4000 Series 150W
High Stability Temperature Controller

User Manual

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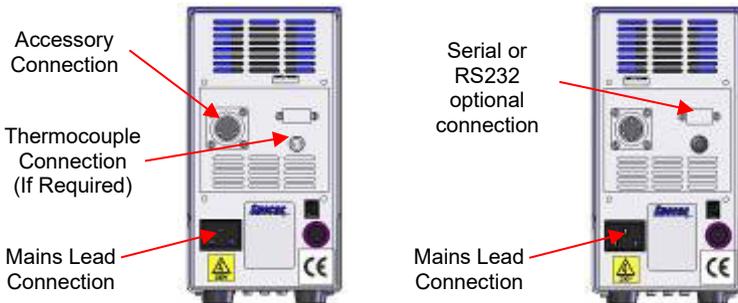
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Table of Contents

QuickStart Guide

1. On front panel check the power switch is in the off position.

Power Switch Off

2. Make all necessary connections from Accessory/Thermocouple and plug in the mains cord at the rear panel of the Controller.

Accessory Connection

Thermocouple Connection (If Required)

Mains Lead Connection

Serial or RS232 optional connection

Mains Lead Connection

3. Turn power on at the mains socket before switching on the controller. Switch on the controller (the green tab upper part of the rocker will be visible).
Wait for startup messages to clear and the temperature values shown on the controller display

Power Switch On

4. Set required temperature in lower display using up/down buttons. When up/down buttons are released, after a short time the temperature begins to rise in the upper display (actual temperature).

Actual Temp
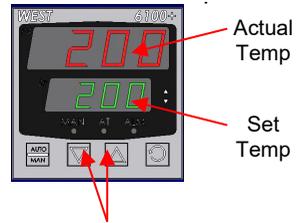
Set Temp

Up/Down Buttons

5. Wait until the temperature is steady (stabilizes) before making any measurements. (The actual temperature and set temperature are the same).

Actual Temp
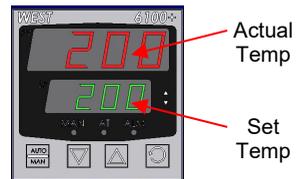
Set Temp

6. Before shutdown, return lower display temperature (set temp) to ambient e.g. 20ºC to prevent accidental heating on next power- up. (Use down button).

Set Temp
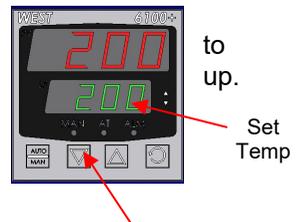
Down Button

7. To shut down, press power switch to off. Allow accessory to cool if necessary and disconnect from controller. Remove mains lead. Store carefully.

Power Switch Off

1. Introduction

Thank you for purchasing a Specac product.

The Specac 4000 Series comprises a range of high stability temperature controllers for use with Specac accessories that incorporate an electrical heating element. A communications interface hardware port (if option is fitted) permits control via a PC, when used in conjunction with suitable software.

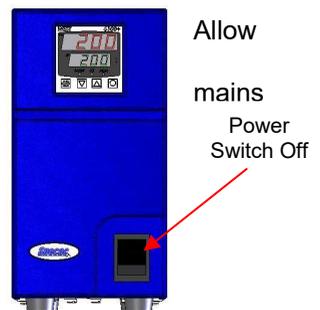Different accessories from Specac have different power and heating requirements. Each 4000 Series controller is assembled and configured to match the specific requirements of the accessory it is intended to operate.

The name of the accessory is shown on the front panel of the controller as shown below.

Important! *Do not use the 4000 Series temperature controller with an accessory having a different part number to that indicated.*

Name of Specac Accessory intended to be controlled is placed on the front panel here

2. Safety Considerations

List of Safety Symbols

Safety Symbol	Meaning
⚠️	**Caution** (Reference ISO 7000-0434B, 2004-01)
♨️	**Caution – Hot Surface** (Reference IEC 60417-5041, 2002-10)
⚡	**Caution – Possibility of Electric Shock**
🏠	**Indoor Use Only**

General Safety

It is important to read any associated safety information before use of any Specac accessory and/or the 4000 Series temperature controller.

⚠️ **Caution!** This user instruction manual should be read in conjunction with the manual provided with the intended Specac accessory for which this controller was supplied.

🏠 **Caution!** For indoors use only. Do not subject to dripping or splashing. Not for use in wet locations.

Electrical Safety

Caution! If the inlet fuse requires replacement, replace only with the correct fuse type as indicated on the rating label of the controller and in section 3 Specification of this user manual.

Whenever it is likely that the safety protection has been impaired the controller shall be made inoperative and be secured against unintended operation. The protection is likely to be impaired if for example the controller:

- Shows visible damage.
- Fails to perform the intended measurements.
- Has been subjected to prolonged storage under unfavourable conditions.
- Has been subjected to severe transport stresses.

Warning: This equipment is intended to be connected to an earthed mains socket outlet. Protection provided by this equipment will be impaired if the earth connection is not present.

