PULSED HEAT CONTROL

UNIFLOW 4 / UNIFLOW 4 REMOTE

OPERATION MANUAL

990-908 REV K

Models Described In This Manual

STANDARD Versions (Control and Transformer in one unit)

2 kVA transformer (90 – 132 VAC input single phase)	**4 kVA transformer (180-264 VAC single phase input)**	**4 kVA transformer (180-264 VAC single phase input)**	**2 kVA transformer (180-264 VAC single phase input)**	**2 kVA transformer (180-264 VAC single phase input)**
Secondary Voltage: 3.81V (Fast) 1.9V (Medium) 1.27V (Slow) 0.95V (Very Slow)	Secondary Voltage: 3.81V (Fast) 1.9V (Medium) 1.27V (slow) 0.95V (very slow)	Secondary Voltage: 7.62V (Fast) 3.8V (Medium) 2.54V (Slow) 1.90V (Very Slow)	Secondary Voltage: 3.81V (Fast) 1.9V (Medium) 1.27V (Slow) 0.95V (Very Slow)	Secondary Voltages: 7.62V (Fast) 3.8V (Medium) 2.54V (Slow) 1.90V (Very slow)
PART NUMBER	**PART NUMBER**	**PART NUMBER**	**PART NUMBER**	**PART NUMBER**
1-298-02	1-298-02-01 1-298-02-02 1-298-02-03	1-298-02-05 1-298-02-06 1-298-02-07	1-298-02-09 1-298-02-10 1-298-02-11	1-298-02-13 1-298-02-14 1-298-02-15

REMOTE Versions (Separate Control and Transformer units)

Controller

PART NUMBER
1-299-02-01 1-299-02-02 1-299-02-03

Remote Transformers

4 kVA transformer (180-264 VAC single phase input)	**4 kVA transformer (180-264 VAC single phase input)**	**2 kVA transformer (180-264 VAC single phase input)**	**2 kVA transformer (180-264 VAC single phase input)**
Secondary Voltage: 3.81V (Fast) 1.9V (Medium) 1.27V (Slow) 0.95V (Very Slow)	Secondary Voltage: 7.62V (Fast) 3.8V (Medium) 2.54V (Slow) 1.90V (Very Slow)	Secondary Voltage: 3.81V (Fast) 1.9V (Medium) 1.27V (Slow) 0.95V (Very Slow)	Secondary Voltages: 7.62V (Fast) 3.8V (Medium) 2.54V (Slow) 1.90V (Very Slow)
PART NUMBER	**PART NUMBER**	**PART NUMBER**	**PART NUMBER**
9-040-01	9-041-01	9-042-01	9-043-01

REVISION RECORD

Revision	EO	Date	Basis of Revision
A	41208	1/12	Original publication.
B	41769	2/12	Minor corrections, added explanations.
C	41773	2/12	Updated communication codes and technical data.
D	41917	4/12	Minor corrections, changed reset of alarm states, added alarm states
E	41942	5/12	Updated Installation instructions in Chapter 2.
F	42230	12/12	Increased number of profiles from 15 to 63 in software version3.06G.
G	42622	6/13	Updated pictures in Chapter 2, updated programming instructions, and correct **Schedule Setup Screen 3 of 5** in Chapter 3, added notes and message information in Chapter 5, updated schematics and **Remote Profile Inputs** table in Appendix B.
H	42861	11/13	Update to Miyachi America name and logo.
J	43482	11/14	Updated to Amada Miyachi America name and logo.
K	43878	9/15	Updated to Amada Miyachi America format.

Shipment Contents

PART NUMBER	SHIPMENT CONTENTS
All Controller Part Numbers	1. Control Unit 2. Ship Kit 3. Fan 24VDC Pwr Cable, 4-38927-01
All transformer part numbers	1. Transformer

Ship Kit Cross Reference

PART NUMBER	SHIP KIT PART NUMBER INCLUDED WITH MODEL / PART NUMBER
1-298-02-01, 1-298-02-05, 1-298-02-09, 1-298-02-13	4-81203-01
1-299-02-01, 1-299-02-05, 1-299-02-09, 1-299-02-13	4-81204-01
1-298-02-02, 1-298-02-03, 1-208-02-06, 1-298-02-07, 1-298-02-10, 1-298-02-11, 1-298-02-14, 1-298-02-15	4-81205-01
1-299-02-02, 1-299-02-03, 1-299-02-06, 1-299-02-07, 1-299-02-10, 1-299-02-11, 1-299-02-14, 1-299-02-15	4-81206-01
1-298-02	4-81207-01

Ship Kit Contents

Ship Kit Part Number 4-81203-01

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, Uniflow 4	1
4-38758-01	Thermocouple Cable Assembly, K Type	1
4-38771-01	CD ROM Manual, Uniflow 4	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
755-321	Split Lock Washer	2
755-322	Flat Washer, M6	4
755-335	Spring Lock Washer, M8	2

Ship Kit Part Number 4-81204-01

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, Uniflow 4	1
4-38758-01	Thermocouple Cable Assembly, K Type	1
4-38771-01	CD ROM Manual, Uniflow 4	1
4-38927-01	FAN 24VDC Power Cable Assy	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
755-321	Split Lock Washer	2
755-322	Flat Washer, M6	4
755-335	Spring Lock Washer, M8	2

Ship Kit Part Number 4-81205-01

PART NUMBER	DESCRIPTION	QUANTITY
4-39005-01	Cord,3x#14,8ft,1conn End	1
4-38703-01	Plug Set, Uniflow 4	1
4-38758-01	Thermocouple Cable Assembly, K Type	1
4-38771-01	CD ROM Manual, Uniflow 4	1

Ship Kit Part Number 4-81206-01

PART NUMBER	DESCRIPTION	QUANTITY
4-39005-01	Cord,3x#14,8ft,1conn End	1
4-38703-01	Plug Set, Uniflow 4	1
4-38758-01	Thermocouple Cable Assembly, K Type	1
4-38771-01	CD ROM Manual, Uniflow 4	1
4-38927-01	FAN 24VDC Power Cable Assy	1

Ship Kit Part Number 4-81207-01

PART NUMBER	DESCRIPTION	QUANTITY
160-116	Bolt, Cap, Hex Head, M6, 25,4l	2
160-117	Bolt, Cap, Hex Head, M8, 25mml	2
205-2524-39004-01	Cord,3x#14,8ft,2conn End	1
4-38703-01	Plug Set, Uniflow 4	1
4-38758-01	Thermocouple Cable Assembly, K Type	1
4-38771-01	CD ROM Manual, Uniflow 4	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
755-321	Split Lock Washer	2
755-322	Flat Washer, M6	4
755-335	Spring Lock Washer, M8	2

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Chapter 6. Calibration

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CONTACT US

Thank you for purchasing a Miyachi Unitek® Uniflow® 4 Pulsed Heat Control. Upon receipt, please inspect it thoroughly for shipping damage ***before*** you install it. If there is any damage, contact the shipping company immediately to file a claim, and notify us at:

AMADA MIYACHI AMERICA

Amada Miyachi America
1820 South Myrtle Avenue
P. O. Box 5039
Monrovia, California 91016

Phone: **(626) 256-4128**

FAX: **(626) 303-5396**

E-mail: **info@amadamiyachi.com**

MIYACHI EUROPE

Lindberghstraße 1, D-82178
Puchheim, Germany

Telephone: **+49-89-839403-0**

FAX: **+49-89-839403-10**

The contents of this manual are subject to change without notice. If you have any questions, or find any errors or omissions in this manual, please contact us.

Amada Miyachi America is not responsible for any losses due to improper use of this product.

SAFETY PRECAUTIONS

General

This instruction manual describes the operation and maintenance of the Control and provides instructions relating to its safe use. Procedures described in this manual ***must*** be performed as detailed by ***Qualified*** and ***Trained*** personnel.

For ***Safety***, and to effectively take advantage of the full capabilities of the Control, please read this instruction thoroughly ***before*** attempting to use it.

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

Operation

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

When operating any Reflow unit, ***always*** wear appropriate personal protective gear.

Maintenance/Service

Before performing any maintenance on the Control unit, read *Chapter 5, Maintenance* thoroughly. Use the appropriate tools for terminating the connecting cables, being careful not to nick the wire conductors.

Do ***not*** modify the Control without prior written approval from Amada Miyachi America.

HIGH VOLTAGE is used in the operation of this equipment.

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

WHEN REFLOWING ***always*** wear safety glasses.

Before using this equipment, read the **SAFETY PRECAUTIONS** carefully to understand the correct usage of the equipment.

- These precautions are given for safe use of the equipment and for prevention of injury to operators or others.
- Be sure to read each of the instructions, as they are all important for safe operation.
- The meanings of the words and symbols are as follows:

⚠ WARNING

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

⚠ DANGER

Denotes operations and practices that may imminently 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 equipment if not correctly followed.

These symbols denote **PROHIBITION**. They are warnings about actions that should ***not*** be performed because they can damage the equipment and will void the warranty.

These symbols denote actions which operators ***must*** take.

Each symbol with a triangle denotes that the contents gives notice of **DANGER**, **WARNING**, or **CAUTION** to the operator.

DANGER

DO NOT TOUCH THE INSIDE OF THE CONTROL UNNECESSARILY.

High Voltages are present inside the Control Cabinet. Do ***not*** touch the inside of the Control unnecessarily with the power turned ON. You may receive an electric shock. When inspecting the inside of the Power Supply, be sure to turn the power source OFF.

NEVER DISASSEMBLE, REPAIR, OR MODIFY THE CONTROL.

These actions can cause electric shock and fire. Do ***not*** do anything other than the maintenance described in the Operator Manual.

WARNING

Do NOT put your hands or fingers between the Thermode and the part.
When soldering, keep your hands and fingers away from the thermode.

Do NOT touch any soldered part or Thermode during, or just after reflow soldering.
The soldered parts and the Thermode are very ***hot***. If you touch them you may be burned.

Ground the equipment.
If the equipment is not grounded, you may get an electric shock.

Use a ground fault breaker.
Use a ground fault breaker to prevent an electric shock.

Only use specified cables.
A cable with insufficient capacity or loose connections can cause electric shock or fire.

Do NOT use a damaged power cable, connecting cables, or plugs.
Do ***not*** step on, twist, or tense any cable. The power cable and connecting cables may be damaged which can cause electric shock, short circuit, or fire. If any part needs to be repaired or replaced, consult Amada Miyachi America or your distributor.

Stop operation if any trouble occurs.
If you detect a burning smell, abnormal sounds, abnormal heat, smoke, etc., turn power OFF immediately to prevent fire or electric shock. Contact Amada Miyachi America or your distributor for help.

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.

Wear protective gear.
Put on protective gear such as protective gloves, long sleeved jacket, and leather apron to avoid being burned.

CAUTION

Apply the specified source voltage.

Applying the ***wrong*** voltage can cause fire and electrical shock.

Keep water and water containers away from the Control.

Water spilled on the Control can cause a short circuit, electrical shock, or fire.

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

Do ***not*** nick the wire conductor. Doing so can cause a short circuit, electric shock, or fire.

Install the Control on a firm, level surface.

Injury may result if the Control falls over or drops from an uneven surface.

Keep combustible matter away from the Control.

Spatter can ignite combustible materials. If you cannot remove all combustible materials, cover them with a non-combustible material.

Do NOT cover the Control with a blanket, cloth, etc.

Heat generated by the operating Control may ignite a blanket or cover.

Keep a fire extinguisher nearby.

Make sure there is a fire extinguisher in or near the shop in case of fire.

Regularly inspect and maintain the Control.

Regular inspection and maintenance is essential to safe operation and long life of the equipment. If you see any damage, make necessary repairs before operation.

Operator Guide –Miyachi Unitek power supplies

Bedieningshandleding - Voedingsbronnen voor Amada Miyachi America.
Användarhandledning - Kraftaggregat för Amada Miyachi America.
Käyttöopas - Amada Miyachi America tehonlähteet.
Guide d'utilisation - Alimentation de électrique Amada Miyachi America.
Bedienungsanleitung - Energieversorgung für Amada Miyachi America.
Guida dell'operatore - Alimentazioni di corrente delle apparecchiature Amada Miyachi America.
Guia do Operador - Componentes eléctricos da Amada Miyachi America.
Guía del operador - Fuentes de alimentación de Amada Miyachi America.

CAUTION! This symbol designates an operation which requires a qualified technician and User's Manual

OPGELET! Dit symbool duidt een bediening aan waarvoor een gekwalificeerde technicus en de gebruikershandleiding vereist zijn.
VARNING! Denna symbol indikerar ett arbetsmoment som bör utföras av en kvalificerad tekniker med hjälp av Användarhandledningen.
VAARA! Tämä merkki osoittaa toimenpiteen, jossa tarvitaan asiantuntevaa teknikkoa sekä käyttökäsikirjaa.
ATTENTION ! Ce symbole désigne une opération exigeant un technicien qualifié et le Manuel d'utilisation.
VORSICHT! Dieses Symbol kennzeichnet einen Arbeitsgang, der einen qualifizierten Techniker sowie ein Benutzerhandbuch erfordert.
ATTENZIONE! Questo simbolo indica un'operazione che richiede un tecnico qualificato ed il manuale dell'utente.
CUIDADO! Este símbolo indica uma operação que requer um técnico qualificado e o Manual do Usuário.
¡PRECAUCIÓN! Este símbolo designa una operación que requiere un técnico competente y el Manual del usuario.

1. Install power supply system

Installeer het voedingssysteem.
Installera kraftaggregatsystemet.
Asenna voimanlähdejärjestelmä.
Installer le système d'alimentation électrique.
Das Elektroenergieversorgungssystem installieren.
Installazione del sistema d'alimentazione elettrico.
Instale o sistema de fonte de alimentação.
Instale el sistema de fuente de alimentación.

2. Refer all program or setting changes to a qualified technician

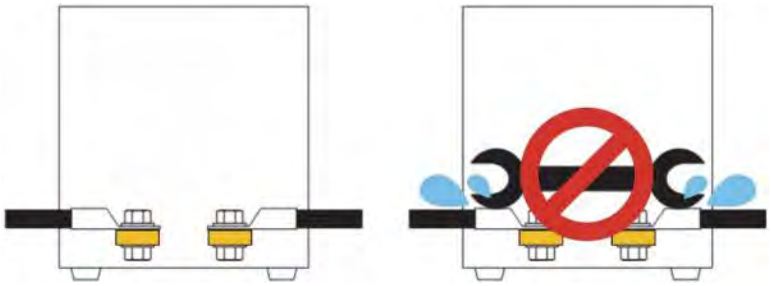
Alle programma- of instellingswijzigingen moeten door een gekwalificeerd technicus.
Hänvisa alla program- och inställningsändringar till en kvalificerad tekniker.
na kaikki ohjelman tai asetusten muutokset asiantuntevan teknikon suoritettaviksi.
Confier toutes les modifications de programme ou de réglages à un technicien qualifié.
Sämtliche Programm - oder Einstellungsänderungen müssen einem qualifizierten Techniker überlassen werden.
Rivolgersi ad un tecnico qualificato per tutti i cambiamenti di programma di impostazione.
Consulte um técnico qualificado quanto a qualquer alteração de programa ou ajuste.
Comfíele a un técnico competente todos los cambios de programas o ajustes.

3. *Use eye protection*

Oogbescherming dragen. Augenschutz verwenden.
Använd skyddsglasögon. Usare occhiali di protezione.
Käytä silmäsuojaimia. Use óculos de proteção.
Porter une protection oculaire. Use protección para los ojos.

4. *Examine weld terminals*

Kijk de lasterminals na.
Inspektera svetsterminalerna.
Tarkista hitsausterminaalit.
Examiner les bornes de soudure.
Schweißverbindungen prüfen.
Esaminare i terminali di saldatura.
Examine os terminais de soldagem.
Examine las terminales soldadas.



5. *Use WELD/NO WELD switch to stop weld current from flowing*

Gebruik de schakelaar **WELD/NO WELD** om de lasstroom te stoppen.

Använd omkopplaren **WELD/NO WELD** för att koppla från svetsströmmen.

Katkaise hitsausvirta **WELD/NO WELD** - kytkimestä.

Utiliser l'interrupteur **WELD/NO WELD** pour arrêter le passage du courant de soudure.

Der Schweißstromfluß wird mit dem Schalter **WELD/NO WELD** angehalten.

Usare l'interruttore **WELD/NO WELD** per interrompere il flusso della corrente di saldatura.

Use a chave **WELD/NO WELD** para interromper o fluxo da corrente de soldagem.

Utilice el interruptor de **WELD/NO WELD** para cortar el flujo de la corriente e soldar.

EMERGENCY STOP - Open electrical circuit to retract weld head

NOODSTOPOODSTOP Open het elektrische circuit om de laskop terug te trekken.

NÖDSTOPP - Öppna den elektriska kretsen för att dra tillbaka svetstråden.

HÄTÄKYTKIN POIS - Avaa virtapiiri vetääksesi hitsauspään takaisin.

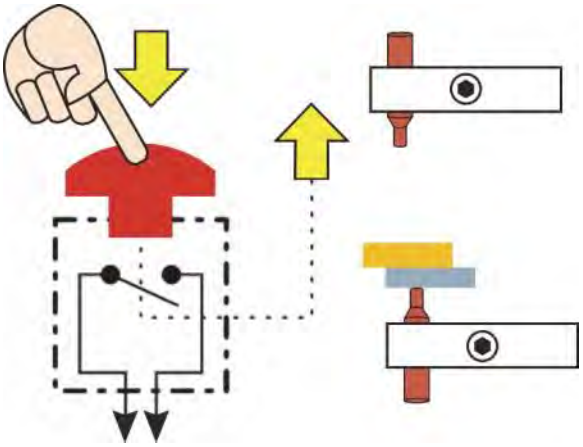
ARRET D'URGENCE - Ouvrez le circuit électrique pour retirer la tête de soudure.

NOT-AUS-SCHALTER – Öffnet den elektrischen Kreis, der Schweißkopf wird zurückgezogen.

EMERGENZA DISINSERITA - Aprire il circuito elettrico per ritrarre la testa della saldatura.

DESCONEÇÃO DE EMERGÊNCIA - Abra o circuito elétrico para retrair a cabeça da soldadura.

DESCONECCION DE EMERGENCIA - Abra el circuito eléctrico para retraer la cabeza de soldadura.



Declaration of Conformity

Application of Council Directive: 2004/108/EC

Standards To Which Conformity Is Declared:	**EN61326-1: 2006** **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**
Manufacturer's Name:	**Miyachi Unitek**
Manufacturer's Address:	**1820 S. Myrtle Avenue** **Monrovia, CA 91016** **626-303-5676**
Equipment Description:	**Reflow System**
Equipment Class:	**Electrical Equipment Measurement, Control & Laboratory Use - Industrial**
Model Numbers:	**UNIFLOW 4/MR-130B**

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

Place: MONROVIA, CA USA

Signature: David Cielinski

Full Name: DAVID CIELINSKI

Position: V.P. STANDARD PRODUCT DEVELOPMENT

DECLARATION OF CONFORMITY

Application of Council Directive: 2006/95/EC

Standards to which conformity is declared:	EN61010-1:2001
Manufacturer's Name:	Miyachi Unitek
Manufacturer's Address:	1820 S. Myrtle Avenue Monrovia, CA 91016
Equipment Description:	Welding System
Equipment Class:	Class I
Model Number:	**UNIFLOW 4 STANDARD VERSION/MR-130B**

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

Place: MONROVIA, CA USA
Signature: David Cielinski
Full Name: DAVID CIELINSKI
Position: V.P. STANDARD PRODUCT DEVELOPMENT

Declaration of Conformity

Application of Council Directive: 2004/108/EC

Standards To Which Conformity Is Declared:	**EN61326-1: 2006** **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**
Manufacturer's Name:	**Miyachi Unitek**
Manufacturer's Address:	**1820 S. Myrtle Avenue** **Monrovia, CA 91016** **626-303-5676**
Equipment Description:	**Reflow System**
Equipment Class:	**Electrical Equipment Measurement, Control & Laboratory Use - Industrial**
Model Numbers:	**MODEL # UNIFLOW 4R VERSION/MR-140A WITH X4/240UNF, X4/240UNFHV, X2/240UNF, X2/240UNFHV/MTL40A2, MTM-40A2, MTJ-20A2, MTK-20A2 TRANSFORMERS**

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

MONROVIA, CA USA

Place:

David Cielinski

Signature:

DAVID CIELINSKI

Full Name:

V.P. STANDARD PRODUCT DEVELOPMENT

Position:

DECLARATION OF CONFORMITY

Application of Council Directive: 2006/95/EC

Standards to which conformity is declared:	EN61010-1:2001
Manufacturer's Name:	Miyachi Unitek
Manufacturer's Address:	1820 S. Myrtle Avenue Monrovia, CA 91016
Equipment Description:	Reflow System
Equipment Class:	Class I
Model Number:	Uniflow 4R Version/MR-140A with X4/240UNF, X4/240UNFHV, X2/240UNF, X2/240UNFHV/MTL40A2, MTM-40A2,MTJ-20A2,MTK-20A2 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: David Cielinski

Full Name: DAVID CIELINSKI

Position: V.P. STANDARD PRODUCT DEVELOPMENT

LIMITED WARRANTY

1. (a) Subject to the exceptions and upon the conditions set forth herein, Seller warrants to Buyer that for a period of one (1) year from the date of shipment ("**Warranty Period**"), that such Goods will be free from material defects in material and workmanship.

(b) Notwithstanding the foregoing and anything herein to the contrary, the warranty set forth in this Section 1 shall be superseded and replaced in its entirety with the warranty set forth on **Exhibit A** hereto if the Goods being purchased are specialty products, which include, without limitation, laser products, fiber markers, custom systems, workstations, Seller-installed products, non-catalogue products and other custom-made items (each a "**Specialty Products."**

(c) EXCEPT FOR THE WARRANTY SET FORTH IN SECTION 1(A), SELLER MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO THE GOODS (INCLUDING ANY SOFTWARE) OR SERVICES, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.

(d) Products manufactured by a third party and third party software ("**Third Party Product**") may constitute, contain, be contained in, incorporated into, attached to or packaged together with, the Goods. Third Party Products are not covered by the warranty in Section 1(a). For the avoidance of doubt, **SELLER MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO ANY THIRD PARTY PRODUCT, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.** Notwithstanding the foregoing, in the event of the failure of any Third Party Product, Seller will assist (within reason) Buyer (at Buyer's sole expense) in obtaining, from the respective third party, any (if any) adjustment that is available under such third party's warranty.

(e) Seller shall not be liable for a breach of the warranty set forth in Section 1(a) unless: (i) Buyer gives written notice of the defect, reasonably described, to Seller within five (5) days of the time when Buyer discovers or ought to have discovered the defect and such notice is received by Seller during the Warranty Period; (ii) Seller is given a reasonable opportunity after receiving the notice to examine such Goods; (iii) Buyer (if requested to do so by Seller) returns such Goods (prepaid and insured to Seller at 1820 South Myrtle Avenue, Monrovia, CA 91016or to such other location as designated in writing by Seller) to Seller pursuant to Seller's RMA procedures and Buyer obtains a RMA number from Seller prior to returning such Goods for the examination to take place; and (iii) Seller reasonably verifies Buyer's claim that the Goods are defective and that the defect developed under normal and proper use.

(f) Seller shall not be liable for a breach of the warranty set forth in Section 1(a) if: (i) Buyer makes any further use of such Goods after giving such notice; (ii) the defect arises because Buyer failed to follow Seller's oral or written instructions as to the storage, installation, commissioning, use or maintenance of the Goods; (iii) Buyer alters or repairs such Goods without the prior written consent of Seller; or (iv) repairs or modifications are made by persons other than Seller's own service personnel, or an authorized representative's personnel, unless such repairs are made with the written consent of Seller in accordance with procedures outlined by Seller.

(g) All expendables such as electrodes are warranted only for defect in material and workmanship which are apparent upon receipt by Buyer. The foregoing warranty is negated after the initial use.

(h) Subject to Section 1(e) and Section 1(f) above, with respect to any such Goods during the Warranty Period, Seller shall, in its sole discretion, either: (i) repair or replace such Goods (or the defective part) or (ii) credit or refund the price of such Goods at the pro rata contract rate, provided that, if Seller so requests, Buyer shall, at Buyer's expense, return such Goods to Seller.

(i) THE REMEDIES SET FORTH IN SECTION 1(H) SHALL BE BUYER'S SOLE AND EXCLUSIVE REMEDY AND SELLER'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH IN SECTION 1(A). Representations and warranties made by any person, including representatives of Seller, which are inconsistent or in conflict with the terms of this warranty, as set forth above, shall not be binding upon Seller.

Exhibit A
Warranty for "Specialty Products"

Limited Warranty

EXCEPT FOR THE WARRANTY SET FORTH BELOW IN THIS EXHIBIT A, SELLER MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO THE GOODS (INCLUDING ANY SOFTWARE) OR SERVICES, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.

Warranty Period: The Warranty Period for Specialty Products is for one (1) year, and the Warranty Period for laser welders and laser markers is two (2) years (unlimited hours), and the Warranty Period for the laser pump diodes or modules is two (2) years or 10,000 clock hours, whichever occurs first (as applicable, the "**Warranty Period**"). The Warranty Period begins as follows: (i) on orders for Goods purchased directly by Buyer, upon installation at Buyer's site or thirty (30) days after the date of shipment, whichever occurs first; or (ii) on equipment purchased by a Buyer that is an OEM or systems integrators, upon installation at the end user's site or six (6) months after the date of shipment, whichever occurs first.

Acceptance Tests: Acceptance Tests (when required) shall be conducted at Amada Miyachi America, Inc., Monrovia, CA, USA (the "**Testing Site**") unless otherwise mutually agreed in writing prior to issuance or acceptance of the Acknowledgement. Acceptance Tests shall consist of a final visual inspection and a functional test of all laser, workstation, enclosure, motion and accessory hardware. Acceptance Tests shall include electrical, mechanical, optical, beam delivery, and software items deliverable under the terms of the Acknowledgement. Terms and conditions for Additional Acceptance Tests either at Seller's or Buyer's facility shall be mutually agreed in writing prior to issuance or acceptance of the Acknowledgement.

Performance Warranty: The system is warranted to pass the identical performance criteria at Buyer's site as demonstrated during final Acceptance Testing at the Testing Site during the Warranty Period, as provided in the Acknowledgement. Seller explicitly disclaims any responsibility for the process results of the laser processing (welding, marking, drilling, cutting, etc.) operations.

Exclusions: Seller makes no warranty, express or implied, with respect to the design or operation of any system in which any Seller's product sold hereunder is a component.

Limitations: The limited warranty set forth on this Exhibit A does not cover loss, damage, or defects resulting from transportation to Buyer's facility, improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the equipment, or improper site preparation and maintenance. This warranty also does not cover damage from misuse, accident, fire or other casualties of failures caused by modifications to any part of the equipment or unauthorized entry to those portions of the laser which are stated. Furthermore, Seller shall not be liable for a breach of the warranty set forth in this Exhibit A if: (i) Buyer makes any further use of such Goods after giving such notice; (ii) the defect arises because Buyer failed to follow Seller's oral or written instructions as to the storage, installation, commissioning, use or maintenance of the Goods; (iii) Buyer alters or repairs such Goods without the prior written consent of Seller; or (iv) repairs or modifications are made by persons other than Seller's own service personnel, or an authorized representative's personnel, unless such repairs are made with the written consent of Seller in accordance with procedures outlined by Seller.

Seller further warrants that all Services performed by Seller's employees will be performed in a good and workmanlike manner. Seller's sole liability under the foregoing warranty is limited to the obligation to re-perform, at Seller's cost, any such Services not so performed, within a reasonable amount of time following receipt of written notice from Buyer of such breach, provided that Buyer must inform Seller of any such breach within ten (10) days of the date of performance of such Services.

Seller shall not be liable for a breach of the warranty set forth in this Exhibit A unless: (i) Buyer gives written notice of the defect or non-compliance covered by the warranty, reasonably described, to Seller within five (5) days of the time when Buyer discovers or ought to have discovered the defect or non-compliance and such notice is received by Seller during the Warranty Period; (ii) Seller is given a reasonable opportunity after receiving the notice to examine such Goods and (a) Buyer returns such Goods to Seller's place of business at Buyer's cost (prepaid and insured); or (b) in the case of custom systems, Seller dispatches a field service provider to Buyer's location at Buyer's expense, for the examination to take place there; and (iii) Seller reasonably verifies Buyer's claim that the Goods are defective or non-compliant and the defect or non-compliance developed under normal and proper use.

All consumable, optical fibers, and expendables such as electrodes are warranted only for defect in material and workmanship which are apparent upon receipt by Buyer. The foregoing warranty is negated after the initial use.

No warranty made hereunder shall extend to any product whose serial number is altered, defaced, or removed.

Remedies: With respect to any such Goods during the Warranty Period, Seller shall, in its sole discretion, either: repair such Goods (or the defective part). **THE REMEDIES SET FORTH IN THE FOREGOING SENTENCE SHALL BE BUYER'S SOLE AND EXCLUSIVE REMEDY AND SELLER'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH IN THIS EXHIBIT A.** Representations and warranties made by any person, including representatives of Seller, which are inconsistent or in conflict with the terms of this warranty, as set forth above, shall not be binding upon Seller.

Products manufactured by a third party and third party software ("**Third Party Product**") may constitute, contain, be contained in, incorporated into, attached to or packaged together with, the Goods. Third Party Products are not covered by the warranty in this Exhibit A. For the avoidance of doubt, **SELLER MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO ANY THIRD PARTY PRODUCT, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.** Notwithstanding the foregoing, in the event of the failure of any Third Party Product, Seller will assist (within reason) Buyer (at Buyer's sole expense) in obtaining, from the respective third party, any (if any) adjustment that is available under such third party's warranty.

CHAPTER 1
DESCRIPTION

Section I: Features

Overview

For the rest of this manual, the **Uniflow® 4 Pulsed Heat Control** will simply be referred to as ***the Control***. There are two versions of the Control, both have the same control panel, operating procedures, and specifications. **Uniflow 4** is a single unit containing the control panel and output transformer. **Uniflow 4R** is the Control without the transformer inside the control unit. The **Uniflow 4R** requires an external transformer. This allows you to place the transformer next to the reflow head, while the 2-meter connecting cable allows you to put the control panel in a more convenient location such as a shelf at eye-level. Consult Amada Miyachi America if custom lengths of connecting cables are required.

For the rest of this manual, both models of **Uniflow** will simply be referred to as "***the Control,***" except in specific instances where unique descriptions are required such as specifications, connections, etc. In those cases reference will be made specifically to ***Uniflow 4*** **or** ***Uniflow 4R***.

Uniflow 4

Uniflow 4R

If you have questions about custom items in your Control that are not covered in this manual, contact Amada Miyachi America using the phone, e-mail, or mailing information on the **CONTACT US** page in the front of this manual.

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, ease of use, 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 Control operation, can be set. The Control will then abort the process and stop heat to the thermode if the temperature is ever reached.

Section II. Control Models

The ***standard*** and ***remote*** versions of the Control have a front panel with controls and a display for operator control of the Control.

Amada Miyachi America Part #	Type of Operation	AC Input Voltage	Output Heating Capability
1-298-02	**Front panel.** Has front panel controls and display for local operator programming. 24 VAC or 24VDC* valve outputs	120	2 KVA For thermodes up to 2.3" (60 mm) long
1-298-02-01 **1-298-02-02** **1-298-02-03** **1-298-02-05** **1-298-02-06** **1-298-02-07**	**Front panel.** Has front panel controls and display for local operator programming. 24 VAC or 24 VDC* valve outputs	240	4 KVA For thermodes up to 4" (100 mm) long
1-298-02-09 **1-298-02-10** **1-298-02-11** **1-298-02-13** **1-298-02-14** **1-298-02-15**	**Front panel.** Has front panel controls and display for local operator programming. 24 VAC or 24 VDC* valve outputs	240	2 KVA For thermodes up to 2.3" (60 mm) long
1-299-02-01 **1-299-02-02** **1-299-02-03**	**Front panel.** Has front panel controls and display for local operator programming. 24 VDC valve outputs	240	For use with 2 and 4 kVA transformers
9-040-01 Model X4/240UNF	Remote Transformer for use with Uniflow 4R Control	Power from Uniflow 4R Control	4 KVA For thermodes up to 4" (100 mm) long
9-041-01 Model X4/240UNFHV	Remote Transformer for use with Uniflow 4R Control	Power from Uniflow 4R Control	4 KVA For thermodes up to 4" (100 mm) long
9-042-01 Model X2/240UNF	Remote Transformer for use with Uniflow 4R Control	Power from Uniflow 4R Control	2 KVA For thermodes up to 2.3" (60 mm) long
9-043-01 Model X2/240UNFHV	Remote Transformer for use with Uniflow 4R Control	Power from Uniflow 4R Control	2 KVA For thermodes up to 2.3" (60 mm) long

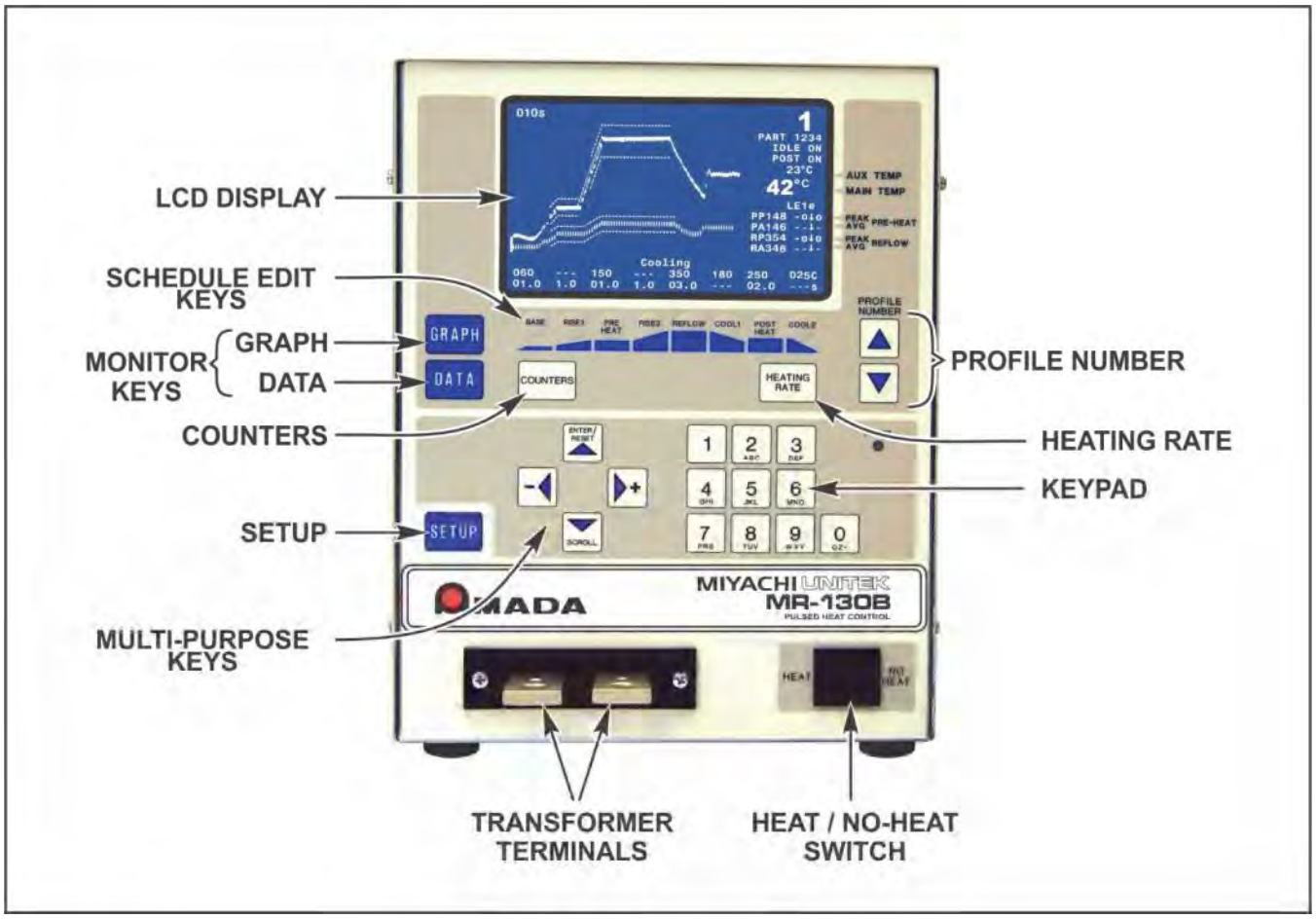
***** Refer to *Appendix B, Electrical And Data Connections* for additional information of 24 VAC or 24 VDC value outputs.

Heads, Thermodes and Accessories

For details of solder reflow and heat seal heads, thermodes and accessories available from Amada Miyachi America, please contact Amada Miyachi America using the phone, e-mail, or mailing information in the *Foreword* of this manual.

