ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

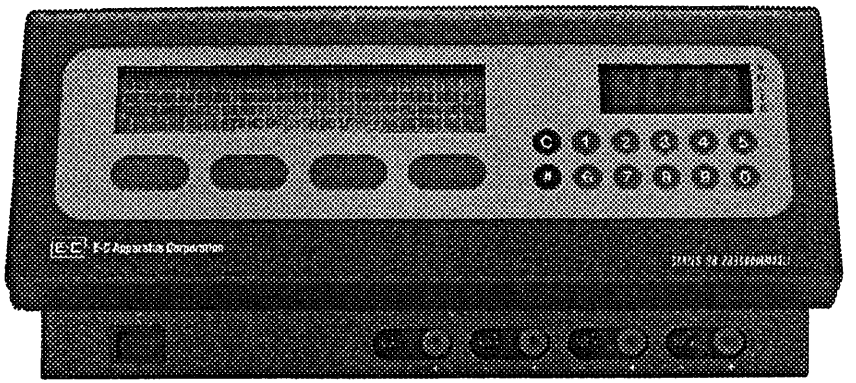
- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Thermo 3000P* at our website: ***Click HERE***

Instruction Manual
EC Series 90 Programmable Power Supplies



⚠ WARNING ⚠

Please read these instructions carefully before using this power supply.

⚠ AVERTISSEMENT ⚠

Veuillez, avant tout emploi du générateur, lire attentivement ce manuel d´utilisation.

E-C APPARATUS CORPORATION
100 Colin Drive
Holbrook, NY 11741-4306
Tel: 1-516-244-2929
Toll Free: 1-800-EC-RANGE
FAX: 1-516-244-0606
For Technical Service: 1-800-327-2643

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SAFETY NOTICES
NOTICES DE SÉCURITÉ

⚠ WARNING: This notice alerts you to a potentially dangerous situation.

⚠ AVERTISSEMENT: Cette notice attire votre attention sur des dangers potentiels.

⚠ CAUTION: This notice means serious damage may occur to your power supply or chamber.

⚠ ATTENTION: Cette notice attire votre attention sur des dangers sérieux pour votre générateur ou votre chambre d´électrophorèse.

NOTE: This notice gives useful advice or suggestions to raise the performance or reliability of your power supply.

⚠ WARNING

This power supply has been designed to be used as a source of DC power for electrophoresis. It is capable of generating lethal currents. Use the same precautions as with any electrical device. Do not operate without the cover in place. Do not connect the output to earth ground. Do not operate in a damp, humid, environment where condensing moisture may short out internal electrical components. Do not operate with connecting cables which have exposed live wires. Do not pull the leads out of the 4mm output connectors while the unit is in operation. Follow all appropriate safety measures outlined by the chamber manufacturer.

⚠ AVERTISSEMENT

Ce générateur a été concu pour être utilisé comme source de courant (DC) pour l´électrophorèse, et il est capable de générer un courant mortel. Prenez les mêmes précautions que pour tout autre appareil électrique. N´utilisez pas l´appareil sans que le couvercle de la chambre soit placé. Ne raccordez pas les sorties à la terre. N´utilisez pas l´appareil dans des environnements humides, où la condensation pourrait causer des dommages aux composants électriques internes. Ne mettez pas l´appareil en route avec des câbles ou partie de câble dénudé. Ne retirez pas les câbles des sorties de 4mm pendant que l´appareil est en fonctionnement. Prendre toutes les précautions recommandé par le fabriquant de la chambre d´électrophorèse.

TABLE OF CONTENTS

Table of Contents 1

Operation of the Programmable Power Supply 2

Overview of the Flow Charts 6

Messages and Other Menus 6

Selecting the Operating Language, Clearing the Memory and all Programs 6

FAULT DETECTED Messages 7

INVALID ENTRY Messages 9

Glossary 11

Appendix A. Setting Safe Operating Limits 16

Appendix B. Relationships Between Volts, Milliamps, Watts and Chamber Resistance 17

Appendix C. Running Multiple Chambers 17

Appendix D. Utilizing Automatic Crossover 18

Appendix E. Integration 18

Appendix F. Set-Up and Location 19

Service 20

Specifications 21

Warranty 22

Appendix G. Program Worksheet ..... Inside back page

Flow Charts ..... Inside back cover

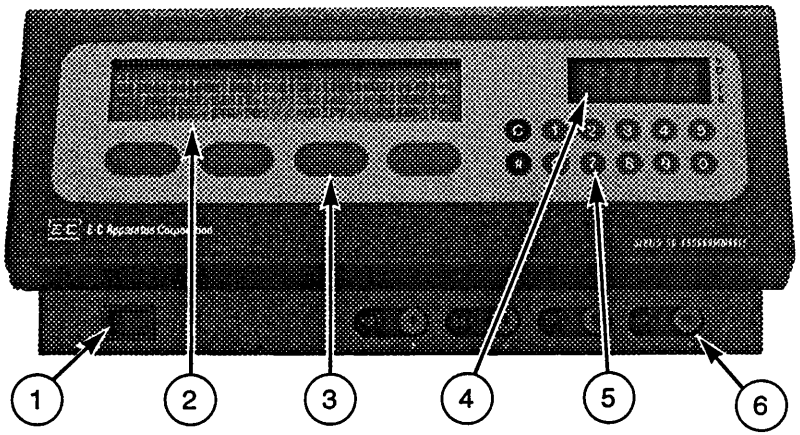
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INTENDED USES

This power supply is intended to be used with electrophoretic devices which operate below the rated output levels listed in the table below. The table lists the maximum output levels for each model described in this instruction manual. Four sets of output connectors operate in parallel to provide an output of constant voltage or constant current (milliamps) or constant power (watts).

