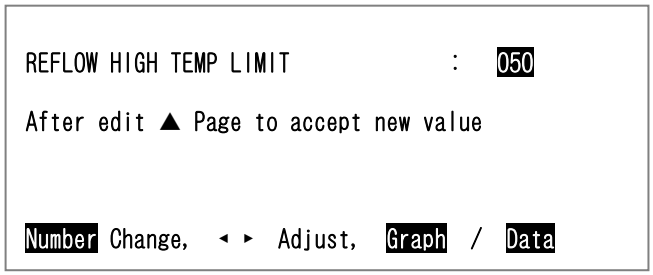
Press the **3** or **4** key to set the **RISE1** or **RISE2 TIME DELAY**s. These parameters allow the user to set the envelope to begin at some point after the start of Rise1 or Rise2.

If the **RISE1 TIME DELAY** is greater than or equal to the **RISE1** Period time, there will not be any envelope during **Rise1**.

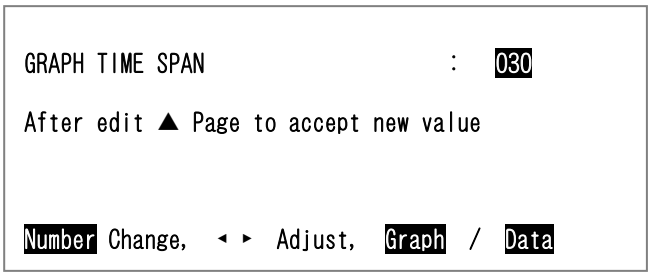
Even if the value for **RISE1 TIME DELAY** is greater than the **RISE1** Period time, there will be an envelope during the entire **PREHEAT** time. The **RISE2 TIME DELAY** has the same functionality as the **RISE1 TIME DELAY**.

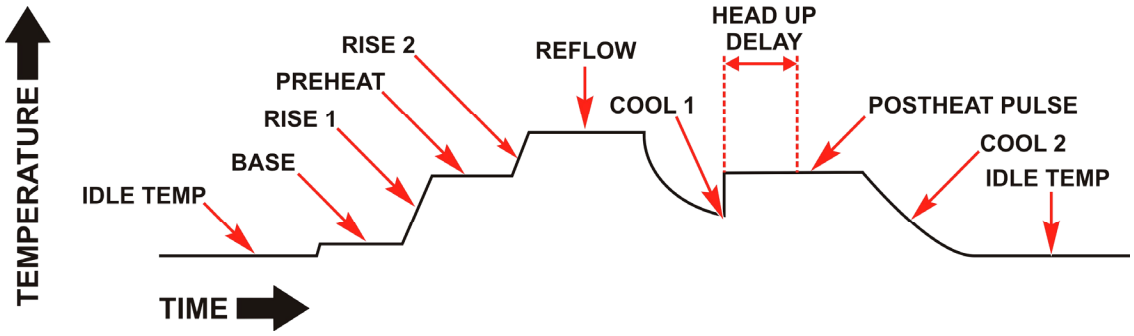


Press the **5** though **8** keys to set the Envelope Limits. These parameters allow the user to set the upper and lower envelope limits. The numbers entered will be the difference between the profile set temperature and the envelope limit. For example, if the user wants an envelope that is 50°C greater than the **RISE2** and **REFLOW**, then the user should enter 50°C in the **REFLOW HIGH TEMP LIMIT** field.



Press the **9** key to set the time length of the x axis of the Graph. The **GRAPH TIME SPAN** can be set from 0 to 600 seconds and can be changed after a reflow if an expanded or close-up view is desired of a reflow.





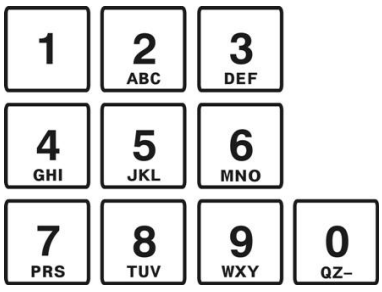
Press the **0** key to set the time length of the **HEAD UP DELAY**. The **HEAD UP DELAY** starts at the beginning of the Postheat period and sets the point when the head will be lifted from the part. The **HEAD UP DELAY** can be set from 0 to 99.9 seconds. The **HEAD UP DELAY** will only be executed on Profiles with a **POSTHEAT** time greater than 0 seconds.

```
HEAD UP DELAY                    :  01.0
After edit ▲ Page to accept new value


Number Change,  ◂ ▸  Adjust,  Graph  /  Data
```

Press the **<** key to set the **IDLE TEMPERATURE**. The **IDLE TEMPERATURE** can be set from 25° to 300°C. The Control will maintain the thermode at the **IDLE TEMPERATURE** when both a process is not active and the **IDLE TEMPERATURE** has been set to **ON** in the Reflow Setup.

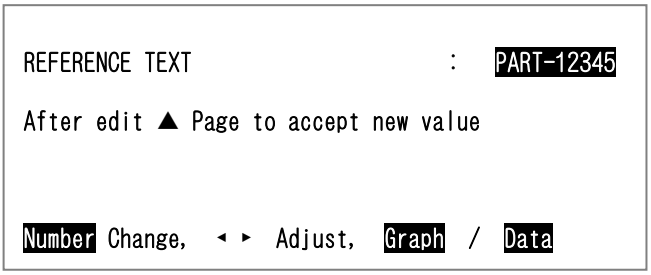
```
IDLE TEMPERATURE                 :  035
After edit ▲ Page to accept new value


Number Change,  ◂ ▸  Adjust,  Graph  /  Data
```

Press the **>** key to enter the **REFERENCE TEXT**. This field will accept any alphanumeric character, "-", or space. The numbers and letters are entered via the numeric keypad. One press will enter a number, a second, third or fourth press of the same key will enter a letter in the sequence printed on the key for each number.



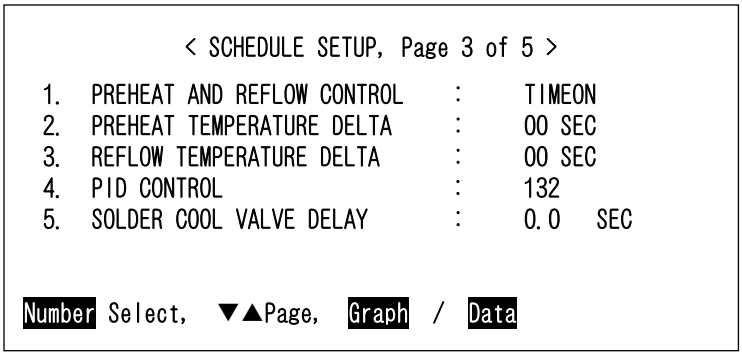
Press the **1** button twice to enter a space.

Characters are entered on the right side of the Schedule Reference Text. To enter the next character, press the right arrow key once and then presses the desired key for the next character. If the next character uses a different key than the last key pressed, the user can just press the next key without pressing the right arrow key.



If you enters an eleventh character, the left most character will be lost so that only ten characters remain. To correct a character, should enter spaces until the ten character Schedule Reference Text is blank and then re-enter the new reference text you want.

If the user enters an eleventh character, the left most character will be lost so that only ten characters remain. To correct a character, the user should enter spaces until the ten character Schedule Reference Text is blank and then re-enter the user's desired reference text.



Pressing the **GRAPH** key when the **Schedule Setup, Page 2 of 5** screen is displayed will change the display to the **Schedule Setup, Page 3 of 5**. This screen contains control parameters.

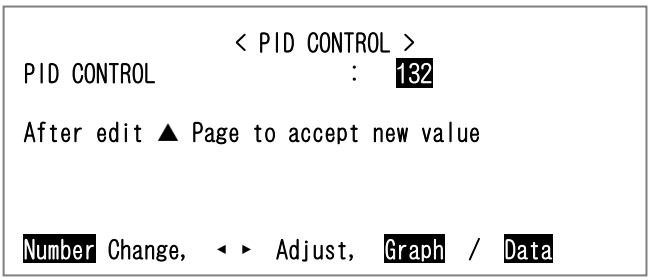
Press the **1** key to toggle **PREHEAT AND REFLOW CONTROL** to between **TIME** and **TEMP**. Refer to *Chapter 5, Operating Instructions* for more information on this feature.

Item 2 on the menu, **PREHEAT TEMPERATURE DELTA**, allows the operator to set a temperature used for Time and Temperature Control during the Rise1 process step. This parameter can be set from 0 to 99°C.

Item 3 on the menu, **REFLOW TEMPERATURE DELTA**, allows the operator to set a temperature used for Time and Temperature Control during the Rise2 process step. This parameter can be set from 0 to 99°C.

Item 4 on the menu, **PID CONTROL**, allows the operator to fine tune the temperature control. A PID CONTROL number in the range of 100 to 269 can be selected from the following table to achieve different control features such as faster rise time or less temperature overshoot. The default is **PID CONTROL 262**.

Item 5 on the Menu, **SOLDER COOL VALVE DELAY**, allows the operator to delay the turn on of the Solder Cool Valve after the end of the Reflow or Post heat periods. This single delay applies to both the end of Reflow and Post heat periods. This parameter can be set from 0 to 9.9 seconds.



(7) Selecting the PID CONTROL Number

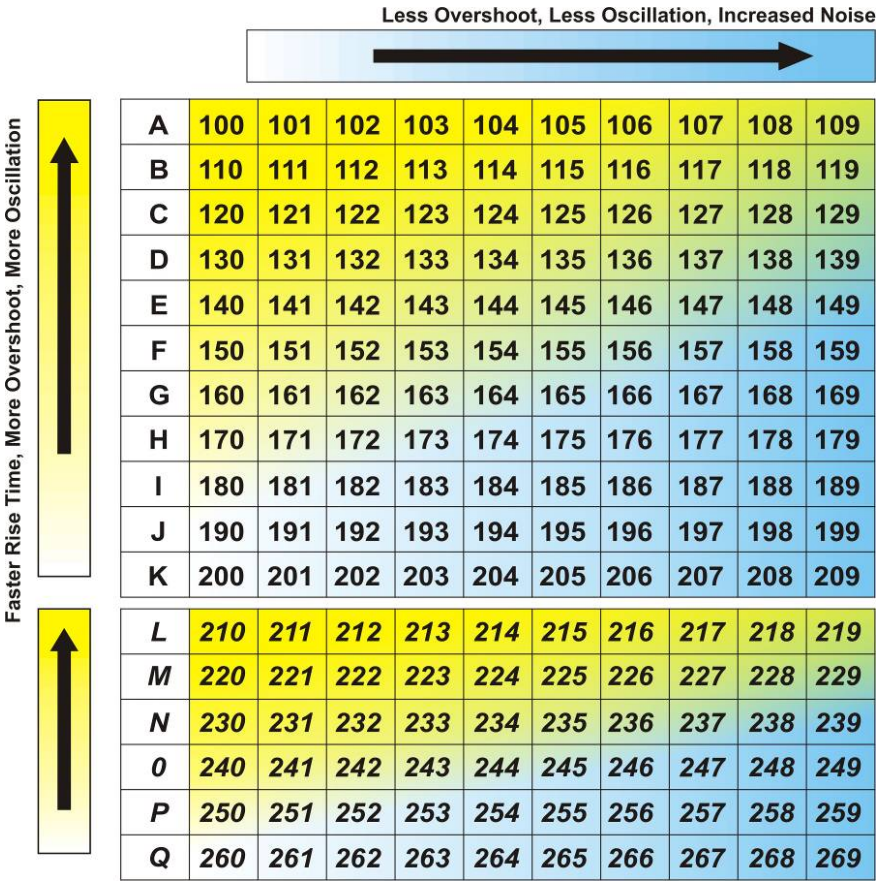
The following table provide a guide to selection of a **PID CONTROL** number. It is recommended to start with a **PID CONTROL** number of **185**. With these initial settings you can then optimize the **Coarse Heat Rate** and **Fine Heat Rate** settings. After that you can return to the **PID CONTROL** number for additional adjustments. For applications that require very fast rise of temperature with minimal overshoot, you'll need to experiment with changes to all three control parameters: **PID CONTROL**, **COARSE HEAT RATE**, and **FINE HEAT RATE**.

The table of **PID CONTROL** numbers consists of two separate sections.

Rows **A** through **K** typically provide the best **PID CONTROL** number for most thermodes.

PID CONTROL numbers in rows **L** through **Q** may provide better performance for thermodes of very low thermal mass or for applications where additional damping of oscillations is needed.
When selecting a **PID CONTROL** number in rows **L** through **Q** it is recommended to start with a **PID CONTROL** number of **243**.

There is a big change in performance when jumping from Row **K** to **L**. Row **L** has roughly control performance similar to Row **A** and Row **K** has roughly similar control performance to Row **Q**. Performance is optimized within rows **A** through **K** or within rows **L** through **Q**.
When trying different **PID Control** numbers, move up from **185** or **243** for faster rise time or down to reduce overshoot and oscillations. Move right from **185** or **243** to reduce overshoot and oscillations. Move left from **185** or **243** for less damping of the temperature rise.



A	100	101	102	103	104	105	106	107	108	109
B	110	111	112	113	114	115	116	117	118	119
C	120	121	122	123	124	125	126	127	128	129
D	130	131	132	133	134	135	136	137	138	139
E	140	141	142	143	144	145	146	147	148	149
F	150	151	152	153	154	155	156	157	158	159
G	160	161	162	163	164	165	166	167	168	169
H	170	171	172	173	174	175	176	177	178	179
I	180	181	182	183	184	185	186	187	188	189
J	190	191	192	193	194	195	196	197	198	199
K	200	201	202	203	204	205	206	207	208	209
L	*210*	*211*	*212*	*213*	*214*	*215*	*216*	*217*	*218*	*219*
M	*220*	*221*	*222*	*223*	*224*	*225*	*226*	*227*	*228*	*229*
N	*230*	*231*	*232*	*233*	*234*	*235*	*236*	*237*	*238*	*239*
0	*240*	*241*	*242*	*243*	*244*	*245*	*246*	*247*	*248*	*249*
P	*250*	*251*	*252*	*253*	*254*	*255*	*256*	*257*	*258*	*259*
Q	*260*	*261*	*262*	*263*	*264*	*265*	*266*	*267*	*268*	*269*

Pressing the **GRAPH** key when the **Schedule Setup, Page 3 of 5** screen is displayed will change the display to the **Schedule Setup, Page 4 of 5**. This screen contains parameters for the **Auxiliary** thermocouple's Peak and Average limit settings.

```
          < SCHEDULE SETUP, Page 4 of 5 >
              AUXILIARY THERMOCOUPLE

 1.  ENABLE PEAK AND AVG LIMITS :        OFF
 2.  PREHT PEAK TIME DELAY      :      00.0SEC
 3.  PREHT AVG  TIME DELAY      :      00.0SEC
 4.  PREHT PEAK HI TEMP LIMIT   :      +030°C
 5.  PREHT PEAK LO TEMP LIMIT   :      -030°C
 6.  PREHT AVG  HI TEMP LIMIT   :      +030°C
 7.  PREHT AVG  LO TEMP LIMIT   :      -030°C
 8.  REFLOW PEAK HI TEMP LIMIT  :      +030°C
 9.  REFLOW PEAK LO TEMP LIMI   :      -030°C
 0.  REFLOW AVG  HI TEMP LIMIT  :      +030°C
 <.  REFLOW AVG  LO TEMP LIMIT  :      -030°C
Number Select,  ▼▲Page,  Graph  /  Data
```

Press the **1** key to toggle **ENABLE PEAK AND AVG LIMITS** to between **ON** and **OFF**.

If set to **ON**, then the Control will monitor temperatures and trigger an **Out of Limits** if the peak and/or average temperature is outside the set limits. If set to **OFF**, the Control will not monitor any peak or average temperatures.

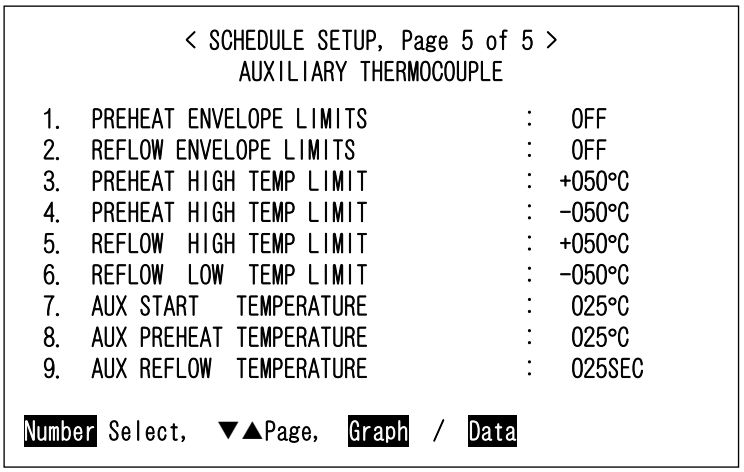
Item 2 on the menu, **PREHT PEAK TIME DELAY**, allows the operator to set the Control to ignore the first part of the Preheat process cycle when selecting the peak Preheat temperature. This parameter can be set from 0 to 99.9 seconds. If this parameter is set equal to or greater than the Preheat Time, then the Control will not evaluate any peak temperature error, and will use 0°C as the Preheat Peak Temperature for display and communication.

Item 3 on the menu, **PREHT AVG TIME DELAY**, allows the operator to set the Control to ignore the first part of the Preheat process cycle when calculating the average Preheat temperature. This parameter can be set from 0 to 99.9 seconds. If this parameter is set equal to or greater than the Preheat Time, then the Control will not evaluate any average temperature error, and will use 0°C as the Preheat Average Temperature for display and communication.

Press the **4** through **<** keys to edit the high and low limits for the peak and average temperatures. The number entered will be the difference between the profile set temperature and the limit. For example, if the **AUX PREHEAT TEMPERATURE** is set to 150°C, and the peak temperature should not exceed 180°C, then you should enter 30°C in the **PREHT PEAK HI TEMP LIMIT** field. Use the numeric keys on the front panel to enter a number and then press the ▲, **GRAPH or DATA** keys to save the value.

For the Reflow process step the Control will use the **AUX REFLOW TEMPERATURE** as the reference temperature.

Pressing the **GRAPH** key when the **Schedule Setup, Page 4 of 5** screen is displayed will change the display to the **Schedule Setup, Page 5 of 5**. This screen contains parameters for the **Auxiliary** thermocouple's envelope settings.



Press the **1** key to toggle **PREHEAT ENVELOPE LIMITS** to between **ON** and **OFF**.

If set to **ON**, then the Control will monitor temperatures and trigger an **Out of Limits** and messages if the temperature at any point is outside the user-set **Preheat Envelope Limits**.

If set to **OFF**, the Control will ***not*** monitor or display any temperature envelopes for Preheat.

Press the **2** key to toggle **REFLOW ENVELOPE LIMITS** to between **ON** and **OFF**. If set to **ON**, then the Control will monitor temperatures and trigger an **Out of Limits** if the temperature at any point is outside the user-set Reflow Envelope Limits. If set to **OFF**, the Control will ***not*** monitor or display any temperature envelopes for Reflow.

Press the **3** though **6** keys to set the Envelope Limits. These parameters allow you to set the upper and lower envelope limits for the auxiliary thermocouple temperature. The numbers entered will be the difference between the expected temperature of the Auxiliary thermocouple and the envelope limit.

For example, if you want an envelope that is 50°C greater than the expected Auxiliary thermocouple temperature, then you should enter 50°C in the **REFLOW HIGH TEMP LIMIT** field.

You set the expected Auxiliary thermocouple temperature by entering the parameters for the **AUX START TEMPERATURE, AUX PREHEAT TEMPERATURE** and **AUX REFLOW TEMPERATURE**. Press the **7** though **9** keys to set these parameters. The **AUX START TEMPERATURE** is the expected Auxiliary thermocouple temperature at the start of Rise1. If the Rise1 time has been set to 0 seconds, then any entry for **AUX START TEMPERATURE** will be ignored by the Control.

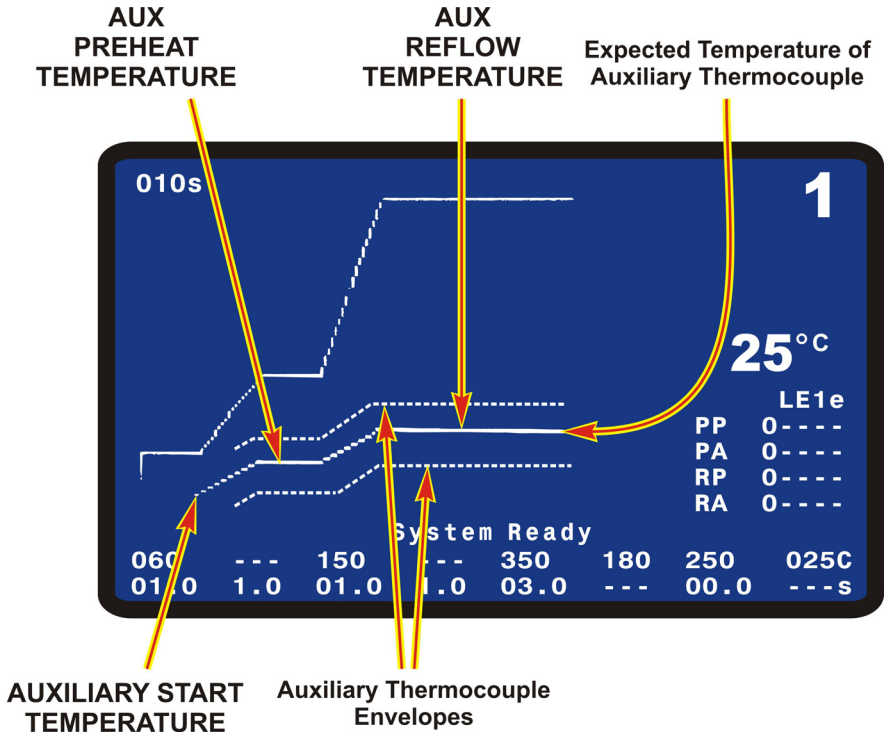
The **AUX PREHEAT TEMPERATURE** is the expected Auxiliary thermocouple temperature during Preheat. The **AUX REFLOW TEMPERATURE** is the expected Auxiliary thermocouple temperature during Reflow.

NOTE: The expected Auxiliary thermocouple temperature and its envelope will only be displayed if **DISPLAY AUX TEMP LINE** is set to **ON** on the **REFLOW TEMPERATURE SETUP** Screen.

Sample Auxiliary Thermocouple Temperature and Envelope Setup: This is based on the following Control settings:

- **AUX START TEMPERATURE** = 25° C (schedule setup page 5 of 5)
- **AUX PREHEAT TEMPERATURE** = 75° C (schedule setup page 5 of 5)
- **AUX REFLOW TEMPERATURE** = 120° C (schedule setup page 5 of 5)
- **PREHEAT HIGH TEMP LIMIT** = +25° C (schedule setup page 5 of 5)
- **PREHEAT LOW TEMP LIMIT** = -25° C (schedule setup page 5 of 5)
- **REFLOW HIGH TEMP LIMIT** = +25° C (schedule setup page 5 of 5)
- **REFLOW LOW TEMP LIMIT** = -25° C (schedule setup page 5 of 5)
- **RISE1 TIME DELAY** = 0.5 SEC (schedule setup page 2 of 5)
- **RISE2 TIME DELAY** = 0.0 SEC (schedule setup page 2 of 5)

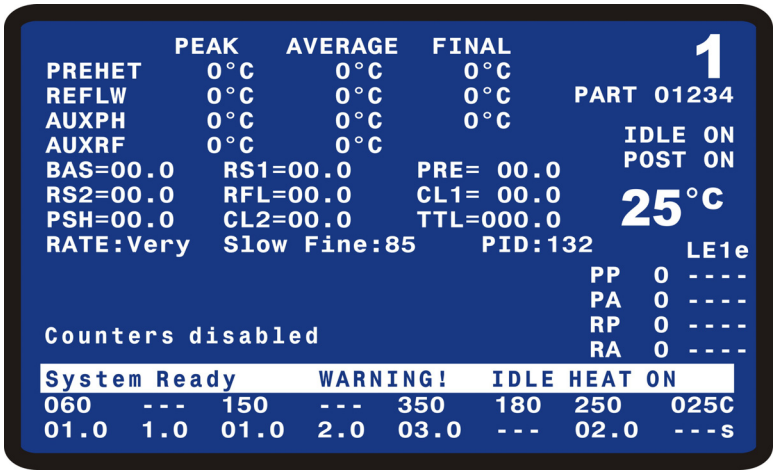
The results of these sample settings are shown below.



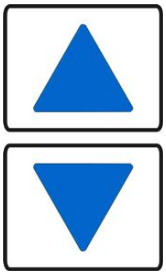
(8) DATA Key

The **DATA** key brings up the data screen to the display. The data screen reports the most recent heat cycle parameters in numerical format: time, temperature, and counter status (when enabled).

You may initiate the **HEAT** cycle while the **DATA** screen (rather than the **GRAPH** screen) is displayed.



(9) PROFILE NUMBER ▲ ▼ Keys



With the graphics screen on the display, these keys will increment/decrement the heat profile number on the graphics screen. With the data screen on the display, pressing either **PROFILE NUMBER** key returns the graphics screen to the display; the keys will then increment/decrement the profile number on the screen. The **PROFILE NUMBER** up/down keys are disabled when any screen other than the graphic screen or data screen is on the display.

The number of possible heat profiles than can be stored ranges from 1 to 63.

(10) COUNTERS Key

This key brings up the **REFLOW COUNTERS** screen. Based on the user settings for the Reflow Counters, the Control will display messages when the thermode needs cleaning or replacement. This screen provides a menu of selections for setting the thermode cleaning and thermode replacement counters, and choosing responses to the counter settings.


```
                < REFLOW COUNTERS >
1.  TOTAL USAGE COUNTER          : 0000004
2.  GOOD REFLOW COUNTER          : 0000004
3.  CLEAN COUNTER                : +999999
4.  REPLACE COUNTER              : +999999
After edit ▲ Page to accept new value

Number Select an item,  Graph  /  Data
```

NOTE: With this and all other menu screens on the display, you will not be able to initiate the heating cycle.

①TOTAL USAGE COUNTER

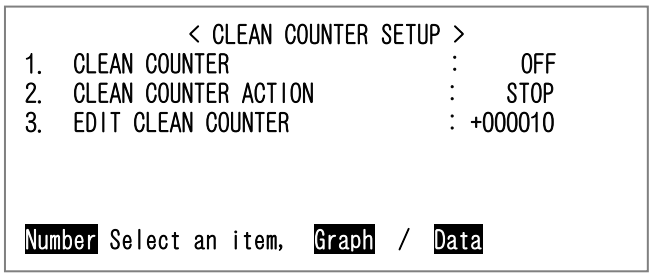
Press the **1** key to edit the total usage counter. With the numeric keys, you may select a number up to 9999999. The selected number is the total number of reflows completed since the counter was last edited. When the counter reaches 9999999, it will change to 0000000 after the next process.

②GOOD REFLOW COUNTER

Press the **2** key to edit the good reflow counter. This option is the same as the total usage counter except that only good reflows are counted. A good reflow occurs when the actual temperature is within all enabled peak temperature, average temperature and envelope limits. When the counter reaches 9999999, it will change to 0000000 after the next process.

③CLEAN COUNTER

Press the **3** key to edit the clean counter. The count that you enter will raise an alarm to signal the operator to remove baked-on flux and other residues from the face of the thermode. Particle buildup slows down heat transfer from the thermode to the parts. Use an initial Clean Thermode value that is based on real factory operating conditions. Pressing **1** will toggle **CLEAN COUNTER** between **ON** and **OFF**. **ON** will activate this feature and **OFF** will de-activate it. Pressing **2** will toggle **CLEAN COUNTER ACTION** between **STOP** and **CONTINUE**. When the clean counter value is reached, **STOP** will require the Operator to reset the clean counter before the Control will run another process and the System Ready relay state will be inactive. **CONTINUE** will allow the Control to perform additional processes even if the clean counter is not reset. If **CONTINUE** is selected, the Control will continue to display the Clean Counter message after each process and the System Ready relay state will be active. Press **3** to edit the remaining counts before the **Clean Counter** must be reset. With the numeric keys, you may select a number up to 999999.



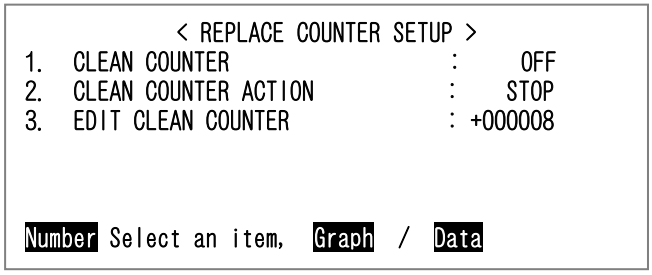
④REPLACE COUNTER

Press the **4** key to edit the replace counter. The count that you enter will raise an alarm to signal the operator that it is time to replace the thermode. Thermodes ultimately fail due to repeated heat cycles that cause internal cracking, slowing down heat generation in the thermode. In addition, repeated heating cycles cause the thermocouple junction to oxidize and, eventually, break free of the thermode. Use an initial **Replace Thermode** value that is based on real factory operating conditions.