Section III: Controls and Indicators

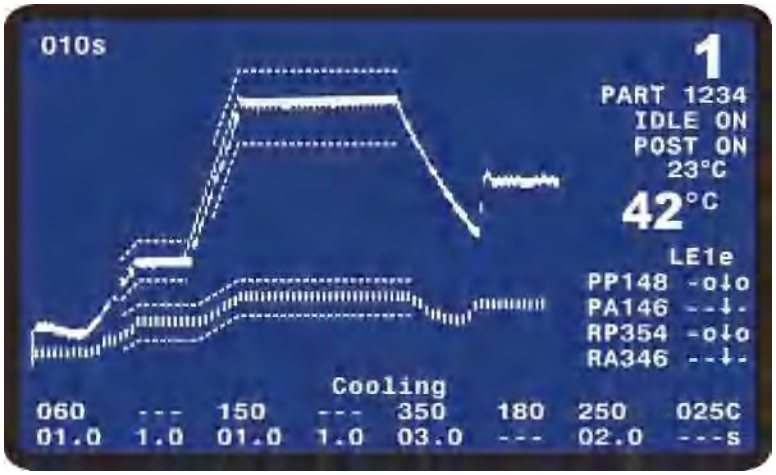
Front Panel



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 3, Using Programming Functions and Chapter 4, Operation.*

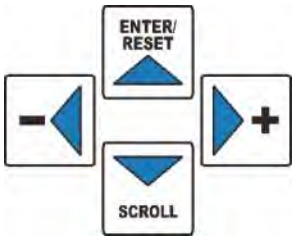


Numerical Keypad

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

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.

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.

DATA Key

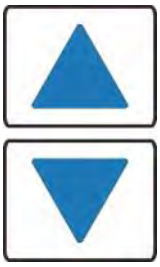
The **DATA** key brings up the data screen to the display.

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.

For rest of this manual, screens containing text only will be shown as black & white screens as shown on the right.

```
        PEAK    AVERAGE   FINAL                  1
PREHT    0°C      0°C      0°C
REFLW    0°C      0°C      0°C
AUXPH    0°C      0°C
AUXRF    0°C      0°C
BAS=00.0   RS1=00.0   PRE= 00.0
RS2=00.0   RFL=00.0   CL1= 00.0
PSH=00.0   CL2=00.0   TTL=000.0      22°C
RATE:Medium        FINE:35                  LE
                                      PP  0 ----
                                      PA  0 ----
                                      RP  0 ----
Counters disabled                     RA  0 ----
                   System Ready
060   ---  150   ---  350   180  250    025C
01.0  1.0  01.0  2.0  03.0  ---  00.0    ---s
```

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.

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.

```
                < REFLOW COUNTERS >

1.  TOTAL USAGE COUNTER          :   0000001
2.  GOOD REFLOW COUNTER          :   0000001
3.  CLEAN COUNTER                :  +999999
4.  REPLACE COUNTER              :  +999999



Number Select an item,  Graph  /  Data
```

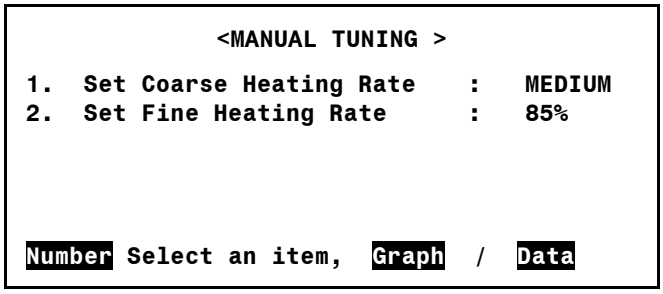
Schedule Edit Keys

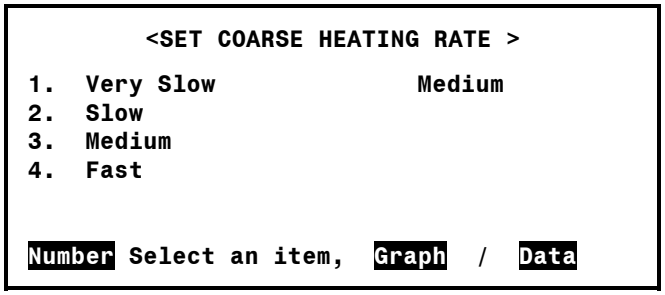
The Schedule Edit Keys allow you to edit the time and temperature parameters of the heat profile on the graphic display. The **BASE**, **RISE1**, **PREHEAT**, **RISE2**, **REFLOW, COOL1, POSTHEAT** and **COOL2** keys are vertically aligned with the profile heating states as displayed on the graphic screen.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

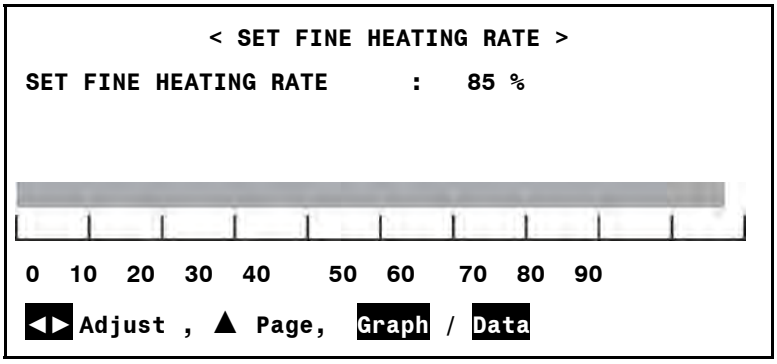
These keys are ***only*** active when the graphic screen is displayed.

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. See *Chapter 3, Using Programming Functions* for details.







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
```

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 work pieces prior to initiating a heating cycle.

CHAPTER 2
INSTALLATION AND SETUP

Section I: Planning for Installation

Space Requirements

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

Uniflow 4

Uniflow 4R

2KV Transformer

4KV Transformer

Weight:

2 KVA models: 48 pounds (21.8 kg) ● 4 KVA models: 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.
- Make sure 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.

Utilities

Input power requirements for the Control are as listed below.

Control Model	Input Voltage, 50 or 60 Hz, Single phase (Vrms)	Circuit Breaker Rating (Amps)
1-298-02	120	15
1-298-02-XX & 1-299-02-XX, where XX is any number	240	

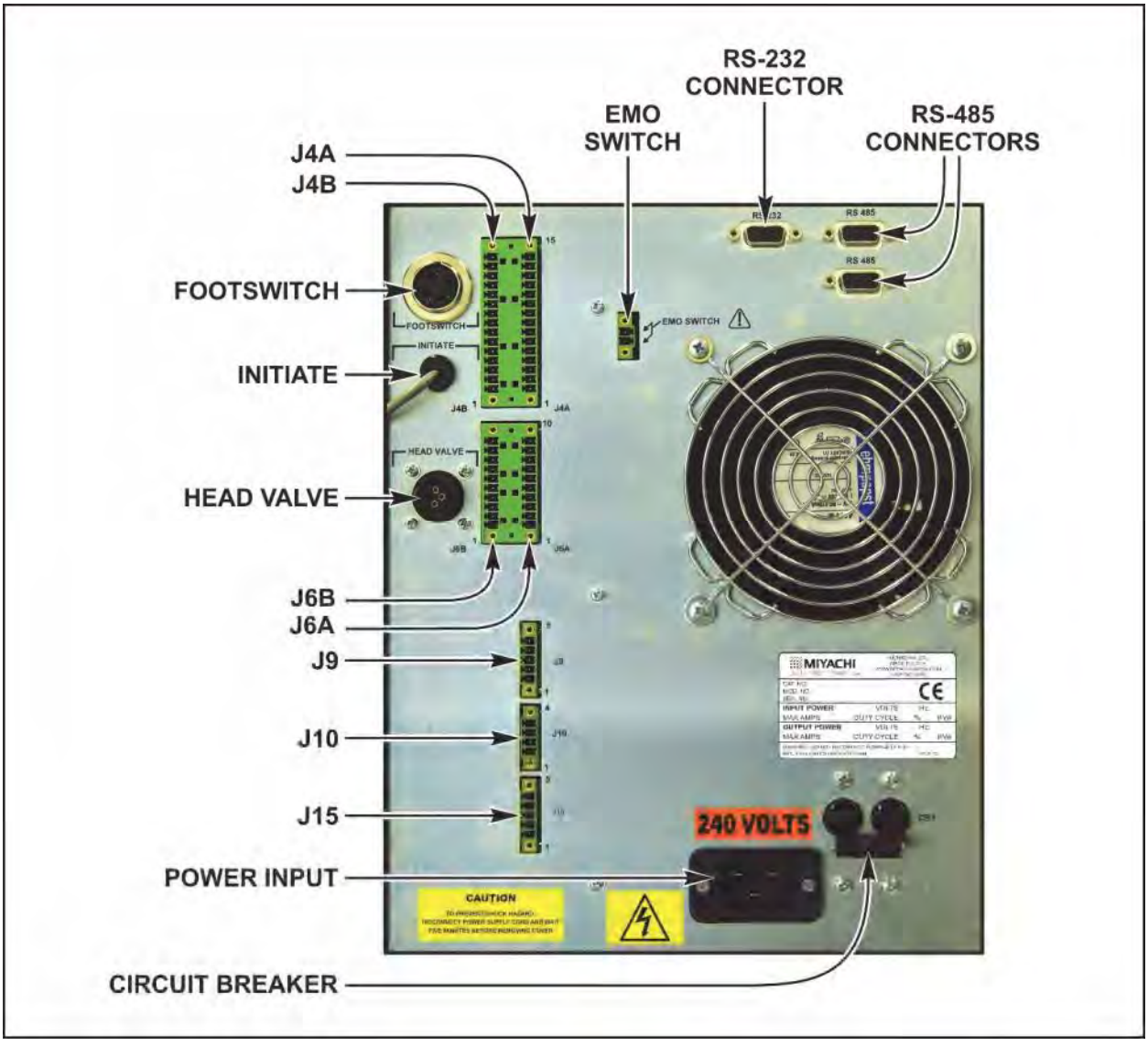
Section II: Connections To External Equipment

Overview

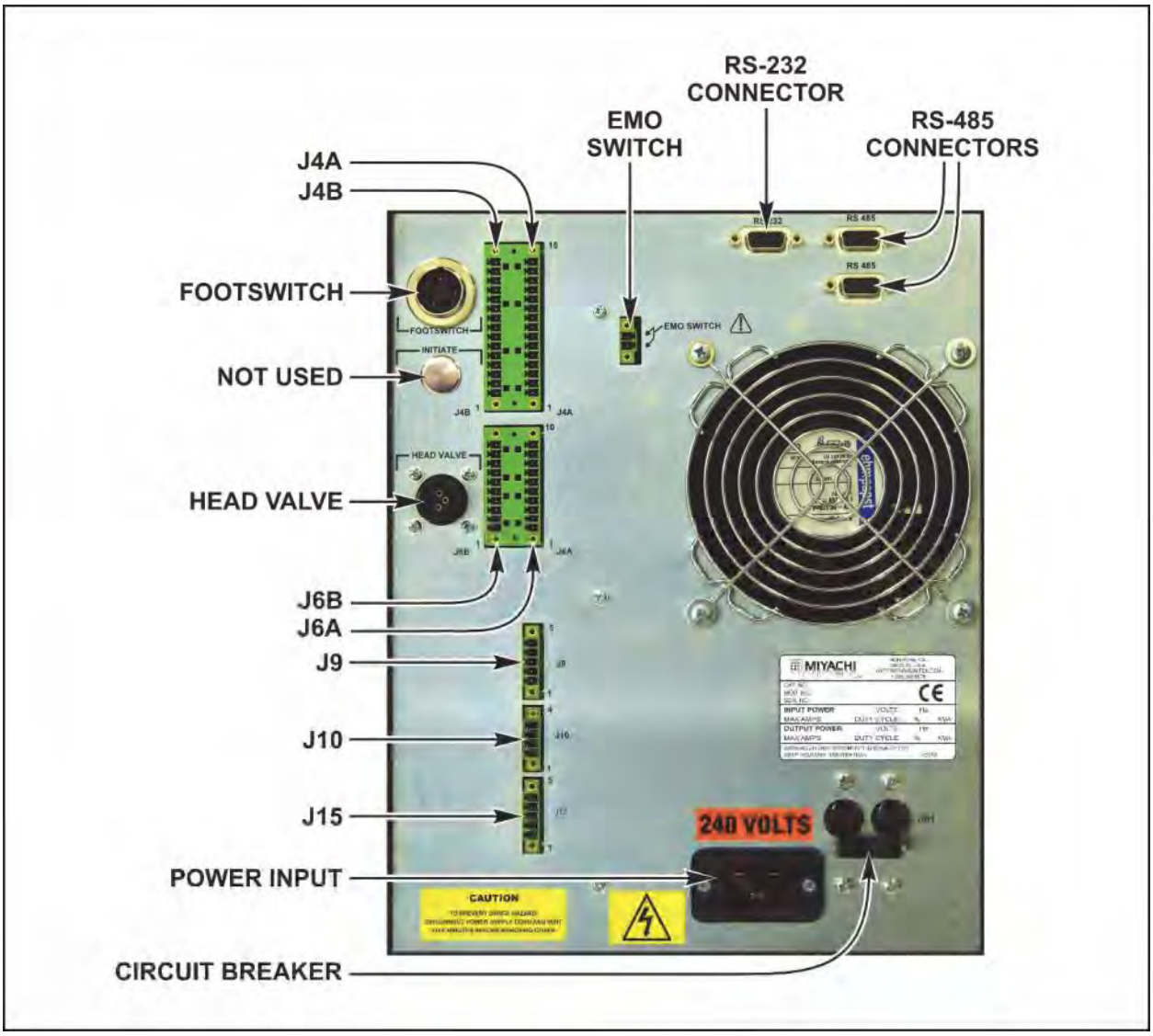
All connections, other than the transformer cable connections, between the Control and external equipment are made through the rear panel. The transformer cable connections from the reflow soldering or heat seal head are made at the transformer cable terminals on the front panel.

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.

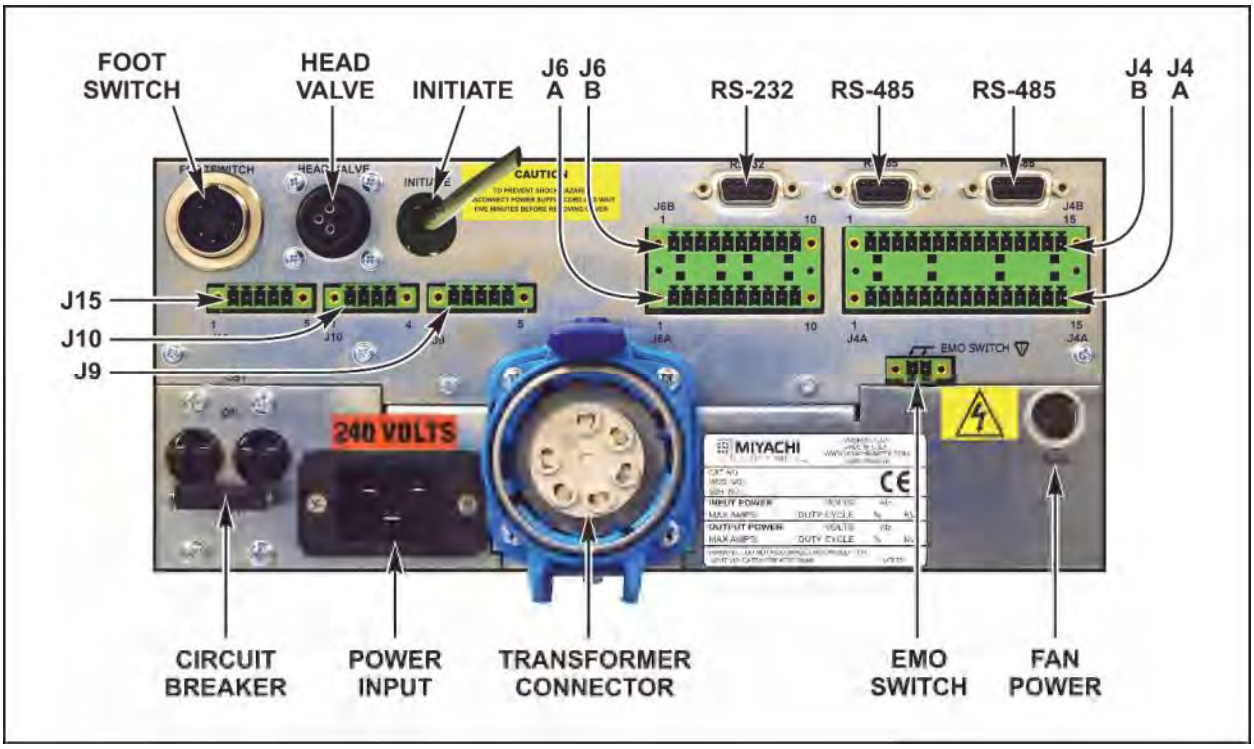
UNIFLOW 4 Rear Panel (With INITIATE Connector)



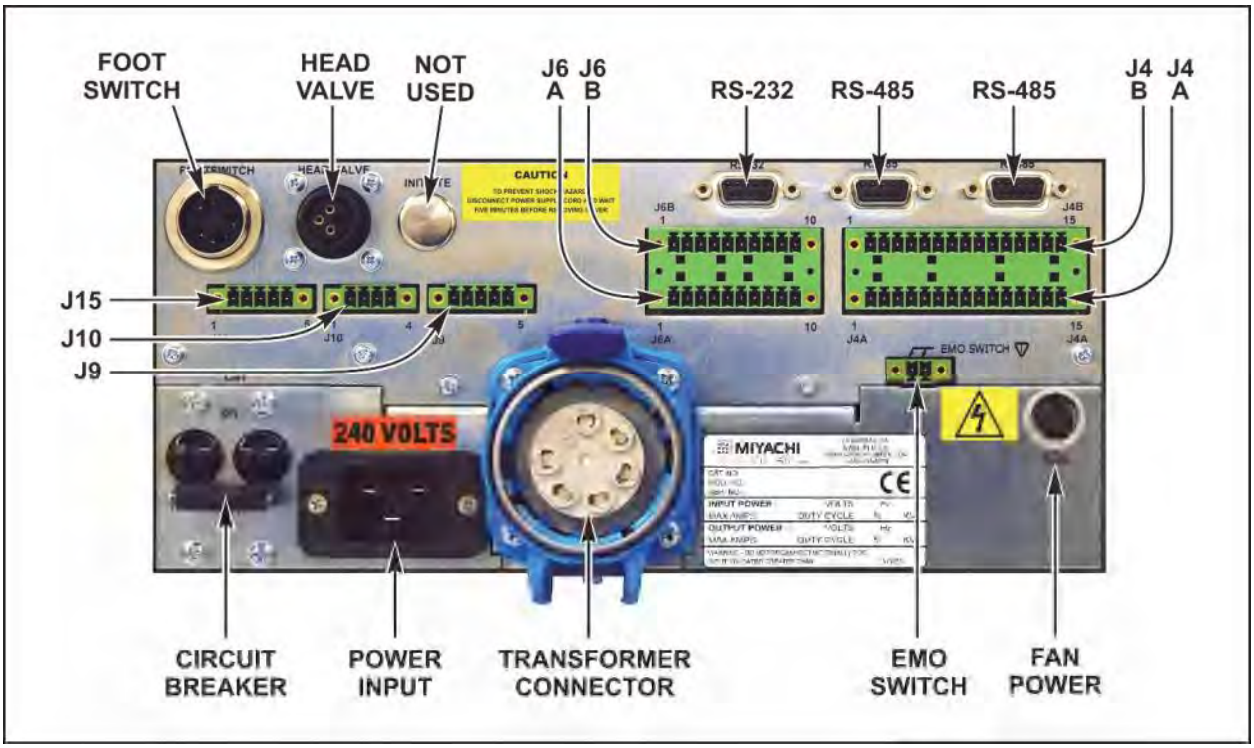
UNIFLOW 4 Rear Panel (Without INITIATE Connector)



UNIFLOW 4R Rear Panel (With INITIATE Connector)



UNIFLOW 4R Rear Panel (Without INITIATE Connector)



Input Power Connections

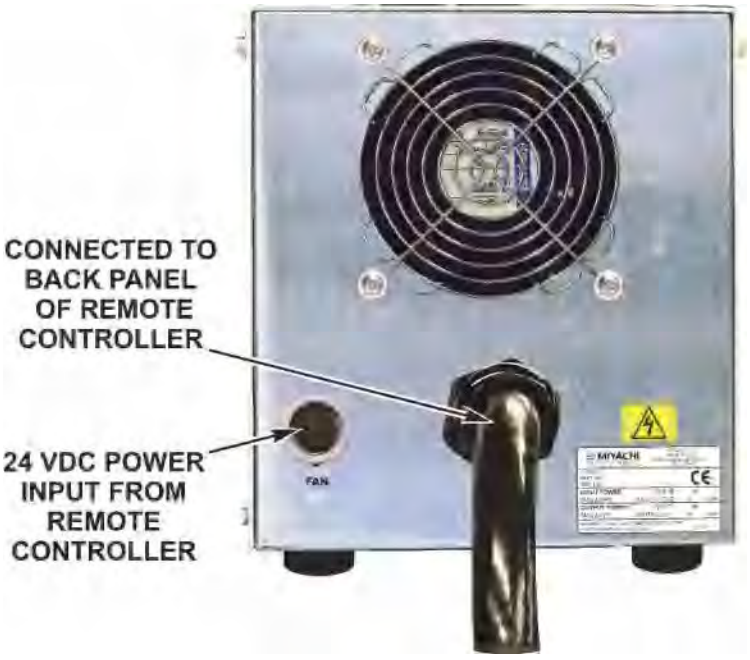
CAUTION
Be sure that the source power is appropriate for your Control model.

Attach an electrical plug to the power cable supplied in the Ship Kit. Connect the Control power cable to a single-phase, 50/60Hz power source. The nominal voltage range for each model is set at the factory: either 100 to 120 VAC, or 200 to 240 VAC.

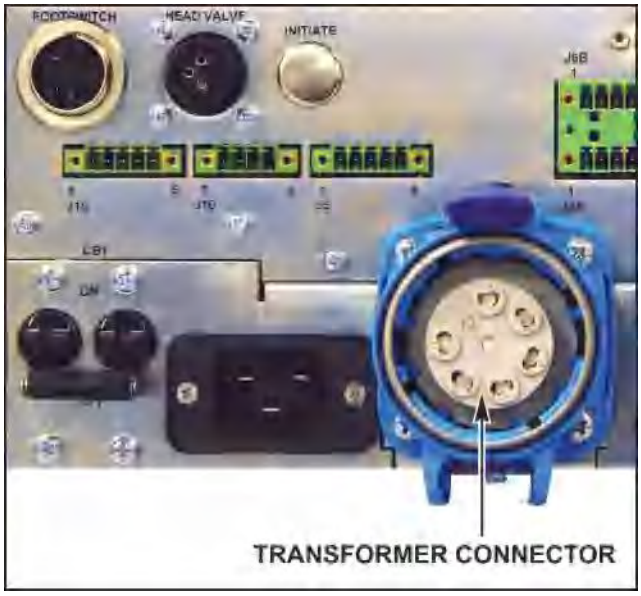
Connect the Transformer (Uniflow 4R Version Only)

Before you start, be aware that electrical noise may cause error messages such as the **MAX TEMP** alarm, and the temperature control will ***not*** be as good. ***To prevent electrical noise***, follow the instructions for proper cable placement in the following instructions.

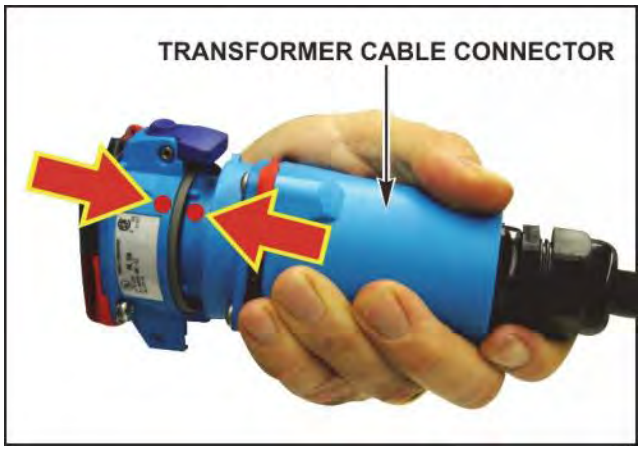
The 24 VDC power cable must be connected to the 24 VDC connectors on the back of the transformer and the back of the control.



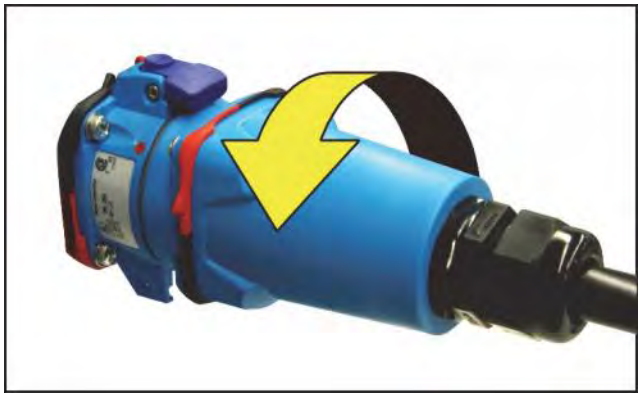
1. Locate the **TRANSFORMER CONNECTOR** at the bottom of the Control's rear panel.



2. Align the RED dot on the **TRANSFORMER CABLE CONNECTOR** to the RED dot on the **TRANSFORMER CONNECTOR**.



3. Once the RED dots are aligned, push the cable into the transformer connector until it stops, then twist slightly ***counterclockwise*** until the connectors are secured together.



4. ***To*** prevent ***electrical noise on the thermocouple***, place the thermocouple cable along side of the transformer cable that goes between the Transformer and Control.

NOTE: To disconnect, twist the **TRANSFORMER CABLE CONNECTOR** slightly *clockwise*, then un-plug the cable.

Control to Head Connections

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.

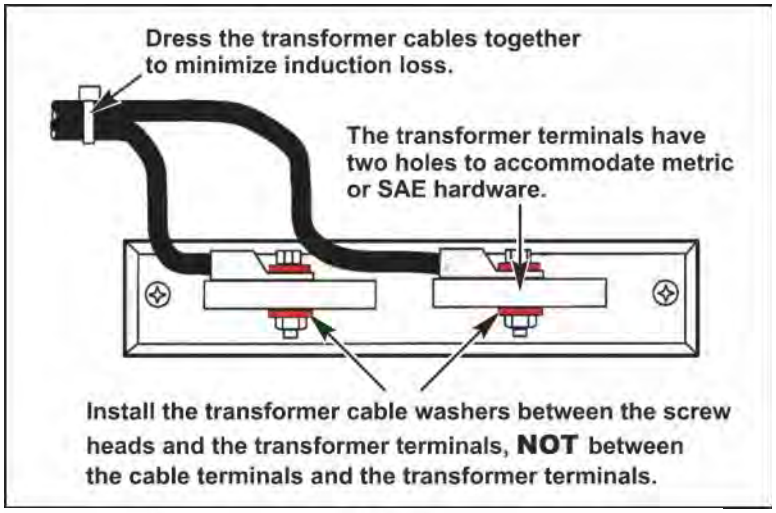
1. Connect the reflow soldering or heat seal head thermocouple cable, referenced in this manual as **MAIN** thermocouple, to terminal block **J9** on the rear panel. Connect a second thermocouple, referenced in this manual as **AUXILIARY** thermocouple, to terminal block **J15** on the rear panel.
2. ***To reduce noise pickup,*** make sure the thermocouple cables do ***not*** run next to the transformer cables that connect the head to the transformer terminals on the remote transformer. If you are using two individual thermocouple wires, they ***must*** be twisted together in order to reduce noise pickup.

   NOTES:

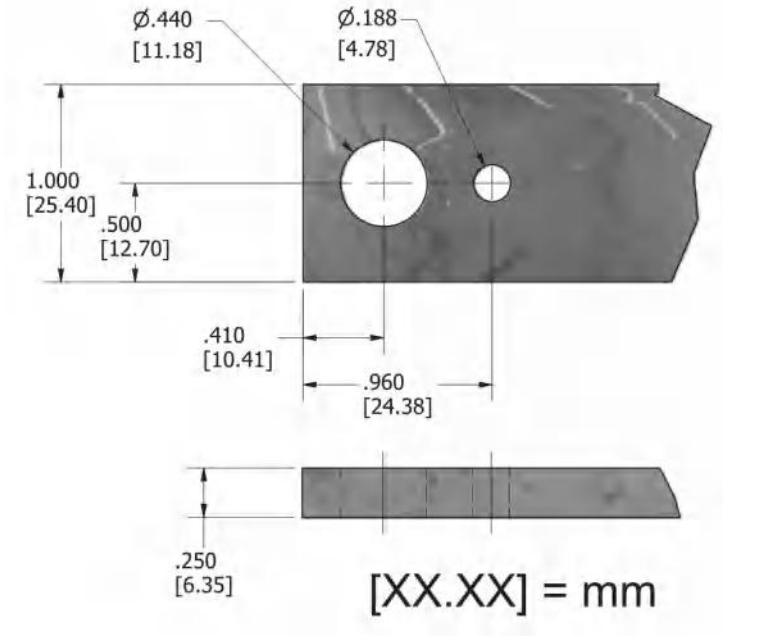
   - The connector is keyed so that it cannot be installed improperly.
   - The Control requires that the thermocouple polarity be correct. If the thermocouple polarity is reversed, the control may display the error message "OVER POWER ALARM – Check TC (thermocouple), Cycle Power." See *Appendix B*, Main Thermocouple Input Connector (J9) for the correct connection.
   - 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.
3. Plug the green **CONTROL INPUT JUMPER** plug (marked **P4B)** into connector **J4B** on the rear panel.
4. Connect the data interface connectors on the rear panel to the PLC using the Phoenix-type connector, J6A/J6B.
5. 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 supplied in the Ship Kit on the **EMO SWITCH** connector. This plug shorts Pins 1 and 2, labeled **EMO SWITCH** on the rear panel. See *Appendix B, Electrical and Data Connections* for details.

   NOTE: If the EMO jumper plug, or an Emergency Stop Switch, is ***not*** connected to pins 1 and 2, an **Emergency Stop Alarm** will be activated.

6. Connect the two transformer cables from the head to the transformer terminals on the Control front panel for the ***standard version*** or to the transformer terminals on the remote transformer for the ***remote version***.



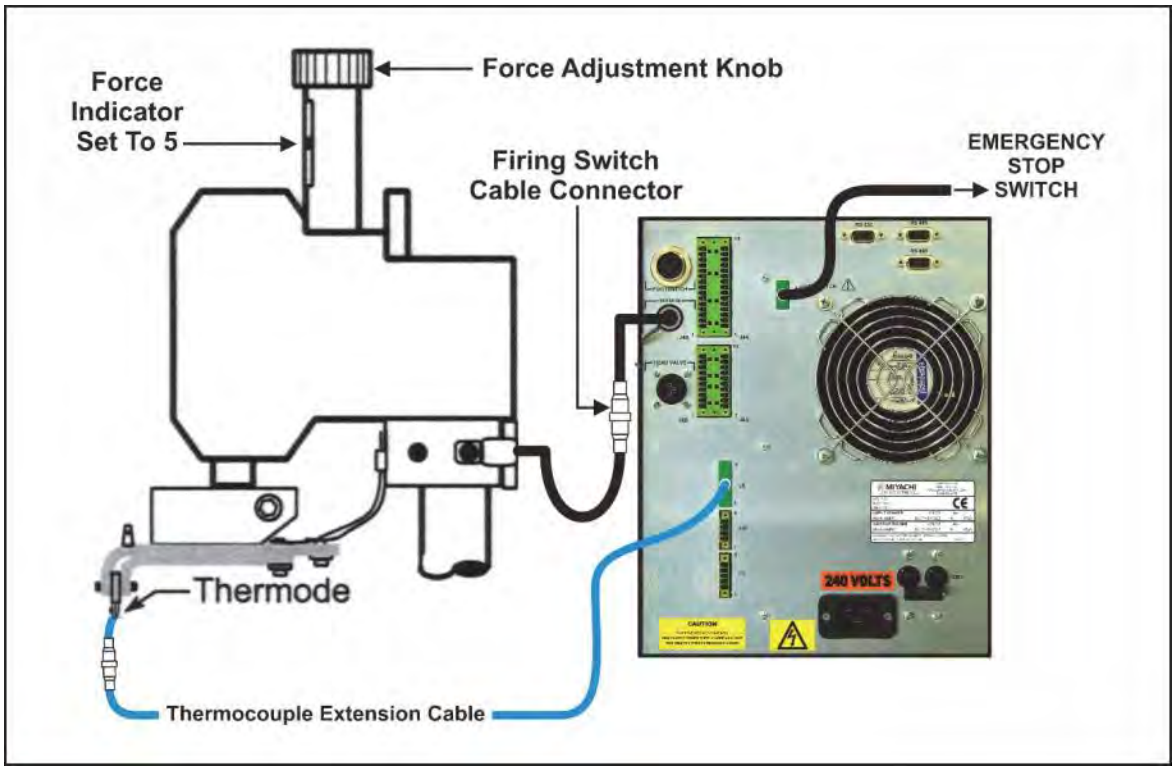
Transformer Terminal Dimensions



Section III: Equipment Setup

Force Fired, Mechanically Actuated Head

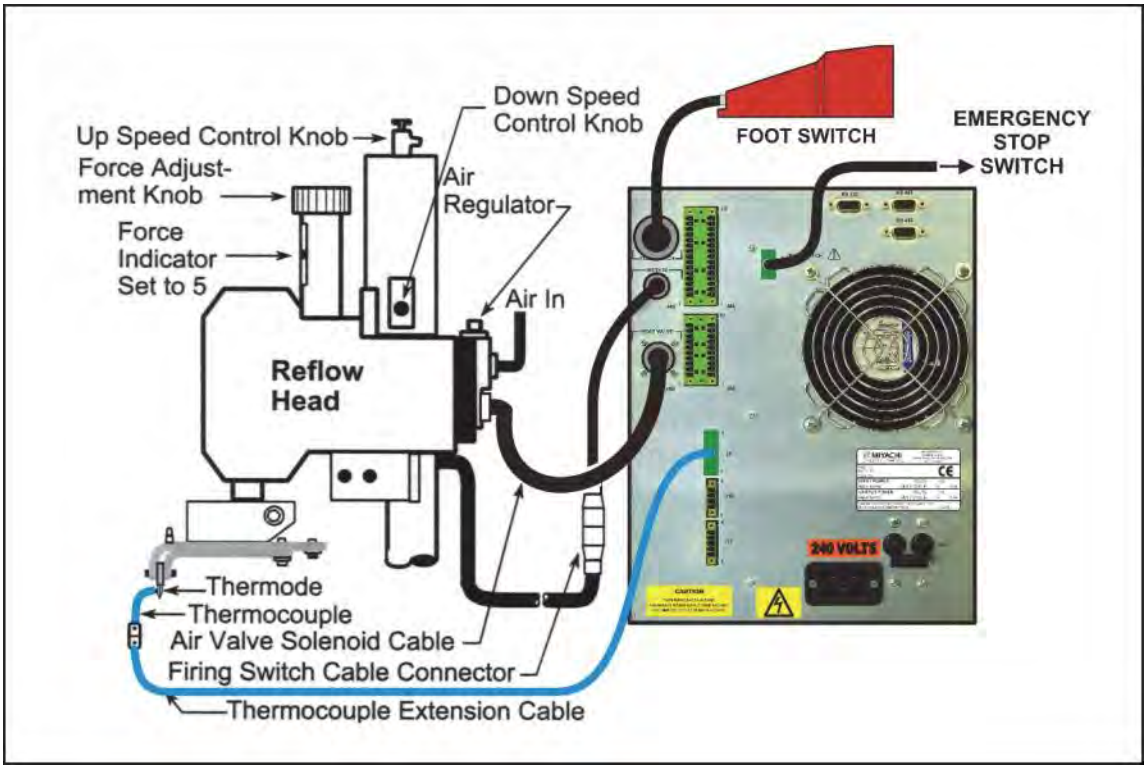
NOTE: If you are using an Air Actuated Head, skip this section and go the next page for the *Force Fired Air Actuated Head* instructions.



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 firing switch **INITIATE** cable connector.
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.

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 firing switch **INITIATE** cable connector.
3. Connect the Foot Switch Cable 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 VDC or 24VAC power for the ***standard version***, or 24VDC only for the ***remote version***. It will ***not*** drive 115 VAC air valves.

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.

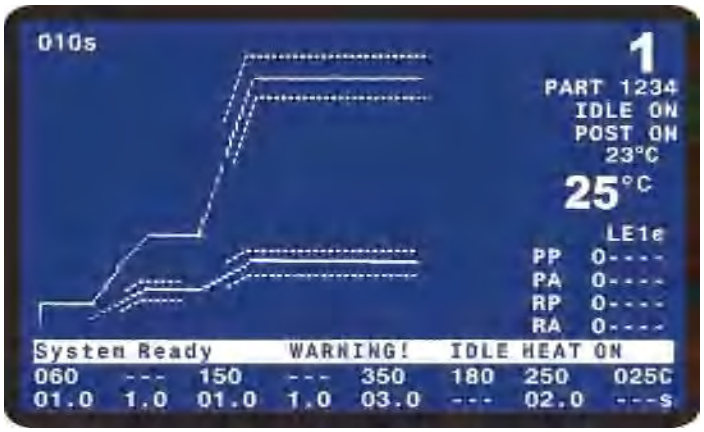
   NOTE: Use a lubricator ***only*** with automated installations.

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 14. If the head does ***not*** retract, go to Step 13.

12. Increase air pressure in **5 psi increments** and repeat Steps 11 and 12 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 16. If it does not descend ***smoothly***, go to Step 15.

14. Adjust the head down speed control knob and repeat Step 14 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 17.
16. Repeat Step 16, adjusting the Head Up Speed Control Knob until the thermode does ***not*** impact at the UP position.

CHAPTER 3
USING PROGRAMMING FUNCTIONS

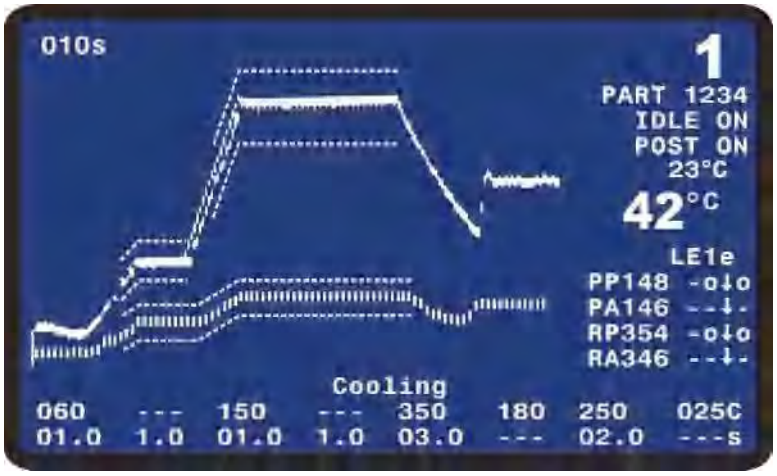
Overview

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 1, 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.

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 on the right.



Screen Navigation and Menu Selection

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 on the right.

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

1.  ENABLE PEAK AND AVG LIMITS    :   OFF
2.  PREHT PEAK TIME DELAY         :   00.0    SEC
3.  PREHT AVG TIME DELAY          :   00.0    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
```

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.

