MeiVac INC.

VTAC

SU-A750

*Variable Temperature
AC Controller Heater Controller
and Power Supply*

SU-200 Substrate Heater

VTAC
Variable Temperature
AC Controller

WATLOW   EZ-ZONE®

950 °C
950

EZ

ON

POWER

ON

HEATER

MeiVac INC

OPERATION MANUAL
220V
www.meivac.com

Voltage, Removing the VTAC cover may expose the User to Hazardous voltages. All electrical power to the VTAC circuits and from the heater system must be disconnected before removing the cover from the enclosure or disconnecting any wiring.

Fire/Explosion, Disconnect all electrical power from the VTAC prior to removing the cover from the enclosure. Failure to do so may result in sparks that could cause a fire or an explosion.

Heat, Do not obstruct air circulation to the enclosure. Overheating and possible fire may occur.

Weight Imbalance, The VTAC enclosure has a significant weight imbalance front to rear. Use caution in lifting, handling, mounting, or installing this case.

Electrical Code, This product is supplied with Input and Output connectors and power cables suitable for use with the specified MeiVac SU-200 substrate heaters (*See specification table Section 1.2).* Users who substitute cables or connectors of different sizes or capacities do so at their own risk and are responsible for determining that any such substitutions are suitable for the purpose selected and meet all relevant local and national codes.

Feedthrough capacity, A vacuum feedthrough that is adequately sized for the VTAC's specified power levels and thermocouple signals must be utilized. *Such feedthroughs are available from MeiVac as extra cost Options.*

Process Advisory: Glow Discharge
A Plasma discharge may be created around the portion of the feedthrough and conductors located within the vacuum chamber. Adequate shielding may be required to minimize interference with process conditions in the chamber.

Caution, The VTAC equipment described in this Manual is designed, factory programmed and tested for use with the MeiVac SU-200 substrate heaters specified herein. Modifying or re-programming this VTAC equipment in any manner other than described in this Manual, or using it with any products other than the specified substrate heaters, is done at the User's sole risk. Such modification, re-programming and/or use with other products may damage the VTAC and/or the product it's being used with and void their respective warranties.

Table of Contents

Attachments, Watlow, EZ-Zone PM User's Manual, 0600-0058-0000 <mark>Rev. C</mark>

1.0 Introduction: The SU-A750 VTAC is designed to control MeiVac SU-200 Substrate Heaters.

1.1 PRODUCT DESCRIPTION

The VTAC variable temperature AC controller provides a closed loop solution to drive and control the MeiVac SU-200 series substrate heaters. There is a PID controller at the heart of this unit with auto tuning capability for fast and efficient control of your thermal process. The controller drives the heater using SSR technology which regulates the voltage applied to the heater. Temperature feedback is relayed through a Type K thermocouple which provides for the closed loop control.

1.2   Table 1. Specifications: VTAC SU-A750-220V for use with MeiVac SU-200 heater

Controller model	SU-A750-220V
Power Output, Max	1000 W
Input Voltage	220 VAC 50 / 60 Hz
Input Current	≥ 6 A
Output Voltage	< 60 VAC
Input connector or cord length	Connector European CEE 7/7 Cord length 6 ft
Output conductor length and connector	10 ft Standard. *Optional length available upon reques*t Output connectors, (2) Altech CB4/1
Weight	50 pounds (23 kg)
Dimensions	6.5" (165 mm) tall 10" (254 mm) wide 14'' (356 mm) deep
Fuse	1 A & (2) 6 A
Thermocouple (not supplied)	Type K

1.3   Standard Features and Benefits:

1.3.1 Advanced PID Control Algorithm
- Provides auto tuning for fast, efficient start ups
- Allows tighter control of thermal processes

1.3.2 Variable Set-point
- Temperature controlled to user selected setpoint
- Setpoint can range from room temperature to 950º C

1.3.3 Programmable Ramp
- User defined ramps for rate-of-rise sensitive thermal processes
- Ramp intervals designated in minutes or hours

1.3.4 Program Lock-out
- Protection against unintended changes
- Secures process parameters from unauthorized users

1.3.5 Over-temp Alarm
- Sonalert alarm sounds if operating temperature exceeds the programmed setpoint by 30º C (86º F)
- Corrective action required to silence the alarm

1.3.6 Air Cooled
- Forced air cooling integrated into the unit to provide protection against overheating

1.4 The User must supply the following, which are available from MeiVac as *Extra Cost Options. See section 5.0*
1.4.1 Power and Thermocouple vacuum feedthrough appropriately sized for the VTAC output power and thermocouple type.
1.4.2 Electrical wiring to connect the vacuum feedthrough to the substrate heater in the vacuum system
1.4.3 Thermocouple
1.4.4 Thermocouple signal wiring from the thermocouple to the VTAC controller

