EPC3000 Temperature Control Applications

Basic Commissioning Guide

EPC3016, EPC3008, EPC3004

HA033033ENG Issue 1

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Eurotherm®

by Schneider Electric

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Introduction

This manual is a supplement to the EPC3000 series User Manual HA032842 which can be found on www.eurotherm.co.uk.

The EPC3000 series of controllers differ from traditional PID controllers in having a powerful graphical wiring configuration programmed using Eurotherm iTools installed on a PC. To ease the process of commissioning a controller, EPC3000 includes a set of ready to use applications which in many cases can be commissioned without use of a PC tool.

The applications described in issue 1 of this supplement apply to firmware version V2.03. Applications found in later versions of firmware may differ.

Applications may be selected when the instrument is being commissioned for the first time, or may be ordered as part of the standard order code:

- No application has been ordered or selected (Q Code Set 1 = 'X'). In this case the controller is unconfigured and powers up, when new, showing the Quick Configuration Codes. At this point any application can be selected but if Quick Code Set 1 = 'X' is selected and accepted (saved) then the controller must be configured using iTools Graphical Wiring, see section "Temperature applications" on page 7.

- Heat only controller (Q Code Set 1 = '1')

- Heat/Cool controller (Q Code Set 1 = '2')

- Valve Position Heat Only controller (Q Code Set 1 = 'V')

If the controller has been ordered using the order code with an application already loaded, as shown by the last three items in the above list, it will power up briefly showing the Quick Codes but will automatically enter operating level 1. The Quick Codes can be re-selected if required as described in the User Manual part number HA032842.

The applications are basic configurations that will get many processes up and running quickly. To customise them for a particular application this will also require the use of iTools Graphical Wiring. This is explained in section "Temperature applications" on page 7. Further details may be found in the EPC3000 series User Manual part number HA032842 and the iTools Help Manual part number HA028838 available from www.eurotherm.co.uk.

What's in this chapter

Modules fitted

General description of heat only temperature control

Terminal connections

Soft wiring

Configuration parameters

Modules fitted, I/O assignment and terminal layout

Modules fitted are defined by the order code. Those shown in italics are the expected default options.

I/O Name	Terminals	Function	I/O type
AI1	V+, V-, VI	PV input	*Thermocouple*, PRT, Analogue
IO1	1A, 1B	Time proportioning heat output or Valve Position (VP) raise	*Relay*, Triac, Logic, DC
IO2	2A, 2B	Time proportioning cool output or Valve Position (VP) lower	*Relay*, Triac, Logic, DC
OP3	3A, 3B, 3C	Alarm and general notification relay	Changeover relay
IO4	4A, 4B	4-20mA retransmission of actual temperature	DC output (EPC3008 and EPC3004 only) - for the applications described in this supplement

A relay or triac output might be used, for example, to operate a contactor for heat control, a solenoid valve for cool control, raise/ lower for valve position control or to operate external devices such as relays or indicators

A logic output might be used for switching an external SCR/Power controller.

A DC output might be used to drive a proportional valve, SCR/Power controller or provide analogue retransmission of a measured parameter.

Operation

This chapter describes how to start using the EPC3000 series heat only controllers.

What's in this chapter?

Switch on (power up) - new controller or already configured controller

Example start up displays

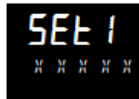Front panel button operation

Switch on

When the controller is new and supplied unconfigured it will open with the Quick Codes. These are explained in the User Manual but for the purposes of this supplement set the first digit in Set 1 to:

X - no application

1 - Heat only controller

2 - Heat/cool controller

V - Heat only controller with valve position output

Configure further characters as required and save as described in the User Manual.
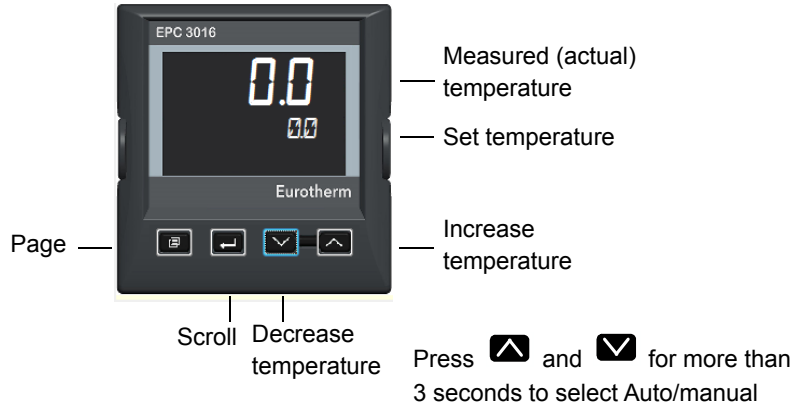
The controller will then start up showing displays shown in the examples in the next section.

If the controller is already configured then the quick codes will be omitted and it will open with displays similar to the following examples.
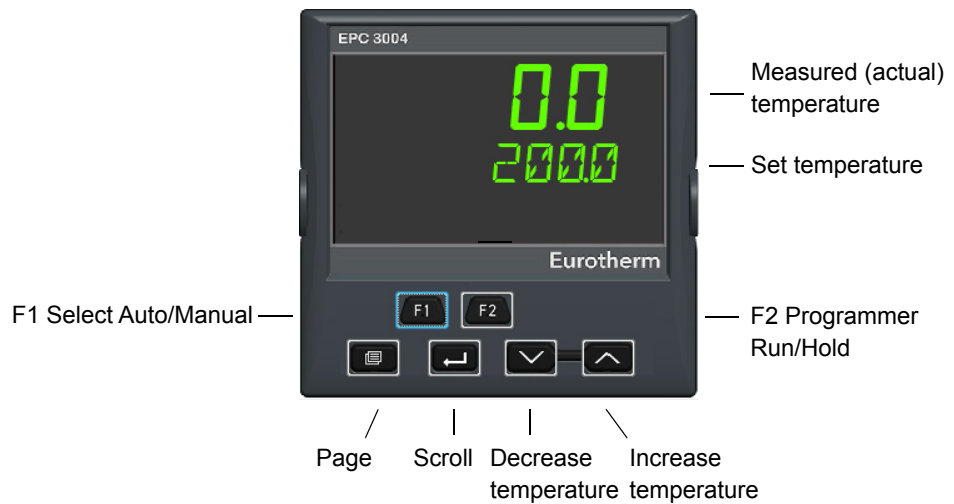
Controller displays