Pressing **1** will toggle **REPLACE COUNTER** between **ON** and **OFF**. **ON** will activate this feature and **OFF** will de-activate it.

Pressing **2** will toggle **REPLACE COUNTER ACTION** between **STOP** and **CONTINUE**. When the replace counter value is reached, **STOP** will require the user to reset the replace counter before the Control will run another process and the System Ready relay state will be inactive. **CONTINUE** will allow the Control to perform additional processes even if the replace counter is not reset. If **CONTINUE** is selected, the Control will continue to display the Replace Counter message after each process and the System Ready relay state will be active.

Pressing **3** will set the value of the **Replace Counter**. The value of the **Replace Counter** is subtracted after each process. With the numeric keys, you may select a number up to 999999.



(11) DATA EDIT Keys

The data edit keys allow you to edit the time and temperature parameters of the heat profile on the graphic display. The Temperature and Time keys for each process segment are vertically aligned with the profile heating states as displayed on the graphic screen.

The keys are ***only*** active when the graphic screen (below) is displayed.

Example: To change the temperature of the Reflow period for Heating Profile 1 to 500°C:

1.Press the **GRAPH** key to display the graphic screen.

2.Press the data edit **REFLOW** [**°C**] key. The Reflow temperature value of 350 will now be highlighted.

3.Enter **500** with the keypad.

4.Press the **GRAPH** key to store the new **Reflow** temperature value to **Heating Profile 1**. The graph will now display **500** as shown below.

(12) Saving Changed Values

When you change values, they are saved in the Control's flash memory ("flash" for short) when the **GRAPH**, **DATA**, **COUNTERS**, **HEATING RATE**, or **SETUP** screens are used.

CAUTION: ***Before*** you power down, go to one or more of the screens above and verify your changes. If you do ***not*** use one of these screens before powering down, your changes will ***not*** be saved.

NOTE: While data is being saved to flash, the screen will display ******* SAVING CHANGES *******.

(13) HEATING RATE Key

The **HEATING RATE** key brings up the **MANUAL TUNING** screen. This screen allows you to go to the **SET COARSE HEATING RATE** and **SET FINE HEATING RATE** capabilities to match the heat generating capability of the thermode to minimize the temperature overshoot and undershoot.

For example, given a very small peg-tip thermode with a heat generating tip diameter of 0.020 inch (0.5 mm), the **COARSE** heating rate should range from **SLOW** to **MEDIUM** to prevent sever temperature overshoot.

Conversely, given a very large fold-up thermode with a tip face of 0.12 inch by 2.37 inch (3 mm by 60 mm) requires a coarse heating rate of **FAST** to produce the optimum temperature profile response.

Selecting **1** on the **MANUAL TUNING** screen brings up the **SET COARSE HEATING RATE** screen.

```
          < SET COARSE HEATING RATE >
1. Very Slow
2. Slow
3. Medium
4. Fast


Number Select an item, Graph  /  Data
```

The progression from **Very Slow** to **Fast** provides more energy to heat the thermode. The table below is a guide to optimize the coarse heating rate. Change **COARSE HEATING RATE** to optimize temperature profile output.

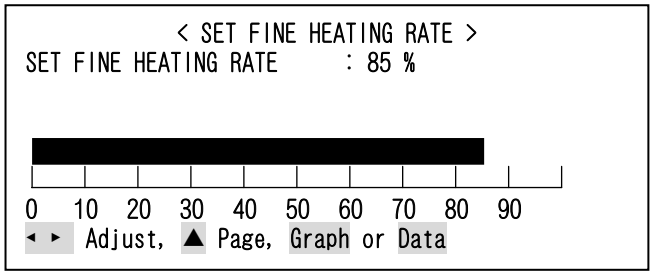
The default value is **Medium**, which is appropriate for 90% of all thermodes. The progression from Very **Slow** to **Fast** provides more energy to heat the thermode.

Use the table below as a guide to optimizing the coarse heating rate. Select the recommended coarse heating rate by pressing keys **1** through **4**.

Thermode Family Series	Coarse Heating Rate			
	Very Slow	Slow	Medium	Fast
17T	1			
17P	1	2		
17BM, up to 10 mm (0.37 in.)		2	3	
17BM, 10 to 30 mm (0.37 to 1.2 in.)		2	3	4
17BW, 30 to 60 mm (1.2 to 2.4 in.)		2	3	4
17BW, 60 to 100 mm (2.4 to 4.0 in.)			3	4
17F, up to 10 mm (0.37 in.)		2	3	
17F, 10 to 30 mm (0.37 to 1.2 in.)		2	3	4
17FW, 30 to 60 mm (1.2 to 2.4 in.)			3	4
17FW, 60 to 100 mm (2.4 to 4.0 in.)			3	4

NOTE: 17BW and 17FW thermodes, 60 to 100 mm long, can ***only*** be heated using 4 kVA Models.

Selecting **2** on the **MANUAL TUNING** screen will bring up the **SET FINE HEATING RATE** screen.



The default value is 85%. A value from 85 to 95% is appropriate for 80% of thermodes. The effective range of the **SET FINE HEATING RATE** is usually in the 50 to 99 % range. A larger percentage means that more energy is available to heat the thermode. A setting of 85% is typical for small peg tip thermodes. A setting of 95-97% is typical of blade and foldup thermodes.

Adjustments in the **SET FINE HEATING RATE** can help optimize temperature rise time with overshoot.

Use the ◄ ► cursor keys to adjust the fine heating rate, from 0 to 99%. The selected rate will be displayed graphically as a percentage of the indexed grid, and as a numerical value.

(14) SETUP Key

This key brings up the **SETUP MENU** screen.

The **SETUP MENU** screen provides a menu of operating characteristics for the Control.

```
                < SETUP MENU >
1. HARDWARE SETUP
2. COMMUNICATIONS
3. REFLOW SETUP
4. SYSTEM SECURITY
5. COPY PROFILE
6. SET TO DEFAULTS
7. LANGUAGE
8. I/O STATUS

Number Select an item, Graph  /  Data
```

①HARDWARE SETUP

Pressing **1** with the **SETUP MENU** screen displayed will bring up the **HARDWARE SETUP** screen.

```
                < HARDWARE SETUP >
1. HEAD COOL VALVE IS              :  OFF
2. SOLDER COOL VALVE IS            :  OFF
3. FOOTSWITCH RESPONSE MODE        :  ABORT
4. LIST OF HARDWARE
5. BACKLIGHT OPERATION             :  ON
6. BUZZER LOUDNESS                 :  50%
7. END OF CYCLE BUZZER             :  ON
8. SET OUTPUT RELAYS

Number Select,▲ Page, Graph  /  Data
```

HEAD COOL VALVE IS

Press the **1** key to toggle between **OFF** and **ON**. Selecting **ON** continuously activates the head cool valve, which supplies drive power for a user-supplied air solenoid valve. The drive power is connector-selectable at either 24 V AC or +24 V DC.

NOTE: If Idle Heat is turned **ON**, the head cool valve is automatically turned on. This valve controls air to cool a hot thermode holder on a reflow solder or heat seal head. See *Chapter 9, Electrical and Data Connections* for connection details.

SOLDER COOL VALVE IS

Press the **2** key to toggle between **OFF** and **ON**. If the Profile does not have a Postheat process cycle, selecting **ON** will activate the solder cool valve starting at the end of the **Reflow** period and de-activating when the thermode reaches either the **COOL1**, **PREHEAT**, or **BASE** temperature which ever is lower. If the Profile does have a Postheat process cycle, selecting **ON** will activate the solder cool valve starting at the end of the Reflow period and de-activate the valve when the thermode reaches the **COOL1** temperature.

The solder cool valve will also activate at the end of **POSTHEAT** and de-activate when the thermode temperature reaches either the **COOL2**, **PREHEAT**, or **BASE** temperature which ever is lower. The solder cool valve is used to direct the cool air onto the thermode to force it to cool faster. The solder cool valve supplies a connector-selectable 24 V AC or +24 V DC signal for controlling a user supplied air solenoid valve.

FOOTSWITCH RESPONSE MODE

Press the **3** key toggle between **ABORT** and **LATCH**. This will deselect and select how the foot switch initiates a Controller process cycle when an air actuated head is used.

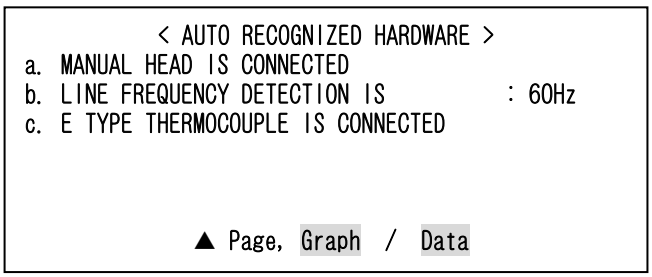
Use **ABORT** when employing an operator to position parts. Releasing the foot switch at any time during the heating cycle immediately turns off thermode heating and retracts the thermode from the surface of the parts.

Use **LATCH** with automated or fixtured applications. Once the second level of a 2-level foot switch is activated, the heating cycle will continue to completion unless the **EMERGENCY STOP** switch is actuated.

LIST OF HARDWARE

Press the **4** key to bring up the **AUTO RECOGNIZED HARDWARE** screen. This screen lists the system software-recognized hardware complement.

See *Chapter 9, Electrical and Data Connections* for connection details.

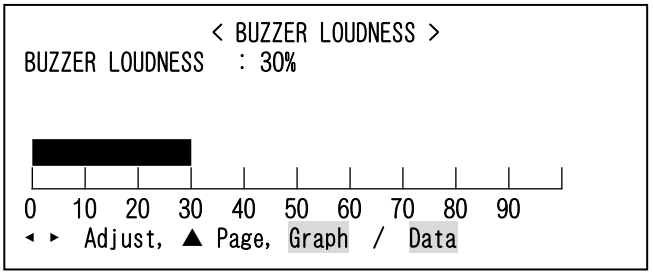


BACKLIGHT OPERATION

Press the **5** key to toggle between **AUTO** and **ON** for the **BACKLIGHT OPERATION** adjustment screen. When you select the **ON** option, the backlight for the LCD will always remain on when power is applied to the Control. If **AUTO** is selected, the backlight will turn off if the Control has been inactive for a period of time of approximately 3 to 4 minutes. When the backlight turns off, press any key on the front panel to turn on the backlight. The first press of any key when the backlight is off will not execute the function of the button.

BUZZER LOUDNESS

Press the **6** key to bring up the **BUZZER LOUDNESS** adjustment screen. With this screen, you may adjust the loudness of the end of cycle buzzer so that it may be heard reliably against background noise.

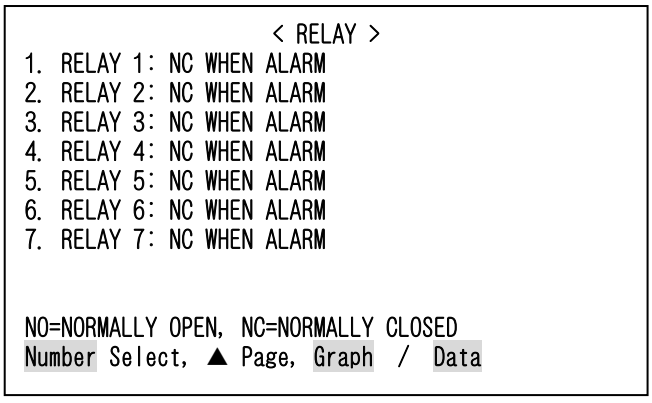


END OF CYCLE BUZZER

Press the **7** key to toggle between OFF and ON for the end of cycle buzzer. When you select the ON option, a buzzer will sound when the actual thermode temperature reaches the Cool temperature setting.

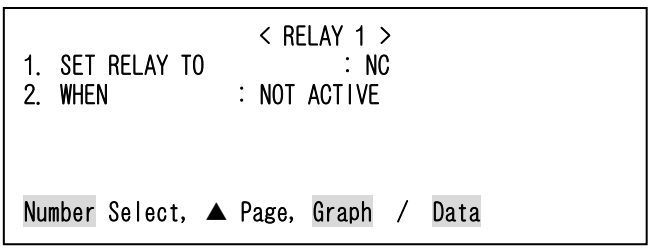
②SET OUTPUT RELAYS

Press the **8** key to bring up the **RELAY** screen. The **RELAY** screen allows you to select the Alarm for Status actuation states or each relay. Each relay requires user-provided power, and is rated for 250 V AC at 5 amps, or 30 V DC at 5 amps.



See *Chapter 9, Electrical and Data Connections* for the relay contact pin assignments at Control Status Connector **J6A**.

Press the **1** through **7** keys to bring up the desired relay screen. For example, press **1** to bring up the **RELAY 1** screen.



Press the **1** key to toggle **SET RELAY TO** to between **NC** and **NO**. **NC** is normally closed, **NO** is normally open.

The **2** key will bring up the **RELAY 1** status option screen.

```
                    < RELAY 1 >
1.  SYSTEM READY
2.  HEAT ON
3.  HEAD IS UP
4.  ALARM
5.  OUT OF LIMITS
6.  CLEAN THERMODE
7.  REPLACE THERMODE
8.  IDLE HEAT
▼ PAGE FOR MORE RELAY SETTINGS
.
Number Select, ▼▲ Page, Graph  /  Data
```

The **1** through **8** keys on the keypad set the **RELAY 1** status options.

1. **SYSTEM READY**: Relay is **OPEN/CLOSED** when the Control is ready for reflow operation.
2. **HEAT ON**: Relay is **OPEN/CLOSED** during baseheat, rise1, preheat,rise2, reflow and postheat process cycle.
3. **HEAD IS UP**: Relay is **OPEN/CLOSED** when head is retracted **CLOSED** from point at which 50% of RISE2 time has elapsed until the end of RISE2.
4. **ALARM**: Relay is **OPEN/CLOSED** for any alarm condition. This relay state is reset as referenced in the following table.

Alarm	Resetting Alarm	Aborting the Process Step of Cooling to Base or Preheat Temperature
All Alarms except for Max Temp Alarm and Emergency Stop (EMO)	The first Digital Input Reset (J4A-7) or Up Arrow key press will clear alarm relay and stop graph lines from plotting. Unit will go to Cooling, Cooling to Base or Preheat Temperature, or System Ready depending on Main thermocouple temperature. NOTE: Cycling Power Also clears alarm.	Once Alarm is reset, Up Arrow key can be used to abort process step of Cooling to Base or Preheat Temperature. When Up Arrow is pressed, unit will go to System Ready condition and allow next reflow.
MAX TEMP ALARM	The first Digital Input Reset (J4A-7) will clear alarm relay and stop graph lines from plotting. Unit will go to Cooling, Cooling to Base or Preheat Temperature, or System Ready depending on Main thermocouple temperature. NOTE: Cycling Power Also clears alarm relay.	Once Alarm is reset, Up Arrow key can be used to abort process step of Cooling to Base or Preheat Temperature. When Up Arrow is pressed, unit will go to System Ready condition and allow next reflow.
EMERGENCY STOP ACTIVATED	Reconnecting Emergency Stop Circuit will clear alarm relay. EMERGENCY STOP message will continue to be displayed on LCD until Main thermocouple drops to Base or Preheat Temperature.	Cannot abort Process Step of Cooling to Base or Preheat Temperature.

5. **OUT OF LIMITS**: Relay is **OPEN/CLOSED** for any out of limits condition. **OUT OF LIMITS** are temperature conditions that are outside any active **PEAK, AVERAGE,** and **ENVELOPE** Limits.

NOTE: If an Out of Limits is triggered, this relay state will continue to remain active until you perform one of the following actions:

a) You apply a signal at J4A-7 on the Control back panel to reset the **ALARM** relay state.

b) You press the Up Arrow Key on the front panel.

c) You initiate another reflow process.

A new reflow process can be triggered when the **Out of Limits** relay is active even though the **Out of Limits** relay has not been reset.

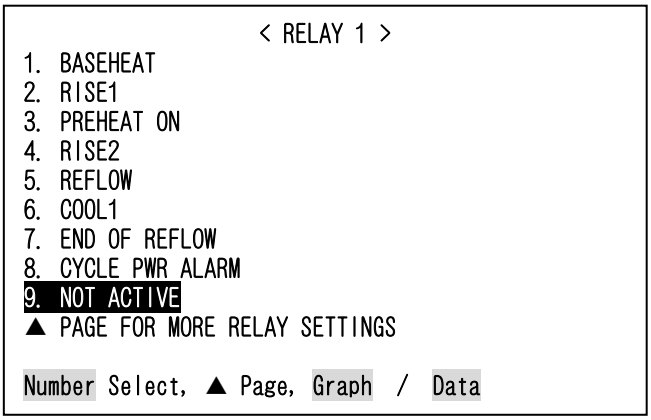
6. **CLEAN THERMODE**: Relay is **OPEN/CLOSED** when clean thermode counter expires. Auto reset when the counter is edited or reset by pushing the zero key at the Graph or Data screen, or reset by apply a signal at J4A-7.

7. **REPLACE THERMODE**: Relay is **OPEN/CLOSED** when replace thermode counter expires. Auto reset when the counter is edited or reset by pushing the zero key at the Graph or Data, or reset by apply a signal at J4A-7.

8. **IDLE HEAT**: Relay is **OPEN/CLOSED** if idle temperature is On.

Chapter 9, Electrical and Data Connections for the relay description that includes the timing diagram showing the sequence of the status options.

If the desired relay state is not on the first Relay State screen, press the ▼ key to select the second relay screen.



The **1** through **8** keys on the keypad set the **RELAY 1** status options.

1. **BASEHEAT**: Relay is **OPEN/CLOSED** during baseheat process cycle.

2. **RISE1**: Relay is **OPEN/CLOSED** from point at which 50% of **RISE1** time has elapsed until the end of **RISE1**.

3. **PREHEAT ON**: Relay is **OPEN/CLOSED** during preheat process cycle.

4. **RISE2**: Relay is **OPEN/CLOSED** from point at which 50% of **RISE2** time has elapsed until the end of **RISE2**.

5. **REFLOW**: Relay is **OPEN/CLOSED** from start of heating to **COOL1** if no Postheat cycle otherwise **COOL2**.
6. **COOL1**: Relay is **OPEN/CLOSED** when **COOL1** temperature is reached.
7. **END OF REFLOW**: Relay is **OPEN/CLOSED** when **COOL1** is reached if no Postheat cycle, otherwise **COOL2**.
8. **CYCLE PWR ALARM**: Relay is **OPEN/CLOSED** when a more severe alarm, as indicated by “Cycle Power” text in the alarm message, occurs.
9. **NOT ACTIVE**: Relay is not active.

③COMMUNICATIONS

The **SETUP** key returns you to the **SETUP MENU** screen. The **2** key on the **SETUP MENU** brings up the **COMMUNICATION** screen.

COMMUNICATION ROLE

Press the **1** key to toggle between **MASTER** and **SLAVE** to set the role of the RS485 communication interface.

When **MASTER** is selected, the Control will automatically send data out of the RS232 or RS485 serial port to the host computer after each heating cycle.

```
                < COMMUNICATION >
1. COMMUNICATION ROLE              : MASTER
2. BAUD RATE                       : 38.4K
3. RS232/485 SELECT                : RS232
4. RS485 ID NUMBER                 : 01


Number Select, ▲ Page, Graph  /  Data
```

When **MASTER** is selected, the Control will automatically send data out of the RS232 or RS485 serial port to the host computer after each heating cycle.

When **SLAVE** is selected, the Control will send data to the host computer only when requested by the host computer. The Default value is **SLAVE**.

RS232/485 SELECT

Pressing the **3** key will alternately select either RS232 or RS485 communications. The Default value is RS232.

BAUD RATE

The **2** key on the **COMMUNICATION** menu brings up the **BAUD RATE** screen. Use the keypad to select the required data transfer rate, from 1200 to 38.4K baud. The Default value is 38.4K.

```
                  < BAUD RATE >
1. 1200                    5.  19.2K
2. 2400                    6.  38.4K
3. 4800
4. 9600


Number Select, ▲ Page, Graph  /  Data
```

I.D. NUMBER

Press the **4** key to bring up the **RS485 ID NUMBER** screen.

Use the ◄ ► keys to adjust. Unit IDs range from 01 – 31. The Default ID value is 01.

```
< RS485 ID NUMBER >

RS485 Unit ID Number      :  01



Number Change, ◄ ►  Adjust, Graph  /  Data
```

④REFLOW SETUP

With the **SETUP MENU** screen displayed, press the **3** key to bring up the **REFLOW SETUP** screen.

```
< REFLOW TEMPERATURE SETUP>

 1.  IDLE TEMPERATURE IS        :    OFF
 2.  SET SAFETY TIMER           :    10SEC
 3.  SET RELEASE TIME           :    00SEC
 4.  MAX TEMPERATURE LIMI       :    600°C
 5.  MAX AUX TEMPERATURE LIMIT  :    600°C
 6.  MAX IDLE TEMPERATURE LIMIT :    300°C
 7.  DISPLAY AUX TEMP NUMBER    :    OFF
 8.  DISPLAY AUX TEMP LINE      :    OFF

Number Select ▼▲ Page, Graph  /  Data
```

IDLE TEMPERATURE IS

Press the **1** key to toggle between **ON** and **OFF**. Selecting **ON** enables the **Idle Temperature** value in the Profile. The Idle temperature is set on the **Schedule Setup screen, Page 2 of 2**. Selecting **ON** forces the thermode temperature to rise to the **Idle** temperature set in the current Profile and to continuously stay at the Idle temperature except during a heating cycle. Selecting **OFF** turns off the Idle temperature function no matter what temperature value is set in the current Profile.

SET SAFETY TIMER

Press the **2** key to bring up the **SET SAFETY TIMER** screen. Use the safety timer to abort the reflow cycle if temperature has ***not*** risen to the temperature set point by the time set in the safety timer. If the time is exceeded, a **SAFETY TIME EXCEEDED** alarm will be set.

Use the number or ◀ ▶ keys to select a safety timer value of 00 to 99 seconds.

```
< SET SAFETY TIMER >

SET SAFETY TIMER          : 00


After edit ▲ Page to accept new value

Number Change, ◂ ▸ Adjust, Graph / Data
```

SET RELEASE TIMER

Press the **3** key to bring up the **SET RELEASE TIMER** screen. You can use the release timer to delay the initiation of a new heating cycle after the thermode has cooled down to the Cool temperature and the release timer has expired.

Use the number or ◀ ▶ keys to select a release timer value of 00 to 99 seconds.

```
< SET RELEASE TIMER >

SET RELEASE TIMER         : 00


After edit ▲ Page to accept new value

Number Change, ◂ ▸ Adjust, Graph / Data
```

MAX TEMPERATURE LIMIT

Press the **4** key to bring up the **MAX TEMPERATURE LIMIT** screen. With this screen, you may set the maximum temperature required for an application. The default temperature of 600°C is shown on the screen to the right. A maximum temperature up to 999°C can be entered. Use the ◀ ▶ keys to edit the value. The Control will abort the process if the **MAX TEMPERATURE LIMIT** is reached.

```
< MAX TEMPERATURE LIMIT >

MAX TEMPERATURE LIMIT : 600


After edit ▲ Page to accept new value

Number Change, ◂ ▸ Adjust, Graph / Data
```

MAX AUX TEMPERATURE LIMIT

Press the **5** key to bring up the **MAX AUX TEMPERATURE LIMIT** screen. With this screen, you may set the maximum temperature possible for the Auxiliary Main Thermocouple. The default temperature of 600°C is shown on the screen to the right. A maximum temperature up to 999°C can be entered. Use the ◀ ▶ keys to edit the value. The Control will abort the process if the **MAX AUX TEMPERATURE LIMIT** is reached.

```
          < MAX AUX TEMPERATURE LIMIT >

    MAX AUX TEMPERATURE LIMIT      : 600


After edit ▲ Page to accept new value

Number Change, ◂ ▸ Adjust, Graph  /  Data
```

MAX IDEL TEMPERATURE LIMIT

Press the **6** key to bring up the **MAX IDLE TEMPERATURE LIMIT** screen. With this screen, you set the maximum temperature that can be entered into a Profile for the Idle Temperature. A maximum temperature up to 300°C can be entered. Use the ◀ ▶ keys to edit the value. The Control will abort the process if the **MAX IDEL TEMPERATURE LIMIT** is reached.

```
          < MAX IDEL TEMPERATURE LIMIT >

    MAX IDEL TEMPERATURE LIMIT     : 300


After edit ▲ Page to accept new value

Number Change, ◂ ▸ Adjust, Graph  /  Data
```

DISPLAY AUX TEMP NUMBER

Press the **7** key to toggle between **ON** and **OFF**. Selecting **ON** will display the numeric value for the Auxiliary thermocouple temperature reading on the **GRAPH** and **DATA** Screens. Select **OFF** if you do not wish to display the Auxiliary Temperature.

DISPLAY AUX TEMP LINE

Press the **8** key to toggle between **ON** and **OFF**. Selecting **ON** will display the planned and actual temperature lines for the Auxiliary thermocouple temperature reading on the **GRAPH** and **DATA** Screens. Select **OFF** if you do not wish to display the Auxiliary Temperature lines.

⑤SYSTEM SECURITY

From the **SETUP MENU** screen the **4** key will bring up the **SYSTEM SECURITY** screen.

```
                  < SETUP MENU >
1. HARDWARE SETUP
2. COMMUNICATIONS
3. REFLOW SETUP
4. SYSTEM SECURITY
5. COPY PROFILE
6. SET TO DEFAULTS
7. LANGUAGE
8. I/O STATUS

Number Select an item, Graph  /  Data
```

This **SYSTEM SECURITY** screen allows you to activate password-only access for changing the three listed system functions.

When you select any one of the three system functions with the keypad, you will bring up the **CHANGE PASSWORD** screen.

```
               < SYSTEM SECURITY >
1. PROFILE LOCK                  : OFF
2. SYSTEM LOCK                   : OFF
3. PROFILE TUNING LOCK           : OFF



Number Select, ▲ Page, Graph  /  Data
```

Enter a user-selected seven-digit (or less) password, using the keypad. When you enter the password, followed by pressing the ► cursor key, the **OFF** indication on the **SYSTEM SECURITY** screen will change to **ON**.

```
               < CHANGE PASSWORD >

PASSWORD                  : *******


Enter NUMBERS followed by the ▸ arrow

               ▲ Page, Setup or Data
```

Once you have returned to the graph or data screens, you can only unlock system security by entering the password again via the **CHANGE PASSWORD** screen.

PROFILE LOCK inhibits the user from modifying any reflow parameters and from selecting different profile schedules.

SYSTEM LOCK prevents the user from making changes to menu items.

PROFILE TUNING LOCK prevents modifying any reflow parameters, but allows users to select different profile schedules.

⑥COPY PROFILE

On the **SETUP MENU** screen, the **5** key will bring up the **COPY PROFILE** screen. This screen allows you to copy the current or a different heat profile to another heat profile.

Use the ► cursor key to advance from the **COPY PROFILE** field to the **TO PROFILE** field.

In the **COPY PROFILE** screen shown, for example, **Profile 2** will be copied to **Profile 4** when you press the right cursor key to exit the **COPY PROFILE** screen.

```
                < COPY PROFILE >

COPY PROFILE [ 2]  TO PROFILE [ 4]


Enter NUMBERS followed by the ▸ arrow

Use Graph or Setup to abort
```

⑦SET TO DEFAULTS

Press the **6** key to bring up the **RESET TO DEFAULT MENU** screen. With this screen, you may reset all user settable parameters including all the settings in all 15 profiles to the default settings.

CAUTION: Pressing **1** on this screen will reset all settings. Press the **2** key to exit this screen without resetting to default. If **SYSTEM SECURITY** is **ON**, defaults cannot be reset.

```
            < RESET TO DEFAULT MENU >

  DO YOU WISH TO SET ALL PARAMETERS TO
  THEIR SYSTEM DEFAULT VALUES?

           1.  YES            2.  NO

Number Select, ▲ Page, Graph  /  Data
```

If the **1** key was pressed on the **RESET TO DEFAULT MENU** screen, this screen will be displayed to confirm the defaults were reset.

```
            < SYSTEM DEFAULTS SET >

  ALL PROFILE AND SYSTEM PARAMETERS HAVE
  NOW BEEN SET TO THEIR DEFAULT VALUES.



              ▲ Page, Graph  /  Data
```

⑧LANGUAGE

Press the **7** key to bring up the **LANGUAGE** screen. With this screen, you may select the screen language to either English by pressing the **1** key or to German by pressing the **2** key.