Run Mode

Press the **GRAPH** or **DATA** key to enter the **RUN** mode. With the **GRAPH** 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.

Setup 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.

```
                    < 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
```

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

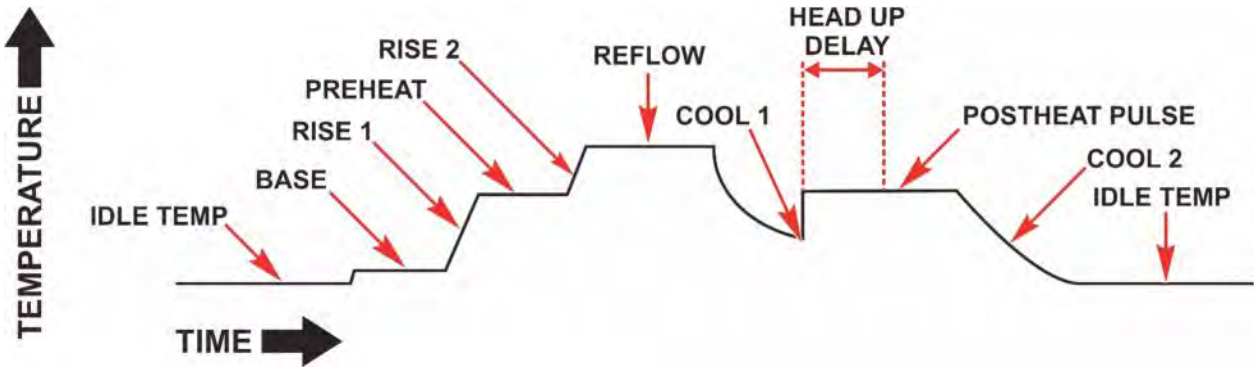
The screen shown to the right displays the default profile settings.

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 4, Operating Instructions.*

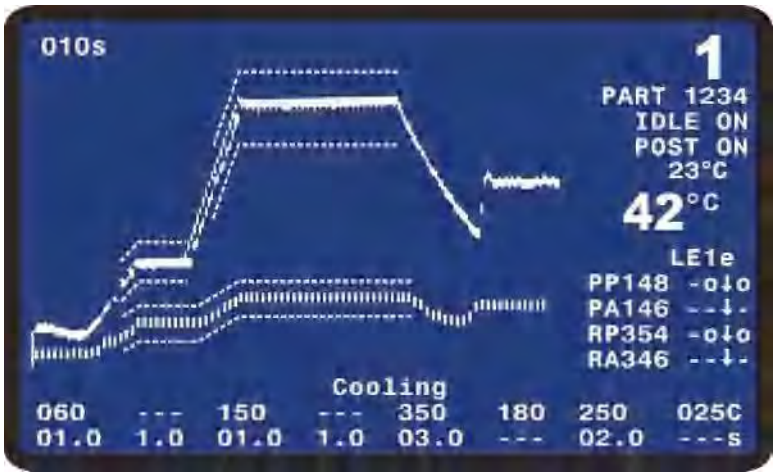
Process Cycles

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



You 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 has at least one process cycle, **Reflow**, with a time of at least 0.1 seconds.



Base

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.

Rise1

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.

Preheat

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.

Rise2

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 2.0 seconds. It can be set from 0 to 9.9 seconds. When it is set to 0.0 seconds, the **Rise2** state is omitted.

Reflow

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°C to 600°C. **Reflow** can also be set in an extended temperature range up to 999°C

Cool1

You use **Cool1** to ensure that a solder joint or heat seal adhesive has solidified. If a Postheat stage is ***not*** being used, 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 200°C. Set-point temperature can be set from 25° to 300°C. The **Cool1** time is not controlled.

Postheat

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. The point at which during the Postheat stage when the thermode will be lifted is determined by the user setting for **Head Up Delay**.

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°C to 600°C.

Cool2

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.

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.

Temperature 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 4, Operating Instructions, Section V.*

Schedule Setup Parameters

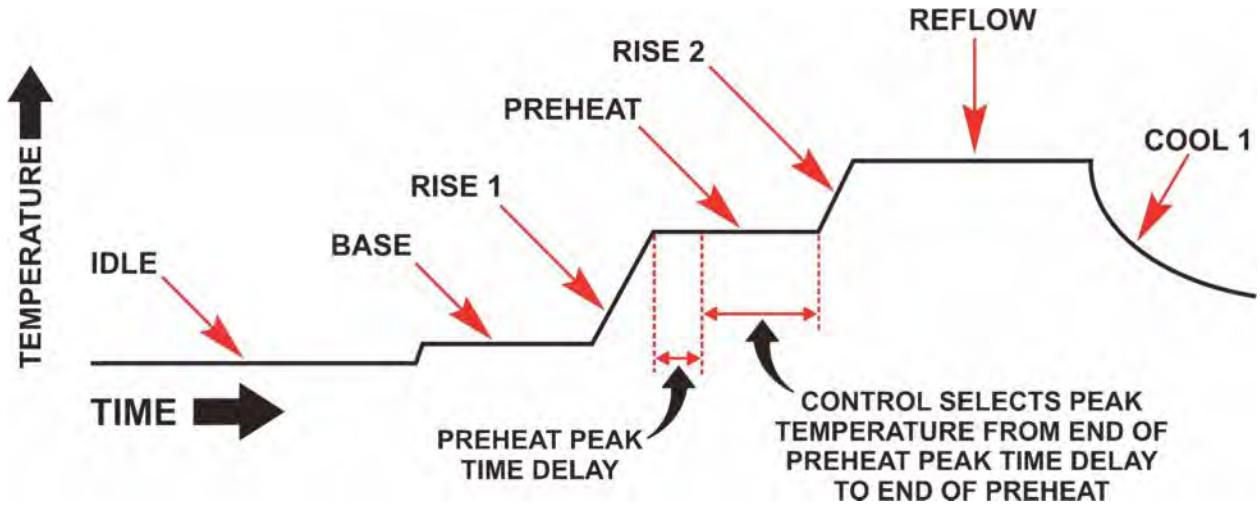
The **Schedule Setup** screens are accessed by pressing the **GRAPH** key.

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.

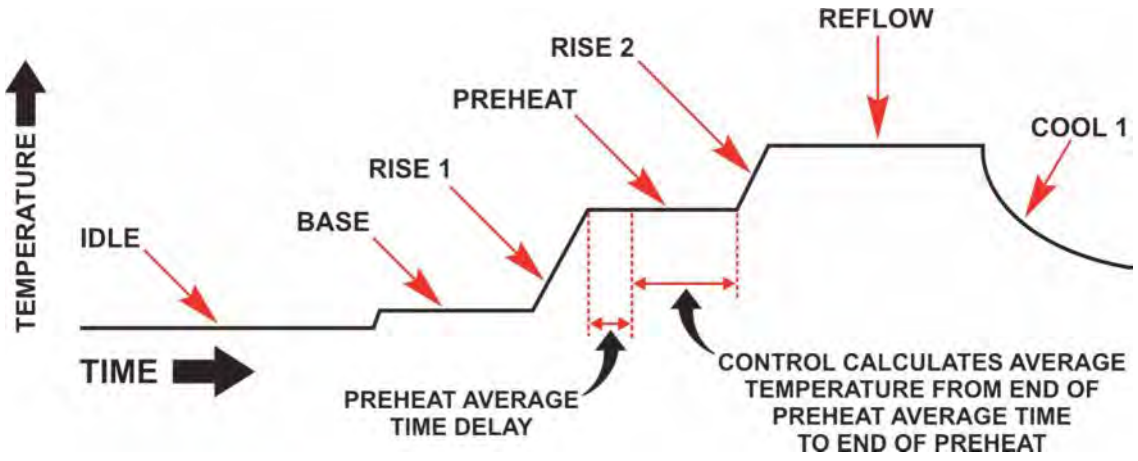
```
          < SCHEDULE SETUP, Page 1 of 5 >

1.  ENABLE PEAK AND AVG LIMITS   :   OFF
2.  PREHT PEAK TIME DELAY        :   00.0    SEC
3.  PREHT AVG TIME DELAY         :   00.0    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 **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 Preheat set temperature is 150 °C, and the peak temperature for the process should not exceed 180 °C, then you should enter 30 °C in the **PRHEAT 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.

```
PREHT PEAK HI TEMP LIMIT          :  +030


After edit ▲ Page to accept new value


Number Change,  ◀ ▶ Adjust,  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**. You can also press the ▲ and ▼ keys to step through the **Schedule Setup** screens.

This screen contains parameters for the **Main** thermocouple and the temperature the Control is controlling. It also includes some general profile parameters.

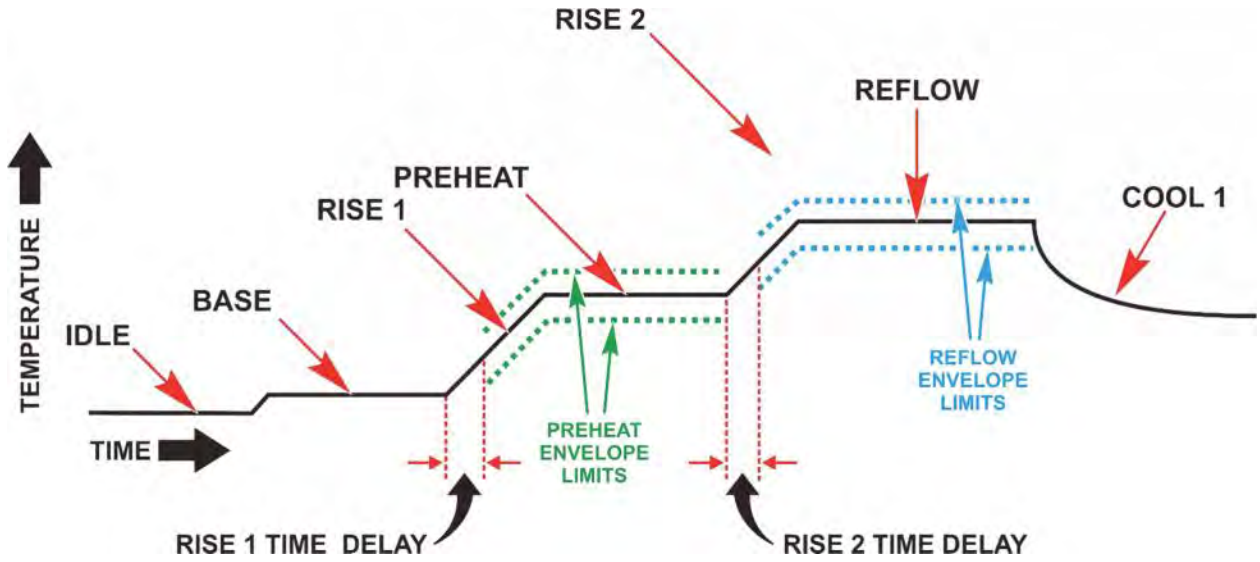
Press the **1** key to toggle **PREHEAT ENVELOPE LIMITS** to between **ON** and **OFF**.

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

1.  PREHEAT ENVELOPE LIMITS       :   OFF
2.  REFLOW ENVELOPE LIMITS        :   OFF
3.  RISE 1 TIME DELAY             :   0.0     SEC
4.  RISE 2 TIME DELAY             :   0.0     SEC
5.  PREHEAT HIGH TEMP LIMIT       :  +050     °C
6.  PREHEAT LOW  TEMP LIMIT       :  -050     °C
7.  RELOW   HIGH TEMP LIMIT       :  +050     °C
8.  REFLOW  LOW TEMP LIMIT        :  -050     °C
9.  GRAPH TIME SPAN               :   010     SEC
0.  HEAD UP DELAY                 :   00.0    SEC
>.   IDLE TEMPERATURE             :   025     °C
<.   SCHEDULE REFERENCE           :

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

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** or **4** key to set the **RISE1 or RISE2 TIME Delays.** These parameters allow you 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**.

```
RISE1 TIME DELAY                :

After edit ▲ Page to accept new value


      Change, ◀ ▶ Adjust,          /
```

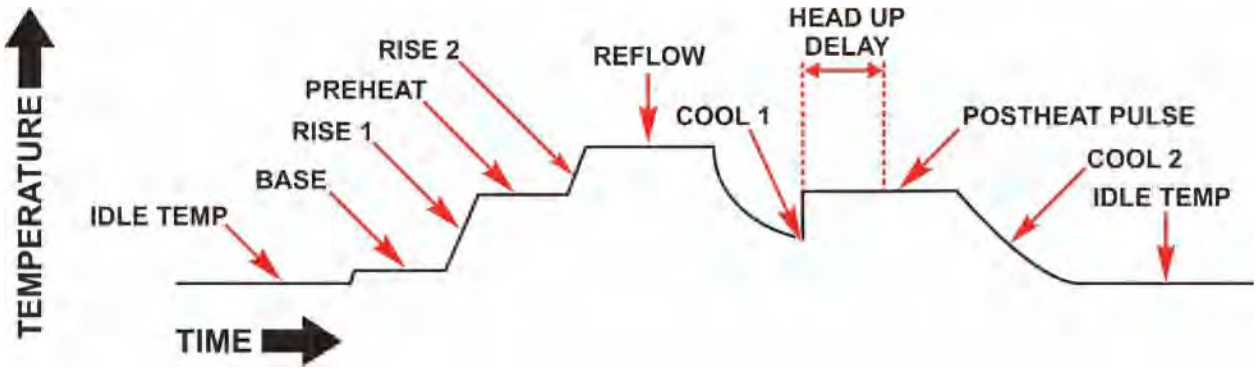
Even if the value for **RISE1 TIME DELAY** is greater than the **RISE1** Period time, there will be an envelope during the entire **PREHEAT** time. The **RISE2 TIME DELAY** has the same functionality as the **RISE1 TIME DELAY.**

Press the **5** though **8** keys to set the Envelope Limits. These parameters allow you 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 you wants an envelope that is 50 °C greater than the **RISE2** and **REFLOW**, then you should enter 50 °C in the **REFLOW HIGH TEMP LIMIT** field.

```
REFLOW HIGH TEMP LIMIT                :

After edit ▲ Page to accept new value


      Change, ◀ ▶ Adjust,          /
```

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.

```
GRAPH TIME SPAN                    :   030

After edit ▲ Page to accept new value


Number Change,  ◀ ▶ Adjust,  Graph  /  Data
```



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, you can just press the next key without pressing the right arrow key.

```
REFERENCE TEXT                :     PART-123

After edit ▲ Page to accept new value


Number Change, ◀ ▶ Advance,   Graph  /  Data
```

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.

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 **TEMPERATURE**. Refer to pages 4-7 and 4-8 in chapter 4 for more information on this feature.

```
          < SCHEDULE SETUP, Page 3 of 5 >
1.  PREHEAT AND REFLOW CONTROL    :   TIME
2.  PREHEAT TEMPERATURE DELTA     :   00      °C
3.  REFLOW TEMPERATURE DELTA      :   00      °C
4.  PID CONTROL                   :   132
5.  SOLDER COOL VALVE DELAY       :   0.0     SEC




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

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.

Note: Please refer to Chapter 4 for more information on Time and Temperature Control and the **PREHEAT TEMPERATURE DELTA** and **REFLOW TEMPERATURE DELTA** settings and functions.

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,

```
< PID CONTROL >

PID CONTROL   :  132

After edit ▲ Page to accept new value


Number Change,  ◀▶ Adjust,  Graph / Data
```

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 Postheat periods. This single delay applies to both the end of Reflow and Postheat periods. This parameter can be set from 0 to 9.9 seconds.

Selecting the PID CONTROL Number

The following table provides a guide to selection of a **PID CONTROL** number. It is recommended to start with a **PID CONTROL** number of 185. With this initial setting 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.

Less Overshoot, Less Oscillation, Increased Noise

Faster Rise Time, More Overshoot, More Oscillation

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*
O	*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*

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.

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      :  00.0       SEC
3.  PREHT AVG  TIME DELAY      :  00.0       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 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 **PRHEAT 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.

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

1.  PREHEAT ENVELOPE LIMITS      :   OFF
2.  REFLOW ENVELOPE LIMITS       :   OFF
3.  PREHEAT HIGH TEMP LIMIT      :  +050     °C
4.  PREHEAT HIGH TEMP LIMIT      :  -050     °C
5.  REFLOW  HIGH TEMP LIMIT      :  +050     °C
6.  REFLOW  LOW  TEMP LIMIT      :  -050     °C
7.  AUX START   TEMPERATURE      :   025     °C
8.  AUX PREHEAT TEMPERATURE      :   025     °C
9.  AUX REFLOW  TEMPERATURE      :   025     SEC


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

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.

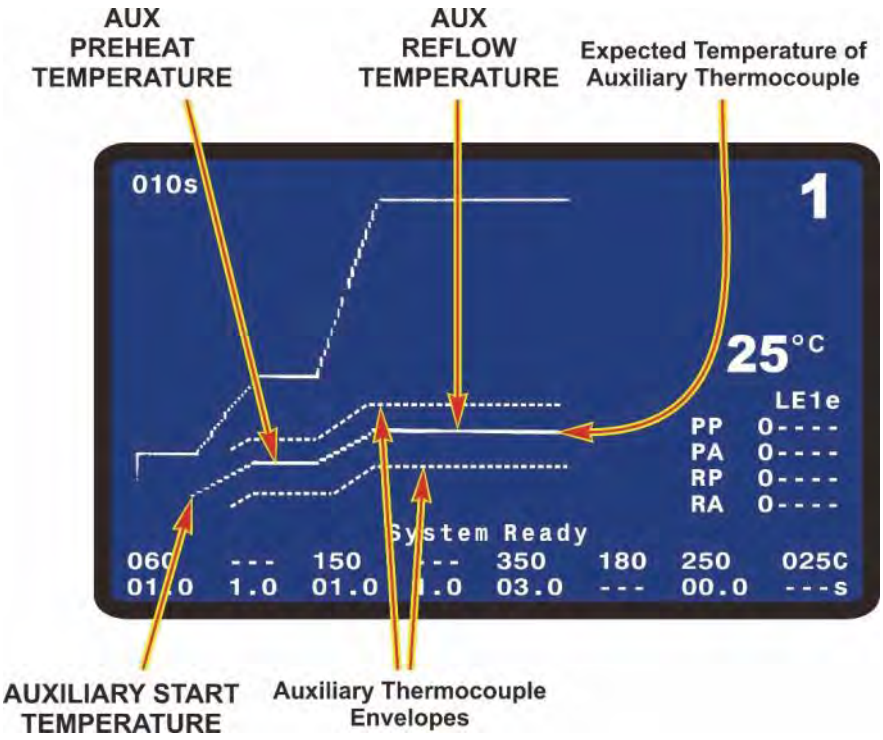
The **AUX PREHEAT TEMPERATURE** is the expected Auxiliary thermocouple temperature during Preheat. The **AUX REFLOW TEMPERATURE** is the expected Auxiliary thermocouple temperature during Reflow.

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 TEMPERTURE** = 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.

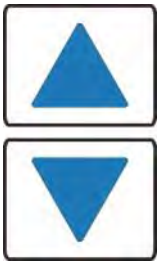


DATA Key

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.

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.

COUNTERS Key

This key brings up the **REFLOW COUNTERS** screen.

Based on your 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.

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

```
                < REFLOW COUNTERS >

1.  TOTAL USAGE COUNTER          :   0000004
2.  GOOD REFLOW COUNTER          :   0000004
3.  CLEAN COUNTER                :  +999999
4.  REPLACE COUNTER              :  +999999



Number Select an item,  Graph  /  Data
```

Total 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.

Good 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.

Clean 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.

```
            < CLEAN COUNTER SETUP >

1.  CLEAN COUNTER                :      OFF
2.  CLEAN COUNTER ACTION         :     STOP
3.  EDIT CLEAN COUNTER           :  +000010



Number Select an item,  Graph  /  Data
```

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.

Replace 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.

```
          < REPLACE COUNTER SETUP >

1.  REPLACE COUNTER              :      OFF
2.  REPLACE COUNTER ACTION       :     STOP
3.  EDIT CLEAN COUNTER           :  +000008



Number Select an item,  Graph  /  Data
```

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.

Press **3** to edit the remaining counts before the **Replace Counter** must be reset. With the numeric keys, you may select a number up to 999999.

Schedule Edit Keys

The Schedule Edit Keys allow you to edit the time and temperature parameters of the heat profile on the graphic display. These 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 **GRAPH** 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 **REFLOW** key. The Reflow temperature value of 350 will now be highlighted.

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

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

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.

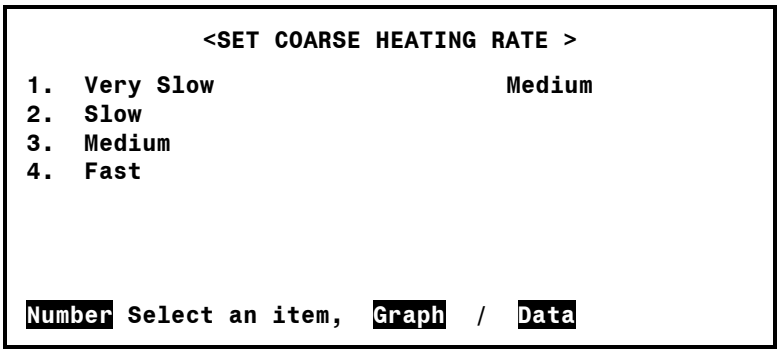
NOTE: While data is being saved to flash, the screen will display ***** SAVING CHANGES *****

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 (0.5mm), the **COARSE** heating rate should range from **VERY SLOW** to **SLOW** to prevent severe temperature overshoot.

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



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.

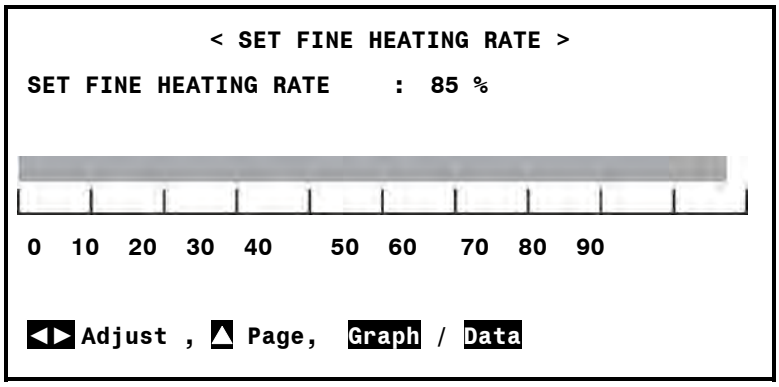
The default value is **Medium**. The progression from **Very Slow** to **Fast** provides more energy to heat the thermode. Use the table below as a guide to optimizing the coarse heating rate. Select the recommended coarse heating rate by pressing keys **1** through **4**. Typical **COARSE HEATING RATES** are **Very Slow** for small peg tip thermodes, **Slow** for 0.4" wide thermodes, **Medium** for 1.5" thermodes, and **Fast** for large thermodes.

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 4kVA 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.

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
```

HARDWARE 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 VAC or +24 VDC

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 *Appendix B, 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 VAC or +24 VDC 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 or fire switch initiates a Control 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 *Appendix B, Electrical and Data Connections* for connection details.

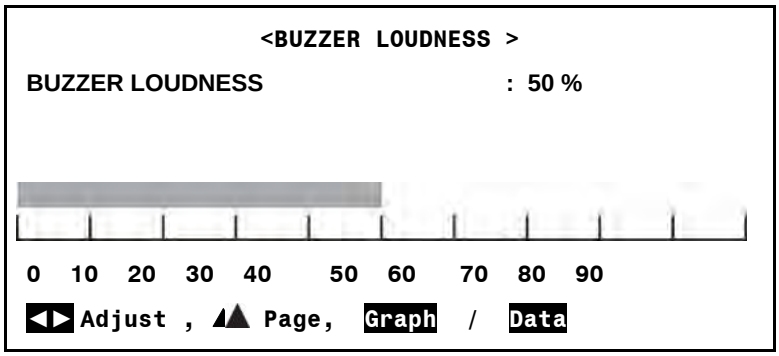
```
          < AUTO RECOGNIZED HARDWARE >

a.  MANUAL HEAD IS CONNECTED
b.  LINE FREQUENCY IS            : 60HZ
c.  E TYPE THERMOCOUPLE IS CONNECTED




        ▲ Page,   Graph  /  Data
```

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.

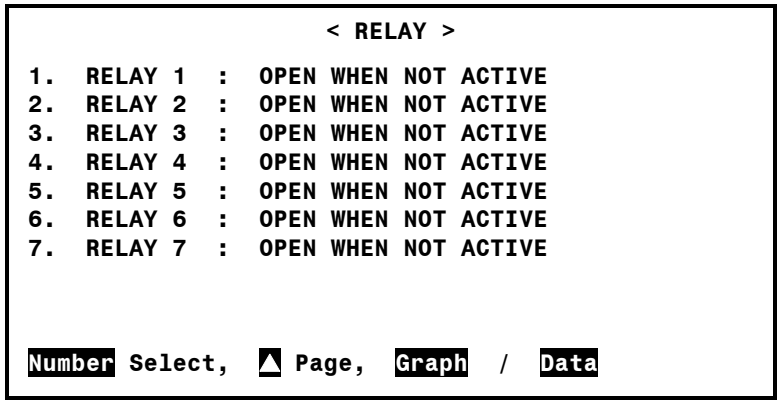


END OF CYCLE BUZZER

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 1** temperature setting if there is no Postheat stage. If there is a Postheat stage, the buzzer will sound at the **Cool 2** temperature setting.

SET OUTPUT RELAYS

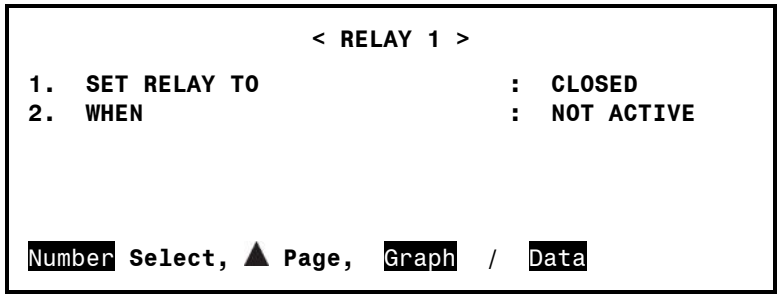
Press the **8** key to bring up the **RELAY** screen. The **RELAY** screen allows you to select the Alarm for Status actuation states or each relay.



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

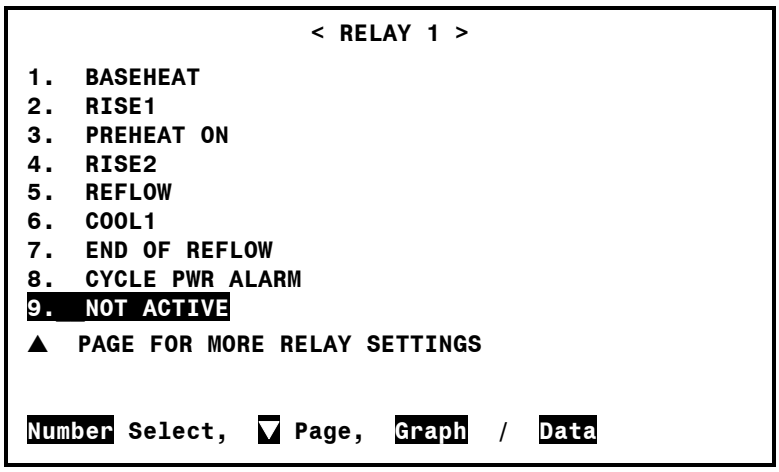
Press the **1** through **7** keys to bring up the desired relay screen. For example, press **1** to bring up the **RELAY 1** screen.

Press the **1** key to toggle **SET RELAY** to between **CLOSED** and **OPEN**.



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

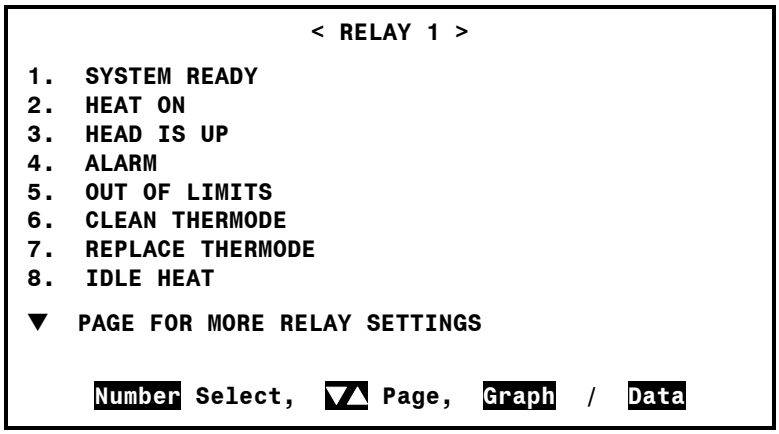
The **1** through **8** keys on the keypad set the **RELAY 1** status options.



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.

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. **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. If process does not have a Postheat stage, then relay switches to active at COOL1. If the process does have a Postheat stage, then relay

switches to active at end of the Head Up Delay time. The relay remains active until the Control receives the fire signal for the next process.

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. If the unit is in the Cooling stage, the Cooling stage will end at COOL 1 temperature if there is no POSTHEAT time, or the Cooling stage will end at COOL 2 temperature if there is a POSTHEAT time. 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 the 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.

   NOTES: 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

   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 applying a signal at the digital input 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 screen, or reset by applying a signal at the digital input J4A-7.

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

See *Appendix B, Electrical and Data Connections* for the relay description that includes the timing diagram showing the sequence of the status options.

COMMUNICATIONS

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**.

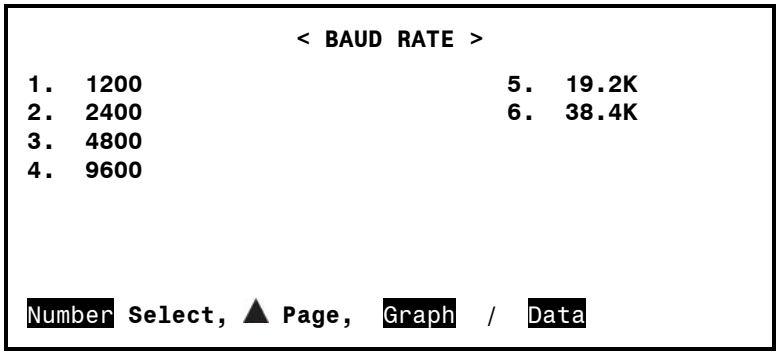
NOTE: Refer to *Appendix D, Communication Codes* for additional information on the serial communication protocol and commands.

RS232/485 SELECT

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

BAUD RATE

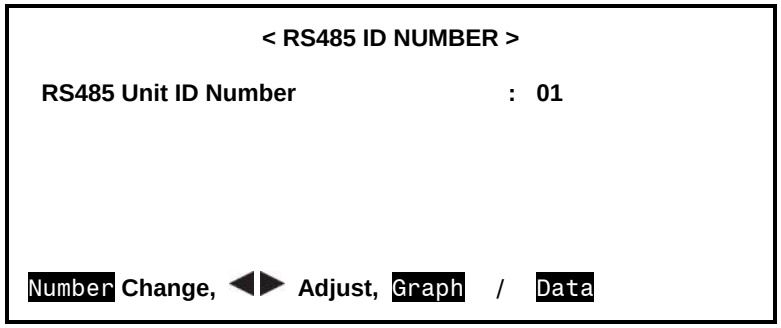
The **2** key on the **COMMUNICATION** menu brings up the **BAUD RATE** screen. Use the keypad to select the required data transfer rate, from 1200 to 38.4K baud. The Default value is 38.4K.



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.



REFLOW SETUP

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

SET IDLE TEMPERATURE ON/OFF

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.

```
          < REFLOW TEMPERATURE SETUP >

1.  IDLE TEMPERATURE IS          :    OFF
2.  SET SAFETY TIMER             :    10     SEC
3.  SET RELEASE TIMER            :    00     SEC
4.  MAX TEMPERATURE LIMIT        :    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
```

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 **REFLOW** temperature set point by the time set in the safety timer. The safety timer starts timing at the beginning of **RISE2**. If the time is exceeded, a **SAFETY TIME EXCEEDED** alarm will be set.

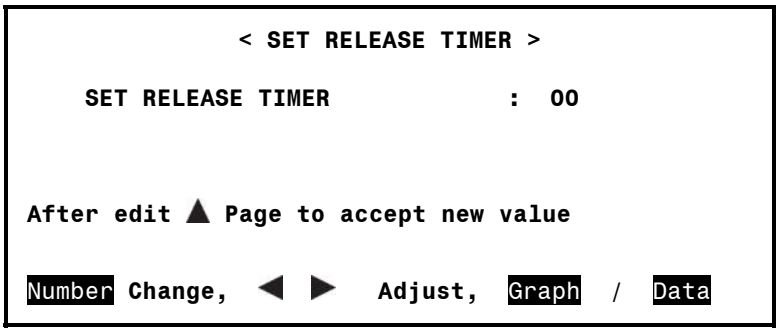
```
              < SET SAFETY TIMER >

    SET SAFETY TIMER             :  00


After edit ▲ Page to accept new value

Number  Change,  ◀ ▶ Adjust,  Graph  /  Data
```

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

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.

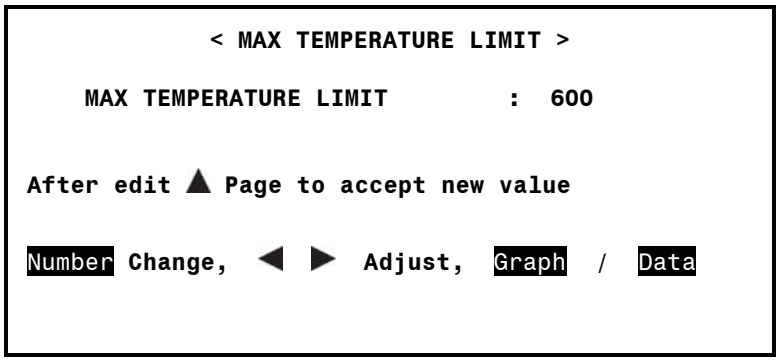
Use the number or ◄ ► keys to select a release timer value of 00 to 99 seconds.



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 for the Main Thermocouple.