Following a start up diagnostic mode the following examples of the 'HOME' displays are shown below:

EPC3016

Measured (actual) temperature

Set temperature

Increase temperature

Page

Scroll   Decrease temperature

Press ⋀ and ⋁ for more than 3 seconds to select Auto/manual

EPC3008/EPC3004

Measured (actual) temperature

Set temperature

F1 Select Auto/Manual

F2 Programmer Run/Hold

Page   Scroll   Decrease temperature   Increase temperature

Operation of the front panel buttons

The default functionality of the buttons, when an application is selected, are summarised below. Further information regarding button operation is described in the User Manual HA032842.

To raise or lower the required temperature (setpoint SP).

Press ⋀ or ⋁ respectively. The rate of change accelerates if the button is held down.

To select auto/manual operation

In EPC3008 and EPC3004 toggle F1. ꓟ is displayed together with the hand icon.

Press ⬆ or ⬇ to raise or lower the output power when in manual.

In EPC3016, press the raise and lower buttons together for more than 3 seconds. Then press either the raise or lower button to toggle between auto and manual.

To acknowledge alarms

Press ▦ and ⏎ together.

To select the programmer parameters.

Press ▦

Then press ⏎ to scroll through the list of parameters.

The list of programmer parameters is given in the User Manual.

To change the value of a selected parameter press ⬆ or ⬇.

To show default parameters

Repeatedly press ⏎.

The list of default parameters in operator level 1 is given in the User Manual.

To change the value of a selected parameter press ⬆ or ⬇.

To select higher levels of access

Press and hold ▦.

Then to select Level 2 press ⬆ or ⬇.

Further descriptions are available in the User Manual.

Temperature applications

The 'standard' temperature applications supplied with the controller are described in the following sections. These applications may be customised to your specific requirements. This requires the use of iTools which is a software package designed to configure Eurotherm instruments and can be loaded onto your PC free of charge from www.eurotherm.co.uk.

Disconnect the controller from the normal power supply then connect it to your PC. The easiest way to configure EPC3000 uses the configuration clip, shown below, which will also provide power to the instrument during the process. This has the order code EPCACC/USBCONF and may be obtained through your supplier.

The configuration clip can be connected through the controller sleeve as shown (for example, when it is new). Alternatively, it may be connected directly to the printed circuit board if the controller is removed from its sleeve (for example, if it has already been wired into the process).

⚠ **WARNING**
UNINTENDED EQUIPMENT OPERATION
Incorrect configuration can result in damage to the process and/or personal injury. Configuration must be carried out by a competent person authorised to do so. It is the responsibility of the person commissioning the controller to ensure the configuration is correct. In configuration level the controller does not control the process or provide alarm indication.
Failure to follow these instructions can result in death, serious injury or equipment damage

⚠ **DANGER**
HAZARD OF ELECTRIC SHOCK
Do not configure a controller on a live process. The configuration clip is not isolated from the thermocouple input. In some installations it is possible for the thermocouple to be connected directly to the heater element. In this case the clip could be at the potential of the heater supply.
Failure to follow these instruction will result in death or serious injury

iTools is described in the EPC3000 series User Manual part number HA032842 and in the iTools Help Manual part number HA028838 both of which are available from www.eurotherm.co.uk.

Application '1': - Heat only controller

The 'standard' heat only application, supplied in firmware version V2.03, is selected by Quick code Set 1, character 1 = '1' and is shown below.
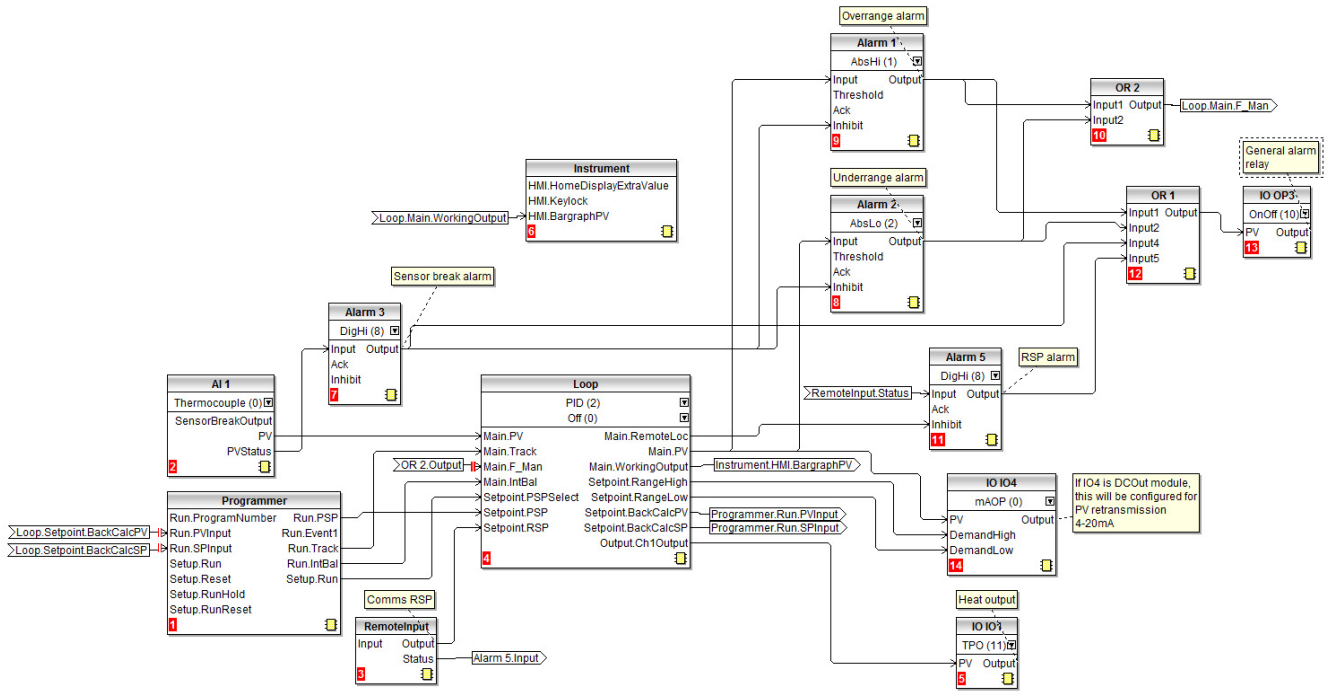
The sensor input is a thermocouple connected to the main analogue input AI1.

