WEST 3100
COMPACT THREE-TERM CONTROLLER
Installation & Operating Instructions

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Please disregard all phone numbers and addresses in this manual. The phone numbers and address on this page are the correct phone number and addresses to use for sales, repair, and application support.

CAUTION: REFER TO MANUAL

THE INTERNATIONAL HAZARD SYMBOL IS INSCRIBED ADJACENT TO THE REAR CONNECTION TERMINALS. IT IS IMPORTANT TO READ THE MANUAL BEFORE INSTALLING OR COMMISSIONING THE UNIT.

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WEST 3100 COMPACT THREE-TERM CONTROLLER INSTALLATION AND OPERATING INSTRUCTIONS

IM-0014-D0

NOTE

Our policy is one of continued improvement and, consequently, the information contained in this publication may differ in some respects from the instrument in question. Therefore, this document does not constitute an offer or part of an offer for sale.

CONTENTS

SECTION 5 - RANGE CHANGING AND RECONFIGURING

SECTION 1 - INTRODUCTION

The WEST 3100 is a compact PID controller, which retains man the features incorporated into other instruments in the West microprocessor based controller range. A specially designed multi-colour liquid crystal display combines a clear and comprehensive display with very low power consumption.

The case conforms to 1/8 DIN measurements, and controllers can be conveniently mounted side by side in multiple installations. Power consumption is only about 3W, so that minimum ventilation is required.

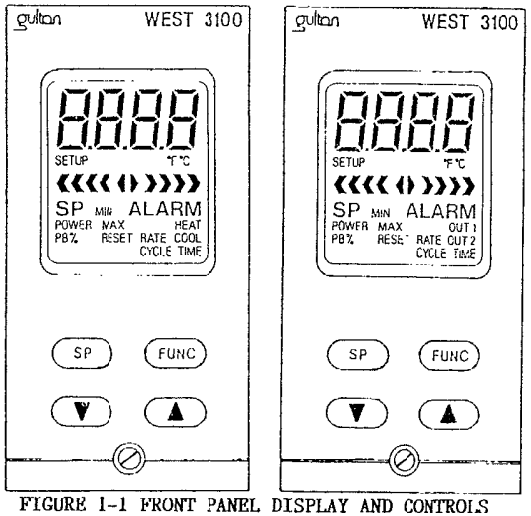


FIGURE 1-1 FRONT PANEL DISPLAY AND CONTROLS

The controller operates in two modes, User Mode and Setup M In User mode the operator can only adjust set-point value a monitor the outputs. In Set-up Mode all control parameters reviewed and adjusted.

1.1 DISPLAYS

Numeric — Four digits, with decimal points; negative numbers up to -1999. Normally displays the of the process variable. Set-point and oth control parameter values are displayed aft selection by means of the front panel pushbuttons.

Bar Graph

A nine segment bar graph shows deviation of the process variable (PV) from the set-point (SP) It shows green in the centre when the PV is the same as the SP; it shows an increasing number of blue segments as the PV goes below the SP, and an increasing number of red segments as the PV goes above the SP.

1.2 LEGENDS

SP	This section of the display is activated when the set-point value is being shown on the numeric display.
ALARM	This flashes when the Process Variable has reached the alarm level, which can be set for a deviation limit or an absolute level.
SETUP	This display indicates Setup Mode, which allows the control parameters to be examined and adjusted.
OUT 1 or HEAT	This is displayed when Output 1 is on.
OUT 2 or COOL	This is displayed when Output 2 is on.
CONTROL PARAMETER LEGENDS	When a control parameter is selected for examination/adjustment, the appropriate legend is displayed and the value of the parameter is shown on the numeric display.

1.3 PUSHBUTTON CONTROLS

SP	Pressing this button changes the display between Process Variable and Set-point
FUNC	Operating this pushbutton causes the control parameters to be selected and displayed in sequence. The selected parameter can be adjusted by means of the RAISE and LOWER buttons
▼	When the LOWER button is pressed momentarily the value of the displayed parameter will be reduced by one unit. If the button is held in for more than a second the value is reduced continuously.
▲	The RAISE button operates in the same way as the LOWER button, but increases the value.

The FUNC, RAISE and LOWER buttons, when used in the correct sequence, cause the controller to change between User Mode and Setup Mode.

SECTION 2 - INSTALLATION

2.1 UNPACKING THE 3100

The 3100 is supplied with a mounting clamp and two screws included in the transit package.

If the Remote Front Panel Option (X74, X75, or X79) has been ordered the package should also include the Remote front panel and the connecting cable with terminating plugs. The length of the cable depends on the order code:-

0.5m long (Product Code ... X79)
2m long (Product Code ... X74)
5m long (Product Code ... X75)

Remove the equipment from the transit package and check for damage. Notify the carrier immediately in case of any damage or deficiences. Check that the Product Code matches your order code and requirements (supply voltage, input type etc)

2.2 MOUNTING THE STANDARD CONTROLLER

2.2.1 Cut-out Dimensions

The instrument can be mounted on a rigid panel of up to 6mm (.25 inches) thickness with a cut-out 92mm, +0.8 -0mm (3.62in, +0.03 -0in) high and 45mm, +0.6 -0mm (1.77in, +0.025 -0in) wide. Units can be mounted side by side in a continuous cut-out, and in this case the width of the cut-out should be (n x 48mm) - 4mm [(n x 1.89in) - 0.16in], where n is the number of instruments.

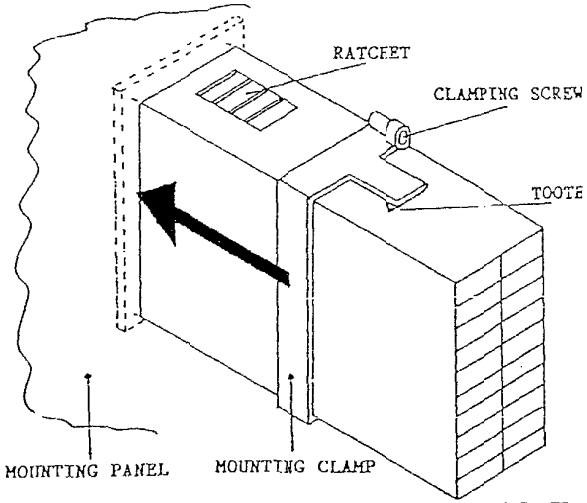


FIGURE 2-1 ATTACHMENT OF HOUSING TO MOUNTING PANEL

The instrument is 150mm (5.9in) deep, measured from the rear face of the front panel. The front panel is 96mm (3.8in) high and 48mm (1.89in) wide; when mounted on a panel it projects 6mm (0.25in).

2.2.2 Attaching Controller Housing to Mounting Panel

Insert the rear of the housing (or housing with instrument in it) through the cut-out and hold the instrument lightly against the front panel.

The instrument is held in place by a plastic mounting clamp. Slide this onto the instrument and push it forwards until it touches the mounting panel. Teeth on the arms projecting to the rear of the clamp engage with ratchets moulded into the top and bottom of the case. Next gently tighten the screws in the clamp so that the front panel of the instrument is a snug fit on the front of the mounting panel. **Do not over-tighten the screws and distort the clamp.**

2.3 MOUNTING THE CONTROLLER WITH REMOTE FRONT PANEL

2.3.1 Remote Front Panel

The Remote Front Panel can be mounted on a rigid panel in the same way as a standard instrument.

The Remote Front Panel is 28mm (1.1in) deep, measured from the rear face of the front panel. The front panel is 96mm (3.8in) high and 48mm (1.89in) wide; when mounted on a panel it projects 6mm (0.25in).

To mount the Remote Front Panel first remove the Mounting Clamp by undoing the screw which attaches it. Next insert the remote front panel into the cut-out, then fasten the mounting clamp to retain it against the mounting panel.

2.3.2 Controller

The Controller can be mounted on a rigid front panel in the same way as a standard controller, or it may be mounted on the Chassis Mounting Bracket (Option X76).

First fix the bracket to the chassis or panel with suitable screws or bolts (max thread diameter 4mm). Note that the controller may be mounted upright or on its side. When mounted on its side the right hand side should be at the bottom.