If you press the **COUNTERS**, or **HEATING RATE** keys while this screen is displayed, this function will be aborted.

```
                < LANGUAGE >

1. LANGUAGE   :  ENGLISH
2. SPRACHE    :  DEUTSCH



Number Select, ▲ Page, Graph  /  Data
```

⑨I/O STATUS

Press the **8** key to bring up the **I/O STATUS SCREEN** screen. This screen displays the current status of the Control inputs and outputs. The digit **1** indicates the I/O point is Active High and the digit 0 indicates the I/O point is Active Low. See *Chapter 9, Electrical and Data Connections* for further description of the Inputs and Outputs on this screen.

If you press the **GRAPH**, **DATA**, **COUNTERS**, or **HEATING RATE** keys, you will exit this screen.

```
                < I/O STATUS SCREEN >

INPUTS                          OUTPUTS
J4A-3     NOHEAT  :  0    J6A-1,2  RELAY 1 :  0
J4A-6     AIRHEAD :  1    J6A-3,4  RELAY 2 :  0
J4A-7     RESET   :  0    J6A-5,6  RELAY 3 :  0
J4B-7     SCHED0  :  0    J6A-7,8  RELAY 4 :  0
J4B-8     SCHED1  :  0    J6A-9,10 RELAY 5 :  0
J4B-9     SCHED2  :  0    J6B-3,4  RELAY 6 :  0
J4B-10    SCHED3  :  0    J6B-5,6  RELAY 7 :  0
J4B-12    FS1:UP  :  0    J6B-1,2  AIRHEAD :  0
J4B-13    FS2:LOW :  0    J6B-6,8  HDCOOL  :  0
J4B-14    FIRE SW :  0    J6B-9,10 SDRCOOL :  0
J4A-9     SCHED4  :  0
J4A-10    SCHED5  :  0
          ▲ Page, Graph  /  Data
```

5. Operating Instructions

I. Before You Start

(1) Preparation

Before operating the Control:

- You ***must*** be familiar with the principles of reflow soldering.
- You ***must*** be familiar with the **location** and **function** of Controls and Indicators. For more information, see *Chapter 2, Description*.
- ***Verify*** that all equipment has been connected properly. See *Chapter 3, Installation and Setup* ***and*** the instructions supplied with the Reflow Head.
- You ***must*** be familiar with how to **select** and **use** the Control functions for your specific applications. For more information, see *Chapter 4, Using Programming Functions*.

(2) General Operator Safety

WARNING

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

WARNING

People with pacemakers ***must*** stay away from the Control. When the Control is operating, it generates a magnetic field, which adversely affects pacemakers. People who use a pacemaker must ***not*** approach the Control, or walk around the soldering shop while the Control is operating, ***unless*** their medical doctor has deemed it safe to do so.

II. Power Up

(1) Powering Up

To turn the Control power ON, set the circuit breaker/power switch on the rear panel to the ON position. After one introductory screen is displayed, the **GRAPH** screen will display with the **SYSTEM READY** message.

NOTES:

- If the EMO jumper plug is ***not*** installed as described in *Chapter 3, Installation and Setup*, the LCD Screen will display a message saying that an emergency stop is in effect. The Control will ***not*** operate until the jumper is installed.

- If the Control has been setup with the Idle temperature on, the message **WARM UP IN PROGRESS – PLEASE WAIT** will be displayed while the Control heats to the set Idle Temperature. Once the Idle Temperature is reached, the **SYSTEM READY** message will be displayed.

III. Graph and Data Screen Descriptions

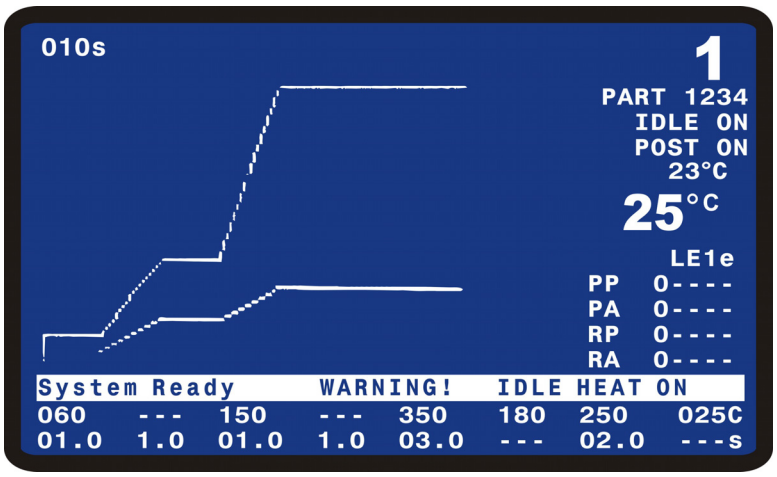
(1) Graph Screen Description

Graph Schedule Profile

A graphical representation of the programmed temperature profile is displayed in the upper left section of the **GRAPH** Screen.

A thin solid line represents the programmed temperature profile with temperature on the Y axis and time on the X axis. The line extends from the start of Baseheat through the end of the Reflow process cycle.

GRAPH

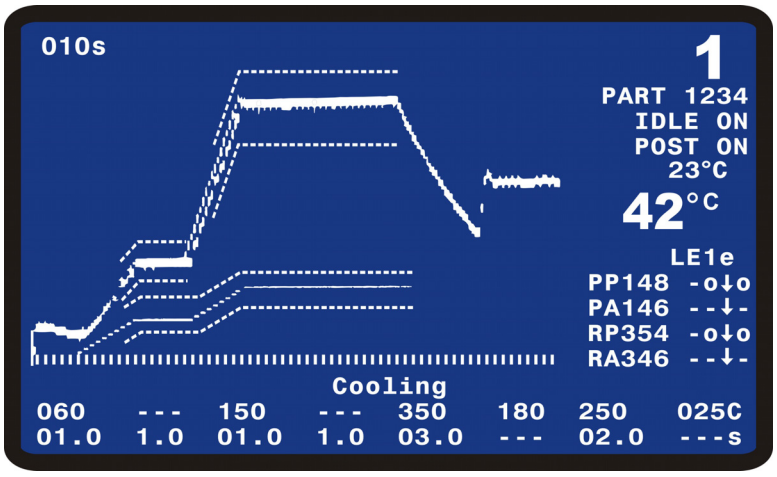


Graph Actual Temperature and Envelope Limits

A bold solid line represents the actual temperature as measured by the **Main** thermocouple.

A dashed solid line represents the actual temperature as measured by the **Auxiliary** thermocouple. In the screen picture shown below, the Auxiliary thermocouple is plotted as a straight horizontal line for illustrative purposes only.

If the **Envelope** functions has been selected for the **Main** and/or **Auxiliary** temperatures in the **Schedule Setup**, then thin dashed lines will be displayed which represent the envelope for **Rise1**, **Preheat**, **Rise2**, and **Reflow**.



GRAPH Screen Detail #1

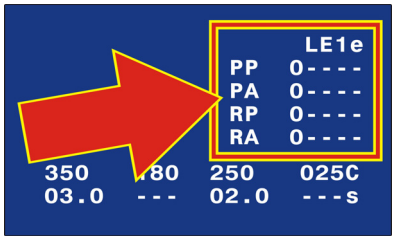
The six lines of information in the upper right corner are:

- Profile Number
- 10 alpha-numeric character user-settable reference for selected profile
- **IDLE ON** will be displayed is the Idle temperature was set to on in Reflow Setup schedule. If Idle is off, then this line will be blank.
- **POST ON** will be displayed if a Postheat process cycle has been setup for the selected profile. During the actual Postheat process cycle, **POST ON** will appear in inverse font.
- Actual temperature of **Auxiliary** thermocouple
- Actual temperature of **Main** thermocouple

GRAPH Screen Detail #2

The table on the right side of the screen indicates the peak and average temperature results:

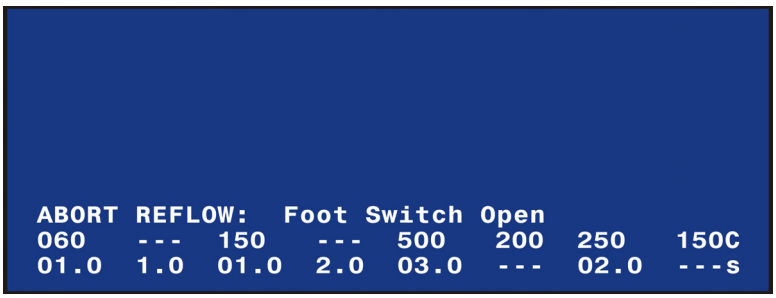
- **PP:** Peak Preheat Temperature
- **PA:** Average Preheat Temperature
- **RP:** Peak Reflow Temperature
- **RA:** Average Reflow Temperature
- The actual temperature is displayed in the middle column as soon as the particular process cycle is over.
- The four columns on the right indicate if the process was outside the peak and average temperature limits (L Column for **Main** thermocouple and l column for **Auxiliary** thermocouple) or outside the envelope (E Column for **Main** thermocouple and e column for **Auxiliary** thermocouple). O indicates pass. Up arrow ↑ indicates above requirement. Down arrow ↓ indicates below requirement. A combined up and down arrow ↕ indicates the parameter was both above and below the requirement.
- A "-" indicates either that the particular process check features is not selected for the profile or that is applicable.



GRAPH Screen Detail #3

The three lines at the bottom of the screen are:

- The lowest line indicates the time length of each process cycle of the current Profile.
- The second line from the bottom of the screen indicates the temperature for each process cycle of the current Profile.
- The third line from the bottom is a status or alarm message. This line will either display the Control status, present process cycle step or an alarm message.



GRAPH Screen Detail #4

The numeric value in the upper left of the screen is the length of time represented by the X-axis of the graph:

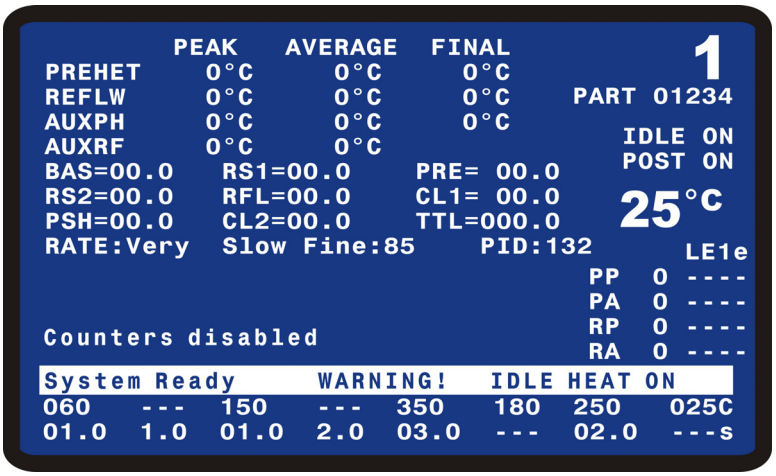
(2) Data Screen Description

The far right and bottom three lines of the **DATA** screen contain the same information as on the **GRAPH** screen.

The information specific to the **DATA** screen is as follows:

- The table in the upper section displays the peak, average, and final temperatures for the **Preheat** and **Reflow** process cycles of most recent reflow.
- The next table down displays the actual times for each process cycle
- The **Coarse** and **Fine** heating rates, and **PID Control** setting for the current profile are displayed

- The status of the Clean and Replace Counters



Data Screen Abbreviations and Time calculations

Abbreviation	Description
PREHET	**Main** Thermocouple Preheat Temperature
REFLW	**Main** Thermocouple Reflow Temperature
AUXPH	**Auxiliary** Thermocouple Preheat Temperature
AUXRF	**Auxiliary** Thermocouple Reflow Temperature

Abbreviation	Time	Calculation
BAS	Baseheat	Initiation of **process** to end of **Baseheat time.**
RS1	Rise1	End of **Base** to when the actual temperature reaches the **Preheat** temperature setting less the user-set **Preheat Temperature Delta** in the Profile..
PRE	Preheat	From the point where **Rise1** reached the **Preheat** temperature setting less the **Preheat Temperature Delta** to end of **Preheat** Time
RS2	Rise2	End of **Preheat Time** to when actual temperature reaches the **Reflow** temperature setting less the **Reflow Temperature Delta**.
RFL	Reflow	From point where **Rise2** reached the **Reflow** Temperature setting less the **Reflow Temperature Delta** to end of **Reflow** time
CL1	Cool1	End of **Reflow** Time to when **Cool1** temperature setting is reached.
PSH	Postheat	End of **Cool1** to end of Postheat Time.
CL2	Cool2	End of **Postheat** Time to when **Cool2** temperature setting is reached.

Preheat and Reflow Control

The process timing for **Preheat**, **Reflow** and **Postheat** can be set for control based on **Time** or **Temperature**. This setting is made in the **Schedule Setup, Page 3 of 5**.

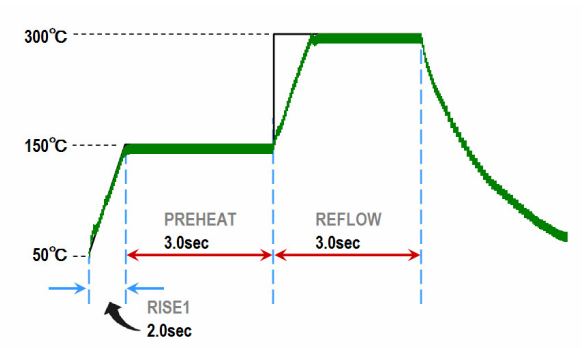
If **Time** is selected for **Preheat and Reflow Control**
In each process, the user-set time takes priority. For example, when 2.0 seconds is set in **Rise2** and 350°C-3.0 seconds is set in **Reflow**, the Control will execute **Reflow** when 2.0 seconds elapses after starting of **Rise2** even if the actual thermode temperature does not reach 350°C.

If **Temperature** is selected for **Preheat and Reflow Control**
In each process, the user-set temperature takes priority. For example, when 2.0 seconds is set in **Rise2** and 350°C-3.0 seconds is set in **Reflow**, the Control will execute the next **Cool1** when the thermode temperature reaches 350°C after starting of **Rise2** and 3.0 seconds elapses in **Reflow**.

Other than profiles, the slope of the temperature increase will be based on the **Coarse** and **Fine** Heating Rates as well as the **PID Control** settings. However, the result may not be obtained as set in profile due to the occurrence of overshoot.

Functionality Example #1: Time is selected for **Preheat and Reflow Control**. This example is based on the following Control settings:

- **Temperature** delta for preheat = 10°C
- **Rise1** time of 2.0 seconds
- **Preheat** time of 3 seconds
- **Preheat** temperature of 150°C



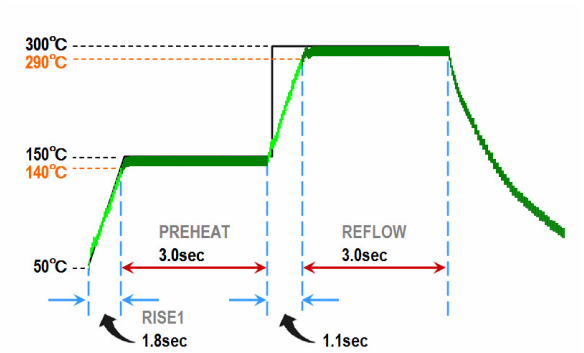
After start, the Control begins to ramp the temperature for 2.0 seconds according to the time set in **Rise1**.

As soon as the time in **Rise1** period reaches 2.0 seconds, **Rise1** will end and Preheat will start. The Control will immediately control the temperature of **Preheat** so that it becomes 150°C, and the next process will start when 3.0 seconds elapse. Since nothing is set in **Rise2** period, **Reflow** will start immediately and **Cool** will start when 3.0 seconds elapse.

As for the display on the **DATA** screen, 2.0 seconds will display for the time of **Rise1**, 3.0 seconds will display for the time of **Preheat**, and 3.0 seconds will display for the time of Reflow. The total time of **Rise1 + Preheat + Reflow** will be 8.0 seconds.

Functionality Example #2: Temperature is selected for **Preheat and Reflow Control**. This is based on the following Control settings:

- **Temperature** delta for preheat = 10°C
- **Rise1** time of 2.0 seconds
- **Preheat** time of 3 seconds
- **Preheat** temperature of 150°C



After start, the Control ramps the temperature according to the time set in **Rise1**.

Since the **Temperature** delta for preheat is set to 10°C, if the temperature of **Rise1** reaches 140°C (150°C-10°C set in **Preheat**), **Preheat** will start.

As for the display on the **DATA** screen, if the time from the start of **Rise1** to 140°C is 1.8 seconds and the time for **Preheat** including overshoot is 3.0 seconds, then 1.8 seconds will display for the time of **Rise1** and 3.0 seconds will display for the time of **Preheat**. The total time of **Rise1 + Preheat** will be 4.8 seconds.

Also, in case of setting like this, even if **Rise2** is not set, a temperature rise amount to Reflow is calculated as **Rise2**. As for the display on the **DATA** screen, 1.1 seconds will display for the time of **Rise2** and 3.0 seconds will display for the time of **Reflow**.

The total time of **Rise1** to **Reflow** will be 8.9 seconds.

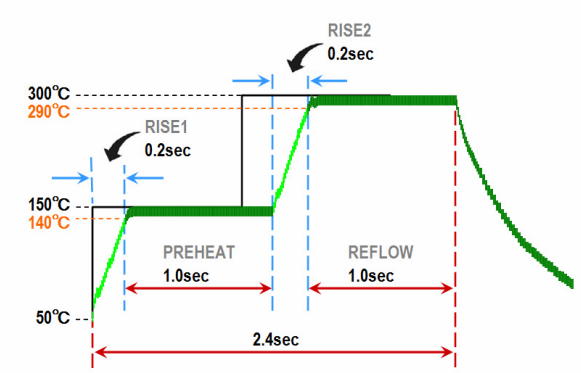
Functionality Example #3: Temperature is selected for **Preheat and Reflow Control**. This is based on the following Control settings:

- **Temperature** delta for preheat = 10°C
- **Temperature** delta for reflow = 10°C
- **Rise1** time of 0.0 seconds
- **Preheat** time of 1 second
- **Preheat** temperature of 150°C
- **Rise2** time of 0.0 seconds
- **Preheat** time of 1 second
- **Preheat** temperature of 300°C

If you select **Temperature** for **Preheat and Reflow Control**, and set **Rise1** and **Rise2** to zero seconds, the Control will behave as shown below:

<Measured time on the **DATA** screen>

- **Rise1** time of 0.2 seconds
- **Preheat** time of 1.0 second
- **Rise2** time of 0.2 seconds
- **Reflow** time of 1.0 second



As explained in Functionality Example #2, if the **Temperature** delta is set, the next **Preheat** and **Reflow** will start from the temperature reached in the middle of rise in **Rise1** and **Rise2**. This behavior is recorded as measurement result on the **DATA** screen.

If the **Temperature** delta is not set, the Control will abort **Preheat** or **Reflow** if the temperature has ***not*** reached the Delta temperature within the length of the programmed **Rise1 + Preheat** time, ***or*** the **Rise2 + Reflow** time. At this time, the Control will display the message **ABORT REFLOW: Heating Too Slow**.

● POSTHEAT setting

Even if you select either **Time** or **Temperature** for Preheat and Reflow Control, **Postheat** will start when the temperature reaches the time set in **Cool1**. On the **DATA** screen, the period to fall to the temperature set in **Cool1** is displayed as **Cool1** and the heating process including the re-rise time to the set time in **Postheat** is displayed as **Postheat**. After **Postheat**, the time to fall to the lowest temperature set in **Baseheat**, **Preheat** or **Cool2** is calculated as the operation time of **Cool2**.

The fall time of **Cool1** and **Cool2** cannot be set.

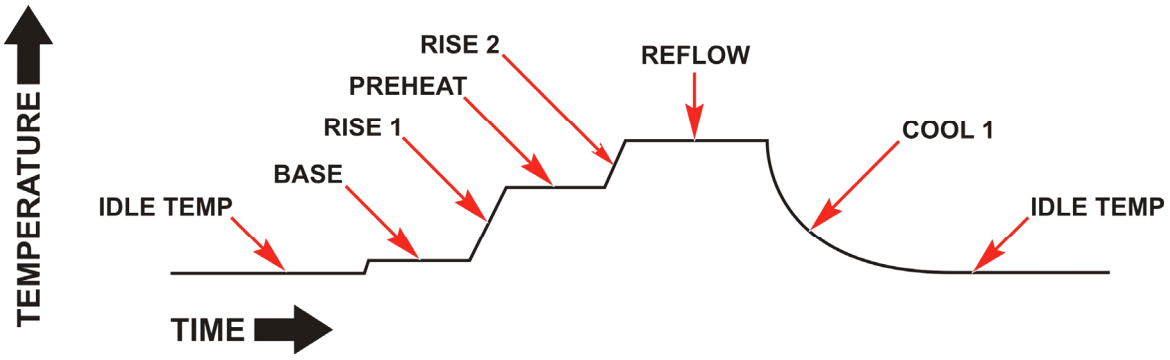
IV. Process Cycle Parameters

(1) Temperature Setting Ranges

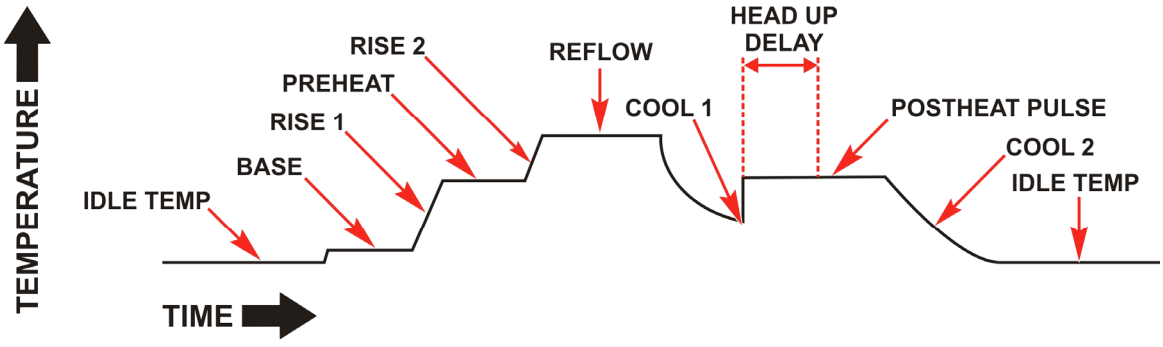
Idle ..... 25° to 300°C
Base ..... 25° to 300°C
Preheat ..... 60° to 500°C
Reflow (default) ..... 60° to 600°C
Reflow (extended mode operation) ..... 60° to 999°C
Cool1 ..... 25° to 300°C
Postheat ..... 25° to 600°C
Cool2 ..... 25° to 300°C
Maximum Temperature ..... 300° to 999°C

(2) Time Setting Ranges

Base .....0 to 99.9 seconds
Rise1 .....0.0 to 9.9 seconds
Preheat .....0 to 99.9 seconds
Rise2 .....0.0 to 9.9 seconds
Reflow .....0.1 to 99.9 seconds
Postheat .....0 to 99.9 seconds



Process Cycle Steps (No Postheat)



Process Cycle Steps (With Postheat)

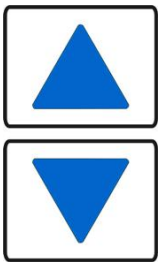
V. Operating Instructions

When the **SYSTEM READY** message displays after Power Up, the Control is ready for operation using either of the following options:

- Pre-Defined Reflow Profiles. For your convenience, you may quickly select a profile stored in the Control that has been pre-defined for your most common reflow applications.
- Direct Input. You may use the front panel controls to input the parameters for a reflow application.

(1) Pre-Defined Reflow Profiles

1. Push the **PROFILE NUMBER** up/down keys until the profile you want (**1** to **63**) is displayed on the LCD screen.



NOTE: The **PROFILE NUMBER** up/down keys are disabled when any screen *other than* the graphic screen or data screen displays on the LCD.

2. Set the **HEAT/NO HEAT** switch to **HEAT**. The Control is now ready to use.

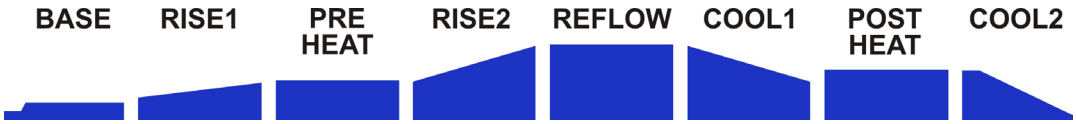
(2) Direct Input

CAUTION

You can accidentally overwrite (erase) an existing stored profile when using the front panel controls. Before you start **Direct Input**, use the **PROFILE NUMBER** up/down keys to select a profile number that is “blank” or “expendable” to prevent overwriting a profile you want to keep.

1. Set the **HEAT/NO HEAT** switch to **HEAT**. In this position, the Control will deliver heating energy to the thermode when you initiate the heating cycle.

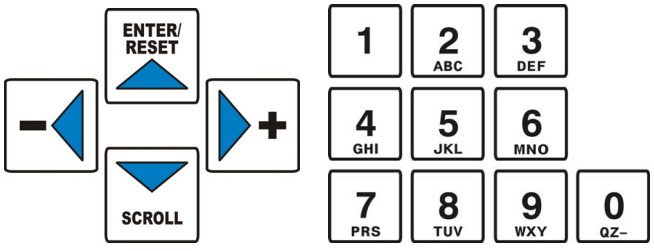
2. Press the **BASE °C** key to select the **BASE** temperature value for editing.



NOTE: The **BASE** temperature value will be highlighted when it is selected. In this example the **BASE** temperature value is **060** as shown in the bottom left corner of the screen below.

3. Set the temperature value to 60°C with the number keys on the keypad or the ◄ ► keys, and then press the ▲ key to save the change.
4. Press the **BASE** key twice to select the **BASE** time field. Use the keypad to enter a **BASE** time of 010 (1.0 seconds), then press the ▲ key.

NOTE: After changing any period temperature or time value, the graphic screen trace will automatically re-size.



5. Press the **RISE1** key to select the **RISE1** time field for editing. Use the keypad to enter a **RISE1** time to 010 (1.0 seconds), then press the ▲ key.
6. Press the **PREHEAT** key to select the **PREHEAT** temperature value for editing. Use the keypad to enter a temperature 150°C, then press the ▲ key.
7. Press the **PREHEAT** key twice to select the **PREHEAT** time field for editing. Use the keypad to enter a **PREHEAT** time to 010 (1.0 seconds), then press the ▲ key.
8. Press the **RISE2** key to select the **RISE2** time field for editing. Use the keypad to enter a **RISE2** time to 010 (1.0 seconds), then press the ▲ key.
9. Press the **REFLOW** key to select the **REFLOW** temperature value for editing. Use the keypad to enter a temperature 350°C, then press the ▲ key.
10. Press the **REFLOW** key twice to select the **REFLOW** time field for editing. Use the keypad to enter a **REFLOW** time to 030 (3.0 seconds), then press the ▲ key.
11. Press the **COOL1** key to select the **COOL1** temperature value for editing. Use the keypad to enter a **COOL1** temperature of 180°C, then press the ▲ key.
12. If using a Postheat process cycle, press the **POSTHEAT** key to select the **POSTHEAT** temperature value for editing. Use the keypad to enter a temperature 250°C, then press the ▲ key.
13. Press the **POSTHEAT** key twice to select the **POSTHEAT** time field for editing. Use the keypad to enter a **POSTHEAT** time to 020 (2.0 seconds), then press the ▲ key.
14. Press the **COOL2** key to select the **COOL2** temperature value for editing. Use the keypad to enter a **COOL2** temperature of 25°C, then press the ▲ key.

NOTE: In the above sequence the ▲ key was pressed to save an entry. For fewer key presses when changing both temperature and time for a process period, the specific process key can be pressed to save the temperature and move the cursor highlight to the time field. For example, after entering a temperature for **BASE**, press the **BASE** key to save the temperature and move the cursor to the Base time field.

15. Make a test joint by pressing the foot pedal or foot switch to initiate a complete heating cycle.
    - For **manual** reflow soldering heads, release the foot pedal when the alarm "beep" sounds indicating that the thermode has reached the **COOL** temperature.
    - For **air actuated** reflow solder heads, release the foot switch after the head has automatically retracted the thermode.
16. If the joint ***is*** good, use the present Control settings for your soldering application. If it is ***not*** good, go to Step 17.
17. Repeat Steps 9, 10, 11 and 15, and use the keypad to increase the **REFLOW** temperature in 25°C increments. Make a test joint ***after each* REFLOW *change***.
18. Upon reaching a temperature of 450°C, use the keypad to increase the **TIME** in 0.5 second increments, repeating Steps 9 and 15 until you have achieved a good joint.