2.0 Receiving, Installation and Maintenance
2.1 Receiving and Inspection
2.1.1 On receipt, the unit should be unpacked and checked for damage such as loose parts or dents and scratches on the enclosure or front and rear panels.
2.1.2 If damage to the shipping carton is evident on receipt, the User should request that shipper's agent be present when the unit is unpacked to confirm visible shipping damage that might be claimed.
2.1.3 If necessary, file claims for damage with the shipper.
2.1.4 If damage appears to be significant, contact MeiVac for product repair or return instructions.
2.1.5 If return to MeiVac is required, repackage and ship in original shipping cartons, when possible.

⚠️   **Caution,** Do not attempt to operate a VTAC if physical damage is evident. When possible, retain shipping cartons and packing material should subsequent return of the unit to MeiVac become necessary.

2.2 Installation

    2.2.1 Mechanical Installation

        2.2.1.1 Because of the VTAC enclosure's weight and weight imbalance, it must be mounted on a flat surface that is properly reinforced and capable of carrying the enclosure's weight. Anchoring or otherwise securing the enclosure to its mounting surface must be in accordance with all local codes and regulations.

        2.2.1.2 Adequate air circulation must be provided to the enclosure.

⚠️ **Warning**, *It is very important to insert the thermocouple all the way into the substrate heater block and make sure it cannot come out during operation. If the thermocouple comes out during operation severe damage to the substrate heater can occur. If the thermocouple breaks, the controller will shut down the system and the Sonalert will sound.*
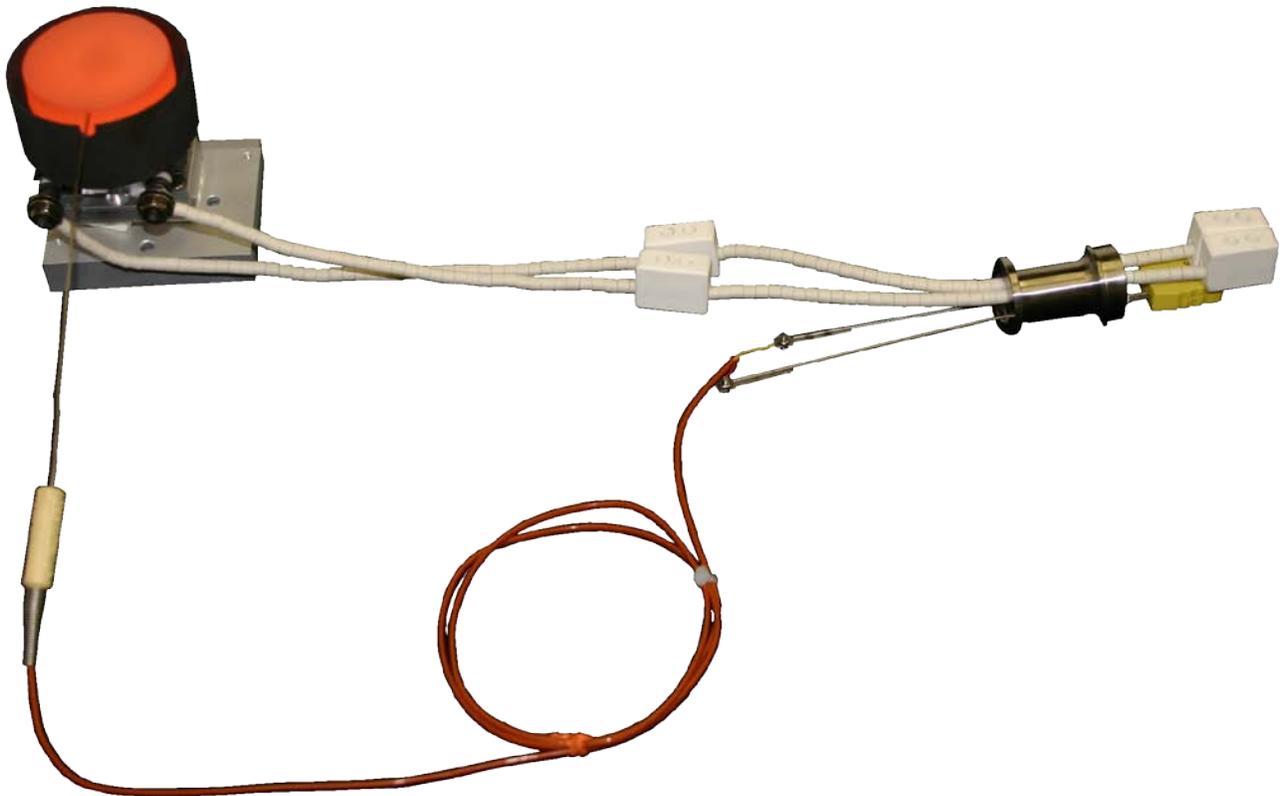
Figure 1. Typical Heater assembly. *(See Options page for additional information)*