- Model EC6000P 6000V, 200mA, 200W
- Model EC5000P 5000V, 200mA, 200W
- Model EC4000P 4000V, 300mA, 300W
- Model EC3000P 3000V, 300mA, 300W
- Model EC2060P 2000V, 600mA, 300W
- Model EC2000P 2000V, 300mA, 300W

Figure 1. The Front Panel Layout.



The operation of this programmable power supply involves these features:

1. AC mains power on/off switch
2. Liquid Crystal Display (LCD) screen
3. Four function keys under the LCD screen
4. Light Emitting Diode (LED) voltage display
5. Numerical keypad with twelve keys under the LED voltage display
6. Four sets of 4mm output connectors

OPERATION OF THE PROGRAMMABLE POWER SUPPLY

The operation of this programmable power supply involves the six features on the front of the unit shown in Figure 1. Audible cues confirm that entries have been made.

This programmable power supply can be operated in five different languages (English, Français, Deutsch, Italiano, Espãnol).

How to select or change the operating language.

NOTE: This procedure clears all the information previously programmed into the unit.

1. Switch the power supply On using the AC Mains Power On/Off Switch (1) while pressing the "#" key on the numerical keypad (5).

NOTE: I means On and O means Off.

2. Using the numerical keypad (5), enter the number corresponding to the desired language.

After selecting the language, the programmable power supply can be operated in three modes of operation defined as the RUN mode, the INTEGRATE mode and the PROGRAM mode as described in the following six examples (A-F).

NOTE: The electrophoresis chamber should first be set up and filled with buffer before plugging the chamber's leads into the appropriate positive and negative 4mm output connectors (6) on the power supply.

A. How to operate the unit in the RUN mode using the timer.

Running an agarose gel at 80V (constant voltage) for 75 minutes.

1. Switch the AC Mains Power On/Off Switch On.
2. Press **RUN**.
3. Press **MODIFY**.
4. Enter the values for 80V, 100mA, 50W and 75 minutes (01:15) using the numerical keypad (5) and the cursor control keys (—> and <—) (3).
5. Press **EXIT**.
6. Press **RUN**.

B. How to operate the unit in the INTEGRATE mode.

Running a sequencing gel at a constant power of 55W for 3400 volt-hours using the integration feature.

1. Switch the AC Mains Power On/Off Switch On.
2. Press **INTEGRATE**.
3. Enter 3400Vh using the numerical keypad (5).
4. Press **CONTINUE**.
5. Enter the values of 2000V, 60mA and 55W using the numerical keypad (5) and the cursor control keys (—> and <—) (3).
6. Press **RUN**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C. How to CREATE A PROGRAM while operating in the PROGRAM mode.

Creating and running a PROGRAM to run an SDS-PAGE gel first at a constant current of 15mA for 45 minutes until the sample has migrated through the stacking gel, and then at a constant current of 30mA for 90 minutes.

1. Switch the AC Mains Power On/Off Switch On.
2. Press **PROGRAM**.
3. Press **CREATE A PROGRAM**.
4. Press **CONTINUE**.
5. Enter the values of 100V, 15mA, 10W and 45 minutes (00:45) using the numerical keypad (5) and the cursor control keys (—> and <—) (3).
6. Press **NEXT STEP**.
7. Enter the values of 300V, 30mA, 20W and 90 minutes (01:30) using the numerical keypad (5) and the cursor control keys (—> and <—) (3).
8. Press **COMPLETE**.
9. Press **RUN**.
10. Press **RUN**.

D. How to EDIT A PROGRAM while operating in the PROGRAM mode.

Editing the PROGRAM created above to change the time for the sample to migrate through the resolving gel (STEP 2) to 120 minutes, and then running the PROGRAM.

1. Switch the AC Mains Power On/Off Switch On.
2. Press **PROGRAM**.
3. Press **EDIT A PROGRAM**.
4. Press **CONTINUE**.
5. Press **NEXT STEP**.
6. Using the numerical keypad (5) and the cursor control keys (—> and <—) (3), move the cursor to the TIMER and enter the value for 120 minutes i.e. 2 hours (02:00).
7. Press **COMPLETE**.
8. Press **RUN**.
9. Press **RUN**.

E. How to LIST a PROGRAM while operating in the PROGRAM mode.

Checking whether the operating limits for the SDS-PAGE experiment outlined above were correctly entered, and then running the PROGRAM.

