

GE Healthcare

# Ettan IPGphor 3

Instrument User Manual



Ettan



## Important user information

All users must read this entire manual to fully understand the safe use of Ettan IPGphor 3.

### WARNING!

The following **WARNING** signs highlight instructions that must be followed to **avoid personal injury**. It is important not to continue until all stated conditions are met and clearly understood.



**WARNING!** Lethal high voltage above 1 kV.



**WARNING!** Read the instructions to avoid hazardous conditions.

### CAUTION!

The **Caution** sign highlights instructions that must be followed to **avoid damage to the product or other equipment**. It is important not to continue until all stated conditions are met and clearly understood.

### Note

The **Note** sign is used to indicate information important for trouble-free and optimal use of the product.

## CE certification

This product meets the requirements of applicable CE-directives. A copy of the corresponding Declaration of Conformity is available on request.

The **CE** symbol and corresponding declaration of conformity is valid for the instrument when it is:

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



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# 1 Ettan IPGphor 3 Isoelectric Focusing System function and description

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The Ettan™ IPGphor™ 3 Isoelectric Focusing System performs the first dimension isoelectric focusing (IEF) step in 2-dimensional (2-D) electrophoresis. The system comprises the Ettan IPGphor 3 unit, combined with separate strip holders or a manifold. Two types of manifolds are available; the ceramic manifold and the light manifold. The IEF separation protocols are programmed, run and controlled from the Ettan IPGphor 3 control panel or from a PC running the Ettan IPGphor Control Software.

**IMPORTANT!** The Ettan IPGphor 3 system is intended for research use only and should not be used in any clinical or in Vitro procedures for diagnostic purposes.

The Ettan IPGphor 3 Isoelectric Focusing System includes the following features:

- an integrated high-voltage DC power supply delivering up to 10 kVolts
- temperature control by Peltier elements
- light exclusion during the run. Compatible with CyDye™ labeled proteins and other light sensitive stains
- IEF runs are programmed from the Ettan IPGphor 3 control panel with up to ten user-defined IEF protocols, each with up to 9 steps per protocol
- programmable functions including: rehydration time, platform temperature, current limit, voltage limit for each step, voltage gradient or step and step duration
- Ettan IPGphor 3 Control Software. From a PC, protocols are created, graphically displayed and stored on the Ettan IPGphor 3 unit. The software records the run parameters over time and presents data as graphs and log files. Data is saved or can be exported to Microsoft® Excel
- Ettan IPGphor 3 Control Software allows easy programming and recommended protocols are generated by providing instrument configuration, IPG strip length and pH gradient
- strip holders for rehydration and automated running
- Ettan IPGphor Cup Loading Manifold for easy running of up to 12 IPG strips. Cup loading improves focusing results particularly when using basic IPG strips

- 
- for larger sample volumes the Ettan IPGphor Cup Loading Manifold facilitates paper bridge loading and in gel rehydration loading

The Ettan IPGphor 3 Control Software has an easy to use interface to the Ettan IPGphor 3 instrument and provides enhanced protocol generation, presentation, and storage.

Recommended standard protocols can be retrieved and used by the user simply providing the instrument configuration, IPG strip length and pH gradient. Using the advanced mode setting, earlier made custom protocols or entire new protocols are made. All protocols are edited and saved for later use. The selected protocol is loaded to Ettan IPGphor 3 Isoelectric Focusing Instrument.

During the run the control software monitors and records the running parameters. All data is displayed as graphs and log file tables. When the run is complete, graph and log files are printed or/and saved. If desired, the log files are exported to programs such as Microsoft Excel.

The Ettan IPGphor 3 Control Software controls up to four Ettan IPGphor 3 units at one time, each running a different set of run parameters.

IPG strip manifolds are available in two models:

- One produced from a ceramic material providing greater temperature uniformity
- One produced from a light polymeric material for less critical experimentation

Both are designed for analytical analysis using cup application and preparative runs applying sample to the gel during the rehydration step or by paper bridge loading. Using the Manifold Immobiline DryStrips are rehydrated in the Rehydration Tray.

Fixed length strip holders are available. Once the IPG strip is placed in the fixed-length strip holder, no further handling is required. The holder is placed on the Ettan IPGphor 3 electrode platform for rehydration and can be immediately followed by isoelectric focusing. The sample is introduced during the rehydration step. The Ettan IPGphor 3 accommodates up to 12 strip holders for any one protocol.

IPG strips are available in five lengths 7, 11, 13, 18, and 24 cm, and a number of pH ranges, several linear and non-linear (listed in section 6.2 Ordering information).

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## 1.1 Unpacking

Carefully unpack all items delivered and make sure that all items are present by comparing the contents with the packing list. If any part is missing, please contact your local GE Healthcare sales office. Inspect all components. If any part appears damaged, please contact the courier immediately. Please keep all packing material and use if damaged parts need to be returned for repair or replacement.

## 1.2 System components



**Fig 1-1.** The Ettan IPGphor 3 instrument.



Fig 1-2. Light protective cover.

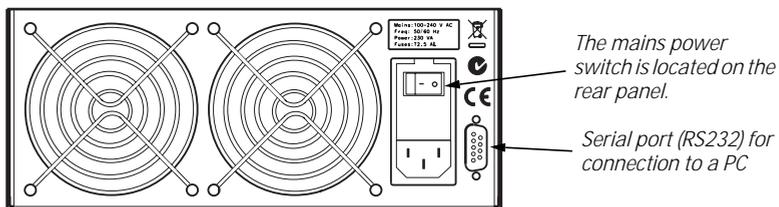
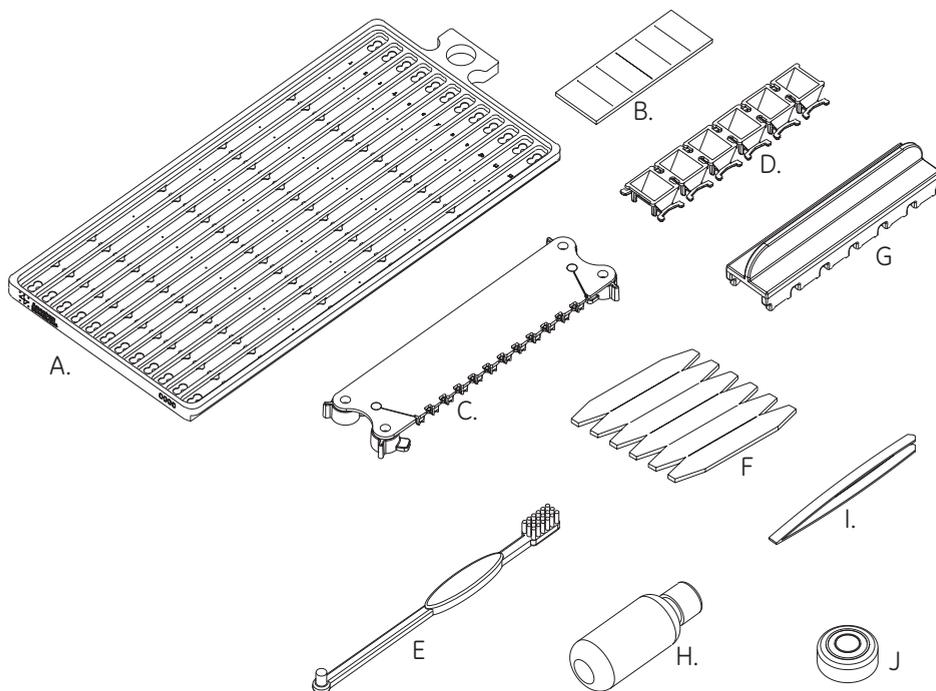


Fig 1-3. Location of mains power switch and serial port.



**Fig 1-4.** Components of the Ettan IPGphor Cup Loading Manifold system. Only one of each item shown.

A. Manifold, ceramic or light	F. Pre-cut paper bridges
B. Pre-cut electrode wicks	G Sample cup insertion tool
C. Electrode assembly	H. Cleaning solution
D. Sample cups	I. Forceps
E. Cleaning brush	J. Spirit level



*Five strip holder lengths are available—7, 11, 13, 18, and 24 cm—one for each IPG strip length.*

Fig 1-5. Strip holders.

**Note:** *All strips (and holders) used at any one time must be of the same length.*

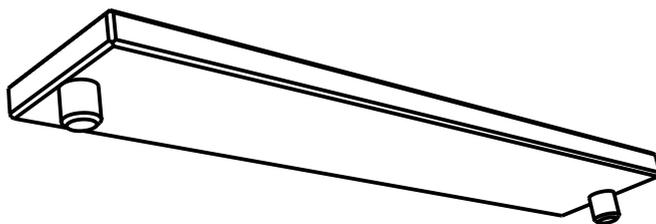


Fig 1-6. Lid adapter.

Control panel	The Ettan IPGphor 3 is controlled by a 7-key membrane keypad. Instrument status is indicated on the LCD screen.
LCD screen	<p>The <b>main screen</b> is "Protocol #1, Name." The default location of the cursor is always under the protocol number "1."</p> <p>Select any protocol by pressing the <b>up</b> and <b>down</b> arrow keys to display the number of the desired protocol. Once the selected protocol is started, the LCD screen indicates the parameters of the step currently being carried out.</p> <p>In "edit mode" the LCD displays the programmable parameters. Position the cursor in the field to be edited using the <b>right</b> and <b>left</b> arrow keys and adjust the value by pressing the <b>up</b> and <b>down</b> arrow keys.</p>
COMMAND keys	<ul style="list-style-type: none"> <li>• The <b>EDIT</b> key switches the display to "edit mode", in which protocol steps can be programmed (see section 3.5). Pressing the <b>EDIT</b> key in edit mode toggles between the identification screen with general settings for all steps and the settings in the three first protocol steps. The key also allows the estimated run time remaining to be viewed while the unit is operating.</li> <li>• The <b>left</b> arrow key moves the cursor to the left. Moving the cursor off the screen to the left repositions the cursor at the left side of the next row. On the bottom row the cursor is repositioned on the left side of the top row.</li> <li>• The <b>right</b> arrow key moves the cursor to the right. Moving the cursor off the screen to the right repositions the cursor at the left of the next row. On the bottom row the cursor is repositioned on the left side of the top row.</li> <li>• The <b>up</b> arrow key increases the value of the selected field or digit, and the <b>down</b> arrow key decreases the value of the selected field or digit. Exceptions when the cursor is positioned to the left under the Step number S1-S9, <b>down</b> arrow change the display to the next group of three protocol steps. <b>Up</b> arrow change to the previous group of three protocol steps. During electrophoresis, the <b>up/down</b> arrow keys are used to toggle between VhS, VhT, and Hrs.</li> <li>• The <b>START</b> key begins the selected protocol.</li> <li>• The <b>STOP</b> key pauses the protocol. Pressing the <b>STOP</b> key a second time cancels the protocol in progress.</li> </ul>
HV ON indicator lamp	The <b>HV ON</b> lamp indicates that the high voltage power supply is on and isoelectric focusing is in progress. This lamp is not illuminated during the rehydration phase of a protocol.
Serial port RS 232	Serial port for connection of a PC.