Warning: Only use the mains cord set supplied with the controller. If an alternative cord set is required, replace it only with an equivalent type of the same rating which is acceptable for use in the country for which the controller is to be used.

Warning: Do not operate the appliance with a broken cord or plug, or if the appliance malfunctions, or is dropped or damage in anyway.

Warning: Do not use this equipment with any accessory it has not been specifically configured to operate. Contact Specac Technical Support or our sales team for further information regarding the compatibility of the controller with other devices and 3rd party accessories.

Warning: Do not position the equipment so that it is difficult to access the disconnecting device (Mains plug and/or appliance coupler) when in use. Only use a main outlet socket that is accessible during operation.

Warning: No user serviceable parts within. Contact Specac and/or your local Specac authorised agent for all service and repair requirements.

Warning: Disconnect the device from the mains supply before cleaning. Only clean with a soft, lightly dampened cloth. Do not use harsh and/or abrasive cleaners on any Specac product. Consult Specac or their authorized agent if in any doubt.

Warning: If this equipment is used in a manner not specified within this manual the protection provided by the equipment may be impaired.

Warning: Do not block or cover the ventilation holes on the rear, and sides of the controller. It is recommended to have at least 100mm spacing around the sides and rear of the product form other objects or electrical equipment and to be placed on a stable, flat surface.

Warning: Never allow liquid or solid objects to fall into the ventilation openings. If any liquid or solid object falls inside the temperature controller, unplug the temperature controller immediately and have it checked by Specac before operating it further. Never push objects of any kind into the temperature controller through the ventilation openings as they may come in contact with dangerous voltage points or short-out parts that could result in a fire or electric shock.

End of Lifetime Equipment Use

If or when the 4000 Series temperature controller and any associated accessory that is powered by the controller have reached their limit of lifetime and need to be replaced, use appropriate WEEE and other local regulations for the safe disposal of electrical equipment and toxic chemicals.

3. Specifications

The 4000 Series temperature controller is designed for connection to an AC supply rated 110/230 VAC 50/60 Hz, depending on intended country of use.

Dimensions: 410(d) x 110(w) x 214(h) mm.
Weight: 4.5 kg.

Rated working voltage input: 230V 50Hz (UK & EU)
        110V 60Hz (USA)
        100V 50/60Hz (Japan)
        220V 60Hz (Korea)
        220V 50Hz (China)

Maximum working voltage tolerances: +/-10%
Fuse rating: T1.6AH 250V – 220/230V models
        T3.15AH 250V – 100/110V models
Protection Class: Class I (Earthed)
Insulation Category: CAT II
Over Voltage Category: II

Rated output voltage: 27 VDC max
Rated output current: 5.6A (150W)
Controller temperature range: -196 to +250°C
Temperature set steps: 1°C
Temperature stability: ±1°C

Rated operating & Storage Temperatures.
Normal: 5 to 40°C (0% to 80% relative humidity and noncondensing)
Storage: -20 to 55°C (0% to 95% relative humidity and noncondensing)

Altitude: Up to 2000m
Pollution degree: 2

4. Unpacking and Checklist

On receipt of your 4000 Series temperature controllers please check that the following have been supplied.

- 4000 Series temperature controllers.
- Appropriate mains power lead for country and voltage.
- USB memory stick that has user instruction manuals for the temperature controller and associated accessory.
- RS232, USB or RS485 Communications connectivity where fitted (Optional: P/N's GS28000, GS28001 or GS28002).

Unpack the controller and check that the input voltage on the silver appliance label (**1**) at the rear of the controller is compatible with your mains voltage.

Different types of this controller covering different temperature ranges and operating parameters are supplied to suit specific Specac products. At the end of this user instruction manual (page 28) please see diagrams of the two rear panel types for the 4000 Series controller showing the position of the appliance labels. One panel has a six-way connection plug with a separate thermocouple connection and the other panel has a six-way connection plug and the separate thermocouple connection is blanked. It would be useful at this stage to note the appliance label information from your specific controller on page 29 of this manual.

The 4000 Series temperature controller is supplied without a thermocouple. All Specac accessories are supplied with their own appropriate screened thermocouple for operation and connection to the 4000 Series temperature controller.