1. Switch the AC Mains Power On/Off Switch On.
2. Press **PROGRAM**.
3. Press **LIST PROGRAM** and check the values in PROGRAM 1 STEP 1.
4. Press **NEXT STEP** and check the values in PROGRAM 1 STEP 2.
5. Press **SELECT**.
6. Press **RUN**.

F. How to RUN A PROGRAM while operating in the PROGRAM mode.

Running the PROGRAM which was previously entered for the SDS-PAGE experiment as outlined above.

1. Switch the AC Mains Power On/Off Switch On.
2. Press **PROGRAM**.
3. Press **RUN A PROGRAM** and check that the correct PROGRAM number has been selected. If not, enter the correct number using the numerical keypad (5).
4. Press **RUN**.

⚠ WARNING

Do not pull the leads out of the 4mm output connectors while the power supply is in operation.

⚠ AVERTISSEMENT

Ne retirez pas les câbles des sorties de 4mm pendant que l´appareil est en fonctionnement.

How to clear ALL PROGRAMS without having to reset the language.

NOTE: This procedure clears all information previously programmed into the unit.

1. Switch the power supply On using the AC Mains Power On/Off Switch (1) while pressing the "#" key on the numerical keypad (5). ALL PROGRAMS CLEARED will appear on the screen.
2. After the language selection menu appears on the screen, switch the power supply Off.
3. Switch the power supply back On. The language which was used before will still be used, but ALL PROGRAMS will have been cleared.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

OVERVIEW OF THE FLOW CHARTS

The flow chart that folds out of the inside of the back cover, is intended to illustrate the general organization and operational logic of this programmable power supply. Only those steps leading directly to the activation of the high voltage output are shown. Refer to the Glossary on page 11 to obtain additional information about the messages and other options you will encounter.

MESSAGES AND OTHER MENUS

Selecting the Operating Language, Clearing the Memory and All Programs

To clear all of the programs in the programmable power supply, switch the AC Mains Power On/Off Switch to On while the "#" key is being depressed. ALL PROGRAMS CLEARED will appear on the screen; this message on the screen will then be followed by the language selection menu. Press one of the numerical keys (1-5) to select the language of your choice. Once the language has been selected, all subsequent menus for the operation of the programmable power supply will be presented in that language.

```
ALL PROGRAMS CLEARED
```

```
1) ENGLISH      2) FRANCAIS      3) DEUTSCH
4) ITALIANO     5) ESPANOL

SELECT LANGUAGE
```

FAULT DETECTED MESSAGES

⚠ WARNING: This notice and these messages alert you to potentially dangerous situations.

⚠ AVERTISSEMENT: Cette notice attire votre attention sur des dangers potentiels.

⚠ CAUTION: This notice means serious damage may occur to your power supply or chamber.

⚠ ATTENTION: Cette notice attire votre attention sur des dangers sérieux pour votre générateur ou votre chambre d´électrophorèse.

NO LOAD detection message

```
FAULT DETECTED
NO LOAD
PRESS "#" KEY TO RESET
PRESS "C" KEY TO CONTINUE
```

The NO LOAD detection message and continuous tone alarm indicate that the circuit between the power supply and the electrophoresis chamber (the load) is not closed. Check that all the leads are connected properly, and press the "C" KEY TO CONTINUE with the run. Alternatively, press the "#" KEY TO RESET the power supply so that the menu preceding the activation of the run appears. If one of the keys under the screen is pressed, the continuous tone will also cease.

NOTE: Some electrophoretic techniques can store energy in the chamber over a period of time. This energy, which manifests itself as a low voltage, may inhibit the normal function of the load sensing interlock. When a run is restarted, the NO LOAD detection message may appear and the power supply may not start. To overcome this effect, press the "C" key until the power supply reaches its proper operating voltage. Upon releasing the key, the power supply should remain engaged.

GROUND LEAK #1 message

```
FAULT DETECTED
GROUND LEAK #1

CYCLE POWER TO RESET
```

The GROUND LEAK #1 message indicates that there is a ground leak, i.e. some of the current output is flowing from the anode lead (+) to earth ground. This situation can be hazardous. Switch the AC Mains Power On/Off Switch Off, check the leads and connections and make sure that there is no leakage of buffer from the electrophoresis chamber onto the bench before proceeding with the run. Contact technical service if the problem persists.

GROUND LEAK #2 message

```
FAULT DETECTED
GROUND LEAK #2

CYCLE POWER TO RESET
```


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The GROUND LEAK #2 message indicates that there is a ground leak, i.e. some of the current output is flowing from the cathode lead (-) to earth ground. This situation can be hazardous. Switch the AC Mains Power On/Off Switch Off, check the leads and connections, and make sure that there is no leakage of buffer from the electrophoresis chamber onto the bench before proceeding with the run. Contact technical service if the problem persists.