<b>Platform</b>	<p>The platform accommodates one manifold for the first dimension isoelectric focusing (IEF) run.</p> <p>Up to 12 fixed-length strip holders can be placed on the platform for rehydration and IEF.</p> <p>The embedded electrode areas provide the electrical connection between strip holder or manifold electrodes and the integral power supply.</p> <p>Platform temperature is controlled by Peltier thermoelectric modules.</p>
<b>Electrode areas</b>	<p>Both electrode areas are gold-plated copper. Placing a manifold or a strip holder so that it bridges both electrode areas completes the electrical circuit (once the safety lid is in position).</p>
<b>Safety lid</b>	<p>The safety lid must be properly closed before power is applied.</p>
<b>Light protective cover</b>	<p>When analyzing proteins labeled with light sensitive stains like CyDye®, a light protective cover (Fig 1-2) is used. The cover is applied by magnetic force but is easy to partially remove for checking the isoelectric focusing procedure, especially the migration of bromo-phenol-blue at start.</p>
<b>Lid adapter for strip holders</b>	<p>When using the Ettan IPGphor 3 standard strip holders a lid adapter (Fig 1-6) must be used to apply the correct amount of pressure to the lids of the Ettan IPGphor 3 strip holders.</p>
<b>Ettan IPGphor 3 Control Software</b>	<p>Ettan IPGphor 3 Control Software allows the user to control the Ettan IPGphor 3 Isoelectric Focusing Instrument. The software provides an enhanced functionality in the areas of data presentation, data storage, and protocol handling. The PC is connected to the Ettan IPGphor 3 over a serial cable or USB converter.</p> <p>Ettan IPGphor 3 Control Software controls up to four Ettan IPGphor 3 units at one time, each running a different set of run parameters.</p>
<b>Manifolds</b>	
<b>Ettan IPGphor Cup Loading Manifold Ceramic</b>	<p>The manifold (Fig 1-4) is made of aluminum oxide ceramic for efficient heat transfer and temperature control during IEF. The manifold accommodates up to 12 IPG strips from 7 cm to 24 cm long. Immobiline DryStrip is placed with the gel side facing up.</p> <p>Samples are applied in a cup. Cup loading has been found to improve protein focusing patterns, particularly on basic IPG strips (pH 6-9 and 6-11). Larger sample volumes can be applied by gel rehydration loading or anodic paper bridge loading.</p> <p>Protrusions along the channel inside the manifold align the rehydrated IPG strip, keeping it straight and centered when placed inside the manifold. The manifold has a coating to minimize protein adsorption. The unit may also be used for IPG strip equilibration prior to second dimension electrophoresis.</p> <p>The manifold is fragile and should be handled with care.</p>

Ettan IPGphor Cup Loading Manifold Light	<p>The manifold (Fig 1-4) is made of polymers polycarbonate and ABS (acrylonitrile-butadiene-styrene). The light manifold and the ceramic manifold have the same design/measurements with only the choice of materials the only difference. The manifold accommodates up to 12 IPG strips from 7 cm to 24 cm long.</p> <p>The unit may also be used for IPG strip equilibration prior to second dimension electrophoresis.</p>
Electrode Assembly	<p>These electrodes fit to both the ceramic and light manifold. The movable electrodes (Fig 1-4) can be placed along the manifold to fit from 7 to 24 cm long IPG strips.</p> <p>Electrode pins make contact with the power supply electrode areas on the platform of the Ettan IPGphor 3. The electrodes have a platinum wire that is strung across the bottom of the electrode teeth to provide electrical contact to the IPG strips. The hold down teeth for paper bridge loading are found along the opposite length of the electrode. Cams on the sides of the electrode secure the position.</p>
Sample Cups	<p>Sample cups (Fig 1-4) can be placed along the length of the Ettan IPGphor Manifold that is not blocked by a centering protrusion.</p> <p>The sample cups are supplied in strips of 6 for easy handling and placement. Each sample cup accommodates sample volumes of up to 150 <math>\mu</math>l.</p>
IEF electrode paper wicks	<p>The small, precut rectangular wicks (Fig 1-4) must be placed at both the anodal and cathodal ends of the rehydrated IPG strips just under the electrodes.</p> <p>The wicks absorb excess water, salts, and proteins with pI values that lie outside the pH range of the IPG strip.</p>
Paper bridge loading pads	<p>Paper Bridge loading pads (Fig 1-4) are used to load larger volumes of sample (375-500 <math>\mu</math>l). The bridges are 0.8 cm <math>\times</math> 5.0 cm in size including the pointed ends.</p> <p>One end of the pad is in contact with the IPG strip and is held in position by the hold down teeth of the electrode assembly. The other end of the bridge loading pad makes contact with a paper wick placed under the platinum wire of the electrode assembly.</p>
<b>Immobiline DryStrip Reswelling Tray</b>	<p>When using the manifold the Immobiline DryStrip Reswelling Tray is required for proper strip rehydration. The longer Tray fits 7-24 cm strip lengths.</p>
<b>Strip holders</b>	<p>The strip holders are made of aluminum oxide ceramic with electrodes of platinum on titanium. The ceramic is very brittle so the holders are fragile and must be handled with care.</p> <p>The ceramic is treated with a special coating to minimize protein binding and must be cleaned only with the Ettan IPGphor Cleaning Solution supplied to retain that coating.</p> <p>Strip holders are available for the following IPG strip lengths: 7, 11, 13, 18, and 24 cm.</p> <p>Each fixed-length strip holder base holds a single IPG strip throughout rehydration and isoelectric focusing. A matching length holder is available for each size strip.</p>

Sample application wells	Each of the two wells accepts up to 15 $\mu$ l of sample (7.5 $\mu$ l on either side of the strip) in excess of the rehydration volume (i.e. 30 $\mu$ l maximum for both wells). Introduce the sample through the wells if it is not included in the rehydration solution.
Cover	The cover is made of acrylic and protects the IPG strip during rehydration. The shape of the underside of the cover ensures electrical continuity during IEF by pressing the strip against the electrode while allowing electrolysis gases to escape. Rehydration and separation progress can be monitored visually through the clear cover.

### 1.3 Specifications

#### *Working surface*

Electrode areas	Gold-plated copper
Capacity	Up to 12 fixed-length strip holders or one manifold
Platform temperature	15–30 °C ±2 °C

#### *User interface*

Control panel	7-key membrane keypad.
Liquid crystal display (LCD)	4 lines, 24 characters per line
Programmable parameters	Rehydration time, platform temperature, maximum current limit per strip, voltage limit in each step, voltage step or gradient, and step duration.
Protocol capacity	10 protocols, with up to 9 steps each
Serial port	RS232, 1200 or 9600 baud, 8 data bits 1 stop bit, no parity, no flow control. 9600 baud is mandatory for connection with Ettan IPGphor 3 Control Software.

#### *Operating environment*

Temperature	15–32 °C
Relative humidity	0–70%*
* High relative humidity may result in condensation forming on the platform surface. Runs conducted at a platform temperature of 20 °C and relative humidity less than 70% will generally not cause condensation. Platform temperatures greater than 20 °C allow for higher relative humidity without condensation. Environments for which condensation occurs on the platform surface may vary. If condensation occurs, the unit may require conditioned air to reduce temperature and relative humidity.	

**Power requirements**

Mains supply voltage	100-240 V AC $\pm$ 10%
Frequency	50/60 Hz
Power consumption	230 VA

**Electrophoresis**

High voltage	Up to 10 kV
Current	Up to 1.5 mA

**Physical parameters**

Dimensions (h $\times$ w $\times$ d)	160 $\times$ 278 $\times$ 471 mm
Weight	8.3 kg

**Safety**

Safety features	Automatic voltage cutoff when safety lid is opened
Safety certifications	CE

**1.4 Associated documentation**

- The *Ettan IPGphor 3 Software User Manual* contains instructions for controlling Ettan IPGphor 3 Isoelectric Focusing Unit from a PC.
- The *Ettan IPGphor Cup Loading Manifold User Manual* contains instructions for first-dimension isoelectric focusing of proteins on IPG strips.
- The *Ettan IPGphor 3 Safety Handbook* contains safety information.
- Instructions attached to each package of Immobiline DryStrip.

## 2 Instrument set up

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### 2.1 *Placing the instrument*

**WARNING!** The vents at the front, back, and bottom of the instrument must not be obstructed. Air must be free to circulate for the cooling apparatus to function properly. Minimum free space behind the rear panel should be 10 cm.

**IMPORTANT!** Select a place for Ettan IPGphor 3 where it is possible to access the mains power switch on the rear panel of the instrument.

Position the instrument on a flat surface with the spirit level in the center. Turn the leveling feet as necessary to make the instrument level and stable.

### 2.2 *Power connection*

Two power cords are supplied: one cord has a "North American" style (UL817) 3-pronged plug for 115 V~ power outlets, and the other has a "Central European" style (CEE7/VII) plug for 230 V~ power outlets.