NOTE: If the process does not require a **POSTHEAT** cycle, then the **POSTHEAT** time should be set to zero. If the **POSTHEAT** time is set to zero, both the **POSTHEAT** and **COOL2** will not execute and **COOL1** will be the last programmable process step.

(3) Display Backlight On/Auto

The Display backlight can be set to remain always on or to turn off if there has not been any process starts or key presses in a 3 to 4 minute period. This feature is selected in the Control Setup screens. If the backlight is set to turn off if there is a period of inactivity, press any key on the front panel to turn on the backlight. The first press of any key when the backlight is off will not execute the function of the button.

6. Maintenance

I. Before You Start

(1) Preparation

DANGER

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

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

- Do *not* modify the Control without prior written approval from us.
- Use the appropriate tools for terminating the connecting cables, being careful not to nick the wire conductors.
- *Never* use paint thinner, benzene or acetone to clean the exterior of the Control. Use a dry cloth or, if it is heavily soiled, use a cloth moistened with a mild detergent or alcohol.

(2) Status Messages

Message	Description
Baseheat Time	The Control is operating in the Baseheat Time period.
Cooling	The Control is operating in the Cool period.
Cooling to Base or Preheat Temperature	The Control has passed the Cool temperature at the end of reflow and is cooling down to the Base or Preheat Temperature, whichever is lower. Note: When this message is displayed, the up arrow key can be pressed or a digital input reset (J4A-7) can be sent to erase this message and put the Control back in the System Ready condition so a reflow can be started without waiting for the temperature to reach the Base or Preheat Temperature.
Modify Profile	The user has pressed a ºC or Time Key and the unit is ready to accept a new value.
Preheat Time	The Control is operating in the Preheat Time period.
Postheat – Head Up	The Control is operating in the Postheat Time period after the Head Up time has passed.
Postheat – Head Up Delay	The Control is operating in the Postheat Time period but the Head up Delay time has not been reached yet.
Reflow Time	The Control is operating in the Reflow Time period
Rise1 Time	The Control is operating in the Rise1 Time period
Rise2 Time	The Control is operating in the Rise2 Time period
System Ready	The Control is ready to begin a reflow process cycle.
System Ready, PROCESS WARNING	The Control is ready to begin a reflow process cycle. A temperature was Out Of Limits or Envelope during the previous process.
System Ready WARNING! IDLE HEAT ON	The Control is ready to begin a reflow process cycle. Idle Heat has been set to On.
Warm Up in Progress – Please Wait	The system is ramping up to the Idle temperature.

II. Troubleshooting

Alarm Message	Description	Corrective Action
ABORT REFLOW: Firing Switch Open	When the FOOTSWITCH RESPONSE MODE is set to ABORT, releasing the firing switch connection aborts the reflow and produces this message.*	Maintain firing switch closure for required time.
ABORT REFLOW: Foot Switch Open	When the FOOTSWITCH RESPONSE MODE is set to ABORT, lifting the head during a reflow aborts the reflow and produces this message.*	Lift the footswitch all the way up and try the reflow again.
ABORT REFLOW: Heating Too Slow	If TEMP is selected for PREHEAT AND REFLOW CONTROL, the unit will abort preheat or reflow if the temperature has not reached the PREHEAT TEMPERATURE DELTA or REFLOW TEMPERATURE DELTA within the length of the programmed RISE1 + PREHEAT time or RISE2 + REFLOW time.	Change COARSE and/or FINE HEATING RATE, PID CONTROL SETTING, or Process Temperatures.
ABORT REFLOW: Safety Timer expired	Thermode is taking longer than 10 seconds to reach Pre-heat or Reflow temperature.*	Verify that all electrical connections between the thermode and the Control output are tight. ***Increase*** coarse heating rate.
ACCESS DENIED! SYSTEM SECURITY ON	Operator has attempted to change the heat Profile variables or the Profile Number while the System Security is in effect.	Access the SYSTEM SECURITY menu. Re-enter user password to unlock the System Security feature.
ACCESS DENIED! REMOTE PROFILE SELECTED	Operator has attempted to change profile numbers at the Control's panel while the remote inputs are already specifying a profile.	Ignore, or remove the remote profile selection before changing profile numbers at the panel.
BASEHEAT EXCEEDS PREHEAT TEMP SETTING	New Baseheat temperature value is greater than Preheat temperature value.	Re-enter a Baseheat value that is ***less*** than the Preheat temperature value.
CLEAN THERMODE: Press 0 to reset counter	Clean Thermode Counter has reached zero.	Reset Clean Thermode Counter.
Clean Thermode Counter Reset to	Clean Thermode Counter has been reset by Controller.	No action needed. Information message only.
COOL1 EXCEEDS POSTHEAT TEMP SETTING	New Cool1 temperature value is greater than the Postheat Temperature.	Re-enter a Cool1 value that is ***less*** than the Postheat temperature.
COOL2 EXCEEDS POSTHEAT TEMP SETTING	New Cool2 temperature value is greater than the Postheat Temperature.	Re-enter a Cool2 value that is ***less*** than the Postheat temperature.

Alarm Message	Description	Corrective Action
EMERGENCY STOP ACTIVATED	Reflow soldering head will not activate without installing a CE required Emergency Stop switch or jumper wire. The system has detected a potentially hazardous condition necessitating operator intervention. Normal reflow operation is inhibited. *	Connect a normally closed relay or switch between pin 1 and pin 2 on the Control rear panel connector, EMO. Using a jumper wire in place of a relay or switch will work, but will not meet CE safety requirements. Operator must clear the condition causing the emergency stop before reflowing can continue.
EXCEEDED MAXIMUM TEMPERATURE OF	New Reflow temperature value is greater than the maximum temperature limit set in the Reflow Setup Screen.	Re-enter a lower Reflow value, increase the maximum temperature in the Reflow Setup Screen, and then enter the desired higher Reflow temperature.
FIRING SWITCH NOT ACTUATED	Air Actuated Reflow Soldering Head Firing Switch has not actuated. Switch must actuate within 20 seconds after initiating a new reflow process cycle. When this message is displayed the Alarm Relay state will be active and the System Ready state will be active. You can initiate another process when this message is displayed. A Digital Input Reset (J4a-7), an Up Arrow key press, or a fire signal will reset this message and alarm state.	Initiate another reflow process cycle. Increase Air Actuated Reflow Soldering Head air pressure until heating begins. Check Reflow Soldering Head stroke specification. If stroke is exceeded, the Firing Switch will *never* actuate.
IDLE EXCEEDS BASEHEAT TEMP SETTING	New Idle temperature value is greater than the Baseheat temperature.	Re-enter an Idle temperature value that is ***less*** than the Baseheat temperature.
IDLE EXCEEDS COOL1 TEMP SETTING	New Idle temperature value is greater than the Cool1 temperature.	Re-enter an Idle temperature value that is ***less*** than the Cool1 temperature.
IDLE EXCEEDS COOL2 TEMP SETTING	New Idle temperature value is greater than the Cool2 temperature.	Re-enter an Idle temperature value that is ***less*** than the Cool2 temperature.
ILLEGAL SECURITY CODE ENTERED	Operator has attempted to enter a security code that does not match the password code.	Re-enter a new security code.

Alarm Message	Description	Corrective Action
MAX TEMP ALARM. Check System, Cycle Power	Maximum Temperature detected by the either the Main or Auxiliary thermocouple is above the user-set Max Temperature Limit or the Main thermocouple is 100°C above the Programmed Process Set Point. Notes: If the thermocouple wire is opened, then this message will be displayed and the temperature shown on the GRAPH and DATA screens will increase to 999°C even though there is not any power going to the thermode.	a)Cycle the Main Power, then reduce the Heating Rate. b)Check to see that the Thermocouples are connected properly. c)Check to see if the SCR has shorted. When finished, recycle the Power on the Control.
OVER POWER ALARM – Check TC (thermocouple), Cycle Power	An increase in power did not result in an increase in temperature. This message is displayed for Over Power Condition when fine heat rate is greater than or equal to 45.	Make sure that the Thermocouple is plugged in, is undamaged, and is still bonded to the Thermode. Then recycle the Power on the Control.
OVER_PWR ALARM-Chk TC, Fine Heat: Cyc Pwr	An increase in power did not result in an increase in temperature. This message is displayed for Over Power Condition when fine heat rate is less than 45.	Make sure that the Thermocouple is plugged in, is undamaged, and is still bonded to the Thermode. Then recycle the Power on the Control.
POSTHEAT TIME SHORTER THAN HEAD UP DELAY	New Postheat time is less than the Head Up Delay.	Re-enter a Postheat time value that is ***greater*** than Head Up Delay.
REFLOW ALARM: Increase Heating Rate	Actual thermode temperature never reaches the REFLOW LOW TEMP LIMIT value on the Schedule Setup Page 2 of 2 during the Reflow time period. **NOTES:** This alarm will function if the REFLOW ENVELOPE LIMITS are set to either ON or OFF. If the fine heat rate is set for 17% or less, there will not be any heating, the thermode temperature will remain at its ambient, and the REFLOW ALARM will not be displayed. The actual temperature will be plotted across the display graph. The System Ready message will be displayed when the user can change the profile settings or initiate another reflow.*	Set Coarse Heating Rate one setting faster. ***Increase*** the LOW LIMIT value. ***Increase*** the Preheat Time. Check cables between the Control output and the Reflow Soldering Head for loose connections. Check connection between the thermode and thermode holder for loose connections. Increase the diameter of the cables between the Control output and the Reflow Soldering Head.
REFLOW BELOW COOL TEMP SETTING	New Reflow temperature value is lower than Cool1 temperature	Re-enter a Reflow value that is ***greater*** than the Cool1 temperature.

Alarm Message	Description	Corrective Action
REPLACE THERMODE: Press 0 to reset count	Replace Thermode Counter has reached zero.	Reset Replace Thermode Counter.
Replace Thermode Counter Reset To	Replace Thermode Counter has been reset by Controller.	No action needed. Information message only.
Transformer Over Temperature	The temperature measured by the thermal switch has exceeded 65°C. When the thermal switch exceeds 65°C, it will abort any process and prevent initiation of another process.	Check process settings and consult us. Once the thermal switch temperature has dropped below 65°C, the Up Arrow Key, Reset Digital Input, or new fire command will clear message and alarm state.
WARNING! HEAT SWITCH IN NO HEAT POSITION	Heat switch is pushed to No Heat so heat will not be applied to thermode.	Push Heat switch to Heat position to apply heat to thermode.

* The alarm messages indicated can be cleared as referenced in the following table.

Alarm	Resetting Alarm	Aborting the Process Step of Cooling to Base or Preheat Temperature
All Alarms except for Max Temp Alarm and Emergency Stop (EMO)	The first Digital Input Reset (J4A-7) or Up Arrow key press will clear alarm relay and stop graph lines from plotting. Unit will go to Cooling, Cooling to Base or Preheat Temperature, or System Ready depending on Main thermocouple temperature. Note: Cycling Power Also clears alarm.	Once Alarm is reset, Up Arrow key can be used to abort process step of Cooling to Base or Preheat Temperature. When Up Arrow is pressed, unit will go to System Ready condition and allow next reflow.
MAX TEMP ALARM	The first Digital Input Reset (J4A-7) will clear alarm relay and stop graph lines from plotting. Unit will go to Cooling, Cooling to Base or Preheat Temperature, or System Ready depending on Main thermocouple temperature. Note: Cycling Power Also clears alarm relay.	Once Alarm is reset, Up Arrow key can be used to abort process step of Cooling to Base or Preheat Temperature. When Up Arrow is pressed, unit will go to System Ready condition and allow next reflow.
EMERGENCY STOP ACTIVATED	Reconnecting Emergency Stop Circuit will clear alarm relay. EMERGENCY STOP message will continue to be displayed on LCD until Main thermocouple drops to Base or Preheat Temperature.	Cannot abort Process Step of Cooling to Base or Preheat Temperature.

III. Maintenance

(1) Thermode Maintenance

When a heat profile has been suitable for a particular application over many bonds, but poor quality bonds are now resulting, thermode surface deterioration could be the problem. If you need to increase heat period temperature and time to maintain the same bond quality, the thermode surface is probably coated with heavy flux, adhesive or polyimide ribbon flex cable residue.

Clean the thermode surface either chemically with your vendor-recommended solvents, or mechanically using number 600 grit (or finer) silicon carbide paper.

Replace thermodes that have become warped or cracked.

- Warped thermodes will not adequately transfer heat to the parts.
- Cracked thermodes will not heat, ***or*** they may overheat in the cracked area.

(2) Repair Service

If you have problems with your Control that you cannot resolve, please contact us.

7. Calibration

(1) Overview

This Controller does *not* use internal calibration adjustments. High precision temperature capturing electronics is used which does not drift with age or use. This procedure allows the user to verify the calibration condition of the unit.

Any out-of-calibration condition can only be caused by an internal part failure on the main board and can only be remedied by replacing the broken part.

(2) Required Equipment

- OMEGA Digital Calibrator/Thermometer Model CL26 or equivalent
- Calibration Kit with J, K and E type thermocouple cable

NOTE: The appropriate thermocouple and connector for the selected thermocouple type *must* be used to get accurate readings.

Before You Start
Ensure that secondary cable is ***disconnected*** from the weld head/thermode.

(3) Calibration

1. Install a J, K or E type thermocouple cable between J9 of the unit and the Calibrator output.
2. Turn the test unit ON.
3. Select the thermocouple type on the Calibrator according to the cable used.
4. Set the Calibrator to an output temperature of 250°C.
5. Observe the temperature reading in the upper right hand corner of the screen.
6. Verify the temperature reading is within +/-6°C.
7. Turn the test unit OFF.
8. Remove the calibration cable, then re-attach the thermodes, thermocouple, and secondary cables.

8. Technical Specifications

Electrical Mains

AC Voltage Ranges ..... 200 to 240 V AC±10%

Line Frequency ..... 50 or 60 Hz

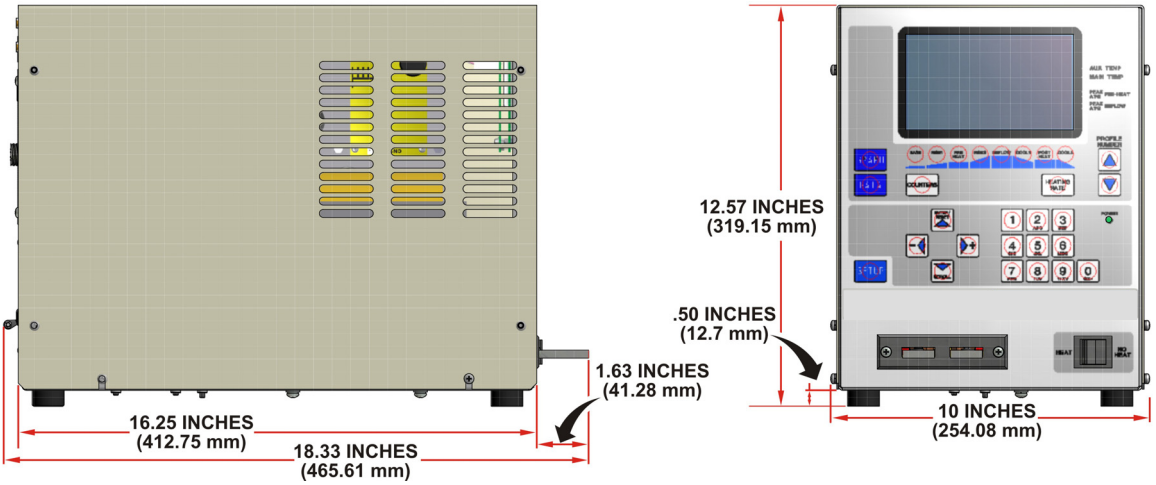
Line Phase ..... Single

Input Circuit Breaker Rating ..... 15 A

Leakage Current ..... 3.5 mA max.

Power Cord Connection ..... European CE Harmonized Wiring Code, or NEMA Wiring Code

Dimensions



(Including all projections from the housing, but ***excluding*** cabling.)

Weight: 60 pounds (27.2 kg)

Environment

Location ..... Indoor Use

Ambient Temperature:

Maximum ..... 104°F (40°C)

Minimum ..... 59°F (15°C)

Relative Humidity, Maximum ..... 93% at 104°F (40°C)

Performance

User Programmable Heat Profiles ·····63

Flash Memory

NOTE: Software versions 3.00A through 3.05F only have 15 profiles. Version 3.06G and later have 63 profiles.

Thermocouple Inputs (automatic recognition):

Type E ·····For temperatures below 900°C

Type J ·····For temperatures below 750°C

Type K ·····For temperatures below 1000°C

Thermocouple Calibration Input Standards User provided NIST standard

(Separate calibration required for each thermocouple type)

(*) NIST = National Institute of Standards and Technology

Temperature Control

Accuracy:

600°C and below ·····±6°C or ±2% of reading, whichever is greater

Above 600°C ·····±3% of reading

Repeatability ·····±1% of setting

Display Range·····15°C to 999°C

Settings:

Base ·····25° to 300°C

Preheat·····60° to 500°C

Reflow·····60° to 999°C

Cool1 ·····25° to 300°C

Postheat ·····25° to 999°C

Cool2 ·····25° to 300°C

Idle·····25° to 300°C

Periods:

Base ·····0 to 99.9 seconds

Rise1 ·····0.0 to 9.9 seconds

Preheat·····0 to 99.9 seconds

Rise2 ·····0.0 to 9.9 seconds

Reflow·····0.1 to 99.9 seconds

Postheat ·····0 to 99.9 seconds

Heating Rate Control

Coarse·····Fast, Medium, Slow, Very Slow

The user selected Coarse heating rate selects the secondary voltage setting for the transformer.

Switched Input Electrical Requirements

Form and Rating ..... Switch or sensor inputs must be normally open SPST switches, transistors or opto-isolators rated at 24 V DC, 20 mA minimum

Heat Profile Select ..... Select 63 heat profiles using six inputs activated in a binary coded pattern

Operator Initiation Switch ..... 1-level or 2-level foot switch

Heat Initiation Sensor ..... Heat force or MR-130B head down sensor for initiating thermode heating

No Heat Switch ..... Heat only inhibit

Emergency Stop (CE Requirement) ..... SPST switch open to remove valve driver power and retract head

Analog Inputs

Thermocouple ..... E, J, or K type

Thermocouple Extension Cables, Omega Standard:

Type E, PN 10-355-02 ..... 60 in. (152.4 cm)

Type J, PN 10-355-02-02 ..... 60 in. (152.4 cm)

Type K, PN 10-355-02-01 ..... 60 in. (152.4 cm)

Outputs

Audible Alarm ..... Buzzer, volume adjustable

Coarse Heating Output Power (nominal) and Coarse Heating Output (secondary) Voltage (nominal) at 240 VRMS transformer primary voltage:

Solid State Relays:

Air Head Valve ..... ON/OFF for head actuation

Head Cool Valve ..... ON/OFF for cooling thermode holder

Solder Cool Valve ..... ON at start of COOL1 or COOL2, OFF when the COOL1, COOL2, PREHEAT, or BASE temperature is reached

Power (MR-130B control provided) ..... +24 V DC

Contact Rating ..... 24 V DC, 0.3 A

Programmable Solid State Relays:

Relays Available 7

Power ..... User provided

Contact Rating ..... 0.5 A at 30 V AC or 30 V DC maximum

Programmable Electromechanical Relays Functions:

System Ready	On/Off when the Control is ready for reflow operation
Heat On	On/Off during baseheat, rise1, preheat, rise2, reflow and postheat process cycle
Head Is Up	On/Off when head is retracted
Alarm	On/Off for any alarm condition
Out of Limit	On/Off for any out of limit condition
Clean Thermode	On/Off when clean thermode counter expires
Replace Thermode	On/Off when replace thermode counter expires
Idle	On/Off if idle temperature On
Baseheat	On/Off during baseheat process cycle
Rise1	On/Off when 50% of the programmed Rise1 time has elapsed. At the end of the programmed Rise1 time, the relay will switch back to Off/On
Preheat On	On/Off during preheat process cycle
Rise2	On/Off when 50% of the programmed Rise2 time has elapsed. At the end of the programmed Rise2 time, the relay will switch back to Off/On
Reflow	On/Off from start of heating to COOL1 if no Postheat cycle otherwise COOL2
Cool1	On/Off when the COOL1 temperature is reached
End of Reflow	On/Off when COOL1 is reached if no Postheat cycle, otherwise COOL2
Cycle Pwr Alarm	On/Off for “cycle power” alarm condition

NOTE: Refer to Chapter 6 to reset alarm relay states.

Output Timing ..... See *Chapter 10, System Timing*.

Front Panel Switches

User Interface Buttons ..... 29 membrane keys

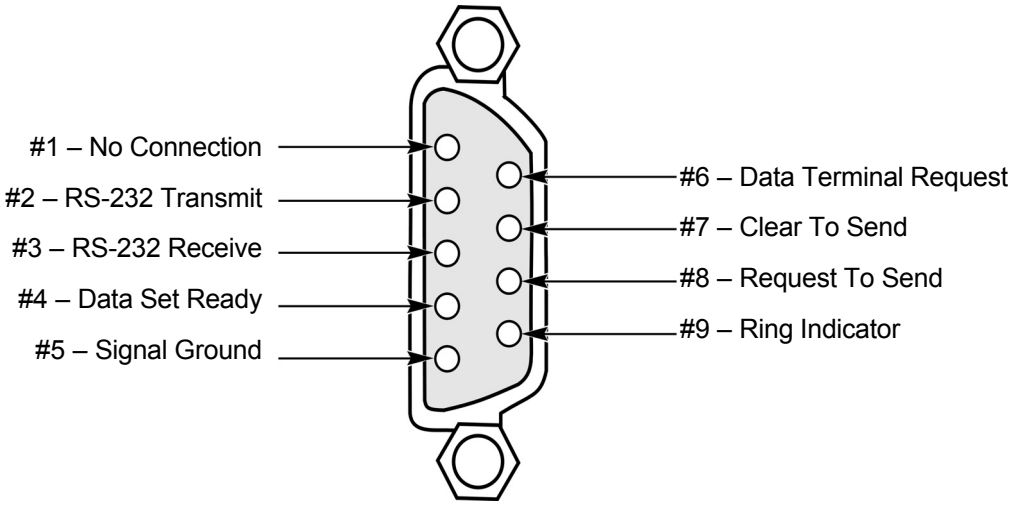
HEAT/NO HEAT Switch ..... Heat only inhibit

RS-232/RS-485 Connectors

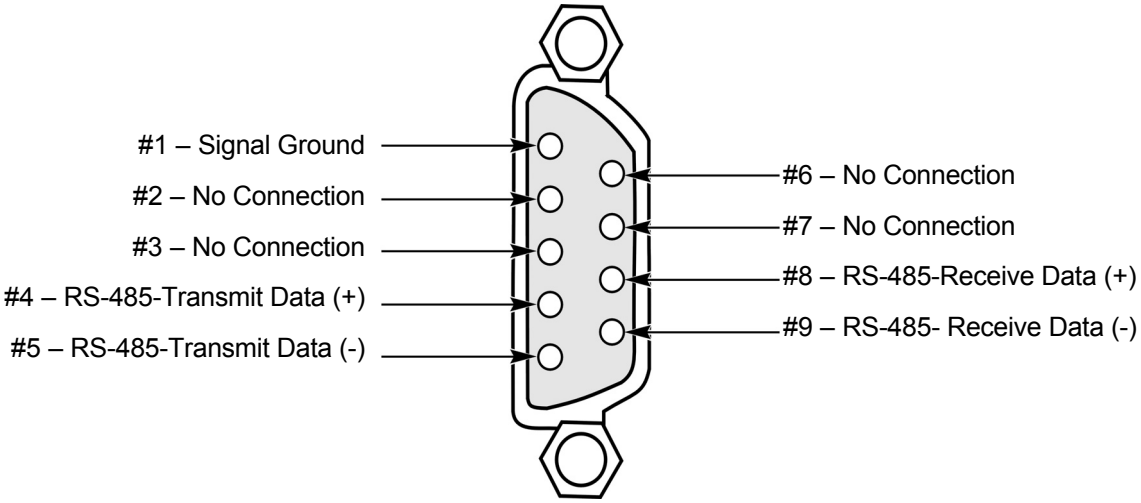
Connector type ..... Standard 9 Pin D-Sub female connector

