

LUXEL CORPORATION

# User's Guide

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## Radak Dual Controller

**Configured for integration with Inficon SQC-310C Deposition Controller**

**10/17/2011**



Thank you for choosing a Luxel **RADAK** Power Controller. We hope that you will find it simple to operate while offering advanced control options. Although specifically designed and optimized for controlling one of Luxel's line of **RADAK** evaporation furnaces, your **RADAK** Power Controller is also well-suited for many other power control applications, such as lamps, filament heaters, etc

## Warnings

Before installing, operating, inspecting or maintaining this instrument, carefully read this manual and fully understand safety cautions, specifications and operating procedures.

The information contained in this manual is subject to change without notice due to any engineering change or modification of the product for improvement. Please visit [www.luxel.com](http://www.luxel.com) for any available updates.

**Caution! Installation must be carried out by qualified personnel. Failure to install or operate this power controller in the manner described in this manual could result in injury of the operator and/or failure of the controller to meet its stated specifications.**

**Caution! Always unplug the power cord from the rear panel before removing any of the cabinet covers or components. Line voltage is present on exposed connectors and components inside the cabinet, and is capable of causing injury or death.**

Whenever it is likely that function of the unit has been impaired, the unit shall be made inoperative, and secured against accidental operation. Luxel should be contacted for advice.

The unit must be wired according to the instructions in this manual.

Signal and supply voltage wiring should be kept separate from one another. Where this is impractical, shielded cables should be used for the signal wiring.

In addition to the restrictions of this manual, requirements of the Eurotherm 3504 Engineering manual must also be observed.

## Warranty

Your Luxel **RADAK** Power Controller is warranted to be free of defects due to materials or workmanship for 1 (one) year from date of purchase. This warranty excludes damage caused by improper installation and intentional or inadvertent misuse (e.g. operating into an unsuitable load).

In the event of a warranty claim, Luxel Corporation reserves the right to either repair or replace the unit at our discretion.



## Introduction

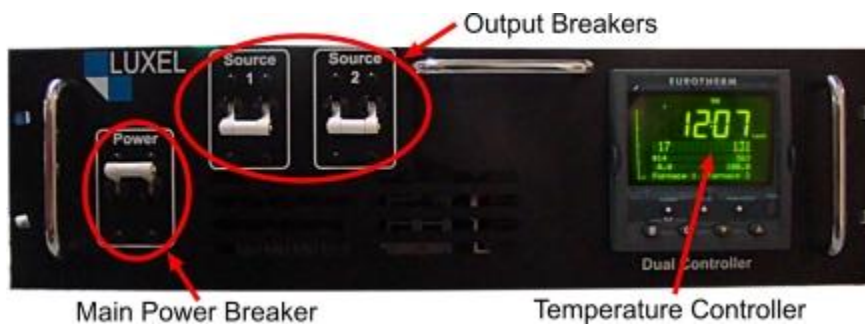
The Luxel Dual Controller provides power, programming, and feedback capabilities for fully automated control of two Luxel RADAK thermal evaporation sources.



Based on Eurotherm's 3504 temperature controller/ programmer, the Dual controller has the flexibility needed to interface with your process control equipment, offering Ethernet communications, four programmable outputs, and five programmable inputs. Up to 20 additional logic inputs relay outputs can be added with the optional I/O expander board.

The following section provides a quick overview of system installation and setup. For detailed coverage of the Dual controller's programming and operation, please refer to the Eurotherm 3504 Engineering Handbook.

## Front Panel



### Main Power Breaker

The 15A main power breaker is the primary power shut off for power controller.

### Output Breakers

Two 30A breakers protect the controller in the event of a short in the power circuit outside of the controller. Placing the breakers in the off position (down) is also useful for controller setup allowing testing of programs and automation without applying power to the sources.



### Temperature Controller

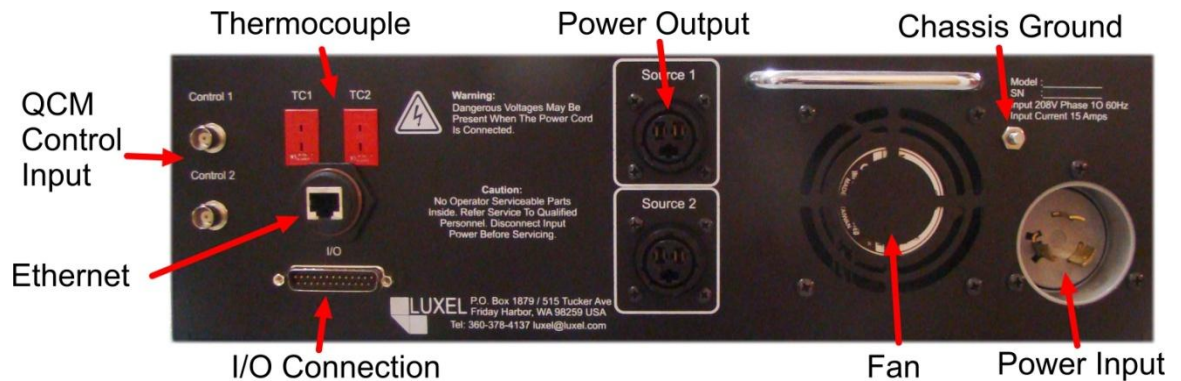
The Dual Controller is based on the Eurotherm 3504 temperature/ program controller.