Insert the controller housing through the aperture in the bracket and attach it by means of the mounting clamp as described above for a rigid mounting panel.

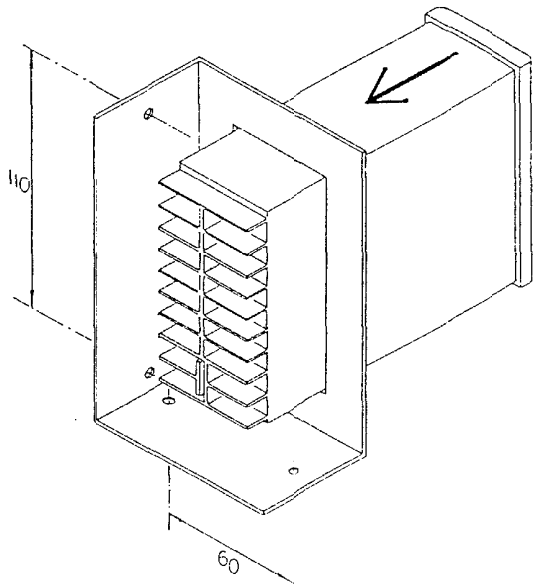


FIGURE 2-3 CHASSIS MOUNTING BRACKET

2.3.3 Connecting Controller and Remote Front Panel by the Cable

Plug in the two ends of the cable to the IDC sockets on the Remote Front Panel and the Controller, with the square plastic pip or the cable plugs mating with the slot on the socket. Squeeze together the plastic retainers.

DO NOT RUN THE CONNECTING CABLE IN CLOSE PROXIMITY WITH POWER CARRYING CABLES.

2.4 REMOVAL OF INSTRUMENT FROM HOUSING (See Figure 2-4)

For replacement or servicing the instrument can be easily removed from the housing, leaving the housing and back-wiring attached to the mounting panel.

> WARNING
> **The mains (line) supply must be disconnected from the instrument before attempting to remove it from its housing.**

CAUTION: THIS INSTRUMENT CONTAINS STATIC SENSITIVE DEVICES AND A LITHIUM BATTERY. PRECAUTIONS SHOULD BE TAKEN, DURING HANDLING, TO MINIMISE THE RISK OF STATIC DAMAGE OR BATTERY SHORT CIRCUIT. IF BATTERY REPLACEMENT IS REQUIRED, THIS MUST BE CARRIED OUT BY A TRAINED TECHNICIAN.

With a suitable size screwdriver turn the screw near the base of the front panel anti-clockwise. This will first jack out the instrument and disengage the conrector at the rear; then the screw will disengage itself from the bush in the housing. Carefully pull the instrument out from the housing.

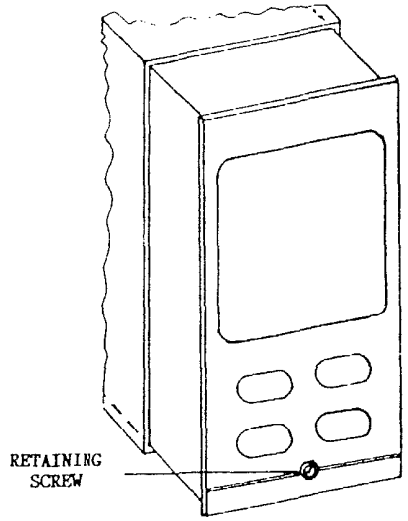


FIGURE 2-4 REMOVAL AND REPLACEMENT OF 3100 WITHIN HOUSING

2.5 INSERTING INSTRUMENT INTO HOUSING

Carefully slide the the instrument into the housing previously mounted on the mounting panel or bracket; **make sure that the circuit board(s) locate against the outside of the card guides moulded in the top and bottom of the housing.** Push the instrument firmly home so that the rear connections of the circuit boards make a good connection with the rear terminals.

Engage the screw near the base of the front panel and tighten it until the instrument is firmly in place.

2.6 REMOVAL OF HOUSING FROM MOUNTING PANEL

Loosen the clamping screws (shown in figure 2-1). Support the housing with one hand and remove the plastic mounting clamp by disengaging the teeth from the ratchets and sliding the mounting clamp rearwards. (Inserting stiff card or plastic between the teeth and the ratchets helps.) Remove the housing from the mounting panel by pulling the housing forwards through the mounting hole.

2.7 CONNECTIONS AND WIRING

> **CAUTION**
> **This equipment is designed for installation in an enclosure which provides adequate protection against electric shock. Local requirements regarding electrical installation should be rigidly observed. Ground terminals must be separately connected and not made common to the neutral. Consideration should be given to the prevention of unauthorised personnel gaining access to the power terminations.**

The following inputs and outputs are provided on the rear of the instrument housing. (Depending on configuration, some of the connections may not be present).

a) Mains (Line) Input
b) Thermocouple or RTD Input
c) Output 1 (Heat) - Relay or SSR
d) Output 2 (Cool) - Relay or SSR
e) Alarm Output

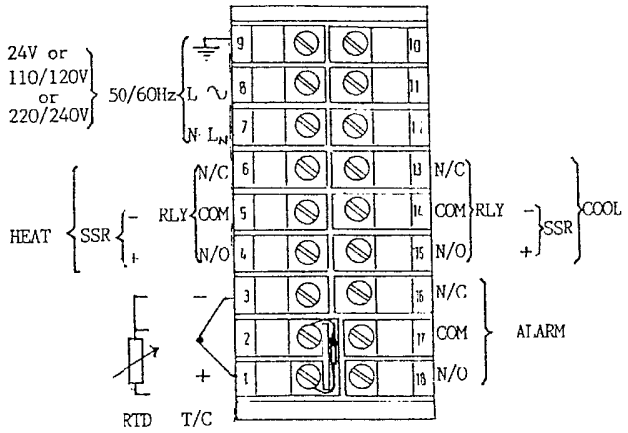


FIGURE 2-5 3100 REAR CONNECTIONS

2.7.1 Mains (Line) Input

The instrument is supplied for operation on 24V, 193V - 264V or 100V - 132V 50/60Hz as stated on the label attached to the side of the instrument. **Check voltage before applying power.**

Local requirements regarding electrical installation should be rigidly observed. Ground terminals must be separately connected and not made common to the neutral. Consideration should be given to the prevention of unauthorised personnel gaining access to power terminations.

The ground terminal 9 should be connected to a protective ground conductor before any other connections are made, and should remain connected at all times.Power should be connected via a two pole switch and a 1A fuse (5A for 24V operation), as shown in Figure 2-6

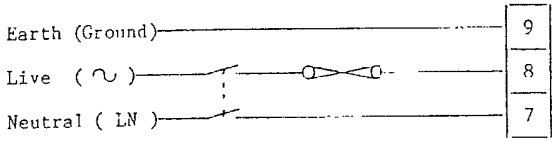


FIGURE 2-6 POWER CONNECTIONS

2.7.2 Input

Thermocouple

Thermocouple connections are made as shown in Figure 2-7

An open circuit thermocouple will cause [ ] to be displayed and output power to go to either 0% or 100% as defined by the configuration and the Product Code. Thermocouple leads should be connected to terminal 1 (positive) and terminal 3 (negative). The correct type of thermocouple extension leadwire or compensating cable must be used for the entire distance between the instrument and the thermocouple, ensuring that the correct polarity is observed throughout. Joints in the cable should be avoided if possible. All instruments supplied with a thermocouple input have a cold junction compensation unit connected across terminals 1 & 2. This unit should never be removed.

DO NOT RUN THERMOCOUPLE LEADS ADJACENT TO POWER CARRYING CONDUCTORS. IF THE WIRING IS RUN IN A CONDUIT, USE A SEPARATE CONDUIT FOR THE THERMOCOUPLE WIRING. IF THE THERMOCOUPLE IS GROUNDED, THIS MUST BE DONE AT ONE POINT ONLY. IF THE THERMOCOUPLE EXTENSION LEAD IS SHIELDED, THE SHIELD MUST BE GROUNDED AT ONE POINT ONLY.