9. Electrical and Data Connections

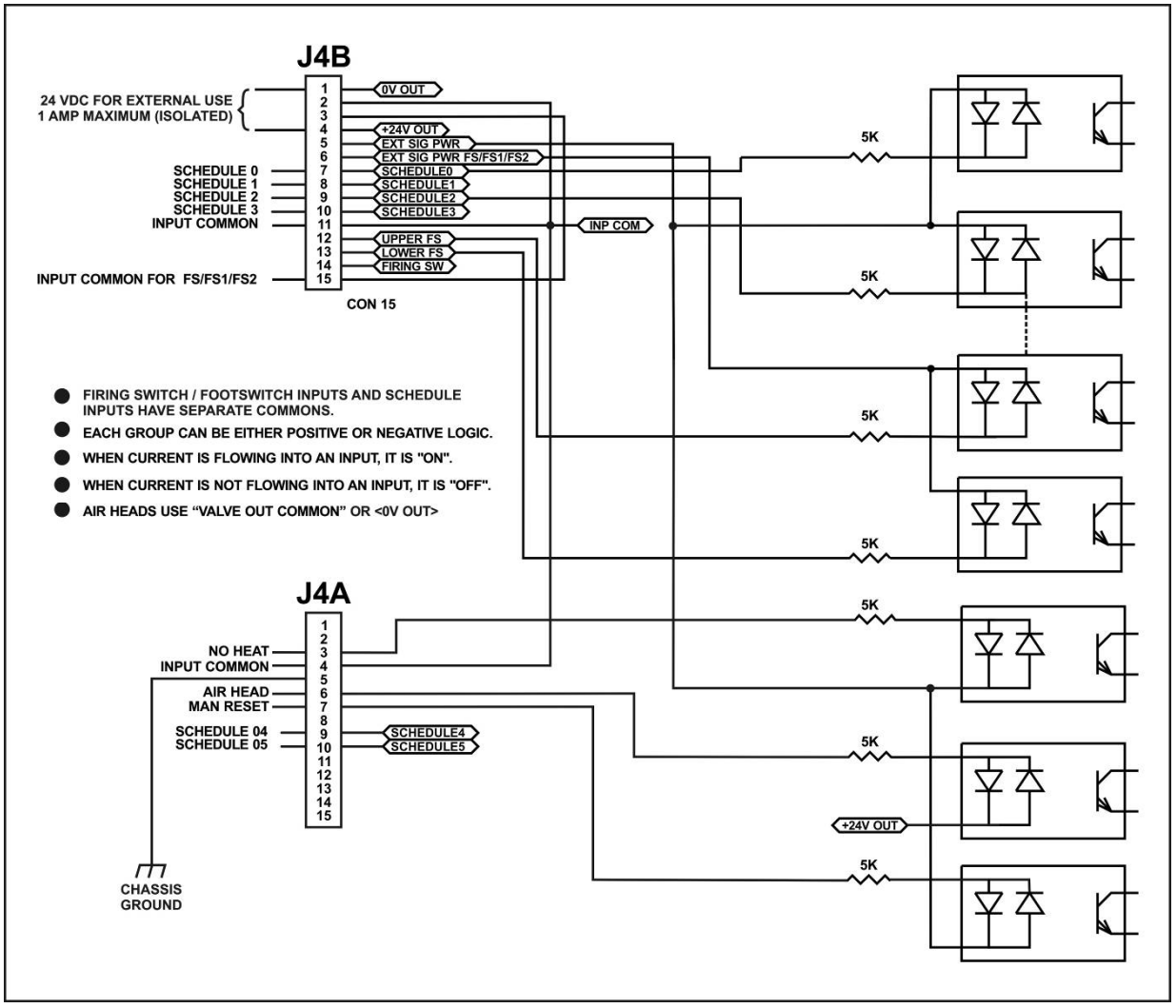
(1) RS-232 Connections



(2) RS-485 Connections

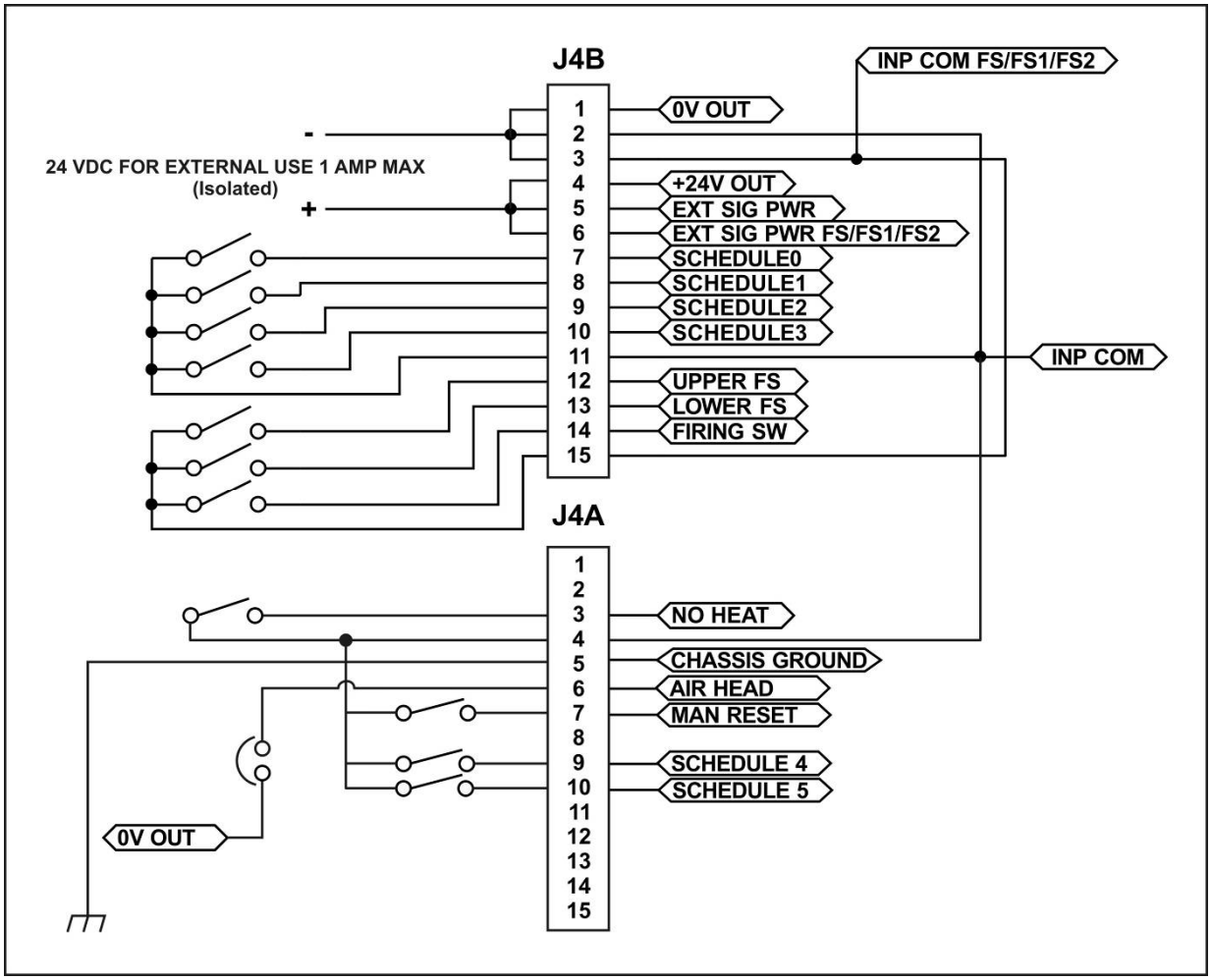


(3) Control Input Interface

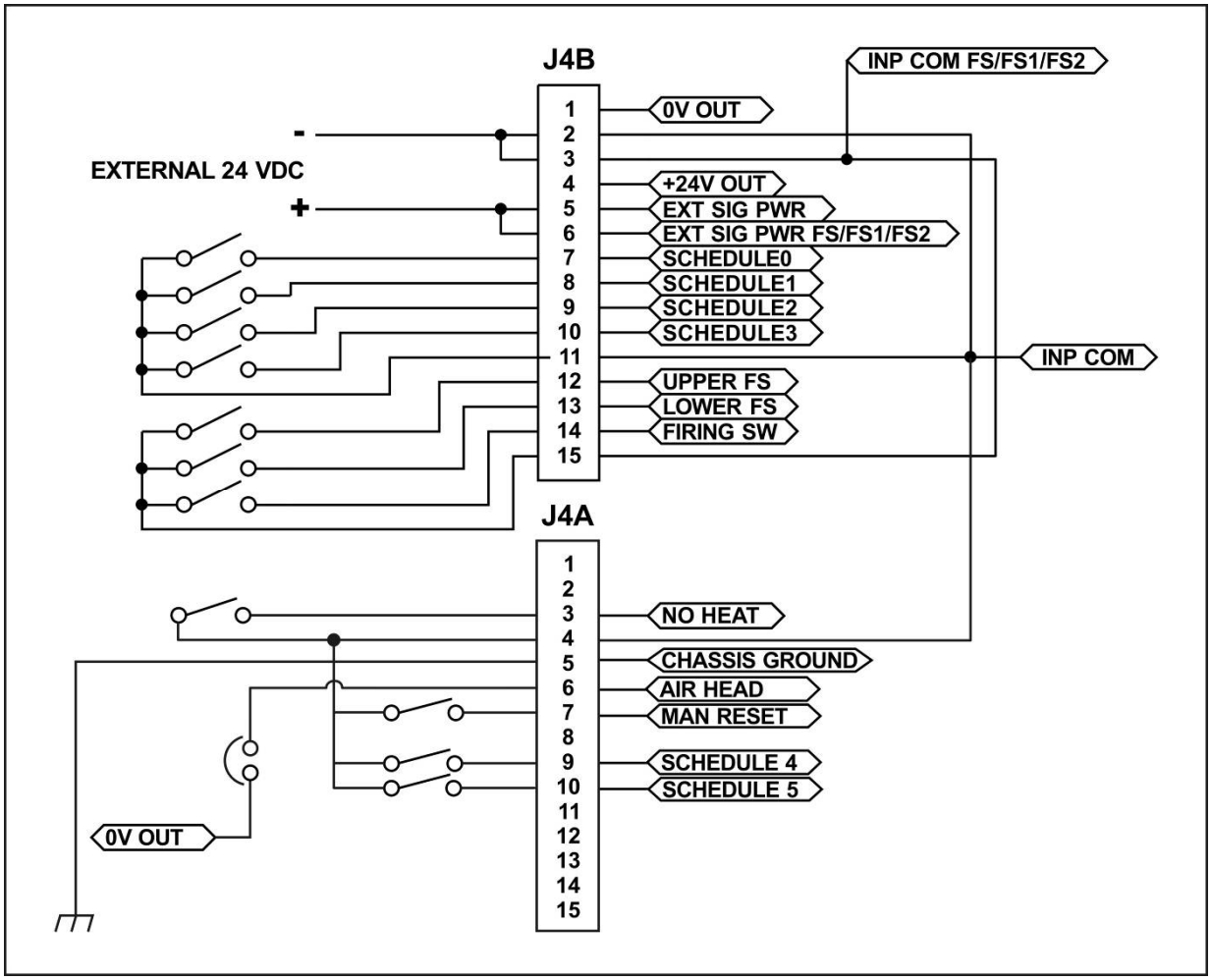


NOTE: The Control Input Interface may be connected to a PLC or other interface in the configurations shown on pages 9-4 to 9-9.

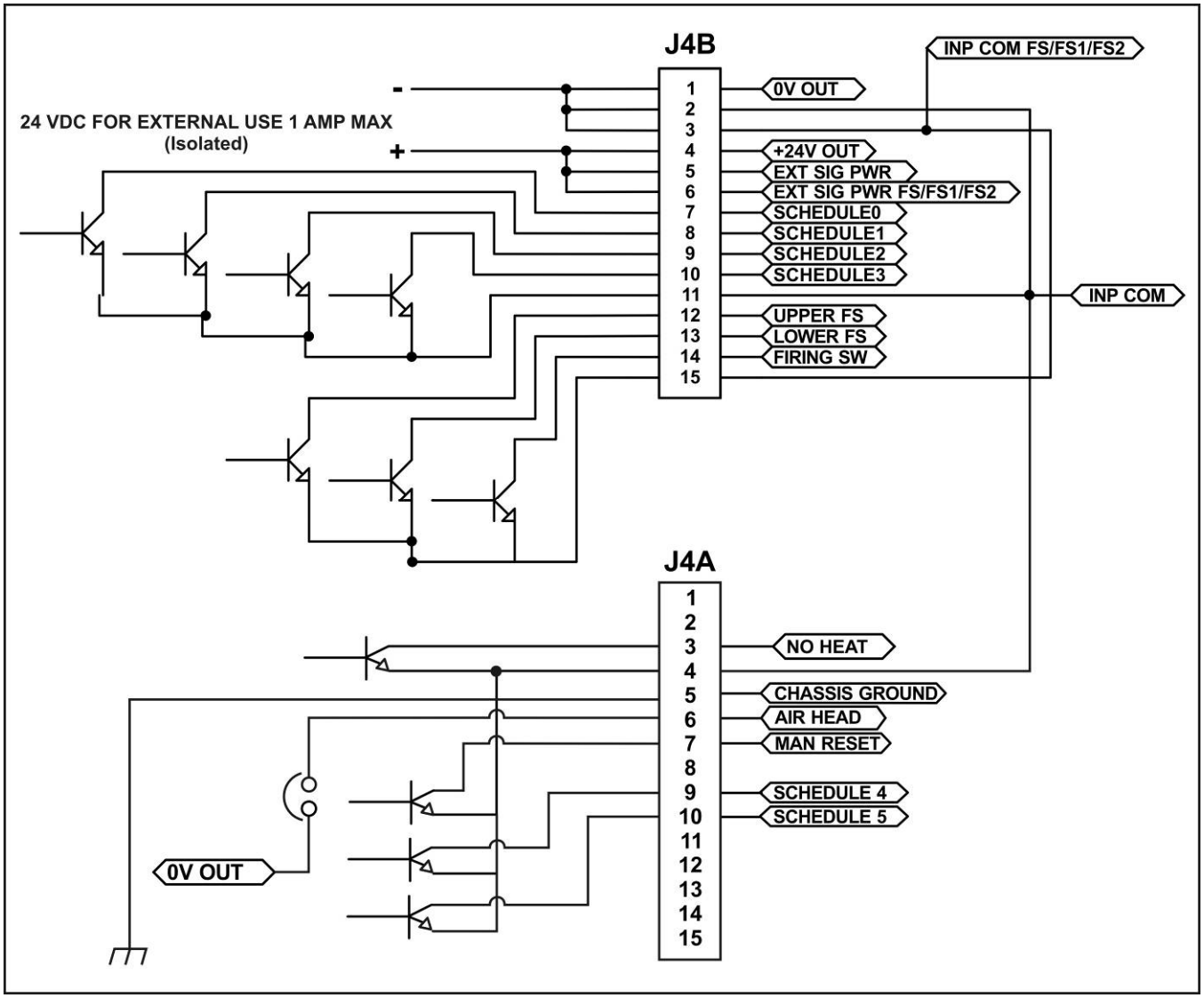
(4) Switch Contact Input (Internal Power)



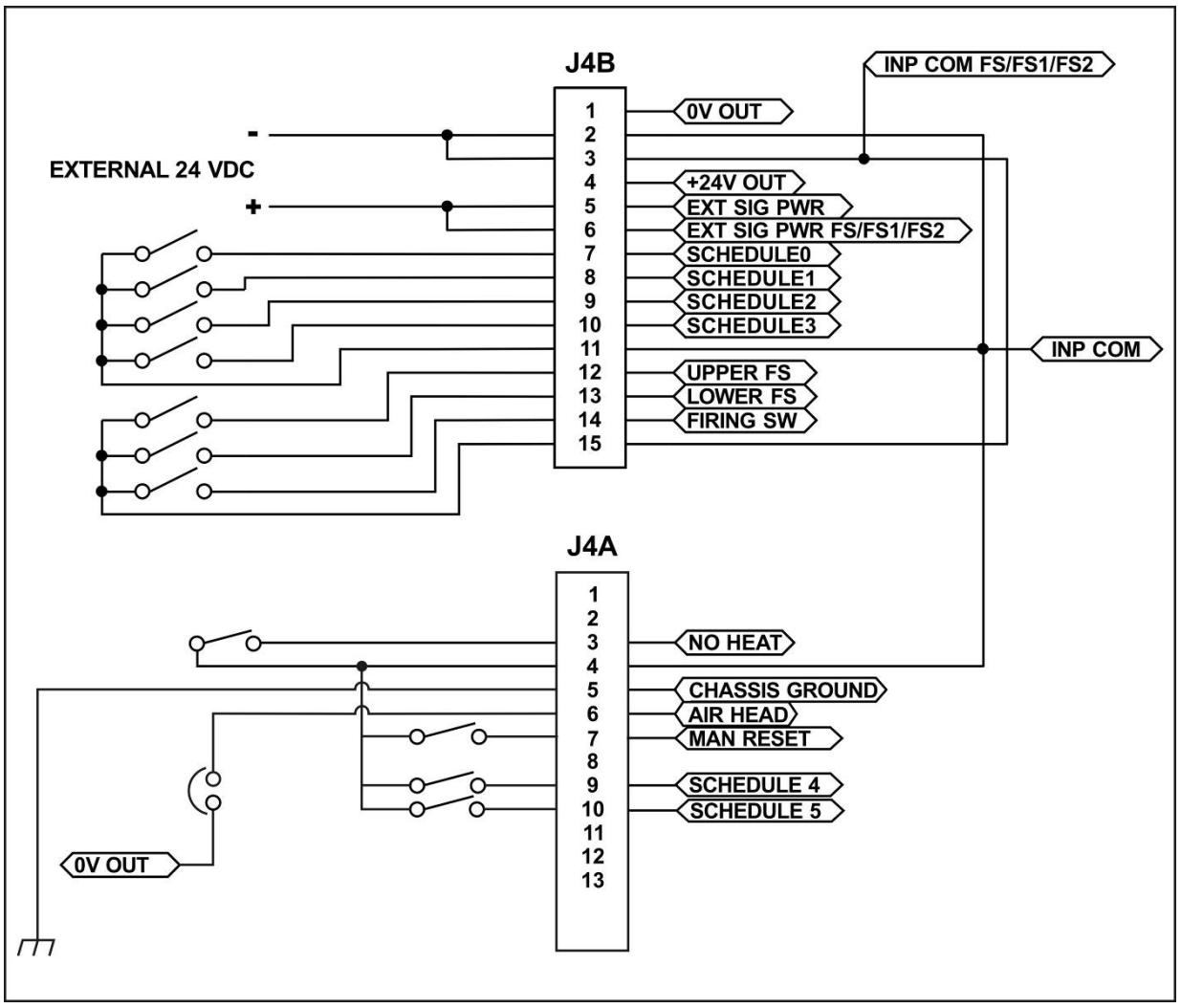
(5) Switch Contact Input (External Power)



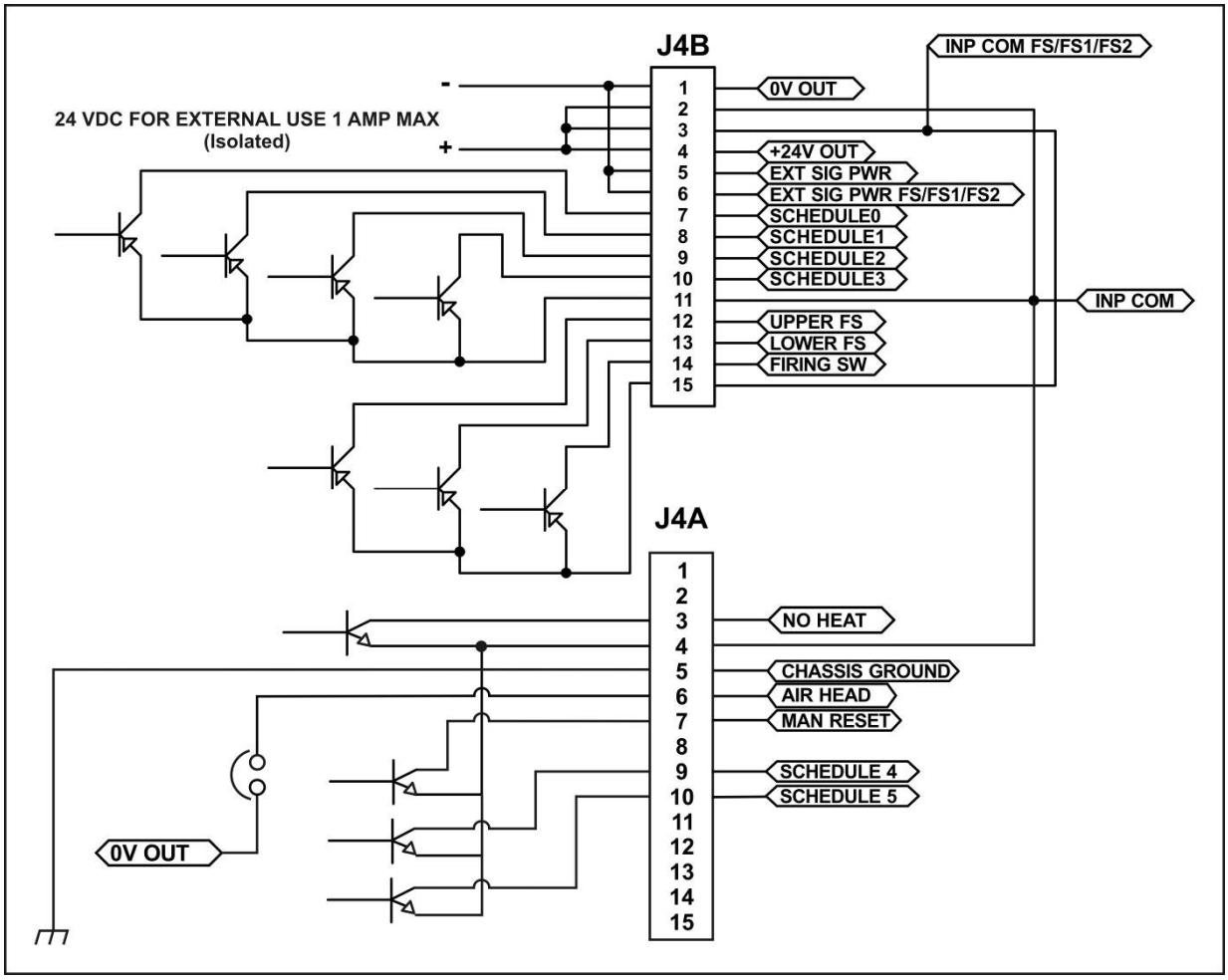
(6) Common Negative Input (Internal Power)



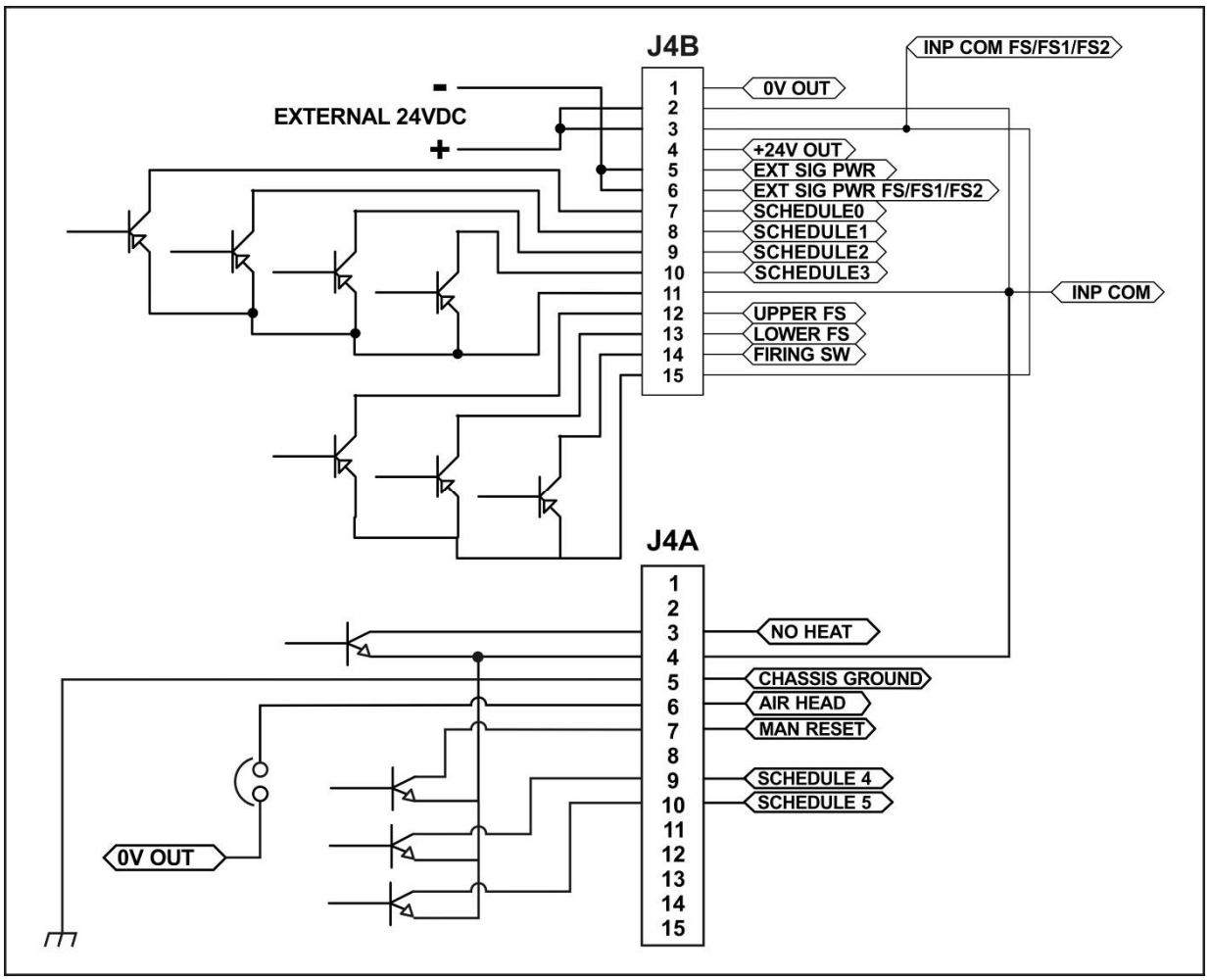
(7) Common Negative Input (External Power)



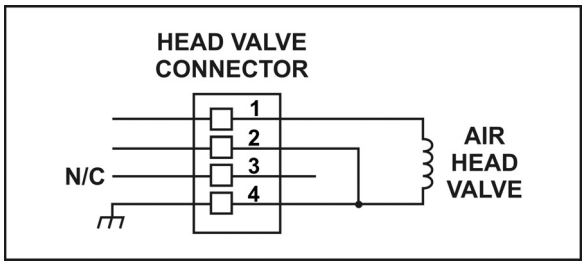
(8) Common Positive Input (Internal Power)



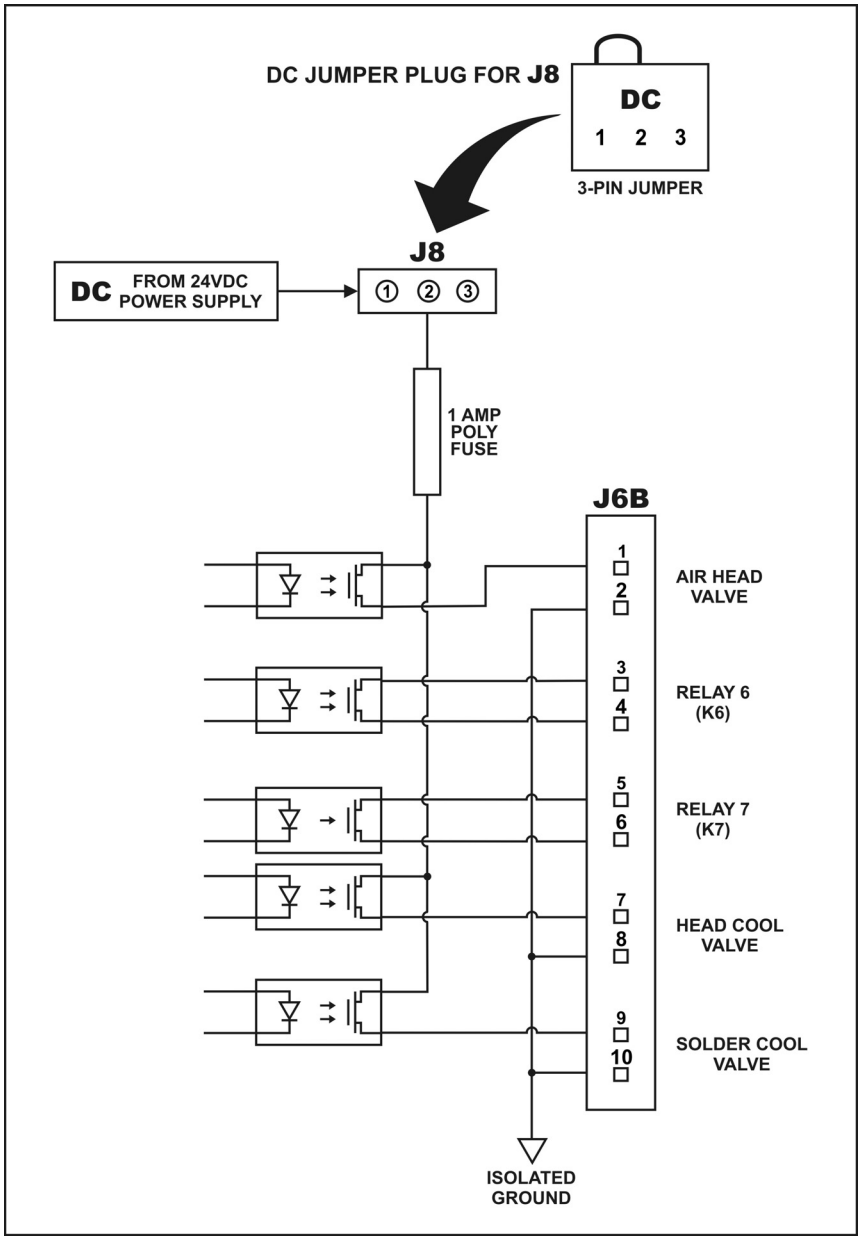
(9) Common Positive Input (External Power)



(10) Force Valve Drive Connections



(11) Valve Driver Outputs and Relays 6 and 7



Relay 6 and 7 Rating and Configuration Refer to Relay ratings and configuration information on the next page.

Valve Driver Output Rating and Configuration

Output Rating: ·····24 V DC, 0.3 A

Output Voltage Selection:·····24 V DC only

NOTES:

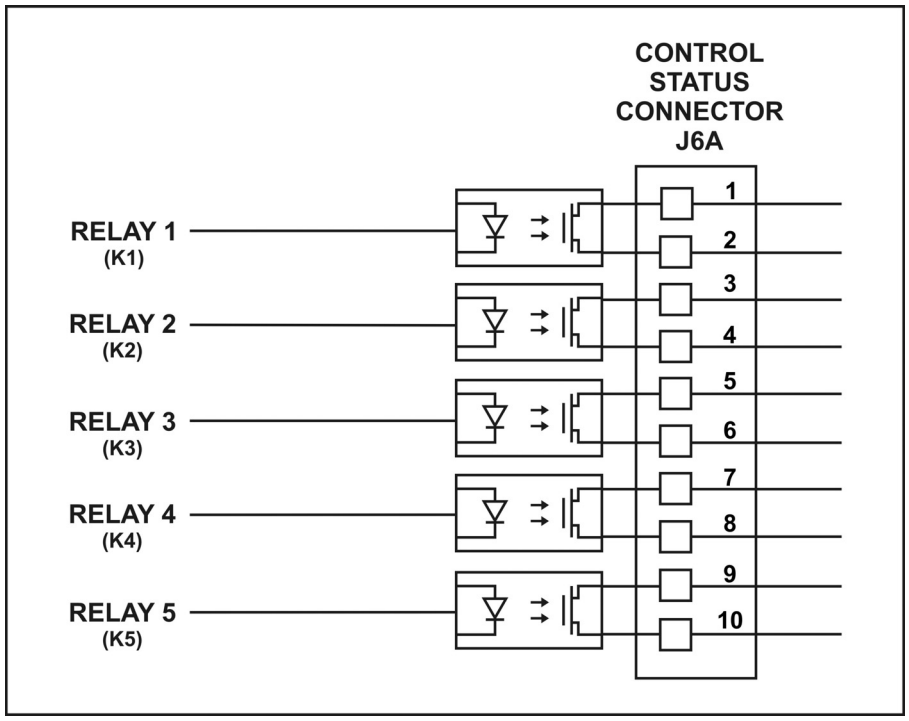
- For **AIR HEAD VALVE** operation either (1) jumper **HEAD VALVE CONNECTOR** pin 2 and pin 4 or (2) jumper **J4A** pin 6 (**AIR HEAD**) to **VALVE DRIVER COMMON** or <**0V OUT**> (see **J4A/B** pin out)
- If using connection configuration **SWITCH CONTACT INPUT (INTERNAL POWER)** or **COMMON NEGATIVE INPUT (INTERNAL POWER**), J4A pin 4 is <**0V OUT**>.