A programmer block provides the programmed setpoint (PSP) to the loop.

A remote setpoint (RSP) is available, the value of which can be written over comms using Modbus address 277. When the loop is in remote auto mode, the RSP must be written-to at least every second. If updates stop then an alarm will trip and the loop will fallback to forced local auto.

Four alarms are configured:

- Alarm 1 operates when the PV exceeds an absolute high threshold

- Alarm 2 operates when the PV exceeds an absolute low threshold

  These are combined using an OR function to provide an out of range alarm. When either of these alarms trip the controller is placed into 'Forced Manual' mode. This sets the output to the 'Fallback Value', allowing the process to be immediately returned to its required good state.

- Alarm 3 is a digital alarm providing sensor break alarm

- Alarm 5 is a digital high alarm wired to the Remote Input Status

These four alarms are combined using an OR function to provide a general alarm outputted via OP3. IO4 can provide a 4-20mA retransmission signal only if configured with a DC output, otherwise it remains unconnected. IO1 is the heat control output.

The application can be modified by the user using the procedures described in subsequent sections.

Note: The number shown in brackets after a parameter in the soft wiring diagram is the enumeration for this parameter.

Physical wiring heat only controller plus general relay

This example shows typical physical wiring for an EPC3016 heat only temperature controller based on the configuration shown above in Application 1. Appropriate fusing and power isolation must be supplied in accordance with local regulations.
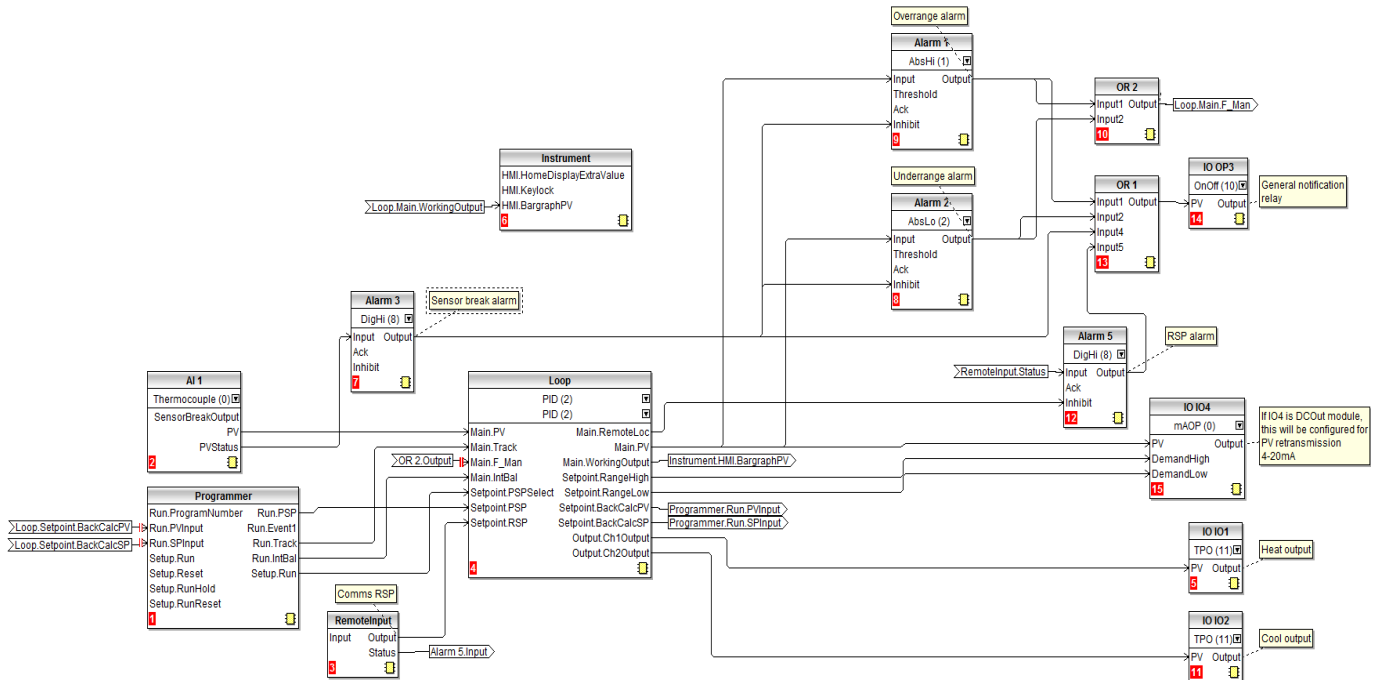

Heat only non-default parameter settings

This table lists all instrument parameters that are changed from their default values. All other parameters remain at their default values.

Parameter	Value
Instrument.HMI.BargraphMax	100
Loop.1.Setpoint.RSP_En	On (1)
Loop.1.Setpoint.SPTracksRSP	On (1)
IO.3.Sense	Invert (1)
Alarm.1.Type	AbsHi (1)
Alarm.1.Latch	Auto (1)
Alarm.1.Hysteresis	1
Alarm.2.Type	AbsLo (2)
Alarm.2.Latch	Auto (1)
Alarm.2.Hysteresis	1
Alarm.3.Type	DigHi (8)
Alarm.3.Latch	Auto (1)
Alarm.3.StandbyInhibit	On (1)
Alarm.5.Type	DigHi (8)
Alarm.5.Latch	Auto (1)
Alarm.5.StandbyInhibit	On (1)
Loop.Config.RecoveryMode	ManModeFallbackOP (1)

Note: The number shown in brackets after a parameter in the table is the enumeration for this parameter.

Application '2': Heat/cool controller

The 'standard' heat/cool application, supplied in firmware version V2.03, is selected by Quick code Set 1, character 1 = '2' and is shown below. This application is essentially the same as the heat only application but the Loop block is configured for PID in Channel 2 (cool) and 'IO IO2' is added and connected to the 'Loop.Ch2Output'.

Note: The number shown in brackets after a parameter in the soft wiring diagram is the enumeration for this parameter.

Physical wiring heat/cool controller

This example shows typical physical wiring for an EPC3004 heat/cool temperature controller based on the configuration shown above in Application 2. Appropriate fusing and power isolation must be supplied and in accordance with local regulations.
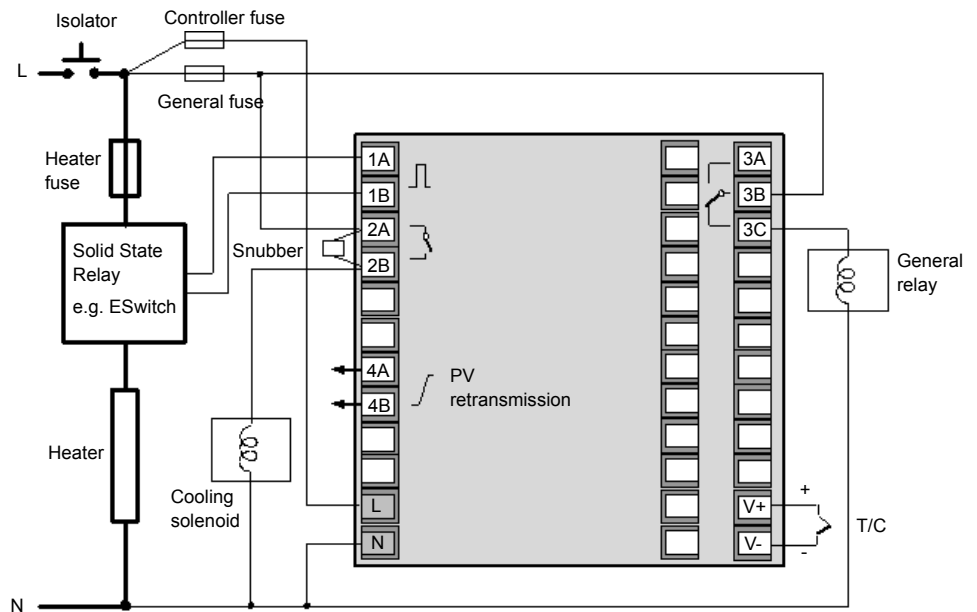
Heat/cool non-default parameter settings

This table lists all instrument parameters that are changed from their default values. All other parameters remain at their default values.

Parameter	Value
Instrument.HMI.BargraphType	Centered (1)
Instrument.HMI.BargraphMin	-100
Instrument.HMI.BargraphMax	100
Loop.1.Setpoint.RSP_En	On (1)
Loop.1.Setpoint.SPTracksRSP	On (1)
IO.3.Sense	Invert (1)
Alarm.1.Type	AbsHi (1)
Alarm.1.Latch	Auto
Alarm.1.Hysteresis	1
Alarm.2.Type	AbsLo (2)
Alarm.2.Latch	Auto (1)
Alarm.2.Hysteresis	1
Alarm.3.Type	DigHi (8)
Alarm.3.Latch	Auto (1)
Alarm.3.StandbyInhibit	On (1)
Alarm.5.Type	DigHi (8)
Alarm.5.Latch	Auto (1)
Alarm.5.StandbyInhibit	On (1)
Loop.Config.Ch2ControlType	PID (2)
Loop.Config.RecoveryMode	ManModeFallbackOP (1)

Note: The number shown in brackets after a parameter in the table is the enumeration for this parameter.

Application 'V': Valve position heat only controller

The 'standard' heat only application with valve position outputs, supplied in firmware version V2.03, is selected by Quick code Set 1, character 1 = 'V' and is shown below.
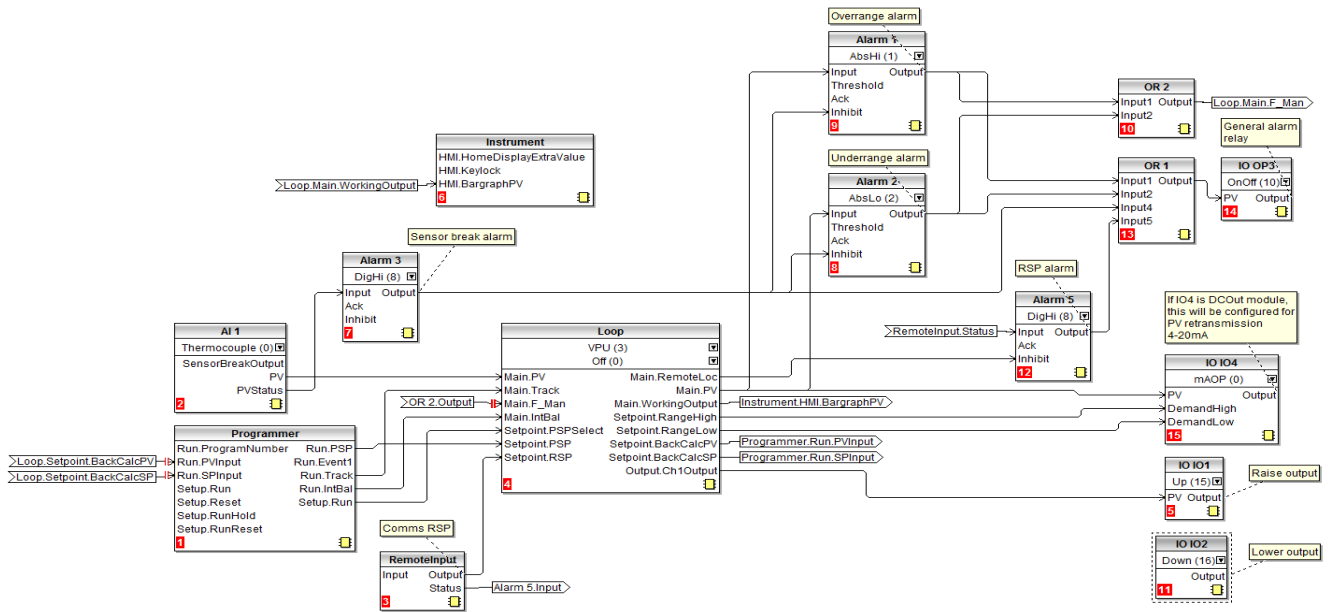

The valve position algorithm used in EPC series is unbounded (VPU) which does not require a feedback potentiometer. An explanation of boundless control may be found in the User Manual HA032842.

- The Loop block is configured for VPU in channel 1 and Off for channel 2

- 'IO IO1' is wired to the 'Loop.Ch1Output' and is configured for Raise (valve open).

- 'IO IO2' automatically becomes Lower (valve close)

Note: The number shown in brackets after a parameter in the soft wiring diagram is the enumeration for this parameter.

Physical wiring heat only VP controller

This example shows typical physical wiring for an EPC3004 heat only temperature controller with valve position outputs based on the configuration shown above in Application 3. Appropriate fusing and power isolation must be supplied and in accordance with local regulations.
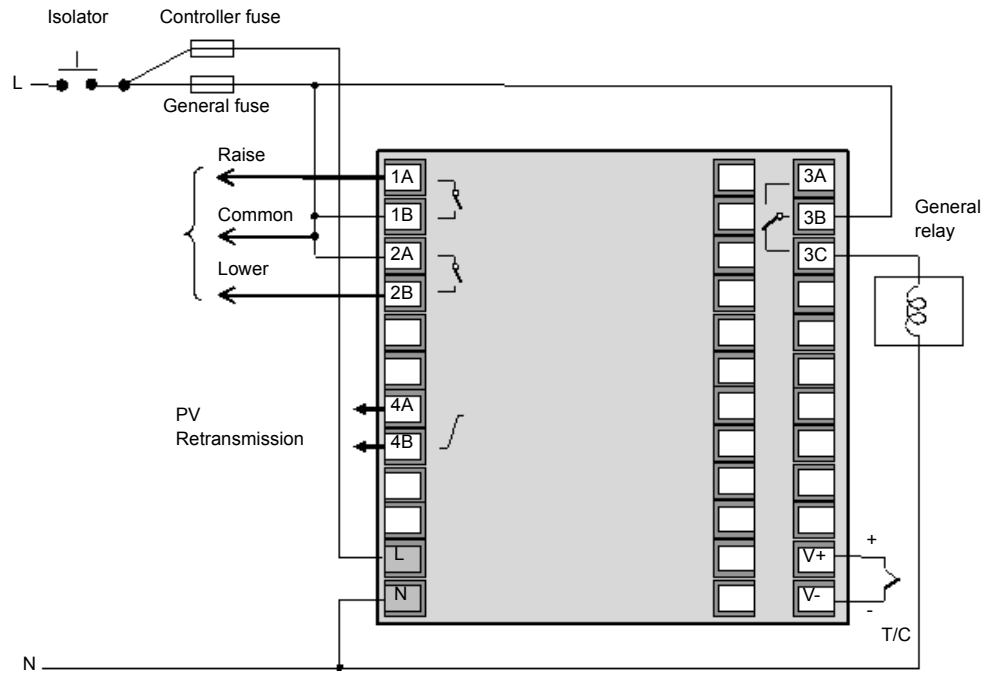
⚠ **CAUTION**
HAZARD OF HIGH VOLTAGE MOTORS
Valve position motors can generate approximately twice the supply voltage measured across the raise and lower terminals. When one side is energised the other side sees a reflected voltage of 2xsupply voltage. For this reason any motor rated greater than 110Vac should not be driven directly from the internal relays in the controller.   For motors greater than 110Vac use separately mounted external relays which can be driven from the controller.
Failure to follow these instructions can result in injury or equipment damage

VPU heat only non-default parameter settings

This table lists all instrument parameters that are changed from their default values. All other parameters remain at their default values.

Parameter	Value (enumerated value)
Instrument.HMI.BargraphMax	100
Loop.1.Setpoint.RSP_En	On (1)
Loop.1.Setpoint.SPTracksRSP	On (1)
IO.3.Sense	Invert (1)
Alarm.1.Type	AbsHi (1)
Alarm.1.Latch	Auto (1)
Alarm.1.Hysteresis	1
Alarm.2.Type	AbsLo (2)
Alarm.2.Latch	Auto (1)
Alarm.2.Hysteresis	1
Alarm.3.Type	DigHi (8)
Alarm.3.Latch	Auto (1)
Alarm.3.StandbyInhibit	On (1)
Alarm.5.Type	DigHi (8)
Alarm.5.Latch	Auto (1)
Alarm.5.StandbyInhibit	On (1)
Loop.Config.Ch2ControlType	VPU (3)
Loop.Config.RecoveryMode	ManModeFallbackOP (1)
IO.1 Type	Up (15)

Note: The number shown in brackets after a parameter in the table is the enumeration for this parameter.

Application 'X': Controller unconfigured

This is a specific case in which the controller is unconfigured and, therefore, must be manually created using the Graphical Wiring function in iTools. It is selected by Quick code Set 1, character 1 = 'X'.
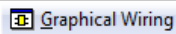
The following sections use various examples to illustrate how this may be done.

Similarly, to customise one of the 'standard' applications also requires the use of the Graphical Wiring function in iTools. The examples described may be used as a basis for modifying an application. The final example, therefore, selects an application and shows the procedure which may be used to make changes.

Graphical wiring

Applications may be configured by connecting together 'function blocks' using 'soft wiring'. A function block inputs data from various sources, manipulates this data (using its internal parameters) and outputs the results. Soft wiring is a means of connecting function blocks together to produce a specific task. The process is termed 'Graphical Wiring' and is managed within the iTools configuration package.

This section is not intended to describe all the features of graphical wiring, which is explained in the iTools help manual part number HA028838. It is intended to provide a step by step guide to customise a standard application or to set up a simple controller when no application is selected i.e. Quick Code Set 1, Application = 'X'.

In iTools, open graphical wiring . If no application has been selected, a blank page is shown.

Example 1: To produce a simple heat only temperature controller

This simple example consists of three function blocks; a sensor input, control block and output to operate plant control devices.

From the 'Blocks' list drag and drop the required function blocks as follows:

1. Drag AI1 to the display. This will be the sensor input. Use the drop down to configure the input type.

2. Drag the Loop block to the display. Use the drop down to configure the control type.

3. Drag IO IO1 block to the display. Use the drop down to configure the output type. Other output blocks may be chosen of preferred.
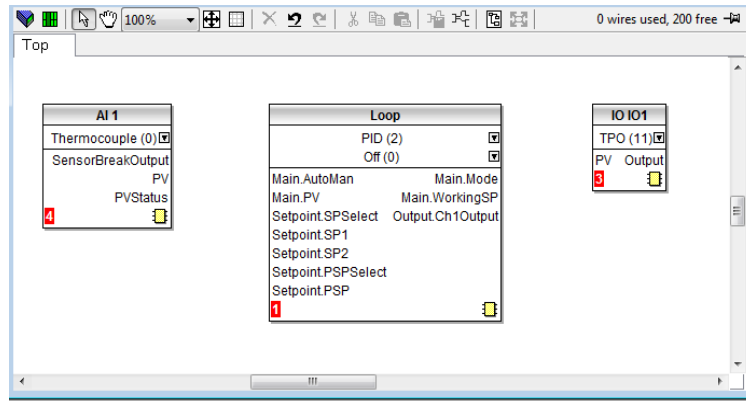

Now wire these together.

1. Click PV on AI1 and drag the wire to Main.PV on the Loop block. This provides the linearised temperature input to the control block.

2. Click Output.Ch1Output on the control block and drag the wire to IO IO1 and select PV from the drop down.

At this stage wires are shown dotted.

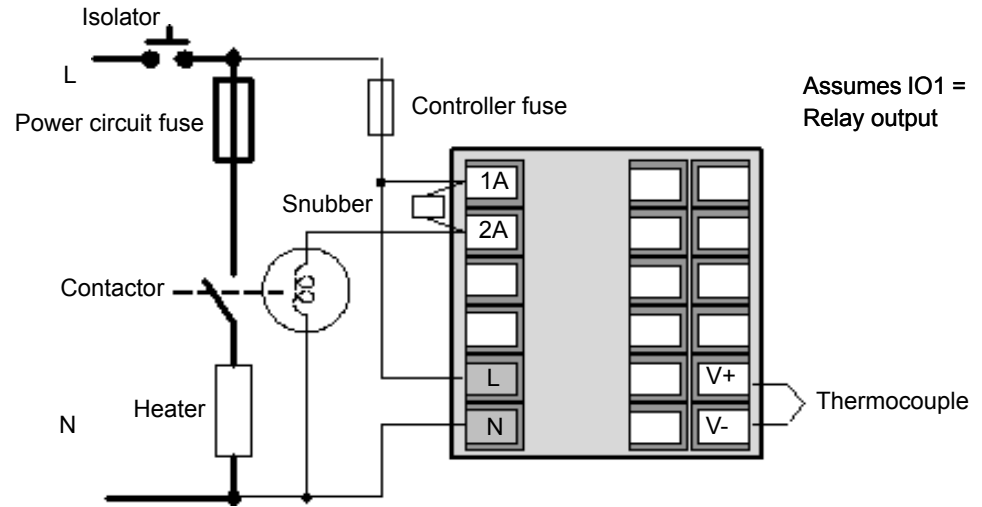**Note:** Wires can be deleted by clicking on the wire and selecting 'Delete'.

Now load this into the instrument.

1. Select 'Download Wiring to Instrument'

2. The wires change from dotted to solid
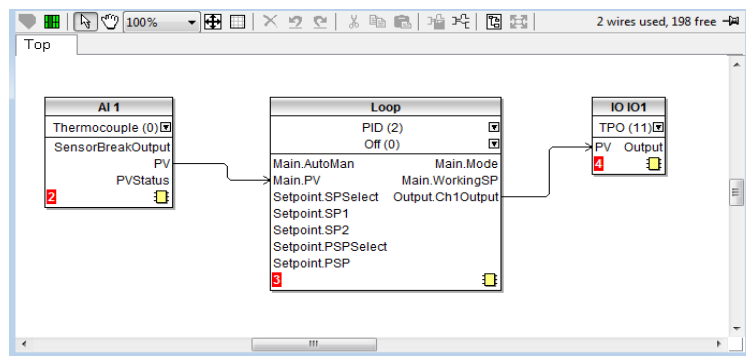
Physical wiring heat only controller

The controller is now ready to be hard wired into the process. This is shown diagrammatically below

Below is a brief summary of the operation of the controller.

When switched on, the controller display will be similar to that shown in section "Controller displays" on page 5 except that it will start in Manual with 0.0% power demand.

1. Select Auto.

2. Raise/lower the setpoint. IO1 will proportion the control device on or off depending on the measured temperature and the required setpoint. The front panel indicator will switch accordingly.

## Example 2: Add a high alarm to the process variable.

1. Drag an alarm block to the display (e.g. Alarm 1)

2. Use the drop down to select 'AbsHi'

3. On the Loop block click [icon] . On the pop up select PV and drag the wire to 'Input' on the alarm block

4. Select 'Download Wiring to Instrument' [icon]

At this stage the alarm is a 'soft' alarm which means it is indication only. If the alarm threshold is exceeded the PV display changes to red and [icon] is displayed.

Example 3: Add a relay output to the alarm

In this example the relay will be the changeover relay OP3

1. Drag IO OP3 to the display. Use the drop down to configure On/Off

2. Click 'Output' on the alarm block and drag the wire to IO OP3

3. In the pop up select 'PV'
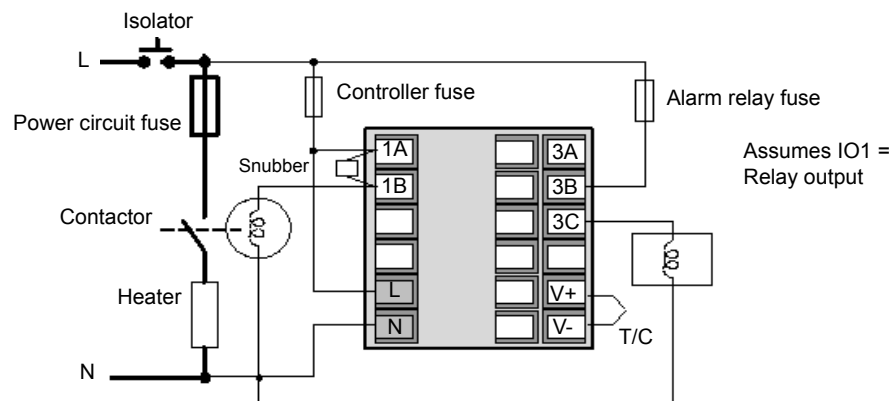
4. Select 'Download Wiring to Instrument'
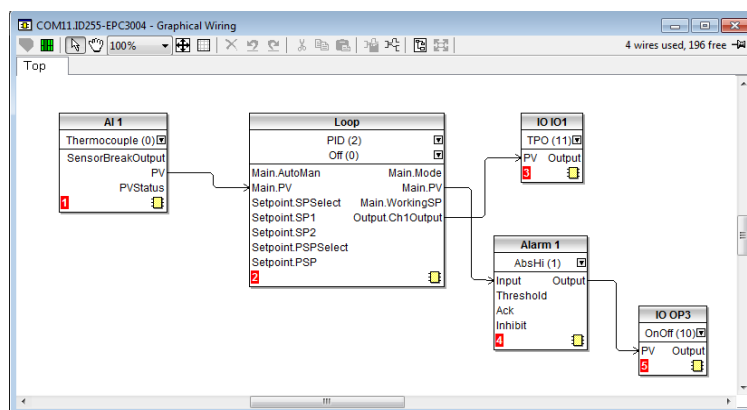
Save your application.

Further alarms and other function blocks can be added using the same procedure.
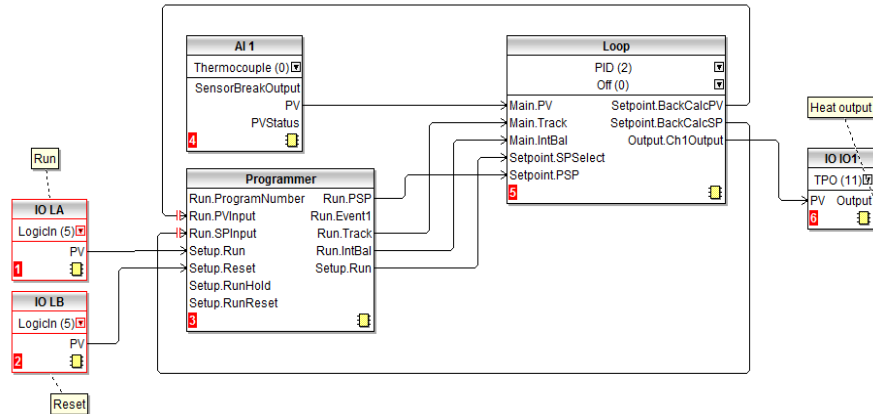
Physical wiring heat plus alarm relay

The diagram shows a summary of physical wiring for this example.

Example 4: Add a programmer

The figure below shows a simple soft wiring diagram for a programmer added to the basic controller.

The thermocouple is hard wired to Analogue Input AI1. The PV output from AI1 provides the input to the control loop. The setpoint for the control loop is provided by the programmer block using the parameter Run.PSP. The programmer will run when the Setup.Run parameter changes to true.

Integral balance is required to 'pre-load' the integral term. This minimises any sudden changes of output when it is known that a step change in the SP or PV may occur, as, for example, when the programmer is put into Run or Hold. This is provided by the wire between Programmer. Run.IntBal and Loop. Main.InBal.

LA provides an external contact input to run the selected program.

LB provides an external contact input to reset the selected program.