THERMOCOUPLE TYPE	CABLE MATERIAL	BRITISH BS	AMERICAN ASTM	GERMAN DIN	FRENCH NFE
T	Copper Constantan	+white -blue blue	+blue -red blue	+red -brown brown	+yellow -blue blue
J	Iron/Constantan	+yellow -blue black	+white -red black	+red -blue blue	+yellow -black black
K	Nickel Chromium Nickel Aluminium	+brown -blue red	+yellow -red yellow	+red -green green	+yellow -purple yellow
R S	13% Copper 10% Copper Nickel	+white -blue green	+black -red green	+red -white white	+yellow -green green

TABLE 2-1 THERMOCOUPLE LEADWIRE COLOUR CODES
(last colour in each group refers to the overall sheath).

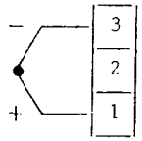


FIGURE 2-7 THERMOCOUPLE INPUT CONNECTIONS

GULTON manufactures and supplies a range of suitable thermocouples and thermocouple extension cables.

2.7.2 Input (contd)

Resistance Temperature Detector

RTD connections are made as shown in Figure 2.8, with the compensating lead connected to terminal 3. For 2-wire RTDs terminals 2 and 3 should be linked.

The extension leads should be of copper and the resistance of the wires connecting the resistance element should not exceed 5 Ohms per lead. (The leads should be of equal length.)

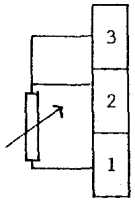


FIGURE 2.8 3-WIRE RESISTANCE THERMOMETER INPUT CONNECTIONS

2.7.3 Output 1 (Heat)

NOTE: Product Codes H10 and H50.. have Output 1 reverse acting i.e. the relay is energised when the process variable is below the setpoint, and de-energised when is it above. If Output 1 is direct acting the Product Code H10 or H50 has a suffix ..31.

Relay (Product Code H10..)

The output relay has contacts connected to the rear terminals. The contacts are rated at 5A 240V a.c. with a resistive load. When the relay is energised the front panel displays OUT 1.

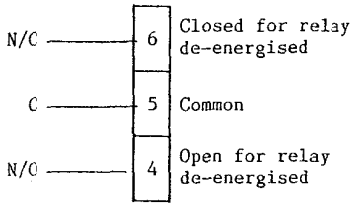


FIGURE 2.9 OUTPUT 1 RELAY CONNECTIONS

2.7.3 Output 1 (Heat) (contd)

SSR Drive (Product Code H50..)

Instruments with this output produce a time proportioned non-isolated D.C. signal, 0V/12V nominal, output impedance 1kΩ. This is suitable for driving the WEST 2200 Series Thyristor Units or other solid state relays with an isolated input.

When the output is ON the display shows OUT 1.

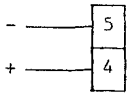


FIGURE 2-10 OUTPUT 1 SSR DRIVE CONNECTIONS

2.7.4 Output 2 (Cool)(optional)

NOTE: This output is always the opposite of Output 1; if Output 1 is reverse acting, Output 2 is direct acting, i.e. the relay is energised if the Process Variable is above the OUT 2 Value.

Relay (Product Code C10..)

The output relay has SPDT contacts connected to the rear terminals. The contacts are rated at 2A 240V a.c. with a resistive load. When the relay is energised the front panel displays OUT 2.

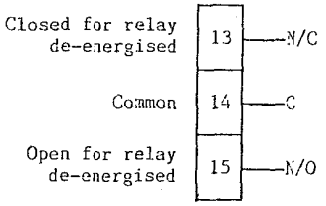


FIGURE 2-11 OUTPUT 2 RELAY CONNECTIONS

2.7.4 Output 2 (Cool)(optional) (contd)

SSR Drive (Product Code C50..)

Instruments with this output produce a time proportioned non-isolated D.C. signal, 0V/12V nominal, output impedance 1kΩ. This is suitable for driving the WEST 2200 Series Thyristor Units or other solid state relays with an isolated input.

When the output is ON the display shows OUT 2.

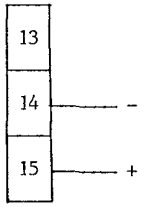


FIGURE 2.12 OUTPUT 2 SSR DRIVE CONNECTIONS

2.7.5 Alarm Output (optional) (Product Codes C—46 to C—51)

The relay connections are shown in Figure 2.13

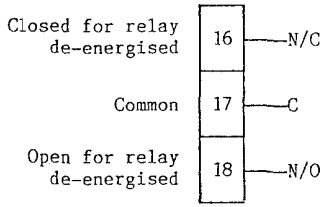


FIGURE 2.13 ALARM CONNECTIONS

Section 4.9 gives details of alarm operation. The above connections apply to all alarm configurations.

2.8 INDUCTIVE LOADS, EXTERNAL CONTACTORS AND MAINS OPERATED RELAYS AS LOADS

W A R N I N G

Operating the instrument with inductive loads and without the appropriate protection components may give rise to a hazard due to high voltage transients which may occur during the switching cycles.

REMOVAL OF THE INSTRUMENT'S INTERNAL SNUBBER COMPONENTS COULD GIVE RISE TO A SERIOUS HAZARD. GULTON LIMITED AND MARK IV INDUSTRIES INC. DO NOT ACCEPT RESPONSIBILITY FOR ANY DAMAGE WHICH MAY OCCUR AS A RESULT OF THE UNAUTHORISED REMOVAL OF THESE COMPONENTS.

2.8.1 GENERAL

The standard relay contacts fitted are suitable for a.c. supplies of 24V to 240V. The Output 1 relay is rated at up to 5A with a resistive load and up to 1A with an inductive load. The Output 2 and Alarm relays, if fitted, are rated at at up to 2A with a resistive load and 1A with an inductive load.

The 3100 instruments contain Voltage Dependent Resistors (VDRs) across all relay contacts. These protect the instrument for all loads up to the maximum rating. No external protection components are necessary unless an external switch or contact is fitted in series with the instrument relay contacts.

2.8.2 External Switch in Series with an External Inductive Load

Damage to the instrument may result if the contacts of a switch, relay or contactor are connected externally in series with the instrument relay contacts as shown in Figure 2.14.

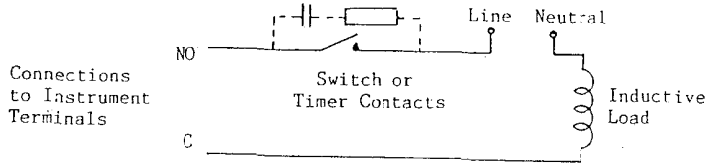


FIGURE 2.14
EXTERNAL SWITCH IN SERIES WITH AN EXTERNAL INDUCTIVE LOAD

Under these conditions the external contacts may operate while the instrument relay contacts are closed (i.e. the internal protection components short circuited and therefore ineffective).

In applications where it is necessary to fit external switch, relay or contactor contacts in series with the instrument relay, a suitable VDR or a snubber network must be fitted either across the inductive load or across the unprotected contacts. The values given in Table 2-2 may be used for applications up to 240V r.m.s.