Timing: The force valve actuates when the first level of the foot switch is closed. It automatically de-activates when the **COOL1** temperature is reached if there is not a Postheat process cycle, or after the Head Up Delay if there is a Postheat process cycle, or in the event of a reflow alarm.

The head cool valve is user-programmable to be ON or OFF. It is independent of the reflow process cycle. It is used to prevent the thermocouple holder from overheating.

The solder cool valve is user-programmable to be ON or OFF. If the Profile does not have a Postheat process cycle, selecting **ON** will activate the solder cool valve starting at the end of the **Reflow** period and de-activating when the thermode reaches either the **COOL1, PREHEAT, or BASE** temperature which ever is lower. If the Profile does have a Postheat process cycle, selecting **ON** will activate the solder cool valve starting at the end of the Reflow period and de-activate the valve when the thermode reaches the COOL1 temperature. The solder cool valve will also activate at the end of **POSTHEAT** and de-activate when the thermode temperature reaches either the **COOL2, PREHEAT, r BASE** temperature which ever is lower. The solder cool valve is used to cool the hot thermode quicker.

(12) Alarm/Status Relays Connections For Relays 1 to 5



NOTE: See Connector **J6B** for **Relays 6** and **7**. The following relay rating applies to all **Relays 1** through **7**.

Relay Rating: ····· 30 V AC or 30 V DC at 0.5 Amps

User Programmable Options for Relay States:

System Ready ····· On/Off when Controller is ready for reflow operation

Heat On ····· On/Off during baseheat, rise1, preheat,rise2, reflow and postheat process cycle

Head Is Up ····· On/Off when head is retracted

Alarm ····· On/Off for any alarm condition

Out of Limit ····· On/Off for any out of limit condition

Clean Thermode ····· On/Off when clean thermode counter expires

Replace Thermode ····· On/Off when replace thermode counter expires

Idle ····· On/Off if idle temperature On

Baseheat ····· On/Off during baseheat process cycle

Rise1 ····· On/Off when 50% of the programmed Rise1 time has elapsed. At the end of the programmed Rise1 time, the relay will switch back to Off/On

Preheat On·····On/Off during preheat process cycle

Rise2·····On/Off when 50% of the programmed Rise2 time has elapsed. At the end of the programmed Rise2 time, the relay will switch back to Off/On

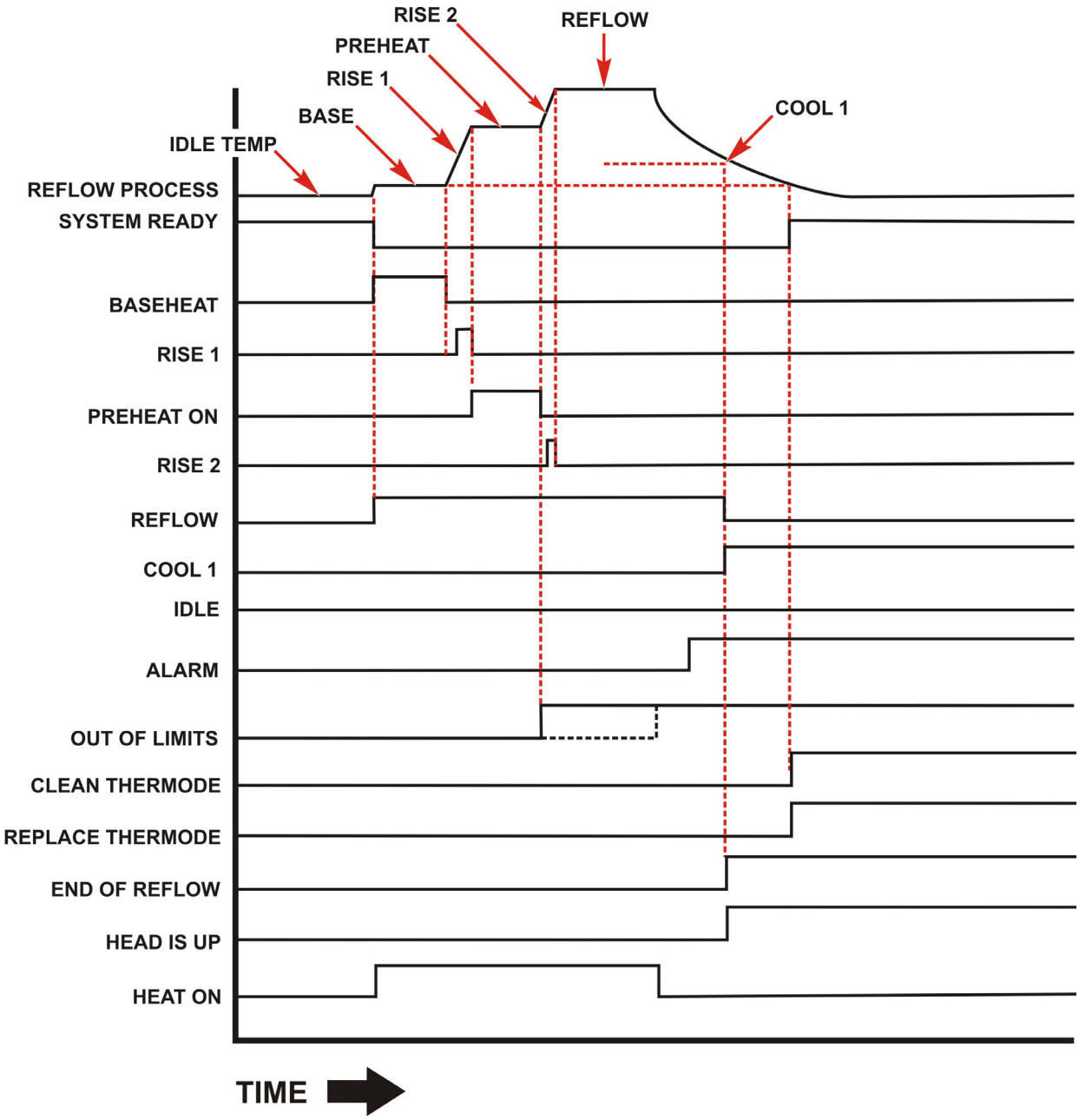
Reflow·····On/Off from start of heating to COOL1 if no Postheat cycle otherwise COOL2

Cool1·····On/Off when the COOL1 temperature is reached

Cycle Pwr Alarm·····On/Off for “cycle power“ alarm conditions

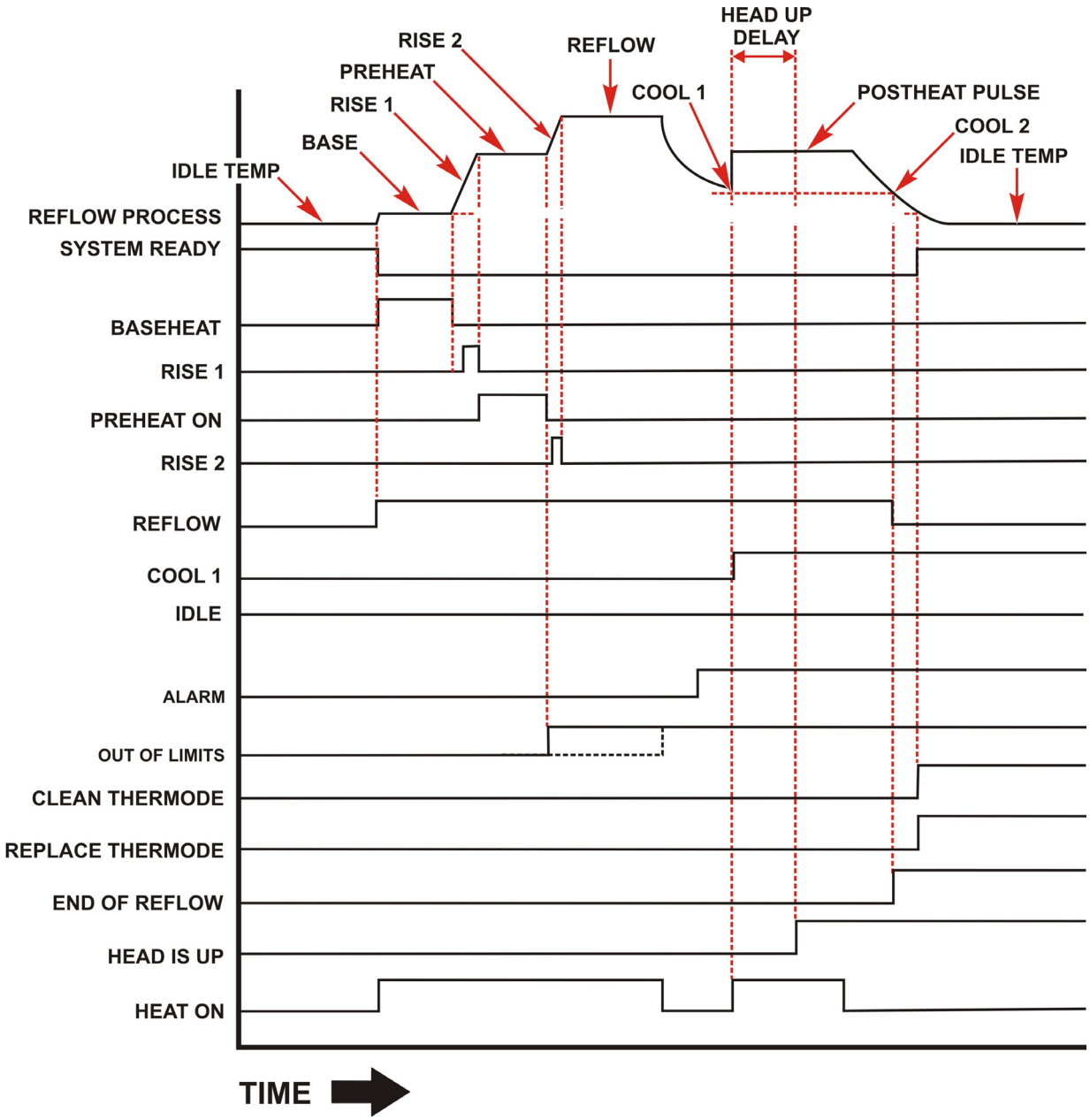
Not Active: The relay is not active.

(13) Relay State Timing (without Postheat Process Cycle)



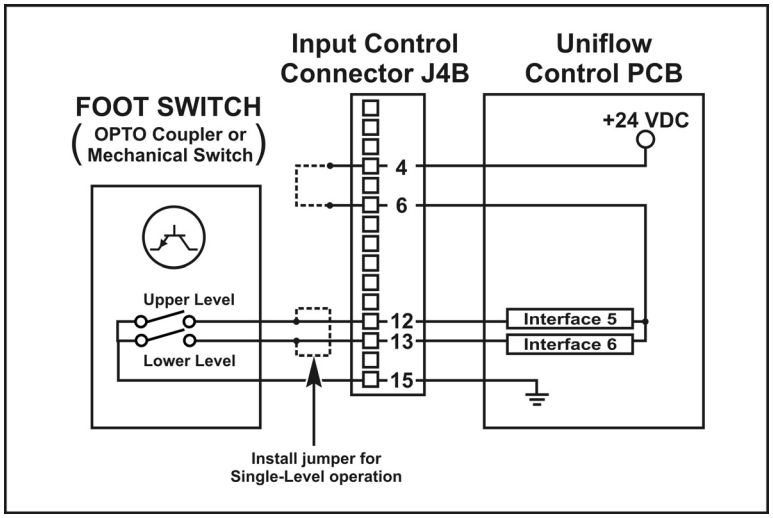
NOTE: If any out of limits conditions occur, the **Out of Limits** relay state updates at the end of **Preheat** and the end of **Reflow**.

(14) Relay State Timing (with Postheat Process Cycle)



NOTE: If any out of limits conditions occur, the **Out of Limits** relay state updates at the end of **Preheat** and the end of **Reflow**.

(15) Remote Selection with Switches or Opto-Couplers



Foot Switch Inputs: You may use either a 1-level or 2-level foot switch with the Control. When using a 1-level foot switch, you must jumper the two-level inputs together so that the two levels operate as an OR-function, as shown in the Figure above.

When using a 2-level foot switch, when the first level closes, the Control energizes the air-actuated head. The thermode descends and applies force to the work pieces. If you release the foot switch before pressing it to the second level, the Control will automatically return the thermode to the home position so that you may reposition the work pieces.

If you do not release the foot switch and proceed to the second level, the force firing switch in the head will close. Heating current will flow, and the Control will return the thermode to the home position following the heating cycle.

Connect the FS2L or FS1L, a double-pole single-throw reed relay, or the open collectors of opto-couplers to Input Control Connector J4B. If using opto-couplers, connect the emitters to Pin 15 of J4B (INPUT COM FS/FS1/FS2).

NO HEAT Input: The NO HEAT input is the remote equivalent of the front panel HEAT/NO HEAT switch, as described in *Chapter 2, Description*.

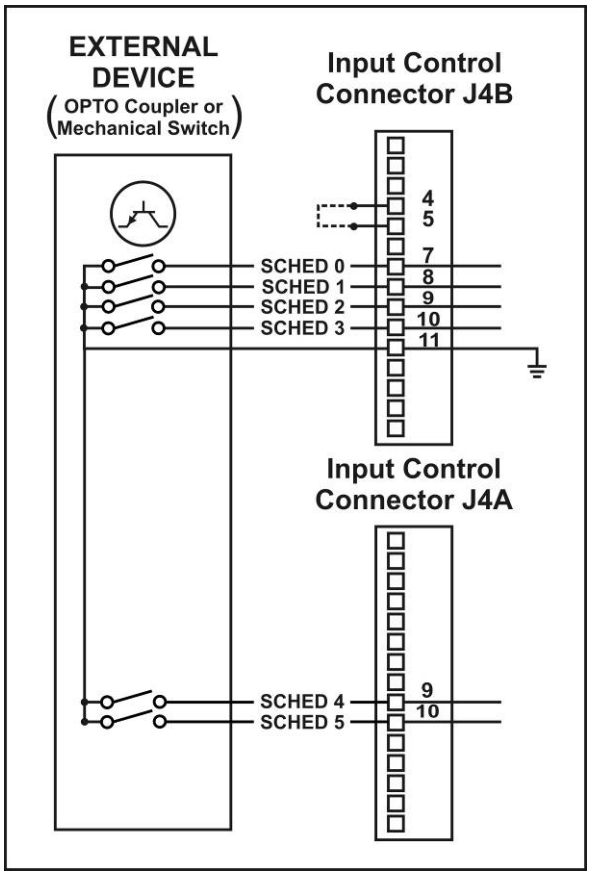
(16) Automation Control Inputs Connections

Input Signal: ····· 0 or 24 V DC

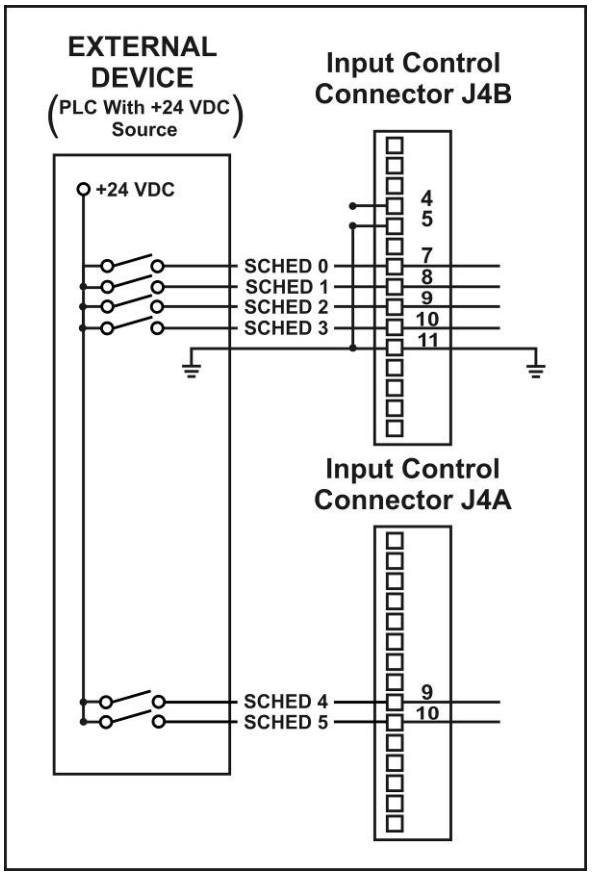
Remote Profile Inputs: All Profiles must be entered and saved in the Control memory locally (from the Front Panel). Once they are saved, they can be recalled prior to initiating the Reflow process by placing a binary value on the six SCHED lines. This may be done with an external PLC (Programmed Logic Controller) or host computer. When all of the SCHED Inputs are inactive (000000), the Profile Number (1-63) can be selected from the Front Panel. When any of the SCHED Inputs are active the Profile Number Keys on the Front Panel become disabled and the Profile Number is selected through the Profile Remote Inputs, SCHED 0, SCHED 1, SCHED 2, SCHED 3, SCHED 4 and SCHED 5. The Profile Number Zero (0) is not a displayable selection.

Remote Profile Inputs Binary Profile						
Profile Number	SCHED 0 J4B Pin 7	SCHED 1 J4B Pin 8	SCHED 2 J4B Pin 9	SCHED 3 J4B Pin 10	SCHED 4 J4A Pin 9	SCHED 5 J4A Pin 10
0	0	0	0	0	0	0
1	1	0	0	0	0	0
2	0	1	0	0	0	0
3	1	1	0	0	0	0
4	0	0	1	0	0	0
5-62	Binary progression from 5 to 62					
63	1	1	1	1	1	1

You may use mechanical switches, opto couplers, or a PLC for remote profile selection.

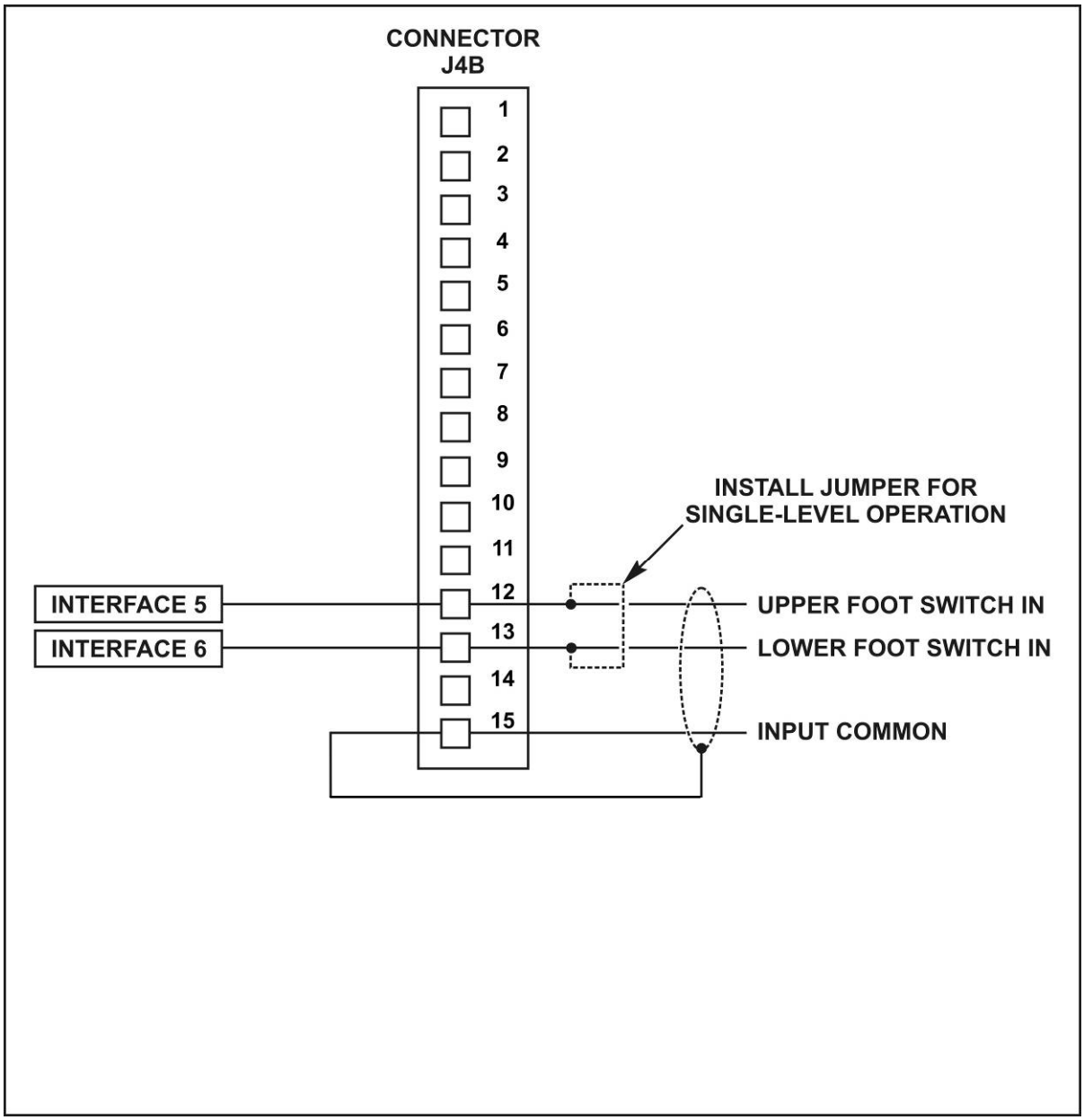


Remote Profile Selection with Switches or Opto-Couplers



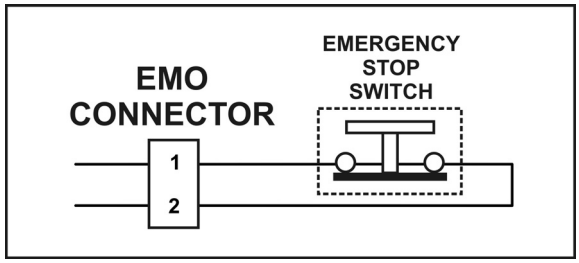
Remote Profile Selection with PLC

(17) Operator Initiation Switch and Firing Switch Inputs



Input Signal: ····· 0 or 24 V DC

(18) EMERGENCY STOP Input

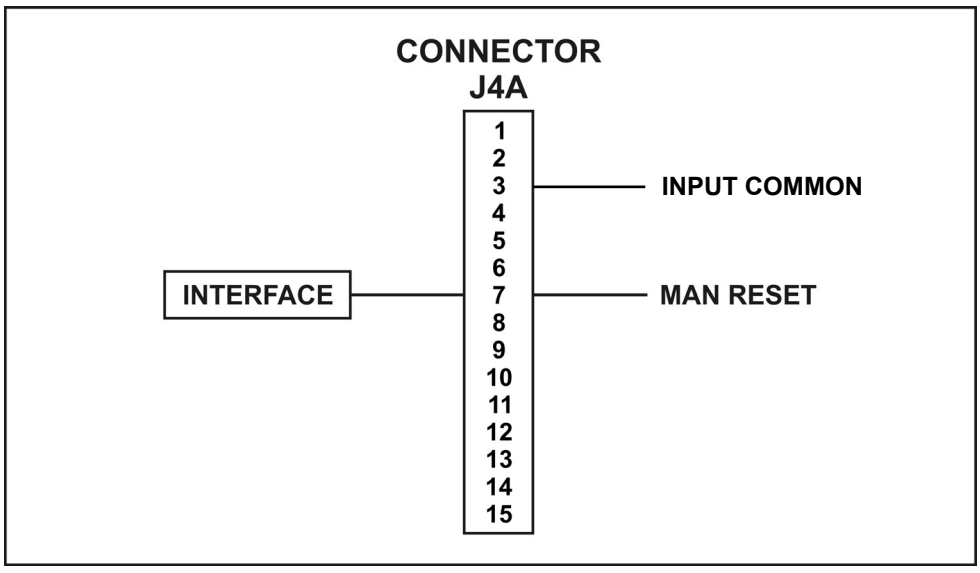


Switch Rating: ····· **48** V DC at 2 Amps minimum

Type of Switch: ····· Normally closed pushbutton

Timing: ····· When the **EMERGENCY STOP** switch is pressed, it removes 24-volt power from the reflow head, causing it to retract immediately.

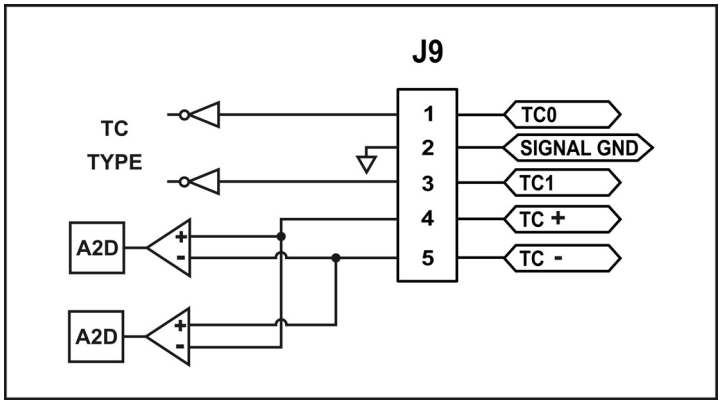
(19) Manual Alarm Reset



Input Signal: ····· 0 to 24 V DC

Timing: ····· By applying a signal at J4A-7, a PLC or external computer can readily reset all alarms and out of limits conditions before proceeding with the next reflow process.

(20) Main Thermocouple Input Connector (J9)



Thermocouple wires are to be connected to pins 4 and 5 on Connector **J9**.

	Polarity	Type “E”	Type “J”	Type “K”
J9 - Pin 4	(+)	Chromel (purple)	Iron (white)	Chromel (yellow)
J9 - Pin 5	(-)	Constantan (red)	Constantan (red)	Almel (red)

CAUTION

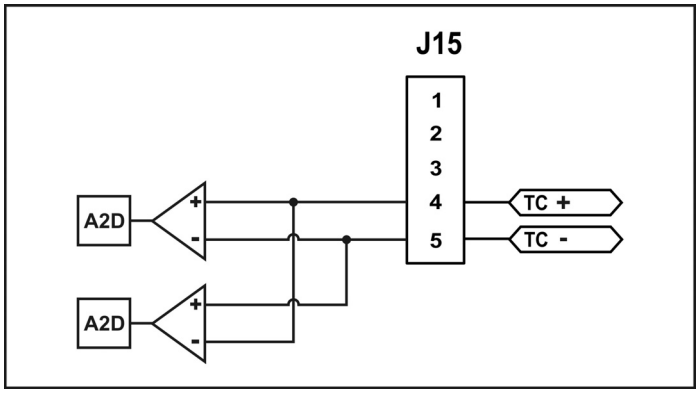
Incorrect wiring of the main thermocouple may cause damage to thermode.

If the main thermocouple is not wired correctly on Pins 4 and 5 of J9 or the thermocouple is damaged, the temperature displayed for the main thermocouple may slowly decrease as the Control applies heat to the thermode during a process. This may cause an error message or may damage the thermode due to overheating.

Pins 1, 2, and 3 on connector J9 are jumpered to inform the Control of the type of thermocouple used for both the Main and Auxiliary thermocouples. Both thermocouples must be of the same type. Pins 1, 2, and 3 are to be jumpered according to the configurations listed in the following table.

Thermocouple Type	Configuration
Type “E”	No Jumpers on J9
Type “J”	Jumper Pins **J9-1** and **J9-2** together. **J9-3** to be unconnected.
Type “K”	Jumper Pins **J9-2** and **J9-3** together. **J9-1** to be unconnected.

(21) Auxiliary Thermocouple Input Connector (J15)

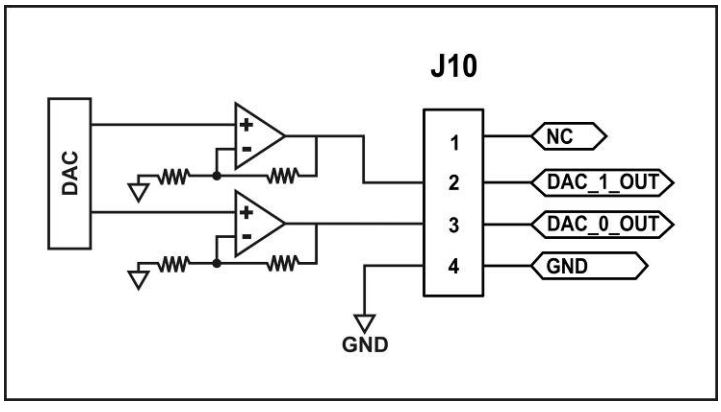


Thermocouple wires are to be connected to pins 4 and 5 on Connector **J15**. ***No*** connections are to be made to pins 1, 2 and 3 on connector **J15**. Refer to the instructions in this chapter for connector **J9** to set the thermocouple type for the auxiliary thermocouple.