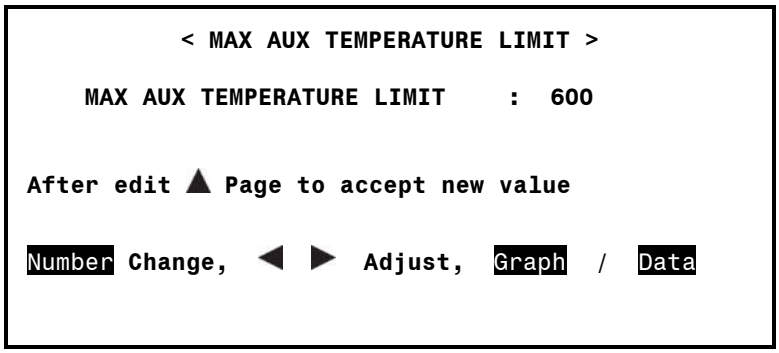
When entering reflow temperatures in profiles, the new reflow temperature must be ***below*** the user set **MAX TEMPERATURE LIMIT.**



The default temperature of 600°C is shown on the screen above. A maximum temperature up to 999°C can be entered. Use the ◄ ► keys to edit the value.

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. IDLE 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

```
          < MAX IDLE TEMPERATURE LIMIT >

    MAX AUX 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.

SYSTEM 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
```

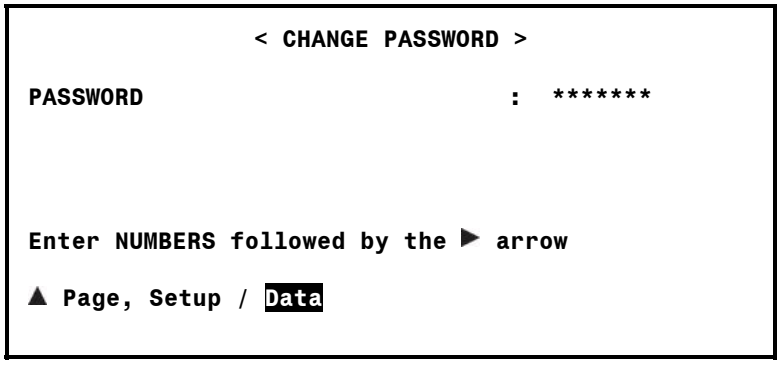
This **SYSTEM SECURITY** screen allows you to activate password-only access for changing the three listed system functions.

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**.

If you press the **GRAPH**, **COUNTERS**, or **HEATING RATE** keys during entry of a password, this function will be aborted.



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 you from modifying any reflow parameters and from selecting different profile schedules.

SYSTEM LOCK prevents you from making changes to menu items.

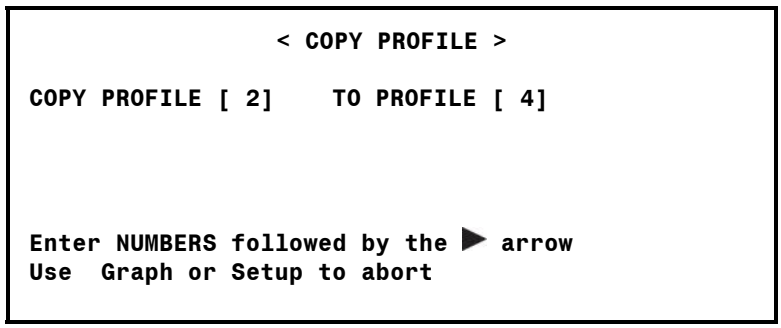
PROFILE TUNING LOCK prevents modifying any reflow parameters, but allows users to select different profile schedules.

NOTE: The **SYSTEM SECURITY LOCKS** prevent keypad actions. When **SYSTEM SECURITY LOCKS** are active, inputs received through the Profile Binary Inputs and Serial Ports will still be executed.

COPY 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.



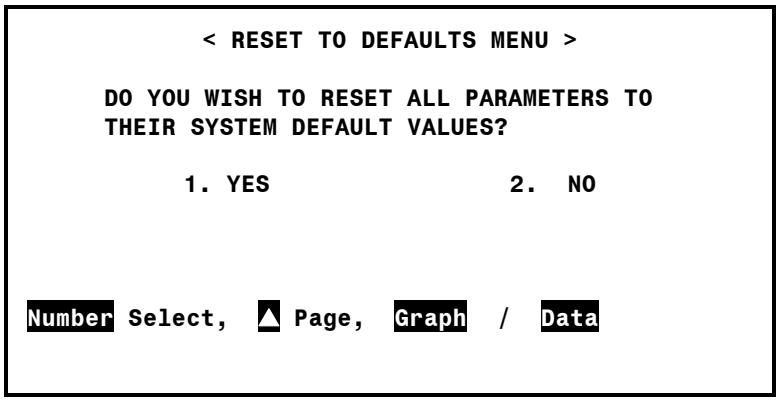
If you press the **GRAPH**, **COUNTERS**, or **HEATING RATE** keys during entry of a password, this function will be aborted.

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.

SET TO DEFAULTS

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

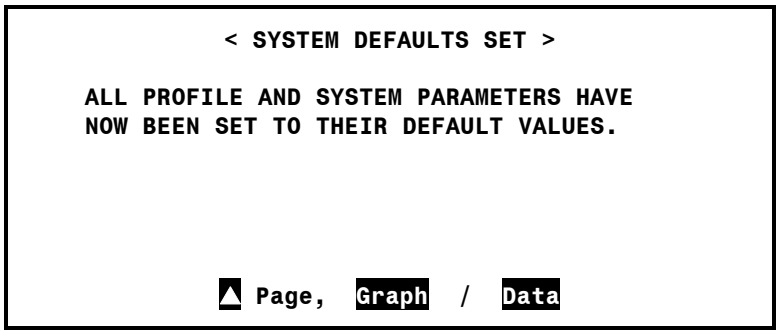
CAUTION: pressing **1** on this screen will reset all settings. Press the **2** key to exit this screen without resetting to default. If **SYSTEM SECURITY** is **ON** defaults cannot be reset.



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

SYSTEM DEFAULTS SET

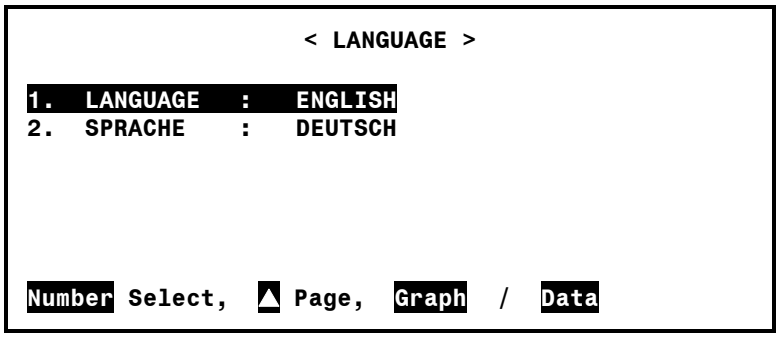
If the 1 key was pressed on the **RESET TO DEFALUTS** screen, this screen will be displayed to confirm the defaults were reset.



LANGUAGE

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.



I/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. Reference *Appendix B, 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    RELAY1  :  0
J4A-6  AIRHEAD :  1      J6A-3,4    RELAY2  :  0
J4A-7  RESET   :  0      J6A-5,6    RELAY3  :  0
J4B-7  SCHED0  :  0      J6A-7,8    RELAY4  :  0
J4B-8  SCHED1  :  0      J6A-9,10   RELAY5  :  0
J4B-9  SCHED2  :  0      J6B-3,4    RELAY6  :  0
J4B-10 SCHED3  :  0      J6B-5,6    RELAY7  :  0
J4B-12 FS1:UP  :  0      J6B-1,2    AIRHEAD :  0
J4B-13 FS2:LOW :  0      J6B-7,8    HDCOOL  :  1
J4B-14 FIRE SW :  0      J6B-9,10   SDRCOOL :  0
J4A-9  SCHED4  :  0
J4A-10 SCHED5  :  0