EXCESS CURRENT message

```
FAULT DETECTED
EXCESS CURRENT

CYCLE POWER TO RESET
```

The EXCESS CURRENT message indicates that there is an internal excess current in the power supply. Switch the AC Mains Power On/Off Switch Off and On to reset the power supply. If this does not clear the error message, contact technical service.

OVERHEAT message

```
FAULT DETECTED
OVERHEAT

CYCLE POWER TO RESET
```

The OVERHEAT message indicates that the heatsink located at the rear of the unit has exceeded safe operating temperatures. Switch the AC Mains Power On/Off Switch Off momentarily and let the unit cool off. Make sure that there is enough ventilation behind the unit so that the heatsink fins can be properly cooled before switching the AC Mains Power On/Off Switch back On and resuming operation.

INVALID ENTRY MESSAGES

MAX VOLTAGE message

```
INVALID ENTRY

MAX VOLTAGE IS 4000
```

The MAX VOLTAGE message indicates that an unacceptable value of more than 4000V is being entered. Check the values being entered and the specifications for the power supply.

NOTE: The maximum voltage of 4000 shown above applies only to power supplies with that rated output level. Other models have different output levels.

MAX CURRENT message

```
INVALID ENTRY

MAX CURRENT IS 300
```

The MAX CURRENT message indicates that an unacceptable value of more than 300mA is being entered. Check the values being entered and the specifications for the power supply. For the EC2060P, the "MAX CURRENT is 600"

MAX POWER message

```
INVALID ENTRY

MAX POWER IS 300
```

The MAX POWER message indicates that an unacceptable value of more than 300W is being entered. Check the values being entered and the specifications for the power supply.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MAX TIME message

```
INVALID ENTRY

MAX TIME IS 99:59
```

The MAX TIME message indicates that an unacceptable value of more than 99 hours and 59 minutes is being entered. Check the values being entered and the specifications of the power supply.

ZERO DISALLOWED message

```
INVALID ENTRY

ZERO DISALLOWED
```

The ZERO DISALLOWED message indicates that one of the operating limits (V, mA, W) has been entered as a zero value. Check the values of the operating limits and adjust them appropriately before proceeding with the run.

PROGRAM STEP SET TO RUN CONTINUOUSLY message

```
INVALID ENTRY

PROGRAM STEP SET TO RUN CONTINUOUSLY
```

The PROGRAM STEP SET TO RUN CONTINUOUSLY message indicates that the program step being completed requires a timed operating limit. Check the operating limits entered with that step, and make sure that one of the four timed operating limits (TIMER, Vh, mAh or Wh) is set, before completing the program.

PROGRAM NUMBER DOES NOT EXIST message

```
INVALID ENTRY

PROGRAM NUMBER DOES NOT EXIST
```

The PROGRAM NUMBER DOES NOT EXIST message indicates that the user is attempting to run a program which has not been created. Check which programs have been created by using the LIST PROGRAM option before proceeding with the run.

GLOSSARY

ACTUAL: ACTUAL is used as a designator for the real time operating output levels of the power supply and the accumulation of integrator values and time.

ALL PROGRAMS CLEARED: This messages indicates that all PROGRAMS and operating limits entered into the memory of the programmable power supply have been erased, and that the default values (10V, 300mA, 300W and TIMER OFF) have been entered. **NOTE: 600mA for the EC2060P.** To erase all the programs and reset the power supply, the "#" key should be depressed while switching the AC Mains Power On/Off Switch On.

COMPLETE: In the PROGRAM mode, COMPLETE indicates that the last STEP of the PROGRAM can be completed by pressing the key underneath. It also indicates that the PROGRAM of the specified number has been completed and entered.

CONTINUE: The CONTINUE option is used to get out of STANDBY mode and proceed with the electrophoretic run. In the PROGRAM mode, CONTINUE appears when the options CREATE A PROGRAM and EDIT A PROGRAM are being used. In this case it allows you to advance.

CREATE A PROGRAM: In the PROGRAM mode, the CREATE A PROGRAM option is used when a new PROGRAM has to be created.

CYCLE POWER TO RESET: This instruction appears as part of a FAULT DETECTED message when a GROUND LEAK has been detected by the power supply. Switch the AC Mains Power On/Off Switch Off and On to reset the power supply.

DELETE: In the PROGRAM mode, after having selected the EDIT A PROGRAM option, DELETE is used to delete a specific PROGRAM identified by its PROGRAM number. The numbering of the other PROGRAMS is not effected by the deletion.

EDIT A PROGRAM: In the PROGRAM mode, the EDIT A PROGRAM option is used to modify any or all aspects of an existing program.

ENTER PROGRAM NUMBER TO BE EDITED OR DELETED: In the EDIT A PROGRAM option, of the PROGRAM mode, this instruction is used to designate the PROGRAM NUMBER to be edited or deleted.

ENTER PROGRAM NUMBER TO BE RUN: In the RUN A PROGRAM option of the PROGRAM mode, this instruction is used to designate the PROGRAM NUMBER TO BE RUN.