LOAD CURRENT	VALUE OF C µF	WEST PART NO.	VALUE OF R ohms	WEST PART NO.
70mA	0.047	22206	22	23220-304
150mA	0.1	22207	47	23470-304
0.5A	0.22	22208	47	23470-304
1A	0.47	22209	47	23470-304

NOTE: ALL CAPACITORS SHOULD CONFORM TO VDE (CLASS X) AND BE SUITABLE FOR OPERATION AT 260V A.C

ALL RESISTORS (WIREWOUND OR ALLEN BRADLEY TYPE HB) SHOULD HAVE A MINIMUM RATING OF 2 WATTS

TABLE 2-2 VALUES OF PROTECTION NETWORK COMPONENTS

SECTION 3 - OPERATING INSTRUCTIONS

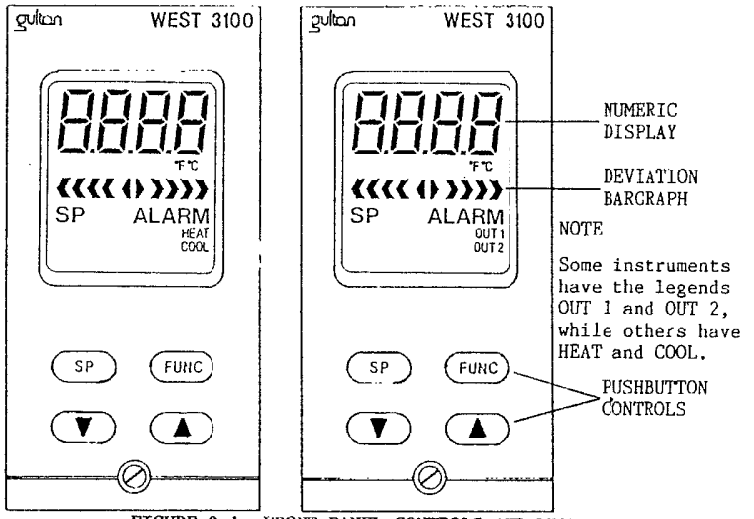


FIGURE 3-1 FRONT PANEL CONTROLS AND DISPLAYS

3.1 Displays (User Mode)

Numeric Display: This indicates numerical information relating to the function selected. Where the value is a temperature °C or °F will also be displayed.

Bargraph Display: BLUE / GREEN / RED — Both green chevrons displayed indicates that PV is within 1% of SP. Each blue or red chevron indicates a deviation of 1% high (red) or 1% low (blue).

3.2 Front Panel Legends (User Mode)

OUT 1 or HEAT: This indicates when the Output 1 relay is energised or the SSR drive is on.

OUT 2 or COOL: (Optional) This indicates when the Output 2 relay is energised or the SSR drive is on.

ALARM: (Optional) This display flashes to indicate an alarm condition. (See Section 4.9 for details of alarm operation)

3.3 Self Test Procedure

When power is applied to the controller it first carries out a self test procedure which displays all the segments of the numeric display and bargraph, and displays the legends for all the outputs and control parameters.

3.4 Controller Function

On completion of the self-test routine the 3100 starts operating in User Mode, with the numeric display showing the value of the Process Variable. When delivered, the controller has all its parameters set to default values, and these should be adjusted to the correct values for the application, as described in Section 4, Setting Up. Once they have been set, the values are stored in a memory with battery back-up which retains them for several years.

For normal operation, the 3100 will function in User Mode, operating with the parameters previously set. In this mode the operator can adjust only the set-point. To review and adjust other control parameters see Section 4, Setting Up Procedures.

3.5 Set-point Adjustment

Display: SP

To adjust the set-point press the SP pushbutton. The front panel will show SP flashing and the numeric value of the current set-point. Next press RAISE (▲) or LOWER (▼). When one of these buttons is pressed momentarily the set-point value is changed by one unit in the least significant digit. If a button is held in for more than a second, the least significant digit of the set-point value will change at a rate of 25 units per second. If a button is held in for more than 10 seconds the 2nd lsd will change at a rate of 25 units per second.

To get the numeric display back to showing the process variable, press the SP button again. In user mode, the FUNC button has the same effect as the SP button.

3.6 Default Parameter Indication

If the controller is operating with the default parameters this is indicated by the numeric display showing all the decimal points. See Section 4 for details of setting up control parameters.

SECTION 4 SETTING UP PROCEDURES

4.1 CONTROLS AND DISPLAYS

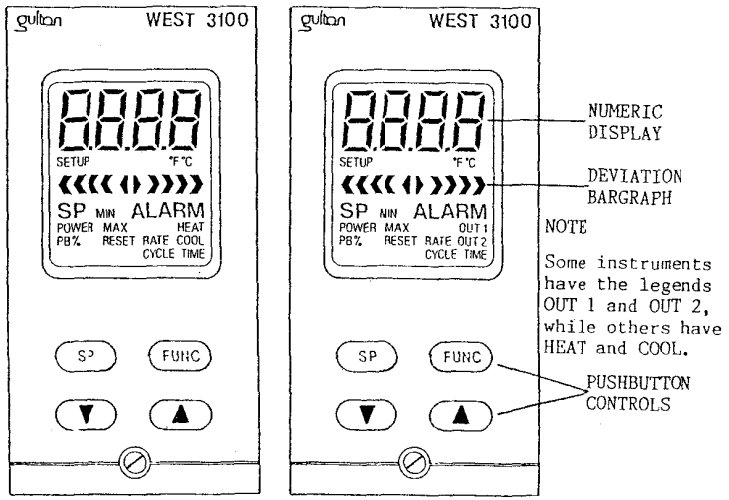


FIGURE 4-1 INSTRUMENT FRONT PANEL

4.1.1 Displays

Numeric Display: This indicates numerical information relating to the function selected. Where the value is a temperature °C or °F will also be displayed.

Bargraph Display: BLUE / GREEN / RED. Both green chevrons displayed indicates that PV is within 1% of SP. Each blue or red chevron indicates a deviation of 1% high (red) or 1% low (blue).

Legends: OUT 1, OUT 2 and ALARM are used as output indicators in User Mode (see Section 4.5) and as parameter labels in Setup Mode.
SETUP shows that the controller is in Setup Mode.
SP, POWER, PB%, RESET, RATE, CYCLE, TIME, MAX are used singly and in combination as parameter labels.

4.1.2 Control Pushbuttons

RAISE (▲) — Used to increase the value of the selected parameter. Also used, in conjunction with other buttons, to change between User Mode and Setup Mode.

LOWER (▼) — Used to decrease the value of the selected parameter. Also used, in conjunction with other buttons, to change between User Mode and Setup Mode.

(SP) — Selects Set-point for display and adjustment if numeric display is showing anything other than SP. If SP is being displayed, returns the display to showing process variable.

(FUNC) — Selects parameters in sequence for display and adjustment. Also used, in conjunction with other buttons, to change between User Mode and Setup Mode.

4.2 TO PUT THE CONTROLLER INTO SET-UP MODE

4.2.1 With Process Variable being displayed press RAISE and LOWER simultaneously and hold them in until the SETUP legend on display starts to flash (5 seconds).

4.2.2 Within the next 3 seconds press FUNC and hold it in until SETUP is displayed continuously (two seconds). The controller is now in Setup Mode.

4.2.3 To return the controller to User Mode select the Process Variable display (using the FUNC or SP buttons), and follow the same procedure as in 4.2.1 and 4.2.2. SETUP will now go off.

4.2.4 If the sequence in incorrectly carried out, the controller will revert to the mode it was in before the attempt.

4.2.5 When the controller is is Setup Mode, it will automatically revert to User Mode if a minute elapses and no control button has been pushed.

NOTE: The instrument continues to function as a controller when it is in Setup Mode.

4.3 TO DISPLAY A PARAMETER

4.3.1 Set-point

Press either SP or FUNC button.
Display will show SP legend and numeric display will show current value of Set-point.

When SP is being displayed, if the SP button is pressed the numeric display will revert to showing the process variable.

4.3.2 Other Parameters

Press FUNC momentarily to access the next parameter in the sequence shown in table 4-1. If the button is held in for more than a second, the parameters will be stepped through at approximately one per second until the end of the sequence, when the display will revert to the process variable, and will stay there until the button is released and pressed again.

Methods of setting the controller parameter values for the required application are described in Section 4.8.

4.4 To ADJUST A PARAMETER

Operate the SP or FUNC buttons as described in section 4.3 until the required parameter is displayed. The legends for each parameter are shown in Table 4-1.

Press RAISE (▲) or LOWER (▼) momentarily.
The value will be incremented or decremented by one unit in the least significant digit every time a button is pressed. If a button is held in for more than a second the lsd will change at 25 units per second. After 10 seconds, if the button is still held in the value will change at 250 units a second.

The numeric display and the parameter label will flash and no adjustment will be made if the user:-

- attempts to adjust a parameter to a value outside the range of the instrument
- attempts to adjust a parameter to a value beyond the limit set by another parameter (such as Set-point Limit)
- attempts to adjust a 'read only' parameter such as PV value

4.5 FRONT PANEL LEGENDS (USER MODE)

OUT 1 - This indicates when Output 1 relay is energised or the SSR drive is on.

OUT 2 - (Optional) This indicates when Output 2 relay is energised or the SSR drive is on.

ALARM - (Optional) This display flashes to indicate an alarm condition (See section 4.9 for details of alarm operation).

4.6 FRONT PANEL LEGENDS (SETUP MODE)

When the controller is in Setup Mode, OUT 1, OUT 2 and ALARM are used to indicate parameter selection, and do not indicate that an output is active.

Table 4.1 shows the parameters and their legends in the order in which they are selected by the FUNC button in Setup Mode. Where a parameter is for an optional feature which is not fitted, or where the parameter is invalidated by another parameter setting (e.g. PB% set to 0), the parameter is skipped in the sequence.

When the controller is delivered from the factory parameters are set to the default values shown in the table. Once set the working values are held in a memory with battery back-up. If the configuration of the controller is changed, the controller reverts to operating with the default values. This action is signalled to the operator by the numeric display showing decimal points after every digit. When any parameter, apart from set-point, is set again, the display reverts to normal.

Parameter	Legend	Range	Default Value
Process Variable	None	Span of Instrument	Read Only
Set-point	SP	Within SP MAX and Range min	Range min
Output 1 Power	POWER	0 to 100% of full pwr	Read Only
Proportional Band	PB%	0 to 100% of span	10%
*Integral Time Constant	RESET	10 sec to 30 min	5 min 00 s
*Derivative Time Constant	RATE	00 sec to 10 min	30 sec
†On/Off Differential	PB% RESET OUT 1:OUT 2	0.1 to 10.0% of span	0.5%
SP High Limit	SP MAX	Span of instrument	Range max
*O/P 1 Power limit	POWER MAX	0 to 100% of full pwr	100%
*O/P 1 Cycle Time	CYCLE TIME	1,2,4,8,16,32,64sec	32 sec
§Out 2 value	OUT 2	Span of instrument	0
§Alarm value	ALARM	Span of instrument	Range max for Process Alarm 5 units for Deviation Alarm

TABLE 4-1 PARAMETER LEGENDS, RANGES AND DEFAULT VALUES

NOTES 'Span' = Span of instrument i.e. range max - range min
* The functions are not operative or accessible if PB% is set to 0
§ These functions are optional
† If PB% = 0 the display shows PB% RESET OUT 1. If Output 2 is fitted display shows PB% RESET OUT 2. If PB% = 0 and Output 2 is fitted the display shows PB% RESET OUT 1 OUT 2.

4.7 CONTROL PARAMETERS

4.7.1 Proportional Band

Can be set between 0 and 100% of span of instrument. If set to 0 the controller operates in On/Off mode.

4.7.2 Integral Time Constant (RESET)

Can be set to between 10 sec and 30 min. If raised above 30 min it becomes inoperative, and the numeric display is blank

4.7.3 Derivative Time Constant (RATE)

Can be set to between 0 sec and 10 min.

4.7.4 On/Off Differential (PB% RESET)

This applies to Output 1 if the Proportional Band is set to zero, and to Output 2 if fitted. It provides a dead band to prevent too frequent load switching, and can be set to between 0.1 and 10% of span of instrument.

4.7.5 Output 2 Deviation Value (OUT 2) [Action opposite to OUT 1]

With Output 2 direct acting, it will switch on at SP + OUT 2 + 1/2 PB%RESET (On/Off Differential) and switch off at SP + OUT 2 - 1/2 PB%RESET. Note that OUT 2 can be set to a negative value, and in this case the above formulae are still applicable but Output 2 switches on below the set-point.

4.7.6 Output 1 Power Limit (POWER MAX)

This is used to limit the power level of Output 1 and may be used to protect the process. If no process protection is required, it may be set at 100%.

4.7.7 Output 1 Cycle Time (CYCLE TIME)

The selection of cycle times depends on the type of process to be controlled. For relay outputs, the cycle time should be as large as possible (consistent with satisfactory control) in order to maximise relay life. If the instrument has the SSR output option, the cycle time can be selected from the lower values in the range. The values available are 1, 2, 4, 8, 16, 32 and 64 seconds.

NOTE: Output 2 (where fitted) only operates on an on/off basis. It has no proportional output and hence no cycle time.

4.7.8 Set-point Limit High (SP MAX)

This should be set to limit the setpoint to the highest value which is safe for the process.

4.8 TUNING THE CONTROLLER

BEFORE STARTING TO TUNE THE INSTRUMENT TO THE LOAD, CHECK THAT POWER MAX HAS BEEN SET TO THE REQUIRED LEVEL. (See Section 4.7.6).

The following is a simple technique for determining values for proportional band (PB%), derivative (RATE) and integral (RESET).

Output 2, when fitted, operates in on/off mode, and is not affected by the P I D terms. However if the Output 2 Deviation Value is set to a low value it can be within the Proportional Band, and this will alter the control characteristics of the instrument. Before tuning the P I D terms set the OUT 2 value to a level high enough to prevent OUT 2 acting within the Proportional Band.

NOTE: The techniques are suitable only for processes that are not harmed by large fluctuations in the process variable. They provide an acceptable basis from which to start fine tuning for a wide range of processes. For additional information on tuning, including alternative tuning techniques, refer to the book 'Principles of Temperature Control', available from WEST.

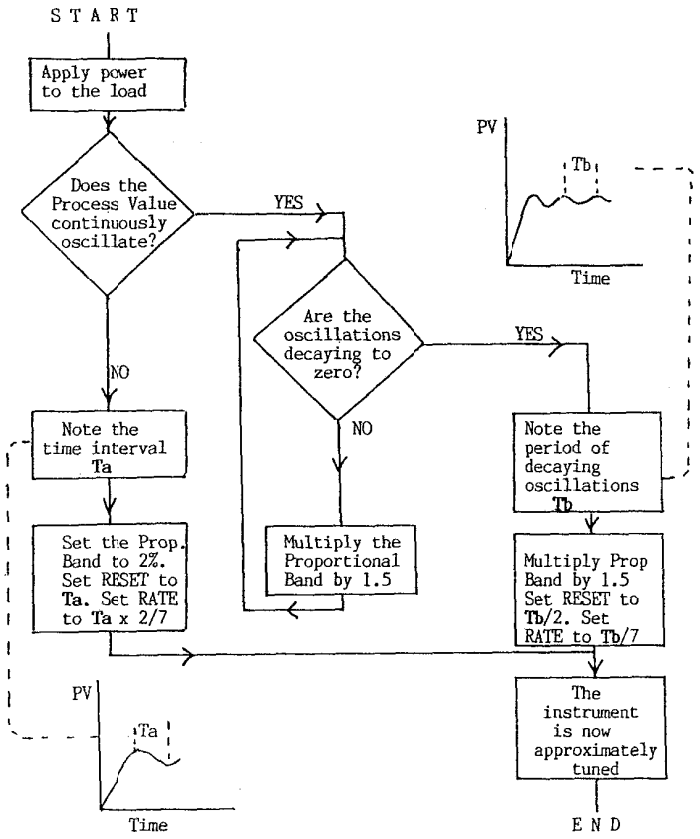
Option 1

1) Set the setpoint to the normal operating process value (lower if overshoot beyond this value is likely to cause damage).

2) Set the proportional band (PB%) to 1%: integral (RESET) to OFF (to turn the integral off, raise RESET until the numeric display is blank) and set the derivative (RATE) to zero.

3) Follow the instructions in Fig. 4-2. At each stage,allow sufficient time before moving on to the next stage.

A self-tuning version of the controller, the 3400, is available, and this automatically optimises the control parameters to suit the application. It compensates for any changes to the operating conditions.



AFTER SETTING UP THE PARAMETERS, SET THE CONTROLLER TO USER MODE (SEE SECTION 4.2) TO PREVENT UNAUTHORISED ADJUSTMENT OF THE VALUES

FIGURE 4-2 TUNING HEAT OUTPUT

Option 2

1) Set the setpoint to the normal operating process value (or lower if overshoot beyond this value is likely to cause damage).

2) Set the proportional band (PB%) to 0% and On/Off Differential to 0.1%; (this sets the instrument to ON/OFF control, and RESET and RATE will be skipped on the front panel).

3) Switch on the power supply to the heater.

Under these conditions the process will oscillate about setpoint, and the following parameters should be noted:

a) The peak to peak variation (P) of the first cycle (i.e. the difference between the highest value of the first overshoot and the lowest value of the first undershoot).

b) The cycle time (T) of this oscillation in minutes (see Fig. 4-3).

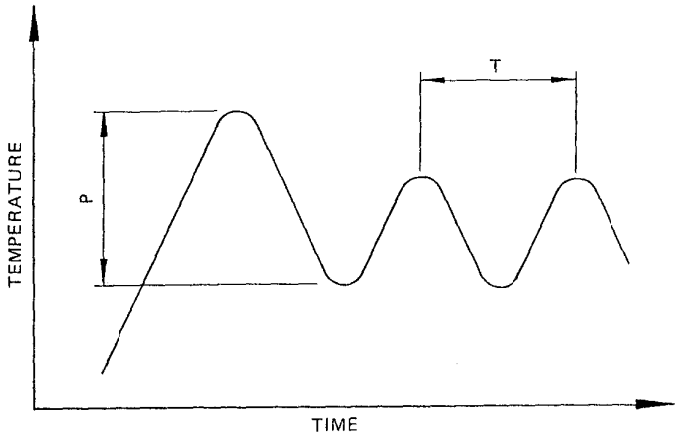


FIGURE 4-3 OPTION 2 SETTING UP PROCEDURE

4) The control setting should then be set as follows:

Proportional band (PBAND%) $= \frac{P}{\text{scale range}} \times 100$

Integral time (RESET) = T minutes
Derivative time (RATE) = T/6 minutes.

AFTER SETTING UP THE PARAMETERS, SET THE CONTROLLER TO USER MODE (SEE SECTION 4.2) TO PREVENT UNAUTHORISED ADJUSTMENT TO THE VALUES

4.9 ALARMS

Six possible configurations are available:-

Product Code	Type	Action
C--46	Band Alarm	Relay On in Band
C--47	Band Alarm	Relay On out of Band
C--48	Process Alarm	Direct
C--49	Process Alarm	Reverse
C--50	Deviation	Direct
C--51	Deviation	Reverse

Product Codes C--46, C--47, C--50, and C--51 refer to Deviation Alarms. Codes C--48 and C--49 refer to alarms with a value which is absolute, i.e. not relative to set-point.

For configurations C--50 and C--51 the value may be set positive or negative.

Codes C--46 and C--47 refer to band alarms.

Table 4-2 shows the operation of the displays and relays for the various alarm functions.

	PV Temp below SP \ SP / PV Temp above SP		
C--50 +ve Dev	Bargraph normal Relay OFF	Alm val	ALARM flashes Red BG flashes Relay ON
C--50 -ve Dev	ALARM flashes Blue BG flashes Relay ON	Alm val	Bargraph normal Relay OFF
C--51 +ve Dev	Bargraph normal Relay ON	Alm val	ALARM flashes Red BG flashes Relay OFF
C--51 -ve Dev	ALARM flashes Blue BG flashes Relay OFF	Alm val	Bargraph normal Relay ON
C--46	ALARM flashes Blue BG flashes Relay OFF	Alm val / Aln val	Bargraph normal Relay ON ALARM flashes Red BG flashes Relay OFF
C--47	ALARM flashes Blue BG flashes Relay ON	Alm val / Alm val	Bargraph normal Relay OFF ALARM flashes Red BG flashes Relay ON
C--48	Alarm value Bargraph normal Relay OFF		ALARM flashes Bargraph flashes Relay ON
C--49	Alarm value Bargraph normal Relay ON		ALARM flashes Bargraph flashes Relay OFF

TABLE 4-2 OPERATION OF ALARM

The operations of the alarm shown in Table 4-2 represent typical settings. However it should be noted that if the value for one of the alarms is set to less than 1% of span from set-point, the alarm level will be reached when only the green <> is being displayed, and this will flash.

SECTION 5 - RANGE CHANGING AND RECONFIGURING

5.1 GENERAL

The options board, which is required for Output 2 (Cool) or Alarm Output may be added if these functions are required.

Changes described in these instructions are confined to those which can be effected by changing links. It is not possible to change between relay and SSR outputs, or between linear, RTD and thermocouple inputs.

5.2 DISMANTLING THE CONTROLLER

5.2.1 To withdraw the instrument from its housing

ENSURE THAT THE MAINS SUPPLY IS DISCONNECTED

With a suitable size screwdriver turn the screw on the front panel near the base anti-clockwise to disengage the back connectors from their sockets, then continue turning until the screw is free from the bush in the housing.

Withdraw the controller gently from its housing.

CAUTION: THIS INSTRUMENT CONTAINS STATIC SENSITIVE DEVICES AND A LITHIUM BATTERY. PRECAUTIONS SHOULD BE TAKEN, DURING HANDLING OF EXPOSED PARTS, TO MINIMISE THE RISK OF STATIC DAMAGE OR BATTERY SHORT CIRCUIT. IF BATTERY REPLACEMENT IS REQUIRED IT MUST BE CARRIED OUT BY A TRAINED TECHNICIAN.

5.2.2 To separate the circuit boards (Only necessary if the Option Board is fitted)

1) Extract the screw securing the CPU Board (RH side viewed from the front) to the metal bracket attached to the front panel assembly.

2) Grasp the plastic guides projecting rearwards from the bottom of the front panel (See Figure 5-1), and pull them downwards until the bottoms of the PCBs can be disengaged from the guides and withdrawn backwards. Next grasp the plastic guides at the top of the front panel and disengage the tops of the PCBs. The two PCBs can now be detached from the front panel asembly.

3) Extract the screw securing the Options Board to the pillar on the CPU Board (See Figure 5-2), then pull the two boards apart, keeping them parallel to avoid bending the plugs and sockets which link them.

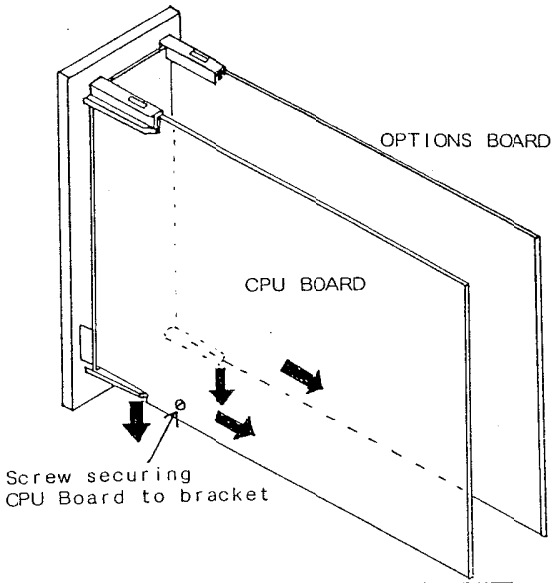


FIGURE 5-1 - DETACHING THE PCBs FROM THE FRONT PANEL

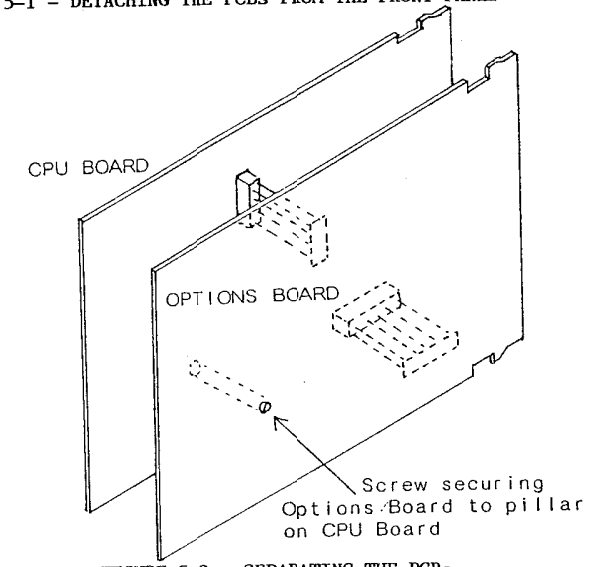


FIGURE 5-2 - SEPARATING THE PCBs

5.3 CHANGING INPUT RANGES (See Appendix 2 for details of inputs available)

5.3.1 Thermocouple inputs

A controller with thermocouple input can be reconfigured to a different thermocouple input by changing links on the CPU Board (See Figure 5-3) in accordance with Table 5-1.