              ▲ Page,  Graph  /  Data
```

CHAPTER 4
OPERATING INSTRUCTIONS

Section I: Before You Start

Preparation

Before operating the Control:

- You ***must*** be familiar with the principles of reflow soldering and/or heat sealing.
- You ***must*** be familiar with the **location** and **function** of Controls and Indicators. For more information, see *Chapter 1, Description*.
- ***Verify*** that all equipment has been connected properly. See *Chapter 2, 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 3, Using Programming Functions*.

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.

Section II: Power Up

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 2, 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.

Section III: Graph and Data Screen Descriptions

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.

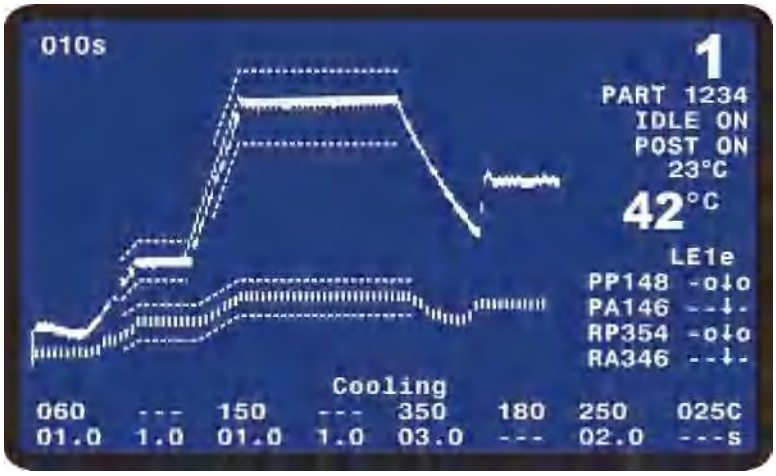
A thin solid line represents the programmed temperature profile with temperature on the Y axis and time on the X axis. The line extends from the start of Baseheat through the end of the Reflow process cycle.

A separate solid thin line also represents the expected temperature plot for the **Auxiliary** thermocouple. This line begins at the start of Rise1 and ends at the end of the Reflow process cycle.

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 to the right, 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.

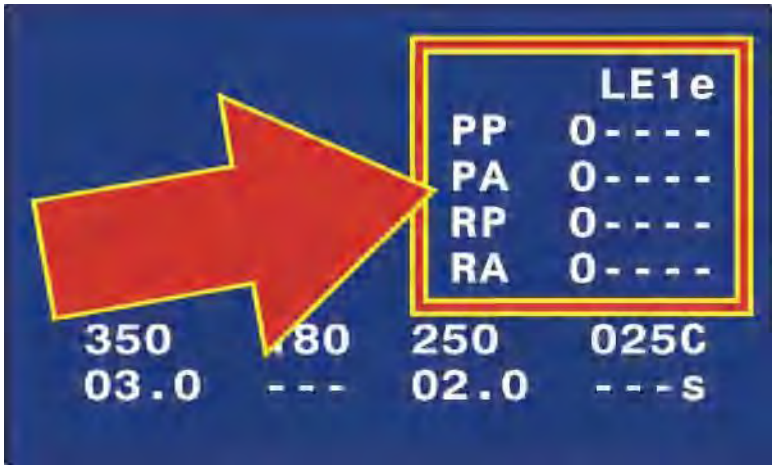
Close-UP View

- **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.



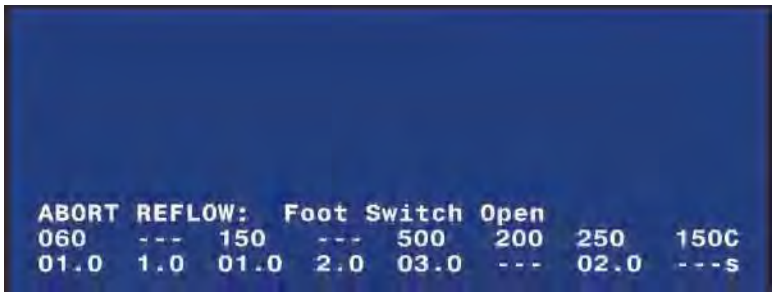
Close-UP View

- 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.



Close-UP View

- 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.

Close-UP View

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.

If **TIME** is selected for **Preheat and Reflow Control**, the Control will execute the full **Rise1** and **Rise2** user-set times before starting the **Preheat** and **Reflow** user-set times. The Control will follow the programmed **Rise1** and **Rise2** ramp slopes for the full **Rise1** and **Rise2** times. The Control will also execute the full **Preheat** and **Reflow** times.

If **TEMPERATURE** is selected for **Preheat and Reflow Control,** the Control will execute **Rise1** until the actual temperature reaches the **Preheat** temperature setting less the user-set **Preheat Temperature Delta** in the Profile. At that point, the Control will switch to the Preheat stage and control to the Preheat temperature for the length of time the user-set for the Preheat time. For example, if the **Preheat** temperature is set to 150°C and the **Preheat Temperature Delta** is set to 10°C, **Rise1** will end and **Preheat** will begin when the temperature reaches 140°C during **Rise1**. **Rise2** and **Reflow** will perform in a similar manner.

Functionality Example #1: Temperature 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

The Control begins to ramp the temperature during the **RISE1** period at the ramp rate you set. As soon as the temperature in **Rise1** reaches 140° C, **Rise1** will end and **Preheat** will start. The Control will immediately control temperature to the **Preheat** temperature and there could be a fast rise to **Preheat** temperature. The temperature increase may ***not*** follow the programmed **RISE1** ramp rate after the **Temperature** delta is reached. **Rise2** and **Reflow** will perform in a similar manner.

As for the display on the **DATA** screen, if the time from the start of **Rise1** to 140° C is 1.7 seconds, then 1.7 seconds will display for the time of **Rise1**. The length of **Preheat** will be 3.0 seconds and the total time of **Rise1** + **Preheat** will be 4.7 seconds.

Functionality Example #2: Time 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

With these settings the Control ramps the temperature during the entire **RISE1** period at the ramp rate you set, and it switches control to the **Preheat** temperature at the end of the full **RISE1** time.

As for the display on the **DATA** screen, if the time from the start of **Rise1** to 140° C is 1.7 seconds, then 1.7 seconds will display for the time of **Rise1**. The length of **Preheat** will be 3.3 seconds, so the ***total time*** of **Rise1** + **Preheat** will be 5 seconds.

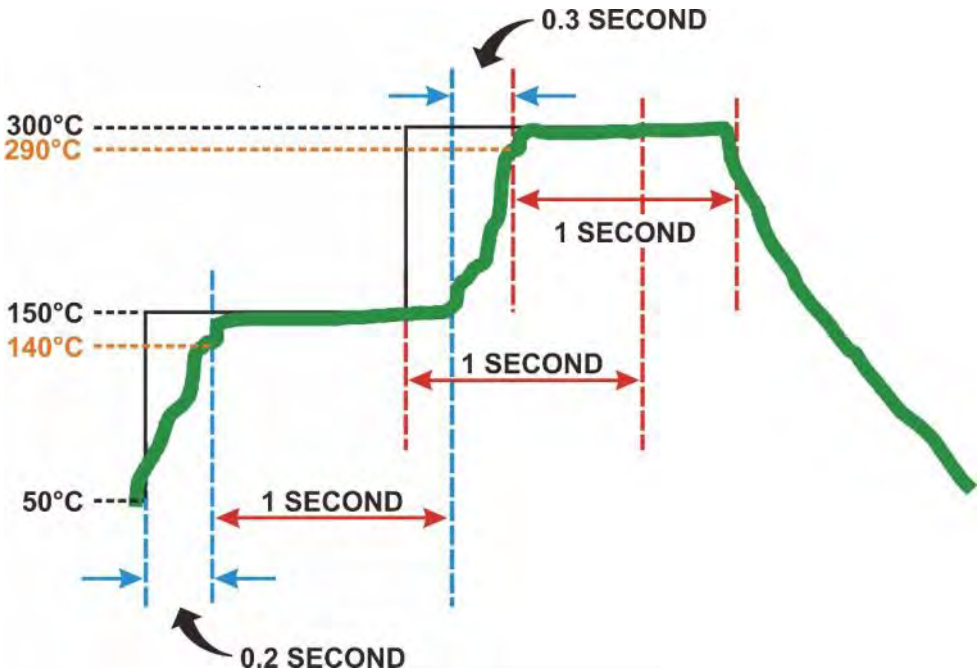
If you select **Temperature** for the Preheat and Reflow Control, and set **Rise1** and **Rise2** to zero seconds, the Control will behave as shown below. (If you set **Rise1** or **Rise2** to zero, the **DATA** screen will display zero seconds for these periods.)

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
- **Rise1** time of 0.0 seconds
- **Preheat** time of 1 seconds
- **Preheat** temperature of 150°C
- **Rise2** time of 0.0 seconds
- **Reflow** time of 1 seconds
- **Reflow** temperature of 300°C

The Control will perform as shown in the following diagram. The slope of the temperature increase will be based on the **Coarse** and **Fine** Heating Rates as well as the **PID Control** settings. The times reported on the **DATA** screen will be as follows:

- **Rise1** time of 0.0 seconds
- **Preheat** time of 1.2 seconds
- **Rise2** time of 0.0 seconds
- **Reflow** time of 1.3 seconds



If you select **Temperature** for Preheat and Reflow Control, 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. The Control will display the message **ABORT REFLOW: Heating Too Slow**.

If you select **Time** for Preheat and Reflow Control, the **Postheat** will begin at the **Cool1** temperature and last for the exact **Postheat** time you specified. The **DATA** screen will display the exact **Postheat** Time you selected as the **Postheat** time.

If you select **Temperature** for Preheat and Reflow Control, heating for postheat will begin at the **Cool1** temperature. Once a temperature equal to the **Postheat** temperature you selected, less the Reflow Temperature Delta is reached, the **Postheat** period will continue for the exact **Postheat** time you selected. The **DATA** screen will display the time between **Cool1** and the end of **Postheat** as the **Postheat** time.

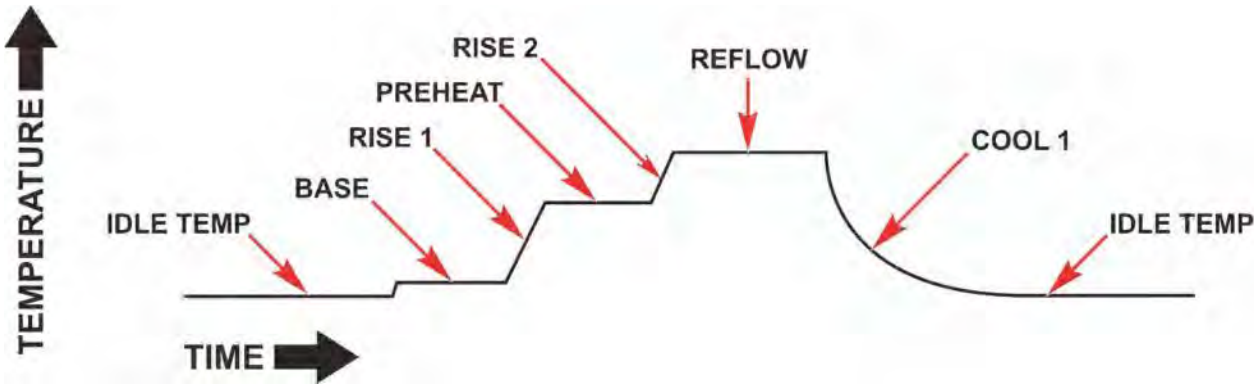
Section IV: Process Cycle Parameters

Temperature Setting Ranges:

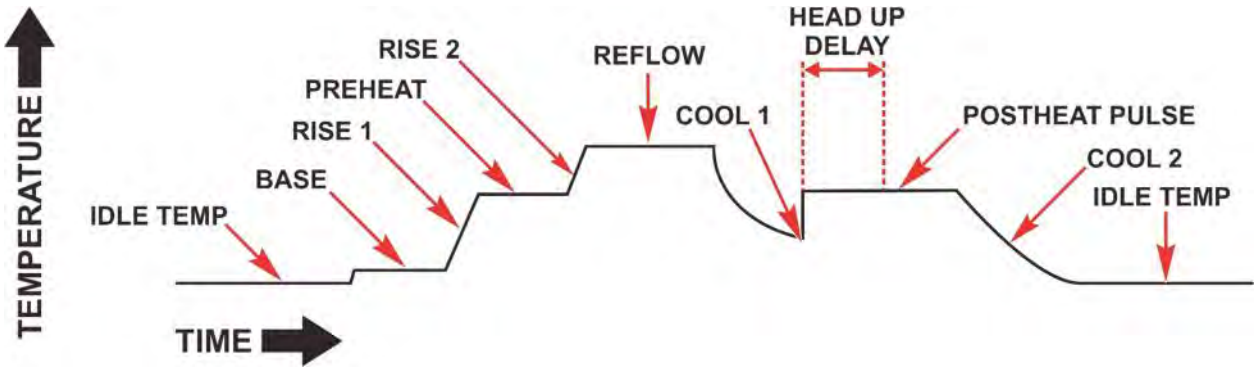
Idle	25° to 300°C
Base	25° to 300°C
Preheat	60° to 500°C
Reflow (default)	60° to 600°C
Reflow (extended mode operation)	60° to 999°C
Cool1	25° to 300°C
Postheat	25° to 600°C
Cool2	25° to 300°C
Maximum Temperature	300° to 999°C

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)

Section 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.

Pre-Defined Reflow Profiles

1. Push the **PROFILE NUMBER** up/down keys until the profile you want (**1 ➔ 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.

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** 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 on the right.

3. Set the temperature value to 50°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 01.5 (1.5 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 1.5 (1.5 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 03.5 (3.5 seconds), then press the ▲ key.
8. Press the **REFLOW** key to select the **REFLOW** temperature value for editing. Use the keypad to enter a temperature 250°C, then press the ▲ key.
9. Press the **REFLOW** key twice to select the **REFLOW** time field for editing. Use the keypad to enter a **REFLOW** time to 03.5 (3.5 seconds), then press the ▲ key.

10. Press the **COOL1** key to select the **COOL1** temperature value for editing. Use the keypad to enter a **COOL1** temperature of **100°C**, then press the ▲ key.
11. 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 200°C, then press the ▲ key.
12. Press the **POSTHEAT** key twice to select the **POSTHEAT** time field for editing. Use the keypad to enter a **POSTHEAT** time to 02.0 (2.0 seconds), then press the ▲ key.
13. Press the **COOL2** key to select the **COOL2** temperature value for editing. Use the keypad to enter a **COOL2** temperature of 80**°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.
14. 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.
15. If the joint ***is*** good, use the present Control settings for your soldering application. If it is ***not*** good, go to Step 16.
16. Repeat Steps 8, 9, 10 and 14, and use the keypad to increase the **REFLOW** temperature in 25°C increments. Make a test joint ***after each* REFLOW *change***.
17. Upon reaching a temperature of 450°C, use the keypad to increase the **TIME** in 0.5 second increments, repeating 8 and 14 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.

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.

CHAPTER 5
MAINTENANCE

Section I. Before You Start

Precautions

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 Amada Miyachi America.
- 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.

Status Messages

Message	Description
Baseheat Time	The Control is operating in the Baseheat Time period.
Cooling	The Control is operating in the Cool 1 or Cool 2 periods.
Cooling to Base or Preheat Temperature	The Control has either passed **a)** the Cool 1 Temperature at the end of the reflow where there is no Postheat period and is cooling down to the Base or Preheat Temperature, whichever is lower, *OR* **b)** the Cool 2 Temperature at the end of Posteheat 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.

Message	Description
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.

Section 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. Note: You will get this message if you are using a force-fired reflow head and the FOOTSWITCH RESPONSE MODE is set to ABORT. When a force-fired head lifts up off the workpiece, the FIRE switch activated by the head will open. When using a force-fired head, it is recommended to set the FOOTSWITCH REPONSE MODE to LATCHED after the application has been setup.
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 TEMPERATURE 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 the user-set SAFETY TIMER time to reach 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.

Alarm Message	Description	Corrective Action
Clean Thermode Counter Reset to	Clean Thermode Counter has been reset by Control	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.
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 Relay 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 status.	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 Auxiliary thermocouple is above the user-set Max Temperature Limit, or the Main thermocouple is 100 degrees 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 999C 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.* Note: The OVER POWER ALARM can be caused if the TC polarity is reversed. See *Appendix B*, Main Thermocouple Input Connector (J9) for the correct connection.	Make sure that the Thermocouple is plugged in, is undamaged, and is still bonded to the Thermode. Also check Thermocouple polarity. 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.* Note: The OVER POWER ALARM can be caused if the TC polarity is reversed. See *Appendix B*, Main Thermocouple Input Connector (J9) for the correct connection.	Make sure that the Thermocouple is plugged in, is undamaged, and is still bonded to the Thermode. Also check Thermocouple polarity. 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

Alarm Message	Description	Corrective Action
REFLOW ALARM: Increase Heating Rate	Actual thermode temperature never reaches the REFLOW LOW TEMP LIMIT value on the Schedule Setup Page 2 of 5 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 Course 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.
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 Control	No action needed. Information message only.
Transformer Over Temperature	The temperature measured by the thermal switch has exceeded 65C. When the thermal switch exceeds 65C, it will abort any process and prevent initiation of another process.	Check process settings and consult Amada Miyachi America Service. Once the thermal switch temperature has dropped below 65C, 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. If the unit is in the Cooling stage, the Cooling stage will end at COOL1 temperature if there is no POSTHEAT time, or the Cooling stage will end at COOL2 temperature if there is a POSTHEAT time. 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

Section III. Maintenance

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.

Repair Service

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

CHAPTER 6
CALIBRATION

Overview

This pulsed heat control equipment does ***not*** use internal calibration adjustments. High precision temperature capturing electronics is used which does not drift with age or use. This procedure allows you 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.

Required Equipment

- OMEGA Digital Calibrator/Thermometer Model CL26 or equivalent
- Calibration Kit with **J**, **K** and **E** type thermocouple cable (Amada Miyachi America Part Number: 10-359-01)

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

Before You Start

Ensure that reflow cable is ***disconnected*** from the weld head/thermode.

Calibration

1. Install a **J**, **K** or **E** type thermocouple cable between **J9** of the unit and the Calibrator output.
2. Turn the 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 or +/-2% of reading.
7. Turn the test unit OFF.
8. Remove the calibration cable, then re-attach the thermodes, thermocouple, and reflow cables.

APPENDIX A
TECHNICAL SPECIFICATIONS

Electrical Mains

AC Voltage Ranges:

Model Part Numbers 1-298-02 ..... 90 to 132 VAC

All Model Part Numbers ***except*** 1-298-02 ..... 180 to 264 VAC

Line Frequency ..... 50 or 60 Hz

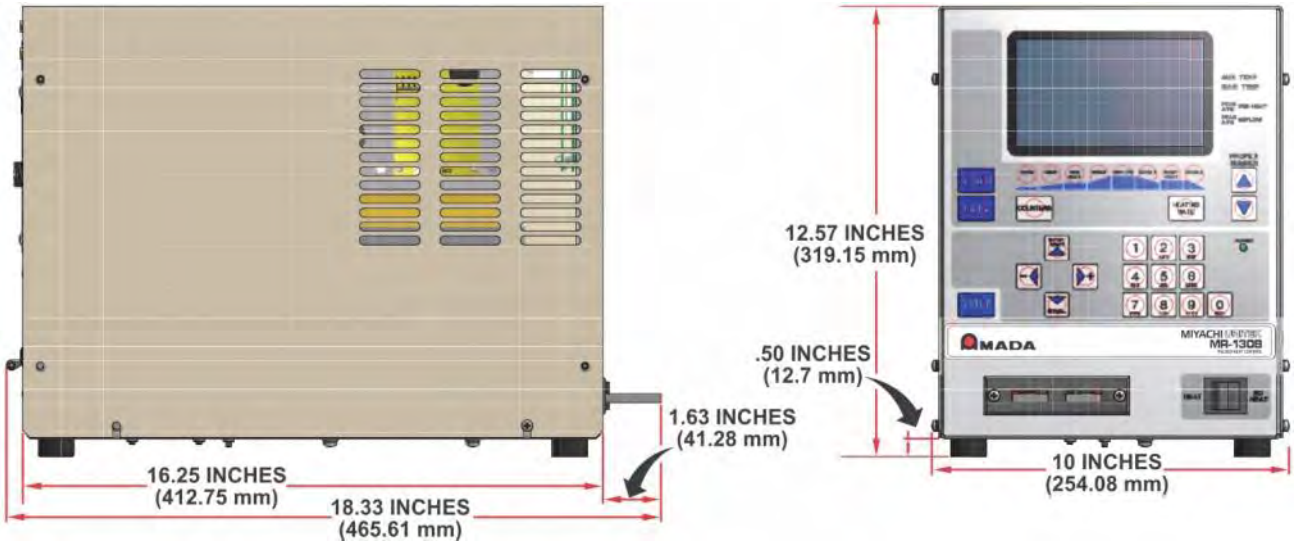
Line Phase ..... Single

Input Circuit Breaker Rating ..... 15 A

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

Dimensions

STANDARD Version



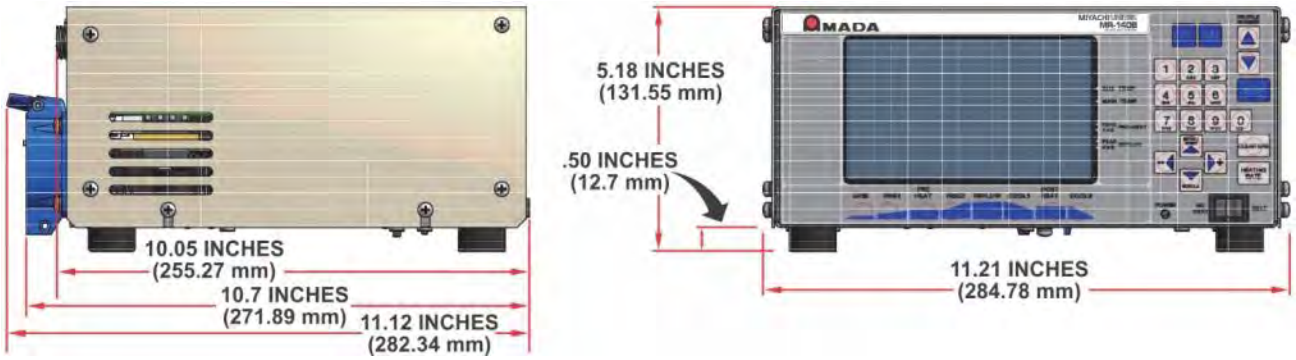
(Including all projections from the housing, but ***excluding*** cabling):

Weight:

4 KVA models: 60 pounds (27.2 kg)

2 KVA models: 48 pounds (21.8 kg)

REMOTE Version

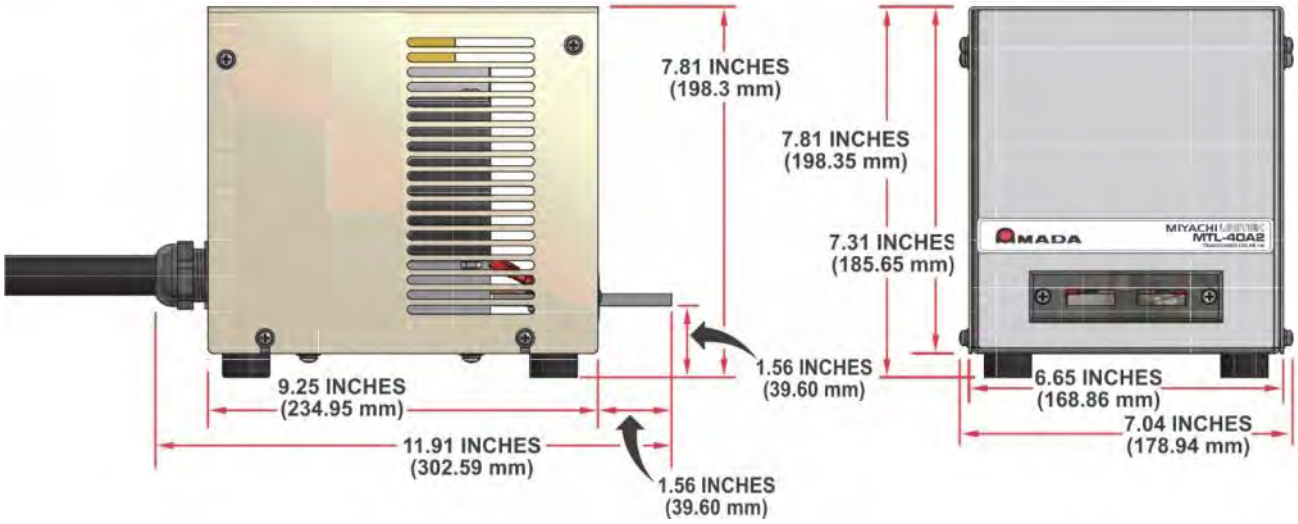


(Including all projections from the housing, but ***excluding*** cabling.

Remote Controller Weight:

All models: 19 pounds (8.6 kg)

REMOTE 2KV Transformer

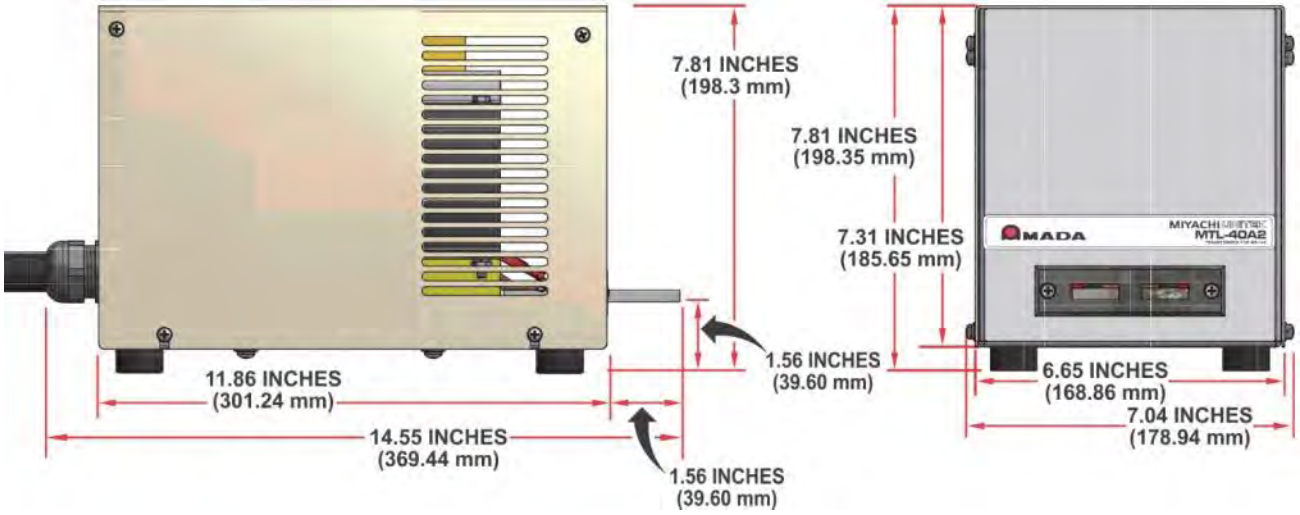


(Including all projections from the housing, but ***excluding*** cabling.

Weight:

31 pounds (14.1 kg)

REMOTE 4KV Transformer



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

Weight:

48 pounds (21.8 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. Versions 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)

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 VDC, 20 mA minimum

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

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

Heat Initiation Sensor..... Heat force or Uniflow4 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, Amada Miyachi America Part Number 10-355-02.....60 in. (152.4 cm)
Type J, Amada Miyachi America Part Number 10-355-02-02 .....60 in. (152.4 cm)
Type K, Amada Miyachi America Part Number 10-355-02-01.....60 in. (152.4 cm)

Outputs

Audible Alarm.....Buzzer, volume adjustable

Course Heating Output Power (nominal) and Coarse Heating Output (secondary) Voltage (nominal) at 120 VRMS or 240 VRMS transformer primary voltage:

STANDARD Versions

2 kVA transformer (90 – 132 VAC input single phase)	**4 kVA transformer (180-264 VAC single phase input)**	**4 kVA transformer (180-264 VAC single phase input)**	**2 kVA transformer (180-264 VAC single phase input)**	**2 kVA transformer (180-264 VAC single phase input)**
Secondary Voltage: 3.81V (Fast) 1.9V (Medium) 1.27V (Slow) 0.95V (Very Slow)	Secondary Voltage: 3.81V (Fast) 1.9V (Medium) 1.27V (slow) 0.95V (very slow)	Secondary Voltage: 7.62V (Fast) 3.8V (Medium) 2.54V (Slow) 1.90V (Very Slow)	Secondary Voltage: 3.81V (Fast) 1.9V (Medium) 1.27V (Slow) 0.95V (Very Slow)	Secondary Voltages: 7.62V (Fast) 3.8V (Medium) 2.54V (Slow) 1.90V (Very slow)
Model / Part Number	**Model / Part Number**	**Model / Part Number**	**Model / Part Number**	**Model / Part Number**
1-298-02	1-298-02-01 1-298-02-02 1-298-02-03	1-298-02-05 1-298-02-06 1-298-02-07	1-298-02-09 1-298-02-10 1-298-02-11	1-298-02-13 1-298-02-14 1-298-02-15

REMOTE Versions

4 kVA transformer (180-264 VAC single phase input)	**4 kVA transformer (180-264 VAC single phase input)**	**2 kVA transformer (180-264 VAC single phase input)**	**2 kVA transformer (180-264 VAC single phase input)**
Secondary Voltage: 3.81V (Fast) 1.9V (Medium) 1.27V (Slow) 0.95V (Very Slow)	Secondary Voltage: 7.62V (Fast) 3.8V (Medium) 2.54V (Slow) 1.90V (Very Slow)	Secondary Voltage: 3.81V (Fast) 1.9V (Medium) 1.27V (Slow) 0.95V (Very Slow)	Secondary Voltages: 7.62V (Fast) 3.8V (Medium) 2.54V (Slow) 1.90V (Very Slow)
Model: Part Number	**Model: Part Number**	**Model: Part Number**	**Model: Part Number**
X4/240UNF: 9-040-01	X4/240UNFHV: 9-041-01	X2/240UNF: 9-042-01	X2/240UNFHV: 9-043-01

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 COOL period, OFF at PREHEAT period
STANDARD Version
Power (Uniflow4 control provided) ..... 24 VAC or +24 VDC
Contact Rating ..... 24 VAC/24 VDC, 0.3 A
REMOTE Version
Power (Uniflow4 control provided) ..... +24 VDC
Contact Rating ..... 24 VDC, 0.3 A

Programmable Solid State Relays:

Relays Available 7
Power ..... User provided
Contact Rating ..... 0.5 A at 30 VAC or 30 VDC maximum

Programmable Electromechanical Relays Functions:

System Ready ..... On/Off when Uniflow4 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" conditions

NOTE: If an Alarm is triggered and then the alarm condition is removed, the alarm relay state will continue to remain active until one of the following actions occurs:

a) The User applies a signal at **J4A-7** on the Control back panel to reset the **ALARM** relay state.
b) The User presses the Up Arrow Key on the front panel.
c) The User initiates another reflow process and the reflow process completes without an alarm and returns to the **System Ready** condition.

NOTE: Refer to *Chapter 5, Maintenance* to reset alarm relay states.

Output Timing ..... See *Appendix C, System Timing*

Front Panel Switches

User Interface Buttons ..... 29 membrane keys

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

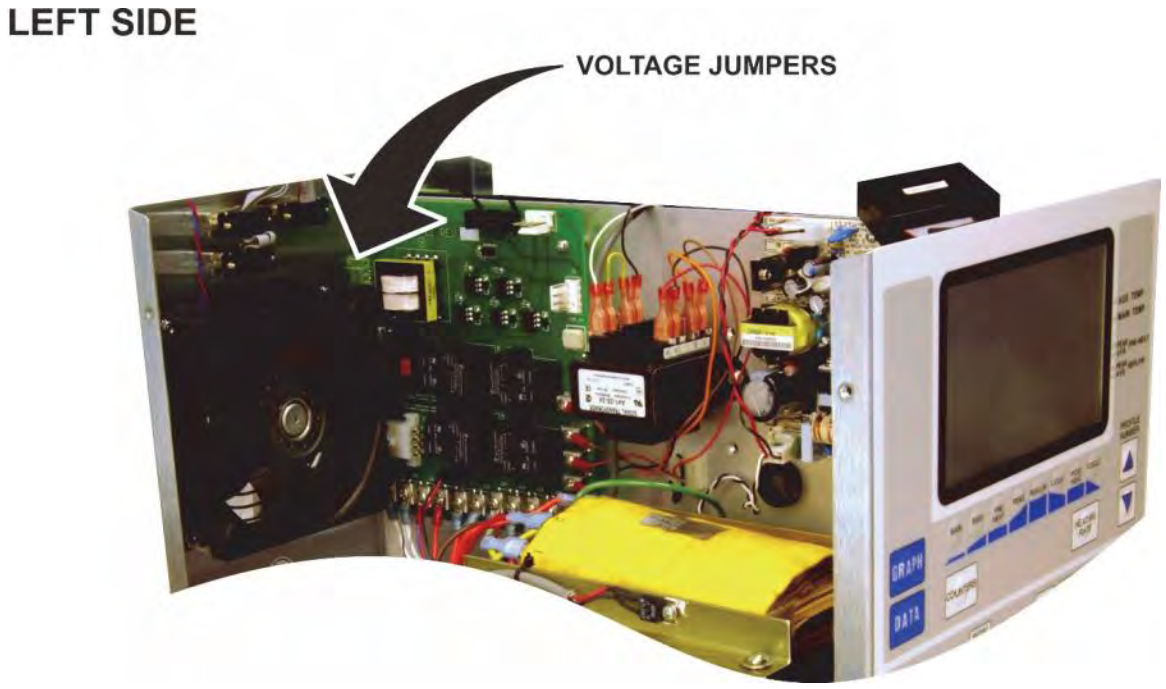
RS-232/RS-485 Connectors

Connector type..... standard 9 Pin D-sub connector

115VAC and 230VAC Input Power Settings

CAUTION

This section is for reference only. Input Voltage settings are performed at the factory before the Control is shipped. While the voltage can be changed, doing so should ***only*** be performed by a qualified MUC technician. These procedures require loosening of the motherboard which will void the warranty and may cause permanent damage to the Control. If you need to change the voltage setting, contact Amada Miyachi America using the phone, e-mail, or mailing information on the **CONTACT US** page in the front of this manual.

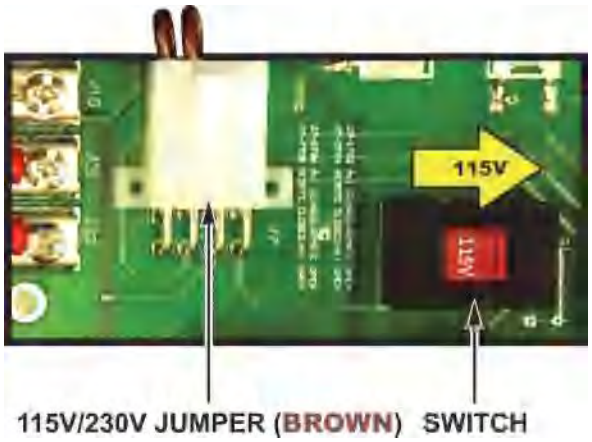


NOTE: The 115/230VAC input power selection is made with jumper and switch settings on the Power Circuit located on the left side of the Control.

STANDARD **Version** • 115 VAC **Configuration**

Switch **S1** is set with **115V** visible on the switch.

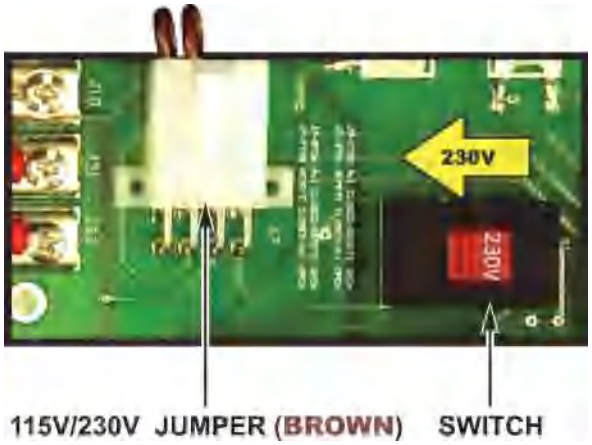
The factory-supplied **115V/230V** jumper with the BROWN wires is installed on connector **J7** as shown.



STANDARD **Version** • 230 VAC **Configuration**

Switch **S1** is set with **230V** visible on the switch.

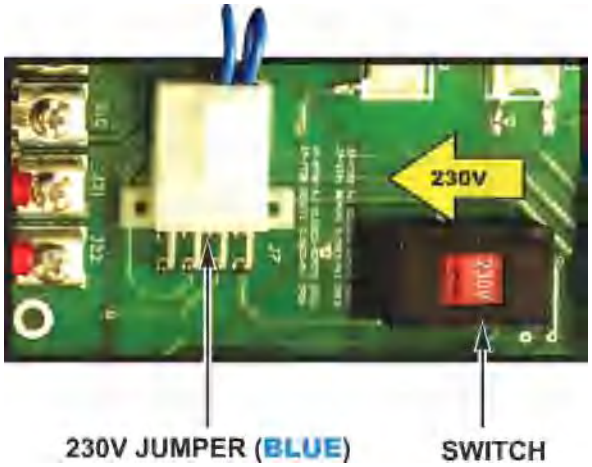
The factory-supplied **115V/230V** jumper with the BROWN wires is installed on connector **J7** as shown.



REMOTE **Version** • 230 VAC **Configuration**

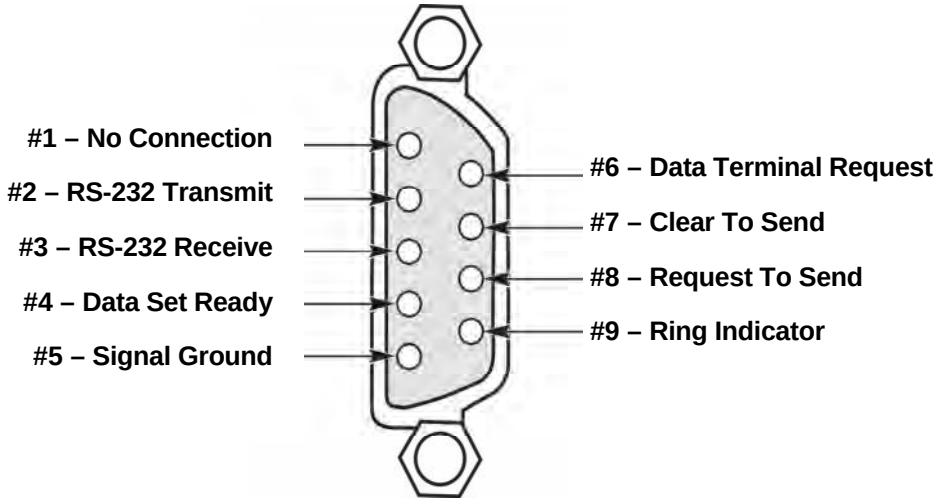
Switch **S1** is set with **230V** visible on the switch.

The factory-supplied **230V** jumper with the BLUE wires is installed on connector **J7** as shown.

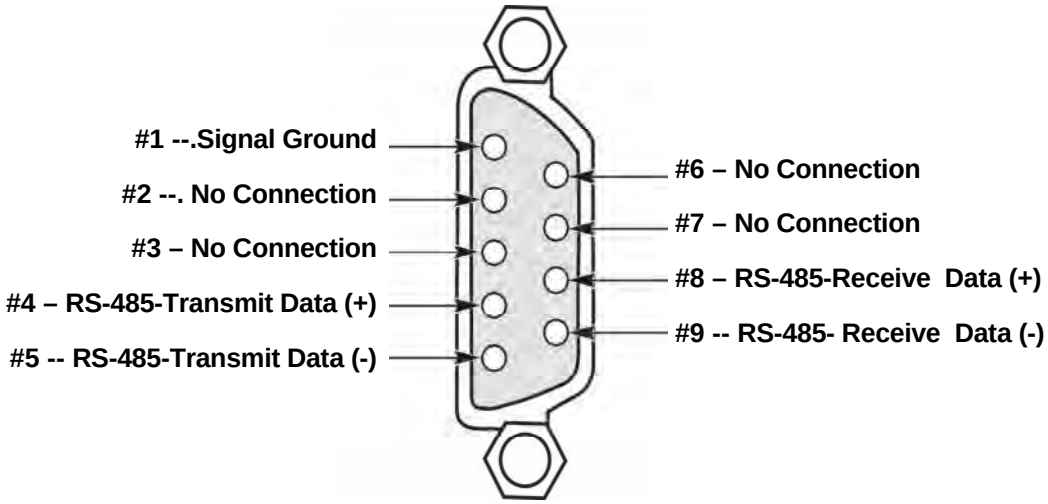


APPENDIX B
ELECTRICAL AND DATA CONNECTIONS

RS-232 Connections



RS-485 Connections



Negative/Positive Logic Operation

Your Control is factory-configured for negative logic, active low. That is, when an input terminal is unterminated, an internal resistor pulls the input terminal to a positive voltage and the input terminal is considered to be inactive. When a switch connects the input terminal to common, the input terminal is considered as active.

The voltage source may be supplied by the Control or an external source (see *Automation Control Inputs Connections,* page B-16).

You may reverse the logic sense of the inputs to negative logic, active high, by rejumpering connector J4 on the rear panel. In the rejumpered configuration, an internal resistor pulls an unterminated input terminal to common and the input is considered as inactive. Supplying 24 volts to the input terminal will make it become active.

NOTE: For jumper information, see pages B-4 ➔ B-9.

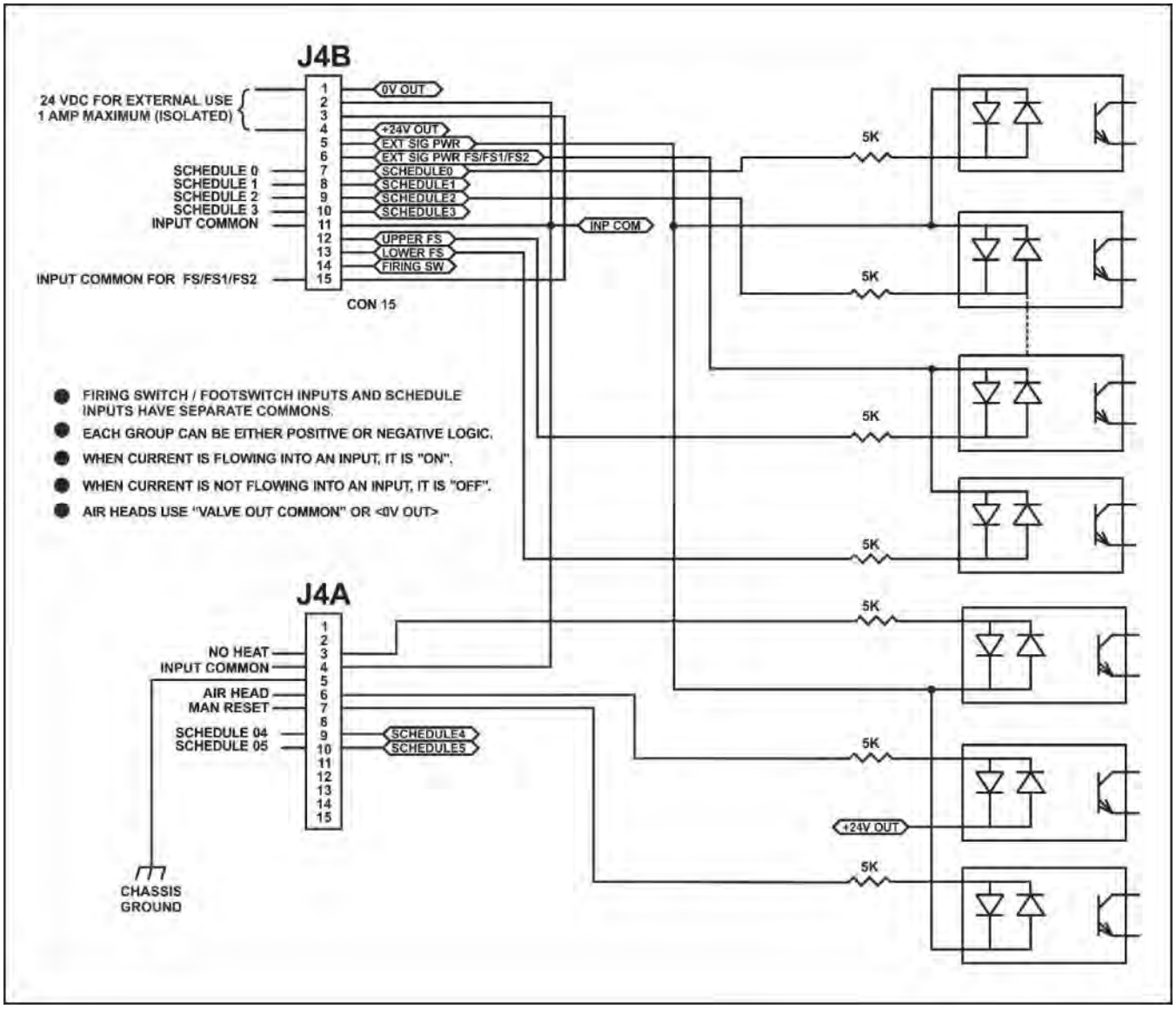
The inputs that have bipolar logic selection capability are in two groups: Input switches and control switches. The devices within these groups are as follows:

Input Switches	Control Switches
Upper Footswitch Lower Footswitch Firing Switch	All other inputs except **HEAT/NO HEAT** **PNEUMATIC/ MANUAL**

NOTES:

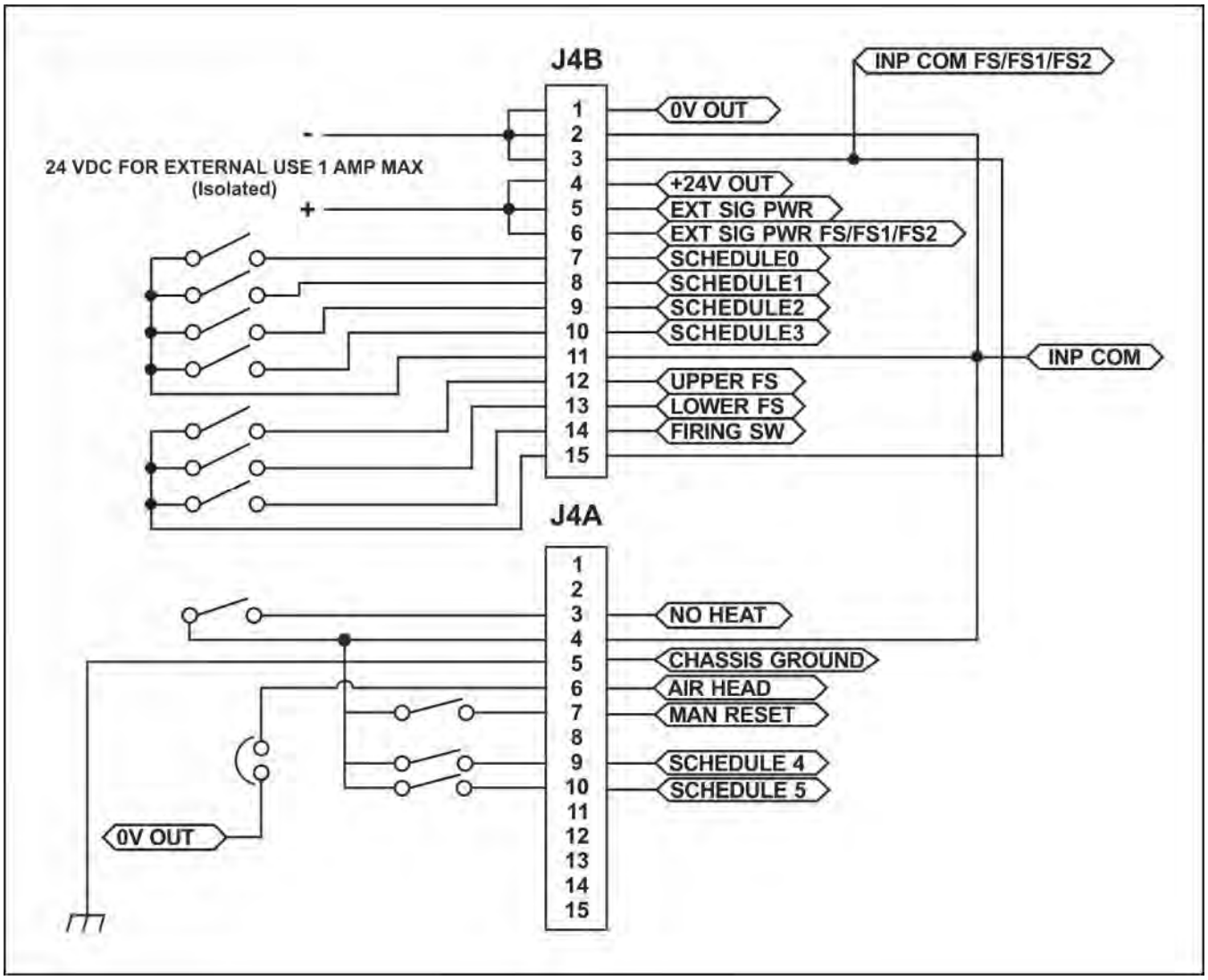
- The heat/no heat input pull-up/pull-down configuration will change along with the jumper selection; however, the active sense will ***not*** change.
- Pneumatic/Manual is always negative logic. "Pneumatic/Manual" is represented as **AIR HEAD** in the diagrams in this Appendix.

Control Input Interface

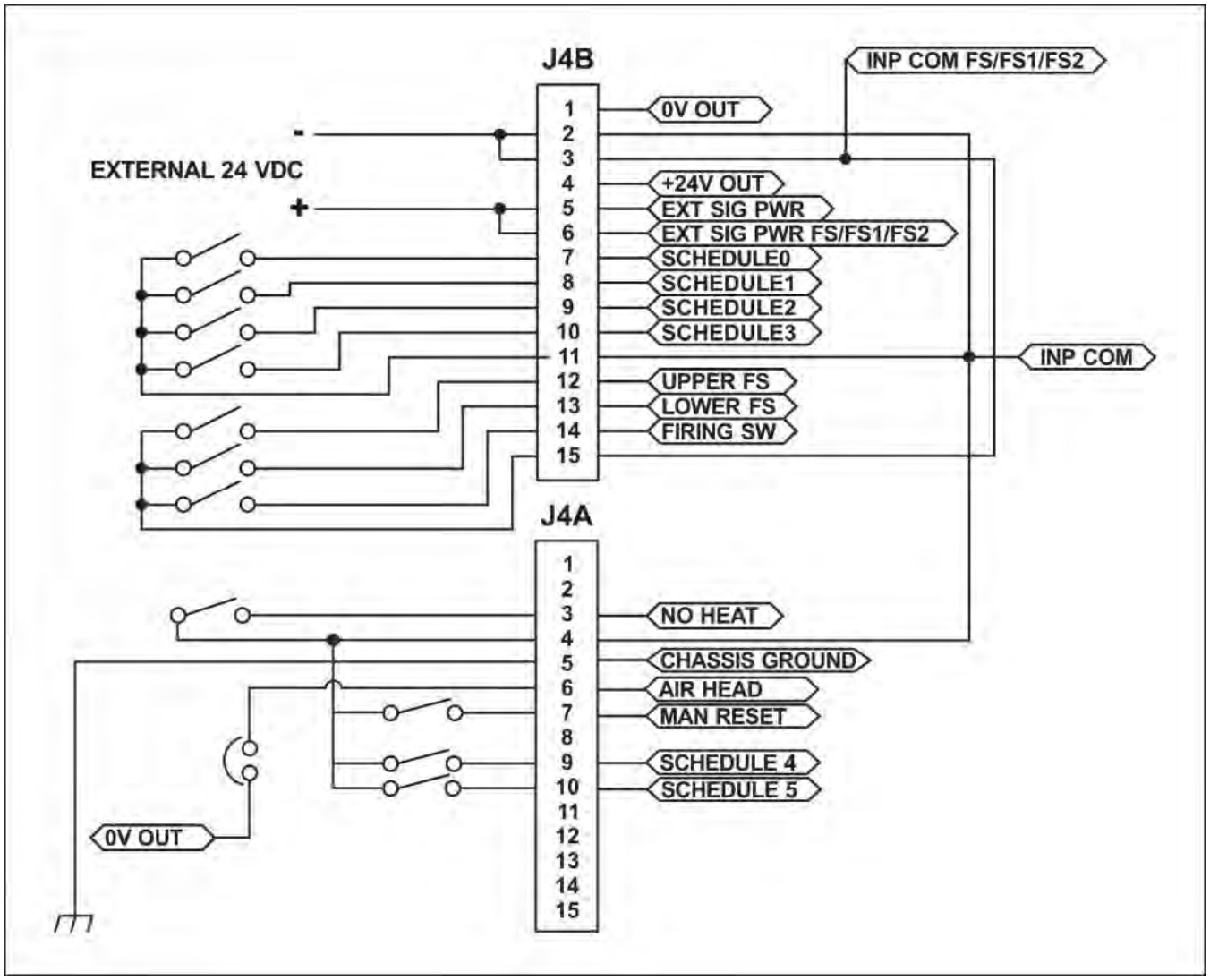


NOTE: The **Control Input Interface** may be connected to a PLC or other interface in the configurations shown on pages B-4 ➔ B-9.

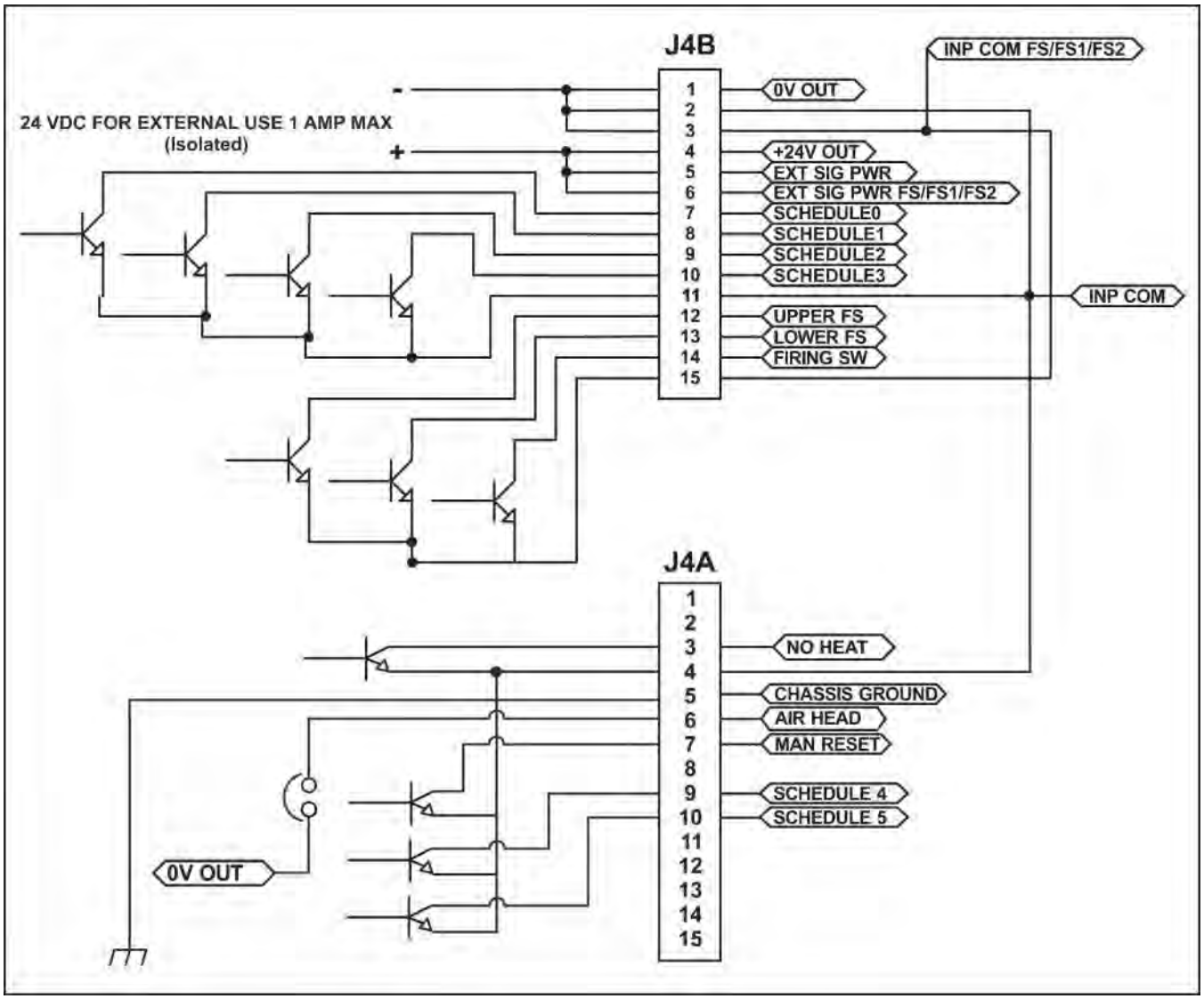
Switch Contact Input (Internal Power)



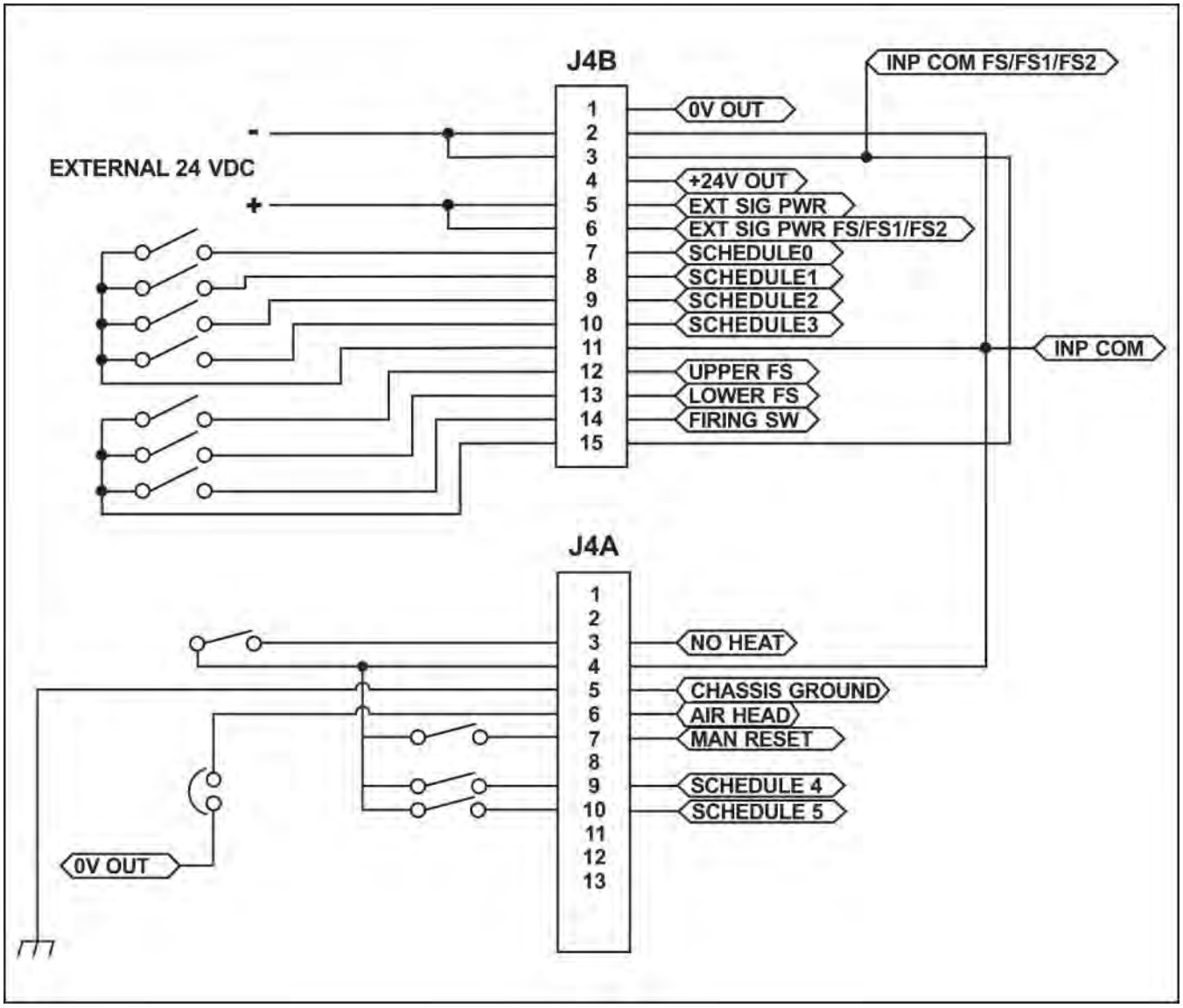
Switch Contact Input (External Power)



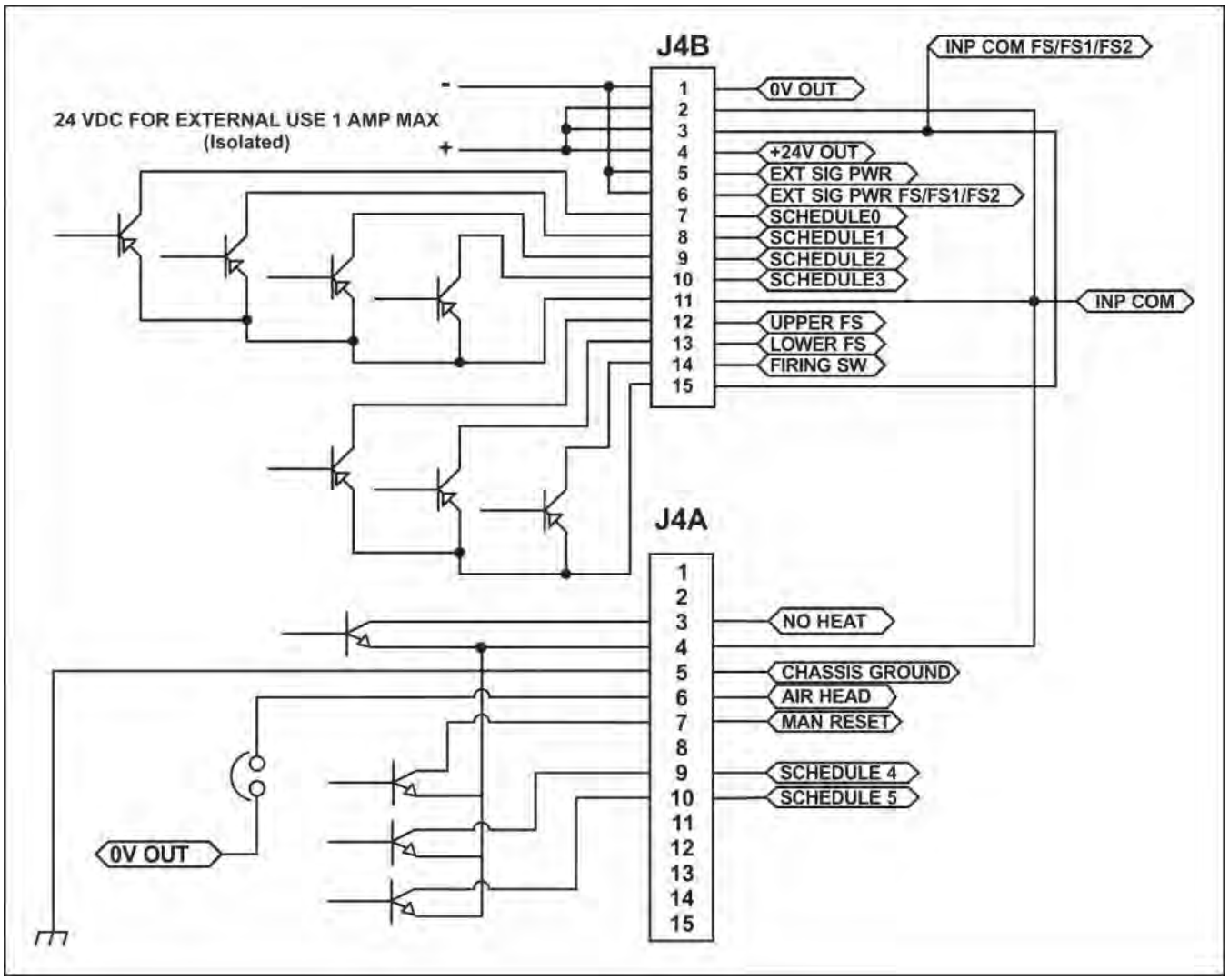
Common Negative Input (Internal Power)



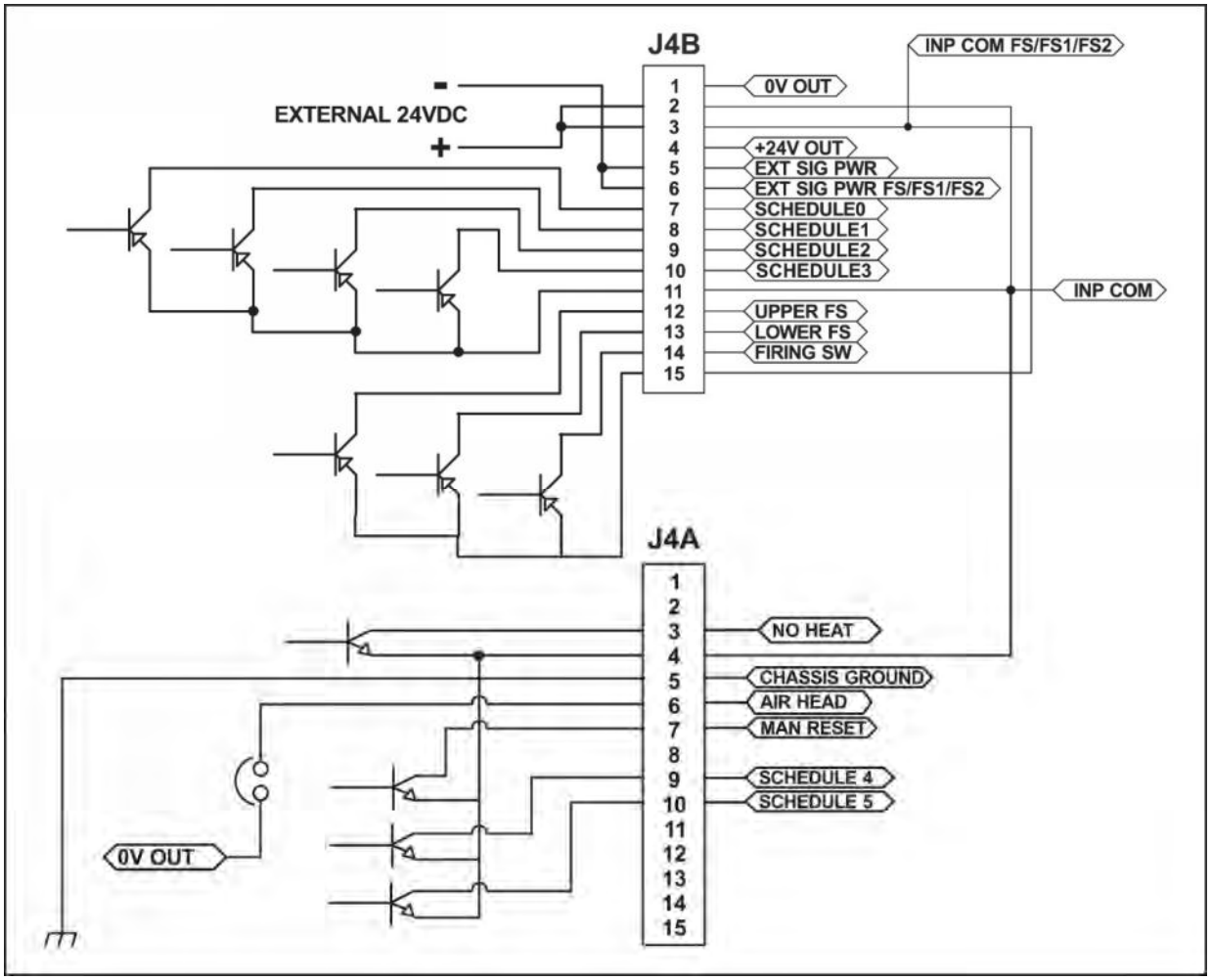
Common Negative Input (External Power)



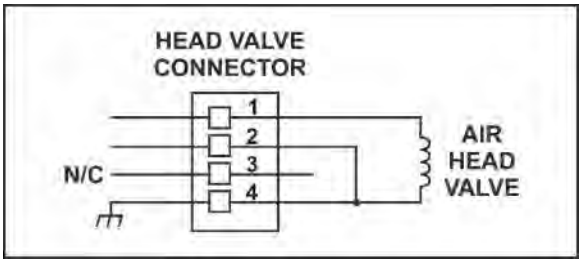
Common Positive Input (Internal Power)



Common Positive Input (External Power)

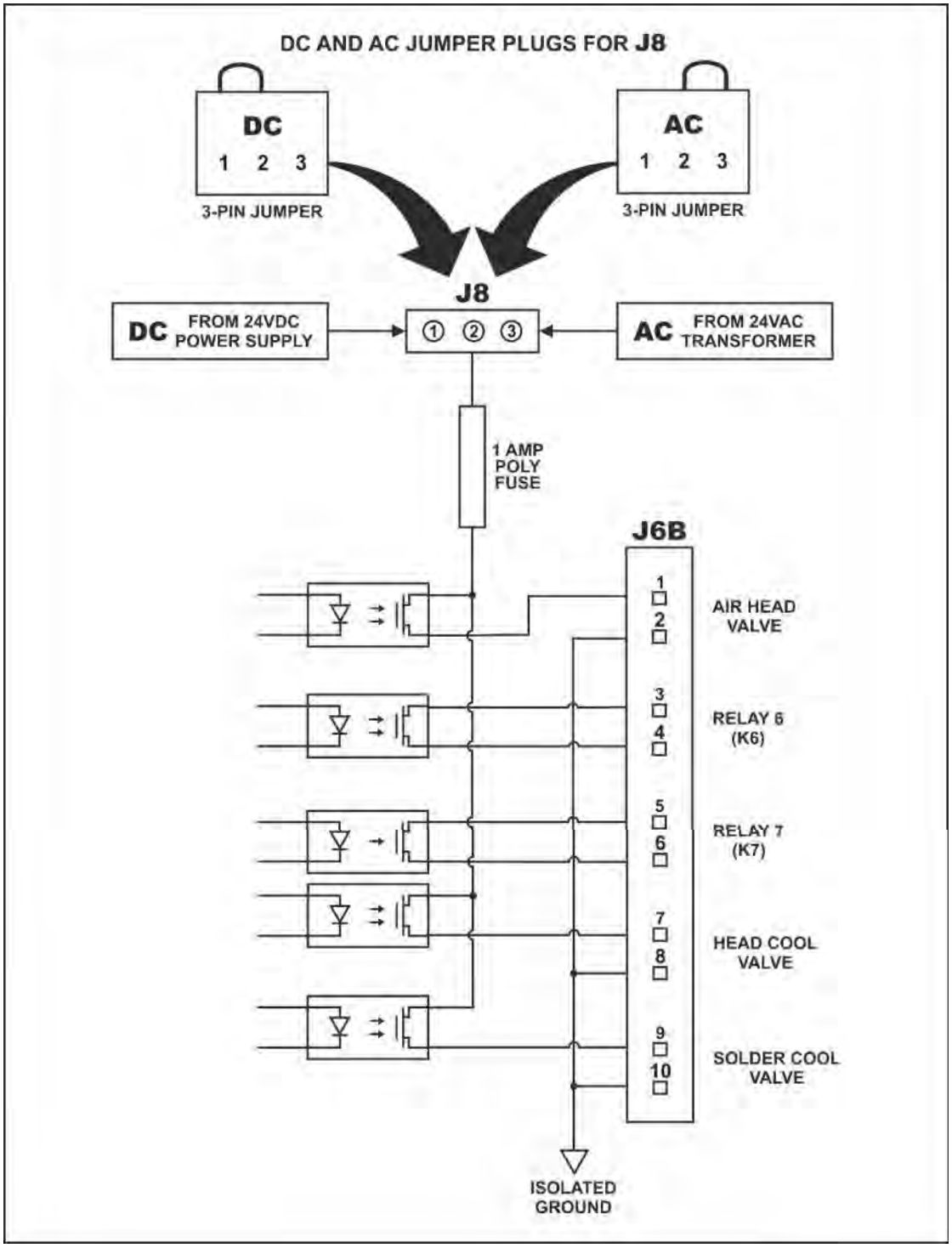


Force Valve Drive Connections



Valve Driver Outputs and Relays 6 and 7

Relay 6 and 7 Rating and Configuration Refer to Relay ratings and configuration information on page B13.



Valve Driver Output Rating and Configuration

Output Rating: 24 VAC/VDC, 0.3 A max for STANDARD VERSION
24VDC, 0.3 A for REMOTE VERSION

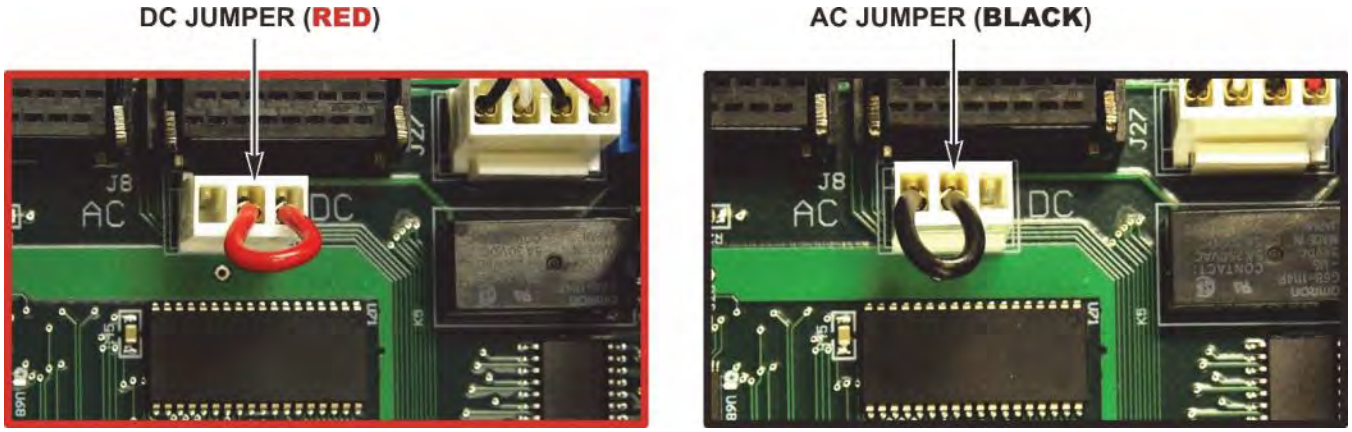
Output Voltage Selection: For STANDARD VERSION, AC or DC 24 volt output power is selectable by connecting the proper **AC** or **DC** plug as shown on the next page. REMOTE VERSION units are 24 VDC only.

NOTES:

- To set the Control for **AIR HEAD VALVE** operation, you ***must*** make one of two connections:
  - Either jumper **HEAD VALVE CONNECTOR** pin 2 and pin 4.
  - Or jumper **J4A** pin 6 (**AIR HEAD**) to <**0V OUT**> (see **J4A/B** pin out).
- For Standard Version, to change from 24VAC output power to 24 VDC output power, the white AC connector with black jumper should be replaced with the white DC plug with red jumper in connector J8 on the Main Circuit Board. These color coded connectors will jumper pins 2 and 3 for AC output and pins 1 and 2 for DC output.

NOTE: The Main Circuit Board is located on the right side of the Control.

NOTE: The photos below are rotated 90° for clarity.

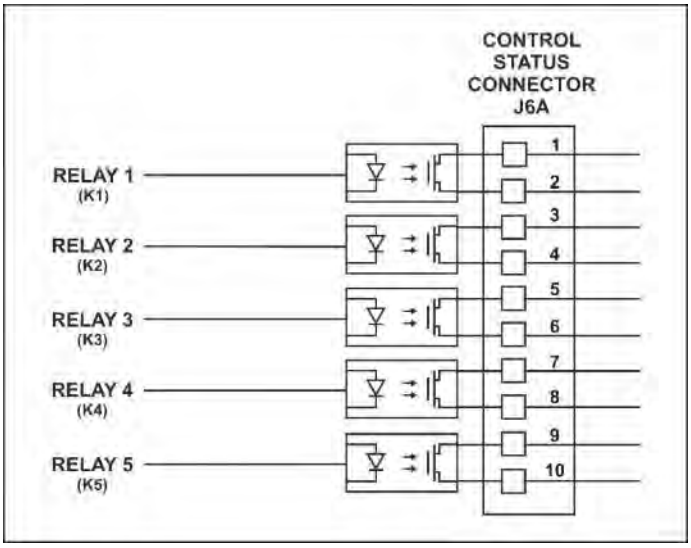


Timing: The force valve actuates when the first level of the foot switch is closed. It automatically de-activates when the **COOL1** temperature is reached if there is not a Postheat process cycle, or after the Head Up Delay if there is a Postheat process cycle, or in the event of a reflow alarm.

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,** or **BASE** temperature which ever is lower. The solder cool valve is used to cool the hot thermode quicker.

Alarm/Status Relays Connections For Relays 1 ➔ 5



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

ATTENTION: The previous version Uniflow 4 with part numbers beginning with 1-298-01 had a Chassis Ground connection on Pin J6A-10. This Chassis Ground connection has been moved to J4A-5 for this new version of Uniflow 4 with part numbers 1-298-02.

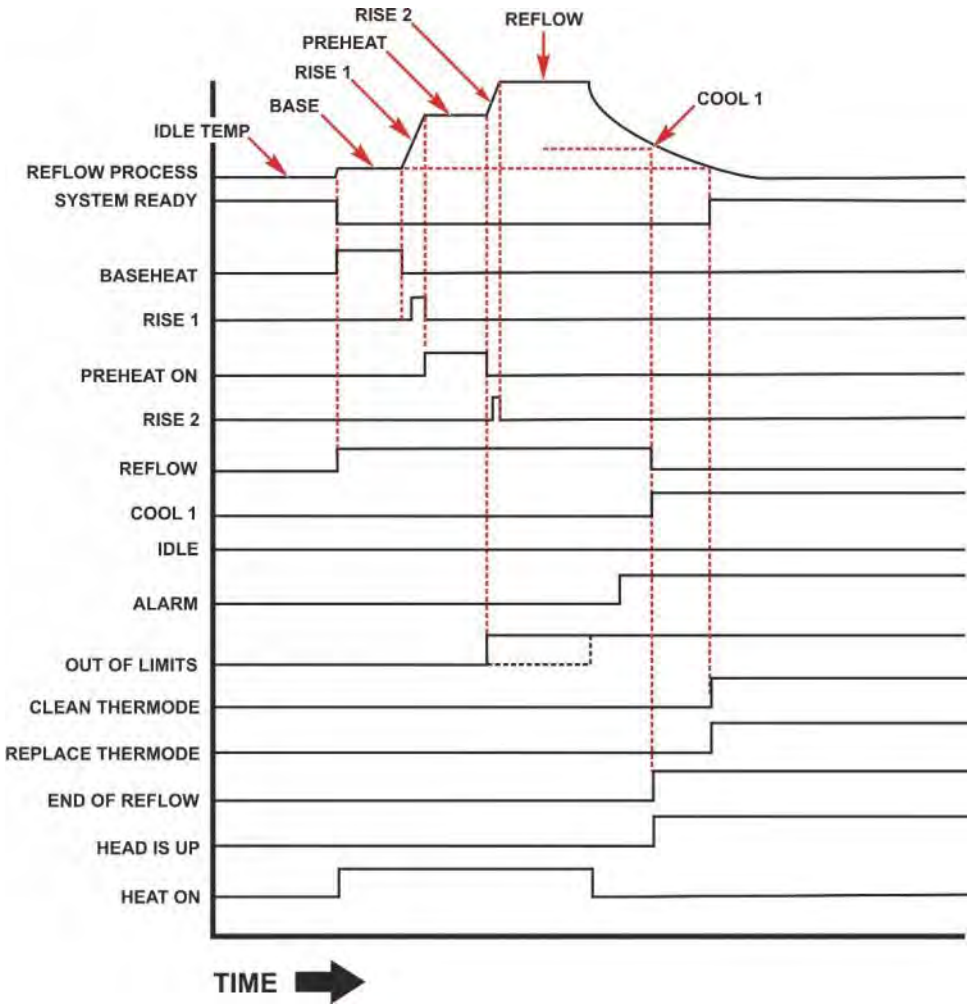
Relay Rating: 30 VAC or 30 VDC at 0.5 Amps

User Programmable Options for Relay States:

System Ready On/Off when Uniflow 4 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 conditions

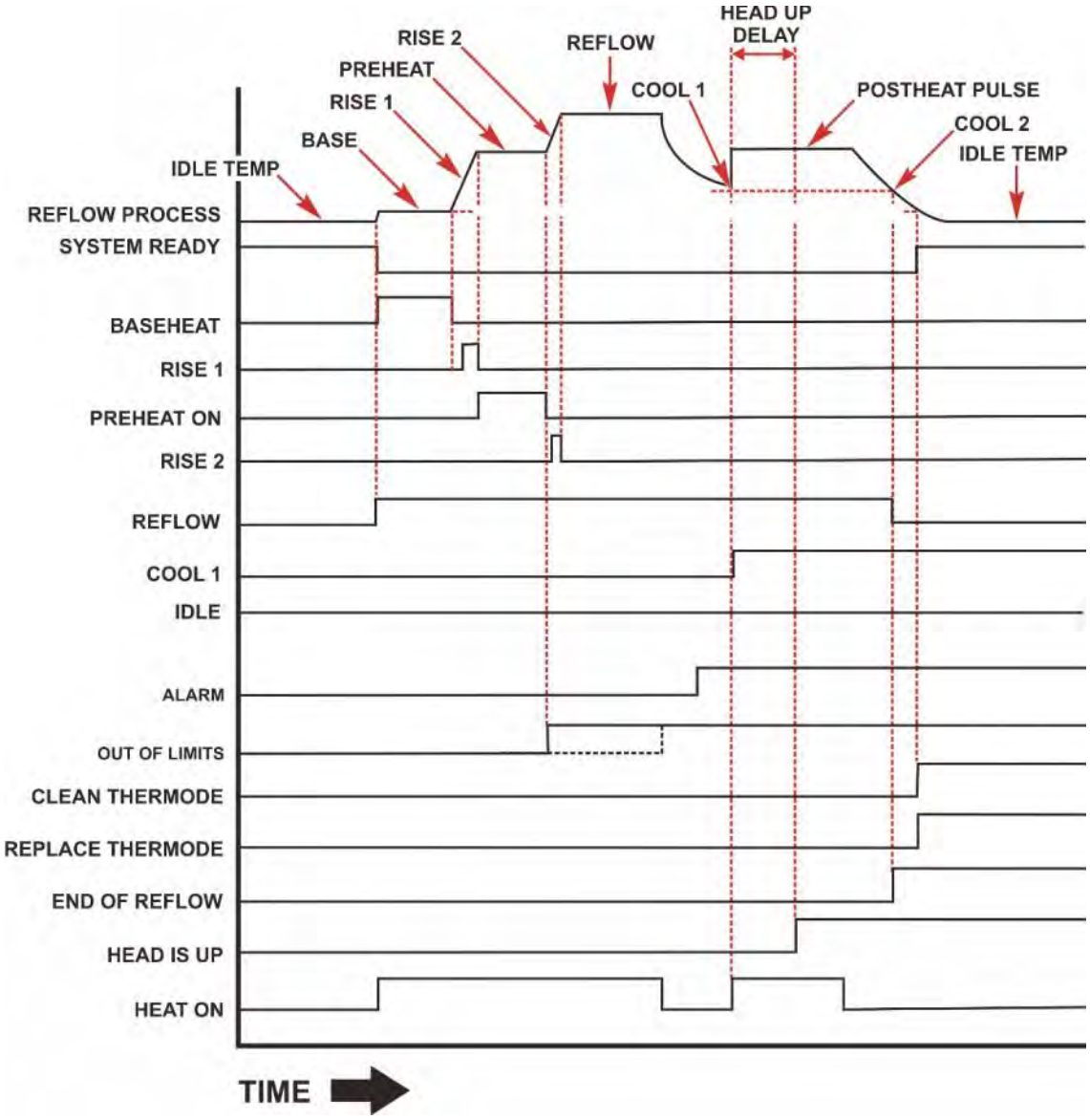
Not Active: The relay is not active.

Relay State Timing (Without Postheat process cycle)



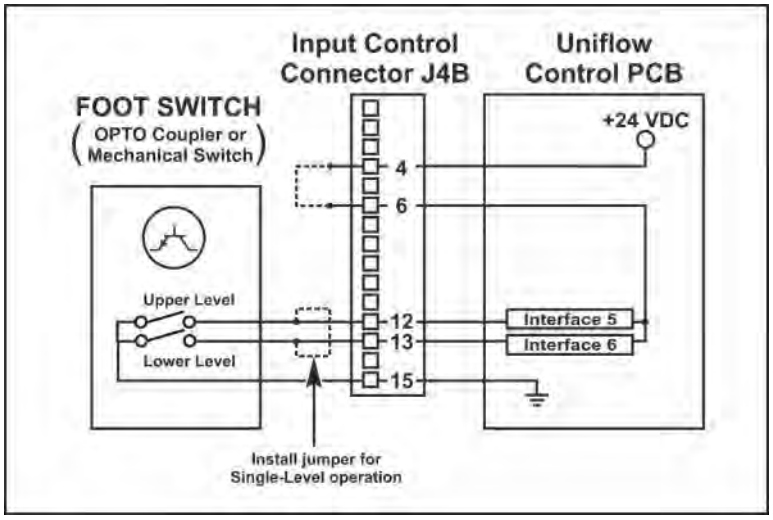
NOTE: If any out of limits conditions occur, the **Out of Limits** relay state updates at the end of **Preheat** and the end of **Reflow**.

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**.

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 Unitek FS2L or Unitek 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, on **J4A** Pin 3, is the remote equivalent of the front panel **HEAT/NO HEAT** switch, as described in *Chapter 1, Description*.

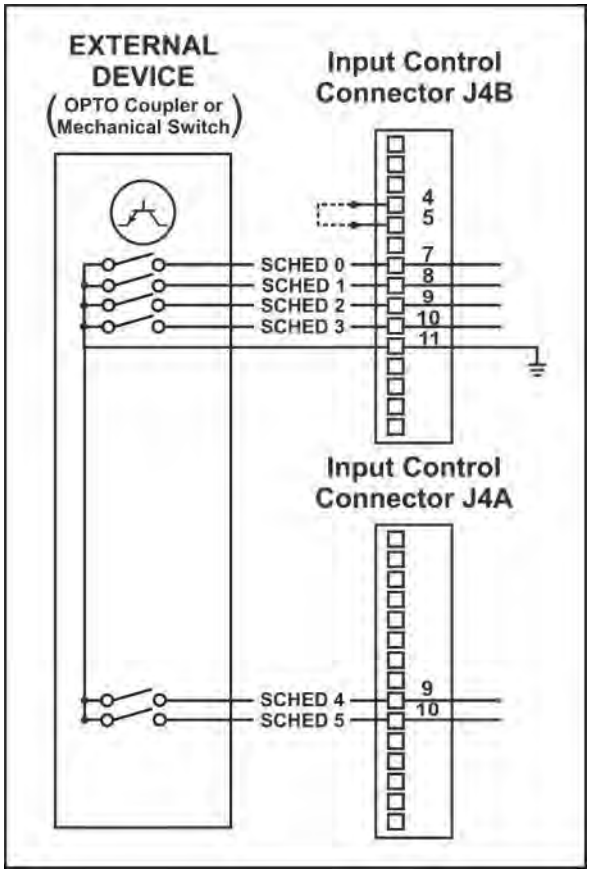
Automation Control Inputs Connections

Input Signal: 0 or 24 VDC

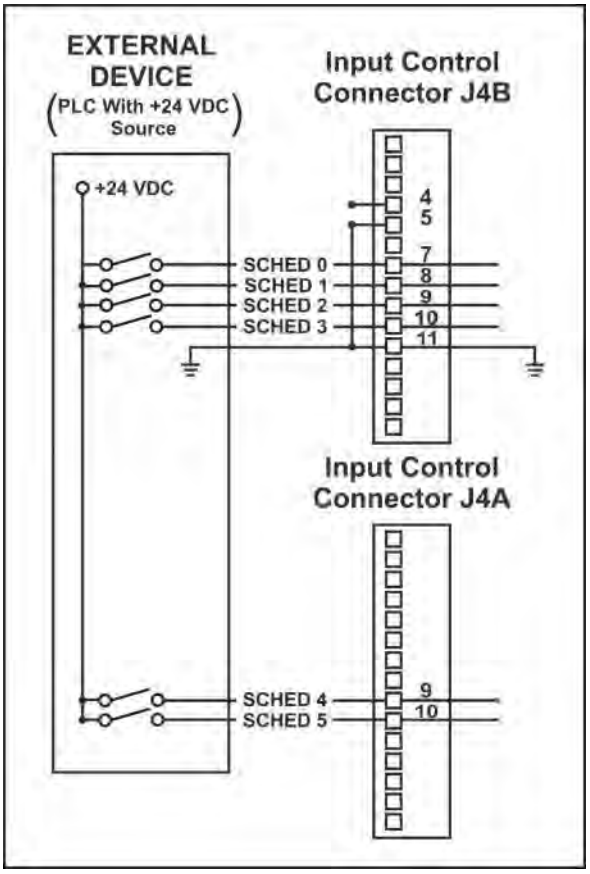
Remote Profile Inputs: All Profiles must be entered and saved in the Control memory locally (from the Front Panel). Once they are saved, they can be recalled prior to initiating the Reflow process by placing a binary value on the four **SCHED** lines. This may be done with an external PLC (Programmed Logic Controller) or host computer. When all of the **SCHED** Inputs are inactive (**0000**), 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						
Profile Number	**SCHED 0 Pin J4B-7**	**SCHED 1 Pin J4B-8**	**SCHED 2 Pin J4B-9**	**SCHED 3 Pin J4B-10**	**SCHED 4 Pin J4A-9**	**SCHED 5 Pin J4A-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

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

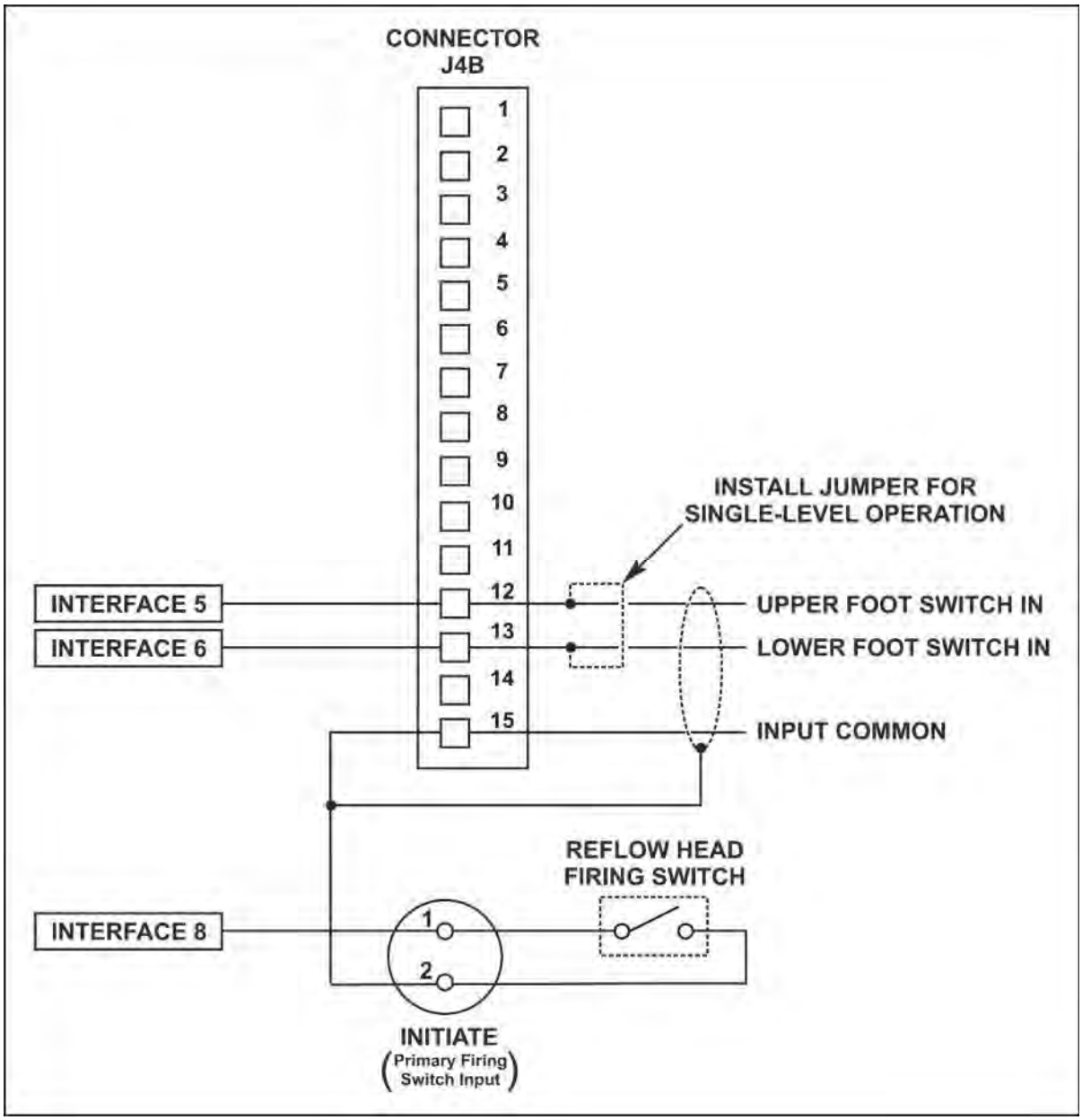


Remote Profile Selection with Switches or Opto-Couplers



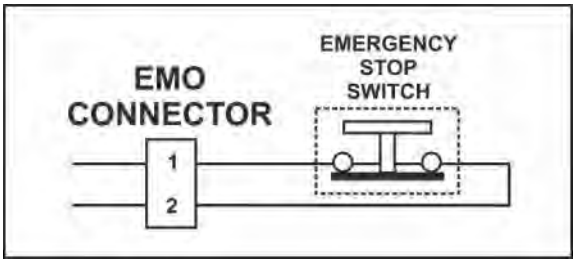
Remote Profile Selection with PLC

Operator Initiation Switch and Firing Switch Inputs



Input Signal: 0 or 24 VDC

EMERGENCY STOP Input

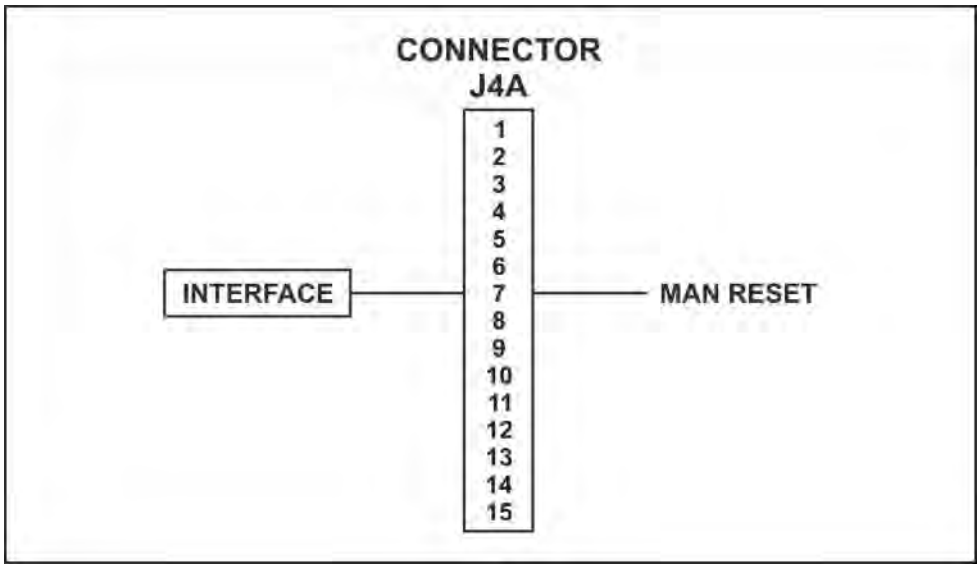


Switch Rating: **48** VDC at 2 Amps minimum

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.

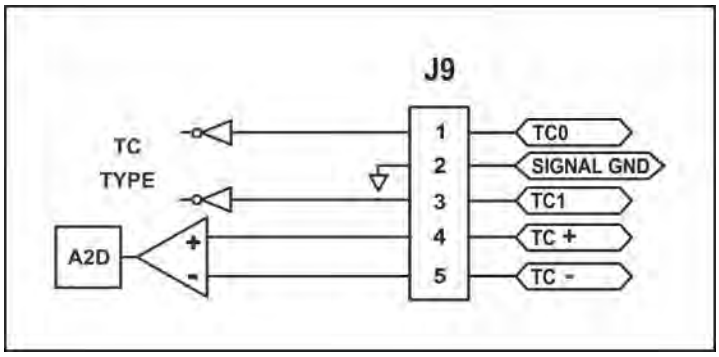
Manual Alarm Reset



Input Signal : 0 to 24 VDC

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.

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

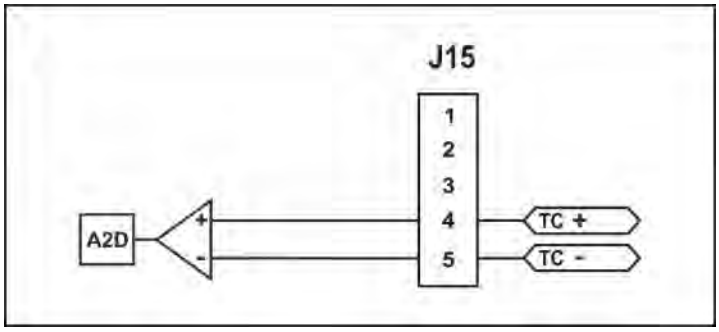
Incorrect wiring of the main thermocouple may cause damage to thermode.

If the main thermocouple is not wired correctly on Pins 4 and 5 of J15 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.

Auxiliary Thermocouple Input Connector (J15)



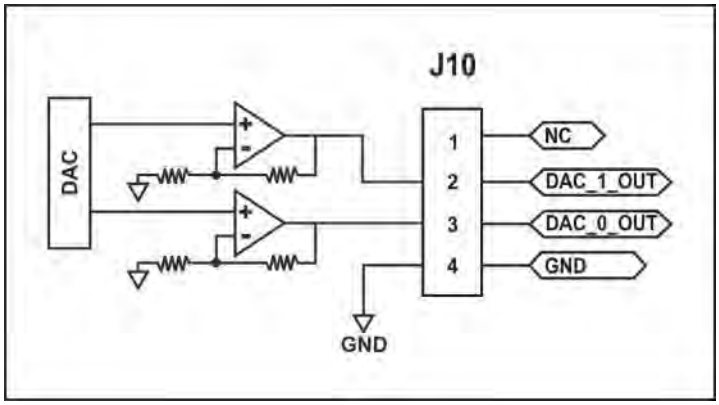
Thermocouple wires are to be connected to pins 4 and 5 on Connector **J15**. ***No*** connections are to be made to pins 1, 2 and 3 on connector **J15**.

NOTE: Both the **Auxiliary** and **Main** thermocouples ***must*** be of the same type: E, J, or K. Refer to the instructions on the previous page (B-21) for connector **J9** to set the thermocouple type for both the **Auxiliary** and **Main** thermocouples.

	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.

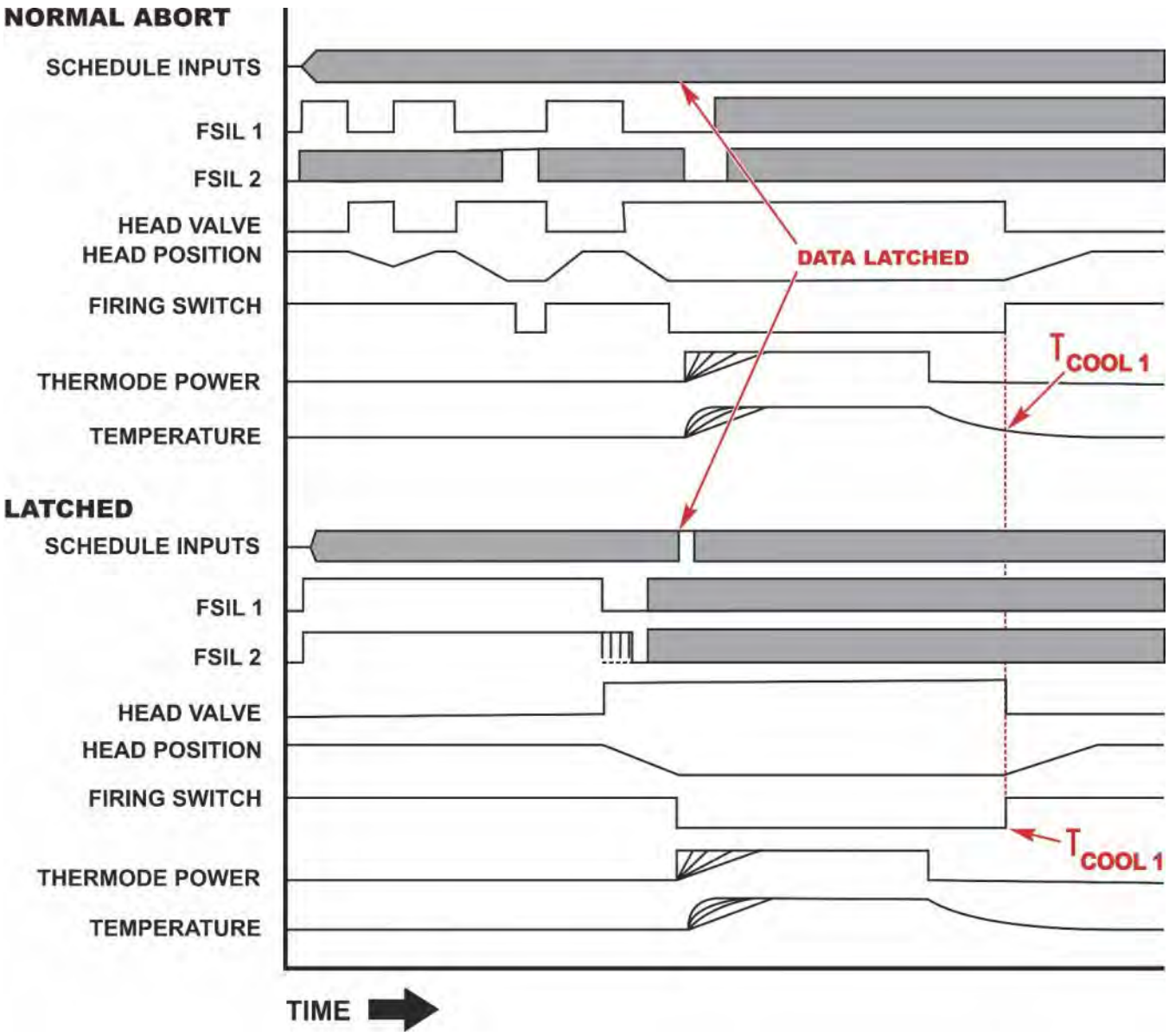
Temperature Analog Output Connector (J10)



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.

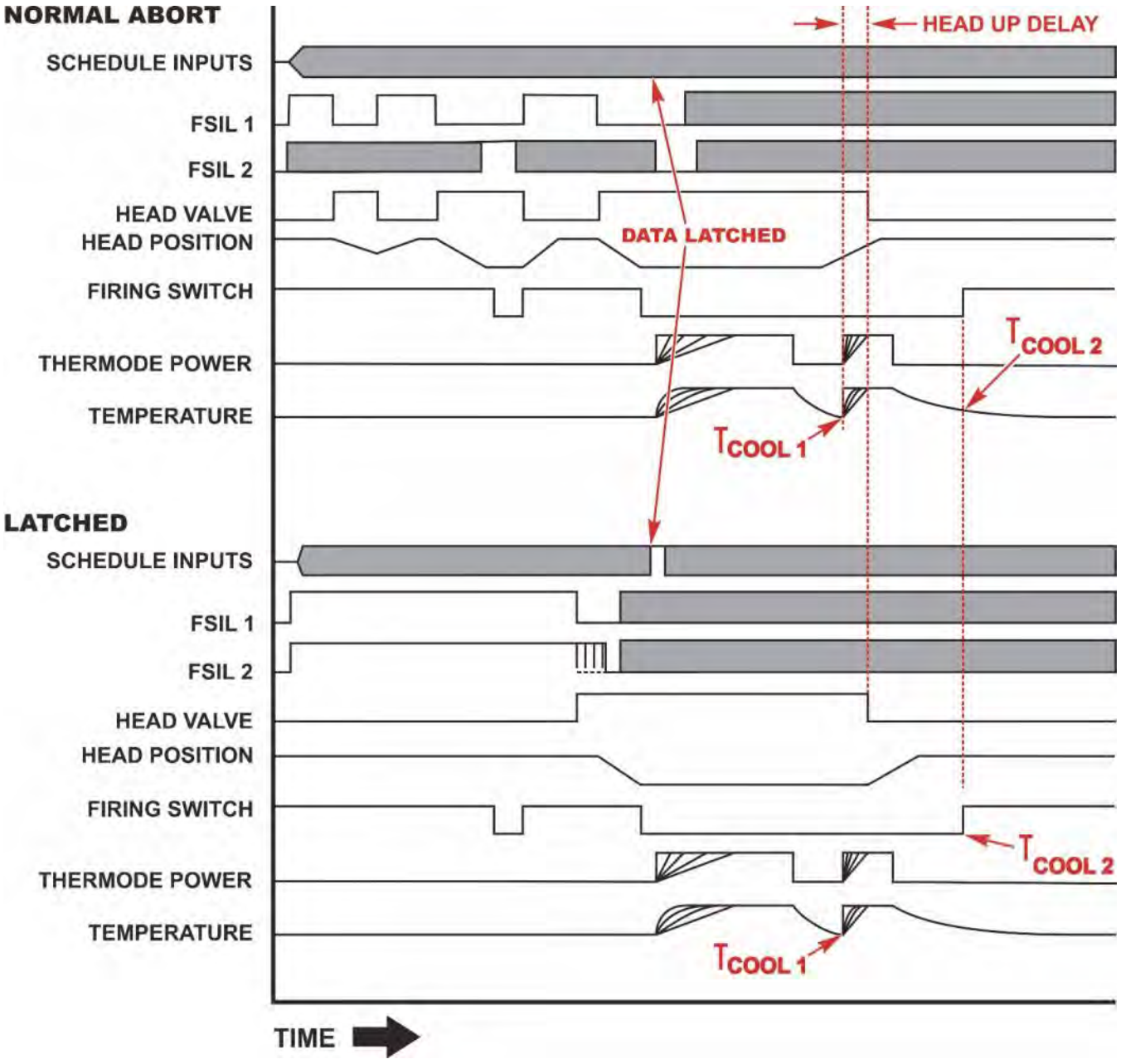
APPENDIX C
SYSTEM TIMING

No Post-Heat Pulse



T_{COOL1} = Cool1 Temperature Setpoint

Process With Post-Heat Pulse



T_{COOL2} = Cool2 Temperature Setpoint

APPENDIX D
COMMUNICATION CODES

Section I. Command Format

COMMAND KEYWORDS: **BOLD.**

VARIABLE: *italics.*

REQUIRED PARAMETERS: {enclosed in braces} (one required and only one parameter allowed).

CHOICE OF PARAMETERS: separated by vertical bar " | " indicates one ***or*** another of choices presented.

ON = 1 ASCII

OFF = 0 ASCII

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

Section II. Control Communication Codes

RS-232 and RS-485 Communication Protocol

Each command will be formatted as follows:

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

Definition of Command Elements

<soh>	1 BYTE	The data packet will start with a **SOH** (start of header **0x01**) character .
<@>	2 BYTES	This is the address of the unit to which data is requested converted into ASCII decimal numbers. **(“01" - “31").** Note: this is the **RS-485** unit address.
<cmd>	2 BYTES	This is a two character ASCII string denoting the command. **(i.e. “SR”)**.
<cnt>	3 BYTES	This is a count of data bytes to follow, converted into a ASCII decimal number. **(“000" - “999").**
<data>	n BYTES	This is optional **ASCII** data formatted into fields with each field separated by a comma
<cksum>	2 BYTES	This is a two charter ASCII HEX string calculated from the sum of all bytes except <soh>, <cksum>, and <eot> and then masked with 255 (0xFF).
<eot>	1 BYTE	This terminates the transmission. (End transmit **0x04**).

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. ‘4’ Timeout.
‘3’ Unrecognized command. ‘6’ Data Bad.

There is No Acknowledgement sent when the data is correct and accepted by the Control.

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.

Error checking at the unit is as follows:

1. If the Control decodes an RS-485 address that does not match the unit's address, the command is ignored.
2. The Control will ignore an external command that does not end with an <eot> or one that does not have the correct number of data bytes specified in the message.
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. 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 check 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 Unit's COMMUNICATIONS ROLE Parameter on the Communications Screen:

1. This 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 reporting will be turned off and the unit will 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 and selecting option 2: **COMMUNICATIONS**.

Significance of the Control's RS232/485 SELECT Parameter on the Communications Screen

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

   NOTE: Due to the way RS-232 handles line logic states, it 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 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

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

NAME	COMMAND	DATA	SIZE
COPY	"CP" Set	Source schedule #	2 Bytes
		,	1 Byte
		Destination schedule #	2 Bytes
			5 Bytes Total
COUNTER	"CR" Read	Read the Counters Data	0 Bytes
	"CS" Set	ReflowCntrs.dwTotalUsageCnt (Total Usage Cntr: 0000000 – 9999999)	7 Bytes
		,	1 Byte
		ReflowCntrs.dwGoodReflowCnt (Good Rflo Cntr: 0000000 – 9999999)	7 Bytes
		,	1 Byte
		ReflowCntrs.stClean.sdCnt (Clean Counter: 000000 – 999999)	6 Bytes
		,	1 Byte
		ReflowCntrs.stReplace.sdCnt (Replace counter: 000000 – 999999)	6 Bytes
		,	1 Byte
		ReflowCntrs.stClean.fStatus (Clean counter status: 0 = OFF, 1 = ON)	1 Byte
		,	1 Byte
		ReflowCntrs.stReplace.fStatus (Replace counter status: 0 = OFF, 1 = ON)	1 Byte
		,	1 Byte
		ReflowCntrs.stClean.enAction (Clean counter action: 0 – 1) 0 = STOP 1 = CONTINUE	1 Byte
		,	1 Byte
		ReflowCntrs.stReplace.enAction (Replace counter action: 0 – 1) 0 = STOP 1 = CONTINUE	1 Byte
			37Bytes Total
LOAD	"LS" Set	The profile # to become active	2 Bytes
	"LR" Read	Returns the current active profile	0 Bytes
MONITOR	"MR" Read	Read System State	0 Byte
	"MS" Set	DispProfile.ProfileNum (Active screen number 000 – 255)	3 Bytes

0 NO_SCRN_DEF = 0,
1 ALLPIXELSON,
2 ALLPIXELSOFF,
3 BAUDSCR,
4 BUZZER,
5 CLEAN_CNTR,
6 CLEAN_CNTR_SETUP,
7 COARSE_HEATING,
8 COMMID,
9 COMMSCR,
10 COPYSCR,
11 COPYSCR2,
12 COPYRIGHT

13 DATASCR,
14 DEFAULTS,
15 FINE_HEATING,
16 FREQ_DETECT,
17 GOOD_REFLOW_CNTR,
18 GRAPHSCR,
19 HARDWARE,
20 UNUSED_SCREENID1,
21 HEATSWTEST,
22 Not Used
23 HW_LIST,
24 KBDTEST,
25 KDSCR,
26 KISCR,
27 KPSCR,
28 UNUSED_SCREENID2,
29 LOWER_TEMP,
30 MANUAL_TUNING,
31 MAX_TEMP,
32 PASSWORD,
33 PIDPARAMS,
34 PIXELONTEST,
35 PIXELOFFTEST,
36 REFLOW,
37 UNUSED_SCREENID3,
38 REFLOW_COUNTERS,
39 RELAY,
40 RELAY1,
41 RELAY2,
42 RELAY3,
43 RELAY4,
44 RELAY1WHENSCR,
45 RELAY2WHENSCR,
46 RELAY3WHENSCR,
47 RELAY4WHENSCR,
48 RELEASE_TIMER,
49 REPLACE_CNTR,
50 REPLACE_CNTR_SETUP,
51 SETTODEFAULTS,
52 SAFETY_TIMER,
53 SETUP,
54 SHOWPASSWD,
55 SYSTEM_SEC,
56 SYSTEMTESTS,
57 TESTRELAYS,
58 TOTAL_USAGE,
59 UPPER_TEMP,
60 NEW_IDLE_TEMP,
61 LANGUAGE_SETUP,
62 HEADUP_DELAY,
63 SCHEDULE1,
64 SCHEDULE2,
65 Not Used
66 PREHEAT_PEAK_DELAY_TIME

67 PREHEAT_AVG_DELAY_TIME
68 PREHEAT_PEAKHI_TEMP,
69 PREHEAT_PEAKLO_TEMP,
70 PREHEAT_AVGHI_TEMP,
71 PREHEAT_AVGLO_TEMP,
72 REFLOW_PEAKHI_TEMP,
73 REFLOW_PEAKLO_TEMP,
74 REFLOW_AVGHI_TEMP,
75 REFLOW_AVGLO_TEMP,
76 PREHEAT_ENVHI_TEMP,
77 PREHEAT_ENVLO_TEMP,
78 REFLOW_ENVHI_TEMP,
79 REFLOW_ENVLO_TEMP,
80 RISE1_ENV_DELAY_TIME
81 RISE2_ENV_DELAY_TIME
82 GRAPHPERIOD_TIME,
83 Not Used
84 NEW_REF_TEXT,
85 IOSTATUS
86 RELAY5,
87 RELAY6,
88 RELAY7,
89 RELAY5WHENSCR
90 RELAY6WHENSCR
91 RELAY7WHENSCR
92 RELAY1WHEN2SCR
93 RELAY2WHEN2SCR
94 RELAY3WHEN2SCR
95 RELAY4WHEN2SCR
96 RELAY5WHEN2SCR
97 RELAY6WHEN2SCR
98 RELAY7WHEN2SCR
99 SCHEDULE3
100 SCHEDULE4
101 SCHEDULE5
102 AUX_PREHEAT_PEAK_DELAY_TIME
103 AUX_PREHEAT_AVG_DELAY_TIME
104 AUX_PREHEAT_PEAKHI_TEMP,
105 AUX_PREHEAT_PEAKLO_TEMP,
106 AUX_PREHEAT_AVGHI_TEMP,
107 AUX_PREHEAT_AVGLO_TEMP,
108 AUX_REFLOW_PEAKHI_TEMP,
109 AUX_REFLOW_PEAKLO_TEMP,
110 AUX_REFLOW_AVGHI_TEMP,
111 AUX_REFLOW_AVGLO_TEMP,
112AUX_PREHEAT_ENVHI_TEMP,
113AUX_ PREHEAT_ENVLO_TEMP,
114 AUX_REFLOW_ENVHI_TEMP,
115 AUX_REFLOW_ENVLO_TEMP,
116 MAX_AUX_TEMP
117 MAX_IDLE_TEMP
118 PREHEAT_DELTA
119 REFLOW_DELTA
120 PIDCONTROL

121 AUX_START
122 AUX_PREHEAT
123 AUX_REFLOW
124 SOLDER_COOL_VALVE

			3 Bytes Total
PROFILE	"DR" Read	Profile #	2 Bytes
	"DS" Set	ProfileNum (Profile number to be modified: 01 - 63)	2 Bytes
		,	1 Byte
		PreheatTemp (Preheat temperature: 060 - 300)	3 Bytes
		,	1 Byte
		ReflowTemp (Reflow temperature: 060 - 600)	3 Bytes
		,	1 Byte
		Cool1Temp (Cool1 temperature: 025 - 300)	3 Bytes
		,	1 Byte
		PreheatTime (Preheat time: 000 – 999)	3 Bytes
		,	1 Byte
		Rise2Time (Rise2 time: 00 – 99)	2 Bytes
		,	1 Byte
		ReflowTime (Reflow time: 000 – 999)	3 Bytes
		,	1 Byte
		BaseTemp (Base temperature: 025 – 300)	3 Bytes
			1 Byte
		PostheatTemp (Postheat temperature: 025 - 600)	3 Bytes
		,	1 Byte
		Cool2Temp (Cool2 temperature: 025 - 300)	3 Bytes
		,	1 Byte
		IdleTemp (Idle temperature: 025 - 100)	3 Bytes
		,	1 Byte
		BaseTime (Preheat time: 000 – 999)	3 Bytes
		,	1 Byte
		PostheatTime (Postheat time: 000 – 999)	3 Bytes
		,	1 Byte
		Rise1Time (Rise1 time: 00 – 99)	2 Bytes
		,	1 Byte
		GRAPH Time Span (000-999)	3 Bytes
			1 Byte
		Head Up Delay (000-999)	3 Bytes
			1 Byte
		Schedule Reference (0000000000-ZZZZZZZZZZ)	10 Bytes
			1 Byte
		CoarseRate (Coarse heating rate: 0 – 3) 0 = Very Slow 1 = Slow 2 = Medium 3 = Fast	1 Byte
		,	1 Byte
		FineRate (00 – 99)	2 Bytes
		,	1 Byte
		Preheat Reflow Control (0=TIME, 1=TEMP)	1 Byte
		,	1 Byte
		Preheat Delta Temperature (00 – 99)	2 Bytes

		,	1 Byte
		Reflow Delta Temperature (00 – 99)	2 Bytes
		,	1 Byte
		PID Control (100 – 269)	3 Byte
		,	1 Byte
		Solder Cool Valve Delay (00 – 99	2 Bytes
			91 Bytes Total
PROFILE	"PR" Read	Profile #	2 Bytes
	"PS" Set	ProfileNum (Profile number to be modified: 01 - 63)	2 Bytes
			1 Byte
		Enable Peak and Average Limits (1 = yes, 0 = no)	1 Byte
			1 Byte
		Preheat Peak Upper Temperature Limit (000-999)	3 Bytes
			1 Byte
		Preheat Peak Lower Temperature Limit (000-999)	3 Bytes
			1 Byte
		Reflow Peak Upper Temperature Limit (000-999)	3 Bytes
			1 Byte
		Reflow Peak Lower Temperature Limit (000-999)	3 Bytes
			1 Byte
		Preheat Peak Delay (000-999)	3 Bytes
			1 Byte
		Preheat Avg Delay (000-999)	3 Bytes
			1 Byte
		Rise1 Envelope Delay (00-99)	2 Bytes
			1 Byte
		Rise2 Envelope Delay (00-99)	2 Bytes
			1 Byte
		Preheat Average Upper Temperature Limit (0-999)	3 Bytes
			1 Byte
		Preheat Average Lower Temperature Limit (0-999)	3 Bytes
			1 Byte
		Reflow Average Upper Temperature Limit (0-999)	3 Bytes
			1 Byte
		Reflow Average Lower Temperature Limit (0-999)	3 Bytes
			1 Byte
		Enable Preheat Envelope Limits (1 = yes, 0 = no)	1 Bytes
			1 Byte
		Enable Reflow Envelope Limits (1 = yes, 0 = no)	1 Bytes
			1 Byte
		Preheat Upper Temperature Limit (000-999)	3 Bytes
			1 Byte
		Preheat Lower Temperature Limit (000-999)	3 Bytes
			1 Byte

		Reflow Upper Temperature Limit (000-999)	3 Bytes 1 Byte
		Reflow Lower Temperature Limit (000-999)	3 Bytes 1 Byte
		Aux Enable Peak and Average Limits (1 = yes, 0 = no)	1 Byte 1 Byte
		Aux Preheat Peak Delay (000-999)	3 Bytes 1 Byte
		Aux Preheat Avg Delay (000-999)	3 Bytes 1 Byte
		Aux Preheat Peak Upper Temperature Limit (000-999)	3 Bytes 1 Byte
		Aux Preheat Peak Lower Temperature Limit (000-999)	3 Bytes 1 Byte
		Aux Reflow Peak Upper Temperature Limit (000-999)	3 Bytes 1 Byte
		Aux Reflow Peak Lower Temperature Limit (000-999)	3 Bytes 1 Byte
		Aux Preheat Average Upper Temperature Limit (0-999)	3 Bytes 1 Byte
		Aux Preheat Average Lower Temperature Limit (0-999)	3 Bytes 1 Byte
		Aux Reflow Average Upper Temperature Limit (0-999)	3 Bytes 1 Byte
		Aux Reflow Average Lower Temperature Limit (0-999)	3 Bytes 1 Byte
		Aux Enable Preheat Envelope Limits (1 = yes, 0 = no)	1 Bytes 1 Byte
		Aux Enable Reflow Envelope Limits (1 = yes, 0 = no)	1 Bytes 1 Byte
		Aux Preheat Upper Temperature Limit (000-999)	3 Bytes 1 Byte
		Aux Preheat Lower Temperature Limit (000-999)	3 Bytes 1 Byte
		Aux Reflow Upper Temperature Limit (000-999)	3 Bytes 1 Byte
		Aux Reflow Lower Temperature Limit (000-999)	3 Bytes 1 Byte
		Aux Start Temperature (000-999)	3 Bytes 1 Byte
		Aux Preheat Temperature (000-999)	3 Bytes 1 Byte
		Aux Reflow Temperature (000-999)	3 Bytes
			144 Bytes Total
RELAY	"VR"	Read relay values	0 Bytes
	"VS"	Relays1.on_off (0 = NORMALOPEN, 1 = NORMALCLOSED)	1 Byte
		,	1 Byte
		Relays1.when SYSTEMREADY = 00 HEATON=01 HEADUP=02	2 Byte

		ALARM=03 OUTOFLIMIT=04 CLEANTHERM=05 REPLACETHERM=06 IDLEHEAT=07 BASEHEAT=08 RISE1=09 PREHEAT=10 RISE2=11 REFLOW=12 COOL1=13 ENDOFREFLOW=14 CYCLEPWR=15 NOTACTIVE_TRIG = 16	
		,	1 Byte
		Relays2.on_off (As above)	1 Byte
		,	1 Byte
		Relays2.when (As above)	2 Byte
		,	1 Byte
		Relays3.on_off (As above)	1 Byte
		,	1 Byte
		Relays3.when (As above)	2 Byte
		,	1 Byte
		Relays4.on_off (As above)	1 Byte
		,	1 Byte
		Relays4.when (As above)	2 Byte
		,	1 Byte
		Relays5.on_off (As above)	1 Byte
		,	1 Byte
		Relays5.when (As above)	2 Byte
		,	1 Byte
		Relays6.on_off (As above)	1 Byte
		,	1 Byte
		Relays6.when (As above)	2 Byte
		,	1 Byte
		Relays7.on_off (As above)	1 Byte
		,	1 Byte
		Relays7.when (As above)	2 Byte
			34 Bytes Total
RESET	“RX” Reset	Resets system	0 Bytes
SECURITY	“SR” Read	Read Security Locks	0 Bytes
	“SS” Set	Password (0000000 – 9999999)	7 Bytes
(Note: Password is not set by this command. It must match the password in the unit in order to set security locks below)			
		,	1 Byte
		ProfileLock (Profile Lock: 0 = OFF, 1 = ON)	1 Byte
		,	1 Byte
		SystemLock (System Lock: 0 = OFF, 1 = ON)	1 Byte
		,	1 Byte
		ProfileTuneLock (Profile Tuning Lock: 0 = OFF, 1 = ON)	1 Byte