	Polarity	Type "E"	Type "J"	Type "K"
J15 - Pin 4	(+)	Chromel (purple)	Iron (white)	Chromel (yellow)
J15 - Pin 5	(-)	Constantan (red)	Constantan (red)	Almel (red)

If the auxiliary thermocouple is not wired correctly on Pins 4 and 5 of J15 or the thermocouple is damaged, there will not be any error message on the Control and the temperature displayed will remain at approximately ambient room temperature.

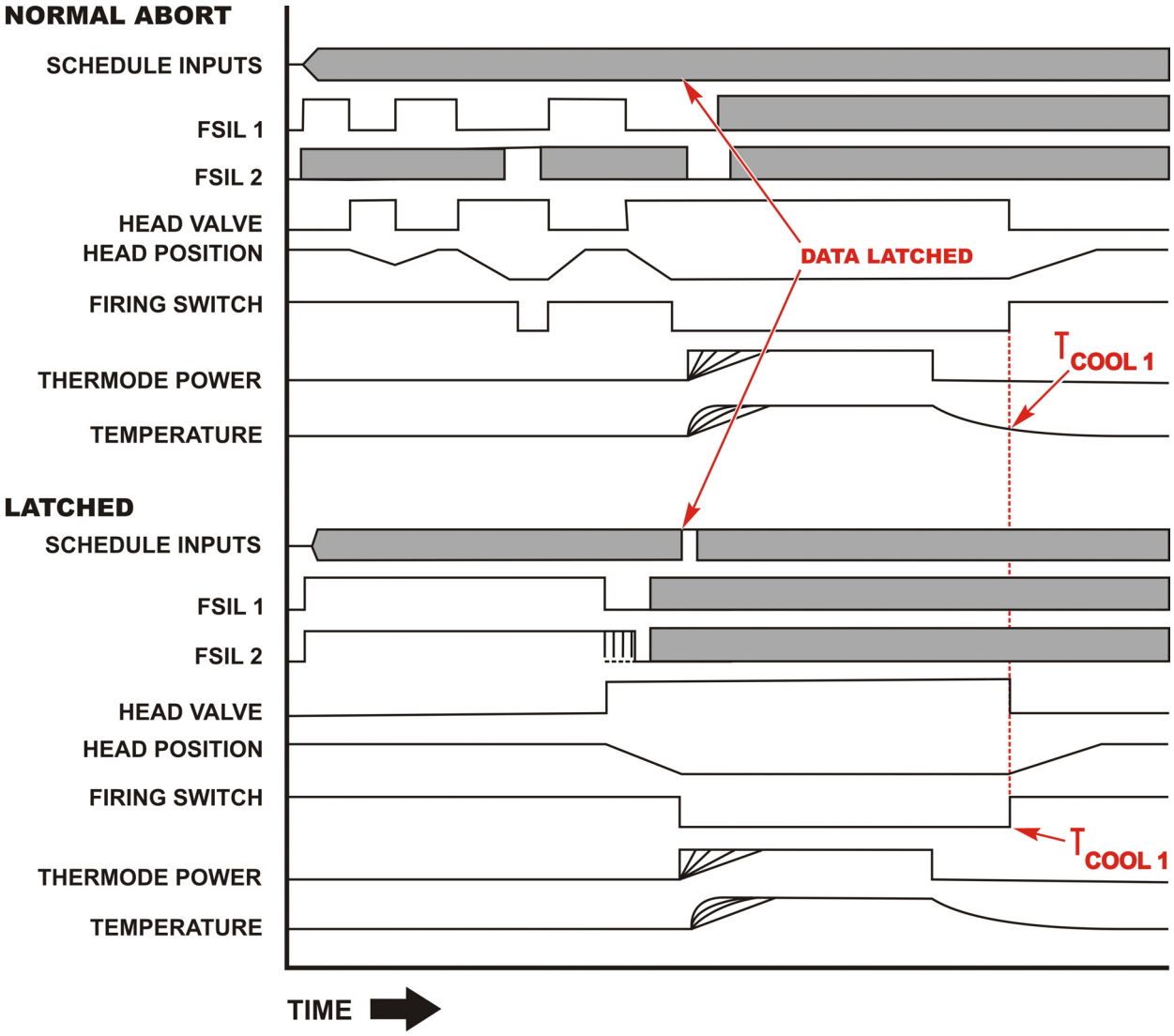
(22) Temperature Analog Output Connector (J10)



Connector **J10** provides analog output signals proportional to the temperatures of the **Main** and **Auxiliary** thermocouples. The temperature of the **Main** thermocouple is present on **J10** Pin 3. The temperature of the **Auxiliary** thermocouple is present on **J10** Pin 2.

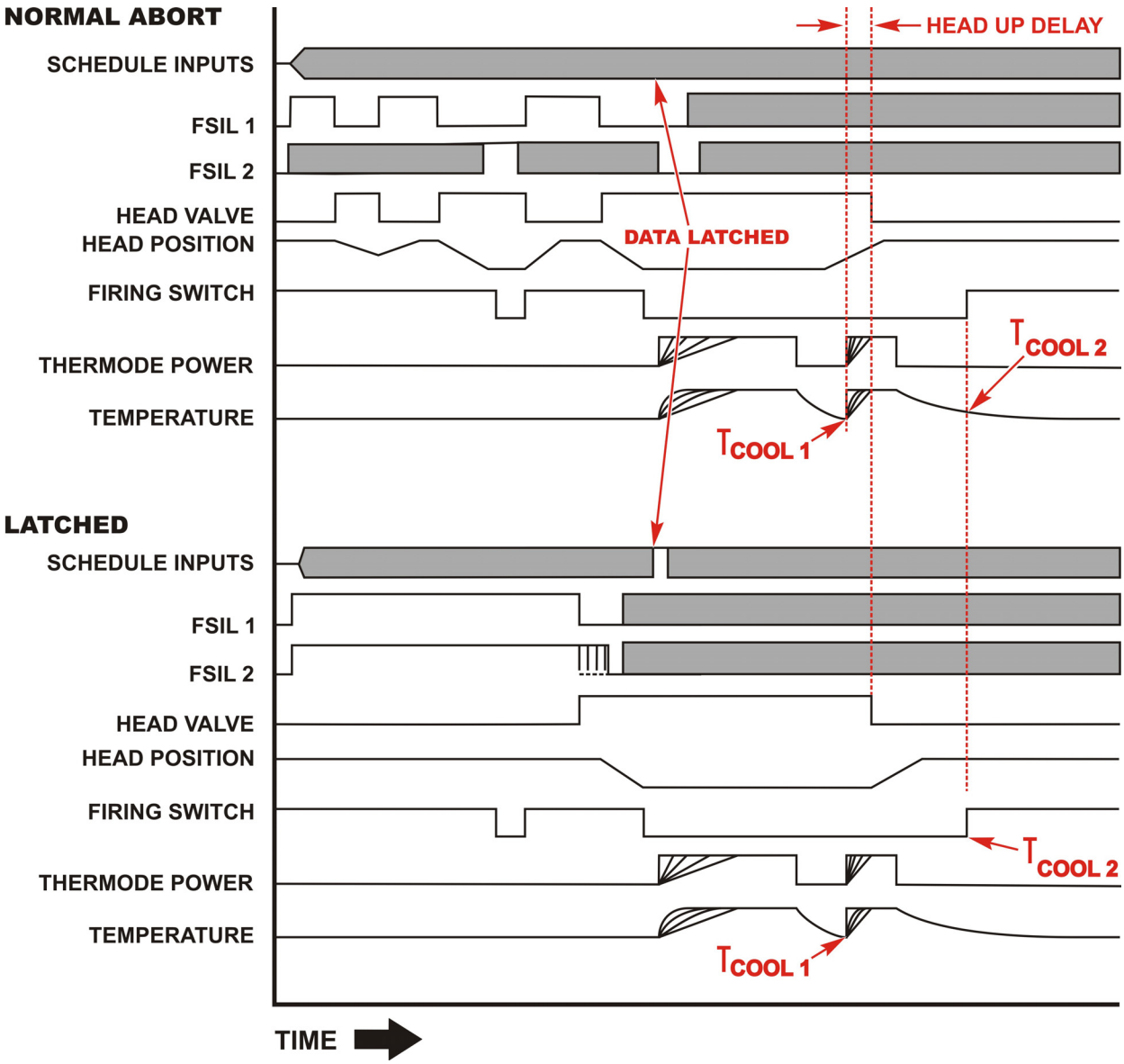
10. System Timing

(1) No Post-Heat Pulse



T_{COOL1} = Cool1 Temperature Setpoint

(2) Process With Post-Heat Pulse



T_{COOL2} = Cool2 Temperature Setpoint

11. Communication Codes

I. Command Format

Default settings:

Baud Rate is adjustable at 9600, 19.2k, and 38.4k Baud, 8 Data bits (fixed), 1 Stop (fixed), No Parity (fixed).

II. Control Communication Codes

(1) RS-232 and RS-485 Communication Protocol

Each command will be formatted as follows:

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

(2) Definition of Command Elements

<soh>	1 BYTE	The data packet will start the transmission with a **SOH** (start of header **0x01**) character.
<@>	2 BYTES	This is a two figure number ("**01**" - "**31**") denoting the address of the Control. Note: This is the **RS-485** unit address.
<cmd>	2 BYTES	This is a two character string denoting the command (i.e. "**SR**"). For commands, refer to the command set on page 11-5 and after.
<cnt>	3 BYTES	This is a data size of packet to follow. The range is "**000**" - "**999**" and be sure to set it with a three figure number, for example, "000" for 0 bytes and "001" for 1 byte. For the data size of each command, refer to the command set on page 11-5 and after.
<data>	n BYTES	This is optional data used when a parameter is individually set in each command. When there are two or more settings, parameters are separated by a comma. For the presence or absence of parameter and its contents, refer to the command set on page 11-5 and after.
<cksum>	2 BYTES	This is a two character HEX calculated from the sum of all bytes except <soh>, <cksum>, and <eot> and then masked with 255 (0xFF).
<eot>	1 BYTE	The data packet terminates the transmission (End transmit **0x04**).

EXAMPLES:

1) An example of sending a TYPE command to the Control.

The command is <soh>01TY0009E<eot>.

The Control's address <@>: "01" (default)

The command <cmd>: "TY"

The total number of data bytes <cnt>: "000"

The check sum <cksum> is "9E". Which is calculated from the ASCII (American Standard code for information interchange) and is a two character ASCII HEX string calculated from the sum of all bytes except <soh>, <cksum>, and <eot>.

'0' + '1' + 'T' + 'Y' + '0' + '0' + '0'

Looking up the value for each character, we get 0x30 + 0x31 + 0x54 + 0x59 + 0x30 + 0x30 + 0x30 = 0x19E HEX. ANDed with 0xFF is 9E.

2) Now we wish to change the profile we are on to number 5.

The command would be <soh>01LS00205F7<eot>.

"01" is the Control address <@>, "LS" is the command <cmd>, "002" is the total number of data bytes <cnt>, "05" is the new profile to go to <data>, and "F7" is the check sum <cksum>.

'0' + '1' + 'L' + 'S' + '0' + '0' + '2' + '0' + '5'

Calculating the checksum in HEX, we get 0x30 + 0x31 + 0x4C + 0x53 + 0x30 + 0x30 + 0x32 + 0x30 + 0x35 = 0x1F7 HEX. ANDed with 0xFF is F7.

3) We wish to set the security.

The command is <soh>01SS0131234321,1,0,112<eot>.

"01" is the Control address <@>. "SS" is the set security command. "013" is the total number of data bytes. "1234321,1,0,1" is the input data <data> ("1234321," is the password. "1," is Profile lock ON. "0," is System lock OFF. "1" is Profile Tune Lock ON.) And "11" is the check sum <cksum>.

'0' + '1' + 'S + 'S' + '0' + '1" + '3' + '1' + '2' + '3' + '4' + '3' + '2' + '1' + ',' + '1' + ',' + '0' + ',' + '1'

Calculating the checksum including ', (comma)' in HEX, we get 0x30 + 0x31 + 0x53 + 0x53 + 0x30 + 0x31 + 0x33 + 0x31 + 0x32 + 0x33 + 0x34 + 0x33 + 0x32 + 0x31 + 0x2C + 0x31 + 0x2C + 0x30 + 0x2C + 0x31 = 0x411 HEX. ANDed with 0xFF is 11.

(3) Response to Errors or Unsupported Commands

The Control will respond to the receipt of incorrect transmitted data with a NAK command under the following conditions.

The format of the NAK command string is:

<soh> <@> “NK” “001” <nak value> <cksum> <eot>.

Where <nak value> is: '1' NO <soh >.

‘2’ BAD checksum.

‘3’ Unrecognized command.

‘4’ Timeout.

‘6’ Data Bad.

Example:

<soh>01NK0012BD<eot>

01: Control’s address

NK: Fixed phrase of NAK response

001: Fixed phrase of NAK response

2: Contents of NAK response (‘2’ BAD checksum.)

BD: Checksum

Therefore, the above example means that you issued an incorrect checksum to the Control 01.

When you issue a command to the Control, you need to wait about 250 ms before you issue the next command. The answer timeout is set to about 250 ms in case the Control doesn’t respond to a command.

More than one NAK response will be replied if there is more than one problem in a message.

Error checking at the unit is as follows:

1. If the Control receives an RS-485 address that does not match the unit’s address, the command is ignored. There is no NAK response.
2. The Control will ignore a command that does not end with an <eot> or one that does not have the correct number of data bytes specified in the message. The Control will return a Nak #4.
3. If the Control reflows during reception or transmission of a command there is a possibility that bytes may be missed or the message truncated.
4. Unsupported commands will return a Nak #3.
5. Incorrect checksums will return a Nak #2.
6. If the Control is dropping incoming characters, the Control may return either a Nak #1, #2 or #4 depending on which character was dropped.

7.When the temperature data in the DS command is set to ‘0’, or any of the data is out of range, the Control will return a Nak #6.

Suggested error checking procedure on the external host side of the interface:

1.For a host “read” command, e.g. DR (read profile data), the host must timeout if the unit does not send a complete response within a reasonable amount of time. Host can also compare the number of bytes received against the expected number for that message, range check the received data, or do whatever else is thought necessary to have confidence in the received data.

2.Following a host “set” command, the host must subsequently read the data just “set” and make sure the data “set” matches data “read.” For example, if a “set profile 1” command is sent, the unit must then do a “read profile 1” and compare the set data against the read data.

Significance of the Control’s COMMUNICATION ROLE Parameter on the COMMUNICATION Screen:

1.This COMMUNICATION ROLE parameter must be set to **MASTER** under normal running conditions to turn on the “Read Report” command which sends the results of the latest reflow to the host automatically.

2.When the parameter is set to **SLAVE**, this automatic sending function will be turned off and the unit can accept both “Read” and “Set” from the host.

3.When **MASTER**, the unit will not accept any commands from the host. This avoids potential collisions between these commands and the automatic reporting of reflow results.

4.**MASTER** or **SLAVE** must be set at the Control panel by pressing the SETUP key, selecting option 2: COMMUNICATIONS, and then selecting option 1: COMMUNICATION ROLE.

Significance of the Control’s RS232/485 SELECT Parameter on the COMMUNICATION Screen:

1.**RS-232** and **RS-485** are mutually exclusive. One ***or*** the other is selected at the COMMUNICATION screen.

2.The serial link to the host computer should be plugged into the proper socket on the back of the Control. If **RS-232** is the selection, this socket would be labeled **RS 232**. Likewise, if **RS-485** is selected, the serial link to the host should be plugged into the socket labeled **RS 485**.

NOTES:

RS-232: RS-232 will work even if RS-485 is selected and even if the serial link is plugged into the RS 485 socket. The reverse is ***not*** true, however.

RS-485: RS-485 will work ***only*** if selected and the link plugged into the correct socket. For consistency and clarity, please follow the guidelines in 1 and 2 above.

Host Originated Command Set (Send)

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

NAME	COMMAND	TYPE	DATA	SIZE
COPY	CP	Set	Copy Source Profile # (Range: 01 – 63)	2 Bytes
			,	1 Byte
			Copy Destination Profile # (Range: 01 – 63)	2 Bytes
			Total	5 Bytes

COUNTER	CR	Read	Read the Counters Data	0 Bytes
	CS	Set	Total Usage Counter start value (Range: 0000000 – 9999999)	7 Bytes
			,	1 Byte
			Good Reflow Counter start value (Range: 0000000 – 9999999)	7 Bytes
			,	1 Byte
			Clean Counter (Range: 000000 – 999999)	6 Bytes
			,	1 Byte
			Replace Counter (Range: 000000 – 999999)	6 Bytes
			,	1 Byte
			Clean Counter ON/OFF status (0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Replace Counter ON/OFF status (0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Clean counter action (0 – 1) 0 = STOP 1 = CONTINUE	1 Byte
			,	1 Byte
			Replace counter action (0 – 1) 0 = STOP 1 = CONTINUE	1 Byte
			Total	37 Bytes

LOAD	LS	Set	The profile # to become active (Range: 01 – 63)	2 Bytes
	LR	Read	Returns the current active profile	0 Bytes

MONITOR	MR	Read	Read System State	0 Bytes
	MS	Set	Active screen number (Range: 000 – 131) 000 = Reserved 001 = Reserved 002 = Reserved 003 = BAUD RATE Screen 004 = BUZZER LOUDNESS Screen 005 = CLEAN COUNTER 006 = CLEAN COUNTER SETUP Screen 007 = COARSE HEATING RATE Screen 008 = RS485 ID NUMBER Screen 009 = COMMNICATION Screen 010 = COPY PROFILE Screen 011 = COPY PROFILE Screen 2 012 = COPYRIGHT Screen 013 = DATA Screen 014 = RESET TO DEFAULTS MENU Screen 015 = SET FINE HEATING RATE Screen 016 = LINE FREQUENCY DETECTION 017 = GOOD REFLOW COUNTER 018 = GRAPH Screen 019 = HARDWARE SETUP Screen 020 = Reserved 021 = Reserved 022 = Reserved 023 = AUTO RECOGNIZED HARDWARE Screen 024 = Reserved 025 = Reserved 026 = Reserved 027 = Reserved 028 = Reserved 029 = Reserved 030 = LOWER TEMP 031 = MANUAL TUNING Screen 032 = MAX TEMPERATURE LIMIT Screen	3 Bytes

033 = CHANGE PASSWORD Screen
034 = Reserved
035 = Reserved
036 = Reserved
037 = REFLOW TEMPERATURE SETUP Screen
038 = Reserved
039 = REFLOW COUNTERS Screen
040 = RELAY Screen
041 = RELAY 1 Screen
042 = RELAY 2 Screen
043 = RELAY 3 Screen
044 = RELAY 4 Screen
045 = RELAY 1 Status Option Screen 1/2
046 = RELAY 2 Status Option Screen 1/2
047 = RELAY 3 Status Option Screen 1/2
048 = RELAY 4 Status Option Screen 1/2
049 = SET RELEASE TIMER Screen
050 = EDIT REPLACE COUNTER
051 = REPLACE COUNTER SETUP Screen
052 = SYSTEM DEFAULTS SET Screen
053 = SET SAFETY TIMER Screen
054 = SETUP MENU Screen
055 = Reserved
056 = SYSTEM SECURITY Screen
057 = Reserved
058 = Reserved
059 = TOTAL USAGE COUNTER
060 = Reserved
061 = IDLE TEMPERATURE
062 = LANGUAGE Screen
063 = HEAD UP DELAY
064 = SCHEDULE SETUP, page 1 of 5
065 = SCHEDULE SETUP, page 2 of 5
066 = Reserved
067 = PREHEAT PEAK TIME DELAY
068 = PREHEAT AVG TIME DELAY
069 = PREHEAT PEAK HI TEMP LIMIT
070 = PREHEAT PEAK LO TEMP LIMIT
071 = PREHEAT AVG HI TEMP LIMIT
072 = PREHEAT AVG LO TEMP LIMIT
073 = REFLOW PEAK HI TEMP LIMIT
074 = REFLOW PEAK LO TEMP LIMIT
075 = REFLOW AVG HI TEMP LIMIT
076 = REFLOW AVG LO TEMP LIMIT
077 = ENV_PREHEAT HI TEMP LIMIT
078 = ENV_PREHEAT LO TEMP LIMIT
079 = ENV_REFLOW HI TEMP LIMIT
080 = ENV_REFLOW LO TEMP LIMIT
081 = ENV_RISE1 TIME DELAY
082 = ENV_RISE2 TIME DELAY
083 = GRAPH TIME SPAN
084 = Reserved
085 = REFERENCE TEXT
086 = I/O STATUS Screen
087 = RELAY 5 Screen
088 = RELAY 6 Screen
089 = RELAY 7 Screen
090 = RELAY 5 Status Option Screen 1/2
091 = RELAY 6 Status Option Screen 1/2
092 = RELAY 7 Status Option Screen 1/2
093 = RELAY 1 Status Option Screen 2/2
094 = RELAY 2 Status Option Screen 2/2
095 = RELAY 3 Status Option Screen 2/2
096 = RELAY 4 Status Option Screen 2/2
097 = RELAY 5 Status Option Screen 2/2
098 = RELAY 6 Status Option Screen 2/2
099 = RELAY 7 Status Option Screen 2/2
100 = SCHEDULE SETUP, page 3 of 5
101 = SCHEDULE SETUP, page 4 of 5
102 = SCHEDULE SETUP, page 5 of 5
103 = AUX) PREHEAT PEAK TIME DELAY
104 = AUX) PREHEAT AVG TIME DELAY
105 = AUX) PREHEAT PEAK HI TEMP
106 = AUX) PREHEAT PEAK LO TEMP
107 = AUX) PREHEAT AVG HI TEMP
108 = AUX) PREHEAT AVG LO TEMP
109 = AUX) REFLOW PEAK HI TEMP

			110 = AUX) REFLOW PEAK LO TEMP 111 = AUX) REFLOW AVG HI TEMP 112 = AUX) REFLOW AVG LO TEMP 113 = AUX) ENV_PREHEAT HI TEMP 114 = AUX) ENV_PREHEAT LO TEMP 115 = AUX) ENV_REFLOW HI TEMP 116 = AUX) ENV_REFLOW LO TEMP 117 = MAX AUX TEMPERATURE LIMIT 118 = MAX IDLE TEMPERATURE LIMIT 119 = PREHEAT TEMPERATURE DELTA 120 = REFLOW TEMPERATURE DELTA 121 = PID CONTROL 122 = AUX START TEMPERATURE 123 = AUX PREHEAT TEMPERATURE 124 = AUX REFLOW TEMPERATURE 125 = SOLDER COOL VALVE DELAY 126 = Reserved 127 = Reserved 128 = Reserved 129 = Reserved 130 = Reserved 131 = Reserved	
			Total	3 Bytes

PROFILE	DR	Read	Read Conditions of the Specified Profile # (Range: 01 – 63)	2 Bytes
	DS	Set	Set Conditions of the Specified Profile # (Range: 01 – 63)	2 Bytes
			,	1 Byte
			Preheat Temp (Range: 060 – 500)	3 Bytes
			,	1 Byte
			Reflow Temp (Range: 060 – 600)	3 Bytes
			,	1 Byte
			Cool1 Temp (Range: 025 – 300)	3 Bytes
			,	1 Byte
			Preheat Time (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Rise2 Time (Range: 00 – 99)	2 Bytes
			,	1 Byte
			Reflow Time (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Base Temp (Range: 025 – 300)	3 Bytes
			,	1 Byte
			Postheat Temp (Range: 025 – 600)	3 Bytes
			,	1 Byte
			Cool2 Temp (Range: 025 – 300)	3 Bytes
			,	1 Byte
			Idle Temp (Range: 025 – 300)	3 Bytes
			,	1 Byte
			Base Time (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Postheat Time (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Rise1 Time (Range: 00 – 99)	2 Bytes
			,	1 Byte
			GRAPH Time Span (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Head Up Delay (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Schedule Reference (Range: All blank or 0000000000 – ZZZZZZZZZZ)	10 Bytes
			,	1 Byte
			Coarse Heating Rate (Range: 0 – 3) 0 = Very Slow 1 = Slow 2 = Medium 3 = Fast	1 Byte
			,	1 Byte
			Fine Heating Rate (Range: 00 – 99)	2 Bytes
			,	1 Byte
			Preheat Reflow Control (0 = TIME, 1 = TEMP)	1 Byte
			,	1 Byte
			Preheat Delta Temperature (Range: 00 – 99)	2 Bytes
			,	1 Byte
			Reflow Delta Temperature (Range: 00 – 99)	2 Bytes
			,	1 Byte
			PID Control (Range: 100 – 269)	3 Bytes

			,	1 Byte
			Solder Cool Valve Delay (Range: 00 – 99)	2 Bytes
			Total	91 Bytes

LIMITS	PR	Read	Read SCH SETUP Data of the Specified Profile # (Range: 01 – 63)	2 Bytes
	PS	Set	Set SCH SETUP Data of the Specified Profile # (Range: 01 – 63)	2 Bytes
			,	1 Byte
			Enable Peak and Average Limits (1 = ON, 0 = OFF)	1 Byte
			,	1 Byte
			Preheat Peak Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Preheat Peak Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Reflow Peak Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Reflow Peak Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Preheat Peak Delay (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Preheat Avg Delay (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Rise1 Envelope Delay (Range: 00 – 99)	2 Bytes
			,	1 Byte
			Rise2 Envelope Delay (Range: 00 – 99)	2 Bytes
			,	1 Byte
			Preheat Average Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Preheat Average Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Reflow Average HI Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Reflow Average Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Enable Preheat Envelope Limits (1 = ON, 0 = OFF)	1 Byte
			,	1 Byte
			Enable Reflow Envelope Limits (1 = ON, 0 = OFF)	1 Byte
			,	1 Byte
			Preheat Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Preheat Lower Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Reflow Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Reflow Lower Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Enable Peak and Average Limits (1 = yes, 0 = no)	1 Byte
			,	1 Byte
			Aux Preheat Peak Delay (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Preheat Avg Delay (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Preheat Peak Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Preheat Peak Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Reflow Peak Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Reflow Peak Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Preheat Average Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Preheat Average Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Reflow Average Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Reflow Average Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Enable Preheat Envelope Limits (1 = yes, 0 = no)	1 Byte
			,	1 Byte
			Aux Enable Reflow Envelope Limits (1 = yes, 0 = no)	1 Byte
			,	1 Byte
			Aux Preheat Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte

			Aux Preheat Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Reflow Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Reflow Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Start Temperature (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Preheat Temperature (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Reflow Temperature (Range: 000 – 999)	3 Bytes
			Total	144 Bytes

RELAY	VR	Read	Read relay values	0 Bytes
	VS	Set	Relays1 ON/OFF (0 = NORMAL OPEN, 1 = NORMAL CLOSED)	1 Byte
			,	1 Byte
			Relays1.when 00 = SYSTEM READY 01 = HEAT ON 02 = HEAD IS UP 03 = ALARM 04 = OUT OF LIMIT 05 = CLEAN THERMODE 06 = REPLACE THERMODE 07 = IDLE HEAT 08 = BASEHEAT 09 = RISE1 10 = PREHEAT ON 11 = RISE2 12 = REFLOW 13 = COOL1 14 = END OF REFLOW 15 = CYCLE PWR ALARM 16 = NOT ACTIVE	2 Bytes
			,	1 Byte
			Relays2 ON/OFF (0 = NORMAL OPEN, 1 = NORMAL CLOSED)	1 Byte
			,	1 Byte
			Relays2.when 00 = SYSTEM READY 01 = HEAT ON 02 = HEAD IS UP 03 = ALARM 04 = OUT OF LIMIT 05 = CLEAN THERMODE 06 = REPLACE THERMODE 07 = IDLE HEAT 08 = BASEHEAT 09 = RISE1 10 = PREHEAT ON 11 = RISE2 12 = REFLOW 13 = COOL1 14 = END OF REFLOW 15 = CYCLE PWR ALARM 16 = NOT ACTIVE	2 Bytes
			,	1 Byte
			Relays3 ON/OFF (0 = NORMAL OPEN, 1 = NORMAL CLOSED)	1 Byte
			,	1 Byte