EXCESS CURRENT: This FAULT DETECTED message indicates that there is an internal excess current in the power supply. Switch the AC Mains Power On/Off Switch Off and On to reset the power supply. If this fails to help, contact technical service.

EXIT: In all three modes of operation, EXIT is used to return to the previous screen or to the initial screen.

FAULT DETECTED: This message indicates that there is a problem. The message appears when NO LOAD or a GROUND LEAK has been detected, or when there is an EXCESS CURRENT or the power supply overheats.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

GROUND LEAK # 1: The GROUND LEAK #1 message indicates that a ground leak from the positive lead has been detected.

GROUND LEAK # 2: The GROUND LEAK #2 message indicates that a ground leak from the negative lead has been detected.

hrs: In the PROGRAM mode, while using the LIST PROGRAM option, hrs LIMIT indicates what time limit (in hours and minutes) has been assigned to a particular PROGRAM STEP.

INTEGRATE: INTEGRATE refers to one of the three modes of operation of the programmable power supply. In this mode, the product of one of the operating values (V or mA or W) and time is being measured and accumulated as volt-hours or milliamp-hours or watt-hours.

INVALID ENTRY: The INVALID ENTRY message appears when values that exceed the maximum permissible operating limits (V, mA, W, or TIMER), or zero values for V, mA or W are being entered. In the PROGRAM mode, the INVALID ENTRY also appears when a PROGRAM without a time limit (an incomplete PROGRAM) is being created, or when an attempt is made to RUN A PROGRAM which has not been entered and for which no number has been assigned.

LIMIT: In the PROGRAM mode, while using the LIST PROGRAM option, LIMIT indicates what value has been set for the TIMER or Vh or mAh or Wh for a particular PROGRAM STEP.

LIST PROGRAM: In the PROGRAM mode, LIST PROGRAM is used to list the operating limits which have been entered into each one of the steps of the program.

mA: mA stands for milliamps (or milliamperes) i.e. current.1000mA = 1A i.e one ampere.

mAh: mAh stands for milliamp-hours which is the integration of milliamps over time (e.g. 100mA for 2 hours = 200mAh). The milliamp-hours accumulated during a run can only be set and monitored in the INTEGRATE mode and in the PROGRAM mode.

MAX CURRENT IS 300: This INVALID ENTRY message indicates that an unacceptable value of more than 300mA is being entered. **NOTE: EC2060P max current is 600.**

MAX POWER IS 300: This INVALID ENTRY message indicates that an unacceptable value of more than 300W is being entered.

MAX TIME IS 99:59: This INVALID ENTRY message indicates that an unacceptable value of more than 99 hours and 59 minutes is being entered.

MAX VOLTAGE IS XXXX: This INVALID ENTRY message indicates that an unacceptable value of more than the maximum output voltage is being entered.

MILLIAMPS AT LIMIT: MILLIAMPS AT LIMIT indicates that the power supply is operating in a constant current i.e. constant milliamps (or milliamperes) mode. Volts and watts are not held constant.

MODIFY: MODIFY is presented as an option in which the operating limits can be changed before or during the electrophoretic run.

MORE: The MORE option is used in the INTEGRATE mode and PROGRAM mode to monitor the SET and ACTUAL values for Vh, mAh and Wh.

NEXT PROGRAM: In the PROGRAM mode, while using the LIST PROGRAM option, the NEXT PROGRAM option is used to select the PROGRAM to be listed.

NEXT STEP: In the PROGRAM mode, NEXT STEP is used to list, create or edit an additional program STEP.

NO LOAD: This FAULT DETECTED message indicates that there is no electrical connection between the positive and negative output connectors of the power supply. Check that the leads are connected properly and that the wires in the leads or in the electrodes are not broken.

OUTPUT IS OFF: OUTPUT IS OFF appears as a message when the POWER SUPPLY IS ON STANDBY; it indicates that the power supply's high voltage output is off.

OVERHEAT: This FAULT DETECTED message appears when the power supply internal operating temperature exceeds safe limits. Switch the AC Mains Power On/Off Switch Off. Let the power supply cool off for a few minutes, and make sure that air circulation at the rear of the unit is not obstructed before switching the AC Mains Power On/Off Switch back On.

POWER AT LIMIT: POWER AT LIMIT indicates that the power supply is operating in a constant power i.e. constant watts mode. Volts and milliamps are not held constant.

POWER ON: POWER ON flashing indicates that the high voltage output of the power supply has been activated; the voltage display shows the number of volts generated.

POWER SUPPLY IS ON STANDBY: This message indicates that the STANDBY option has been activated and the high voltage is disabled.

PRESS "#" KEY TO RESET: This instruction appears in conjunction with the FAULT DETECTED, NO LOAD message. When the "#" is pressed, the power supply operating limits and the TIMER are reset.

PRESS "C" KEY TO CONTINUE: This instruction appears in conjunction with the FAULT DETECTED, NO LOAD message. When the "C" key is pressed after correcting the NO LOAD problem, the run is re-initiated without resetting the TIMER.

PROGRAM: PROGRAM appears as an option on the initial screen; this option is used to operate the power supply in the PROGRAM mode.