The default display on the Dual Controller is a custom display different from the standard shown in the 3504 manual. This display allows monitoring of both furnaces simultaneously, and can be changed by the user as described in the 3504 Engineering Manual.

The main section of the display shows the time remaining in the current segment of the program. Below the main section are two columns displaying pertinent information on furnace 1 (left) and furnace 2 (right).

### Rear Panel



All external connection to the power controller are made via the back panel.

#### QCM Control Input

Input 0-10V signal to provide feedback from a deposition controller or other rate feedback mechanism.

#### Ethernet

Provides communication with the Eurotherm 3504 via Modbus TCIP protocol.



### Thermocouple

Provides temperature feedback from each Radak Furnace being controlled.

### I/O Connection

Digital input and output connection for process control equipment.

### Power Output

Supplies the Dual Controller power output to the Radak Furnaces.

### Power Input

NEMA L6-20 Connects the controller to 208VAC 1Ø 60Hz mains power supply.

## Installation

1. Secure the Dual controller in the position intended for use. The Dual Controller fits a standard 19" full width rack space. When mounting in a rack, the back of the controller must be supported.  
**Note: Supporting the controller with the front panel will result in damage to the controller case.**
2. Connect the cassis ground
3. Connect the power output cables to your vacuum chamber feedthrough
4. Connect the controller end of the power output cables to the Source 1 or Source 2 output connector.
5. Connect the thermocouple leads to connector TC1 or TC2 for source 1 or source 2 respectively. Be sure to rout the thermocouple leads away from high voltage sources which may induce signal noise.
6. Connect an Ethernet cable for access to the controller via your local area network.
7. Connect the I/O port to external equipment if desired. The I/O port may be connected to an Inficon SQC deposition controller directly using a standard DB-25 cable.
8. If using external setpoint feedback, connect a 0-10V signal using a BNC connector to Control 1 and Control 2 for remote setpoint trim on source 1 and source 2 respectively.

## Operation

### iTools

The 3504 controller is a feature rich device. Though all of the features of the 3504 can be accessed via the front panel, using iTools is *highly* recommended for anything but the most basic operations.

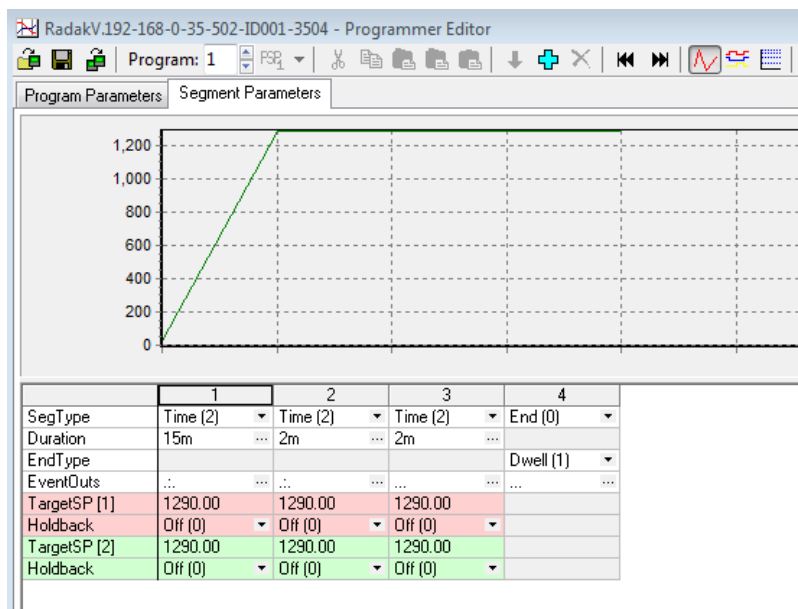
iTools is a free utility provided by Eurotherm. For the most current version, download and install iTools from [www.eurotherm.com/products/controllers/itools/](http://www.eurotherm.com/products/controllers/itools/).



To set up the controller for TCP communications over Ethernet, please follow the guide at the end of this document.

## Program

The Dual Controller comes with 10 programs with up to 500 segments each standard (upgradeable to 50 programs). A program consists of segments with a temperature setpoint and a segment type (ramps, steps, and dwells). The following is a discussion of a basic program setup using the Program Editor function inside iTools; for a complete description of the 3504 programming features refer to the 3504 Engineering Manual.



In the program above, both furnaces are ramped to 1290C over 15 minutes (segment 1), the source dwells at 1290C for 2 minutes (segment 2), runs at 1290C for 2 minutes (segment 3) and ends (segment 4) dwelling indefinitely at 1290C. TargetSP [1] and TargetSP [2] correspond to Output 1 and Output 2 respectively.