- 1 Select the cord with the appropriate plug for the power outlet in your laboratory. If neither of these cords are suitable for your power outlets, obtain a detachable cord with an IEC/320/C13 (CEE22/V) outlet.
- 2 Plug the connectors into the power cord receptacle on the rear panel and into a properly grounded power outlet.

### 2.3 Serial port connector for a computer connection

The RS232 serial port for a computer connection is at the rear of the unit. The type of cable required (shielded straight serial or shielded null modem) depends on the type of device (DTE or DCE) that it is connected to:

- If the computer is configured to receive data on pin 2 and transmit on pin 3, a regular straight serial cable is required.
- For any other configuration, a null modem cable is required.

Pin number assignments and device set up details follow:

#### The Ettan IPGphor 3 RS232 signal and pin number assignments:

Pin 2	Transmit
Pin 3	Receive
Pin 5	Ground
Other pins	Not connected

#### The Ettan IPGphor 3 requires these settings in the device receiving data:

Baud rate	9600
Data bits	8
Stop bit	1
Start bit	1
Parity	None
Flow control	None

To set the baud rate:

- 1 Press the **Up** and **Down** arrows together to access the **Baud** menu.
- 2 Use the **Up** or **Down** arrows to set the baud rate.
- 3 Use the **Right** arrow to exit to the main menu.

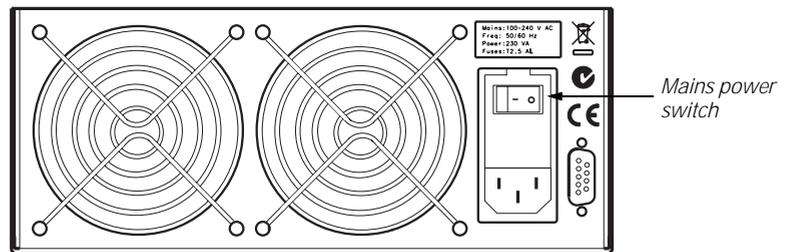
```
Serial Port Setup
Baud Rate: 9600
Set Up or Dn      Exit>
```

## 3 Operating instructions

The following sections will guide you through each stage of the isoelectric focusing process using the Ettan IPGphor 3.

### 3.1 Power up

- 1 Turn on the mains power switch (I) located on the rear panel.



This activates a self diagnostic program that runs for approximately 10 seconds. A series of screens indicate progress. If any component fails, the diagnostic program will stop and a message will indicate the source of the fault; note the fault and press the **START** key to skip to the next test. If any failure is detected, call GE Healthcare service.



**WARNING!** In a situation where there is a risk of injury, turn off the instrument by switching the mains power switch (located on the rear panel) to position **0**. Malfunctions must be rectified before the Ettan IPGphor 3 is restarted.

#### 3.1.1 Ettan IPGphor 3 control panel

Once the diagnostic program is successfully completed, the main screen indicates that the instrument is ready, as shown below.



Fig 3-1. Ettan IPGphor 3 control panel.

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- The **main screen** is "Protocol #1, Name." The default location of the cursor is always under the protocol number "1." Select any protocol by pressing the **up** and **down** arrow keys to display the number of the desired protocol.
  - The **START** key begins the selected protocol.
  - The **STOP** key pauses the protocol. Pressing the **STOP** key a second time cancels the protocol in progress, and pressing it a third time resets the instrument to start another protocol.
  - The **EDIT** key switches the display to "edit mode", in which protocol steps can be programmed. Pressing the **EDIT** key in edit mode toggles between the identification with general settings for all steps and the settings in the three first protocol steps.

The **EDIT** key also allows the estimated run time remaining to be viewed while the unit is operating.

- The **up** arrow key increases the value of the selected field or digit, and the **down** arrow key decreases the value of the selected field or digit.

Exceptions when the cursor is positioned to the left under the Step number S1-S9, **down** arrow change the display to the next group of three protocol steps. **Up** arrow change to the previous group of three protocol steps.

During electrophoresis, the **up/down** arrow keys are used to toggle between VhS, VhT, and Hrs.

- The **left** arrow key moves the cursor to the left. Moving the cursor off the screen to the left wraps the cursor either to the left end of the next line or to the left end of the top row.
- The **right** arrow key moves the cursor to the right. Moving the cursor off the screen to the right repositions the cursor at the left of the next row or wraps the cursor to the left end of the top row.

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### 3.2 Using the Ettan IPGphor Cup Loading Manifold

For more detailed information, refer to *Ettan IPGphor Cup Loading Manifold User Manual*.



**WARNING!** Check that the high voltage is turned off before opening the safety lid. The HV ON indicator on the front panel should not light.

#### 3.2.1 Rehydrating Immobiline DryStrip in the Rehydration Tray

Rehydrate the IPG strips with the gel side down in the appropriate volume of rehydration solution, with or without sample, using the Immobiline DryStrip Reswelling Tray.

Rehydration in the Cup Loading Manifold is not recommended, the channel is too wide to ensure proper rehydration.

Also, follow the instructions included with the Immobiline DryStrips. Cover the IPG strips with Immobiline DryStrip Cover Fluid, and allow the strips to rehydrate overnight (10-20 hours).

#### 3.2.2 Positioning the manifold on the Ettan IPGphor 3

- 1 Clean and dry the Ettan IPGphor 3 platform before placing the manifold on the unit.
- 2 Position the manifold on the Ettan IPGphor 3 platform. The small T-shaped protrusion fits into a cutout section of the Ettan IPGphor 3 platform near the lid hinge.
- 3 Ensure that the manifold is level by placing the round spirit level on the center of the manifold tray after it is placed on the Ettan IPGphor 3 unit.
- 4 Measure out 108 ml of Immobiline DryStrip Cover Fluid (even if fewer than 12 strips will be loaded into the manifold). Add the cover fluid evenly in the 12 manifold channels.

#### 3.2.3 Positioning the IPG strips in the manifold

- 1 Transfer the strips to the Ettan IPGphor Cup Loading Manifold.
- 2 Position the strips under the cover fluid face up in the tray with the anodic (+, pointed) end of the IPG strip pointing at the anode of the Ettan IPGphor 3.
- 3 Center the strip down the length of the manifold channel. Protrusions along the sides guide the strip approximately straight, although some manual adjustment of the strip may be necessary. See also the *Ettan IPGphor Cup Loading Manifold User Manual*.

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### 3.2.4 Sample cups

- 1 Position a strip of sample cups in the appropriate position, for example ~1 cm from the end of the gel portion of the IPG strip. Do NOT place the cup with the feet over a center protrusion.
- 2 Ensure that the feet of the cups are properly seated at the bottom of the channel. Use the insertion tool, wiggle the tool gently while pushing it down.
- 3 Fill the cups with cover fluid to test for proper seating of the cups.
- 4 Remove the cover fluid after 10 minutes.

### 3.2.5 Electrode paper wicks

- 1 Add 150 µl distilled water to each paper wick.
- 2 Position the wicks on each end of the IPG strips so that one end of the wick overlaps the end of the gel on the IPG strip.

### 3.2.6 Positioning the electrodes

- 1 With the electrode cams in the open position, position the electrode assembly on top of all the wicks. The electrode must be in contact with the wick.
- 2 Swivel the cams into the closed position under the external lip of the tray. The electrodes should not be moved while the cams are in the closed position.

### 3.2.7 Loading samples into the sample cups.

- 1 A maximum of 150 µl of sample may be placed in these cups.
- 2 Check to make sure that there is cover fluid over the samples. When the sample is introduced into the cups, it will sink through the oil to the bottom of the cup and come into contact with the IPG strip.
- 3 Close the Ettan IPGphor 3 lid.
- 4 Start the Ettan IPGphor 3 from the Ettan IPGphor 3 Control Software. See section 3.4 for more details,

or

Program and run the Ettan IPGphor 3 from its own control panel display. See section 3.5.



### 3.3 Using fixed-length Ettan IPGphor 3 strip holders

**WARNING!** Check that the high voltage is turned off before opening the safety lid. The HV ON indicator on the front panel should not light.

Ettan IPGphor 3 fixed-length strip holders allow IPG strips to be rehydrated and samples loaded in one step before proceeding automatically to perform the separation. The IPG strips are 3 mm wide and 0.5 mm thick after rehydration.

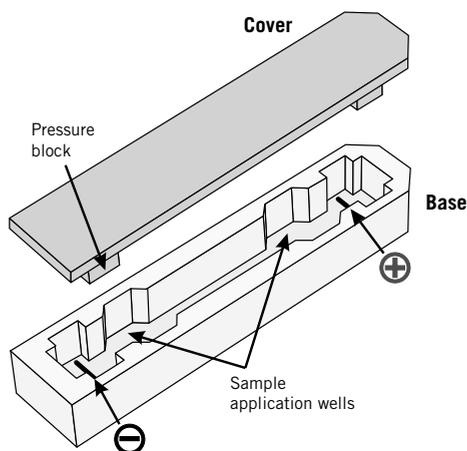


Fig 3-2. Strip holder.

#### 3.3.1 Preparing the strip holder(s).

**IMPORTANT!** Handle the ceramic holders with care, as they are brittle and fragile.

- 1 Select the strip holder(s) corresponding to the IPG strip length chosen for the experiment (7, 11, 13, 18, or 24 cm).
- 2 Wash each holder with the strip holder cleaning solution supplied to remove residual protein.
- 3 Rinse thoroughly with double distilled water.
- 4 Use a cotton swab or a lint-free tissue to dry the holder or allow it to air-dry. The holder must be completely dry before use.

**Rehydrate the Immobiline DryStrip**

- 1 Prepare the rehydration solution and rehydrate the Immobiline DryStrip in the strip holder or in the rehydration tray when using the manifold.
- 2 Follow the recommended procedures found in the Instructions attached to each Immobiline DryStrip package.