Example 5: Add a BCD switch to the programmer

An external BCD switch can be used to select a program. An example of the soft wiring for this for EPC3008 or EPC3004 using a four or eight digital input option is shown in the diagram below.
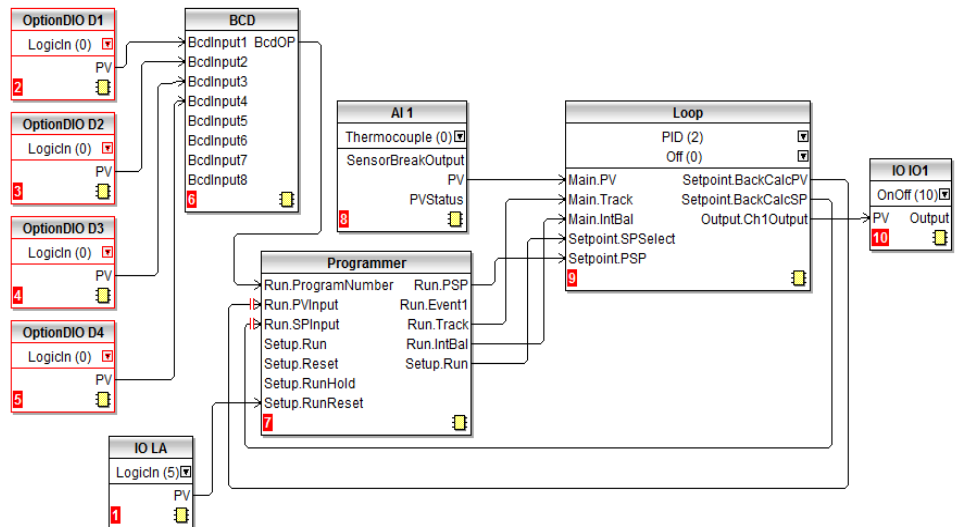
Further soft wiring examples may also be found in the User Manual.

## Example 6: Modify the alarms in the heat only controller.

This example uses the heat only standard application described in section "Application '1': - Heat only controller" on page 8. The general alarm relay will be removed. Alarm 1 and Alarm 2 will be wired to separate relay outputs (IO OP3 and IO2" respectively). Alarm 1 will be changed to deviation band. The sensor break alarm will be a 'soft' alarm (i.e. indication only). The remote setpoint alarm will be removed.

Note: It is useful make a clone file before making any changes to an application so that it is easy to revert to the original in the event that an incorrect change is made.

1. Select OR1, OR2 and Alarm 5 and delete. Comments may be deleted in the same way.

2. Select the wires to the Inhibit inputs of Alarm 1 and Alarm 2 and delete.

3. Click on the Output of Alarm 1 and drag a wire to the PV of IO OP3.

4. Click on the drop down in the Alarm 1 function block and select DevBand (5).

5. From the 'Blocks' list drag an output block (IO IO2) to the layout. Click on the drop down in the IO2 function block to select OnOff if necessary.

6. Click on the Output of Alarm 2 and drag a wire to the PV of IO OP2.

7. From the 'Blocks' list drag and drop a 'Comment' and add the required text (Underrange Alarm Relay). To link the comment to the function block click in the right hand corner of the comment box and drag a line to IO IO2.

8. Double click the comment related to IO OP3 and re-name as appropriate.

9. Select 'Download Wiring to Instrument'

The illustration below shows this modification downloaded to the controller
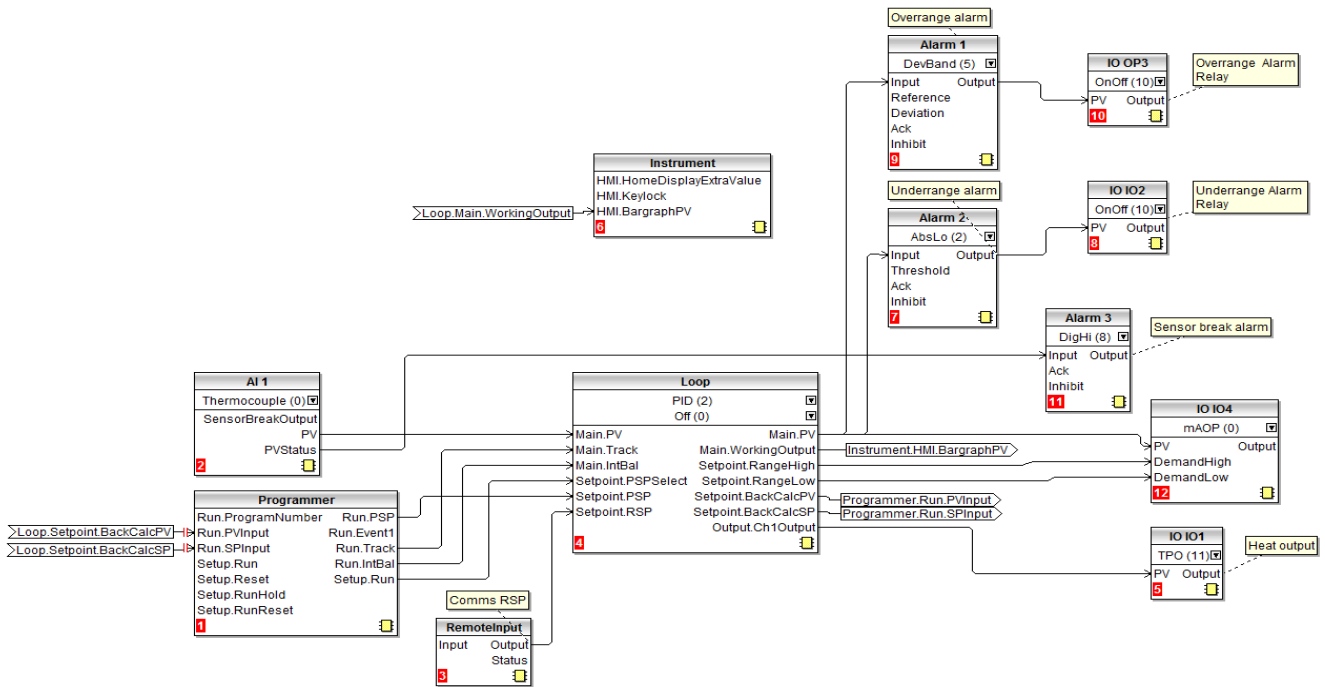
Save the application

Whenever an application has been developed make sure it is saved. In iTools select the SaveAs command and save it to a known place where it can be retrieved for future use. The file has a .uic extension.

This file may then be used clone other controllers which are used in the same application or to replace an existing controller should it be required in the future.

Scan for local contents

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this publication.