In this program, EventOut 2 is on in the first two segments then turned off in the third segment. The Dual controller is configured with EventOut 2 driving IO.Mod 2 B. Turning on EventOut 2 closes the contact between I/O connector pins 3 and 4. In the example above, this is used to trigger the Hold command in an attached deposition controller.

Once the source is at temperature and conditioned properly, EventOut 2 is turned off (segment 3) allowing the deposition controller to continue with the deposition.

With segment 4 (End) set to Dwell, the Dual Controller would maintain the furnace at 1290C indefinitely. An external signal from the deposition controller is used to reset the Dual Controller at the end of the deposition causing the temperature setpoints to return to 0 and the run is complete.

### Inficon SQC-310C Deposition Controller

The SQC-310C Quick Start guide has an excellent description of setting up



## Process

### Layers

Rate

Thickness

Sensor

### Film

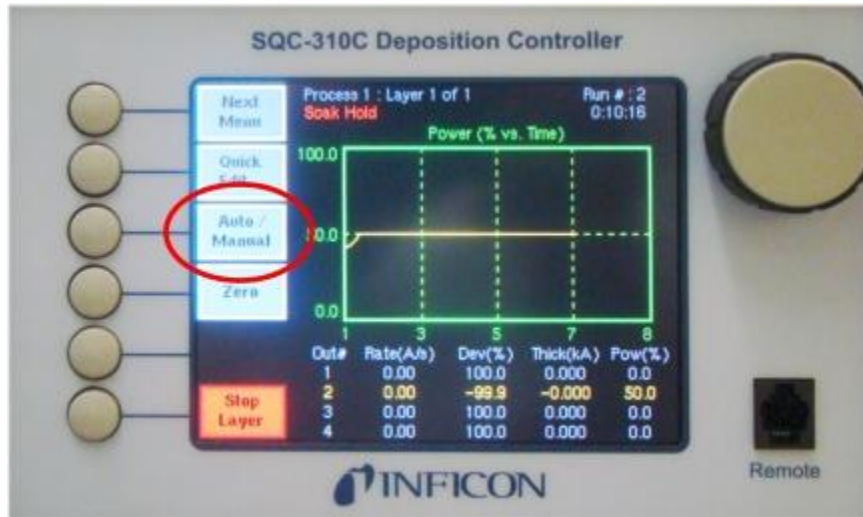
Material,  
Source

Z,TF,PID

Conditioning,  
Deposit

First, define the films to be deposited. Pay special attention to the conditioning and deposit phases. The conditioning phase is normally used to control the source heat up and soak to prepare the material for deposit. With the dual controller, this is done in the active program selected in the 3504. There is a logic statement in the SQC that triggers the active program to run when the SQC is in the preconditioning phase. While the SQC is not actively controlling the source temperature during warmup, this segment must be long enough for the logic statement to trigger the 3504 (1 to 5 seconds should be sufficient), the power must also be at 50% at the end of this phase to prevent the SQC from biasing the 3504's temperature setpoint.

The Deposition phase shutter delay and capture percentage define how long the SQC should wait for the desired rate to be achieved before opening the shutter and how close the deposition rate should be to the target rate (%). During this phase, the SQC will adjust the temperature setpoint in the 3504 to obtain rate. The SQC is tuned to react slowly to rate deviations so the program in the 3504 should be set to get rate as close as possible to the desired rate at the end of the preconditioning phase to prevent prohibitively long shutter delays. In co-depositions, the SQC will wait until both sources are within the capture percentage before opening the shutters.

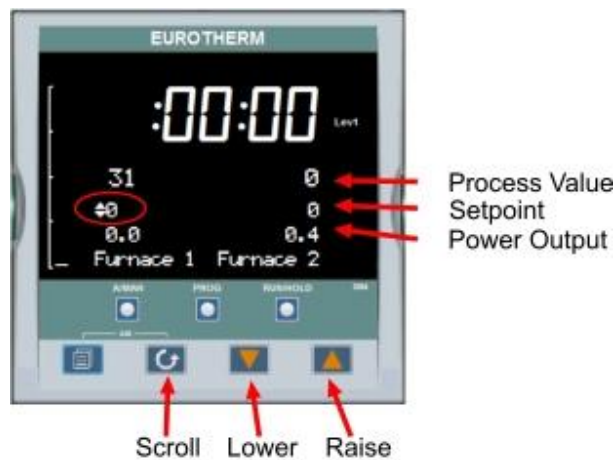


**NOTE: The SQC must be in Auto mode to trigger program operation in the 3504.**

### Dual Controller 3504 Operation

The home page, default on startup, is a custom page for the Dual Controller and is not addressed in the 3504 manual. You can return to this page at any time by pressing Page + Scroll except when in Config mode. The display will automatically return to the home page after 1 minute of inactivity. This can be adjusted in the config mode under Instrument.Display.HomeTimeout.