**Note:** See also the *2-D Electrophoresis, Principles and Methods* guide containing commonly used recipes.

**Pipet the appropriate volume of rehydration solution into each holder.**

**CAUTION!** Always wear protective gloves when working with rehydration solution.

**IMPORTANT!** To ensure complete sample uptake, do not apply excess rehydration solution.

The correct volume to each strip length is found in the instructions attached to each Immobiline DryStrip package.

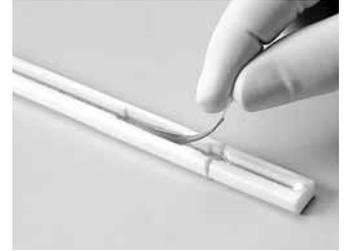
- 1 Deliver the solution slowly at a central point in the strip holder channel away from the sample application wells.
- 2 Remove any larger air bubbles.

**Position the IPG strip**

- 1 Remove the protective cover from the IPG strip.
- 2 Position it with the gel side down and the pointed (anodic) end of the strip directed toward the pointed end of the strip holder.
- 3 Pointed end first, lower the strip onto the solution. To help coat the entire strip, gently lift and lower the strip and slide it back and forth along the surface of the solution, tilting the strip holder slightly as needed to assure complete and even wetting.



- 4 Finally, lower the cathodic (square) end of the strip into the channel, making sure that the IPG gel is in contact with the strip holder electrodes at each end. The gel can be visually identified once the rehydration solution begins to dye the gel. Be careful not to trap bubbles under the strip.



#### ***Applying Immobiline DryStrip Cover Fluid***

Apply Immobiline DryStrip Cover Fluid to minimize evaporation and urea crystallization.

- 1 Pipet the cover fluid dropwise into one end of the strip holder until one half of the strip is covered.
- 2 Then pipet the cover fluid dropwise into the other end of the strip holder, adding fluid until the entire IPG strip is covered.

#### ***Placing the cover***

Position the cover on the holder. Pressure blocks on the underside of the cover ensure that the strip maintains good contact with the electrodes as the gel rehydrates.

#### ***Rehydration proceeding***

Rehydration can proceed on the bench top or on the Ettan IPGphor 3 unit platform. Ensure that the holder is on a level surface. A minimum of 10 h is required for rehydration; overnight is recommended.

Alternatively, the rehydration period can be programmed as the first step of an Ettan IPGphor 3 protocol. This is especially convenient if temperature control during rehydration is a concern, or if a low voltage is applied during rehydration.

### **3.3.2 Optional: Sample rehydration under voltage**

If desired, the sample can be absorbed by the IPG strip under low voltage. This may improve the uptake of high molecular weight proteins.

To perform rehydration under voltage:

- 1 Set the rehydration time to 0:00 and program Step 1 of the protocol for low voltage (30 –100 V) for 10–12 h.
- 2 Program additional steps as desired to achieve complete focusing.

### 3.3.3 Optional: Applying electrode pads prior to IEF

Under certain conditions, such as prolonged focusing, water may migrate toward one end of the strip, causing the other end to begin drying out. This effect can be minimized by placing paper electrode pads between the IPG strip and each strip holder electrode just before IEF. Electrode pads may also absorb ions that would otherwise accumulate at the ends of the IPG strip and possibly interfere with the separation.

#### *Applying electrode pads*

- 1 Cut two 3 mm wide electrode pads from a paper IEF electrode strip (18-1004-40).
- 2 Position on a clean, flat surface such as a glass plate and soak with deionized water. Remove excess water by blotting with tissue paper.

**IMPORTANT!** Electrode pads must be damp, not saturated or dripping.

- 3 Using forceps or tweezers, lift one end of the rehydrated IPG strip. Position an electrode pad over the electrode, then lower the strip back in place.
- 4 Repeat at the other end.

### 3.3.4 Optional: Applying sample after rehydration

If the sample was not applied by inclusion in the rehydration solution, it can be applied immediately prior to IEF.

**Note:** *The IPG strip backing is impermeable; do not apply the sample to the back of the strip.*

- 1 Prepare the sample in a solution similar in composition to the rehydration solution used.
- 2 Pipet the sample into either or both of the lateral wells at either end of the strip holder. Introduce the sample below the cover fluid.



Up to 7.5  $\mu\text{l}$  of sample solution can be added to each side (i.e. 15  $\mu\text{l}$  per well or 30  $\mu\text{l}$  max. if both sides of both wells are used).

### 3.3.5 Positioning the strip holders

The Ettan IPGphor 3 platform has two electrode areas:

- The larger area is the positive electrode (anode)
- The smaller area is the negative electrode (cathode)

Position the strip holder on the platform as shown below: The pointed end of the holder is over the anode (pointing to the back of the unit) and the blunt end is over the cathode. Guidemarks along the sides of the platform show approximate positioning for each strip holder size (7, 11, 13, 18, and 24 cm).

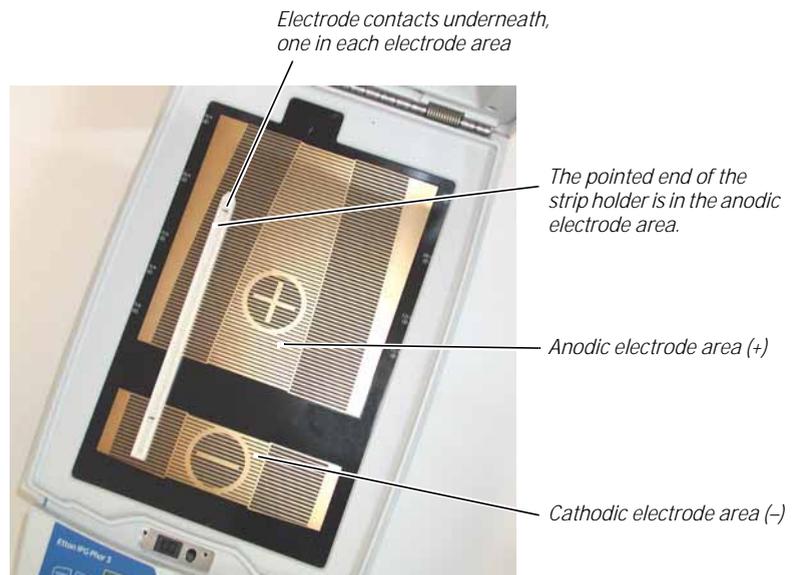


Fig 3-3. Ettan IPGphor 3 electrode areas.

### 3.3.6 Closing the safety lid

When using the IPGphor standard strip holders, lid adapters (see Fig 3-4) must be used to apply the correct amount of pressure to the lids of the IPGphor strip holders. The pressure keeps the IPG strip in contact with the IPG strip holder electrodes.

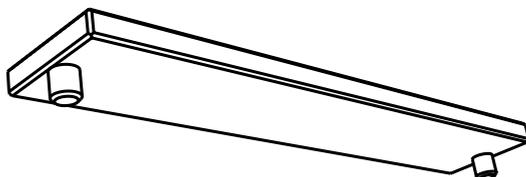


Fig 3-4. Lid adapter.

To ensure good electrical contact when using the fixed length strip holder:

- 1 Apply two lid adapters right across the lids of the strip holders, one over the anodic area and the other over the cathodic area, see Fig 3-5.



Fig 3-5. Safety lid and lid adapters.

- 2 Use two or more strip holders and place them wide apart (see Fig 3-5) to ensure that the lid adapters are only hanging on one strip holder and not pressing down on the other.
- 3 Carefully close the safety lid by applying light downwards pressure, ensure the mechanism locks the lid.

---

To inspect the run the light protective cover (see figure below) can be lifted without stopping the run.



To open the safety lid:

- Press down the lid and the lock is released and the run is stopped. Close the lid and the run continues.



### 3.4 *Running a pre-programmed protocol from the PC*

**WARNING!** Check that the high voltage is turned off before opening the safety lid. The HV ON indicator on the front panel should not light.

#### 3.4.1 **Ettan IPGphor 3 Control Software**

The Ettan IPGphor 3 Control Software allows the user to control the instrument and capture data from the serial port with a Windows® based computer and serial cable or USB converter.

The following functions are provided:

- Selecting run protocols by choosing strip length and pH gradient
- Editing of the protocols and transferring them to the instrument
- Starting, stopping and pausing of IEF runs on the instrument:
  - Acquisition of run data, which is displayed in the graph and the numerical displays
  - Event logging
- Printing and saving the display, and saving data and session log to a Microsoft Excel spreadsheet file

For detailed instructions on installation and usage of Ettan IPGphor 3 Control Software, and also on computer instrument connection, please refer to the *Ettan IPGphor 3 Software User Manual*.

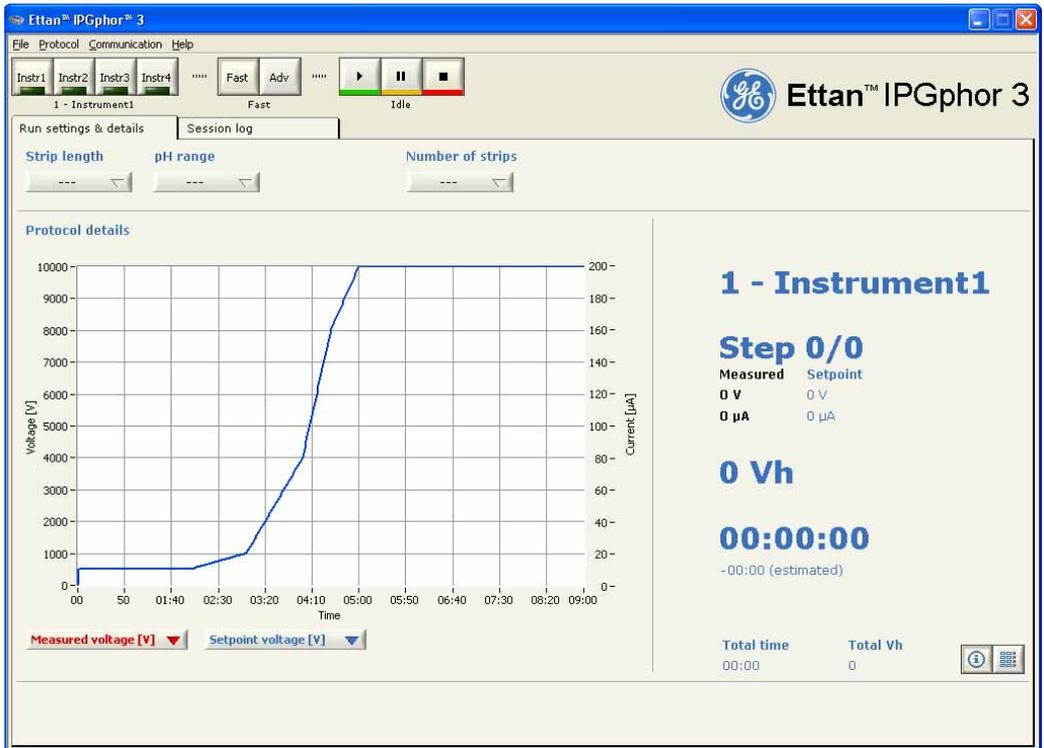


Fig 3-6. Ettan IPGphor 3 Control Software.