			13 Bytes Total
SYSTEM	"YR" Read	Read system values	0 Bytes
	"YS" Set	HeadCoolValveStatus (0 = OFF, 1 = ON)	1 Byte
		,	1 Byte
		SolderCoolValveStatus (0 = OFF, 1 = ON)	1 Byte
		,	1 Byte
		FootSwResponseMode (0 = ABORT, 1 = LATCH)	1 Byte
		,	1 Byte
		BuzzerLoudness (00 – 99)	2 Bytes
		,	1 Byte
		BuzzerAtEnd (0 = OFF, 1 = ON)	1 Byte
		,	1 Byte
		Idle Temperature (0=ON, 1 = OFF)	1 Byte
		,	1 Byte
		SafetyTimerTime (00 – 99)	2 Bytes
		,	1 Byte
		ReleaseTimerTime (00 – 99)	2 Bytes
		,	1 Byte
		MaxTempLimit (300 – 999)	3 Bytes
		,	1 Byte
		Backlight Operation (0=AUTO, 1=ON)	1 Byte
		,	1 Byte
		Max Aux Temp Limit (300 – 999)	3 Byte
		,	1 Byte
		Max Idle Temp Limit (025 – 300)	3 Bytes
		,	1 Byte
		Aux Temp Line (0=OFF, 1=ON)	1 Bytes
		,	1 Byte
		Aux Temp Number (0=OFF, 1=ON)	1 Bytes
			36 Bytes Total
TEMP	"TR" Read	Read current temperature	0 Bytes
TYPE	"TY" Read	Software release number and version number	0 Bytes
GRAPH	"GR" Read	Graph data points	0 Bytes

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.

Control Originated Response Command Set

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

NAME	COMMAND	DATA	SIZE
COUNTER	"CR" Read	ReflowCntrs.dwTotalUsageCnt (Total Usage Cntr: 0000000 – 9999999)	7 Bytes
		,	1 Byte
		ReflowCntrs.dwGoodReflowCnt (Good Rflo Cntr: 0000000 – 9999999)	7 Bytes
		,	1 Byte
		Sign (Clean Counter plus or minus sign: + or -)	1 Byte
		ReflowCntrs.stClean.sdCnt (Clean Counter: 000000 – 999999)	6 Bytes
		,	1 Byte
		Sign (Replace Counter plus or minus sign: + or -)	1 Byte
		ReflowCntrs.stReplace.sdCnt (Replace counter: 000000 – 999999)	6 Bytes
		,	1 Byte
		ReflowCntrs.stClean.fStatus (Clean counter status: 0 = OFF, 1 = ON)	1 Byte
		,	1 Byte
		ReflowCntrs.stReplace.fStatus (Replace counter status: 0 = OFF, 1 = ON)	1 Byte
		,	1 Byte
		ReflowCntrs.stClean.enAction (Clean counter action: 0 – 1) 0 = STOP 1 = CONTINUE	1 Byte
		,	1 Byte
		ReflowCntrs.stReplace.enAction (Replace counter action: 0 – 1) 0 = STOP 1 = CONTINUE	1 Byte
			39 Bytes Total
LOAD	"LR" Read	Returns the current active profile (01 – 63)	2 Bytes
MONITOR	"MR" Read	DispProfile.ProfileNum (Active screen number 000 – 255)	3 Bytes

0 NO_SCRN_DEF = 0,
1 ALLPIXELSON,
2 ALLPIXELSOFF,
3 BAUDSCR,
4 BUZZER,
5 CLEAN_CNTR,
6 CLEAN_CNTR_SETUP,
7 COARSE_HEATING,
8 COMMID,
9 COMMSCR,
10 COPYSCR,
11 COPYSCR2,
12 COPYRIGHT
13 DATASCR,
14 DEFAULTS,
15 FINE_HEATING,
16 FREQ_DETECT,
17 GOOD_REFLOW_CNTR,
18 GRAPHSCR,
19 HARDWARE,
20 UNUSED_SCREENID1,
21 HEATSWTEST,

22 Not Used
23 HW_LIST,
24 KBDTEST,
25 KDSCR,
26 KISCR,
27 KPSCR,
28 UNUSED_SCREENID2,
29 LOWER_TEMP,
30 MANUAL_TUNING,
31 MAX_TEMP,
32 PASSWORD,
33 PIDPARAMS,
34 PIXELONTEST,
35 PIXELOFFTEST,
36 REFLOW,
37 UNUSED_SCREENID3,
38 REFLOW_COUNTERS,
39 RELAY,
40 RELAY1,
41 RELAY2,
42 RELAY3,
43 RELAY4,
44 RELAY1WHENSCR,
45 RELAY2WHENSCR,
46 RELAY3WHENSCR,
47 RELAY4WHENSCR,
48 RELEASE_TIMER,
49 REPLACE_CNTR,
50 REPLACE_CNTR_SETUP,
51 SETTODEFAULTS,
52 SAFETY_TIMER,
53 SETUP,
54 SHOWPASSWD,
55 SYSTEM_SEC,
56 SYSTEMTESTS,
57 TESTRELAYS,
58 TOTAL_USAGE,
59 UPPER_TEMP,
60 NEW_IDLE_TEMP,
61 LANGUAGE_SETUP,
62 HEADUP_DELAY,
63 SCHEDULE1,
64 SCHEDULE2,
65 Not Used
66 PREHEAT_PEAK_DELAY_TIME
67 PREHEAT_AVG_DELAY_TIME
68 PREHEAT_PEAKHI_TEMP,
69 PREHEAT_PEAKLO_TEMP,
70 PREHEAT_AVGHI_TEMP,
71 PREHEAT_AVGLO_TEMP,
72 REFLOW_PEAKHI_TEMP,
73 REFLOW_PEAKLO_TEMP,
74 REFLOW_AVGHI_TEMP,
75 REFLOW_AVGLO_TEMP,

76 PREHEAT_ENVHI_TEMP,
77 PREHEAT_ENVLO_TEMP,
78 REFLOW_ENVHI_TEMP,
79 REFLOW_ENVLO_TEMP,
80 RISE1_ENV_DELAY_TIME
81 RISE2_ENV_DELAY_TIME
82 GRAPHPERIOD_TIME,
83 Not Used
84 NEW_REF_TEXT,
85 IOSTATUS
86 RELAY5,
87 RELAY6,
88 RELAY7,
89 RELAY5WHENSCR
90 RELAY6WHENSCR
91 RELAY7WHENSCR
92 RELAY1WHEN2SCR
93 RELAY2WHEN2SCR
94 RELAY3WHEN2SCR
95 RELAY4WHEN2SCR
96 RELAY5WHEN2SCR
97 RELAY6WHEN2SCR
98 RELAY7WHEN2SCR
99 SCHEDULE3
100 SCHEDULE4
101 SCHEDULE5
102 AUX_PREHEAT_PEAK_DELAY_TIME
103 AUX_PREHEAT_AVG_DELAY_TIME
104 AUX_PREHEAT_PEAKHI_TEMP,
105 AUX_PREHEAT_PEAKLO_TEMP,
106 AUX_PREHEAT_AVGHI_TEMP,
107 AUX_PREHEAT_AVGLO_TEMP,
108 AUX_REFLOW_PEAKHI_TEMP,
109 AUX_REFLOW_PEAKLO_TEMP,
110 AUX_REFLOW_AVGHI_TEMP,
111 AUX_REFLOW_AVGLO_TEMP,
112AUX_PREHEAT_ENVHI_TEMP,
113AUX_ PREHEAT_ENVLO_TEMP,
114 AUX_REFLOW_ENVHI_TEMP,
115 AUX_REFLOW_ENVLO_TEMP,
116 MAX_AUX_TEMP
117 MAX_IDLE_TEMP
118 PREHEAT_DELTA
119 REFLOW_DELTA
120 PIDCONTROL
121 AUX_START
122 AUX_PREHEAT
123 AUX_REFLOW
124 SOLDER_COOL_VALVE

,	1 Byte
CurrStatusMsg (0 – 61)	2 Bytes

0 SYSTEMREADY = 0,
1 EMERJMPR,
2 BASEHEAT_HIGHERPREHEAT,
3 SYSTEMREADY_IDLEON,
4 PREHEAT_HIGHERREFLOW,
5 COOL_HIGHERREFLOW,
6 COOL_HIGHERPOSTHEAT
7 REFLOW_HIGHLIMIT,
8 RISE1TIME,
9 IDLE_HIGHER_COOL1TEMP,
10 IDLE_HIGHER_COOL2_TEMP,
11 ACCESSDENIED,
12 SETDEFAULTS,
13 FIRINGSWOPEN,
14 SAFETYTIMER,
15 FIRINGSWNOTACTIVATED,
16 DECREASEHEATINGRATE,
17 INCREASEHEATINGRATE,
18 REPLACE,
19 CLEAN,
20 REPLACERESET,
21 CLEANRESET,
22 POWERMODE,
23 NOHEATSWITCH,
24 BASEHEATTIME,
25 HEADDOWN,
26 PREHEATTIME,
27 RISE2TIME,
28 HEATTIME,
29 COOL1TIME,
30 COOLIDLETIME,
31 WELDCMPLT,
32 MODIFYPROFILE,
33 LASTPROFILE,
34 IDEALPROFILE,
35 EMERSTOP,
36 MAXTEMP,
37 NOPWR,
38 OVPWR1,
39 THERMODE,
40 ACCESSDENIEDREM,
41 FOOTSWOPEN,
42 OVPWR2,
43 POSTOFF4,
44 RAMPIDLE,
45 IDLE_HIGHERBASEHEAT,
46 POSTON4,
47 POSTON4H,
48 COOL2_HIGHERPOSTHEAT,
49 POSTHEATTM_LT_HDUPDELAY,
50 COOL2TIME,
51 POSTHEATTIME_HDDLY,
52 POSTHEATTIME_HDUP,
53 IDLEON3,

54 IDLEOFF3,
55 IDLEWARM3
56 POSTHEAT_HIGHLIMIT
57 PREHEATDELTA_TOOHIGH
58 REFLOWDELTA_TOOHIGH
59 HEATINGTOOSLOW
60 THERMOSTATTOOHOT

			6 Bytes Total
PROFILE	"DR" Read	ProfileNum (Profile number read: 01 - 63)	2 Bytes
		,	1 Byte
		PreheatTemp (Preheat temperature: 060 - 300)	3 Bytes
		,	1 Byte
		ReflowTemp (Reflow temperature: 060 - 600)	3 Bytes
		,	1 Byte
		Cool1Temp (Cool1 temperature: 025 - 300)	3 Bytes
		,	1 Byte
		PreheatTime (Preheat time: 000 – 999)	3 Bytes
		,	1 Byte
		Rise2Time (Rise2 time: 00 – 99)	2 Bytes
		,	1 Byte
		ReflowTime (Reflow time: 000 – 999)	3 Bytes
		,	1 Byte
		BaseTemp (Base temperature: 025 – 300)	3 Bytes
			1 Byte
		PostheatTemp (Postheat temperature: 025 - 600)	3 Bytes
		,	1 Byte
		Cool2Temp (Cool2 temperature: 025 - 300)	3 Bytes
		,	1 Byte
		IdleTemp (Idle temperature: 025 - 100)	3 Bytes
		,	1 Byte
		BaseTime (Preheat time: 000 – 999)	3 Bytes
		,	1 Byte
		PostheatTime (Postheat time: 000 – 999)	3 Bytes
		,	1 Byte
		Rise1Time (Rise1 time: 00 – 99)	2 Bytes
		,	1 Byte
		GRAPH Time Span (000-999)	3 Bytes
			1 Byte
		Head Up Delay (000-999)	3 Bytes
			1 Byte
		,	1 Byte
		FineRate (00 – 99)	2 Bytes
		,	1 Byte
		Preheat Reflow Control (0=TIME, 1=TEMP)	1 Byte
		,	1 Byte
		Preheat Delta Temperature (00 – 99)	2 Bytes
		,	1 Byte
		Reflow Delta Temperature (00 – 99)	2 Bytes
		,	1 Byte
		PID Control (100 – 269)	3 Bytes
		,	1 Byte

		Solder Cool Valve Delay (00 – 99)	2 Bytes
			91 Bytes Total
PROFILE	"PR" Read	ProfileNum (Profile number read: 01 - 63)	2 Bytes
		Enable Peak and Average Limits (1 = yes, 0 = no)	1 Byte
			1 Byte
		Preheat Peak Upper Temperature Limit (000-999)	3 Bytes
			1 Byte
		Preheat Peak Lower Temperature Limit (000-999)	3 Bytes
			1 Byte
		Reflow Peak Upper Temperature Limit (000-999)	3 Bytes
			1 Byte
		Reflow Peak Lower Temperature Limit (000-999)	3 Bytes
			1 Byte
		Preheat Peak Delay (000-999)	3 Bytes
			1 Byte
		Preheat Avg Delay (000-999)	3 Bytes
			1 Byte
		Rise1 Envelope Delay (00-99)	2 Bytes
			1 Byte
		Rise2 Envelope Delay (00-99)	2 Bytes
			1 Byte
		Preheat Average Upper Temperature Limit (0-999)	3 Bytes
			1 Byte
		Preheat Average Lower Temperature Limit (0-999)	3 Bytes
			1 Byte
		Reflow Average Upper Temperature Limit (0-999)	3 Bytes
			1 Byte
		Reflow Average Lower Temperature Limit (0-999)	3 Bytes
			1 Byte
		Enable Preheat Envelope Limits (1 = yes, 0 = no)	1 Bytes
			1 Byte
		Enable Reflow Envelope Limits (1 = yes, 0 = no)	1 Bytes
			1 Byte
		Preheat Upper Temperature Limit (000-999)	3 Bytes
			1 Byte
		Preheat Lower Temperature Limit (000-999)	3 Bytes
			1 Byte
		Reflow Upper Temperature Limit (000-999)	3 Bytes
			1 Byte
		Reflow Lower Temperature Limit (000-999)	3 Bytes
			1 Byte
		Aux Enable Peak and Average Limits (1 = yes, 0 = no)	1 Byte
			1 Byte
		Aux Preheat Peak Delay (000-999)	3 Bytes
			1 Byte
		Aux Preheat Avg Delay (000-999)	3 Bytes
			1 Byte
		Aux Preheat Peak Upper Temperature Limit (000-999)	3 Bytes
			1 Byte
		Aux Preheat Peak Lower Temperature Limit (000-999)	3 Bytes

			1 Byte
		Aux Reflow Peak Upper Temperature Limit (000-999)	3 Bytes
			1 Byte
		Aux Reflow Peak Lower Temperature Limit (000-999)	3 Bytes
			1 Byte
		Aux Preheat Average Upper Temperature Limit (0-999)	3 Bytes
			1 Byte
		Aux Preheat Average Lower Temperature Limit (0-999)	3 Bytes
			1 Byte
		Aux Reflow Average Upper Temperature Limit (0-999)	3 Bytes
			1 Byte
		Aux Reflow Average Lower Temperature Limit (0-999)	3 Bytes
			1 Byte
		Aux Enable Preheat Envelope Limits (1 = yes, 0 = no)	1 Bytes
			1 Byte
		Aux Enable Reflow Envelope Limits (1 = yes, 0 = no)	1 Bytes
			1 Byte
		Aux Preheat Upper Temperature Limit (000-999)	3 Bytes
			1 Byte
		Aux Preheat Lower Temperature Limit (000-999)	3 Bytes
			1 Byte
		Aux Reflow Upper Temperature Limit (000-999)	3 Bytes
			1 Byte
		Aux Reflow Lower Temperature Limit (000-999)	3 Bytes
			1 Byte
		Aux Start Temperature (000-999)	3 Bytes
			1 Byte
		Aux Preheat Temperature (000-999)	3 Bytes
			1 Byte
		Aux Reflow Temperature (000-999)	3 Bytes
			144 Bytes Total
RELAY	"VR" Read	Relays1.on_off (0 = NORMALOPEN, 1 = NORMALCLOSED)	1 Byte
		,	1 Byte
		Relays1.when SYSTEMREADY = 00 HEATON=01 HEADUP=02 ALARM=03 OUTOFLIMITS=04 CLEANTHERM=05 REPLACETHERM=06 IDLEHEAT=07 BASEHEAT=08 RISE1=09 PREHEAT=10 RISE2=11 REFLOW=12 COOL1=13 ENDOFREFLOW=14 CYCLEPWRALARM=15 NOTACTIVE_TRIG = 16	2 Bytes
		,	1 Byte

Relays2.on_off (As above)	1 Byte
Relays2.when (As above)	2 Byte
,	1 Byte
Relays3.on_off (As above)	1 Byte
,	1 Byte
Relays3.when (As above)	2 Byte
,	1 Byte
Relays4.on_off (As above)	1 Byte
,	1 Byte
Relays4.when (As above)	2 Byte
,	1 Byte
Relays5.on_off (As above)	1 Byte
,	1 Byte
Relays5.when (As above)	2 Byte
,	1 Byte
Relays6.on_off (As above)	1 Byte
,	1 Byte
Relays6.when (As above)	2 Byte
,	1 Byte
Relays7.on_off (As above)	1 Byte
,	1 Byte
Relays7.when (As above)	2 Byte
	34 Bytes Total

REPORT **"RR" Read** (Reports the results of the last reflow. Sent automatically by the Control at the end of the reflow.)

ProfileNum (Profile number: 01 – 63)	2 Bytes
,	1 Byte
StartTemp (Starting Temperature: 000 – 999)	3 Bytes
,	1 Byte
PeakTemp (Peak Reflow Temperature: 000 – 999)	3 Bytes
,	1 Byte
FinalTemp (Final Reflow Temperature: 000 – 999)	3 Bytes
,	1 Byte
AverageTemp (Average Reflow Temperature: 000 – 999)	3 Bytes
,	1 Byte
Cool1Time (Actual Cool1 time: 000 – 999)	3 Bytes
,	1 Byte
Cool2Time (Actual Cool2 time: 000 – 999)	3 Bytes
,	1 Byte
PeakPreheatTemp (Peak Preheat Temperature: 000 – 999)	3 Bytes
,	1 Byte
AveragePreheatTemp (Average Preheat Temperature: 000 – 999)	3 Bytes
,	1 Byte
AuxPeakTemp (Aux Peak Reflow Temperature: 000 – 999)	3 Bytes
,	1 Byte
AuxAverageTemp (Aux Average Reflow Temperature: 000 – 999)	3 Bytes
,	1 Byte
AuxPeakPreheatTemp (Aux Peak Preheat Temperature: 000 – 999)	3 Bytes
,	1 Byte
AuxAveragePreheatTemp (Aux Average Preheat Temperature: 000 – 999)	3 Bytes
,	1 Byte

StatusMsg (Resulting Status Msg: 00 – 61) 2 Bytes

0 SYSTEMREADY = 0,
1 EMERJMPR,
2 BASEHEAT_HIGHERPREHEAT,
3 SYSTEMREADY_IDLEON,
4 PREHEAT_HIGHERREFLOW,
5 COOL_HIGHERREFLOW,
6 COOL_HIGHERPOSTHEAT
7 REFLOW_HIGHLIMIT,
8 RISE1TIME,
9 IDLE_HIGHER_COOL1TEMP,
10 IDLE_HIGHER_COOL2_TEMP,
11 ACCESSDENIED,
12 SETDEFAULTS,
13 FIRINGSWOPEN,
14 SAFETYTIMER,
15 FIRINGSWNOTACTIVATED,
16 DECREASEHEATINGRATE,
17 INCREASEHEATINGRATE,
18 REPLACE,
19 CLEAN,
20 REPLACERESET,
21 CLEANRESET,
22 POWERMODE,
23 NOHEATSWITCH,
24 BASEHEATTIME,
25 HEADDOWN,
26 PREHEATTIME,
27 RISE2TIME,
28 HEATTIME,
29 COOL1TIME,
30 COOLIDLETIME,
31 WELDCMPLT,
32 MODIFYPROFILE,
33 LASTPROFILE,
34 IDEALPROFILE,
35 EMERSTOP,
36 MAXTEMP,
37 NOPWR,
38 OVPWR1,
39 THERMODE,
40 ACCESSDENIEDREM,
41 FOOTSWOPEN,
42 OVPWR2,
43 POSTOFF4,
44 RAMPIDLE,
45 IDLE_HIGHERBASEHEAT,
46 POSTON4,
47 POSTON4H,
48 COOL2_HIGHERPOSTHEAT,
49 POSTHEATTM_LT_HDUPDELAY,
50 COOL2TIME,

		51 POSTHEATTIME_HDDLY, 52 POSTHEATTIME_HDUP, 53 IDLEON3, 54 IDLEOFF3, 55 IDLEWARM3 56 POSTHEAT_HIGHLIMIT 57 PREHEATDELTA_TOOHIGH 58 REFLOWDELTA_TOOHIGH 59 HEATINGTOOSLOW 60 THERMOSTATTOOHOT	
			53 Bytes Total
SECURITY	"SR" Read	ProfileLock (Profile Lock: 0 = OFF, 1 = ON)	1 Byte
		,	1 Byte
		SystemLock (System Lock: 0 = OFF, 1 = ON)	1 Byte
		,	1 Byte
		ProfileTuneLock (Profile Tuning Lock: 0 = OFF, 1 = ON)	1 Byte
			5 Bytes Total
SYSTEM	"YR" Read	HeadCoolValveStatus (0 = OFF, 1 = ON)	1 Byte
		,	1 Byte
		SolderCoolValveStatus (0 = OFF, 1 = ON)	1 Byte
		,	1 Byte
		FootSwResponseMode (0 = ABORT, 1 = LATCH)	1 Byte
		,	1 Byte
		BuzzerLoudness (00 – 99)	2 Bytes
		,	1 Byte
		BuzzerAtEnd (0 = OFF, 1 = ON)	1 Byte
		,	1 Byte
		Idle Temperature (0=ON, 1 = OFF)	1 Byte
		,	1 Byte
		SafetyTimerTime (00 – 99)	2 Bytes
		,	1 Byte
		ReleaseTimerTime (00 – 99)	2 Bytes
		,	1 Byte
		MaxTempLimit (000 – 999)	3 Bytes
		,	1 Byte
		Backlight Operation (0=AUTO, 1=ON)	1 Byte
		,	1 Byte
		Max Aux Temp Limit (300 – 999)	3 Byte
		,	1 Byte
		Max Idle Temp Limit (025 – 300)	3 Bytes
		,	1 Byte
		Aux Temp Line (0=OFF, 1=ON)	1 Bytes
		,	1 Byte
		Aux Temp Number (0=OFF, 1=ON)	1 Bytes
			36 Bytes Total
TEMP	"TR" Read	CurrTemp (Current temperature of the thermode (000 – 999))	3 Bytes
		,	1 Byte
		AuxCurrTemp (000 – 999)	3 Bytes

7 Bytes Total

TYPE	"TY" Read	"Control ", Release #, Revision # Example: "Control 1.00 AxP"	17 Bytes
GRAPH	"GR" Read	Graph data points	Variable number of Bytes

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 datapoints followed by each 4 digit data point. The count and each data point are followed by a carriage return/line feed.

NOTE: If the Controlreceives a Fire Command when the Controlis transmitting the GRAPH data, the transmission of the GRAPH data will be terminated incomplete and the Controlwill initiate the new reflow process.

EXAMPLES:

1) An example of sending a TYPE command to the **Control**: <soh>"01TY0009E"<eot>

The Unit's address is "01"

The command: "TY"

The Count is: "000"

The check sum is "9E". Which is calculated from the ASCII (American Standard code for information interchange) and is a two charter 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

In decimal 48 + 49 + 84 + 89 + 48 + 48 + 48 = 414 decimal.

The check sum is a value between 0 and 255; Therefore, 414 – 255*n = 158 decimal = 19E hex.

Where n = (check sum / 255). Here it is only 1.

If the check sum were 9C4 hex = 2500 decimal. Then n = 2500 / 256 = 9.7.

Using only the hole number n = 9

The final check sum is (2500 – (256 * 9)) = 196 decimal.

A better way is to take the final check sum and AND it with 255 (0x0FF).

In hex, taking the final check sum 0x9C4 and ANDing it with 0xFF = 0xC4, or in decimal 2500 AND 255 = 196.

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

The command would be: <soh>"01LS00205F7"<eot>. "01" is the unit address, "LS" is the command, "002" is the count, 05 is the new profile to go to, and "F7" is the check sum.

Calculating the checksum in HEX we get 0x30 + 0x 31 + 0x4C + 0x53 + 0x30 + 0x30 + 0x32 + 0x30 + 0x35 = 0x1F7 HEX. ANDing it with 0xFF yields a checksum of 0xF7.

In decimal 48 + 49 + 76 + 83 + 48 + 48 + 50 + 48 + 53 = 503.

503 / 256 = 1.96. Therefore the check sum is 503 – (256*1) = 247 decimal or F7 hex.

3) We wish to set the security. The Command is:

<soh>"01SS0141234321,1,0,112"<eot>. "01" is the unit address. "SS" is the set security command. "014" is the count. "1234321," is the password. "1," is Profile lock ON. "0," is System lock OFF. "1" is Profile Tune Lock ON. And "12" is the check sum. The check sum is 412 HEX ANDed with 0xFF is 12.

APPENDIX E
GUIDELINES FOR REFLOW SOLDERING

Overview

This Appendix covers the process definition and components used in the pulse heated reflow soldering of flexible circuits to printed circuit boards. We will look in depth at the component part design criteria necessary to achieve the optimum quality and consistency of a flex to PCB assembly, concentrating on the most popular joint designs and component parts used in the process today.

Definition Of Process Technology

Pulse heated reflow soldering is a process where two pre-fluxed, solder coated parts are heated to a temperature sufficient to cause the solder to melt, flow, and solidify, forming a permanent electro-mechanical bond between the parts and solder. Pulse heated soldering differs from the traditional soldering process in that the reflow of solder is accomplished using a heating element called a thermode which is heated and cooled down for each connection. Pressure is applied during the entire cycle including heating, reflow, and cooling. A pulse-heated control delivers energy to the thermode, which is mounted on the reflow soldering head. A thermocouple, attached to the thermode, provides feedback to the control for repeatable, consistent heat generation.

The soldering head brings the two parts into intimate contact. At a precise pressure the head signals the control to begin the heating cycle of the thermode. The thermode conducts heat to the parts, and the subsequent thermal transfer of heat melts the solder between the parts. The molten areas begin to flow resulting in coalescence between the two solder masses. When the reflow cycle is terminated by the Control, the parts continue to be held together during the cooling cycle such that the solder re-solidifies and a joint is formed. A good solder joint is defined as one where the solder adequately joins both surfaces and wetting (flow of solder) has occurred on both part surfaces.

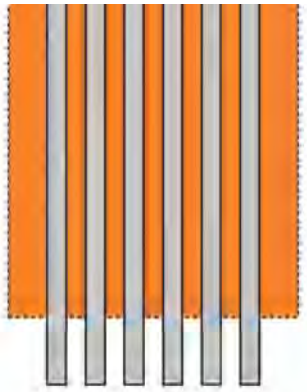
Flex Components

The most common type of flex used in the pulse heated reflow soldering process is manufactured from polyimide (also known under the trade name of *Kapton*). Two layers of polyimide encapsulate the copper traces (normally 0.5 – 2 oz). The two most common copper conductors are rolled annealed (RA) copper and electro-deposited copper (ED). ED is most cost effective and widely used. The thickness of copper traces ranges from 0.0007 – 0.004 inches. The polyimide can have operating temperatures ranging from 130 – 200°C and withstand soldering temperatures up to 300°C for a short time. The temperature of the thermode is always higher than that of the parts that are heated by the thermode. A temperature drop of 50-80ºC can occur between the thermode and joint, across the *Kapton* flex, depending on the thickness. Thickness of the flex ranges from 0.001 – 0.0047 inches.

APPENDIX E: GUIDELINES FOR REFLOW SOLDERING

There are three common types of termination designs used on flex circuits for the pulse heated reflow process:

1. The “exposed lead” design has both sides of the polyimide material removed, leaving the traces free of insulation. This allows the thermode to contact the traces directly, and conduct heat to the parts. If the PCB pads and thermode footprint are sized correctly, this design will tolerate some excess solder on the pads, as there will be open areas into which the solder may flow. During the process, solder will also wet to the top of the trace. Caution must be exercised for part handling as the traces can be easily bent or damaged.

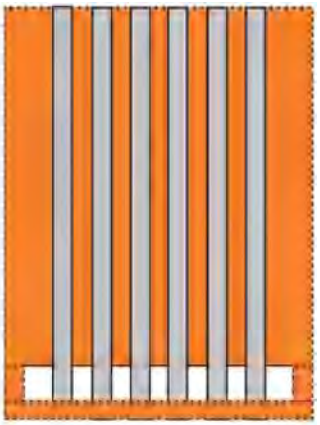


EXPOSED LEAD

2. The “single-sided” flex design has the polyimide removed on one side only. Heat is conducted from the thermode through the solid polyimide surface to the exposed traces underneath. The polyimide conducts heat through the insulation to the exposed traces and pads on the PCB. The polyimide thickness in the joint area is limited to 0.002” enabling conduction. If the polyimide has to be heated much past 260°C, burning of the surface and thermode contamination can result. This design is not tolerant of excess solder on the PCB pads, as there is little room for excess to flow.