5. Operation

Set up and operation of the 4000 Series temperature controller with its appropriate Specac accessory as supplied are as follows.
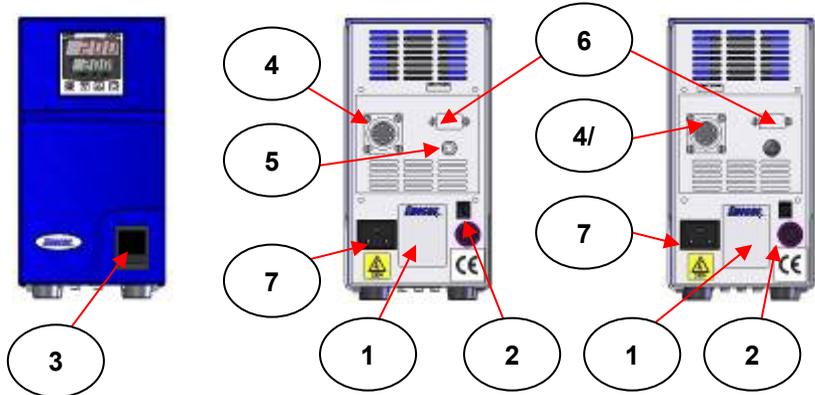
Fig 1. Front and Rear Views of the 4000 Series Temperature Controller

Note: *As a general guide ensure that all cable connections or disconnections are made with the controller switched **off**. When switching off allow at least 10 seconds to pass before switching the controller back on again.*

5.1 Check that the rocker power switch (**3**) on the front of the controller is off. The switch is "off" when the green coloured tab top end is pressed level with the surface of the front panel and the green colour cannot be seen.

5.2 Make all necessary connections from the accessory to the rear panel of the temperature controller. Connections will include power to the accessory (**4**) and input from a thermocouple (**5**). Connection to the port (**6**) for communication control (if fitted) can also be made if automatic operation by software control is required.

5.3 Connect the mains lead to the controller (**7**) and switch power on at the mains.

5.4   The controller should be situated on a flat surface which allows for good ventilation in operation. Turn the controller on by the rocker power switch (**3**) at the front of the controller by pressing the lower half of the switch. The top end of the switch (**3**) shows a green colour when in the "on" position.

5.5   When power is supplied to the 4000 Series temperature controller and the accessory is also connected, the controller undergoes a self-test routine. The routine follows the procedure below as indicated on the digital display of the temperature controller (see **Fig 2**).
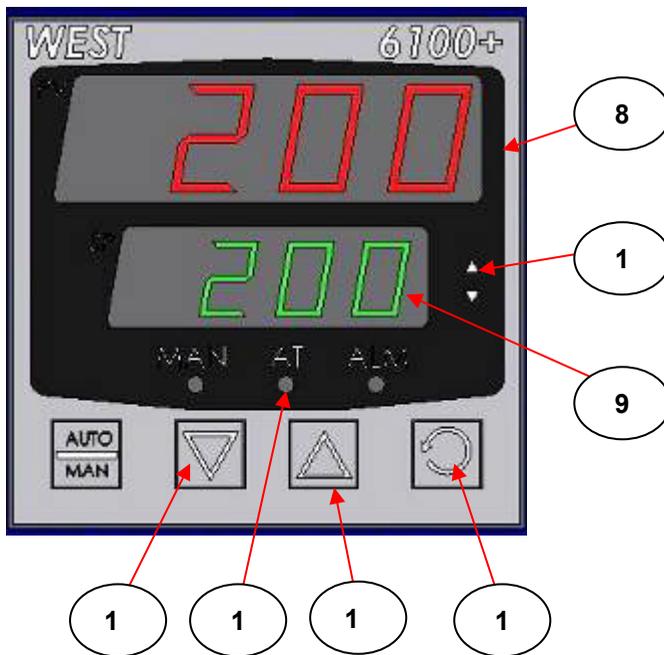
Fig 2. Temperature Controller Digital Display

a)   8888 is shown in red in the upper digital display (**8**) for a few seconds.

b)   All display segments are then illuminated. 8888 is shown in both the upper display (**8**) in red colour and lower display (**9**) in green colour. The MAN, AT and ALM buttons illuminate red as do the up and down arrow indicators.

c)   The lights stay illuminated for approximately 5 seconds before the controller changes to display the **actual** temperature in the upper display (**8**) in red and the **set** temperature in the lower display (**9**) in green. The temperature units are in degrees Centigrade.

d)   If the set temperature value in the lower display (**9**) is **greater than** the actual temperature in the upper display, the up arrow (**10**) light is illuminated in red. This indicates that power is being supplied by the controller to the heater of the accessory. Controlled power will be applied to the accessory until the last set temperature is reached. If the set temperature is **less than** or equal to the actual temperature displayed, the up-arrow light (**10**) will not be illuminated.

The self-test routine is now complete.

Note: *If the sequence for the start-up does not follow the steps a) to d) and the display indicates an OPEN message displayed in red in the upper display (**8**), check that the cable connection(s) to the rear of the controller is/are correct. An OPEN message indicates that there is a problem with the thermocouple. It may be broken or is not making appropriate contact through its connection. Depending on the type of controller and accessory the thermocouple is included as part of the 6-way plug connection (**4** and **5**) or as a separate plug in at the connection port (**5**).*

The up (**11**) and down (**12**) arrow touch buttons may be used to increase or decrease the set temperature. Use these buttons accordingly to set the temperature required. Note that the longer the button is depressed, the faster the temperature will change. Wait until the set (**9**) and actual (**8**) temperatures register the same value on both displays before performing any experimental measurements.

Important!