### 3.4.2 Starting the Ettan IPGphor 3 Control Software

From the **Windows Start** menu select **Programs**. Select the **IPGphor program** from the menu.

#### *Select an instrument*

Select the desired Ettan IPGphor 3 instrument by clicking one of the **instrument selection buttons**. The identity of the instrument should now be shown below the buttons. Up to four instruments can be run simultaneously with the software. To connect to an instrument:

- 1 Open the instrument communication settings from the menu **Communication/Instrument X**.
- 2 Select COM port
- 3 Select instrument name
- 4 Check the **Active** check box.

---

### *Protocol mode options*

When setting the protocol for the run there are two main options:

- Fast mode
- Advanced mode

The selection is made by the **protocol mode buttons** and the selected mode is indicated below the buttons.

In the fast mode option the software selects an optimized protocol based on the tray type, strip length and pH range to be used. Further, by switching to advanced mode, this protocol can be edited and saved to a file.

### *Fast mode protocol*

Select fast mode by clicking the left of the two central control buttons, labeled with an arrow. The display beneath the buttons will now show "Fast".

### **Enter experimental parameters**

After selecting the fast mode protocol select the **Run settings & details** tab. The strip length, pH range and number of strips should be set by using the **combo boxes** at the top of the tab window. The software will now select the optimal protocol for these parameters.

### **Edit selected protocol**

Select the **Protocol view** in the **Run settings & details** tab by clicking the right of the two buttons at the bottom right hand corner of the tab window. The protocol selected by the software is now shown in detail. It is now possible to edit any values in the protocol by clicking the **writing field** and entering desired changes.

### *Transfer the protocol to an instrument*

After finishing the protocol handling as described in *Ettan IPGphor 3 Software User Manual*, the desired protocol must be transferred to the correct instrument before starting a run.

Check that the desired instrument is selected. The identity of the selected instrument is indicated below the instrument selection control buttons, see *Ettan IPGphor 3 Software User Manual*. Change instrument if needed by pressing the correct instrument control button.

Select the **Protocol view** in the **Run settings & details** tab by clicking the tab and then the right of the two buttons at the bottom right hand corner of the tab window. Use the **Protocol to instrument** combo box to transfer the current protocol to the instrument.

---

---

### *Starting a run*

To start the run after transferring the protocol:

- 1 Press the **start run button** (the left button of the instrument control buttons at the top right of the application window). The run is now started and that status is indicated by the word "Running" below the instrument control buttons.

### *Monitoring a run*

- 1 Select the desired instrument by clicking the correct **instrument control button**. The identity of the selected instrument is shown below the control buttons.
- 2 Select the **Info and data view** in the **Run settings & details** tab by clicking the tab heading and then the left of the two buttons at the bottom right hand corner of the tab window. A number of run parameters are displayed.
- 3 In the **protocol details graph** the values of two of three possible parameters (setpoint voltage, measured voltage and measured current) can be displayed by selecting from the **combo boxes** below the graph.

Ettan IPGphor 3 Control Software graphs the data (Voltage, Volt-hours and Current) as it is retrieved from Ettan IPGphor 3 Isoelectric Focusing Unit.

The user can monitor and display the progress of any individual run from any one of four different instruments being run in parallel.

### *Stopping a run*

To stop an ongoing run:

- 1 Press the **stop run button** (the right button of the instrument control buttons at top right in the application window). The run is now stopped. To indicate that the run has stopped, "Idle" is displayed below the **instrument control buttons**.

When using the **stop button** it is not possible to start the protocol again except from the beginning of the protocol.

### *Log file of a run*

During the run important events are logged in the session log, which is shown when the **Session log tab** is selected in the application window. The log file stores instrument identity, User ID, current protocol, start time and many other parameters, see *Ettan IPGphor 3 Software User Manual* for details.

---

### Capturing run data

Run data is acquired from the Ettan IPGphor 3 Isoelectric Focusing Unit automatically every minute during a run, and the data is presented in a graph and in numerical displays.

### Storing data

All run data and the session log can be exported to a Microsoft Excel file. It is also possible to save the current application window as an image file. To export data:

- 1 Select **Export** from the **File** drop-down menu.
- 2 The default file name is the date and time (e.g. Apr 11, 2005 10.56.45).
- 3 The default location for the saved file is C:\IPGphor3\RunData.

### 3.5 *Creating, editing, and running protocol programs from the Ettan IPGphor 3 control panel*



**WARNING!** Check that the high voltage is turned off before opening the safety lid. The HV ON indicator on the front panel should not light.

#### 3.5.1 Protocol parameters

The Ettan IPGphor 3 can store up to ten protocols. Programmable protocol parameters include:

- duration and temperature of the rehydration phase
- duration, temperature, and power parameters for up to nine IEF steps for each protocol
- power parameters including maximum current, voltage, and voltage change pattern.

Please refer to the *2-D Electrophoresis, principles and methods guide* for sample handling recommendations and protocol guidelines. The permitted range of values for each programmable parameter is listed below.

Parameter	Operational range	Recommended values
Steps	1–9	
Step duration (hrs)	rehydration: 0–99:59 focusing: 0–99:59	10:00–14:00 2:00–10:00
Volts (V)	0–10000	100–10000
Max. current	1500 $\mu$ A total for 12 strips max.	50–75 $\mu$ A per strip
Platform temperature ( $^{\circ}$ C)	rehydration: 15–30 focusing: 15–30	20 20

#### *Navigating parameter “fields” and “digits”:*

- Each screen consists of information as well as one or more fields that can be edited. The active fields contain individually adjustable digits or characters.
- Certain digits are also linked to their neighbouring digits. For example, three of the four digits in the voltage field can each be adjusted individually, but when adjusting the value from 1000 to 990, for instance, even though only the ten’s place is adjusted manually, three digits are affected.
- Whether individual or linked, digits “wrap around,” so increasing from 9 produces 0 and decreasing from 0 produces 9—until a parameter limit is reached.

The Ettan IPGphor 3 can be programmed in volt-hours (Vhr) or hours and minutes in step-n-hold or in gradient mode. Any values within the operating limits listed above can be used.

### 3.5.2 Editing protocol parameters

All protocol parameters are set in the edit mode. Pressing the **EDIT** key toggles between the first editable screen and the protocol identification screen. For each protocol, the four different screens accessible in edit mode are:

Screen 1	Protocol number and name Rehydration time, temperature IEF run conditions (temperature and maximum current/strip), number of strips and number of steps in the selected protocol.
Screen 2-4	the nine steps available for IEF conditions (voltage change pattern, voltage, and step duration) in groups of 3

*This section covers the programming, editing, or verifying of all parameter values*

#### *Selecting protocol*

Select the protocol to be created or edited from the **main screen**:

- 1 Position the cursor under the protocol number field using the **right** and **left** arrow keys.
- 2 Move to the desired protocol number using the **up** and **down** arrow keys.

```
Prot# 1 File 1
Rehydrate 0:00Hr @ 20°C
IEF @ 20°C 50µA/Strip
1 Strips 0 Steps
```

- 3 The file name may be edited by using the **right** arrow to move into the file name and **up** and **down** arrows to adjust the characters as desired. To skip editing the name use the **left** arrow to proceed to the next line.
- 4 To change any letter, move the cursor to that location using the **right** and **left** arrow keys and then scroll through the 37 available options using the **up** and **down** arrow keys. Once the desired letter appears, move the cursor to the next character to be set.
- 5 The original label "File #" occupies 6 of the 16 available characters. To change the label to a more descriptive name, such as "11 CM 3-10L," requires scrolling through the alphanumeric options for each of the 11 digits in the name.

---

### *Editing protocol parameters*

Edit the Rehydration parameters, time and temperature, and the IEF parameters, temperature,  $\mu\text{A}/\text{Strip}$  and number of strips as necessary.

```
Prot# 1 File 1
Rehydrate 10:00Hr @ 20°C
IEF @ 20°C 50 $\mu\text{A}$ /Strip
1 Strips 0 Steps
```

**Note:** *The cursor stops only in the fields that can be edited. Once the cursor is in position, press the **up** or **down** arrow keys to adjust the value.*

The available time range is 0–99:59 h, with 10 min resolution. (Hence, only the first three digits are editable). A minimum of 10 h is required for the rehydration of IPG strip gels, but overnight is recommended. This protocol step can also be used as a simple timer to start the protocol at a convenient time. If the IPG strips are already rehydrated and ready for immediate focusing, set the rehydration duration to 00:00 Hrs.