    2.2.2 Electrical Installation

      Confirm that the VTAC is connected to a power source operating at the required voltage, and specified input current.

⚠️ ***Caution****: The power supply may be damaged if it is connected to the wrong supply voltage or the wiring is incorrect. Before applying power, make sure that the input voltage specified on the Input Ratings Label on the rear panel of the enclosure corresponds to the voltage of your system.*

⚠️ **Electrical Code**, This product is supplied with Input and Output connectors and power cables suitable for use with the specified MeiVac SU-200 substrate heaters (*See specification table Section 1.2).* Users who substitute cables or connectors of different sizes or capacities do so at their own risk and are responsible for determining that any such substitutions are suitable for the purpose selected and meet all relevant local and national codes

⚠️ **Feedthrough Capacity**, A vacuum feedthrough that is adequately sized for the specified power levels and thermocouple signals must be utilized. *Such feedthroughs are available from MeiVac as extra cost Options.*

2.3 Maintenance & Troubleshooting

2.3.1 In the event that toggling the POWER or HEATER switches ON does not power up the controller or heater, check the fuses (after disconnecting input power) located on the back panel of its main enclosure.

2.3.2 For other maintenance and troubleshooting information Refer to System Schematic (Section 6.0), Replacement parts list (Section 7.0) and/or attached Watlow Manual.

3.0 Principles of operation:

At the heart of the MeiVac VTAC heater power supply and temperature controller is a Proportional–Integral–Derivative (PID) controller. This controller provides adaptive tuning for tighter control and auto-tune for faster start-ups.

A PID controller is a generic control loop feedback mechanism widely used in industrial control systems. A PID controller attempts to correct the difference between a measured Process Variable and a desired Setpoint by calculating and then outputting a corrective action that can adjust the process accordingly and rapidly, to keep the difference minimal.

4.0 Operation

The VTAC utilizes a Watlow Temperature Controller that has been programmed and tested at the factory for use as a setpoint type controller with the SU-200 substrate heater specified in this Manual. The controller will drive the heater at full power until the desired setpoint is achieved. However, certain applications may require slower ramping of the temperature for their process. See Sections 4.3 and 4.4 for the Programmable RAMP function.

4.1 Setting up the controller on start-up: *Reference Watlow EZ-ZONE Panel Figure on the next page*

4.1.1 Apply power to the controller by toggling the POWER switch on the front panel to the ON position.

4.1.2 The temperature controller display will light up.

4.1.3 Press the ADVANCE key 🔄. The lower display should read "C.r7I". The upper display should read "AUTO".

4.1.4 If the upper display does not read "AUTO", then push the UP-DOWN keys 🔼🔽 to change the display from "MANUAL" to "OFF" to "AUTO".

4.1.5 When "AUTO" is displayed, press the INFINITY ∞ key.

4.2 Operating Instructions:

4.2.1 The Controller is now running in the Auto mode.

4.2.2 The upper LED Display is the Heater Temperature.

4.2.3 The lower LED display is the Setpoint Temperature.

4.2.4 Change the Setpoint Temperature using the UP-DOWN keys.

4.2.5 When the desired Setpoint Temperature has been entered, apply power to the heater by toggling the HEATER switch to the ON position.

4.2.6 When the upper display Heater Temperature is equal to the lower display Setpoint Temperature, the controller is in the control mode.

4.2.7 It will remain in that state until you toggle the POWER switch to the OFF position or change the Setpoint.

⚠️ **Caution Max Temp:** The VTAC's Maximum setpoint temperature is programmed at the temperature limit of the MeiVac Substrate Heaters, 950 ºC. Reprogramming to exceed this limit may damage the heater module and void the warranty.

Figure 2. Controller front Panel

Upper Display:
In the Home Page, displays the process value, otherwise displays the value of the parameter in the lower display.

Zone Display:
Indicates the controller zone that the remote user interface (RUI) is currently communicating with.