Product	LJ5	LJ6	LJ7	LJ8	LJ9	LJ17	LJ18	LJ19
T1127	P	X	P	X	X	X	-	X
T1128	X	X	P	X	X	X	-	X
T1227	P	P	X	P	P	X	-	X
T1228	X	P	X	P	P	X	-	X
T1415	P	P	P	P	X	P	X	-
T1416	X	P	P	P	X	P	X	-
T1417	P	P	P	X	P	P	X	-
T1418	X	P	P	X	P	P	X	-
T1541	P	P	P	P	P	X	-	X
T1542	X	P	P	P	P	X	-	X
T1719	P	P	P	X	X	P	X	-
T1720	X	P	P	X	X	P	X	-
T1723	P	X	P	P	P	P	X	-
T1724	X	X	P	P	P	P	X	-
T1983	P	P	X	P	X	X	-	X
T1984	X	P	X	P	X	X	-	X

X = Active P = Parked - = Not Fitted

TABLE 5-1 - THERMOCOUPLE INPUT JUMPERS

5.3.2 Break Protection for Thermocouple Inputs

The controller can be configured for upscale break protection (controller treats open circuit input as above range maximum), downscale break protection, or no protection. To change the protection set the links in accordance with Table 5-2.

Product Code	LJ 14	LJ 15
T ----	X	-
T ----21	-	X
T ----22	P	-

X = Active
P = Parked
- = Not Fitted

TABLE 5-2 - THERMOCOUPLE BREAK PROTECTION

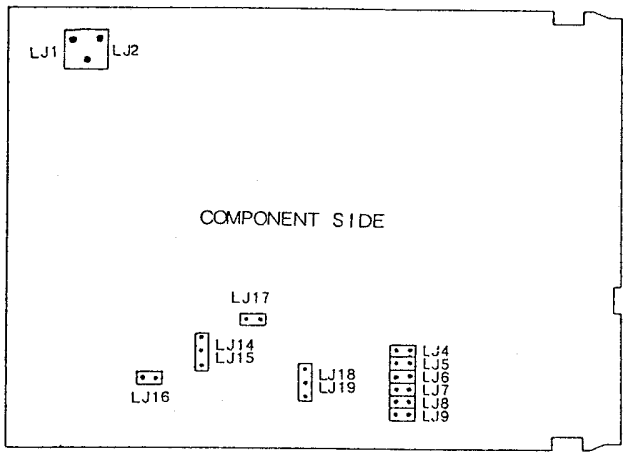


FIGURE 5-3 - POSITION OF LINK JUMPERS ON CPU BOARD

5.3.3 RTD Inputs

A controller supplied with RTD input can be reconfigured to a different RTD input by changing links on the CPU Board (See Figure 5-3) in accordance with Table 5-3.

Product	LJ5	LJ6	LJ7	LJ8	LJ9	LJ16
T2295	P	X	P	P	X	X
T2296	X	X	P	P	X	X
T2297	P	X	P	X	P	X
T2298	X	X	P	X	P	X

X = Active **P = Parked**

TABLE 5-3 RTD INPUT LINK JUMPERS

5.4 CHANGING OUTPUT 1 (HEAT) ACTION

Output 1 (Relay or SSR) can be configured to be direct or reverse acting. It is not possible to change between relay and SSR.

For a direct acting output, Product Code H--31, LJ4 should be fitted on the CPU board. Otherwise it should be parked.

5.5 OUTPUT 2 AND ALARM OUTPUT

The Options board is required if Output 2 and/or Alarm Output is required. This board is supplied in five forms:

1 Output 2 Relay, no Alarm. Code C10
2 Output 2 SSR, no Alarm. Code C50
3 Output 2 Relay, with Alarm Output. Code C1C--.
4 Output 2 SSR, with Alarm Output. Code C5O--
5 Alarm Output only. Code C00--

The Output 2 action cannot be changed on its own; the action is always the opposite of Output 1, i.e. if Output 1 is reverse acting Output 2 is direct, and vice versa.

If Output 2 is used LJ2C on the Options Board (See Figure 5-4) should be fitted, otherwise it should be parked. If LJ 20 is parked when Output 2 is fitted, the output will not operate, and the parameters associated with it will not be included in the display sequence.

To Change the operation of the Alarm, links on the Option Board should be fitted in accordance with Table 5-4.

Product Code	LJ21	LJ22	LJ23
C--50	X	P	P
C--51	X	P	X
C--46	P	X	X
C--47	P	X	P
C--48	X	X	P
C--49	X	X	X

X = Active

P = Parked

TABLE 5-4 ALARM OUTPUT LINK JUMPERS

NOTE: If Alarm Output is not supplied LJ21, LJ22 and LJ23 are omitted.

If the Alarm Output is fitted, but it is required to prevent its operation, LJ21, LJ22 and LJ23 should all be parked. This will also cause the Alarm function to be skipped in Setup Mode.

See Section 4.9 for details of Alarm operation.

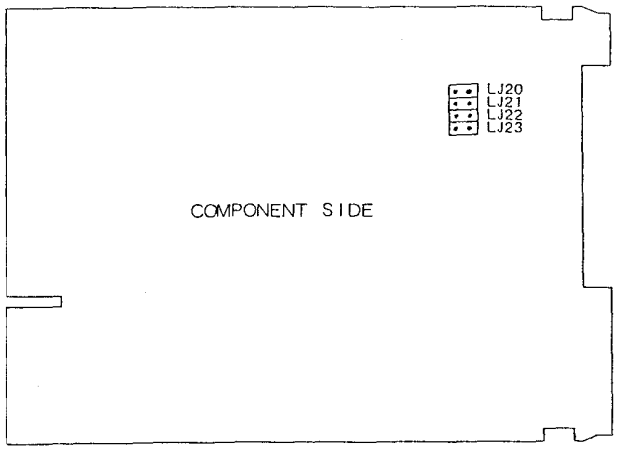


FIGURE 5-4 - POSITION OF LINK JUMPERS ON OPTIONS BOARD

5.6 CHANGING SUPPLY VOLTAGE

With link 1 in position on the CPU board the controller will operate on 193V to 264V (Code LO1) and with link 2 in position it will operate on 100V to 132V (Code LO2).

It is not possible to change to/from 24V operation (Code LO4)

5.7 ASSEMBLING THE CONTROLLER

5.7.1 Fitting CPU Board to Options Board (if required)

Hold the two boards side by side with components sides facing each other and PC connectors corresponding. Carefully align the multiple pin plugs on the Options Board with the sockets on the CPU board, then gently engage the plugs and sockets.

Insert the screw through the Options Board into the pillar on the CPU Board and tighten.

5.7.2 Fitting Boards to Front Panel Assembly

Align the boards with the guides attached to the front panel; the CPU board (with the transformer on it) should be on the RH side when viewed from the front.

Make sure that the plugs on the CPU board are aligned with the sockets on the front panel assembly.

Push the boards into the guides until <u>all</u> the teeth on the boards click into the holes in the guides.

Insert the screw through the CPU Board into the bracket attached to the front panel assembly and tighten.

5.7.3 Fitting the Controller into the Housing

Carefully slide the controller into the housing, making sure that the circuit board(s) locate against the outside of the guides moulded in to the top and bottom of the housing. Push the controller firmly home so that the rear connections of the circuit boards make a good connection with the rear terminals.