To adjust the **rehydration temperature**:

- 1 use the **left** and **right** arrow keys to position the cursor and
- 2 the **up** and **down** arrow keys to select the value within the range of 15–30 °C. The original factory programmed value is 20 °C.

```
Prot# 1 File 1
Rehydrate 10:00Hr @ 20°C
IEF @ 20°C 50 $\mu\text{A}$ /Strip
1 Strips 0 Steps
```

**Note:** *Maintaining the actual platform temperature at <18 °C or >25 °C may require placement of the Ettan IPGphor 3 unit in a location of lower or higher than ambient temperature (e.g. a cold room).*

*It may be necessary to operate the instrument in an air conditioned room to prevent condensation from collecting on the platform in humid environments when the platform is run at greater than 7 °C below ambient temperature.*

The third line contains fields to set the platform temperature and current limit for all isoelectric focusing steps:

The original factory programmed IEF temperature is 20 °C. To adjust the **temperature**:

- 1 use the **left** and **right** arrow keys to position the cursor in the active °C field, and
- 2 use the **up** and **down** arrow keys to select the value within the range of 15–30 °C.

```
Prot# 1 File 1
Rehydrate 10:00Hr @ 20°C
IEF @ 20°C 50µA/Strip
1 Strips 0 Steps
```

The original factory programmed value is 50 µA per IPG strip.

To adjust the **current limit**:

- 1 use the **left** and **right** arrow keys to position the cursor under one of the three active µA digits, and
- 2 use the **up** and **down** arrow keys to select the value within the range 0–200 µA per strip.

**Note:** *The total deliverable amperage is 1500 µA.*

```
Prot# 1 File 1
Rehydrate 10:00Hr @ 20°C
IEF @ 20°C 50µA/Strip
1 Strips 0 Steps
```

- 3 Use the arrow keys to adjust the numbers of strips to run.
- 4 To advance to the next edit screen, press the **EDIT** key.

### **IEF programming**

The second screen in edit mode is the first in a series of nine programmable IEF steps in which the voltage change pattern, voltage, and step duration are set. The steps are displayed in groups of 3 steps per screen. The number of steps which have been programmed is displayed next to the protocol number.

Each step is identified by "S" and the step number and can be accessed by placing the cursor under the step number using the **right** and **left** arrow keys. To advance to the next step group press the **down** arrow key and to return to a previous step group press the **up** arrow key.

The two options for the **voltage change pattern** are:

- **Step**, which sets the voltage at the selected value for the new step and then holds the voltage constant for the step duration; and
- **Gradient**, which increases the voltage limit (linearly with respect to time) from the value set for the previous step to the value set for this step. If this is the first step, the value increases from 0.

The original programmed option is **Step** for each step. To toggle to **Gradient**, move the cursor to the **Step** field using the **right** and **left** arrow keys and toggle with the **up** or **down** arrow key:

```
Prot# 1 3 Steps
S1 Grad 500V 1:00 Hrs
S2 Grad 1000V 4:00 Hrs
S3 Step 8000V 80000 Vhr
```

**IEF voltage** is programmable from 0 –8000 V in increments of 10 V. Each of the first three digits in the voltage field can be set independently.

- 1 First move the cursor to the desired digit location using the **right** and **left** arrow keys, and
- 2 then change the value using the **up** and **down** arrow keys.

```
Prot# 1 3 Steps
S1 Grad 500V 1:00 Hrs
S2 Grad 1000V 4:00 Hrs
S3 Step 8000V 80000 Vhr
```

The original factory programmed voltage for each step is 0. Program each step with the protocol voltage values. If fewer than nine steps are required, end the program by assigning a value of 0 V after the final step. The step duration (0 to 99:59 hours) or volt-hours (0 to 300000 Vhr) are programmable for each step.

To select, set the cursor under the currently selected field and use the **up** or **down** arrow key to toggle between Hrs and Vhrs. To set the digits:

- 1 first move the cursor to the desired digit location using the **right** and **left** arrow keys, and
- 2 then change the value using the **up** and **down** arrow keys.

The original factory programmed time for each step is 0:00, and should be set to 0:00 for all unused steps. The Vhrs value is calculated according to the explanatory note at the left, but these values can be set in the same manner as the Hrs values.

**Note:** *When toggling from Hrs to Vhr, the value in the Vhrs field is automatically calculated according to the selected voltage change pattern:  
For Step-n-hold, Vhr is the product of hours and voltage.  
For Gradient, Vhr is the product of hours and the mean of the voltage limit set for the current step and the previous step.  
Absolute Vhr limits can be set to any value from 1–30000 Vhr.*

Prot# 1 3 Steps	
S1 Grad 500V 1:00 Hrs	hours step
S2 Grad 1000V 4:00 Hrs	
S3 Step 8000V 80000 Vhr	volt-hours step

Prot# 1 3 Steps
S1 Grad 500V 1:00 Hrs
S2 Grad 2000V 1:00 Hrs
S3 Step 8000V 2:00 Hrs

#### **Programming example**

##### **Simplified 4-step protocol and resulting voltage profile**

To illustrate the two voltage change patterns, a simplified example shows program steps and the resulting voltage profile. Note that step 4 ends the protocol.

For recommended IEF protocols, see the *2-D Electrophoresis Principles and Methods guide*.

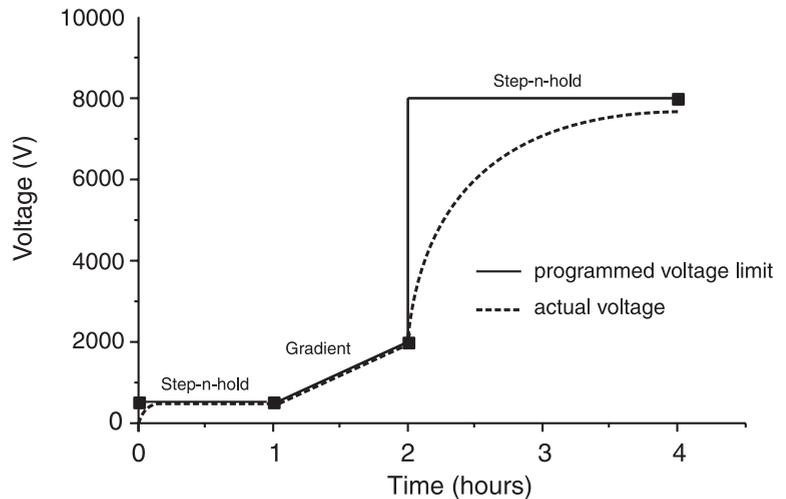


Fig 3-7. Voltage profile.

**Note:** The set voltage is the voltage limit. Under conditions of limiting current, it may take some time for the maximum voltage to be reached, and under certain power conditions, it may not be reached at all.

A lower voltage step may be entered at the end of the Ettan IPGphor 3 protocol. Band sharpness will decrease however.

#### Verifying the protocol

To verify the protocol:

- 1 scroll through each step: position the cursor in the step number field using the **right** and **left arrow** keys, and
- 2 then advance through the steps using the **up** and **down** arrow keys.

Edit as required by placing the cursor with the **right** and **left** arrow keys and adjusting the value with the **up** and **down** arrow keys.

Make sure that the voltage field in all unused steps displays a value of 0, or that the value in the Hrs field is 00:00.

**Note:** Pressing the **up** arrow key in screen 4 wraps back to the **rehydration** screen.

#### Exiting edit mode

Press the **EDIT** key to save any changes and exit the step edit mode. The **protocol identification** screen will appear.

### 3.5.3 Starting isoelectric focusing from the Ettan IPGphor 3 control panel

#### *Selecting the protocol number*

Advance to the **protocol identification** screen by:

- 1 placing the cursor in the **protocol number** field using the **right** and **left** arrow keys, and
- 2 selecting the **protocol number** using the **up** and **down** arrow keys.

```
Prot# 1 MY PROTOCOL
Rehydrate 10:00Hr @ 20°C
IEF @ 20°C 200µA/Strip
12 Strips 3 Steps
```

- 3 Use the **right** and **left** arrow keys to position the cursor to set the number of strips to run, and the **up** and **down** arrow keys to select the number (1–12)
- 4 Press the **START** key.

A screen is displayed to confirm the number of strips to run. Adjust the number of strips if necessary.

```
Number of strips : 12
Press START to continue
```

- 1 Press **START** to continue.

If the safety lid is not properly closed the following message will indicate the required action:

```
Lid open step 1
Close lid to continue
```

#### **CAUTION!** During IEF:

- do not lean on the safety lid,
- do not apply excess pressure or uneven weight to the lid, and
- do not place any items on the lid.

---

After securing the safety lid:

- 1 Press the **START** key again.

Once the protocol begins, each step is carried out automatically, and instrument status for each step is indicated on the screen.

Platform temperature and time remaining can be changed while the protocol is in progress, and each such possibility is discussed in turn below.

The first screen will indicate the protocol, number of steps, and total hours (excluding rehydration time):

```
Starting protocol # 1
3 steps 4:00 Hr
```

If a rehydration period was programmed, the rehydration status screen will indicate the number of hours elapsed and the actual platform temperature:

```
Running Prot# 1
Rehydration for 10:00 Hr
0:01 Hr Elapsed
Rehydrate at 20°C
```

To change rehydration duration or other parameters:

- 1 Press the **EDIT** key to display the **set** screen:

The first line indicates that the protocol is running. Pressing **Edit** again will access the **step setting** screen. Pressing **Edit** again will return to the **Running** screen. Any changes made while a protocol is running are applied to the current run only, the stored protocol is not affected.

```
Running Prot# 1
Rehydrate 10:00Hr @ 20°C
IEF @ 20°C 200 µA/Strip
12 Strips 3 Steps
```

Move the cursor under the digit you wish to set and change it using the **up** and **down** arrow keys. To end this step, set all digits to **0**. This screen is automatically replaced by the regular status screen after a few seconds.

The temperature field can be changed directly (without pressing the **EDIT** key):

- 1 use the **right** and **left** arrow keys to position the cursor in the **temperature** field, and
- 2 use the **up** and **down** arrow keys to adjust the value.

It may take up to 30 minutes to reach the set temperature, depending on ambient conditions.