When not being actively controlled by a running program, the 3504 has two basic operating modes: Auto and Manual. In auto mode, the 3504 varies power as required to achieve and maintain the current setpoint. In Manual mode the operator sets the output power directly.



#### Auto mode

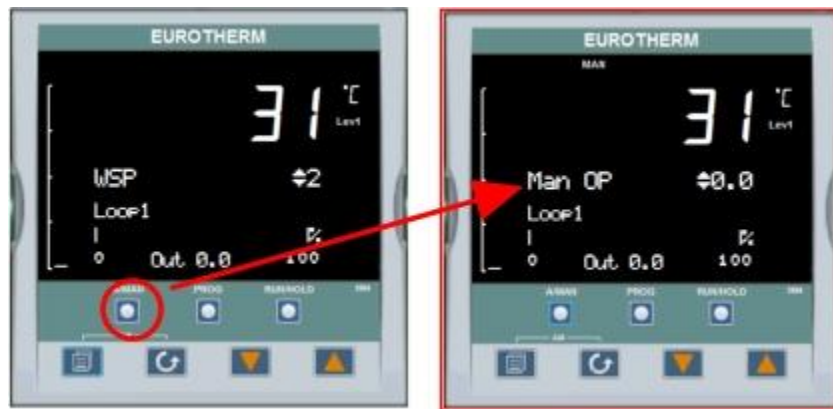
In Auto mode, the temperature setpoint can be changed using the Lower and Raise buttons on the front panel. Pressing the Scroll button advances to Furnace 2. Press the



Scroll button three times to return to the Furnace 1 setpoint. Pressing Page + Scroll -  will also return to the Furnace 1 setpoint. Pressing Page + Scroll will return to the home page from any screen except when in Config mode.

### Manual mode

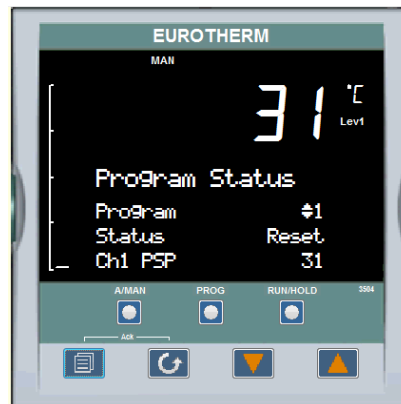
Caution should be used when operating the controller in manual mode as there is no temperature feedback and improper operation can result in damage to your sources. The controller is toggled between Auto and Manual mode by pressing the A/MAN button. **Important Note:** As of this writing, switching from Auto mode to Manual mode from the home screen changes to a display of furnace 1 in auto mode. To avoid confusion we recommend using the page button to advance to the desired furnace (or loop) then using A/Man to switch to manual mode.



Pressing the Page button will advance to Loop 2 (furnace 2). To return to Auto mode, press the A/MAN button.

### Program Selection

Press the page button three times to advance to the Program Status Page. Use the Lower and Raise buttons to select the active program.



### I/O Wiring and Programming

The Dual controller has three options for communication: Ethernet, dedicated I/O port, or optional I/O expander. Ethernet connection is discussed in detail in the iTools section above. Use of the I/O expander is discussed in the I/O expander documentation.



Communications with a PLC or other system controller can be made via the I/O port on the rear of the controller. The I/O port is a DB-25 connector with the following pinout:

Input			Output		
Wiring	Program	Pin(s)	Wiring	Program	Pin(s)
6A	Run	1,2	AA	Available	16,24
6B	Remote Setpoint	3,4	2A*	Event 1	17,24
6C	Reset	5,6	2B*	Event 2	18,24
LA	Available	11,12	2C*	Event 3	19,24
LB	Available	14,15			

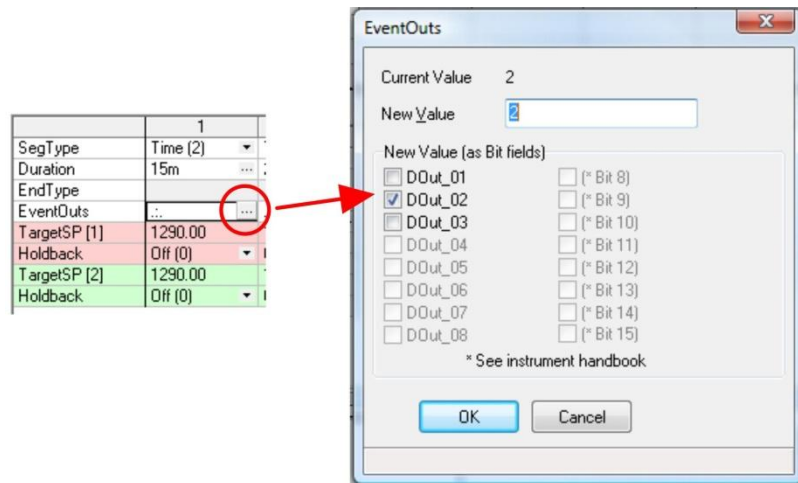
The input is triggered by a contact closure between the respective pins. In the current configuration, the active program is run by making contact between pins 1 and 2. This contact should be momentary to prevent conflict with the reset logic.