1 to *9* = zones 1 to 9

A = zone 10   *E* = zone 14
b = zone 11   *F* = zone 15
C = zone 12   *H* = zone 16
d = zone 13

Lower Display:
Indicates the set point or output power value during operation, or the parameter whose value appears in the upper display.

EZ Key:
This key can be programmed to do various tasks, such as starting a profile.
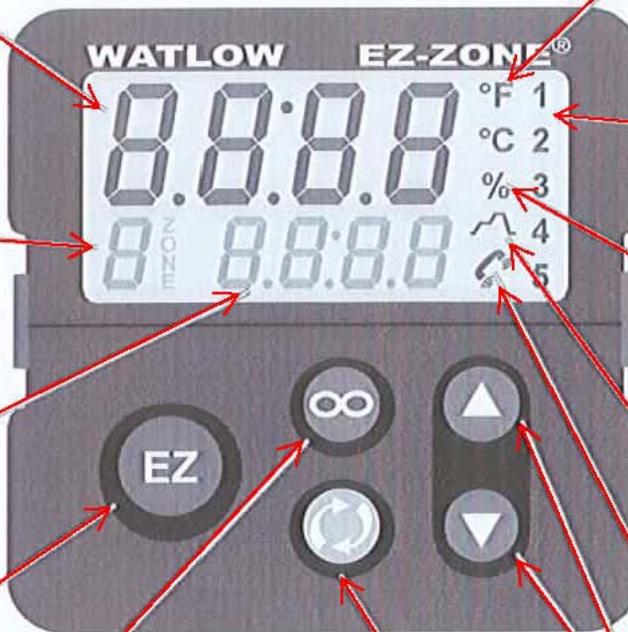
Infinity Key ⊚
Press to back up one level, or press and hold for two seconds to return to the Home Page.

Advance Key ⊛
Advances through parameter prompts.

Temperature Units Indicator Lights:
Indicates whether the temperature is displayed in Fahrenheit or Celsius.

Output Activity:
Number lights indicate activity of outputs 1 through 5. A flashing light indicates retransmit activity.

Percent Units Indicator:
Lights when the controller is displaying values as a percentage or when the open-loop set point is displayed.

Profile Activity:
Lights when a profile is running. Flashes when a profile is paused.

Communications Activity:
Flashes when another device is communicating with this controller.

Up and Down Keys ⦿ ⦾
In the Home Page, adjusts the set point in the lower display. In other pages, changes the upper display to a higher or lower value, or changes a parameter selection.

Safety Feature: If the new Setpoint you input is 30 ºC lower than the Heater temperature, the Sonalert alarm will sound indicating an over-temperature condition. This is a safety feature to alert you that the substrate Heater temperature is significantly higher than the Setpoint temperature. The alarm will turn off automatically when the substrate Heater temperature is less than 30 ºC above the Setpoint temperature. To silence the alarm prior to that, toggle the HEATER switch to the OFF position until the Heater temperature is less than 30 ºC above the new Set-point, then toggle the HEATER switch back to the ON position. The temperature controller will then control to the new Setpoint.

4.3   RAMP Program Programming Optional Ramp Function:

The VTAC model SU-A750 has the ability to be programmed so that the Heater temperature can be ramped to the desired Setpoint temperature over a user defined period of time. This feature could be used if the wafer or substrate might be damaged by a rapid temperature increase. If you need a slower rate of rise for your wafer or substrate, it will be necessary to change the program. The program allows you to control the rate of rise in degrees per minute or hour. When the VTAC model SU-A750 Supply was shipped from our factory, this programming feature was locked out. To use the RAMP mode you will need to unlock the controller and change the program. Below is a step by step method to unlock and re-program the controller for the RAMP feature.

⚠️   ***Warning:*** After you unlock the controller and make changes to the program, you need to relock the controller to maintain security.

Table 2. *Programming the RAMP Function*

With both the POWER and HEATER switches in the OFF position, toggle the POWER switch ON, the temperature controller display will light up. (This is called the Home Page)

Steps	Operation	Function Keys				Display	Step Type Description
		∞	▼	▲	↻	Upper / Lower	
1a	**Press and hold** both keys for **6 seconds**.	∞			↻	Upper LoC	Unlock the controller programming process. (This is covered on the Factory Page, see page 41 in the Watlow Manual.) This is accomplished by pressing both the Advance and Infinity key for six seconds.
1b	**Press** key.			▲		Upper LoC	If "LoC" is not displayed, press the Up arrow key until it is displayed.
2	**Press** key.				↻	SLoC Lower	Press the Advance key until "Sloc" is displayed in the lower display.
3a	**Press** key.			▲		Upper 5	Press the Up arrow key until the upper display reads "5".
3b	**Press and hold** for **5 seconds**.	∞					Press and hold the Infinity key for 5 seconds. This will return you to the Home Page.
4	**Press and hold** both keys for **6 seconds**.		▼	▲		Upper Ai SEt Lower	Press and hold both the Up and the Down arrow keys for 6 seconds. The upper display will read "Ai" and the lower display will read "SEt". This will bring you to the Setup Page (see page 27 in the Watlow Manual).
5	**Press** key.		▼			LooP Lower	Press the Down arrow key until "LooP" is displayed in the lower display.
6a	**Press** key.				↻	rP Lower	Press the Advance key until "rP" is displayed in the lower display.
6b	**Press** key.			▲		Upper Str	Press the Up arrow key until the upper display reads "Str" (Ramp Action Start-up).
7a	**Press** key.				↻	r.SC Lower	Press the Advance key one time and the lower display will read "r.SC". This is where you will select ramp timing in minutes or hours.
7b	**Press** key.			▲		Upper Min	Press the Up arrow key to change the upper display from "Min" to "hoUr".
8a	**Press** key.				↻	r.rT Lower	Press the Advance key one time and the lower display will read "r.rT". This is where you will input the desired Ramp Rate.

Steps	Operation	Function Keys				Display	Step Type Description
		∞	▼	▲	⟳	Upper / Lower	
8b	*Press* either the Up or Down key.		▼	▲		Upper **Rate**	Press the Up arrow or Down arrow key to the desired temperature Ramp Rate shown in the upper display (*Rate* will be a numerical value).
9	*Press and hold* for *5 seconds*.	∞					Press and hold the Infinity key for 5 seconds. This will return you to the Home Page. You have now changed the program in the controller to allow it to ramp to temperature, at a predetermined time, from the start of cycle to the temperature set point.

Re-locking the controller program:

1a	*Press and hold* both keys for *6 seconds*.	∞			⟳	Upper **LoC**	Unlock the controller programming process. (This is covered on the Factory Page, see page 41 in the Watlow Manual.) This is accomplished by pressing both the Advance and Infinity key for six seconds.
1b	*Press* key.			▲		Upper **LoC**	If "LoC" is not displayed, press the Up arrow key until it is displayed.
2	*Press* key.				⟳	**SLoC** Lower	Press the Advance key until "Sloc" is displayed in the lower display.
3a	*Press* key.			▲		Upper **1**	Press the Up arrow key until the upper display reads "1".
3b	*Press and hold* for *5 seconds*.	∞					Press and hold the Infinity key for 5 seconds. This will return you to the Home Page and the controller program is safe and secure.

4.4   Starting a RAMP Cycle from the Home Page

4.4.1   Push the ADVANCE key ⟳ and the lower display will read "Cr71".

4.4.2   Press the DOWN arrow key ▼ until the upper display reads "OFF".

4.4.3   Press the INFINITY key ∞.

4.4.4   Toggle the HEATER switch to the ON position.

4.4.5   Push the ADVANCE key ⟳ and the lower display will read "Cr71".

4.4.6   Press the DOWN arrow key ▼ until the upper display reads "AUTO".

4.4.7   Press the Infinity key ∞ .

4.4.8   This will start the heat cycle and you will see in the top display, flashing "r.rt" and heater temperature. The bottom display will be flashing "Attn" and the temperature set point.

4.4.9 If needed you can set the temperature set point with the UP/DOWN Arrow Keys. The temperature of the heater will ramp per your Rate of Rise setting until it reaches the desired Setpoint. When the heater temperature is equal to the Setpoint temperature, both displays will stop blinking. The controller is now in the control mode. It will remain in that state until you toggle the POWER or HEATER switch to the OFF position or change the setpoint.

4.4.10 When you want to start a new heat cycle, start from 4.4.1.

⚠️ **Caution***:* You must complete the off/auto sequence in-order to reset the ramping feature.

Safety Feature: If the new Setpoint you input is 30 ⁰C lower than the Heater temperature, the Sonalert alarm will sound indicating an over-temperature condition. This is a safety feature to alert you that the substrate Heater temperature is significantly higher than the Setpoint temperature. The alarm will turn off automatically when the substrate Heater temperature is less than 30 ⁰C above the Setpoint temperature. To silence the alarm prior to that, toggle the HEATER switch to the OFF position until the Heater temperature is less than 30 ⁰C above the new Setpoint, then toggle the HEATER switch back to the ON position. The temperature controller will then control to the new Setpoint.

⚠️ **Caution Max Temp:** The VTAC's Maximum setpoint temperature is programmed at the temperature limit of the MeiVac Substrate Heaters, 950 ⁰C. Reprogramming to exceed this limit may damage the heater module and void the warranty.

Returning to the STANDARD function:

Follow these instructions to return to the standard Setpoint operation mode:

Steps	Operation	Function Keys				Display	Step Type Description
		∞	▼	▲	↻	Upper / Lower	
1a	*Press and hold* both keys for *6 seconds* .	∞			↻	Upper **LoC**	Unlock the controller programming process. (This is covered on the Factory Page, see page 41 in the Watlow Manual.) This is accomplished by pressing both the Advance and Infinity key for six seconds.
1b	*Press* key.			▲		Upper **LoC**	If "LoC" is not displayed, press the Up arrow key until it is displayed.
2	*Press* key.				↻	**SLoC** Lower	Press the Advance key until "Sloc" is displayed in the lower display.
3a	*Press* key.			▲		Upper **5**	Press the Up arrow key until the upper display reads "5".
3b	*Press and hold* for *5 seconds* .	∞					Press and hold the Infinity key for 5 seconds. This will return you to the Home Page.
4	*Press and hold* both keys for *6 seconds* .		▼	▲		Upper **Ai** **SEt** Lower	Press and hold both the Up and the Down arrow keys for 6 seconds. The upper display will read "Ai" and the lower display will read "SEt". This will bring you to the Setup Page (see page 27 in the Watlow Manual).
5	*Press* key.		▼			**LooP** Lower	Press the Down arrow key until "LooP" is displayed in the lower display.
6a	*Press* key.				↻	**rP** Lower	Press the Advance key until "rP" is displayed in the lower display.
6b	*Press* key.			▲		Upper **OFF**	Press the Up arrow key until the upper display reads "OFF".
9	*Press and hold* for *5 seconds* .	∞	▼	▲	↻		Press and hold the Infinity key for 5 seconds. This will return you to the Home Page. You have now changed the program in the controller to allow it to ramp to temperature, at a predetermined time, from the start of cycle to the temperature set point.

Re-locking the controller program:

Steps	Operation	Function Keys				Display	Step Type Description
		∞	▼	▲	↻	Upper / Lower	
1a	*Press and hold* both keys for *6 seconds*.	∞			↻	Upper **LoC**	Unlock the controller programming process. (This is covered on the Factory Page, see page 41 in the Watlow Manual.) This is accomplished by pressing both the Advance and Infinity key for six seconds.
1b	*Press* key.			▲		Upper **LoC**	If "LoC" is not displayed, press the Up arrow key until it is displayed.
2	*Press* key.				↻	**SLoC** Lower	Press the Advance key until "Sloc" is displayed in the lower display.
3a	*Press* key.			▲		Upper **1**	Press the Up arrow key until the upper display reads "1".
3b	*Press and hold* for *5 seconds*.	∞					Press and hold the Infinity key for 5 seconds. This will return you to the Home Page and the controller program is safe and secure.

After Re-locking, Refer to Section 4.2 Operation in the user manual for instructions to operate in the Standard Function mode.

4.6 Other Watlow Controller Capabilities

The Watlow Temperature Controller can be programmed to have the VTAC operate in other modes besides Setpoint control and RAMP function. Information on how to program the Watlow Temperature Controller to make use of its other features can be found in the *Watlow, EZ-Zone PM User's Manual, 0600-0058-0000 Rev. C* included with this VTAC equipment. However, any modification or re-programming of the Watlow Controller is done at the User's sole risk. Such modification or reprogramming or use of said VTAC equipment with products other than specified MeiVac SU-200 heaters may damage the VTAC and/or the product it's being used with and void their respective warranties.

5.0 Table 4. Optional Equipment /Accessories:

Part Number	Description
SU-200-HH	2" Sample Substrate Heater
SU-200-IH	2" Wafer Substrate Heater
SU-1018-K	18.0" Hook-up Kit with type "K" TC wire, power leads, and insulating ceramics
SU-925-275	Mounting Stand with power & TC feedthrough on a 2.75" CF Flange
SU-925-450	Mounting Stand with power & TC feedthrough on a 4.5" CF Flange
SU-926-600	Mounting Stand with power & TC feedthrough on a 6.0" CF Flange

Figure 3. Optional Vacuum Power and Thermocouple Feedthrough with Specified Flanges

SU-200 Heater

Ceramic Insulator Beads
Part of 18.0" Hook-up Kit
SU-1018-K

Ceramic Connectors
Part of 18.0" Hook-up Kit
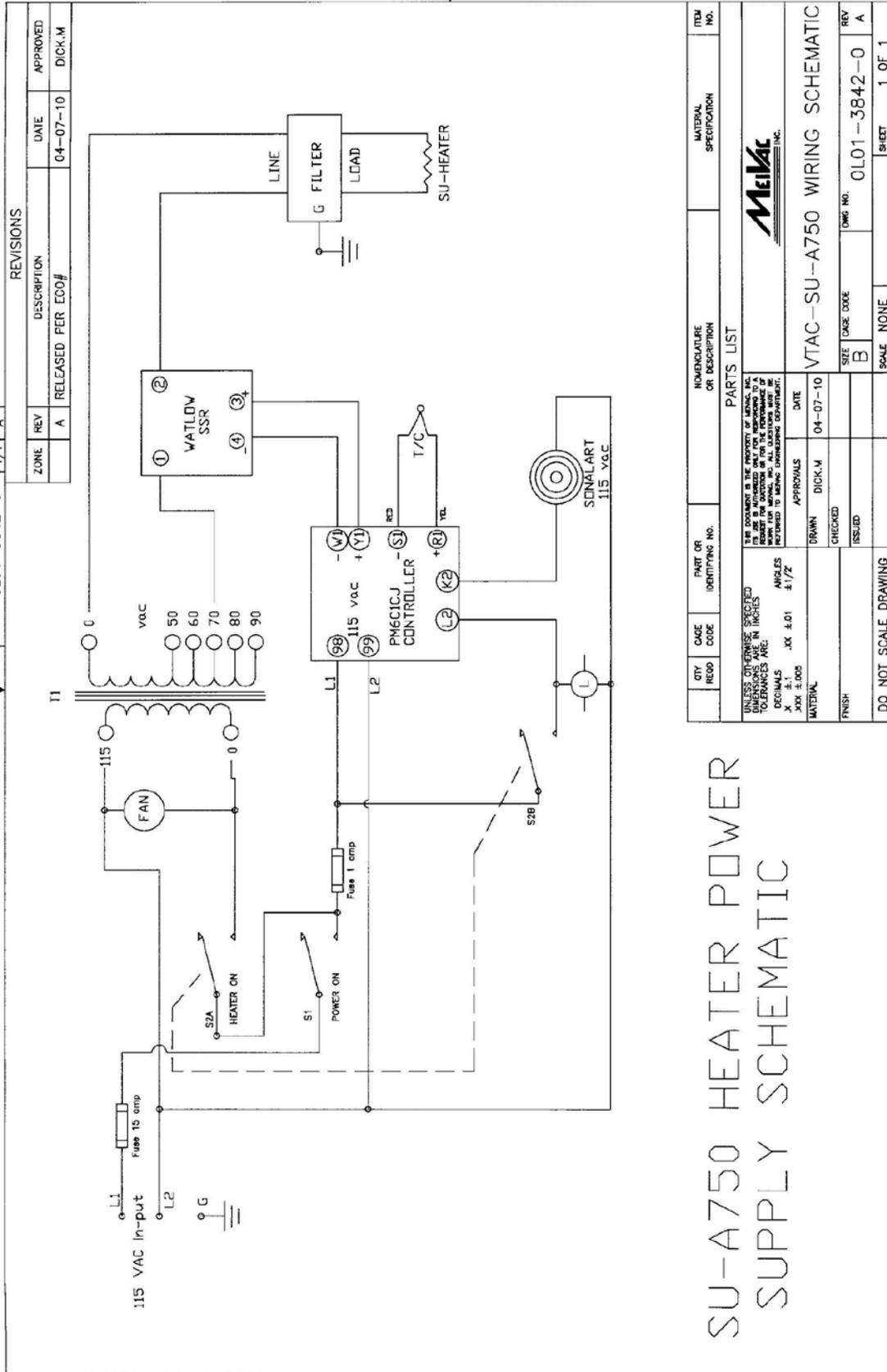SU-1018-K

Thermocouple
Part of 18.0" Hook-up Kit
SU-1018-K

Vacuum, Power and
Thermocouple Feedthrough
Option available with
specified flanges
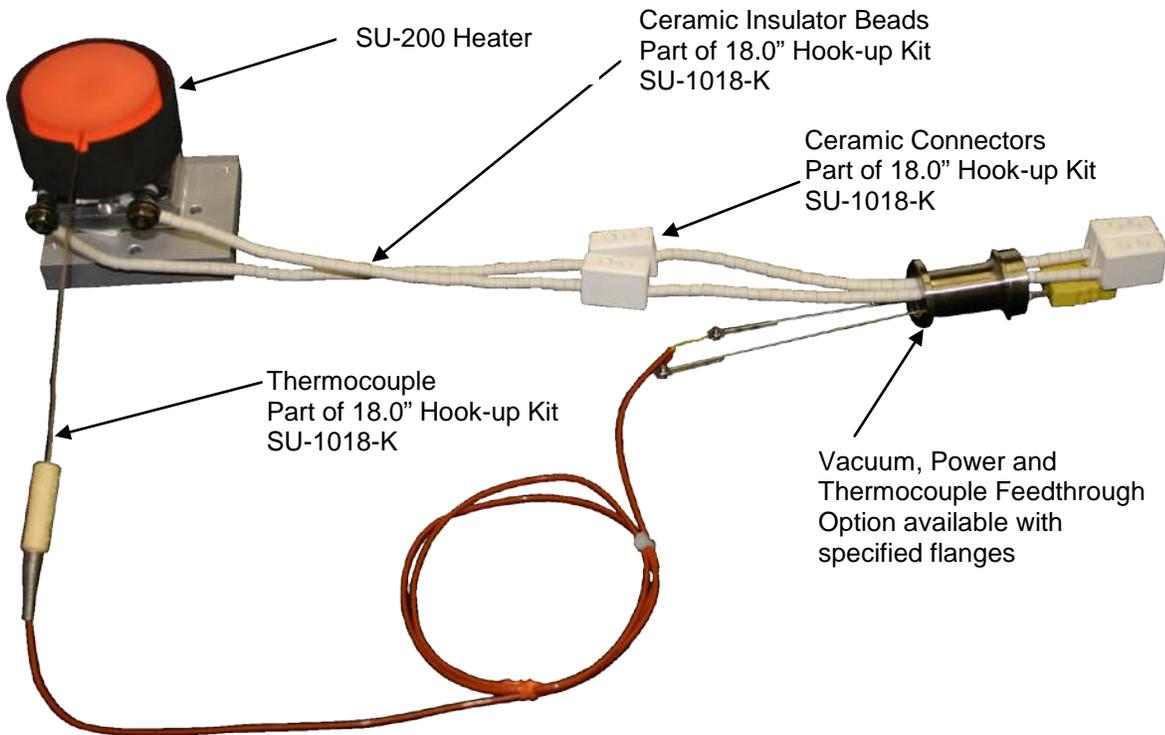
Figure 4. Typical in-vacuum heater assembly with optional Heater, 18" Hook-up Kit, and Vacuum Feedthrough

6.0 Figure 5. System Schematic

NOTES: UNLESS OTHERWISE SPECIFIED

1. DO NOT USE SULPHUR BASED CUTTING FLUIDS FOR MANUFACTURE.
2. BREAK AND DEBURR ALL SHARP EDGES.

220 vac
input power

G

L2 (6)
L1 (1)

Fuse 6 amp
Fuse 6 amp

(6),16
(1),16

S1B
S1A

POWER SW.

(2),16
(6),16

Fuse 1 amp
(2),16

(0),20
(6),20
S2B

(2),16
115 V
220 V
(6),20
(0),16

0
T1

(6),20
115 vac

(0),20
L2
L1

tap vac
90
80
70
60
50
0

L3
(99)
(98)
115 vac

PN6C1CJ
CONTROLLER

(K2)
(-R)
(S1)
(Y1)
(M)

T/C

(3),14
S2A
HEATER SW.

WATLOV
SSR
(4)
(1)
(3)
(2)

(3),14
(3),14
(0),20
(2),20

FAN

SONALART
115 vac

(4),20
(0),20

L
(4),20

(0),20

SU-200-HH

RF
FILTER
LINE
LOAD
G

7.0 Table 5. Replacement Parts List

MeiVac Pt. #	Description	Specification	Supplier	Supplier Pt. #
6056-0001-0	Fuse	1 Amp 3 AG	Little Fuse	312001
6056-6250-0	Fuse (2)	6 Amp	Little Fuse	03266.25HXP
6160-5100-0	Lamp	Red Neon 115 VAC	CML Innovative Tech.	1050C1

8.0 Factory Service,

For factory service and support, contact MeiVac by telephone at +1.408.362.1000 or by e-mail at Support@meivac.com

In the event that the product needs to be returned to the factory, contact MeiVac to request a Return Material Authorization (RMA). Package properly for return shipment to MeiVac, reusing original factory packaging if possible.