PROGRAMS ALLOCATED: PROGRAMS ALLOCATED indicates how many programs have been created and are currently stored in the memory of the programmable power supply.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PROGRAM NUMBER DOES NOT EXIST: In the PROGRAM mode, this INVALID ENTRY message appears when a PROGRAM without a time limit (an incomplete PROGRAM) is being entered, or when an attempt is made to RUN A PROGRAM which has not been entered and for which no number has been assigned.

PROGRAM STEP SET TO RUN CONTINUOUSLY: In the PROGRAM mode, this INVALID ENTRY message appears when attempts are made to create a PROGRAM or a STEP without a time limit defined by the TIMER or by Vh or mAh or Wh.

PROGRAM 1 (2 STEPS) COMPLETE: PROGRAM number (number of STEPS) COMPLETE appears on the screen after the last STEP of a PROGRAM that has been created or edited and is completed while using CREATE A PROGRAM or EDIT A PROGRAM in the PROGRAM mode. The message reconfirms that the program number and the number of steps shown have been completed and programmed into the memory of the power supply.

PROGRAM 5 SELECTED: PROGRAM number SELECTED appears on the screen after a PROGRAM has been selected using SELECT in the LIST PROGRAM option of the PROGRAM mode. This message reconfirms that the program number shown has been selected to be edited or run.

RETURN: RETURN appears in the INTEGRATE mode or in the PROGRAM mode while using the MORE option. The RETURN option is used to bring the user to the screen showing the SET and ACTUAL values of the operating limits and the TIMER.

RUN: RUN is used in several different situations. On the initial screen RUN appears as an option to operate the power supply in the RUN mode. In all three modes of operation, RUN is again presented as an option to activate the power supply's high voltage output to initiate electrophoresis.

RUN A PROGRAM: RUN A PROGRAM is an option presented while operating in the PROGRAM mode. It is used to select and initiate a particular program (identified by its number) without further listing or modifications.

RUN FINISHED: This message indicates that the electrophoretic separation process has been terminated by one of the time limited operating limits (TIMER or Vh or mAh or Wh). The power supply's high voltage output is off.

SELECT: This option is presented in the PROGRAM mode while using LIST PROGRAM to designate the PROGRAM being listed.

SELECT LANGUAGE: This instruction appears on the screen after all the programs have been cleared by pressing the "#" key while switching the AC Mains Power On/Off Switch On. To operate the power supply, the user's language of choice has to be chosen at this stage by entering one of the numbers (1-5).

SELECT ITEM TO MODIFY: This instruction directs the user to choose the operating limit to be changed.

SELECT MODE OF OPERATION: This instruction appears on the initial screen which is presented when the AC Mains Power On/Off Switch is switched On. The message instructs the user to choose PROGRAM or INTEGRATE or RUN.

SELECT OPTION REQUIRED: In the PROGRAM mode, this instruction directs the user to chose one of the four choices (LIST PROGRAM or CREATE A PROGRAM or EDIT A PROGRAM or RUN A PROGRAM).

SET: SET is used as a designator for the values of the operating limits that have been entered; the operating limits (V, mA, W, TIMER, or Vh, or mAh or Wh) are listed thereafter.

STANDBY: STANDBY is used to temporarily interrupt a run without resetting the TIMER or the integration process (Vh or mAh or Wh).

STEP: In the PROGRAM mode, STEP refers to a set of operating limits including one of the time limits (TIMER, Vh, mAh and Wh) entered into a PROGRAM. Up to 10 STEPS can be included in each PROGRAM.

STOP: STOP is used to terminate a run in any mode of operation. The timer is reset by STOP.

TIMER: The TIMER shows how much time has been used for the run; time is shown in hours, minutes and seconds. In the default settings, TIMER=OFF appears. If the TIMER is set by entering hours and minutes, it functions as a countdown timer. Note that the ACTUAL TIMER functions as a count-up timer.

V: V stands for volts.

Vh: Vh stands for volt-hours which is the integration of voltage over time (e.g. 100 volts for 2 hours = 200Vh). The volt-hours accumulated during a run can only be set and monitored in the INTEGRATE mode and in the PROGRAM mode.

VOLTAGE AT LIMIT: VOLTAGE AT LIMIT indicates that the power supply is operating in a constant voltage mode. Milliamps and watts are not held constant.

W: W stands for watts i.e. power. Watts are related to volts and milliamps by the equation W = V x mA x .001

Wh: Wh stands for watt-hours which is the integration of wattage over time (e.g. 100 watts for 2 hours = 200Wh). The watt-hours accumulated during a run can only be set and monitored in the INTEGRATE mode and in the PROGRAM mode.

ZERO DISALLOWED: This INVALID ENTRY message appears when a zero value is being entered for one of the operating limits (V, mA or W).

<—: When the SELECT ITEM TO MODIFY instruction is presented, the left arrow key is used to move the cursor to the left.