\*The output circuitry for 2A-C is configured at the factory for either contact or TTL logic. In the TTL logic configuration, a 5VDC signal is present between the associated pins when active. For contact configuration there is continuity between the pins.

Both inputs and outputs can be user re-assigned. Please refer to the 3504 Engineering manual for logic configuration.

Outputs can be triggered via alarms, program events, or any other aspect of the controller which has a value that changes. Logic statements and math statements can be combined to accomplish many useful tasks.

Outputs 2A, 2B, and 2C are pre-programmed to work with Events 1, 2, and 3 respectively. These events are turned on and off in each segment of the program.



In iTools, edit the program to establish ramps and soaks as needed. In each segment, the status of the events is displayed in the EventOuts row. To set the events for that



segment, click the ellipsis (...) button next to the events display. This will show the EventOuts window pictured above. Select the events to be on or off and click OK to update the status.

## 18. PORT SETUP

### 18.1. ITOOLS CONTROL PANEL


The iTools control panel applet allows access to system-level configuration items. These include Serial and TCP communications, and the ability to enter a product code to enable additional iTools features that have been purchased.

When setting up communications, it is normally necessary to have access to IT personnel in order to obtain some of the required information (e.g. IP addresses).

The control panel can be accessed in three ways:

1. It appears at the end of the installation process.
2. It can be accessed using the host pc Start menu
3. It can be opened from within iTools itself.


#### 18.1.1. Access from the Start menu

1. Operate the keyboard Start key , or click on 'Start' at the bottom left of the screen.



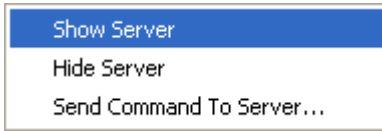
2. Click on 'Control Panel'.
3. If the control panel opens in 'Category View', click on 'Switch to Classic View'



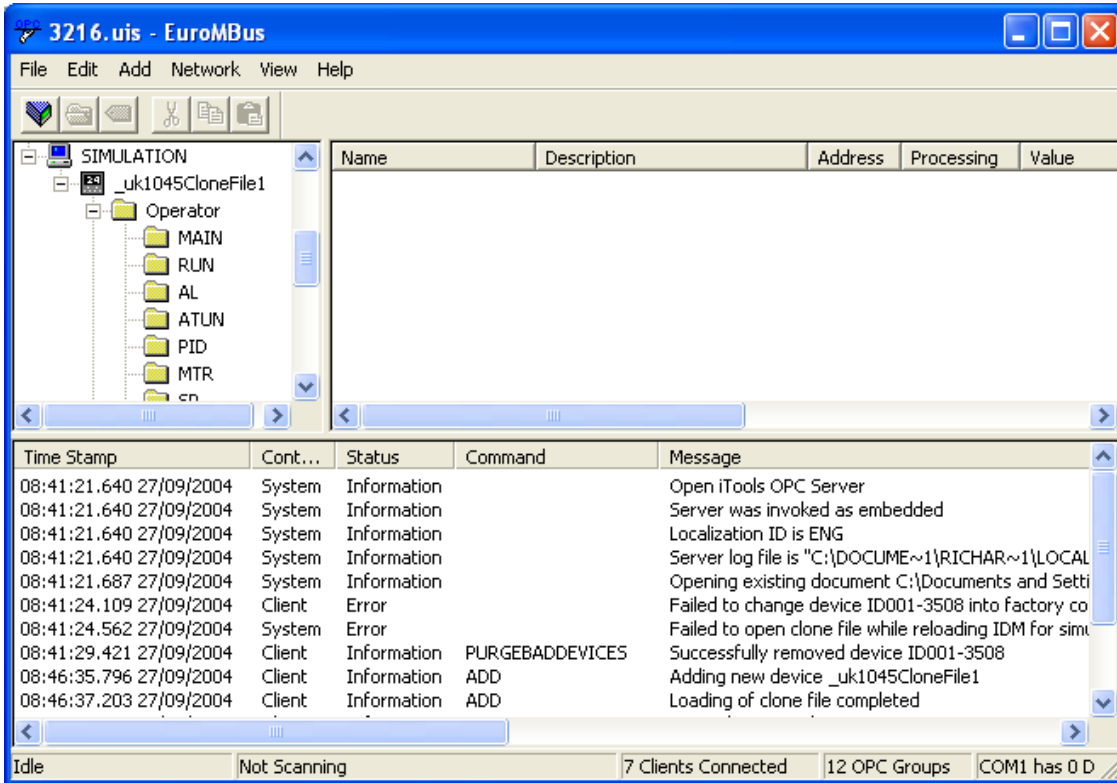
4. Find the iTools logo  and double click it to launch the Registry Settings window.