			Relays3.when 00 = SYSTEM READY 01 = HEAT ON 02 = HEAD IS UP 03 = ALARM 04 = OUT OF LIMIT 05 = CLEAN THERMODE 06 = REPLACE THERMODE 07 = IDLE HEAT 08 = BASEHEAT 09 = RISE1 10 = PREHEAT ON 11 = RISE2 12 = REFLOW 13 = COOL1 14 = END OF REFLOW 15 = CYCLE PWR ALARM 16 = NOT ACTIVE	2 Bytes
			,	1 Byte
			Relays4 ON/OFF (0 = NORMAL OPEN, 1 = NORMAL CLOSED)	1 Byte
			,	1 Byte
			Relays4.when 00 = SYSTEM READY 01 = HEAT ON 02 = HEAD IS UP 03 = ALARM 04 = OUT OF LIMIT 05 = CLEAN THERMODE 06 = REPLACE THERMODE 07 = IDLE HEAT 08 = BASEHEAT 09 = RISE1 10 = PREHEAT ON 11 = RISE2 12 = REFLOW 13 = COOL1 14 = END OF REFLOW 15 = CYCLE PWR ALARM 16 = NOT ACTIVE	2 Bytes
			,	1 Byte
			Relays5 ON/OFF (0 = NORMAL OPEN, 1 = NORMAL CLOSED)	1 Byte
			,	1 Byte
			Relays5.when 00 = SYSTEM READY 01 = HEAT ON 02 = HEAD IS UP 03 = ALARM 04 = OUT OF LIMIT 05 = CLEAN THERMODE 06 = REPLACE THERMODE 07 = IDLE HEAT 08 = BASEHEAT 09 = RISE1 10 = PREHEAT ON 11 = RISE2 12 = REFLOW 13 = COOL1 14 = END OF REFLOW 15 = CYCLE PWR ALARM 16 = NOT ACTIVE	2 Bytes
			,	1 Byte
			Relays6 ON/OFF (0 = NORMAL OPEN, 1 = NORMAL CLOSED)	1 Byte
			,	1 Byte

			Relays6.when 00 = SYSTEM READY 01 = HEAT ON 02 = HEAD IS UP 03 = ALARM 04 = OUT OF LIMIT 05 = CLEAN THERMODE 06 = REPLACE THERMODE 07 = IDLE HEAT 08 = BASEHEAT 09 = RISE1 10 = PREHEAT ON 11 = RISE2 12 = REFLOW 13 = COOL1 14 = END OF REFLOW 15 = CYCLE PWR ALARM 16 = NOT ACTIVE	2 Bytes
			,	1 Byte
			Relays7 ON/OFF (0 = NORMAL OPEN, 1 = NORMAL CLOSED)	1 Byte
			,	1 Byte
			Relays7.when 00 = SYSTEM READY 01 = HEAT ON 02 = HEAD IS UP 03 = ALARM 04 = OUT OF LIMIT 05 = CLEAN THERMODE 06 = REPLACE THERMODE 07 = IDLE HEAT 08 = BASEHEAT 09 = RISE1 10 = PREHEAT ON 11 = RISE2 12 = REFLOW 13 = COOL1 14 = END OF REFLOW 15 = CYCLE PWR ALARM 16 = NOT ACTIVE	2 Bytes
			Total	34 Bytes

RESET	RX	Reset	Resets error	0 Bytes

SECURITY	SR	Read	Read System Security Locks	0 Bytes
	SS	Set	Password (All blank or 0000000 – 9999999) (Note: This command is not for setting password. It must match the password in the unit in order to set security locks below)	7 Bytes
			,	1 Byte
			Profile Lock (0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			System Lock (0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Profile Tuning Lock (0 = OFF, 1 = ON)	1 Byte
			Total	13 Bytes

SYSTEM	YR	Read	Read system values	0 Bytes
	YS	Set	Head Cool Valve Status (0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Solder Cool Valve Status (0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Footswitch Response Mode (0 = ABORT, 1 = LATCH)	1 Byte
			,	1 Byte
			Buzzer Loudness (Range: 00 – 99)	2 Bytes
			,	1 Byte
			End of Cycle Buzzer (0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Idle Temperature (0 = ON, 1 = OFF)	1 Byte
			,	1 Byte
			Safety Timer Time (Range: 00 – 99)	2 Bytes
			,	1 Byte
			Release Timer (Range: 00 – 99)	2 Bytes
			,	1 Byte
			Max Temp Limit (Range: 300 – 999)	3 Bytes
			,	1 Byte
			Max Aux Temp Limit (Range: 300 – 999)	3 Bytes

			,	1 Byte
			Max Idle Temp Limit (Range: 025 – 300)	3 Bytes
			,	1 Byte
			Aux Thermo Graph (0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Aux Thermo Temp (0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Backlight Operation (0 = AUTO, 1 = ON)	1 Byte
			Total	36 Bytes

TEMP	TR	Read	Temperature of the main thermode and auxiliary thermocouple	0 Bytes

TYPE	TY	Read	Software version number	0 Bytes

GRAPH	GR	Read	Graph data points This command returns all of the temperature data points from the start of firing to the end of reflow for the current actual temperature graph.	0 Bytes

Control Originated Response Command Set (Receive)

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

NAME	COMMAND	TYPE	DATA	SIZE
COUNTER	CR	Read	Total Usage Counter current value (Range: 0000000 – 9999999)	7 Bytes
			,	1 Byte
			Good Reflow Counter current value (Range: 0000000 – 9999999)	7 Bytes
			,	1 Byte
			Clean Counter plus or minus sign (+ or -)	1 Byte
			Clean Counter current value (Range: 000000 – 999999)	6 Bytes
			,	1 Byte
			Replace Counter plus or minus sign (+ or -)	1 Byte
			Replace Counter current value (Range: 000000 – 999999)	6 Bytes
			,	1 Byte
			Clean Counter status (Range: 0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Replace Counter status (Range: 0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Clean counter action (0 – 1) 0 = STOP 1 = CONTINUE	1 Byte
			,	1 Byte
			Replace counter action (0 – 1) 0 = STOP 1 = CONTINUE	1 Byte
			Total	39 Bytes
LOAD	LR	Read	Returns the current active profile (Range: 01 – 63)	2 Bytes
MONITOR	MR	Read	Active screen number (Range: 000 – 131) 000 = Reserved 001 = Reserved 002 = Reserved 003 = BAUD RATE Screen 004 = BUZZER LOUDNESS Screen 005 = CLEAN COUNTER 006 = CLEAN COUNTER SETUP Screen 007 = COARSE HEATING RATE Screen 008 = RS485 ID NUMBER Screen 009 = COMMNICATION Screen 010 = COPY PROFILE Screen 011 = COPY PROFILE Screen 2 012 = COPYRIGHT Screen 013 = DATA Screen 014 = RESET TO DEFAULTS MENU Screen 015 = SET FINE HEATING RATE Screen 016 = LINE FREQUENCY DETECTION 017 = GOOD REFLOW COUNTER 018 = GRAPH Screen 019 = HARDWARE SETUP Screen 020 = Reserved 021 = Reserved 022 = Reserved 023 = AUTO RECOGNIZED HARDWARE Screen 024 = Reserved 025 = Reserved 026 = Reserved 027 = Reserved 028 = Reserved 029 = Reserved 030 = LOWER TEMP 031 = MANUAL TUNING Screen 032 = MAX TEMPERATURE LIMIT Screen 033 = CHANGE PASSWORD Screen 034 = Reserved 035 = Reserved 036 = Reserved 037 = REFLOW TEMPERATURE SETUP Screen 038 = Reserved 039 = REFLOW COUNTERS Screen	3 Bytes

040 = RELAY Screen
041 = RELAY 1 Screen
042 = RELAY 2 Screen
043 = RELAY 3 Screen
044 = RELAY 4 Screen
045 = RELAY 1 Status Option Screen 1/2
046 = RELAY 2 Status Option Screen 1/2
047 = RELAY 3 Status Option Screen 1/2
048 = RELAY 4 Status Option Screen 1/2
049 = SET RELEASE TIMER Screen
050 = EDIT REPLACE COUNTER
051 = REPLACE COUNTER SETUP Screen
052 = SYSTEM DEFAULTS SET Screen
053 = SET SAFETY TIMER Screen
054 = SETUP MENU Screen
055 = Reserved
056 = SYSTEM SECURITY Screen
057 = Reserved
058 = Reserved
059 = TOTAL USAGE COUNTER
060 = Reserved
061 = IDLE TEMPERATURE
062 = LANGUAGE Screen
063 = HEAD UP DELAY
064 = SCHEDULE SETUP, page 1 of 5
065 = SCHEDULE SETUP, page 2 of 5
066 = Reserved
067 = PREHEAT PEAK TIME DELAY
068 = PREHEAT AVG TIME DELAY
069 = PREHEAT PEAK HI TEMP LIMIT
070 = PREHEAT PEAK LO TEMP LIMIT
071 = PREHEAT AVG HI TEMP LIMIT
072 = PREHEAT AVG LO TEMP LIMIT
073 = REFLOW PEAK HI TEMP LIMIT
074 = REFLOW PEAK LO TEMP LIMIT
075 = REFLOW AVG HI TEMP LIMIT
076 = REFLOW AVG LO TEMP LIMIT
077 = ENV_PREHEAT HI TEMP LIMIT
078 = ENV_PREHEAT LO TEMP LIMIT
079 = ENV_REFLOW HI TEMP LIMIT
080 = ENV_REFLOW LO TEMP LIMIT
081 = ENV_RISE1 TIME DELAY
082 = ENV_RISE2 TIME DELAY
083 = GRAPH TIME SPAN
084 = Reserved
085 = REFERENCE TEXT
086 = I/O STATUS Screen
087 = RELAY 5 Screen
088 = RELAY 6 Screen
089 = RELAY 7 Screen
090 = RELAY 5 Status Option Screen 1/2
091 = RELAY 6 Status Option Screen 1/2
092 = RELAY 7 Status Option Screen 1/2
093 = RELAY 1 Status Option Screen 2/2
094 = RELAY 2 Status Option Screen 2/2
095 = RELAY 3 Status Option Screen 2/2
096 = RELAY 4 Status Option Screen 2/2
097 = RELAY 5 Status Option Screen 2/2
098 = RELAY 6 Status Option Screen 2/2
099 = RELAY 7 Status Option Screen 2/2
100 = SCHEDULE SETUP, page 3 of 5
101 = SCHEDULE SETUP, page 4 of 5
102 = SCHEDULE SETUP, page 5 of 5
103 = AUX) PREHEAT PEAK TIME DELAY
104 = AUX) PREHEAT AVG TIME DELAY
105 = AUX) PREHEAT PEAK HI TEMP
106 = AUX) PREHEAT PEAK LO TEMP
107 = AUX) PREHEAT AVG HI TEMP
108 = AUX) PREHEAT AVG LO TEMP
109 = AUX) REFLOW PEAK HI TEMP
110 = AUX) REFLOW PEAK LO TEMP
111 = AUX) REFLOW AVG HI TEMP
112 = AUX) REFLOW AVG LO TEMP
113 = AUX) ENV_PREHEAT HI TEMP
114 = AUX) ENV_PREHEAT LO TEMP
115 = AUX) ENV_REFLOW HI TEMP
116 = AUX) ENV_REFLOW LO TEMP

			117 = MAX AUX TEMPERATURE LIMIT 118 = MAX IDLE TEMPERATURE LIMIT 119 = PREHEAT TEMPERATURE DELTA 120 = REFLOW TEMPERATURE DELTA 121 = PID CONTROL 122 = AUX START TEMPERATURE 123 = AUX PREHEAT TEMPERATURE 124 = AUX REFLOW TEMPERATURE 125 = SOLDER COOL VALVE DELAY 126 = Reserved 127 = Reserved 128 = Reserved 129 = Reserved 130 = Reserved 131 = Reserved	
			,	1 Byte
			Current Status Message (Range: 0 – 60) 00 = SYSTEM READY 01 = EMERGENCY STOP OPEN 02 = BASEHEAT HIGHER PREHEAT 03 = SYSTEM READY + IDLE ON 04 = PREHEAT HIGHER REFLOW 05 = COOL1 HIGHER REFLOW 06 = COOL1 HIGHER POSTHEAT 07 = REFLOW HIGHER LIMIT 08 = RISE1 TIME 09 = PREHEAT PEAK HIGHER LIMIT 10 = PREHEAT HIGHER ENVELOPE LIMIT 11 = ACCESS DENIED 12 = SET DEFAULTS 13 = FIRING SW OPEN 14 = SAFETY TIMER ON 15 = FIRING SW NOT ACTIVATED 16 = INCREASE HEATING RATE 17 = DECREASE HEATING RATE 18 = REPLACE THRMODE 19 = CLEAN THERMODE 20 = REPLACE THERMODE COUNTER RESET 21 = CLEAN TEHRMODE COUNTER RESET 22 = POWER MODE ON 23 = NO HEAT SWITCH 24 = BASEHEAT TIME 25 = HEAD DOWN 26 = PREHEAT TIME 27 = RISE2 TIME 28 = HEAT TIME 29 = COOL1 TIME 30 = COOL IDLE TIME 31 = WELD COMPLETE 32 = MODIFY PROFILE 33 = LAST PROFILE 34 = IDEAL PROFILE 35 = EMERGENCY STOP ACTIVATED 36 = MAX TEMP 37 = NO POWER 38 = OVER POWER ALARM 1 39 = THERMODE CHANGED 40 = ACCESS DENIED_REMOTE PROFILE SELECTED 41 = FOOTSW OPEN 42 = OVER POWER ALARM 2 43 = [Not Displayed] POSTHEAT NOT SET 44 = WARM UP 45 = IDLE TEMP HIGHER BASEHEAT 46 = POST ON 47 = POST ON 48 = COOL2 HIGHER POSTHEAT 49 = POSTHEAT TIME SHORTER HEAD UP DELAY 50 = COOL2 TIME 51 = POSTHEAT TIME_HEAD UP DELAY 52 = POSTHEAT TIME_HEAD UP 53 = IDLE HEATING 54 = [Not Displayed] 55 = WARM UP 56 = POSTHEAT HIGH LIMIT 57 = PREHEAT DELTA TOO HIGH 58 = REFLOW DELTA TOO HIGH 59 = HEATING TOO SLOW	2 Bytes

			60 = TRANSFORMER THERMOSTAT TOO HOT	
			Total	6 Bytes

PROFILE	DR	Read	Read Conditions of the Specified Profile # (Range: 01 – 63)	2 Bytes
			,	1 Byte
			Preheat Temp (Range: 060 – 500)	3 Bytes
			,	1 Byte
			Reflow Temp (Range: 060 – 600)	3 Bytes
			,	1 Byte
			Cool1 Temp (Range: 025 – 300)	3 Bytes
			,	1 Byte
			Preheat Time (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Rise2 Time (Range: 00 – 99)	2 Bytes
			,	1 Byte
			Reflow Time (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Base Temp (Range: 025 – 300)	3 Bytes
				1 Byte
			Postheat Temp (Range: 025 – 600)	3 Bytes
			,	1 Byte
			Cool2 Temp (Range: 025 – 300)	3 Bytes
			,	1 Byte
			Idle Temp (Range: 025 – 300)	3 Bytes
			,	1 Byte
			Base Time (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Postheat Time (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Rise1 Time (Range: 00 – 99)	2 Bytes
			,	1 Byte
			GRAPH Time Span (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Head Up Delay (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Schedule Reference (Range: All blank or 0000000000 – ZZZZZZZZZZ)	10 Bytes
			,	1 Byte
			Coarse Heating Rate (Range: 0 – 3) 0 = Very Slow 1 = Slow 2 = Medium 3 = Fast	1 Byte
			,	1 Byte
			Fine Heating Rate (Range: 00 – 99)	2 Bytes
			,	1 Byte
			Preheat Reflow Control (0 = TIME, 1 = TEMP)	1 Byte
			,	1 Byte
			Preheat Delta Temperature (Range: 00 – 99)	2 Bytes
			,	1 Byte
			Reflow Delta Temperature (Range: 00 – 99)	2 Bytes
			,	1 Byte
			PID Control (Range: 100 – 269)	3 Bytes
			,	1 Byte
			Solder Cool Valve Delay (Range: 00 – 99)	2 Bytes
			Total	91 Bytes

LIMITS	PR	Read	Read SCH SETUP Data of the Specified Profile # (Range: 01 – 63)	2 Bytes
			Enable Peak and Average Limits (1 = ON, 0 = OFF)	1 Byte
			,	1 Byte
			Preheat Peak Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Preheat Peak Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Reflow Peak Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Reflow Peak Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Preheat Peak Delay (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Preheat Avg Delay (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Rise1 Envelope Delay (Range: 00 – 99)	2 Bytes
			,	1 Byte

			Rise2 Envelope Delay (Range: 00 – 99)	2 Bytes
			,	1 Byte
			Preheat Average Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Preheat Average Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Reflow Average Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Reflow Average Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Enable Preheat Envelope Limit (1 = yes, 0 = no)	1 Byte
			,	1 Byte
			Enable Reflow Envelope Limits (1 = yes, 0 = no)	1 Byte
			,	1 Byte
			Preheat Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Preheat Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Reflow Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Reflow Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Enable Peak and Average Limit (1 = yes, 0 = no)	1 Byte
			,	1 Byte
			Aux Preheat Peak Delay (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Preheat Avg Delay (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Preheat Peak Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Preheat Peak Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Reflow Peak Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Reflow Peak Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Preheat Average Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Preheat Average Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Reflow Average Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Reflow Average Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Enable Preheat Envelope Limits (1 = yes, 0 = no)	1 Byte
			,	1 Byte
			Aux Enable Reflow Envelope Limits (1 = yes, 0 = no)	1 Byte
			,	1 Byte
			Aux Preheat Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Preheat Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Reflow Hi Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Reflow Lo Temperature Limit (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Start Temperature (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Preheat Temperature (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Reflow Temperature (Range: 000 – 999)	3 Bytes
			Total	144 Bytes

RELAY	VR	Read	Relays1 ON/OFF (0 = NORMAL OPEN, 1 = NORMAL CLOSED)	1 Byte
			,	1 Byte

			Relays1.when 00 = SYSTEM READY 01 = HEAT ON 02 = HEAD IS UP 03 = ALARM 04 = OUT OF LIMIT 05 = CLEAN THERMODE 06 = REPLACE THERMODE 07 = IDLE HEAT 08 = BASEHEAT 09 = RISE1 10 = PREHEAT ON 11 = RISE2 12 = REFLOW 13 = COOL1 14 = END OF REFLOW 15 = CYCLE PWR ALARM 16 = NOT ACTIVE	2 Bytes
			,	1 Byte
			Relays2 ON/OFF (0 = NORMAL OPEN, 1 = NORMAL CLOSED)	1 Byte
			,	1 Byte
			Relays2.when 00 = SYSTEM READY 01 = HEAT ON 02 = HEAD IS UP 03 = ALARM 04 = OUT OF LIMIT 05 = CLEAN THERMODE 06 = REPLACE THERMODE 07 = IDLE HEAT 08 = BASEHEAT 09 = RISE1 10 = PREHEAT ON 11 = RISE2 12 = REFLOW 13 = COOL1 14 = END OF REFLOW 15 = CYCLE PWR ALARM 16 = NOT ACTIVE	2 Bytes
			,	1 Byte
			Relays3 ON/OFF (0 = NORMAL OPEN, 1 = NORMAL CLOSED)	1 Byte
			,	1 Byte
			Relays3.when 00 = SYSTEM READY 01 = HEAT ON 02 = HEAD IS UP 03 = ALARM 04 = OUT OF LIMIT 05 = CLEAN THERMODE 06 = REPLACE THERMODE 07 = IDLE HEAT 08 = BASEHEAT 09 = RISE1 10 = PREHEAT ON 11 = RISE2 12 = REFLOW 13 = COOL1 14 = END OF REFLOW 15 = CYCLE PWR ALARM 16 = NOT ACTIVE	2 Bytes
			,	1 Byte
			Relays4 ON/OFF (0 = NORMAL OPEN, 1 = NORMAL CLOSED)	1 Byte
			,	1 Byte

			Relays4.when 00 = SYSTEM READY 01 = HEAT ON 02 = HEAD IS UP 03 = ALARM 04 = OUT OF LIMIT 05 = CLEAN THERMODE 06 = REPLACE THERMODE 07 = IDLE HEAT 08 = BASEHEAT 09 = RISE1 10 = PREHEAT ON 11 = RISE2 12 = REFLOW 13 = COOL1 14 = END OF REFLOW 15 = CYCLE PWR ALARM 16 = NOT ACTIVE	2 Bytes
			,	1 Byte
			Relays5 ON/OFF (0 = NORMAL OPEN, 1 = NORMAL CLOSED)	1 Byte
			,	1 Byte
			Relays5.when 00 = SYSTEM READY 01 = HEAT ON 02 = HEAD IS UP 03 = ALARM 04 = OUT OF LIMIT 05 = CLEAN THERMODE 06 = REPLACE THERMODE 07 = IDLE HEAT 08 = BASEHEAT 09 = RISE1 10 = PREHEAT ON 11 = RISE2 12 = REFLOW 13 = COOL1 14 = END OF REFLOW 15 = CYCLE PWR ALARM 16 = NOT ACTIVE	2 Bytes
			,	1 Byte
			Relays6 ON/OFF (0 = NORMAL OPEN, 1 = NORMAL CLOSED)	1 Byte
			,	1 Byte
			Relays6.when 00 = SYSTEM READY 01 = HEAT ON 02 = HEAD IS UP 03 = ALARM 04 = OUT OF LIMIT 05 = CLEAN THERMODE 06 = REPLACE THERMODE 07 = IDLE HEAT 08 = BASEHEAT 09 = RISE1 10 = PREHEAT ON 11 = RISE2 12 = REFLOW 13 = COOL1 14 = END OF REFLOW 15 = CYCLE PWR ALARM 16 = NOT ACTIVE	2 Bytes
			,	1 Byte
			Relays7 ON/OFF (0 = NORMAL OPEN, 1 = NORMAL CLOSED)	1 Byte
			,	1 Byte

			Relays7.when 00 = SYSTEM READY 01 = HEAT ON 02 = HEAD IS UP 03 = ALARM 04 = OUT OF LIMIT 05 = CLEAN THERMODE 06 = REPLACE THERMODE 07 = IDLE HEAT 08 = BASEHEAT 09 = RISE1 10 = PREHEAT ON 11 = RISE2 12 = REFLOW 13 = COOL1 14 = END OF REFLOW 15 = CYCLE PWR ALARM 16 = NOT ACTIVE	2 Bytes
			Total	34 Bytes

REPORT	RR	Read	Valid when Communication Role is MASTER. (Sent automatically by the Control at the end of the reflow.) Profile # (Range: 01 – 63)	2 Bytes
			,	1 Byte
			Start Temp (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Peak Reflow Temp (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Final Reflow Temp (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Average Reflow Temp (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Actual Cool1 Time (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Actual Cool2 Time (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Peak Preheat Temp (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Average Preheat Temp (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Peak Reflow Temp (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Average Reflow Temp (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Peak Preheat Temp (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Aux Average Preheat Temp (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Resulting Status Message (Range: 0 – 60) 00 = SYSTEM READY 01 = EMERGENCY STOP OPEN 02 = BASEHEAT HIGHER PREHEAT 03 = SYSTEM READY + IDLE ON 04 = PREHEAT HIGHER REFLOW 05 = COOL1 HIGHER REFLOW 06 = COOL1 HIGHER POSTHEAT 07 = REFLOW HIGHER LIMIT 08 = RISE1 TIME 09 = PREHEAT PEAK HIGHER LIMIT 10 = PREHEAT HIGHER ENVELOPE LIMIT 11 = ACCESS DENIED 12 = SET DEFAULTS 13 = FIRING SW OPEN 14 = SAFETY TIMER ON 15 = FIRING SW NOT ACTIVATED 16 = INCREASE HEATING RATE 17 = DECREASE HEATING RATE 18 = REPLACE THRMODE 19 = CLEAN THERMODE 20 = REPLACE THERMODE COUNTER RESET 21 = CLEAN TEHRMODE COUNTER RESET 22 = POWER MODE ON 23 = NO HEAT SWITCH 24 = BASEHEAT TIME 25 = HEAD DOWN	2 Bytes

			26 = PREHEAT TIME 27 = RISE2 TIME 28 = HEAT TIME 29 = COOL1 TIME 30 = COOL IDLE TIME 31 = WELD COMPLETE 32 = MODIFY PROFILE 33 = LAST PROFILE 34 = IDEAL PROFILE 35 = EMERGENCY STOP ACTIVATED 36 = MAX TEMP 37 = NO POWER 38 = OVER POWER ALARM 1 39 = THERMODE CHANGED 40 = ACCESS DENIED_REMOTE PROFILE SELECTED 41 = FOOTSW OPEN 42 = OVER POWER ALARM 2 43 = [Not Displayed] POSTHEAT NOT SET 44 = WARM UP 45 = IDLE TEMP HIGHER BASEHEAT 46 = POST ON 47 = POST ON 48 = COOL2 HIGHER POSTHEAT 49 = POSTHEAT TIME SHORTER HEAD UP DELAY 50 = COOL2 TIME 51 = POSTHEAT TIME_HEAD UP DELAY 52 = POSTHEAT TIME_HEAD UP 53 = IDLE HEATING 54 = [Not Displayed] 55 = WARM UP 56 = POSTHEAT HIGH LIMIT 57 = PREHEAT DELTA TOO HIGH 58 = REFLOW DELTA TOO HIGH 59 = HEATING TOO SLOW 60 = TRANSFORMER THERMOSTAT TOO HOT	
			Total	53 Bytes

SECURITY	SR	Read	Read System Security Locks Profile Lock (Range: 0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			System Lock (Range: 0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Profile Tuning Lock (Range: 0 = OFF, 1 = ON)	1 Byte
			Total	5 Bytes

SYSTEM	YR	Read	Read System Settings Head Cool Valve Status (0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Solder Cool Valve Status (0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Footswitch Response Mode (0 = ABORT, 1 = LATCH)	1 Byte
			,	1 Byte
			Buzzer Loudness (Range: 00 – 99)	2 Bytes
			,	1 Byte
			End of Cycle Buzzer (0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Idle Temperature (0 = ON, 1 = OFF)	1 Byte
			,	1 Byte
			Safety Timer Time (Range: 00 – 99)	2 Bytes
			,	1 Byte
			Release Timer Time (Range: 00 – 99)	2 Bytes
			,	1 Byte
			Max Temp Limit (Range: 300 – 999)	3 Bytes
			,	1 Byte
			Max Aux Temp Limit (Range: 300 – 999)	3 Bytes
			,	1 Byte
			Max Idle Temp Limit (Range: 025 – 300)	3 Bytes
			,	1 Byte
			Aux Thermo Graph (0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Aux Thermo Temp (0 = OFF, 1 = ON)	1 Byte
			,	1 Byte
			Backlight Operation (0 = AUTO, 1 = ON)	1 Byte
			Total	36 Bytes

TEMP	TR	Read	Current temperature of the main thermode and auxiliary thermocouple Temperature of the main thermode (Range: 000 – 999)	3 Bytes
			,	1 Byte
			Auxiliary thermocouple (Range: 000 – 999)	3 Bytes
			Total	7 Bytes

TYPE	TY	Read	Software version number “Control” + Release # + Revision # Example: “Control 1.00 AXP”	16 Bytes

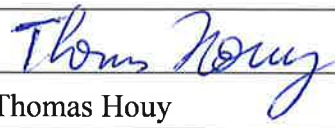
GRAPH	GR	Read	Graph data points This command returns all of the temperature data points from the start of firing to the end of reflow for the current actual temperature graph. It returns a 4 digit count of points with a maximum of 4,096 data points followed by each 4 digit data point. The count and each data point are followed by a carriage return/line feed. NOTE: If the Control receives a Fire Command when the Control is transmitting the GRAPH data, the transmission of the GRAPH data will be terminated incomplete and the Control will initiate the new reflow process.	Variable number of Bytes

Declaration of Conformity

Application of Council Directive:
2014/35/EU, 2014/30/EU & 2011/65/EU

Standards To Which Conformity Is Declared:	**EN61010-1:2010 (LVD)** **EN61326: 2013 (EMC)** **EN55011 Class A Group 1** **EN61000-4-2** **EN61000-4-3** **EN61000-4-4** **EN61000-4-5** **EN61000-4-6** **EN61000-4-8** **EN61000-4-11** **EN50581:2012 (EU RoHS)**
Manufacturer's Name:	**AMADA WELD TECH INC.**
Manufacturer's Address:	**1820 S. Myrtle Avenue** **Monrovia, CA 91016** **626-303-5676**
Equipment Description:	**REFLOW SYSTEM**
Equipment Class:	**- Insulation Class I** **- Electrical Equipment Measurement, Control & Laboratory Use - Industrial**
Model Numbers:	**UNIFLOW4, MR-130B, UNIFLOW4R, MR-140A with X2, X4, MTL, MTM, MTJ & MTK transformers**

I the undersigned, hereby declare that the equipment specified above, conforms to the above Directive(s) and Standard(s).

Place:	Monrovia, CA, USA
Signature:	
Full Name:	Thomas Houy
Position:	Mgr., Sustaining Engineering
Date:	April 1, 2020