It is highly recommended that the set temperature (lower display) (**9**) is reduced to ambient temperature, e.g. 20°C after using the controller before the power is switched off (**6**). This will avoid immediate, unwanted accidental heating of the accessory when powering on again for the start of any experiments, as the last set temperature is maintained in the memory of the power controller when mains power is removed.

Ramp Rate Notes

The Ramp Rate Parameter (rP)

The rate of heating is dependent upon a set ramp rate (rP), specifically for the accessory that is being controlled. The value for rP set on the controller unit is shown when the "cycle" button (**13**) is pressed twice from the temperature display mode.

The rP parameter is shown in the lower display (**9**) in green and its value is shown in the upper display (**8**) in red. The units are displayed in degrees Centigrade per hour e.g. 600 degrees/hour. This represents a typical rate rise of 10 degrees/min.

If you wish to change the ramp rate rP, whilst the parameter value is displayed, use the up (**11**) or down (**12**) arrow buttons. (e.g. for a 5 degrees/min rate rise set the rP parameter to indicate 300.)

If you do not wish to adjust the ramp rate rP parameter, push the cycle button (**13**) once to return to the temperature display. If no action is taken within 2 minutes the controller will automatically default back to display of the set and actual temperature indicators.

The Setpoint Ramp Rate Parameter (SPrP)

Before accessing the ramp rate rP parameter, when the cycle button (**13**) is pressed once, the set point ramp rate SPrP function will be displayed. This is *a non-changeable controller parameter* and is the rate at which the actual temperature value will move towards the set temperature value when the set temperature value is adjusted or changed. With ramping in use, the initial value of the SPrP parameter at

power up will be equal to the current process variable value. The actual SPrP parameter value will rise/fall for the ramp rate (rP) value set until it reaches the target SPrP value. SPrP ramping is used to protect the process from rapid changes at the actual display temperature.

The display code is rP.

Settings on Your 4000 Series Controller

The 4000 Series temperature controller will be supplied with appropriate operating parameter settings specific for the control of the dedicated accessory.

If your accessory has for example a maximum temperature operation of 250°C, the factory set parameters on the controller (SetP function – see Section 6) will allow for the most efficient operation at this maximum value. If you wish to operate the accessory for most of the time at an alternative temperature to the maximum, then certain parameters may need adjusting. This is achieved via the Pre-Tune function (see Section 7).

Essentially, when using the ramp rate (rP) facility to alter the rate of heat that is applied to the accessory, the performance cannot be exceeded to heat an accessory faster than when at a maximum ramp rate (rP) setting.

6. Parameter Settings

The 4000 Series temperature controller is factory set for its control functions (parameters) that relate specifically to an appropriate accessory. (The actual parameter values that are set relating to a specific accessory are found within the accessories own user instruction manual).

Using a tuning function (see Tuning in Section 6), can alter the performance of an accessory over a specific temperature range. However, certain operating parameters will be changed from their factory settings. To change the parameters back to their factory settings after Tuning, they are accessed through the SEtP function.

Warning! *Manually changing a parameter from its factory setting outside of a Tuning Function (Pre-Tune or Self-Tune), will alter the performance and workings of the accessory. The accessory **may be seriously compromised** from any manual changes to the parameter settings causing overheating to the accessory and its parts. When manually inputting a value for an accessible parameter it will **always** be the factory set value, except if wishing to experiment with proportional, integral and derivative parameter values outside of a tuning function.*

Parameter Listing

The parameters that have been factory set on the 4000 Series temperature controller are accessible using the SetP function. Only a few of the 21 parameters that are listed may be affected by the Pre-Tune function (see Section 6 on Pre-Tuning), but **all** the parameters and their descriptions are listed for reference purposes.

To enter the SEtP mode and gain access to the parameter list hold down the cycle button (**13**) and press the up (**11**) arrow button. OPtr in red and SLCt in green are displayed. Press the up (**11**) arrow button once to access the SEtP function. SEtP in red and SLCt in green are displayed.

Press the cycle (**13**) button once. 0 (zero) in red and ULoc in green is displayed. An unlock code needs to be entered to gain access to the parameter list. Using the up (**11**) arrow button select the value 10, which will be displayed in red.

When the unlock code value has been input, press the cycle (**13**) button in succession to scroll through each displayable parameter. To change the value of a specific parameter, use the up (**11**) arrow or down (**12**) arrow buttons. The current value remains fixed when you scroll onto the next parameter in the list via the cycle (**13**) button.

If you wish to exit the SEtP function and parameter list at any stage hold down the cycle (**13**) button and press the up (**11**) arrow button once. SEtP in red and SLCt in green are displayed.

To return to the temperature display continue to push the up (**11**) arrow button four times. The display will scroll through ConF, inFo, Atun to reach OPtr in red and SLCt in green. Press the cycle (**13**) button once to show the temperature display.

Alternatively, if no selections (button pushes) are made for up to two minutes, the controller will automatically default to the temperature display.