Isoelectric focusing will begin after the rehydration step is complete. The HV ON lamp will light and the **status** screen showing the step currently in progress as well as all parameters will appear:

```
Running Prot# 1 @ 20 °C
Step 1 of 3 Vhrs
Step Vhrs Elapsed
500V 40µA/Strip 0.0W
```

**Note:** *The indicated wattage is the total power delivered to all strips, and will often read 0 W because any value less than 0.5 is rounded down to 0. If the delivered power exceeds 0.4 W per strip, stop the run and reduce the V or µA settings.*

The current platform temperature is indicated.

The average current per IPG strip (µA), the total instantaneous power delivered (W), and actual voltage (V) are indicated. If the current is the limiting parameter, the "A" in "µA" will flash.

The Ettan IPGphor 3 will display the volt-hours during the run as:

- VhS, which indicates the total volt hours for that step, or
- VhT, the total volt-hours accumulated during the entire run at the current time.

Hours elapsed for the current step will be indicated by Hrs.

---

To toggle between VhT, VhS and Hrs:

- 1 move the cursor to the **Hrs/Vhrs** field of the display using the **right** or **left** arrow key, and
- 2 change the display to reflect VhT, VhS and Hrs using the **up** and **down** keys.

To change the display to show remaining Hrs, VhS or VhT:

- 1 move the cursor under the **Elapsed** or **~ Remain** field and use the **up** or **down** buttons.

The temperature, voltage and current limits for the current step may be adjusted directly on this screen as well.

Pressing the **Edit** key will access the **step parameter** screen. Pressing **Edit** again will return to the **Running** screen. Use the **up** arrow in the **S1** field to access the **Rehydration/IEF** screen.

```
Running Prot#
S1 Grad 500V 1:00 Hrs
S2 Grad 2000V 1:00 Hrs
S3 Step 8000V 2:00 Hrs
```

***Note:** If you adjust the voltage during a gradient step the step will be converted to Step for the remainder of the step.*

As isoelectric focusing proceeds, the bromophenol blue tracking dye will migrate toward the anode and leave the IPG strip. This generally occurs well before focusing is complete.

***Note:** A colorless strip is no indication that IEF is complete.*

If the tracking dye does not move, then no current is flowing across the strip. Check that the strip holder electrodes are in contact with the electrode areas. See the Troubleshooting section for additional suggestions.

When the protocol ends, audible beeps will sound and the following screen is displayed:

```
Run ended at
8000V 12000 Vhrs Total
50µA 8:00 Hr Total
Press Stop to reset
```

The final instrument values are displayed. Press the **STOP** key, as indicated, to reset the instrument.

---

### 3.5.4 Pausing or stopping a protocol

To pause or stop a protocol in progress, press the **STOP** key:

Paused in step 1  
Press **START** to continue

To continue the protocol, press the **START** key. To cancel the protocol, press the **STOP** key again. This will cause the instrument to respond as though the end of an uninterrupted protocol had been reached as described above.

### 3.5.5 Printing a log of instrument conditions

To document and save run protocols and data during a run, use the Ettan IPGphor 3 Control Software.

An abbreviated log illustrates the format.

```
--- IPGphor 3
Serial No: 4711
Firmware version: A2 02/20/04
-----
```

```
Date: Mar 14, 2005
-----
```

```
17.52.21 User cttcjc logged on
17.52.21
```

```
Protocol: Test
No. of strips: 12
IEF Params: 50uA/Strip at 20 C
Step 1: Step 100V 0:01 Hr
Step 2: Grad 500V 0:01 Hr
Step 3: Grad 8000V 0:01 Hr
Step 4: Step 8000V 0:01 Hr
```

```
17.52.21 Step 1 started
17.53.21 Step 2 started
17.54.22 Step 3 started
17.55.23 Step 4 started
17.56.25 Run finished
```

Ettan IPGphor 3 Control Software may also be used to log and graph and print the output.

In addition the output may be exported to a text or spreadsheet file such as Microsoft Excel.

## 4 Care and maintenance

---

**IMPORTANT!** The ceramic strip holders and manifold are very brittle and fragile. Take care in handling and do not subject to impacts.

**IMPORTANT!** Avoid scratching the electrode surfaces.

**IMPORTANT!** Wipe the exterior surfaces with a damp cloth after each use. Never use abrasive cleansers or solvents.

**IMPORTANT!** Always turn the mains power switch off and unplug the power cord before performing any maintenance.

### 4.1 *Cleaning the Ettan IPGphor 3*

The parts of the instrument that come in contact with liquid reagents are resistant to chemicals typically used for IEF. Before introducing any other chemicals into the system, first test the affected parts. Never use ketones, hot strong acids, or hydrocarbon solvents.



**WARNING!** If large volumes of liquid have penetrated the casing of the instrument and come into contact with the electrical components, immediately switch off the instrument and contact an authorized service technician.

## 4.2 *Cleaning procedures*

IPGphor Strip Holder Cleaning Solution has been specifically formulated for removing protein deposits. It will not damage the strip holder or manifold. IPGphor Strip Holder Cleaning Solution (80-6452-78) can be ordered in 950-ml bottles from GE Healthcare.

### 4.2.1 **Ceramic strip holders/manifold**

The Ettan IPGphor 3 strip holders and manifold are made from a thermally conductive aluminum oxide ceramic. They have been surface-treated to minimize adsorption and interaction with proteins. The surface coating is mechanically robust and can withstand temperatures of up to 300 °C, however it can be damaged by prolonged exposure to extremes of pH.

Clean strip holders/manifold after each first-dimension IEF run. Do not let solutions dry in the strip holder/manifold. Cleaning may be more effective if the strip holder/manifold is first soaked a few hours or overnight in a solution of 2–5% IPGphor Strip Holder Cleaning Solution in water. Strip holders and manifold may also be immersed in boiling 1% SDS.

**IMPORTANT!** You must use a neutral pH detergent, such as the IPGphor Strip Holder Cleaning Solution, to remove residual protein from the strip holders/manifold.

**IMPORTANT!** Fixed length strip holders and manifold may be baked, boiled or autoclaved. DO NOT EXPOSE THEM TO STRONG ACIDS OR BASES, INCLUDING ALKALINE DETERGENTS.

#### *Cleaning procedure*

- 1 First rinse off the strip holder/manifold. Use a mild liquid soap to remove any residual IPG cover fluid.
- 2 Squeeze a few drops of IPGphor Strip Holder Cleaning Solution into the strip holder/manifold slot. Use a toothbrush and vigorous agitation to clean the strip holder/manifold.
- 3 Rinse well with distilled or deionized water.
- 4 Thoroughly air dry the strip holders/manifold or dry well with a lint-free tissue prior to use.
- 5 Wipe the platform and plate electrodes with a lab tissue or paper towel after each use. Other exterior surfaces can be cleaned with a damp cloth. Never use abrasive cleanser or solvents.

---

#### 4.2.2 Manifold Light

Clean the Ettan IPGphor Manifold Light with water, no warmer than 40 °C, and with IPGphor Strip Holder Cleaning Solution.

**CAUTION!** Do not use any organic solvents.

#### 4.2.3 Electrodes

Wash the electrode assemblies with the IPGphor Strip Holder Cleaning Solution. Rinse thoroughly with water then deionized water and allow to air dry.

**CAUTION!** Do not use strong acids, bases, ketones, alcohols, or other reagents to clean the covers, sample cups, or electrodes or the parts may be damaged. Cups may be briefly rinsed with ethanol if desired.



### 4.3 Replacing fuses

**WARNING!** Fuses protect equipment by disconnecting loads too large for the instrument's circuit design, so it is imperative that fuses are replaced only with fuses of identical rating. The mains power module, located at the back of the instrument, contains two input mains fuses which are the same for all models: T2.5 AL 250V, 5 × 20 mm.

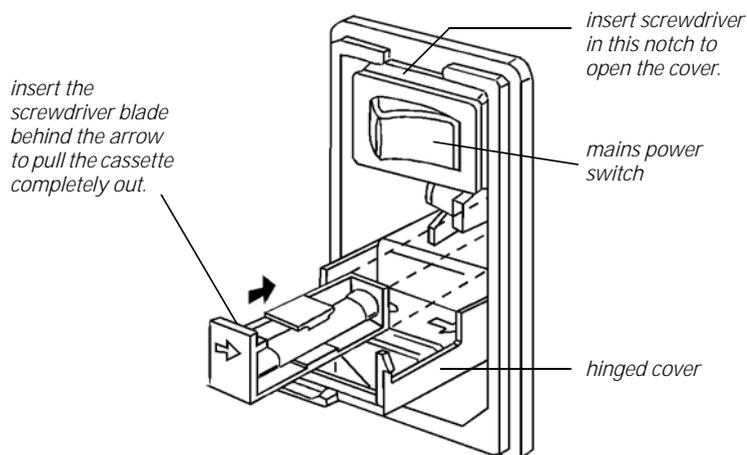


Fig 4-1. The mains power module is located on the rear panel.

**CAUTION!** Turn the mains power supply switch off and detach the power cord before replacing input mains fuses!

To replace the fuse:

- 1 Open the fuse compartment by inserting a small flat-blade screwdriver into the slot at the top of the power module. Twist the screwdriver 1/8 – turn to release the cover, then pull out the hinged compartment, which opens out.
- 2 Insert the screwdriver above the arrow on one fuse cassette, catch the cassette end, and slowly slide it completely out of the module.
- 3 Pull the fuse out of its cassette and inspect. If the fuse element is burned or broken, replace the fuse with an identical type. If the fuse appears to be intact, check it with a multi-meter. (A reading of 1 ohm or less indicates the fuse is still usable.)
- 4 After placing a good fuse into the cassette, slide it into the power module, making sure the arrow on the cassette points to the right (in the same direction as the guide arrows on the inside of the compartment door).

- 
- 5 Repeat steps 3 to 5 for the second cassette.
  - 6 Close the fuse compartment cover and gently press it into the power module until it snaps shut.
  - 7 Plug the power cord into the unit and turn the mains power switch on.
  - 8 If the instrument does not start when power is switched on after replacement of mains fuse(s), call GE Healthcare service.



## 5 Troubleshooting

Symptom	Possible solution
<b>Problems indicated by LCD messages</b>	
Lid open step 1, close to continue	The safety lid is not properly closed. When the safety lid is open, the system has an automatic voltage cutoff safety feature. In order for the protocol to proceed, the safety lid must be closed.
Locked screen in edit mode	Turn off the mains power switch to reset the instrument.
Blank display	If no electrical components are functioning (e.g. HV lamp does not light and the cooling fans are motionless), check the fuses in the mains power module.
Diagnostic program indicates component failure	Note the component that failed and press the <b>START</b> key to continue through the diagnostic program. Call your local GE Healthcare service for further information on how to remedy the failure.
Arc	An electric arc has been detected. The instrument will reduce the voltage setting 500 volts automatically. The run continues, and there is no need for further action.
<b>Power delivery</b>	
Current too low or zero	At least two of three pressure pads under the safety lid should press gently against the strip holders to ensure electrical continuity between the strip holder electrodes and the electrode areas on the platform.
	The gel must be evenly and completely rehydrated to conduct current. Make sure the proper amount of rehydration solution is applied to the IPG strip holder and allow a minimum of 10 hours for rehydration.
	Check that both connecting points of the strip holder or the connecting pins of the manifold electrodes are in contact with the gold surface.
Voltage limit not reached	The ionic strength of the rehydration solution is too high. The instrument has reached the current limit; reduce the IPG buffer concentration; use a mixed-bed ion-exchange resin to remove ionic breakdown products of urea or other additives.
	Desalt the sample or prepare the sample so that the salt concentration is less than 10 mM.

Symptom	Possible solution
Sparks or burning in strips	Reduce the current limit. Do not exceed 50 $\mu$ A per strip.
	Prevent the IPG strip from drying out by always applying Immobiline DryStrip Cover Fluid during rehydration.
	Ensure that the IPG strip is fully rehydrated along the entire length of the strip. The IPG strip should be in complete contact with the correct volume of rehydration solution. Remove any air bubbles trapped under the IPG strip.
	Desalt the sample or prepare the sample so that the salt concentration is less than 10 mM. De-ionize additives to the rehydration solution. Excessive charged material in the sample or rehydration buffer lead to electro-endosmosis which will dry out the middle of the strip, possibly leading to arcing and burning at these points.

## 6 Customer service information

### 6.1 Technical service and repair

GE Healthcare offers complete technical support for all our products. If you have any questions about how to use this product, or would like to arrange to repair it, please call or fax your local GE Healthcare representative.

**IMPORTANT!** Request a copy of the GE Healthcare "Health and Safety Declaration" form before returning the item. No items can be accepted for servicing or return unless this form is properly completed.

### 6.2 Ordering information

Product	Quantity	Code number
<b>Ettan IPGphor 3 Isoelectric Focusing Unit</b>		
Basic unit. Order manifold and strip holders separately	1	11-0033-64
Cable Serial 9 Pin F/F with Null Modem Adapter	1	80-6506-36
Ettan IPGphor 3 Control software	1	11-0036-23
<b>Manifolds</b>		
Ettan IPGphor Cup Loading Manifold ceramic, complete	1	80-6498-38
Ettan IPGphor Cup Loading Manifold ceramic	1	80-6498-57
Ettan IPGphor Cup Loading Manifold Light, complete	1	11-0026-88
Ettan IPGphor Cup Loading Manifold Light	1	11-0025-80
<b>Accessories</b>		
Sample cups	pack of 20 (6x)	80-6498-95
Paper electrode wicks	pack of 40 (6x)	80-6499-14
Paper bridge pads	pack of 20 (6x)	80-6499-33
Electrode set	1	80-6498-76
Lid adapter	1	28-4008-41
Cleaning brush	1	80-6505-98
Spirit level	1	80-6194-19
Forceps SS	1	80-6506-17

Product	Quantity	Code number
USB-RS232 converter	1	28-4001-45
<b>Strip holder covers</b>		
7 cm	2	80-6455-44
11 cm	2	80-6455-63
13 cm	2	80-6455-82
18 cm	2	80-6456-01
24 cm	2	80-6479-76
<b>Strip holders for use with Immobiline DryStrip gels</b>		
7 cm, complete	6	80-6416-11
11 cm, complete	6	80-6416-30
13 cm, complete	6	80-6416-49
18 cm, complete	6	80-6416-68
24 cm, complete	6	80-6469-88
7 cm, complete	1	80-6416-87
11 cm, complete	1	80-6417-06
13 cm, complete	1	80-6417-25
18 cm, complete	1	80-6417-44
24 cm, complete	1	80-6470-07
<b>Immobiline DryStrip Reswelling Trays</b>		
7–18 cm	1	80-6371-84
7–24 cm	1	80-6465-32
<b>IPG Buffer</b>		
pH 3–10 L	1 ml	17-6000-87
pH 3–10 NL	1 ml	17-6000-88
pH 3–11 NL	1 ml	17-6004-40
pH 3.5–5.0	1 ml	17-6002-02
pH 4–7	1 ml	17-6000-86
pH 4.5–5.5	1 ml	17-6002-04
pH 5.0–6.0	1 ml	17-6002-05
pH 5.5–6.7	1 ml	17-6002-06
pH 6–11	1 ml	17-6001-78
pH 7–11 NL	1 ml	17-6004-39
<b>Rehydration Solutions</b>		
DeStreak Rehydration Solution	1 ml	17-6003-19
DeStreak Reagent	5 × 3 ml	17-6003-18

Product	Quantity	Code number
<b>Ettan preparation kits and reagents</b>		
2-D Fractionation Kit	10 preps	80-6501-04
Albumin and 1gG Removal Kit	10 preps	RPN6300
Protease Inhibitor	1 ml	80-6501-23
Nuclease Mix	0.5 ml	80-6501-42
Thiourea	100 g	RPN6301
Iodoacetamide	25 g	RPN6302
Sample Grinding Kit	50 samples	80-6483-37
2-D Clean-Up Kit	50 samples	80-6484-51
SDS-PAGE Clean-Up Kit	50 samples	80-6484-70
2-D Quant Kit	500 assays	80-6483-56
Mini Dialysis Kit, 1 kDa cut-off, 250 µl	1	80-6483-75
Mini Dialysis Kit, 1 kDa cut-off, 2 ml	1	80-6483-94
Mini Dialysis Kit, 8 kDa cut-off, 250 µl	1	80-6484-13
Mini Dialysis Kit, 8 kDa cut-off, 2 ml	1	80-6484-32
<b>PlusOne™ reagents</b>		
Urea	500 g	17-1319-01
CHAPS	1 g	17-1314-01
Triton™ X-100	500 ml	17-1315-01
Dithiothreitol (DTT)	1 g	17-1318-01
Bromophenol Blue	10 g	17-1329-01
Immobiline DryStrip Cover Fluid	1000 ml	17-1335-01
<b>Immobiline DryStrip gels</b>		
<b>7 cm</b>		
pH 3–5.6	12	17-6003-53
pH 3–10	12	17-6001-11
pH 3–10NL	12	17-6001-12
pH 3–11 NL	12	17-6003-73
pH 4–7	12	17-6001-10
pH 5.3–6.5	12	17-6003-58
pH 6–11	12	17-6001-94
pH 6.2–7.5	12	17-6003-63
pH 7–11 NL	12	17-6003-68

Product	Quantity	Code number
<b>11 cm</b>		
pH 3-5.6	12	17-6003-54
pH 3-10	12	18-1016-61
pH 3-11 NL	12	17-6003-74
pH 4-7	12	18-1016-60
pH 5.3-6.5	12	17-6003-59
pH 6-11	12	17-6001-95
pH 6.2-7.5	12	17-6003-64
pH 7-11 NL	12	17-6003-69
<b>13 cm</b>		
pH 3-5.6	12	17-6003-55
pH 3-10	12	17-6001-14
pH 3-10NL	12	17-6001-15
pH 3-11 NL	12	17-6003-75
pH 4-7	12	17-6001-13
pH 5.3-6.5	12	17-6003-60
pH 6-11	12	17-6001-96
pH 6.2-7.5	12	17-6003-65
pH 7-11 NL	12	17-6003-70
<b>18 cm</b>		
pH 3-5.6	12	17-6003-56
pH 3-10	12	17-1234-01
pH 3-10NL	12	17-1235-01
pH 3-11 NL	12	17-6003-76
pH 3.5-4.5	12	17-6001-83
pH 4-7	12	17-1233-01
pH 4.0-5.0	12	17-6001-84
pH 4.5-5.5	12	17-6001-85
pH 5.0-6.0	12	17-6001-86
pH 5.3-6.5	12	17-6003-61
pH 5.5-6.7	12	17-6001-87
pH 6-9	12	17-6001-88
pH 6-11	12	17-6001-97
pH 6.2-7.5	12	17-6003-66
pH 7-11 NL	12	17-6003-71

Product	Quantity	Code number
<b>24 cm</b>		
pH 3–5.6 NL	12	17-6003-57
pH 3–7 NL	12	17-6002-43
pH 3–10	12	17-6002-44
pH 3–10 NL	12	17-6002-45
pH 3–11 NL	12	17-6003-77
pH 3.5–4.5	12	17-6002-38
pH 4.0–5.0	12	17-6002-39
pH 4–7	12	17-6002-46
pH 4.5–5.5	12	17-6002-40
pH 5.0–6.0	12	17-6002-41
pH 5.3–6.5	12	17-6003-62
pH 5.5–6.7	12	17-6002-42
pH 6–9	12	17-6002-47
pH 6.2–7.5	12	17-6003-67
pH 7–11 NL	12	17-6003-72
Cleaning solution, IPGphor Strip Holder	950 ml	80-6452-78
2-D Electrophoresis Principles and Methods	1	80-6429-60
Equilibration tube set for 24 cm IPG Strips	12	80-6467-79
IEF electrode strips	100	18-1004-40
Immobiline DryStrip Cover Fluid	1 liter	17-1335-01





[www.gehealthcare.com](http://www.gehealthcare.com)

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