### 18.1.2. Access from within iTools

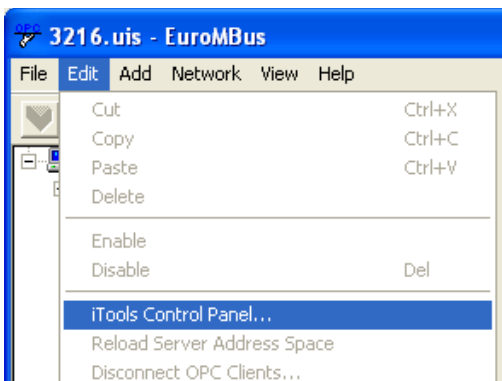
Select 'Advanced/Show Server' in the Options menu.



This opens the Server. The server window may appear on the screen, or may appear only as a new item in the task bar, according to the Windows operating system in use. Click on the Server item in the task bar if necessary to open the Server window.



In the Edit menu, select 'iTools Control Panel'.

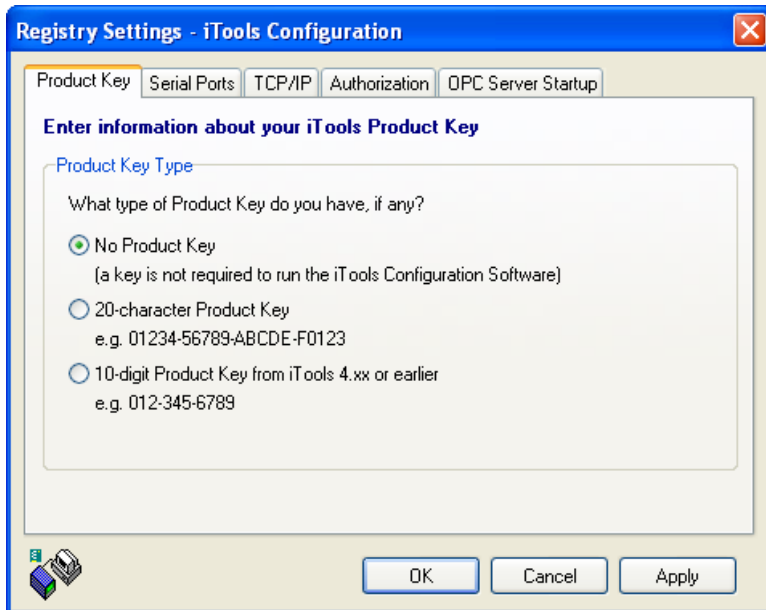


This opens the 'Registry Settings' window:

### 18.1.3. Registry Settings window

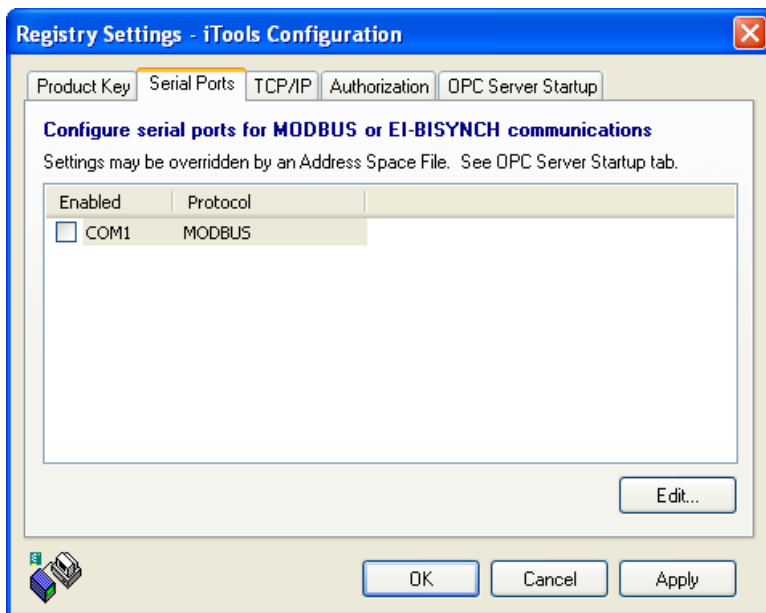
The registry window opens. In order to edit the contents of more than one tab, the 'Apply' key should be clicked on before the next tab is accessed. Clicking on 'OK' in any of the tabs, closes the window

#### PRODUCT KEY TAB



This allows users with Product keys to enter the key number to allow access to iTools features.

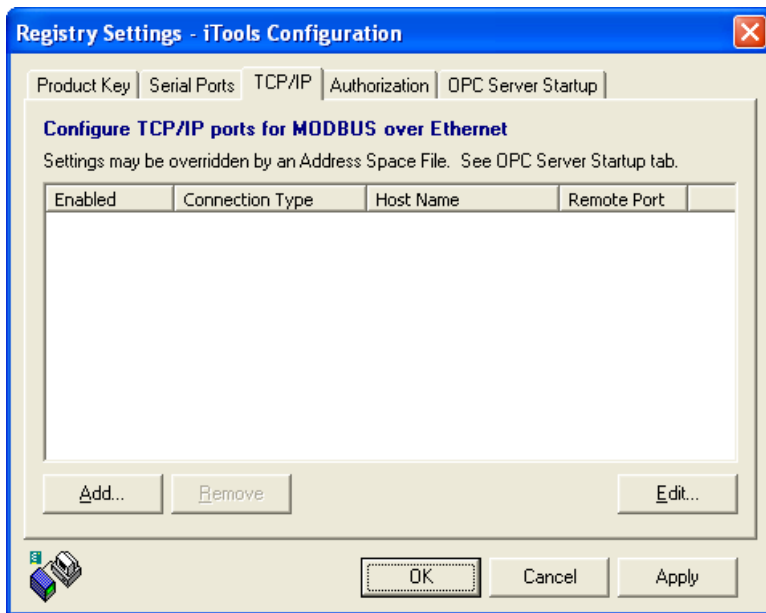
#### SERIAL PORTS TAB



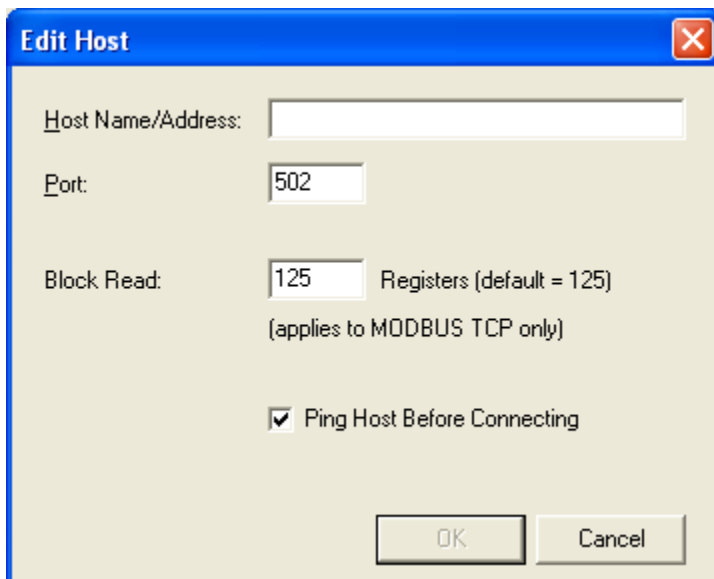
Click on the relevant port to enable it for use by iTools. Port characteristics can be edited if required (Edit... key), but this facility should be used only by advanced users.

## 18.1.3 REGISTRY SETTINGS WINDOW (Cont.)

## TCP/IP TAB

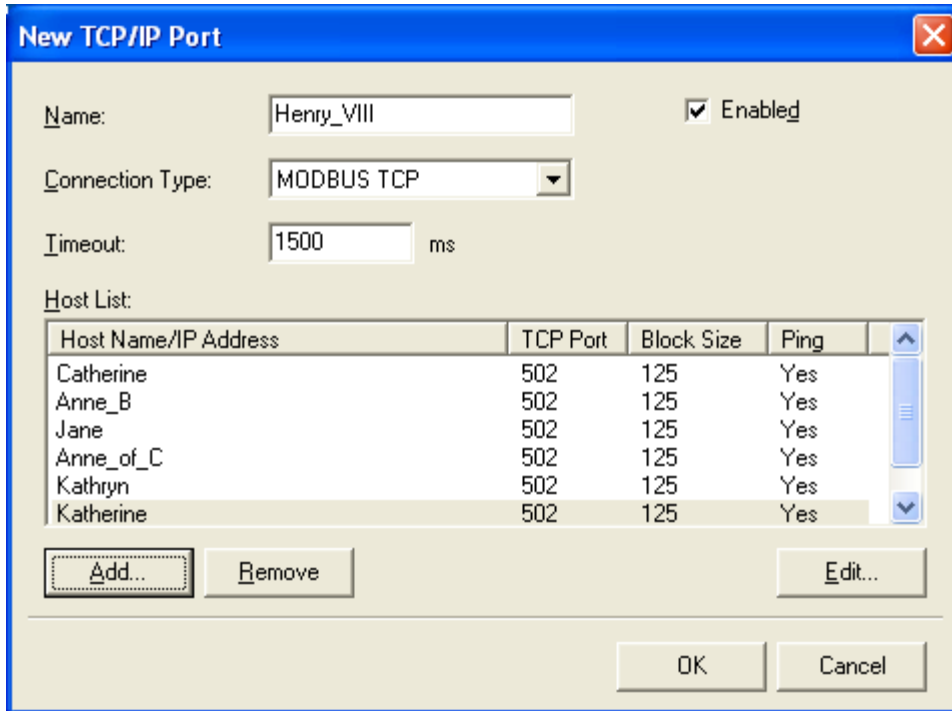


Clicking on 'Add' calls the 'New TCP/IP Port' configuration window. This window is initially empty. New ports can be added to the list by clicking on the 'Add' key, and typing in a name for the Port in the 'Edit Host' window which appears.