Engage the screw near the base of the front panel and tighten it until the controller is firmly in place.

SECTION 6 FAULT FINDING

The following instructions are provided to assist in operational fault identification:

1) Display blank when power applied

   a) Check the mains wiring (see Section 2.7.1)
   b) Check fuses.
   c) Internal component failure; consult WEST

2) Display reads | |

   a) Check the input wiring
   b) Is the input outside the range of the instrument?

3) All decimal points on display (e.g. .1.0.0 instead of 100) indicates that a parameter has been corrupted.

   a) This can occur when power is first applied during setting up. If this is the case, set up the instrument (see Section 4). After adjustment the decimal points will disappear.
   b) If this has occurred during operation, a parameter has been corrupted. To clear the decimal points, enter Setup Mode and change a parameter (not setpoint) Check all other parameters and reset if necessary.

4) Output not switching

   a) Check that power limit has been set (POWER MAX)

5) Process undershoots

   a) Check that the power limit (POWER MAX) has been set to provide sufficient power to the load.
   b) Check that the instrument has been tuned to the load (see Section 4.8).

7) The display flashes on and off when the raise or lower pushbuttons are pressed.

   a) An illegal operation is being attempted:

      1) A change of a parameter that is locked is being attempted.
      2) A change of a parameter that is not alterable from the front panel (e.g. POWER) is being attenpted.
      3) A change of a parameter beyond its limits is being attempted.

APPENDIX 1 - SPECIFICATION FOR CONTROLLER TYPE 3100

INPUT

Input types: Thermocouple and RTD
Common Mode Rejection: Negligible effect up to 264V 50/60 Hz
Series Mode Rejection: 1000% of span (at 50/60Hz) causes negligible effect.
Thermocouple Break Protection: Upscale/Downscale optional
Thermocouple Calibration: Complies with BS4937, NBS125 and IEC584 standards.
RTD (Pt100) Calibration: Complies with BS 1904 and DIN 43760 standards.

OUTPUTS

Output 1 (Heat)
Relay: SPDT contact rating 5A resistive at 120/240V a.c.
Relay life $>10^6$ operations
SSR drive: 0 - 12V nominal, 18V max. Output impedance 1kΩ.

Output 2 (Cool) (Optional)
Relay: SPDT contact rating 2A resistive at 120/240V a.c.
Relay life $>10^6$ operations
SSR drive: 0 - 12V nominal, 18V max. Output impedance 1kΩ.

Alarm (Optional)
Alternative Configurations:-

	Relay Energised	ALARM flashes
Process high alarm (fail safe)	PV below Alm value	PV above Alarm value
Process high alarm	PV above Alm value	PV above Alarm value
Band alarm, relay On inside band	PV within deviation band	PV outside deviation band
Band alarm, relay On outside band	PV outside deviation band	PV outside deviation band
+ deviation direct	PV > SP + Dev	PV > SP + Dev
- deviation direct	PV < SP - Dev	PV < SP - Dev
+ deviation reverse	PV < SP + Dev	PV > SP + Dev
- deviation reverse	PV > SP - Dev	PV < SP - Dev

Relay: SPDT contact rating 2A resistive at 120/240V a.c.
Relay life $>10^6$ operations

CONTROL

Proportional Band: 1 - 100% at 1% resolution and ON/OFF
Proportioning Time: 1, 2, 4, 8, 16, 32, 64 seconds
Integral Time: 10 sec to 30 min 00 sec and OFF (1 sec increments)
Derivative Time: 0 sec to 10 min 00 sec (1 sec increments)
ON/OFF Differential (Hysteresis): 0.1 - 10% of span

ENVIRONMENT

REFERENCE CONDITIONS

Ambient temperature: 20 ±2°C
Supply voltage: 120 or 240V ±1% 50/60 Hz ±1%
Thermocouple source resistance: <10 Ohms
RTD (Pt 100): <0.1 Ohm per lead, both leads equal
Relative humidity: 60 to 70%

OPERATING CONDITIONS

Ambient Temperature
0 to +50°C operating
-20 to +60°C storage

Supply Voltage:
193 to 264V 50/60 Hz
100 to 132V 50/60 Hz

Maximum Source Resistance:
Thermocouple <1000 Ohms
RTD (Pt100) <5 Ohms per lead (equal resistance in each lead)

PERFORMANCE

Reference Accuracy: Typically ±0.5% of span ±1 lsd
Temperature Stability: <0.015% of span for 1°C change in ambient temperature.
Cold junction compensation: <0.1°C change for 1°C change in ambient temperature
Effect of thermocouple resistance: <0.1% of span error for resistance 0 to 100 Ohms
Effect of RTD lead resistance: <0.1% of span error for 3 Ohm lead resistance.
Supply voltage influence on accuracy: less than ±0.1% of span error for supply voltage within specified limits.

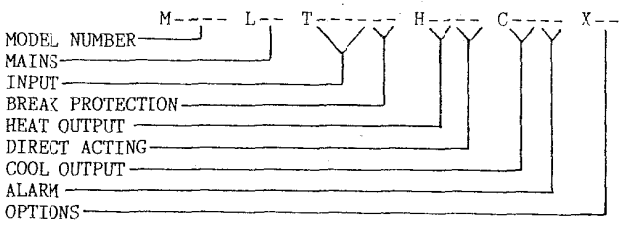
GENERAL

Display: Liquid Crystal showing:-
Four digit seven segment numeric display
Nine segment bar graph
18 parameter labels

Front panel controls: Four pushbuttons:-
Function select
Setpoint select
Raise
Lower

Dimensions: 48mm x 96mm x 153mm
Weight: 0.65 kg
Power consumption: Approx 3VA

APPENDIX 2 - PRODUCT CODES



MODEL NUMBER

M 3100

MAINS VOLTAGE

L 01	220/240V Nominal 50/60 Hz
L 02	110/120V Nominal 50/60 Hz
L 04	24V Nominal 50/60 Hz

INPUT - TYPE AND RANGE

Thermocouple

T 1127	'R' 0 - 1650°C
T 1128	'R' 32 - 3002°F
T 1227	'S' 0 - 1650 °C
T 1228	'S' 32 - 3002 °F
T 1983	'B' 100 - 1820°C
T 1984	'B' 212 - 3308 °F
T 1415	'J' 0 - 205°C
T 1416	'J' 32 - 401°F
T 1417	'J' 0 - 450°C
T 1418	'J' 32 - 842°F
T 1541	'T' 0 - 260°C
T 1542	'T' 32 - 500°F
T 1719	'K' 0 - 760°C
T 1720	'K' 32 - 1400°F
T 1723	'K' 0 - 1371°C
T 1724	'K' 32 - 2500°F

Thermocouple Break Protection Options (Normally Upscale)

T ----21	Downscale break protection
T ----22	No break protection

INPUT (contd)

3-wire Resistance Temperature Detector (RTD)

T 2295	0.0 - 100.0°C
T 2296	32.0 - 212.0°F
T 2297	-200 to +205°C
T 2298	-328 to +401°F

OUTPUTS

Output 1 (Heat)

H 10	Relay
H 50	SSR drive

Output 1 Option (Normally Reverse Acting)

H --31	Direct acting

Output 2 (Cool) (Reverse/Direct Acting -- Opposite to Heat)

C 00	Not fitted
C 10	Relay
C 50	SSR drive

Alarm

C --50	Relay, high/low deviation (direct)
C --51	Relay, high/low deviation (reverse)
C --46	Band alarm, relay On inside band
C --47	Band alarm, relay On outside band
C --48	Relay, process alarm (direct)
C --49	Relay, process alarm (reverse)

INDEPENDENT OPTIONS

X 69	Push-on blade terminals (Faston)
X 73	1/4 to 1/8/ DIN conversion plate.
X 74	Remote Front Panel with 2m cable.
X 75	Remote Front Panel with 5m cable.
X 79	Remote Front Panel with 0.5m cable.
X 76	Chassis Mounting Bracket.

SUBJECT INDEX (FOR MAIN SUBJECTS SEE CONTENTS)

Note: Most subjects are also referred to in the Appendices