SINGLE SIDED

3. The “open windowed” flex design has both sides of the polyimide material removed from the joint area, but has support from the remaining polyimide material on the sides and also along the end of the traces. This design gives some strength to the assembly and is resilient to harsher handling. As the traces are exposed, the thermal transfer to the parts is good and excess solder has extra space to flow. Thermode sizing is critical as it must fit into the window and allow space for the molten solder to flow.



OPEN WINDOWED

Flex and PCB Trace Sizes

Ideally, the flexible circuit pads should be narrower in width than that of the pads on the printed circuit board. As the solder melts and the parts compress, solder is forced to the side. This design will allow space for the solder to flow on either side of the flex pad and will be more tolerant of solder quantity on the PCB, avoiding solder bridging problems.

A smaller pad width on the flex will help with registration and alignment of the two parts. For fine pitch applications, the width of the PCB trace is designed to be 50% of the pitch. This reduces the risk of short circuits due to misalignment.

Printed Circuit Boards (Pcb) And Other Substrates: General Part Design Guidelines

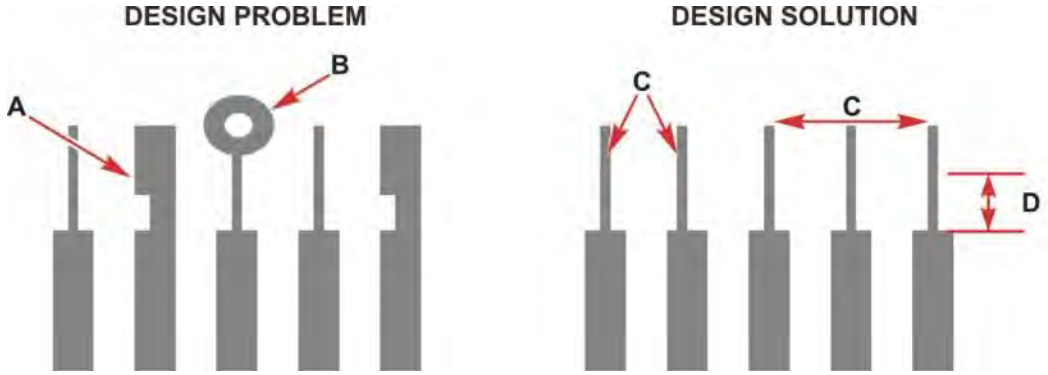
Most PCB materials such as FR2 and FR4 are very resilient to the local application of heat during the process. Materials such as ceramic substrates have to be heated in a more controlled fashion to minimize the chance of cracking. Excessive differences in the heat sinking capability of the two parts can also cause solder cracking during cooling.

Heat sinking differentials along the solder joint length are the most common design problem to overcome. Small differences can have minimal effect, but any large thermal mass change along the joint area will cause inconsistency of temperature and solder joint quality.

Heat Sinks And Land Areas

Common problems and their possible solutions are detailed below:

Design Problems And Solutions Notes



A. Heat is easily transferred away from the joint area to the large landmass, which is positioned too near to the joint area.

B. Increased trace width and plated through-hole draw heat from the joint area.

C. The reduced width trace acts as a thermal dam and prevents any heat sinking of the pad.

D. 0.08” is the effective minimum area in which there must be no heat sinks if small trace heat dams are used.

E. Equally sized small traces act as a thermal dam and ensure equal heating across joint area.

Traces leading from pads should be of equal width and be as narrow as possible. This design will act as a thermal dam, and prevent excessive heat drain from the pad area during soldering.

Alternate designs:

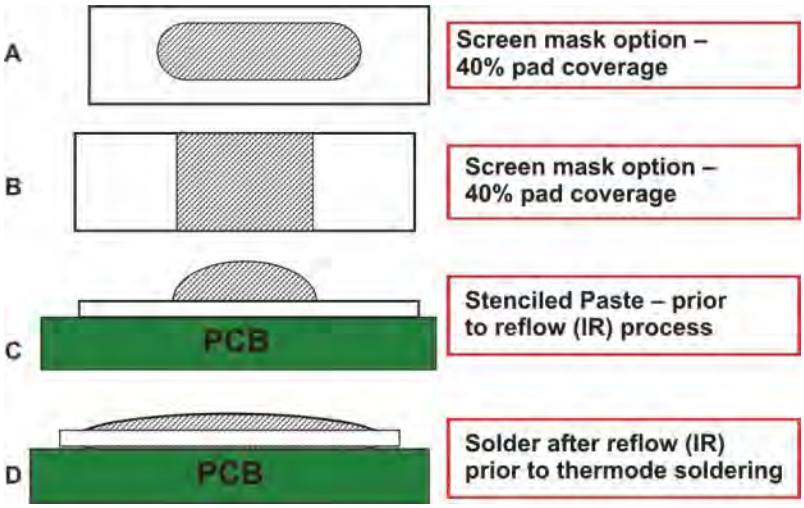
For multi-layer boards, restrict the traces under the bonding area to the smallest width (signal) traces and spread equally under the pads on the PCB. Any shielding on the PCB should have an equal effect along the joint area.

Amount Of Solder Required On Printed Circuit Board Pad

The repeatability of solder deposit is critical in order to achieve good process control. In many cases a certain amount of experimentation is required to achieve the ideal solder volume. A good starting point is using a 0.006” screen print stencil, masked to give 40% pad coverage.

The amount of solder required on the pad of the printed circuit board is dependent on a number of factors. The pad size and pitch determine the maximum and minimum solder quantity that can be applied, using the screen stenciling process. Stenciled solder should be fused prior to the reflow process. Small pad and pitch dimensions require less solder thus preventing bridged joints.

The flex design will also influence the volume of solder. Windowed flex and the exposed trace flex, will stand a slightly greater solder volume in comparison to the single sided flex.



A. A smaller screen aperture can provide 40% solder coverage of pad.

B. Shows an alternate screen design.

C. Resulting solder deposit prior to the reflow (IR) process.

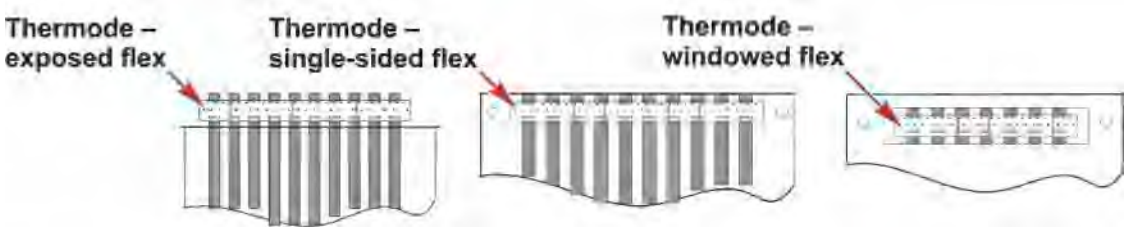
D. Solder is spread evenly across pad after the reflow (IR) process. Note smaller height profile.

PAD SIZE AND PITCH Mm/ inches	TARGET SOLDER VOLUME mm³ / inches	SCREEN THICKNESS Microns / inches	OPENING CHEM.NI/AU HOT AIR LEVEL mm / inches	Cu PASSIVE / PALLADIUM mm / inches
Pad size 0.4 x 3.2mm 0.016 x 0.126” Pitch – 0.8 mm 0.031”	0.02 – 0.03mm 0.00079 – 0.0012”	100 micron / 0.004”	0.36 x 1.2 / 0.014 x 0.047	0.36 x 1.6 / 0.014 x 0.063
		150 micron / 0.006”	0.30 x 1 / 0.012 x 0.039	0.30 x 1.2 / 0.012 x 0.047
		175 micron / 0.007”	0.26 x 1/ 0.010 x 0.039	0.26 x 1.2 / 0.010 x 0.047
Pad size 0.8 x 5.5 mm 0.031 x 0.216” Pitch – 1.5 0.059”	0.07 – 0.10 mm 0.0028 – 0.0039”	100 micron / 0.004”	0.74 x 1.9 / 0.029 x 0.075	0.74 x 2.7 / 0.029 x 0.106
		150 micron / 0.006”	0.6 x 1.5 / 0.024 x 0.059	0.6 x 2.2 / 0.024 x 0.086
		175 micron / 0.007”	0.5 x 1.6 / 0.020 x 0.063	0.5 x 2.3 / 0.020 x 0.091
		200 micron / 0.008”	0.4 x 1.7 / 0.016 x 0.067	0.4 x 2.5 / 0.016 x 0.098
Pad size 0.8 x 4.5 mm 0.031 x 0.177” Pitch 1.6 mm 0.063”	0.057 – 0.08 mm 0.002 – 0.0032”	100 micron / 0.004”	0.7 x 1.6 / 0.028 x 0.063	0.7 x 2.3 / 0.028 x 0.091
		150 micron / 0.006”	0.6 x 1.3 / 0.024 x 0.052	0.6 x 1.8 / 0.024 x 0.071
		175 micron / 0.007”	0.5 x 1.3 / 0.020 x 0.052	0.5 x 1.8 / 0.020 x 0.071

PAD SIZE AND PITCH Mm/ inches	TARGET SOLDER VOLUME mm³ / inches	SCREEN THICKNESS Microns / inches	OPENING CHEM.NI/AU HOT AIR LEVEL mm / inches	Cu PASSIVE / PALLADIUM mm / inches
		200 micron / 0.008”	0.4 x 1.4 / 0.016 x 0.055	0.4 x 2.0 / 0.016 x 0.055
Pad size 1 x 4.5mm 0.039 x 0.177” Pitch – 2.0 mm 0.079”	0.07 – 0.1 mm 0.0028 – 0.0039”	100 micron / 0.004”	0.74 x 1.9 / 0.029 x 0.075	0.74 x 2.7 / 0.029 x 0.106
		150 micron / 0.006”	0.6 x 1.5 / 0.024 x 0.059	0.6 x 2.2 / 0.024 x 0.086
		175 micron / 0.007”	0.5 x 1.6 / 0.020 x 0.063	0.5 x 2.3 / 0.020 x 0.091
		200 micron / 0.008”	0.4 x 1.7 / 0.016 x 0.067	0.4 x 2.5 / 0.016 x 0.098
Pad size 1.5 x 5.5 mm 0.059” x 0.216” Pitch – 3.0 0.118”	0.13 – 0.19 mm 0.0051 – 0.0075”	100 micron / 0.004”	1.2 x 2.2 / 0.047 x 0.087	1.2 x 3.1 / 0.047 x 0.122
		150 micron / 0.006”	1.1 x 1.6 / 0.043 x 0.063	1.1 x 2.3 / 0.043 x 0.091
		175 micron / 0.007”	1.0 x 1.5 / 0.039 x 0.059	1.0 x 2.1 / 0.039 x 0.083
		200 micron / 0.008”	0.9 x 1.4 / 0.035 x 0.055	0.9 x 2.0 / 0.035 x 0.055

Thermode Sizing And Positioning To Parts

Thermodes should be sized according to the pad and flex sizes as shown in the figure below. The thermode length must completely cover the traces and overlap by a minimum of one pad pitch on each side. The thermode width should provide enough thermal transfer of heat to achieve the solder joint in the minimum time thereby eliminating the chance of thermal damage to the parts. The width of the thermode should also accommodate enough room for the molten solder to be displaced, eliminating any chance of solder bridging.



Thermode Width

For the best thermal performance and lifetime of the thermode, the minimum size should be 0.059”. The standard size is 0.079”, due to better performance and longevity. Where solder amounts are not well controlled or room is limited, it is possible to use a 0.047” wide thermode however thermode life and performance will be reduced.

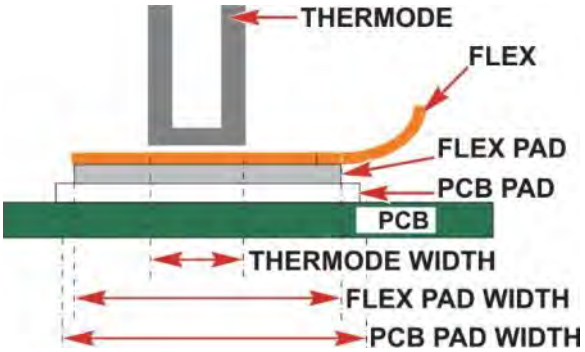
Flex Pad Width

Note that the flex pad finishes short of the PCB pad. This is to allow easy inspection of the joint.

PCB Pad Width

Extra width allows for excess solder and ease of inspection. PCB pad is approximately three times the width of thermode.

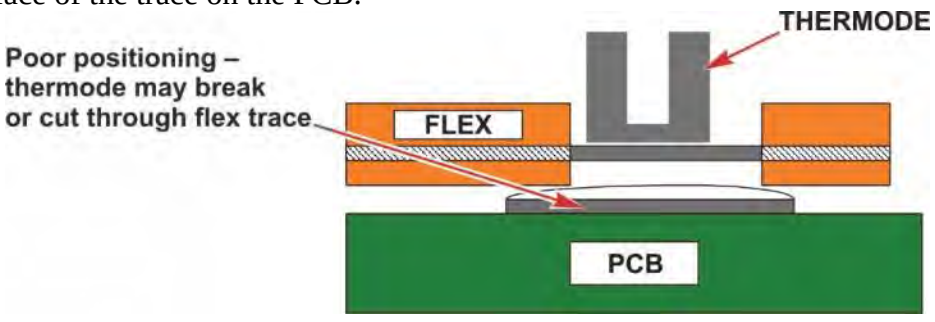
SUGGESTED THERMODE WIDTH / PAD LENGTH AND PITCH		
PCB		
Pad Pitch		**Thermode Width**
mm / inches		mm/ inches
0.8 / 0.031		1.5 / 0.059
1.2 / 0.047		1.5 / 0.059
1.4 / 0.055		2.0 / 0.079
1.5 / 0.059		2.5 / 0.098
1.6 / 0.063		2.5 / 0.098
1.8 / 0.071		2.5 / 0.098
2.0 / 0.079		3.0 / 0.118
3.0 / 0.119		3.0 / 0.118



The dimensions above are guidelines only. Some experimentation may be required, due to different solder volumes.

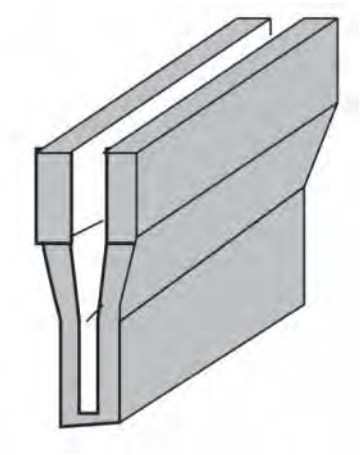
Thermode Positioning

When positioning a thermode on an exposed or windowed flex, it is important that the thermode is not positioned too close to the edge of the main body of the flex. Some flex circuits have thinner and thicker coatings on either side of the traces running through them. If this is the case position the thinner side next to the PCB. This will reduce the chance of the thermode damaging the trace as it pushes it down to the surface of the trace on the PCB.



Thermode Manufacturing And Temperature Characteristics

Modern wire erosion techniques such as EDM and advanced materials have allowed the manufacture of precisely designed thermodes to suit most applications. Three-dimensional thermodes pass the current around the face and thus have zero voltage potential across the traces. These technological advances in machining processes produce designs with constant temperature across the length, and special alloys achieve flatness and co-planarity under heating. Solder will not wet to the materials used and they are resilient to oxidization.



Tooling And Part Positioning

Heat resilient high temperature plastic such as peek (trade name Ketron) or tuffnel should be used under the reflow area to prevent heat sinking from the bond area. Tooling nests should be totally flat as the quality of the process depends upon achieving an equal distribution of heat when the pressure from the thermode is applied. The best finishing technique is to grind the surface in preference to milling. If possible, parts should be located on tooling pins adjacent to the reflow area. It is common practice for the tooling holes in the flex to be reinforced with copper trace for strength and accuracy. If no tooling holes are possible, the parts can be positioned and tooled from a square edge. As the flex is not rigid vacuum holes in the part nest may be required to hold it flat. For fine pitch flex, an alignment x-y stage and camera system may be useful. It is important to take into account any tolerances or batch-to-batch variations in size when designing the part fixturing.

Preparation

It is more common for both parts to be previously solder plated. If this is not the case, it is still possible to achieve wetting between a single sided flex design and a base pad plated with gold or tin. The base plating of the two parts is often enough solder to achieve a reliable joint with a single sided flex.

Most flex designs, however, will require additional solder normally applied by the screen printing process and previously reflowed (quantities are described earlier). For finer pitch applications the solder is normally hot air leveled prior to the reflow process. Hot air leveling allows even distribution of the solder along the pad and good thermal transfer resulting from a flatter surface. This process also makes alignment under the pressure of the heated bar easier to maintain. Parts must be free of dirt and dust and generally clean and oxide free. Flux is normally used to ensure any oxide barrier is removed to allow proper wetting to occur.

Flux

Flux has two important features. It conducts the heat to the solder and it promotes the wetting of the surfaces by cleaning and removal of surface oxides. For easy to solder parts, the pulse heated soldering process requires only a minimum of non-activated flux. No clean fluxes are commonly used. The use of a low solids content flux is recommended. The lower solids content the less pollution of the thermode. Any solvents present should be allowed to dry prior to commencing the soldering process.

Safety

In comparison to conventional soldering the pulse heat thermode soldering process is very safe, as the heating element is only hot when it is pressed to the parts. In addition, only a very small amount of flux is needed and therefore there are much less fumes generated. Operators should still be prevented from touching the thermode during the cycle and should also be protected from entrapment hazards.

Soldering Method -- Process Steps

1. The base substrate is located in a fixture and flux applied to the pads.
2. The flex is positioned in the parts fixture ensuring alignment of both sets of pads.
3. A process start signal is given to the soldering control (footswitch input).
4. The soldering control then actuates the bonding head and thermode module to the parts.
5. At a pre set pressure the heating process is initiated.

The Heating Process

Base

Base provides an additional heating stage which is useful for heat sensitive parts. It also provides a consistent temperature starting point for the reflow process.

Rise1

Rise time to preheat temperature is programmable and allows precise heating rate control. This again is particularly useful where delicate substrates can be easily damaged by too fast a heating rate. Normal rise time for most thermodes is 1.0 – 2 seconds.

Preheat

It takes approximately two seconds to heat a modern designed thermode of up to 2" in length to soldering temperature. During this time, the flux activates and starts to promote wetting by removal of the oxide layer. Preheat is only used where there are excessive heat sinks affecting the thermode or where the application has delicate substrates, like ceramic that need to be heated in a more controlled fashion to avoid cracking.

Rise2

Rise time to soldering temperature is also programmable and allows precise heating rate control. This again is particularly useful where delicate substrates can be easily damaged by too fast a heating rate. Normal rise time for most thermodes is 1.5 – 2 seconds.

Reflow

The actual time and temperature can be programmed for this stage of the process. Time is programmable in 0.1-second increments and temperature in 1-degree increments. Typically, the temperature set point for an open solder joint with direct thermode contact to parts will be between 280 - 330°C. Although normal solder will reflow at 180°C the thermode must be set higher due to the thermal transfer losses. A typical single sided flex will require between 330 - 400°C due to the thermal losses in the *Kapton* material. It is preferred to use the minimum time and temperature to achieve the desired joint, so as to minimize the parts exposure to heat and chance of damage.

Cool1

Cool1, in a process without a Postheat process cycle, is a programmable temperature at which the control unit will actuate the head to the up position. This temperature is set to just below the solder solidification temperature. Therefore as soon as the solder becomes solid the process is ended and a joint is formed. The cooling process can be shortened by the use of forced air cooling. The power supply can be programmed to switch a relay that controls the flow of air at the end of the reflow period and cool the joint and thermode rapidly. Because most connections have a relatively high heat sink, the temperature in the solder is lower than the measured thermode temperature, even when using cooling air. Therefore the release temperature can be set to 180º C in most cases without the chance of encountering a dry joint.

Cool1, in a process with a Postheat process cycle, is a programmable temperature at which the Postheat process cycle will start.

Postheat

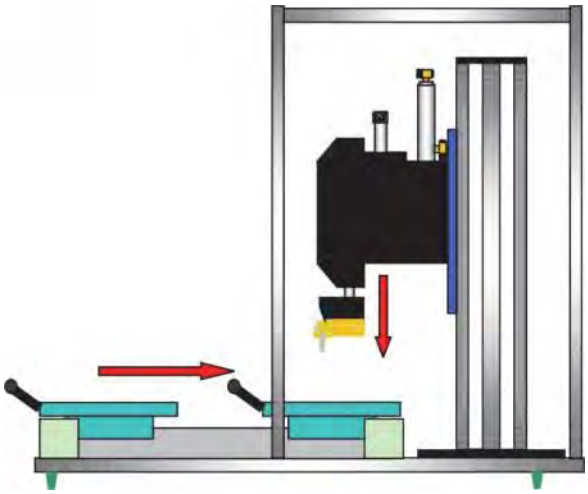
The Postheat process cycle is a step useful for keeping the thermode in good clean condition. The reflow head is typically lifted during the middle of this process cycle. The Control's Head Up Delay parameter is used to control this timing.

Cool2

Cool2 in a process without a Postheat process cycle is a programmable temperature at which the Control will move to the End of Reflow process state.

Force Control And Simple System Examples

Most reflow joints of this nature require fewer than 20lbs. (9 Kg.) pressure. A range of force control modules is available to suit all applications up to 150lbs. (68Kg.). Force must be precisely controlled. Force can be calibrated and set to the correct level to achieve the right thermal transfer of heat to the solder joint. It is desirable to have co-planarity adjustment in the thermode mounting or the head itself, for ease of set up. Modern designs have either air or motorized actuation and built in valves for thermode cooling. Many heads are modular in construction and therefore versatile for integration into tooled or semi automatic fixtures. Linear slides allow loading and unloading of the parts away from the bonding area.



Rotary table systems are preferred for high volume production. The operator can be loading one set of parts concurrent with another set of parts being soldered. This doubles the output from one operator, thus reducing the labor cost.

Quality Control And Inspection

Pressure is maintained as the joint is cooled. Therefore there is little chance of a dry joint occurring. The imprint of the thermode should be seen on the solder joint and be even in width and length. There should be visual evidence that reflow has occurred and when the parts are peeled apart the resulting joint will have a granular appearance over the soldered area. There should be no evidence of burning or delamination of the pads to board or flex. Where a single sided flex is used, there maybe marking or discoloration on the top of the polyimide but no burning or separation should be seen. Any flux residues can be cleaned after the reflow process. No clean, low residue fluxes do not require post cleaning.

Temperature and time process data can be collected from the control and displayed in graphical format to illustrate process stability.

Process Maintenance

Maintenance of the cleanliness of part fixtures is required to ensure that the parts continue to sit flush to the base. Periodic maintenance of the thermode is also needed to prevent the build up of baked on flux. Using a flux solvent, or cleaning the thermode with a very fine emery or grit paper mounted to a flat rigid surface will maintain good thermal transfer to the parts. Care must be taken so as not to round the edges of the thermode or spoil the flatness. There is a distinct difference between the pollution of the thermode for soldering processes where the thermode is positioned directly on the leads in contact with the solder and those where the thermode is in contact with a *Kapton* surface. In the first case the pollution and thermode wear is much higher, and cleaning must be done on a more regular basis. The thermocouple joint connection must be kept clean and in good order to ensure repeatable temperature control. Thermocouple types K and E are not eroded by flux but type J can be attacked and eroded.

Conclusion

Pulse heated thermode reflow soldering of flex to PCB is a stable and well controlled process if certain basic design guide rules are followed. These rules differ from the rules that apply to conventional soldering processes. The process window can be made substantially wider by a joint design that promotes easy and equal heat generation. Even more by a design that accommodates the flow of solder and can compensate for variations in the prior processing steps.

Good joint design and repeatable fine control over solder quantities are the keys to production success. The growing need for product miniaturization and reduced weight are major drivers increasing the use of flexible circuit technology with the electronic industry. Today's control over the thermode soldering process offers a production oriented, reliable solution to the interconnection demands of this growing market.

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