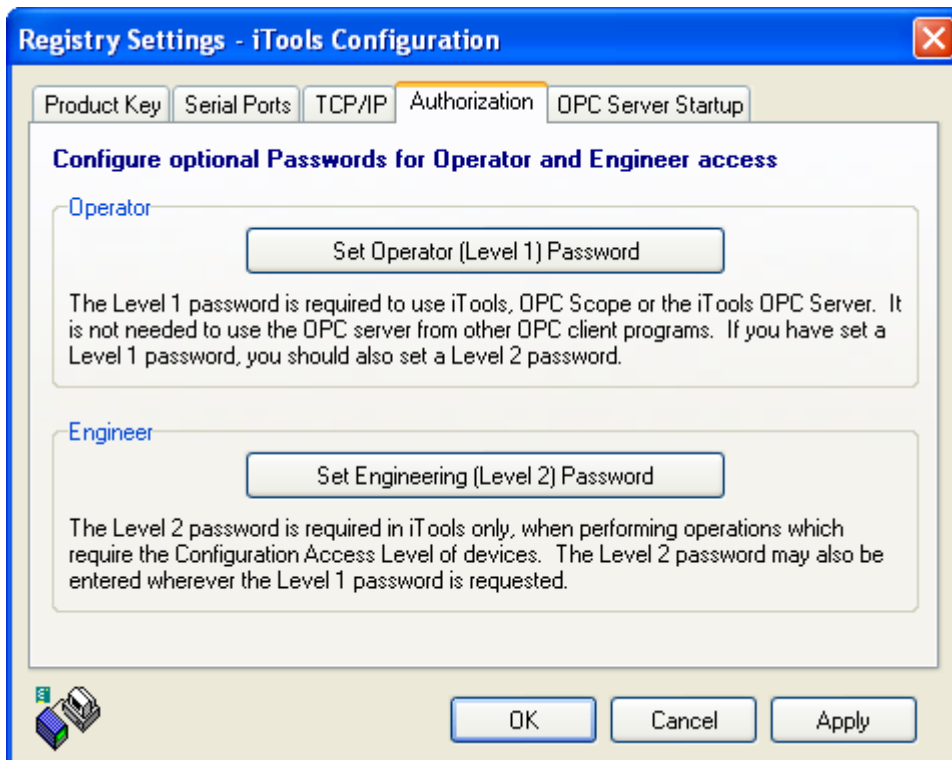


Once a name has been entered for the Port (Henry\_VIII), the with the relevant port selected, clicking on the Add key allows the user to enter the names or IP addresses of one or more hosts to be associated with the new Port.

## 18.1.3 REGISTRY SETTINGS WINDOW (Cont.)



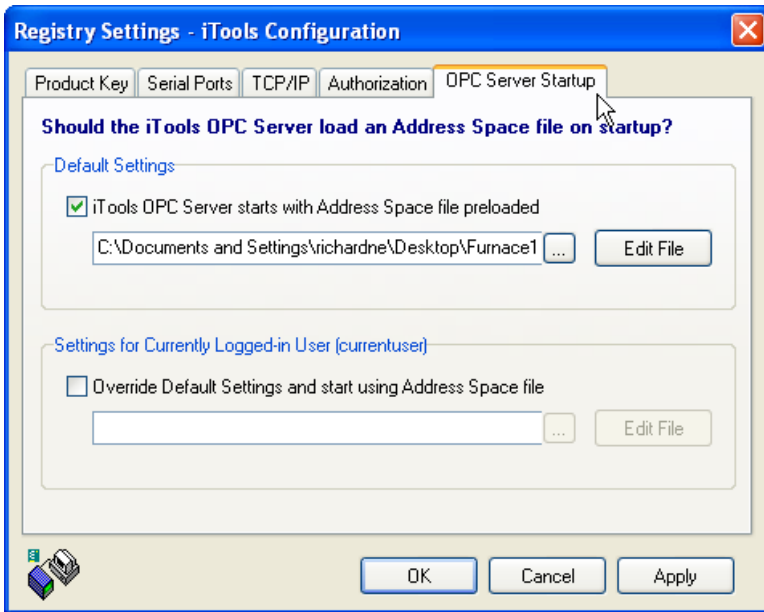
## AUTHORIZATION TAB



This allows passwords to be entered, but the fields can be left blank if so desired.

## 18.1.3 REGISTRY SETTINGS WINDOW (Cont.)

## OPC SERVER STARTUP TAB



If the server configuration has previously been saved, then a saved file path name appears in the Default settings field. The ellipsis key can be clicked on to allow an alternative default to be selected. If required, the default setting can be overridden, for the current user, by clicking on the 'Override Default Settings.....' area and browsing to the required filename.

When saving the server configuration to a new name (Server File menu Save As...) , the user is asked whether this new name is to become the default, and if so, whether it is to be the default for all users or only for the currently logged in user.

