GE Healthcare

MicroCal™ iTC_{200} System

Operating Instructions

Original Instructions

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1 Introduction

Purpose of the Operating Instructions

The Operating Instructions provide you with the instructions needed to handle the MicroCal iTC_{200} in a safe way.

Prerequisites

In order to operate the MicroCal iTC_{200} safely and according to the intended purpose the following prerequisites must be met:

- You should have a general understanding of the use of a personal computer. running Microsoft™ Windows™ in the version provided with your product.
- You should be acquainted with the use of general laboratory equipment and with handling of biological materials.
- You must read the Safety Instructions in *Chapter 2* of these Operating Instructions.
- The system should be installed according to the instructions in *Chapter 3* of these Operating Instructions.
- You should understand the concepts of titration Calorimetry.
- You must read and understand these Operating Instructions.

In this chapter

This chapter contains important user information and a general description of the MicroCal iTC_{200} and its intended use.

1.1 Important user information

Read this before using the MicroCal iTC$_{200}$

All users must read the Safety Instructions in *Chapter 2* of these Operating Instructions before installing, using or maintaining the system.

Do not operate the MicroCal iTC$_{200}$ in any other way than described in the user documentation. If you do, you may be exposed to hazards that can lead to personal injury and you may cause damage to the equipment.

Intended use

The MicroCal iTC$_{200}$ is an Isothermal Titration Calorimeter system designed for bio-molecular interaction studies in research applications.

The MicroCal iTC$_{200}$ system is intended for research use only and shall not be used in any clinical procedures or for diagnostic purposes.

Safety notices

These Operating Instructions contain WARNINGS, CAUTIONS and NOTICES concerning the use of the product, with meanings as defined below.

WARNING
WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury. It is important not to proceed until all stated conditions are met and clearly understood.

CAUTION
CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. It is important not to proceed until all stated conditions are met and clearly understood.

NOTICE
NOTICE indicates instructions that must be followed to avoid damage to the product or other equipment.

Notes and tips

Note: *A Note is used to indicate information that is important for trouble-free and optimal use of the product.*

Tip: *A tip contains useful information that can improve or optimize your procedures.*

Typographical conventions

Software texts and commands are identified by ***bold italic*** text. A colon is used to separate menu levels (e.g. ***File:Open*** refers to the ***Open*** option in the ***File*** menu).

1.2 Regulatory information

This section lists the directives and standards that are fulfilled by MicroCal iTC$_{200}$.

Manufacturing information

Requirement	Content
Name and address of manufacturer	GE Healthcare MicroCal Products Group 22 Industrial Drive East Northampton, Massachusetts 01060 USA
Place and date of declaration	Northampton, Massachusetts, USA, Jan. 2010
Identity of person authorized to sign Declaration of Conformity	See EC Declaration of Conformity in system documentation kit.
Date of manufacture and serial number	The serial number contains the code for the year of the manufacture of the instrument. (the serial number takes the form of) xx.yy.zzz where yy = year of manufacture.

CE conformity

Directive	Title
2006/42/EC	Machinery Directive (MD)
2006/95/EC	Low Voltage Directive (LVD)

Directive	Title
2004/108/EC	ElectroMagnetic Compatibility (EMC) Directive

International standards

Standard	Description	Notes
EN 61010-1, IEC 61010-1, CAN/CSA-C22.2 no. 61010-1	Safety requirements for electrical equipment for measurement, control and laboratory use	
EN 61326-1 (CISPR Group 1, Class A)	EMC emissions and immunity requirements for measurement, control and laboratory use	Harmonized with 2004/108/EC
EN-ISO 12100-1, 12100-2	Safety of machinery – Basic concepts, general principles and design	Harmonized with 2006/42/EC
EN-ISO 14121-1, 14121-2	Safety of machinery – Principles of risk assessment	Harmonized with 2006/42/EC

CE marking

The CE marking and the corresponding Declaration of Conformity is valid for the instrument when it is:

- used as a stand-alone unit, or
- connected to other CE-marked instruments, or
- connected to other products recommended or described in the user documentation, and
- used in the same state as it was delivered from GE Healthcare, except for alterations described in the user documentation or explicitly authorized by GE Healthcare.

Regulatory compliance of connected equipment

Any equipment connected to the MicroCal iTC_{200} should meet the safety requirements of EN 61010-1/IEC61010-1 or relevant harmonized standards. Within the European Union, connected equipment must be CE-marked.

1.3 Instrument

The MicroCal iTC$_{200}$ (Isothermal Titration Calorimeter, 200 µL cell) unit directly measures heat evolved or absorbed in liquid samples as a result of mixing precise amounts of reactants. A spinning syringe is utilized for injecting and mixing of reactants. Spin rates are user selectable; the usual range is 500 to 1000 rpm. The normal temperature operating range is 2°C to 80°C. Wetted cell surfaces are Hastalloy, which are resistant to most solutions, however, strong acids should be avoided.

Sample and reference cells are accessible for filling and cleaning through the top of the unit. The sample cell is on the left as one faces the front of the unit. A pair of identical coin shaped cells is enclosed within two shields; the inner shield is referred to as the jacket. Access stems travel from the top exterior of the instrument to the cells. Both the coin shaped cells and the access stems are completely filled with liquid during operation. This requires approximately 280 µL per cell even though the working volume of the cell is only 200 µL.

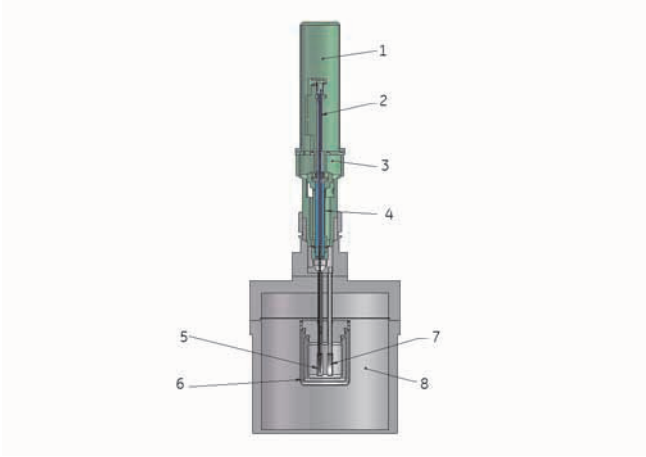

Figure 1-1. Principle drawing of ITC.

Part	Description	Part	Description
1	Pipette	5	Sample cell (with syringe)
2	Plunger screw (dark blue)	6	Adiabatic jackets
3	Stirring motor	7	Reference cell
4	Syringe (light blue)	8	Outer shield

Figure 1-2. MicroCal iTC$_{200}$ complete system.

Part	Description	Part	Description
1	Controller	4	Washing module
2	MicroCal iTC$_{200}$	5	Tower
3	Pipette	6	Cell Unit

Temperature differences between the reference cell and the sample cell are measured, calibrated to power units and displayed to the user as well as saved to disk. The data channel is referred to as the DP signal, or the differential power between the reference cell and the sample cell. This signal is sometimes thought of as the "feedback" power used to maintain temperature equilibrium. Calibration of this signal is obtained electrically by administering a known quantity of power through a resistive heater element located on the cell.

In a typical experiment, the syringe containing a ligand is titrated (injected) into the cell containing a solution of macromolecule. An injection which results in the evolution of heat (exothermic) within the sample cell causes a negative change in the DP power, since the heat evolved chemically provides heat that the DP feedback is no longer required to provide.

The opposite is true for endothermic reactions. Since the DP has units of power, the time integral of the peak yields a measurement of thermal energy, dH. This heat is released or absorbed in direct proportion to the amount of binding that occurs. When the macromolecule in the cell becomes saturated with added ligand, the heat signal diminishes until only the background heat of dilution is observed.

With the MicroCal iTC$_{200}$ system the entire experiment takes place under computer control. The user inputs the experimental parameters (temperature, number of injections, injection volumes) and the computer carries out the experiment. <DoNotTranslate_GE_Color>Origin™ software is then used to analyze the ITC data using fitting models to calculate reaction stoichiometry (n), binding constant (K_A), enthalpy (ΔH) and entropy (ΔS).

1.4 Control software

In order for the system to initialize properly, all components must be powered up in the correct order. First, boot up the computer and log in to Windows. Once Windows has started, power the MicroCal iTC$_{200}$ by operating the switch at the rear of the unit. After several seconds, open the MicroCal iTC$_{200}$ software. If the option is selected, a real-time copy of <DoNotTranslate_GE_Color>Origin will open automatically, as well as the MicroCal iTC$_{200}$ control software.

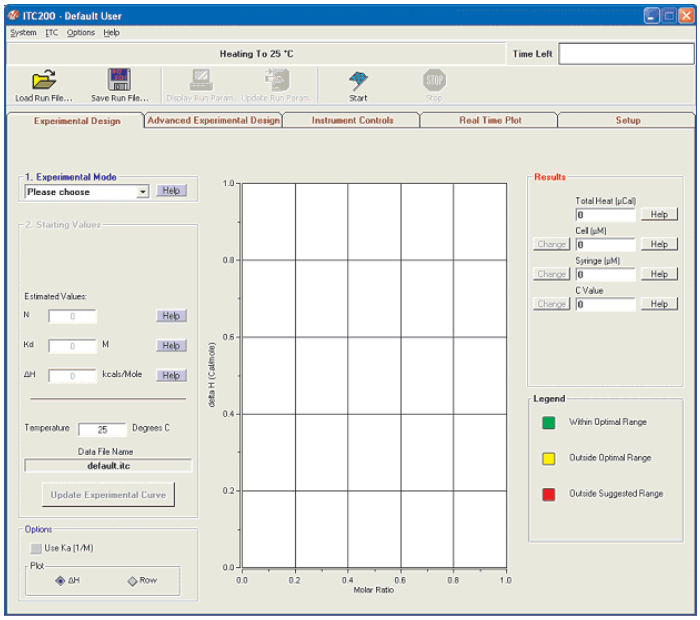

Figure 1-3. Instrument control software.

When the instrument first boots up, the line just below the menus reads "System Initialization - Please Wait", which is the current status of the instrument. After a few seconds, the system will begin heating or cooling to the preset temperature. If the instrument is not attached or not turned on, the program will open into Demo Mode, in which the user can see and manipulate the program, but it will not attempt to control the MicroCal iTC$_{200}$. To the right of the status bar, the ***Time Left*** box, during a run, will show the time left until the end of the run.

When the software is first started, the ***Experimental Design*** tab is selected; this contains the simple run controls. ***Experimental Mode*** can be ***Highest Quality***, ***Minimum Protein***, or ***High Speed***. The expected n, K_D, and ΔH and the desired run temperature will allow the software to calculate the recommended concentrations for the cell and syringe, and set the run parameters. The ***Advanced Experimental Design*** tab contains more direct controls for the more advanced user. This tab should be very familiar to users of the VP line of instruments. The ***Instrument Controls*** tab allows the user to name the output files, choose post-run analysis options, and start and stop the run. The ***Real Time Plot*** tab shows the data currently being generated. The ***Setup*** tab contains various options and preferences.

Origin software

Origin Real-Time Display

This section describes the functionality of the optional copy of <DoNotTranslate_GE_Color>Origin for real-time display. When the software is opened, it will open the <DoNotTranslate_GE_Color>Origin™ project window ***VPITCPLOT.OPJ*** for real time data display. This project of <DoNotTranslate_GE_Color>Origin is dedicated to data display only, and should not be used for data analysis. Users should open a separate copy of <DoNotTranslate_GE_Color>Origin for MicroCal iTC$_{200}$ to perform data analysis. Pictured below is the main <DoNotTranslate_GE_Color>Origin window for MicroCal iTC$_{200}$ data display.

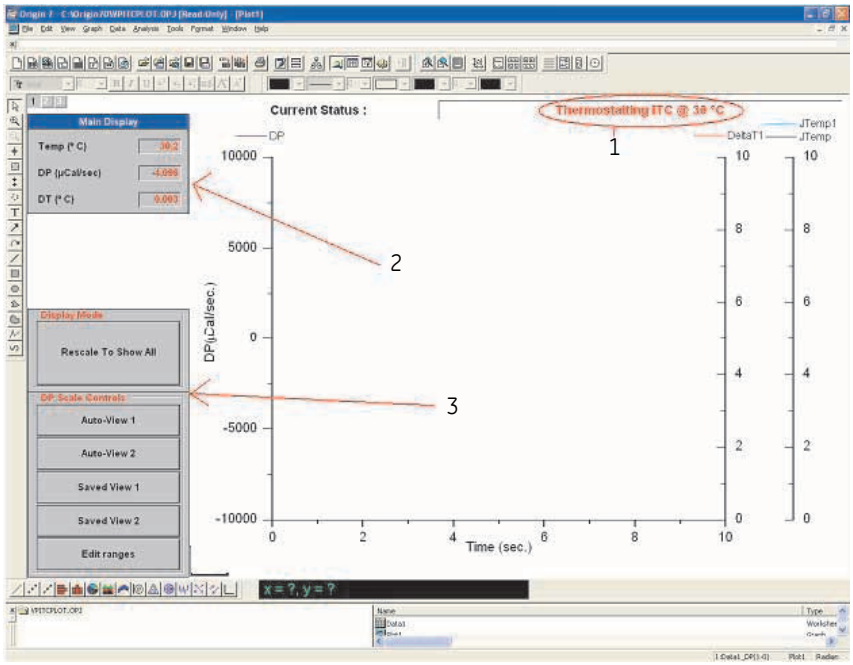

Figure 1-4. <DoNotTranslate_GE_Color>Origin Real-Time display.

No.	Description
1	iTC cell status
2	iTC numeric display
3	Buttons for iTC data display

The ITC cell status, the MicroCal iTC$_{200}$ numeric display and the buttons for MicroCal iTC$_{200}$ data tools (as indicated above) have been added for user convenience in viewing data generated by the MicroCal iTC$_{200}$. For a more thorough description of these real-

time tools in <DoNotTranslate_GE_Color>Origin, refer to the MicroCal iTC$_{200}$ Experimental and Data Analysis Tutorial Guide.

2 Safety instructions

The points below are intended to enhance your safety awareness and to draw your attention to risks which only you, the operator, can prevent. While GE Healthcare works to ensure that the instrument is designed and tested to be as safe as possible, proper handling is also critical. The operators should be responsible people trained in basic laboratory protocol, and they should be familiar with the possible hazards before operating this instrument. All instrument modifications should be performed only by personnel trained by GE Healthcare. Equipment damage, personal injury or even death may result if this equipment is operated, altered or maintained by untrained personnel or in an irresponsible or improper manner.

2.1 Safety precautions

Introduction

Before installing, operating of maintaining the system, you must be aware of the hazards described in the user documentation. Follow the instructions provided to avoid personal injury or damage to the equipment.

The safety precautions in this section are grouped into the following categories:

- General precautions
- Flammable liquids
- Personal protection
- Installing and moving the instrument
- System operation
- Maintenance

General precautions

WARNING!
Provide proper electrical power to the instrument. This should be 100 – 240 Volt, 50/60 Hertz alternating current, with a Ground Fault Circuit Interrupter (GFCI). Some power strips, such as the one provided by GE Healthcare with your instrument, contain a GFCI. All power plugs and cords should be 3-prong, grounded cables or outlets.

WARNING!
In case of fire, unplug instrument.

WARNING!
Do not operate the MicroCal iTC$_{200}$ in any other way than described in the MicroCal iTC$_{200}$ and/or Auto-MicroCal iTC$_{200}$ manuals.

WARNING!
Make sure the rear power connector is always accessible.

WARNING!
Use caution when using solutions near the instrument. If any liquid is spilled on or around the instrument, unplug the instrument immediately and wipe it up. If there is any possibility that liquid may have leaked into the instrument case, contact GE Healthcare immediately. Do not plug the instrument into any electrical outlet until the problem is resolved.

WARNING!
This instrument is not designed to the Medical Devices Directive 93/42/EEC and should not be used for medical purposes and/or in the diagnosis of patients.

NOTICE
The MicroCal iTC$_{200}$ cells are constructed out of Hastelloy. Strong acids should be avoided.

Using flammable liquids

WARNING!
A fume hood or similar ventilation system shall be installed when flammable or noxious substances are used.

WARNING!
Fire Hazard. Before starting the system make sure that there is no leakage.

Personal protection

WARNING!
Always use protective glasses and other personal protective equipment appropriate with the current application, to ensure personal safety during operation.

WARNING!
The operator should always follow proper laboratory procedures in handling and disposing of volatile or hazardous solutions.

WARNING!
This instrument is used for a wide variety of experiments that can utilize potentially hazardous materials. Use of these could cause exposure to biological, chemical and radiation hazards depending on the user's experiments. Users should educate themselves about the samples they are using to avoid these hazards.

Installing and moving the instrument

WARNING!
Power cord. Only use power cords delivered or approved by GE Healthcare.

WARNING!
Do not block the ventilation inlets or outlets on the system.

WARNING!
The Washing Module may only be powered by the power supply provided with the Unit.

WARNING!
Installing the controller. The controller should be installed and used according to the instructions provided by the documentation included in the shipment.

WARNING!
Replace fuses ONLY with 4.00 Amp 250 Volt Time Delay Fuses. Several spare fuses are provided with the original shipment.

WARNING!
Access to power switch and power cord. Do not block the rear and side panel of the instrument. The Power switch must always be easy to access. The power cord must always be easy to disconnect.

NOTICE
Disconnect power. To prevent equipment damage, always disconnect power from the MicroCal iTC_{200} and washing module system before an instrument module is removed or installed or a cable is connected or disconnected.

System operation

WARNING!
All solutions in the cells must be cooled down below 40°C before removal. Any higher temperature may cause the syringe to break, and will increase the dangers of most hazardous solutions.

WARNING!
Do not place containers of liquid on top of the instrument, except those designed for the washing module. Spilled liquid is a fire and electrical hazard.

CAUTION
Waste tubes and containers shall be secured and sealed to prevent accidental spillage.

NOTICE
Never allow liquid in the cells to freeze. The expansion of the liquid can distort the cells and rupture the most critical sensor, causing irreparable damage.

NOTICE
Intermittent operation of the Washing Module is required so that the Washing Module valves are on for a maximum of 20 minutes, then off for 30 minutes. Software limits the valve on period to 10 minutes before an experiment, so this does not affect normal operation of the instrument.

NOTICE
The MicroCal iTC$_{200}$ instrument should always be moved in its normal operating orientation. Other orientations will subject delicate sensors inside the instrument to stress.

Maintenance

WARNING!
Replace fuses ONLY with same type fuses. Several spare fuses are provided with the original shipment and the power receptacle is labeled with the correct type.

WARNING!
Repairs, alterations or modifications must only be carried out by a GE Healthcare specialist, or with explicit directions from a GE Healthcare technician. Removal or modification of any cover or component could result in an unsafe or easily damaged instrument. The GE Healthcare service department will be happy to answer any questions and provide parts and service when necessary.

WARNING!
Only spare parts that are approved or supplied by GE Healthcare may be used for maintaining or servicing the system.

WARNING!
Disconnect power. Always disconnect power from the instrument before replacing any component on the instrument, unless stated otherwise in the user documentation.

WARNING!
Hazardous chemicals during run. When using hazardous chemicals, flush the entire system tubing with distilled water, before service and maintenance.

WARNING!
Hazardous chemicals during maintenance. When using hazardous chemicals for cleaning, wash the system with a neutral solution in the last phase or step.