—>: When the SELECT ITEM TO MODIFY instruction is presented, the right arrow key is used to move the cursor to the right.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Appendix A. Setting Safe Operating Limits

When performing an electrophoretic procedure for the first time, it is important to make certain that you do not exceed the operating limits of the chamber being used. Most chambers are made of acrylic plastic which can warp at high temperatures (above 55° C). For this reason, it is especially important to determine the normal operating conditions for each application and confirm that they do not exceed the safe operating limits of the chamber being used.

Whenever possible, contact the chamber manufacturer and request information regarding maximum operating limits for your chamber. If detailed information regarding maximum operating limits for the chamber is not available, regular monitoring of the chamber operating temperature is recommended during the initial use. Be certain to monitor temperature in a manner that avoids physical contact with the chamber when voltage is applied.

The following procedure illustrates how normal operating conditions can be determined and how this information can be used to choose safe operating limits for an agarose gel run in a submarine chamber at a constant voltage of 125 volts.

1. Adjust the operating limits to 125V, 300mA, 300W.
2. Start the run and note the mA and W values when the voltage has reached 125V and "VOLTAGE AT LIMIT" appears on the screen.
3. Adjust the mA and W settings so that they exceed the actual values by 10%, or by 10 milliamps and 5 watts, whichever is greater. Thus the SET and ACTUAL values may look like this.

SET = 0125V 055mA 011W
ACTUAL = 0125V 045mA 006W

In the procedure listed above, we first determined the actual output wattage and milliamps for operation at 125 volts and then chose operating limits that were at a slightly higher level than those indicated for milliamps and watts. This approach ensures that the maximum output from the power supply will never exceed the normal operating conditions by more than 10%.

NOTE: When operating in constant current or constant power, and setting a limit for voltage, select a value which is greater than the actual value by 10% or 25 volts, whichever is greater.

NOTE: Some users prefer to set up the chamber, switch the power supply's output on, and adjust the operating limits before the samples are actually loaded. Once the user has (i) confirmed that the chamber and the power supply are functioning properly, and (ii) determined what the safe operating limits are, the power supply's output is switched off, and the samples are loaded. Since the power supply will remember the settings of the operating limits, the output can be switched back on without further adjustments.

Appendix B. Relationships Between Volts, Milliamps, Watts and Chamber Resistance

There are three fundamental concepts which form the basis for understanding the relationship between volts, milliamps and chamber resistance. When combined with the power formula they also define watts.

1 A movement of free electrons from atom to atom forms an electric current which is measured in milliamps (mA) or amps (A).
2. Electrostatic lines of force between two different charges produce a pressure that can move electrons (measured in volts).
3. All substances oppose the movement of electrons to some extent and are said to have resistance (measured in ohms).

These three factors are always present in any operating electric circuit. It is possible to incorporate them into one inclusive statement:

Ohm's Law

The value of the current that will flow in any circuit will be directly proportional to the value of the voltage applied and inversely proportional to the value of the resistance.

or

amps = volts / resistance

combined with

The power formula:

volts x amps = watts

(where 1 amp = 1000mA)

Together, these two formulas define all aspects of the relationship between volts, milliamps, watts and chamber resistance.

Appendix C. Running Multiple Chambers

This power supply is equipped with four sets of 4mm output connectors which are connected in parallel. The significance of this can be explained by studying the following statements.

1. The voltage is applied equally to all branch paths in a parallel circuit.
2. The current flow in the branch paths of a parallel circuit is determined by the resistance of the individual paths.
3. The sum of the currents entering the branch paths of a parallel circuit is equal to the sum of the currents leaving the branch paths of a parallel circuit.

A practical example of this is described as follows:

The power supply is connected to two identical horizontal submarine electrophoresis chambers (cells A and B). The power supply output is adjusted to 100 volts, at constant

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

voltage, and the current display indicates 60 milliamps. By applying the three rules for parallel circuits we can determine the following information.

1. The voltage applied to both Cell "A" and Cell "B" is 100 volts. (Rule 1)
2. The sum of the currents flowing through Cell "A" and Cell "B" is equal to 60 milliamps. (Rule 3)

Switch off the power supply and momentarily disconnect Cell "B". Switch the power supply back on and note how the output current reading drops to 35 milliamps. From this, the following information can be derived.

1. The current flow through Cell "B" is equal to 60 milliamps minus 35 milliamps i.e. a net value of 25 milliamps. (Rule 3)
2. The reason Cell "A" and Cell "B" have different current readings is due to the difference in resistance between Cells "A" and "B". (Rule 2)

Appendix D. Utilizing Automatic Crossover

Certain electrophoretic techniques require the careful adjustment of operating limits and the utilization of the automatic crossover feature of this power supply. Automatic crossover involves a transition from one mode of operation (constant current, for example) to another mode of operation such as constant voltage.