Note: *The last input value of a parameter would be accepted if the controller was left to stand for two minutes with no further operation and then automatically defaulting to the temperature display.*

Displayable Parameters

The table on the following page is a list of the 21 control parameters that can be accessed through the SetP function. The parameter is shown how it appears on the lower display of the controller, its name and a brief description for its function. A corresponding list of the parameters with their actual factory set values are found within the separate user instruction manual for the appropriate accessory.

Lower Display	Parameter Name	Parameter Function Description
FiLt	Input Filter Time Constant	This is used to filter out extraneous impulses on the process variable.
OFFS	Process Variable Offset	This is the variable to be measured by the primary input (the thermocouple) of the accessory being controlled.
PPL⌐	Primary (Heat) Output Power	This is the power level of the primary outputs supply.
Pb_P	Primary Output Proportional Band	This is the portion of the input span over which the Primary (Heat) Output Power level is proportional to the process variable value.
ArSt	Automatic Reset (Integral Time Constant)	This is used to automatically bias the proportional output(s) to compensate for process load variations.
rAtE	Rate (Derivative Time Constant)	This specifies how the control action responds to the rate of change in the process variable.
biAS	Manual Reset (Bias)	This is expressed as a percentage of output power to help reduce any overshoot at the set temperature value.
SPuL	Setpoint Upper Limit	This is the maximum limit for setpoint adjustment.
SPLL	Setpoint Lower Limit	This is the minimum limit for setpoint adjustment.
OPuL	Primary (Heat) Output Upper Power Limit	This is used to limit the power level of the primary output and may be used to protect the process being controlled.
Ct l	Output 1 Cycle Time	This is for time proportioning outputs and is used to define the time period over which the average on vs. off time is equal to the required PID output level.
PhAl	Process High Alarm	This defines the process variable value above which an Alarm will be active.
AHyl	Alarm 1 Hysteresis	This is the percentage range of the alarm band that the process variable must pass through before the alarm will change state.
PLA2	Process Low Alarm	This defines the process variable value below which an Alarm will be active.
AHy2	Alarm 2 Hysteresis	This is the percentage range of the alarm band that the process variable must pass through before the alarm will change state.
APt	Auto Pre-Tune enable/disable	When enabled this allows for automatic functioning of the Pre Tune facility on power up of the controller.
PoEn	Manual Control select enable/disable	This determines whether operator selection of manual control is enabled or disabled.
SPr	Setpoint Ramping enable/disable	When enabled, a Setpoint Ramp Rate can be set which limits the rate at which the actual setpoint temperature value can move towards the target (actual) temperature value.
rP	Setpoint Ramp Rate Value	The rate at which the setpoint temperature value will move towards the target (actual) temperature value if Setpoint Ramping is enabled.
SP	SP Value	This is the target temperature value at which the controller will attempt to maintain by adjsutments to the power output level.
SLoc	Set-up Lock Code	Code for gaining access to the set up parameter listing.

7. Tuning Facility

What is Tuning?

In tuning you match the characteristics of the 4000 Series temperature controller to that of the specific accessory to establish good control. Good control means:

- Stable 'straight line' control of the temperature at Setpoint without fluctuation.

- Acceptable overshoot or undershoot of the temperature setpoint.

- Quick response to deviations from the setpoint caused by external disturbances, thereby restoring the temperature rapidly to the setpoint value.

Tuning involves a self-calculation by the WEST 6100+ controller unit in the setting of the various Proportional, Integral and Derivative (PID) parameters for operation. (See SetP parameter listing in Section 5.)

Note: *You should take measurements **only when the actual temperature is stabilized with the set temperature***.

The 4000 Series temperature controllers have two types of tuning function – Pre-Tune (Ptun) and Self-Tune (Stun).

Pre-Tuning (Ptun)

Automatic tuning of the operating parameters (SetP) is achieved by using the Pre-Tune (Ptun) facility.

The 4000 Series temperature controller will be supplied initially with factory set parameter values for the SetP list, for a specific accessory suitable for its broadest, maximum temperature operating range. If the accessory is to be operated for a specific temperature range, whereby the maximum temperature to use is lower than the achievable maximum, the controller parameter values for SetP can be changed to

best match this operating temperature by invoking the Ptun procedure. After Pre-Tuning, the factory PID parameter settings will be changed. If you need to restore them, use the parameter values found in the specific accessory user instruction manual.

Note 1: *Before the Ptun procedure can be used, the ramp rate (rP), parameter value **must** be switched to off. (Set blank). This is achieved by pressing the cycle button (**13**) twice to access the (rP) value and then hold the up (**11**) arrow button until the upper display (**8**) progresses towards the value 9999 and then turns blank.*

Pre-Tuning is to be carried out at a specified set temperature. For the tuning to be effective the **actual** temperature of the accessory at the time of tuning must be at least 5% lower (or higher) in value than the **set** temperature value for tuning. (e.g. to tune at 100°C temperature, set the tuning set point (SP) to 100, but the accessory must be less than 95°C.)

Note 2: *When tuning for higher temperatures (e.g. at 700°C for the HTHP Cell Accessory P/N GS05850), ensure that the accessory is operating reasonably close in temperature value to the tuning temperature, but is still at least 5% lower in value. (e.g. to tune at 700°C, set the tuning set point (SP) to 700, but the accessory must be at about 650°C.)*

To change the tuning set point (SP) temperature, whilst in the routine to switch off the ramp rate (rP) value (see **Note 1:** above on this page) and when the upper display (**8**) is blank, press the cycle button (**13**) once. The actual temperature will be displayed in red in the upper indicator (**8**) and the set temperature in green in the lower indicator (**9**).

AT THIS STAGE, CHANGE THE SET TEMPERATURE TO THE VALUE FOR TUNING USING THE UP (**11**) OR DOWN (**12**) ARROW BUTTONS.

To Switch On Pre-Tune (Ptun)

Hold down the cycle button (**13**) and then press the up (**11**) arrow button once. OPtr in red and SLCt in green are displayed. Press the up (**11**) arrow button four times to reach the Atun function which will be displayed in red in the upper indicator (**8**).

Note: *To reach the Atun function, successive presses of the up (11) arrow button will have displayed SetP, ConF and inFo in red in the upper indicator (8), whilst SLCt remains in green in the lower display indicator (9).*

Whilst the upper display is showing Atun, press the cycle button (**13**) once. An unlocking code Uloc is displayed in green in the lower indicator. Use the up (**11**) arrow button to select the value 40 to gain access to the Ptun function.

Press the cycle button (**13**) once and Ptun is displayed in green in the lower indicator (**9**). OFF in red will be displayed in the upper indicator (**8**). Press the up (**11**) arrow button once to switch Ptun to ON.

Once Pre-Tuning has begun the AT indicator light (**14**) will begin to flash. If you wish to observe the changes being made whilst the Ptun function is operating, hold down the cycle button (**13**) and then press the up (**11**) arrow button once. The Ptun menu is exited and Atun in red and SLCt in green are displayed.

Press the up (**11**) arrow button once and OPtr in red and SLCt in green are displayed. Finally, press the cycle button (**13**) once to bring the controller back to the set and actual temperature display modes.

When the controller has been successfully Pre-Tuned, the AT indicator light (**14**) will stop flashing and remain switched off.

Resetting of Ramp Rate (rP)

A value for the ramp rate function (rP) can now be re-selected after the Ptun procedure has been completed.

Press the cycle button (**13**) once. The ramp rate parameter rP only will be displayed in green. By use of the down (**12**) arrow select a value for the ramp rate. This will start from blank and then a value of 9999, but the maximum value that could be selected will be found from the parameter for (rP) from the specific accessory user instruction manual. (See Ramp Rate Notes – Section 4, page 11.) If a lower rP value than the factory setting is required, this would be allowed.

Self-Tuning (Stun)

The Self-Tune (Stun) function is for setting a more accurate fixed temperature without fluctuation about a specific **set** temperature point. To use the Stun function the accessory MUST be heated to the **actual** temperature of operation and allowed to stabilize at this **set** temperature. The ramp rate rP parameter does not have to be set to off for the Stun function to operate.

To Switch On Self-Tune (Stun)

To select the Stun function, hold down the cycle button (**13**) and then press the up (**11**) arrow button once. OPtr in red and SLCt in green are displayed. Press the up (**11**) arrow button four times to reach the Atun function which will be displayed in red in the upper indicator (**8**).

Note: *To reach the Atun function, successive presses of the up (11) arrow button will have displayed SetP, ConF and inFo in red in the upper indicator (8), whilst SLCt remains in green in the lower display indicator (9).*

Whilst the upper display is showing Atun, press the cycle button (**13**) once. An unlocking code Uloc is displayed in green in the lower indicator. Use the up (**11**) arrow button to select the value 40 to gain access to the Stun function.

Press the cycle button (**13**) twice. From the first press Ptun is displayed in green in the lower indicator (**9**). On the second press Stun is displayed in green in the lower indicator (**9**). OFF in red will be displayed in the upper indicator (**8**). Push the up (**11**) arrow button once to switch Stun to ON.

Once Self-Tuning has begun the AT indicator light (**14**) will be switched on and stays illuminated. The Stun procedure is constantly monitoring the **actual** temperature conditions with respect to the **set** temperature. To switch off the Stun function, when Stun is displayed in green in the lower indicator (**9**) and ON is displayed in red, press the down arrow button (**12**) once to switch OFF the Stun function.

To return to the temperature display, hold down the cycle button (**13**) and then press the up (**11**) arrow button once. The Self-Tune menu is exited and Atun in red and SLCt in green are displayed.

Press the up (**11**) arrow button once and OPtr in red and SLCt in green are displayed. Finally, press the cycle button (**13**) once to bring the controller back to the set and actual temperature display modes.

Manual Changing of PID Parameter Values

The Ptun and Stun functions when switched on will enable the WEST 6100+ controller unit to automatically adjust the value of certain parameters that have been factory set on the SetP listing.

If you wish to set a specific parameter value (manual setting) outside of any tuning function for the individual proportional (P), integral (I) and derivative (D) values then this can be done by accessing the parameter listing as described on page 13.

Principally, the parameters to adjust that affect the power delivery to any heaters and their overall stability for fine temperature control are:

(P) Pb-P – Primary Output Proportional Band

This is a temperature band expressed in % of a full scale or the degrees of temperature within which the controller's action takes place. The wider the proportional band (higher value) the greater the area around the setpoint temperature in which the proportional (**P**) action occurs.

(I) ArSt – Automatic Reset Integral Time Constant

Integral control, also known as reset, is a function which adjusts the (**P**) proportional bandwidth with respect to the setpoint to compensate for offset (droop) from the setpoint. Essentially, it is a function to adjust the controlled temperature to the setpoint after the system reaches stability.

(D) rAtE – Rate Derivative Time Constant

Derivative control, also known as rate, senses the rate of rise or fall of the system temperature and automatically adjusts the (**P**) proportional bandwidth to minimize overshoot or undershoot about the setpoint temperature.

If you wish to alter these PID parameter values manually, as stated in the **Warning** on page 13, *you must be careful that the values you enter do not affect the performance of the accessory whereby damage could occur to the unit.*

Note: *Specac recommends that the above PID parameters are changed and used for control of an accessory with the setpoint ramp rate value parameter rP set to **OFF.***

With practice and experience for different sample types and a temperature range to study using a specific accessory, these general PID parameters and their settings may need to be adjusted to suit for control accordingly. As an example, for use of a Low Temperature Golden Gate top plate (P/N GS10590) with a suitable refrigerant over a temperature range from -30°C to +20°C and changing the temperature in 5° steps, a stable mode of control for operation was achieved with the following P, I and D parameters set manually.
(P) parameter Pb-P set to 10.0.
(I) parameter ArSt set to 4.0.
(D) parameter rAtE set to 0.04.
For these conditions of controller operation, the parameter OpuL (heater power) was also set to 35. (35% power).

8. Automatic Control of the 4000 Series Temperature Controller by Computer

The 4000 Series temperature controller can be factory fitted with serial communications that allows a personal computer, running appropriate software, to read and write data to the WEST 6100+ controller.

If you have ordered your 4000 Series temperature controllers with RS232, RS485 or USB connectivity, it will already be fitted. Please note if the USB connectivity option (P/N GS28001) has been ordered, a CD for the software driver to use should be provided with the controller and parts. If this CD is not supplied, then the information can be downloaded from the following website page:

http://www.mev.co.uk/pages/Support/Downloads.html

The communications protocol is: MODBUS or ASCII

Note: *The communications protocol supplied by Specac is MODBUS. Please contact your local WEST representative for change to ASCII.*

The parameter addresses for the key parameters are given in the table below.

Parameter Name	Parameter Address (MODBUS)	Parameter Address (ASCII)	Read/Write (R/W)
Temperature	1	M	R
Setpoint	2	S	R/W
Output	3	W	R/W
Proportional Band	6	P	R/W
Integral Time	8	I	R/W
Derivative Time	9	D	R/W

Software for WEST 6100+ Controlling Units

Specac uses the WEST 6100+ controlling unit in the 4000 Series temperature controllers for powering appropriate heatable accessories.

http://www.west-cs.com/products/models/6100-single-loop-controller/

The software available from WEST enables the internal control or display parameters to be modified; these do not normally need to be adjusted by the user and should not be done without consultation with Specac.

This WEST software **does not** allow the user to set, for example, the temperature from a computer, as can be set by the physical buttons on the control unit.

At the time of writing, the above link also offers a page where the WEST software and instructions can be downloaded at no charge.

Additional Control

If a user wishes to modify temperature settings automatically from computer (PC/Laptop, etc.) control having an RS232, RS485 or USB communications option port fitted to the 4000 Series controller, additional controlling software can be obtained from ISC Inc.; this is an independent company to WEST or Specac. This software also has other features such as temperature logging and must be purchased.

http://iseinc.com/

At the time of writing, a trial version can be downloaded from:

http://instrumentation-central.com/Pages/commander_supervisory_software.htm

Only Use:

Commander Supervisory Software for communication, data logging and graphing of your process; Version 4.2.20.

Important Notes

1. A table of original display parameters set on the WEST 6100+ controlling unit used with the Specac 4000 Series controller for powering of the specific Specac accessory is supplied in the appropriate Specac user instruction manual for the accessory.

2. The software from either WEST or ISC is manufactured and supplied by them; any questions or requests for help and assistance must be directed to the respective company.

3. The software from either WEST or ISC may not integrate with other software such as the spectrometer/spectra acquisition software.

9. Identification of Your 4000 Series Controller

Different accessories from Specac have different power and heating requirements. Each 4000 Series controller is assembled and configured to match the specific requirements of the accessory with which it is to be used.

There are two configurations of the rear panel, but each has a Specac appliance label (**1**). This label includes the serial number of your 4000 Series temperature controllers. The specific type of 4000 Series controller is identified on its rear panel by the part number of the accessory it is designed to control. The name of the accessory is shown on the front panel of the controller.

Please make a note of the numbers on the appliance label (**1**) of your controller on the blank label on page 29. This information will be useful should you need to contact Specac about your controller.

Important! *On no account should the 4000 Series temperature controller be used with an accessory having a different part number to that shown on the rear panel of the controller.*
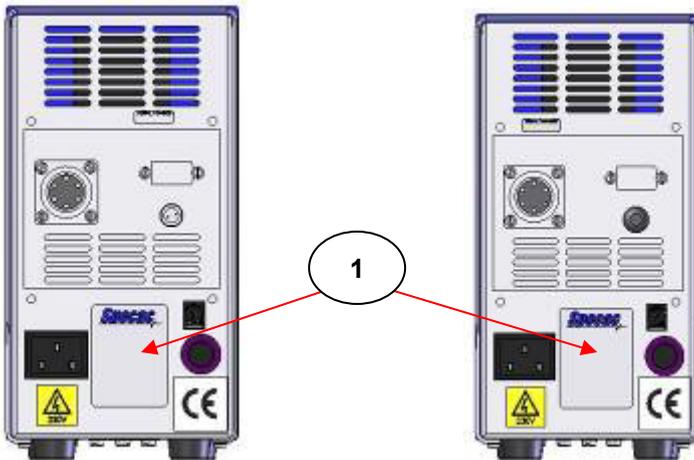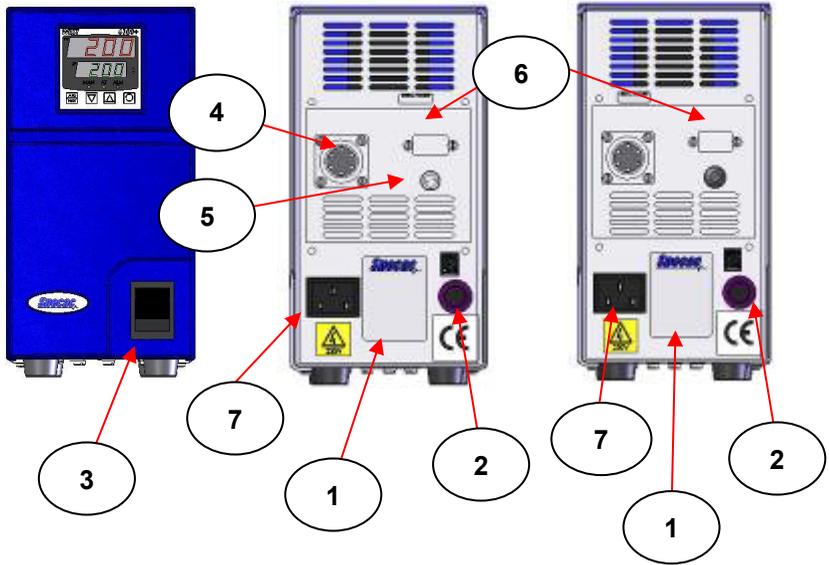
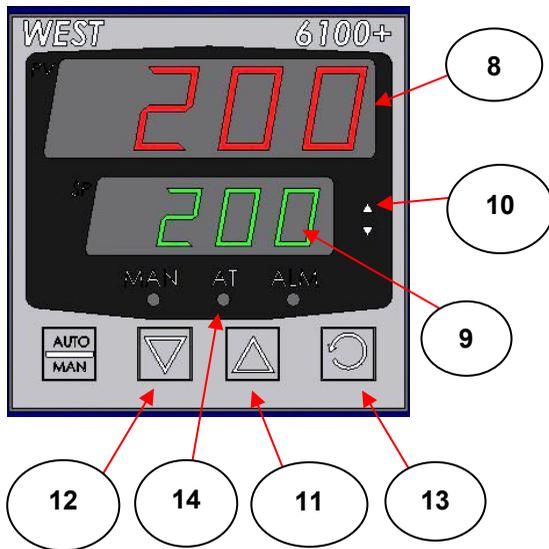# Specac

Part No

Serial No

Voltage

Max Power

Fuse Rating

KENT ENGLAND

10. Bubble Number Features

11. Bubble Number Legend

(**1**) Appliance Label
(**2**) Fuse for appliance
(**3**) Power switch
(**4**) Accessory connection
(**5**) Thermocouple connection
(**6**) Automatic control computer port connection
(**7**) Mains lead connection
(**8**) Upper digital (actual temperature) display
(**9**) Lower digital (set temperature) display
(**10**) Up arrow light (heating indicator)
(**11**) Up arrow button
(**12**) Down arrow button
(**13**) Cycle button
(**14**) AT indicator light

Notes for Use of 4000 Series Controller

Analysis Advancing Life™

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