WARNING!
Decontaminate the equipment before decommissioning to ensure the removal of all hazardous residues.

WARNING!
CONTRAD® 70 (Decon 90) is corrosive and therefore dangerous to health. When using hazardous chemicals, avoid spillage and wear protective glasses, gloves, and other suitable personal protective equipment.

2.2 Labels

Labels on the instrument

The illustration below shows an example of the identification labels attached to the rear of the MicroCal iTC$_{200}$ instrument.

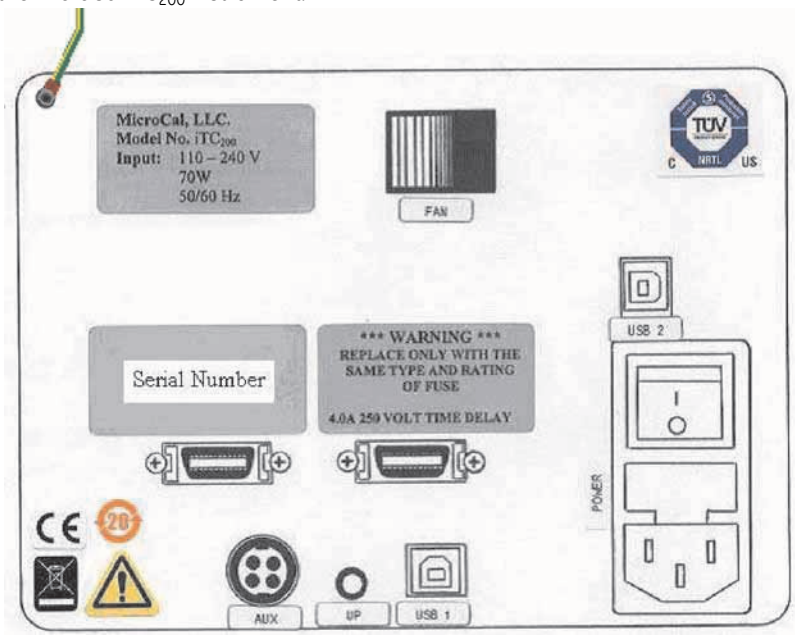

Figure 2-1. Back panel of instrument.

Labels on the USB hub

The illustration below shows an example of the label on the back of the USB hub.

Figure 2-2. USB hub label.

Labels on the Washing Module

The illustration below shows an example of the identification labels attached to the rear of the Washing Module.

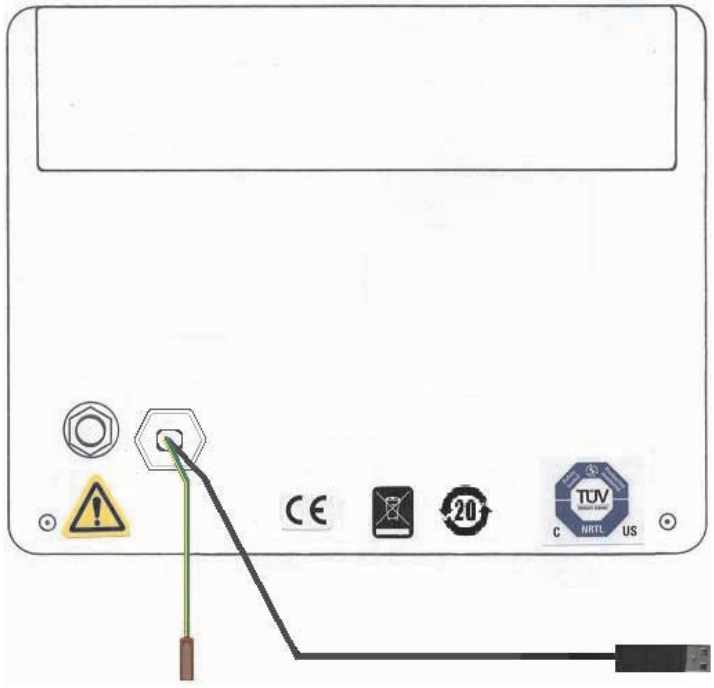

Figure 2-3. Labels on Washing Module.

Symbols used in safety labels

	The system complies with the requirements for electromagnetic compliance (EMC) in Australia and New Zeeland.
	**Warning!** Read the user manual before using the system. Do not open any covers or replace parts unless specifically stated in the user manual.
	The system complies with applicable European directives.

Labels concerning hazardous substances

	This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact and authorized of the manufacturer for information concerning the decommissioning of equipment.
	This symbol indicates that the product contains hazardous materials in excess of the limits established by the Chinese standard SJ/T11363-2006. Requirements for Concentration Limits for certain Hazardous Substances in Electronics.

Emergency procedures

In an emergency situation, do as follows to stop the run:

Step	Action
1	Disconnect the equipment from the power outlet.

Power failure

MicroCal iTC$_{200}$

- The run is interrupted immediately, in an undefined state.
- The data collected up to the time of the power failure is saved.

Controller

- The controller shuts down, in an undefined state.
- The MicroCal iTC$_{200}$ run is interrupted immediately, in an undefined state.

Washing module

- The washing module shuts down immediately, in an undefined state.

2.3 Recycling procedures

The equipment shall be decontaminated before decommissioning and all local regulations shall be followed with regard to scrapping of the equipment.

Disposal, general instructions

When taking the MicroCal iTC$_{200}$ system out of service, the different materials must be separated and recycled according to national and local environmental regulations.

Recycling of hazardous substances

The MicroCal iTC$_{200}$ instrument contains hazardous substances. Detailed information is available from your GE Healthcare representative.

Disposal of electrical components

Waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of GE Healthcare for information concerning the decommissioning of equipment.

3 Installation

NOTICE
It is recommended that the installation of the MicroCal iTC$_{200}$ instrument be performed by GE Healthcare personnel.

This section provides information about the installation of MicroCal iTC$_{200}$.

Figure 3-1. MicroCal iTC$_{200}$ with washing module and control computer..

Any equipment connected to the MicroCal iTC$_{200}$ must fulfill applicable standards and local regulations.

3.1 Site requirements

The MicroCal iTC$_{200}$ with Controller requires about 1 meter of normal bench space (ca. 70 cm wide). This location should be away from strong drafts, room temperature fluctuations, intense sunlight, vibrations and strong electrical or magnetic fields (as may be produced by an NMR, microwave oven, large motors or refrigeration units). In addition the mains power source (100 to 240 VAC) should be properly grounded and free from voltage fluctuations, harmonic distortions, power dips and spikes. The AC power line should be dedicated to the MicroCal iTC$_{200}$ system and should not share that power with additional equipment.

Although, the power filtering in the MicroCal iTC$_{200}$ instrument is adequate for most laboratory environments, some disturbances may affect the performance of the instrument and it may be necessary to have the AC Mains power source evaluated (see table below) or install a power conditioner. Since power source problems can be manifested in many different ways, it is not possible to recommend a power conditioner for all situations. It is recommended that you test a power conditioner, at your location, before you purchase it. If you believe you are experiencing power source related problems, please contact a GE Healthcare field engineer.

Table 3-1. Power supply requirements.

AC Mains Requirements	
Specification	**Requirement**
Voltage Regulation	100 to 240 VAC, stable to ± 3%
Frequency Stability	0.5% Maximum Deviation
Power Line Noise	< 3% Common Mode or Differential Mode at any Frequency
Harmonic Content	< 5% Total Harmonic Distortion to 1500 Hz, < 3% For any Single Frequency
Ground Noise	< 1 VAC Peak-To-Peak, < 2 VAC Ground to Neutral Peak-To-Peak at any Frequency
Ground Quality	< 25 Ohm

It is emphasized that room temperature fluctuations (i.e. maximum 2.5 °C) due to the cycling on/off of heating and cooling systems, strong air currents, sunlight directly on the instrument and through space electromagnetic waves may cause subtle performance problems.

Table 3-2. Environmental operating requirements.

Environmental (Operating) requirements	
Temperature	10 to 28°C, constant to 2.5°C
Humidity	0 to 70% Relative Humidity, non-condensing
Atmospheric Pressure	700 hPa to 1060 hPa

3.2 Transport

NOTICE
Lift the MicroCal iTC$_{200}$ instrument in the upright position. Do not use the front panel cover as a lifting handle.

Before moving the system:

- Disconnect all cables and tubing connected to peripheral components and liquid containers.
- Remove all items from the top of the system.
- Grasp the system under the two sides.

3.3 Unpacking

The MicroCal iTC$_{200}$ is delivered in protective packing material and shall be unpacked with great care.

Check the equipment for damage before starting assembly and installation.

Document any damage and contact your local GE Healthcare representative.

3.4 Set up

Arrange the components on the desktop similar to the picture of the system (see *Figure 3-1*). The computer may be on either side depending on convenience. Do not place the wash station into position yet. Follow the instructions below for assembly.

NOTICE
Before connecting the hardware, make sure the controller PC is off.

1 Remove the top and front panel.

2 Remove the three screws and washers on the top of the instrument used to mount the injection tower.

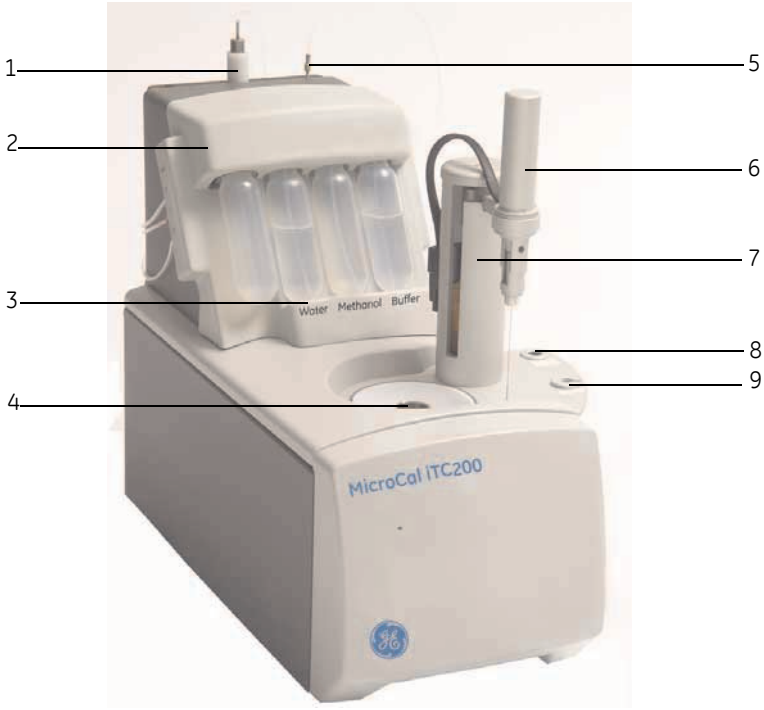

Figure 3-2. MicroCal iTC$_{200}$ with washing module.

Part	Description
1	Cell cleaning adaptor
2	Washing module
3	Solution tubes (Waste, Water, Methanol, Buffer)
4	Cell port
5	Fill port adaptor
6	Pipette
7	Pipette tower
8	Syringe washing and drying station
9	Tube holder

3 Attach the tower with the washers and screws. Do not seat the screws but leave them just slightly loose enough to slide the injector around for alignment in step 5.

4 Carefully insert the pipette into the lock ring. Ensure that the pipette is fully seated and the black cable is parallel with the arm before tightening the screw (below).

5 Very carefully insert the pipette into the cell. You may need to move the injector a small amount to achieve this, and avoid bending the syringe.

6 Align the pipette in the center of the port such that the pipette slides in/out of the cell easily and the spaces on both sides of the pipette are even. This alignment is critical to achieve acceptable noise levels. Hold the injection tower down firmly with one hand while tightening the screws with the other.

7 Plug the pipette connector to the back of the injector tower riser and tighten the lock screws with a 0.05 inch hex driver (1.3mm).

8 Lift the black locking clip on the front of the instrument on the interconnection board behind the faceplate. Insert the ribbon cable from the injection mechanism until it seats.

9 Alternately push the locking clip down to hold the cable in place.

10 Snap the two cover plates back into place.

Washing module installation

USB connector types

The MicroCal iTC$_{200}$ cell and Washing Module connect to the host PC through USB ports with different connector types. You have been supplied with two cables that have Type A and Type B connector ends.

An additional cable has been supplied that has Type A and Type B (mini) connector ends.

Table 3-3. Cable connectors.

Connector	Description
	Type A
	Type B (mini)
	Type B

1 Identify the only cable with the USB type B (mini) cable end. Connect the type B (mini) cable end to the USB hub (see *Fig 3-4*). Connect the USB type A end of that cable to the labeled Controller PC USB port.

Figure 3-3. Controller connector to PC (A).

2 Connect the USB type A ends of two USB cables to the hub as shown in *Figure 3-5*.

Figure 3-4. USB connectors.

3 Connect the USB type B ends to the USB 1 and USB 2 connectors on the rear of the MicroCal iTC$_{200}$ instrument (*Fig 3-6*).

4 Place the Washing Module on top of the MicroCal iTC$_{200}$ cell.

5 Connect the USB type A end from the Washing Module to the hub (*Fig 3-6*).

6 Connect the green grounding strap wire between the Washing Module and the MicroCal iTC$_{200}$ cell.

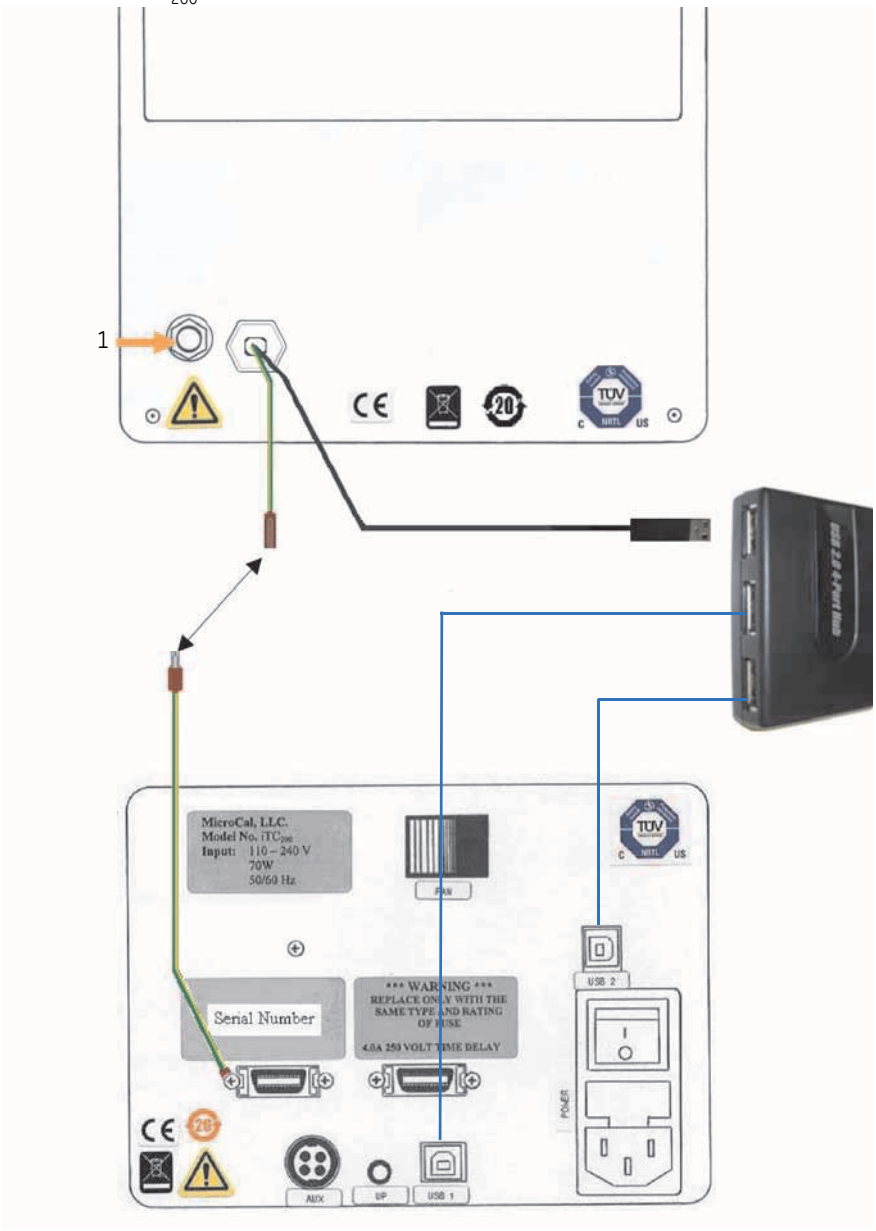

Figure 3-5. Washing Module and MicroCal iTC$_{200}$ cell.

Note: *1 in Figure 3-5 is the power cord grommet.*

Electrical connections

MicroCal iTC$_{200}$ cell

Connect the power cord to the IEC 320 inlet power receptacle (see *Figure 3-6* below) on the back of the cell. Connect the power plug only to a main power supply receptacle with a 3-wire protective Earth ground and a Ground Fault Circuit Interrupter (GFCI).

WARNING
To enhance safety always plug the instrument into a Ground Fault Circuit Interrupter (GFCI) device.

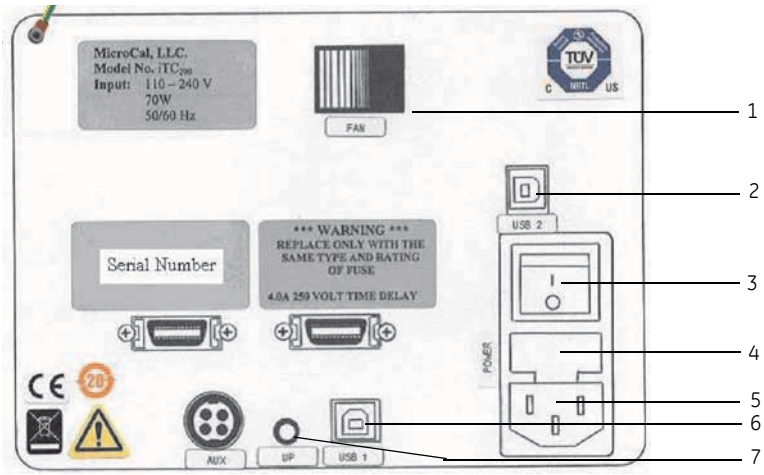

Figure 3-6. MicroCal iTC$_{200}$ view of back plate.

Part	Description	Part	Description
1	Fan	4	Power fuses
2 & 6	USB connectors	5	IEC 320 inlet power receptacle
3	Mains power switch	7	µP activity indicator

Washing module

Connect the power cord from the power supply to the power receptacle (see *Figure 3-7*) on the rear of the Washing module (see *Figure 3-6*, Power). Connect the power supply

only to a main power supply receptacle with a 3-wire protective Earth ground and a Ground Fault Circuit Interrupter (GFCI).

WARNING
To enhance safety always plug the instrument into a Ground Fault Circuit Interrupter (GFCI) device.

Figure 3-7. Washing module power supply unit

Fluid connections

Figure 3-8. Washing Module pipette wash station connections.

Attach Washing Module Tubing

- C1 to syringe fill port (*Figure 3-8*),
- C2 to needle wash port (*Figure 3-8*),
- C3 to top of cleaning device (*Figure 3-9*),
- C4 to side of cleaning device (*Figure 3-9*),
- C5 to waste (*Figure 3-9*).

Figure 3-9. Cell tool connections.

Insert the vacuum vial and three solvent vials

1 To install the vacuum vial (1 in *Figure 3-10*) slide the vial up and back, and screw it into its socket.

2 To install a vial, insert the fill tubing and filter, if applicable, into the vial and slide it up and back into its slot.

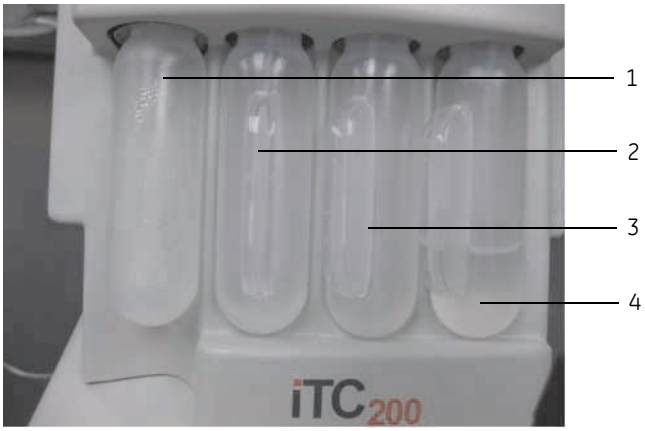

Figure 3-10. Solution vials.

Table 3-4. Solution vials**.**

Part	Description	Part	Description
1	Vacuum vial (opaque color)	3	Methanol vial
2	Distilled water vial	4	Buffer vial

Note: *If buffer is not desired for some reason, this vial may also be filled with water.*

CAUTION
The methanol should be removed and capped when the instrument is not in use, as methanol is very volatile.

3.5 Validation

After installation it is recommended that a titration of a known system be performed to test that the instrument has been installed correctly.

3.6 Configuring a MicroCal iTC$_{200}$ controller for networking

On a MicroCal iTC$_{200}$ controller, there are several actions that must be performed for the networking and MicroCal iTC$_{200}$ control software to work properly. First, the ***InitDT*** watchdog program must be removed, and once the computer has been configured for the local domain, two folders must be given special permissions.

Uninstallation:

1 Click on the ***START*** button on the lower left side of the screen, and then on ***Control Panel***.

2 In the ***Control Panel*** window, click on ***Add or Remove Programs***.

3 Find ***InitDTSetup*** in the program list. Click the ***Remove*** button by it. In the next window, click ***Yes*** to confirm the removal.

Special Permissions:

The MicroCal iTC$_{200}$ software and Origin both need to be able to write data into their own folders. In order to allow a non-administrator to use this software, read/write privileges must be set for all users for the MicroCal iTC$_{200}$ and Origin 70 folders, including all sub-folders. The folder properties must allow ***Read & Execute***, ***List Folder Contents***, ***Read***, and ***Write***, as shown below.

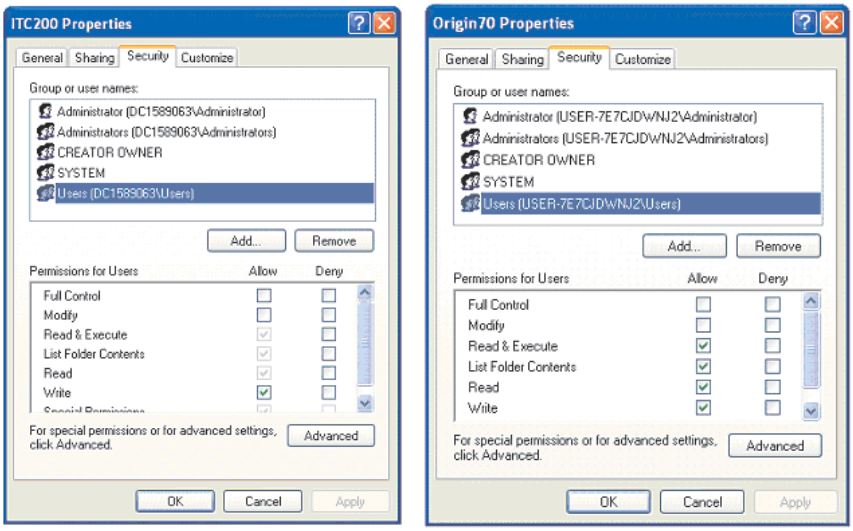

Figure 3-11. Configuration dialogs.

4 Operation

4.1 Procedure before a run

Note: *See Section 1.4 for control software information.*

On / Off Instructions

Turning the MicroCal iTC$_{200}$ cell on

Once the MicroCal iTC$_{200}$ cell has been cabled to the PC, it is ready to use. At the rear of the cell unit is a power on/off switch, which functions as the master power switch and must be in the "on" position. It can be turned to "off" when the MicroCal iTC$_{200}$ cell will not be used for long periods of time i.e., weekends, holidays, etc.

NOTICE
The user interface program, iTC200, has to be running for the cell to function properly even though the power switch is in the "on" position.

Leaving the power on

During frequent "on" periods, the master power may be left as long as the user interface program, MicroCal iTC$_{200}$, is running. The software automatically ensures that the system is does not incur any damage and keeps the MicroCal iTC$_{200}$ cell ready.

Periods of inactivity

GE Healthcare recommends that the MicroCal iTC$_{200}$ application be closed and the master power be turned off, when the system will not be used for extended periods of time.

4.2 Basics of performing a run

In order to perform a basic ITC titration experiment, the user must load the sample cell and the syringe, enter the desired parameters into the control software, and click Start. The reference cell should be filled with water or buffer, and may be left for several days.

4.3 Loading the syringe

To load the titration syringe, place a micro centrifuge tube containing ~100µL of your sample in the tube holder. Be sure to push the tube to the bottom of the holder with the

lid fitting into the slot provided (see image below). Be careful not to leave any part of the tube in the path of the syringe needle to prevent damage.

Figure 4-1. Micro centrifuge tube in the tube holder.

Figure 4-2. Fill port adapter threaded into fill port.

Connect the threaded end of the tubing from the Washing Module to the pipette fill port if necessary (it should still be in place after cleaning and drying of the syringe).

NOTICE
Avoid overtightening the tubing in the pipette fill port. Excessive force will crack the syringe.

In the ***Instrument Controls*** tab, click ***Syringe Fill***. The software will prompt the user to move the pipette as necessary, and the Washing Module will fill the syringe. See sections 4.4 to 4.7 for more information.

4.4 Loading the cell

To load the cell do the following:

1 To load the sample cell, gently insert the glass Hamilton syringe into the (left) sample cell until it touches the bottom.

2 Pull up on the plunger until bubbles are being pulled from the cell, and there is no more liquid.

3 Remove and empty the syringe. Clean the syringe if necessary.

4 Pull approximately 300 µl of sample into the syringe, and tap the syringe glass so that all air is at the top volume of the syringe. Do not allow air to be put into the cells.

5 After removing the bubbles, insert the syringe into the cell and gently touch the bottom of the cell with the tip of the syringe needle.

6 Raise the needle tip about 1 mm off the bottom of the cell, and hold it there until finished filling. Do not raise the syringe during the filling process.

7 Slowly inject solution into the cell until it spills out the top of the cell stem. Finish the filling with several small abrupt spurts of solution to dislodge any bubbles in the cells.

8 Finally, lift the tip of the syringe to the cell port (just below the visible portion of the cell port) and find the ledge (See *Figure 4-3*) that is formed where the cell stem meets the cell port. Place the syringe on the ledge at the top of the metal cell stem and remove the excess solution. If the reference cell needs refilling, follow the same procedure as for the sample cell.

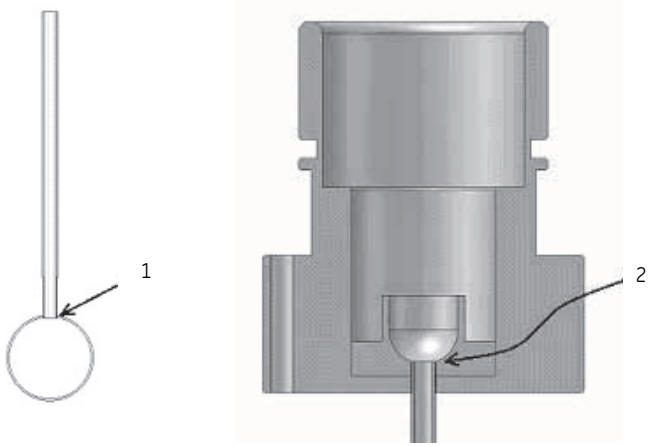

Figure 4-3. Schematic representation of the cell (left) and the top of the cell stem (right) where air bubbles can form if not loaded properly.

Part	Description
1	Place where bubbles are trapped.
2	Ledge formed where cell stem meets plastic overflow reservoir.

Load the run parameters by clicking the ***Load Run File*** button at the top left of the ***Advanced Experimental Design*** tab in the MicroCal iTC_{200} software and select the ***WATER.inj*** file. This will populate all the required fields for performing a run. Then click the ***Start*** button on the bar of buttons across the top of the control software.

Be sure to insert the syringe in to the sample cell before starting the experiment. The instrument will seek experimental temperature, equilibrate to that temperature, start the titration syringe stirring, wait until the DP signal is steady, and then start performing injections. The raw data will appear in the ***Real Time Plot*** tab.

Once a run has finished, the syringe and sample cell should be cleaned as soon as possible.

Procedures after a run

The MicroCal iTC$_{200}$ was designed to have its power on for extended periods of time. This will keep the system electronics at the normal operating temperature. It is recommended that the power of the MicroCal iTC$_{200}$ cell be turned off during extended periods of down time, such as holidays and vacations.

After use, clean the sample cell following procedure in *Section 4.7* and fill the sample cell with distilled water. Wash and dry the syringe using procedure in section *Section 4.7*.

4.5 Experimental design

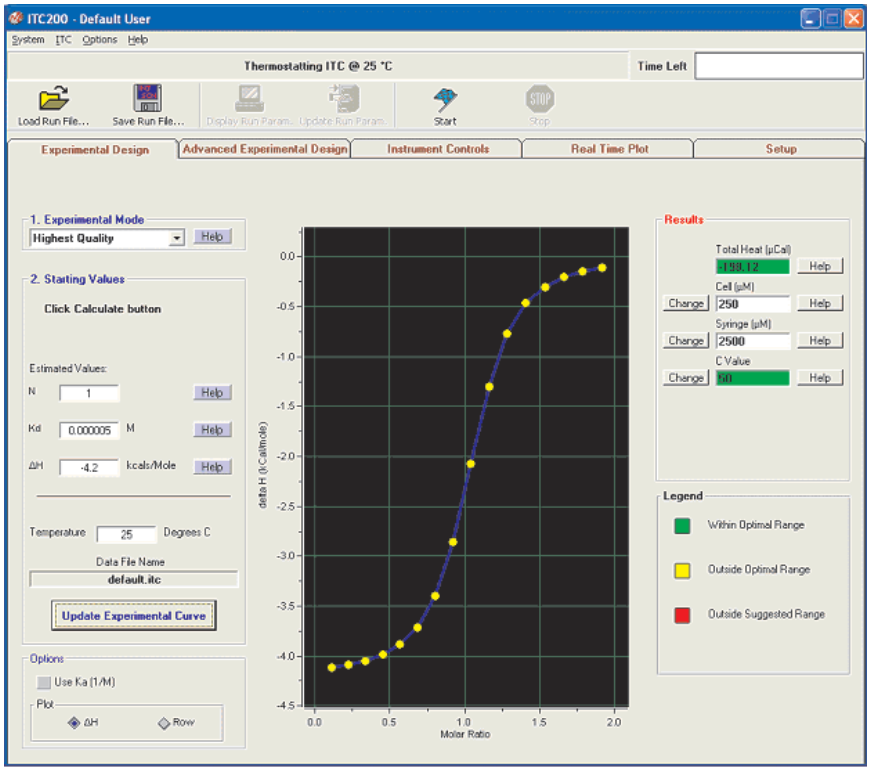

Figure 4-4. Experimental design dialogue box.

When the software is first started, by default, the ***Experimental Design*** tab is selected; this contains the simple run controls. ***Experimental Mode*** can be ***Highest Quality***, ***Minimum Protein***, or ***High Speed***. ***Highest Quality*** uses 20 injections.

These parameters should produce data that is clear and easier to fit. ***Minimum Protein*** uses fewer injections, only 10. The result of these parameters will be the use of the least amount of sample necessary for a successful titration.

The ***High Speed mode*** will do one single longer injection (***Single Injection Mode***, SIM). The expected n, Kd, and H and the desired run temperature will allow the software to calculate the recommended concentrations for the cell and syringe, and set the run parameters based on mode chosen.

If the user is unsure of the Kd for their system, clicking the ***Help*** button causes the software to prompt for the type of compound in cell and syringe. It will then make a guess as to the Kd. The user will still be required to choose values for H and n.

Click the ***Update Experimental Curve*** button to calculate the results. The simulation window will update with a rough graph, and the ***Results*** column at the right of the screen will have values for the cell and syringe concentrations. The calculated C value is listed below; its background is color-coded.

The C-value predicts the shape or sigmoidicity of the curve. Optimal values for C are between 5 and 500 (green); values between 1 and 5, and 500 and 1000 should work but may not give the best result (yellow). C values less than 1 or greater than 1000 will probably not yield usable data (red).

The user may adjust the two experimental concentrations by using the ***change*** buttons beside each concentration box.

Any warnings, such as heats too high for the instrument to measure, will appear in the status bar near the top of the screen. It is highly recommended that the users look carefully at the projected curve and make sure that the shape and rough values are reasonable before proceeding.

A pair of options at the bottom of this tab allows users to work in K_D or K_A, and to choose whether to view the simulation plot using raw heat per injection (ΔH) or the heat normalized to the molar ratio ($N\Delta H$).

4.6 Advanced experimental design

This may be used in addition to the Experimental Design tab to modify the suggested run parameters. It can also be used to save or upload run (*.in) files.

See MicroCal iTC_{200} Experimental and Data Analysis tutorial Guide.

4.7 Instrument controls

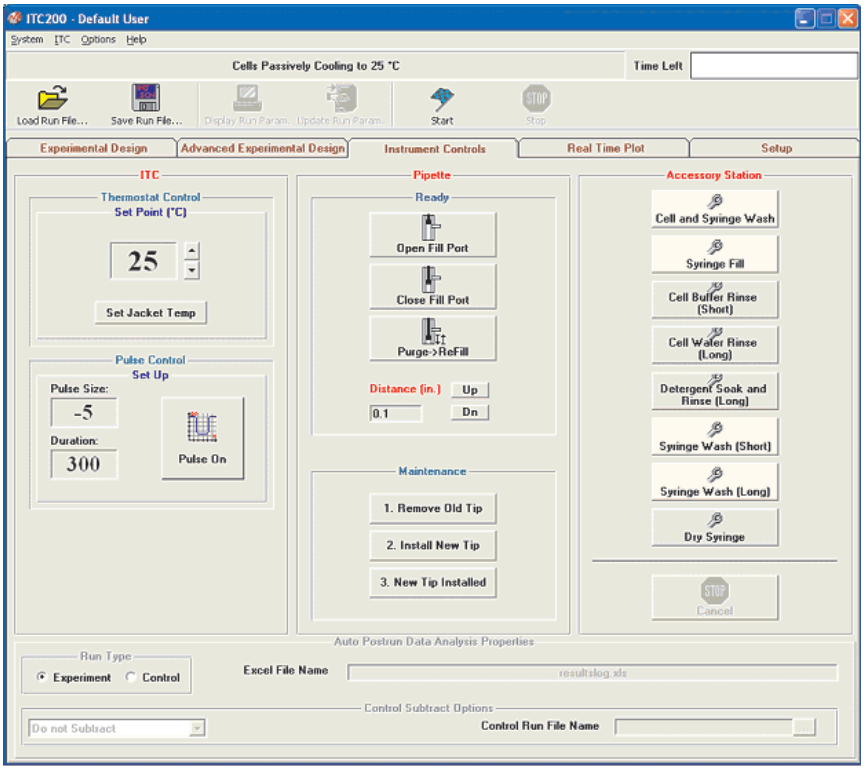

Figure 4-5. Instrument control screenshow.

The ***Instrument Controls*** tab contains the controls for direct operation of the instrument. At the top of the window, the user can ***Start*** the run, using whatever parameters are currently present in the ***Experimental Design*** or ***Advanced Experimental Design*** tabs.

Before clicking this button, it is wise to check that all parameters are correct and that a valid, unique data file name has been entered. The software will double-check with the user before allowing any files to be overwritten. The ***Stop*** button, which is available only during a run, will abort the run immediately.

The ***Thermostat Control*** section allows for setting of the thermostat temperature, which will be maintained during the MicroCal iTC$_{200}$ thermostatic (idle) state. Pre-thermostatting the MicroCal iTC$_{200}$ and samples at the run temperature will result in shorter equilibration times. Also, high temperature thermostatting during cell cleaning can improve the effects of the cleaning. Use the arrow buttons to raise or lower the temperature or click in the text box and type in a new number. Click ***Set Jacket Temp*** to set the temperature.

The ***Pulse Control*** section allows for manually administering a DP calibration pulse. While this is not the most thorough method of checking the *y*-axis calibration, it is the quickest method. Pulses may be applied any time the DP signal is equilibrated and the resulting deflection used as a crude calibration assessment. If Origin for real-time plotting is enabled, Origin will calculate the error. If this is greater than 1%, please see *Section 5.8* for a more thorough check of the DP calibration.

The ***Pipette Control*** panel at the center of this tab provides the controls for loading and cleaning the syringe. The ***Open Port*** button moves the plunger tip to above the fill port in the side of the syringe. C***lose Port*** moves the plunger tip down so that it blocks the fill port. ***Purge/Refill*** pushes the pipette tip all the way down and back up again, dislodging bubbles on the sides of the syringe. The ***Pipette Maintenance*** section provides the software controls used for changing the pipette tip. Please see *Section 5.5* for details on performing this maintenance.

Insert the cell cleaning apparatus into the sample cell (see pictures below). Be sure to push down until the device is firmly seated. Attach the syringe connector to the syringe. Click the ***Cell and Syringe Wash*** button in the ***Instrument Controls*** tab of the iTC200 software. The software will prompt the user to be sure the cleaning tubing is inserted. The program will first execute the ***Cell Buffer Rinse (Short)*** procedure.

A prompt will appear after the cell wash portion of the sequence is complete. The user may then load the cell. Click ***OK*** to continue and clean the syringe. The program then executes the ***Syringe Wash (Short)*** procedure. The syringe cleaning takes about nine minutes. Once that has completed, the syringe may be loaded with sample.

Leave the tubing connected to the syringe. Leave the syringe in the wash position or the rest position. ***Click Syringe Load***.

The plunger will move to the bottom of the syringe to prepare for loading. This must be performed with the syringe NOT in the titrant to prevent turbulence and gassing of the sample. The software will prompt the user to move the pipette to the titrant.

Click **OK** to continue. The pipette tip will move, filling the syringe. After the tip reaches the open port position, the pump will remove the air bubble, reducing titrant usage. The port will move to the close position and the vacuum will remove any excess titrant. Once this has completed, the software will prompt the user to disconnect the syringe tubing, make sure the cells are filled, and move the pipette into the sample cell.

The cell cleaning device must be inserted into the sample cell until it seats firmly. Connect the syringe tubing to the vacuum block port at the rear of the Washing Module to prevent leakage. Click ***Cell Buffer Rinse (Short)***. The Washing Module will perform a short cleaning routine, rinsing the cell with buffer.

The program will rinse the cells with buffer and then with water. It will then empty the cell, although not all the liquid will be removed. The entire sequence takes a little over a minute. The user may then remove the excess water and load the cell with sample, using the Hamilton loading syringe.

The cell cleaning apparatus must be inserted into the sample cell until it seats firmly. Connect the syringe tubing to the vacuum block port to prevent leakage. Click ***Cell Water Rinse (Long)***. The Washing Module will perform a more thorough cleaning routine, which takes about 80 seconds. Like the ***Cell Buffer Rinse (Short)***, the program

will rinse the cell, this time with water, using greater quantities. This is especially useful after a detergent soak, to be sure of removing all of the detergent.

Click the ***Detergent Soak and Rinse (Long)*** button and follow the prompts to load ~5% Contrad70.

The cells will heat to 50°C for half an hour to soak. Once they have cooled, the software will prompt the user to remove the Contrad70 and insert the cleaning device for rinsing, and then to connect the pipette connector to its holder. Be sure that the cells have cooled before removing the Contrad70, as hot liquid may shatter the loading syringe.

This method is used when more vigorous cleaning is required, after a precipitating sample or if trouble is suspected. It is also a good idea to do this every few weeks, or every few days for an instrument under heavy use, to prevent problems.

Connect the syringe tubing to the syringe fill port. Click ***Syringe Wash (Short)***. The software will prompt the user to make sure that the tubing is connected.

Click ***OK***. The Washing Module will perform a short washing routine (approximately 8 minutes). It will rinse the syringe first with water and then with methanol. It will then pull vacuum through the syringe for several minutes to dry it.

Connect the syringe tubing to the syringe fill port. Click ***Syringe Wash (Long)***. The software will prompt the user to make sure that the tubing is connected.

Click ***OK***. The Washing Module will perform a more thorough washing routine (approximately 8½ minutes). It will rinse the syringe first with water and then with methanol. It will then pull vacuum through the syringe for several minutes to dry it.

The ***Dry Syringe*** function is used when the syringe has been cleaned manually and left with methanol in it. Attach the syringe connector to the syringe and place the pipette in the wash position. Click the ***Dry Syringe*** button.

The washing module will pull vacuum through the syringe for several minutes to dry it.

4.8 Real time plot

This tab displays the current DP data.

See MicroCal iTC$_{200}$ Experimental and Data Analysis tutorial Guide.

4.9 Set up

This tab allows for the customizing of data file paths for data storage and setup files. It is also where the ***Extended Data Mode*** button can be found. It is useful to have this box checked when running test experiments. The additional data it provides will be helpful for troubleshooting. See MicroCal iTC$_{200}$ Experimental and Data Analysis tutorial Guide.

4.10 Procedures after a run

The MicroCal iTC$_{200}$ was designed to have its power on for extended periods of time. This will keep the system electronics at the normal operating temperature.
It is recommended that the power of the MicroCal iTC$_{200}$ cell be turned off during extended periods of down time, such as holidays and vacations.

After use, clean the sample cell following procedure in *Section 4.7* and fill the sample cell with distilled water. Wash and dry the syringe using procedure in section *Section 4.7*.

NOTICE
For quick start up leave instrument on.

5 Maintenance

This section provides the user with information on the proper maintenance of the instrument to ensure proper function.

5.1 Cell cleaning

The MicroCal iTC_{200} uses fixed in place cells in order to provide maximum sensitivity and stability. These cells must be cleaned routinely to maintain the high performance of the instrument. Dirty cells will contribute greatly to cell filling problems, accuracy and repeatability problems and possibly misinterpretation of data. Inadequate cleaning is the cause of many problems experienced with the MicroCal iTC_{200}.

The reference cell generally requires no special cleaning; rinsing and refilling every week or so is sufficient. The mildest method of cleaning the sample cell is simply to rinse the cell with buffer several times before loading the sample. This should be done whenever the necessary buffer is available.

After every few runs, or after any sample that precipitates, the sample cell should be cleaned using the Washing Module. Run the appropriate Washing Module sequence and follow the onscreen prompts as noted below.

1 Cell Buffer Rinse with Syringe

- Similar well behaved samples

2 More Extensive Rinsing with Washing Module

- Dissimilar well behaved samples

3 Aggressive Cleaning

- High temperature soak with cleaning agent (general recommendation of 20% Contrad70) followed by a thorough rinsing

See *Section 4.6* for more detailed information.

5.2 Removing injection syringe

Follow steps below:

1 Clean and dry the syringe before removal.

2 Remove sample tube from loading hole and disconnect the cleaning apparatus.

3 Insert the syringe storage case into the loading hole.

Figure 5-1. Syringe removal.

4 Slide the pipette to the cleaning position and insert it firmly into the hole.

5 Turn the inner metal syringe holder to the right several full rotations. This will unscrew the metal nut that holds the syringe in the pipette.

6 Once the nut is loose, move the pipette to the loading hole.

7 Use the manual pipette controls to lower the pipette tip about 0.3 inches. Without the bottom nut, the syringe will move down with the pipette tip.

8 Pull down on the syringe, gently, until it slides down into the storage case. The soft grip tweezers may help with this.

9 Move the pipette out of the way, and screw the cap onto the storage case.

10 Remove it from the loading hole.

5.3 Inserting a new syringe

1 Insert the storage case into the loading hole and unscrew the top.

2 Position the pipette over it.

3 Slide the case up until the syringe glass enters the bottom of the pipette.

Figure 5-2. Syringe insertion.

4 Let the case drop and gently push the syringe up through the filling hole and into the pipette. It will come to a stop with about 4 mm of syringe glass exposed below the metal.

5 Carefully push up on the glass while spinning the metal syringe holder slowly. Once the notch in the syringe aligns with the notch in the holder, the syringe will slide up approximately another 2 mm. Be very careful, as if the syringe is not all the way up, the needle will catch on the edge of the storage case, likely bending the needle and making it unusable.

6 Move the pipette to the cleaning hole and turn the inner metal syringe holder to the left several turns, so that the bottom nut is engaged but not fully tightened.

7 Move the pipette to the loading hole, and insert the fill port adapter. Make sure that it screws in easily; if it does not, loosen the bottom nut until it does.

8 With the adapter in place, tighten the nut. This ensures that the syringe is lined up properly within the pipette.

9 Disconnect the adapter.

5.4 Syringe cleaning

If clogging of the syringe is suspected, first refer to the on screen software section for syringe cleaning to visually see the process.

If this does not solve the issue, then as a backup method you can use the wire method explained here. Note this is not the preferred method and it is rare you will need to use this method.

This must be done very carefully. First, remove the syringe from the pipette.

As always when handling the syringe, be careful not to bend the needle. The wire should always be inserted through the glass first, both to ensure that the clog is fully removed from the syringe and to decrease the likelihood of bending the syringe. It may be difficult to insert the end of the wire from the glass bore into the metal needle; good light and a magnifying glass will help.

Continue to insert the wire until it emerges from the tip of the needle. Carefully pull the wire back through the needle and glass bore.

Figure 5-3. Wire in needle.

5.5 Removing pipette

The pipette is held by the arm and connected to the tower by a black cable. First disconnect the black plastic connector, by removing two screws (see below) and pulling the connector loose. This requires a 0.050" hex driver. Loosen the screw on the side of the arm to remove the pipette.

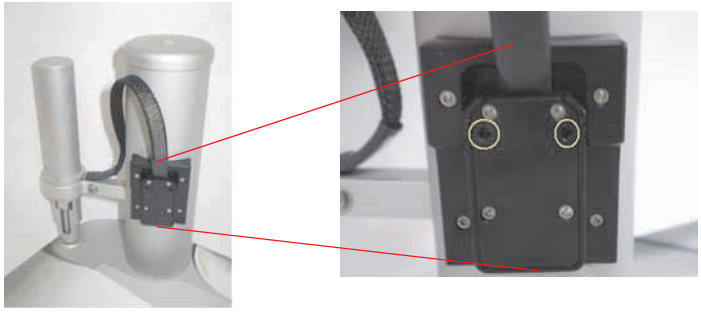

Figure 5-4. Connector cable and the screws that secure it encircled in yellow in picture to the right.

To reinsert the pipette, place the pipette in the socket on the arm and tighten the screw. Insert the cable into its slot, and tighten the two screws. It is a good idea to re-calibrate the open fill port position once the pipette has been replaced; see *Section 5.7*.

5.6 Changing pipette tips

See the instructions above to remove the syringe from the pipette. The pipette should remain connected to the tower.

1 In the Instrument Controls tab, click the ***Remove Old Tip*** button to position the tip.

2 Use the blade of the X-acto knife provided with the instrument to make a diagonal cut on the side of the white Teflon tip (See *Figure 5-5*), and use the small-tipped tweezers to pull the tip off (See *Figure 5-5*).

3 Click the ***Install New Tip*** button to position the tip.

4 Use the tip pusher tool, with the new tip in the slot hole-side up, and firmly press the new tip into place (See *Figure 5-6*). Rotate the tool to ensure that the tip is firmly seated.

5 Remove the tip pusher tool and inspect the tip to be sure it is seated properly.

6 Reinstall the syringe as described above to finish.

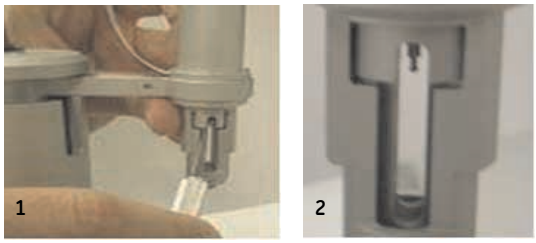

Figure 5-5. Cutting and removing tip (1,2).

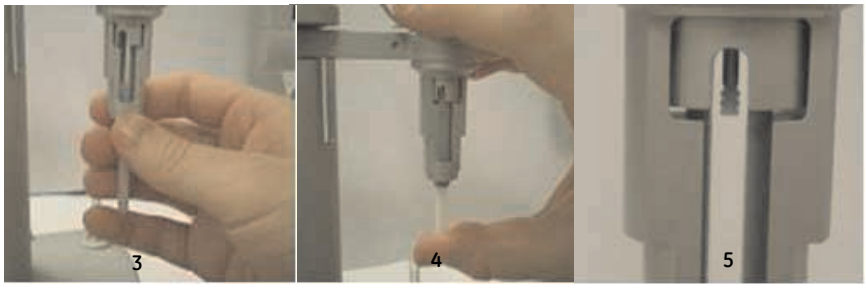

Figure 5-6. Using pusher tool to pipette tip.

5.7 Pipette calibration

The pipette may need to be re-calibrated, especially after a new pipette is installed. The "***ITC => Pipette Tools***" menu option will open the following popup.

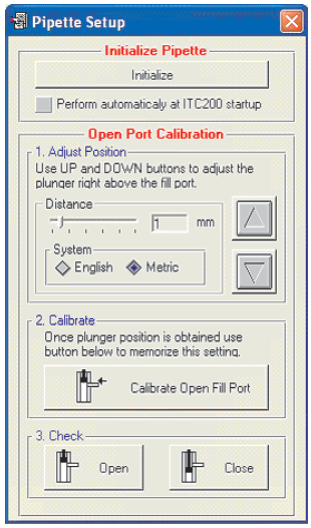

Figure 5-7. Pipette menu.

The ***Initialize Pipette*** section will make the software run a routine that checks the sensors on the pipette and makes sure that the software knows certain constants of the pipette. The checkbox at the bottom of the section will cause the software to run this check every time it starts.

The ***Open Port Calibration*** section contains the controls for adjusting the position of the plunger when the fill port is open. Use the distance slider bar and the up and down buttons to move the plunger tip to just above the fill port in the upper side of the glass syringe bore. Once the position is correct, click the ***Calibrate Open Fill Port*** button to have the software set the current location as the open fill port location. Click the ***Open*** and ***Close*** buttons in the bottom section to check the calibration.

5.8 Y-axis calibration check

It is recommended that the y-axis calibration be checked every few months to ensure accurate data acquisition. The automatic calibration check routine will send a series of pulses to the cell heaters, dissipating a known power. The offset in the DP as a result of this power is analyzed in comparison to the correct DP offset.

Make sure the cells are clean, and fill both cells with degassed, distilled water. Load the titration syringe with water and insert it into the sample cell. It is recommended that Origin for real-time data be enabled.

To begin the y-axis calibration check procedure:

1 Select MicroCal iTC$_{200}$ software menu ***ITC => Start ITC Calibration Run => Y Axis Check***. Once the menu has been selected, the ***Calibration Pulse Setup*** window will appear. This window allows the calibration pulses to be modified.

2 Enter individual pulse parameters by first selecting a pulse or multiple pulses, then enter the desired parameter value into the pulse parameter boxes (***Calibration Power***, ***Pulse Duration*** and ***Pulse spacing***). Users are encouraged to simply use the default y-axis calibration parameters.

3 After the run and pulse parameters are entered, click on the ***Start Run*** button to start the run. The ITC will equilibrate in the same manner as it would during a titration experiment.

If creating customized calibration parameters, users must be aware of the DP range limits when setting reference power and pulse sizes. The reference power must be high enough to allow all pulses without hitting saturation, and if a pulse size is too small, it can show abnormally high error.

After the final equilibration phase has completed, the initial delay will begin and the pulses will be applied as entered. As each pulse completes, Origin will analyze the pulse region and determine the deflection of the baseline as well as the energy (area) of the pulse. The requested power and energy will also be displayed as will a percent error for both power and energy. The reported error in deflection or energy should be less than 1%. If the error is reported as higher than 1%, please contact GE Healthcare.

For a more rigorous analysis, once the calibration is done and the system is thermostatting again, open the ***ITC Calibrations*** project. Click on the ***Y-Axis Calibration (DP, uCal/sec)*** button. Origin will ask for the DP check file. Select the data file just created and click Open. The computer will think for a few moments. If any of the pulses are out of specifications, a pop-up will inform you. It will ask you to save.

Origin will show four graphs. The upper left graph holds the raw data. The lower two graphs show the energy and power of each pulse. The upper right graph displays the percent error for the energy and power of each pulse. Right-click at the upper right portion of the graph and select ***Go To Window*** from the menu. Check the sizes of the errors. If any of the errors is greater than 1%, please contact GE Healthcare.

5.9 Replacement of fuses

WARNING
Always disconnect power supply from the instrument before replacing fuses.

WARNING
Replace fuses ONLY with same type and of fuse and rating. Several spare fuses are supplied with the original shipment and the power receptacle is labeled with the correct type.

The MicroCal iTC_{200} has two fuses, found in the power receptacle at the rear of the instrument, below the power switch and above the plug. If the fuses repeatedly blow, unplug the instrument and contact your local GE Healthcare representative.

6 Troubleshooting

6.1 How to get help

Please contact us for any instrument or data analysis questions or issues you may have. For contact/ordering/service inquiries, visit: www.gelifesciences.com/contact, or for MicroCal-specific information, visit: www.gelifesciences.com/microcal

When e-mailing for technical assistance, if possible, please attach a recent data file(s) (*.itc, raw ITC data file) that demonstrates the problem. Also, please include all details that may be relevant to the problem. For instance, where the problem or question relates to post run data analysis, it is best to attach both the raw data file (***.itc) and the Origin project file (*.opj) and/or Excel (***.xls*)* spreadsheet generated during data analysis.

There are two general categories of troubleshooting for the MicroCal iTC$_{200}$ and its operation. The most extreme category is when a system is not working at all. Problems that prevent users from operating the instrument require immediate consultation with a GE Healthcare technician. Customers should not attempt to repair the hardware or software unless instructed to do so by a MicroCal service representative.

The second, and less extreme general category of a problem is when an MicroCal iTC$_{200}$ instrument is functioning, but is not operating within its normal performance specifications. Large baseline drifting, non-repeatable control peaks (water/water) and/or an increase in short term noise level are examples of performance problems.

These problems may be corrected by the operator in most cases. For these types of performance issues it is recommended that customers carry out the following minimum diagnostic steps prior to requesting service:

Diagnostic steps:

1 Thoroughly clean the cells. Do not assume they are clean; build-up or unexpected sample residue will cause problems. As a minimum, use the Washing Module to perform a ***Cell Water Rinse (Long)***. Discretion may call for a more rigorous cleaning procedure.

2 Using a clean Hamilton syringe, refill both the reference and sample cells with filtered degassed water.

3 Thoroughly clean the titration syringe or use a different syringe.

4 Load the syringe with water.

5 Within the MicroCal iTC$_{200}$ software, activate the extended data mode by clicking the ***Extended Data Mode*** box in the ***Real Time Plot*** tab. While the software is in the extended data mode, the ITC data files will contain all available information produced by MicroCal iTC$_{200}$. This additional information will often help the MicroCal technician diagnose problems.

6 Carry out a minimum of 15, 2 µL injections of water into water.

If, after completion of the steps listed above, the MicroCal iTC$_{200}$ performance is not corrected, please contact the service department for help. The water runs should be provided to the MicroCal service technician for evaluation. Following the evaluation, a representative from the service department will contact you with comments and recommendations.

7 Reference information

7.1 Instrument specifications

Performance specifications

Characteristic	Data
Operating Temperature Range	2°C to 80°C
Response Time	10 seconds
Cell Design:	200 µL, coin-shaped
Titration Syringe:	40 µL
Maximum Usable Volume:	35 µL
Smallest Injection Size:	0.1 µL
Stirring Rate	500 to 1500 r.p.m.

Physical specifications

Description	Data
Cell Material	Hastelloy® Alloy C-276
Dimensions	Calorimeter: 16.5 × 33 × 26.7 cm, (6½ × 13 × 10½") Controller: 39.4 × 41.9 × 19.1 cm, (15½ × 16½ ×7½") Monitor: 44.5 × 40.6 × 14 cm, (17½ × 16 × 5½" Washing Module: 18.4 × 16.5 × 13.3 cm, (7¼ × 6½ × 5¼")
Calorimeter weight	16 lbs/7.3 kg
Controller	20 lbs/9.1 kg
Monitor	9.5 lbs/4.3 kg
Washing Module	6 lbs/2.7 kg

For operation, the MicroCal iTC$_{200}$ with a computer controller requires about 1 meter of normal bench space (ca. 70 cm wide). The ThermoVac degassing station will require another 25 cm of bench space.

Electrical specifications for calorimeter

Characteristic	Data
Voltage	100 to 240 Volts AC
Frequency	50 / 60 Hz
Power	70 Watts
Fuses (2)	4.00 A, 250 V, Time Delay
Output	Secondary/Data connection only
Protective Earth Terminals	Internal/external marking
Mode of Operation	Continuous
Classification	Class I

Environmental conditions

Condition	Characteristic	Limits
Operation	Temperature	10°C to 28°C
	Humidity	0 to 70% RH non-condensing
	Atmospheric Pressure	700 to 1060 hPa
Storage (no liquid in cells)	Temperature	-40°C to 70°C
	Humidity	10% to 90%
	Atmospheric Pressure	500 to 1060 hPa

7.2 Ordering information

For ordering information, visit: www.gelifesciences.com/microcal

For local office contact information, visit
www.gelifesciences.com/contact

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751 84 Uppsala
Sweden

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Amersham Place, Little Chalfont, Buckinghamshire, HP7 9NA, UK

GE Healthcare Bio-Sciences Corp
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28-9639-77 AA 01/2010