Semi-dry electroblotting exemplifies the utility of this feature. Semi-dry transfer chambers contain two closely spaced parallel electrode plates. A "sandwich" consisting of buffer-saturated filter paper sheets on the outside, and a gel and a charged transfer membrane on the inside, is assembled and placed between the electrode plates. Typical protocols suggest that the transfer should be carried out at a constant current. As the transfer process progresses, the buffer in the two filter paper layers heats up and begins to break down. This breakdown leads to an increase in the overall resistance between the two plates. In the constant current mode, the increase in resistance leads to a voltage increase. Left unchecked, the increasing voltage can eventually lead to arcing which would damage the electrode plates, the gel and the transfer membrane.

To eliminate the arcing problem, the voltage should be set at an operating limit which is below the arc threshold . As the voltage increases, it will eventually reach the predetermined operating limit. At this point, the power supply will automatically cross over from the constant current mode to the constant voltage mode of operation. As the transfer is completed, the current will gradually diminish.

Appendix E. Integration

The conductivity of the buffer in the electrophoresis chamber can change during the course of a run and result in changes in the voltage, current or wattage being applied. Integration of the output over a given time period takes such changes into account by monitoring volt-hours or milliamp-hours or watt-hours. The volt-hour integration

method is used most frequently since the rate of migration of molecules through gels is proportional to the voltage that is being applied.

The way this feature can be used is described as follows. If we run an experiment at constant voltage, at an output of 110 volts, for three hours we will accrue 330 volt-hours. We know this is true since the voltage was held constant for the full three hours. During the course of this same experiment the output current varied from a maximum of 50 milliamps to a minimum of 25 milliamps. Now suppose we wish to repeat the experiment at constant current, but we want the same effect as 3 hours at a constant voltage of 110 volts. At constant current, we know the output voltage must vary since the current varied when we performed the experiment at constant voltage. If we select a volt-hour limit of 330 volt-hours, the power supply automatically stops when the total for the volt-hours equals 330 regardless of the fluctuations in the voltage.

⚠ WARNING:	This notice and these messages alert you to potentially dangerous situations.
⚠ AVERTISSEMENT:	Cette notice attire votre attention sur des dangers potentiels.
⚠ CAUTION:	This notice means serious damage may occur to your power supply or chamber.
⚠ ATTENTION:	Cette notice attire votre attention sur des dangers sérieux pour votre générateur ou votre chambre d´électrophorèse.

Appendix F. Set-Up and Location

Location: Make sure that the unit is set up in a location where it is protected from physical damage, moisture, corrosive agents and extreme temperatures. Also, make sure that the "fins" at the rear are not obstructed. For safe operation, the unit should be readily accessible

Connection to the AC Mains: Use the power cord to connect the unit to the AC Mains carrying the appropriate specified voltage (V) in accordance with the rating label located at the rear of the unit. Make sure that the Mains receptacle has the proper three wire (grounded or earthed) connections.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SERVICE

WARNING: This notice alerts you to a potentially dangerous situation.

AVERTISSEMENT: Cette notice attire votre attention sur des dangers potentiels.

This power supply is not equipped with any user serviceable parts.

Contact E-C Apparatus for technical assistance if problems arise. The telephone number is 516-244-2929, or 1-800-EC-RANGE.

SPECIFICATIONS

Type of Output: Constant Voltage, Constant Milliamps or Constant Watts with automatic crossover

Maximum Voltage: 2000-6000 Volts
(refer to the table on the inside of the front cover of this manual which lists the model numbers).

Maximum Current: 200-600 Milliamps

Maximum Power: 200-300 Watts

Regulation: < 1%

Accuracy: ± 1.5 % full scale for each display

Number of Output Terminals:
Four recessed sets of 4 mm output connectors. Safety Interlock: with load sensing shut-down on disconnect. Key actuation necessary to begin voltage generation. In the event of shutdown due to power interruption, automatic restart is provided.

Timer: 00 to 99 hrs. 59 min.

Integration: 999999 Volt-hours, 99999 Milliamp-hours, 99999 Watt-hours

Programmability: 20 Programs, each with 10 Steps

Ground Leakage: Leakage of 400 microamps or more will interrupt the generation of high voltage.

Input Power: 110/240 Volts AC, 50/60 Hertz, 750 Watts

Ambient Operating Temperature Range:
0° C - 30° C (non-condensing atmosphere)

Dimensions: 11.4″ (D) x 12.6″ (W) x 6.2″ (H)
29 cm x 32 cm x 15.8 cm

Weight: **(net)** 12 lbs 5.5 kg
(shipping) 17.5 lbs 8.0 kg

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

WARRANTY

This laboratory equipment was produced by E-C Apparatus Corporation with the highest practical standards of materials, workmanship, and design. The design and manufacture of parts have been conceived with one purpose — to produce a unit which will give satisfactory service.

E-C Apparatus Corporation guarantees this unit to be free from defects in materials or workmanship under normal use or service for four years from date of shipment. If, during this time, this unit proves defective in materials or workmanship, the Company will repair or replace it free of charge if returned to us prepaid. This guarantee does not cover damage in transit, damage caused by carelessness, misuse or neglect, or unsatisfactory performance as a result of conditions beyond our control or consequential losses as a result of our product.

Appendix G. Program Worksheet

Application	Program #	Step #	V	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP