User's Manual

HT 96-Well Electoporation System

Model HT-200 & HT-100
Plate Handler

MA1 45-0400	Model HT-100
MA1 45-0401	Model HT-200

BTX®

HARVARD APPARATUS

The Electroporation Experts

WEEE/RoHS Compliance Statement

EU Directives WEEE and RoHS

To Our Valued Customers:

We are committed to being a good corporate citizen. As part of that commitment, we strive to maintain an environmentally conscious manufacturing operation. The European Union (EU) has enacted two Directives, the first on product recycling (Waste Electrical and Electronic Equipment, WEEE) and the second limiting the use of certain substances (Restriction on the use of Hazardous Substances, RoHS). Over time, these Directives will be implemented in the national laws of each EU Member State.

Once the final national regulations have been put into place, recycling will be offered for our products which are within the scope of the WEEE Directive. Products falling under the scope of the WEEE Directive available for sale after August 13, 2005 will be identified with a "wheelie bin" symbol.

Two Categories of products covered by the WEEE Directive are currently exempt from the RoHS Directive – Category 8, medical devices (with the exception of implanted or infected products) and Category 9, monitoring and control instruments. Most of our products fall into either Category 8 or 9 and are currently exempt from the RoHS Directive. We will continue to monitor the application of the RoHS Directive to its products and will comply with any changes as they apply.

- **Do Not Dispose Product with Municipal Waste**
  - **Special Collection/Disposal Required**

Table of Contents

General Information

Models HT-200 and HT-100

The BTX HT-200 and HT-100 plate handlers allow for the Highthroughput System HT 25 or HT 96 for advanced molecular delivery. The HT 96 (96-well) plates or the HT 25 (25-well) plates can be electroporated using a BTX generator (models: ECM® 830 and ECM® 630) with a plate handler. The Model HT-200 automatically switches columns in a Multi-well plate during electroporation using the Auto-track sensing feature. The Auto-track sensing allows rapid electroporation of an entire plate by setting up all columns and pressing one button. The Model HT-100 requires manual switching of columns using the column select buttons. Both the HT-200 and the HT-100 enable Advanced Molecular Delivery!

Serial Numbers

All inquires concerning our product should refer to the serial number of the unit. Serial numbers are located on the rear of the case.

Calibrations

All electrical apparatus are calibrated at the rated voltage and frequency. No field calibration required.

Warranty

Harvard Apparatus warranties these BTX Plate Handlers for a period of 2 years from date of purchase. At its option, Harvard Apparatus will repair or replace the unit if it is found to be defective as to workmanship or material.

This warranty does not extend to damage resulting from misuse, neglect, or abuse, normal wear and tear, or accident.

This warranty extends only to the original customer purchase.

Failure to use the Enhancer 3000 High Voltage probe to connect a BTX Generator to an external digital oscilloscope for monitoring will result in voiding your warranty; connecting directly to the external monitoring equipment or modified monitoring setup will damage the Generator.

IN NO EVENT SHALL HARVARD APPARATUS BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. Some states do not allow exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. **THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE, OR OF ANY OTHER NATURE.** Some states do not allow this limitation on an implied warranty, so the above limitation may not apply to you.

If a defect arises within the 2 year warranty period, promptly contact **Harvard Apparatus, 84 October Hill Road, Holliston, Massachusetts 01746-1371** using our toll-free number **800-272-2775 (Outside the U.S. call 508-893-8999).** Goods will not be accepted for return unless an RMA (return materials authorization) number has been issued by our customer service department. The customer is responsible for shipping charges. Please allow a reasonable period of time for completion of repairs,

General Information (continued)

replacement and return. If the unit is replaced, the replacement unit is covered only for the remainder of the original warranty period dating from the purchase of the original device.

This warranty gives you specific rights, and you may also have other rights which vary from state to state

IMPORTANT: Read all Instructions, Warnings and Precautions prior to use.

CAUTION

Not for clinical use on human patients.

C A U T I O N
FOR RESEARCH USE ONLY
NOT FOR CLINICAL
USE ON PATIENTS

General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazard, use this product only as specified. Only qualified BTX personnel should perform service procedures.

To Prevent Hazard or Injury

ARCING

Arcing can occur at high voltages. An unfavorable combination of parameters such as high voltage settings and a small sample volume with a highly conductive medium might lead to flashover between the electrodes (ARC) and/or explosive evaporation of the medium. Reduce voltage, pulse length, or increase sample volume and/or select less conductive buffer to avoid repeating this condition.

MAKE PROPER CONNECTIONS

Make sure all connections are made properly and securely. Do not connect or disconnect cables of product while generator or plate handler is powered on.

USE PROPER LINE CORD

Use only the specified line cord for this product and make sure the line cord is certified for country of use.

GROUND THE PRODUCT

The product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making any connections to the input or output terminals, ensure that the unit is properly grounded.

USE PROPER FUSE

Use only specified fuses with this product.

DO NOT OPERATE WITH SUSPECTED FAILURES

If you suspect there is damage to the product, have it inspected by qualified Harvard Apparatus service personnel.

FIRE OR SHOCK HAZARD

Observe all ratings and markings on the product or in the manual before using the device.

AVOID EXPOSED CIRCUITRY

Do not contact electrodes. Do not touch gold connector pins while plate handler is connected to a Pulse Generator. Do not touch any electronic circuitry inside of the product.

PLACE IN PROPER ENVIRONMENT

Do not operate in an explosive environment (for example anesthetics, oxygen etc.) Do not operate in wet/damp conditions. Do not position the equipment so that it is difficult to disconnect the power cords from the equipment and/or power source.

General Safety Summary (Continued)

Safety Terms and Symbols:

TERMS THAT APPEAR IN THIS MANUAL:

WARNING. Warning statements identify conditions or practices that could result in injury or loss of life.

CAUTION. Caution statements identify conditions or practices that could result in damage to these products or other property.

SYMBOLS THAT MAY APPEAR ON THE PRODUCTS:

Danger   Attention   Protective   Functional

Introduction

The Plate Handler is the interface between an Electroporatoration pulse generator and HT 96 or HT 25 plates. The HT-100 and HT-200 Plate Handlers have pulse switching technology integrated into the package and gold plated contacts to mate with the disposable Multi-well Electroporation Plates. Both Plate Handlers allow selection of individual columns for pulsing while the model HT-200 adds an auto-switching feature to automate the pulsing of entire plates. The Plate Handlers were designed to operate in space constrained areas such as laminar flow hoods.

Electrical & Technical Specifications

Standard Capabilities:

Power	100 to 240 VAC, 50/60 Hz, 15 W, 0.50 A fuse (2)
Voltage Range	0 to 3000V DC (Pulse Input)
Pulse Length Range	10 μsec to 10 sec
Pulse Number Range	1 to 99
Operating Temperature	5° to 40°C
Intended Use	Indoor Use
Relative Humidity	20 to 80%
Maximum Altitude	2,000 m (6,562 ft)
Pollution Degree	2
Insulation Degree	Class 1

Physical Characteristics for Models HT-100 and HT-200:

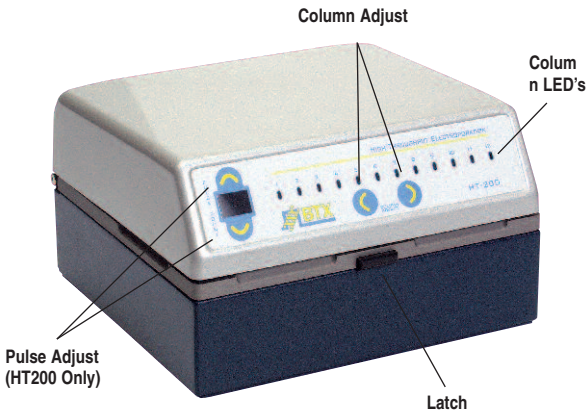|	
Width x Depth x Height	23 x 21.5 x 14 cm (9.1 x 8.5 x 5.5 in)
Weight	4.8 Kg (10.6 lbs)

Operating Basics

WARNING HIGH VOLTAGE
Make sure the BTX electroporator is switched
off before continuing.

CAUTION
Do not use highly conductive solutions when the
electroporator is in high voltage mode (>500V).

Front of the HT-200 Plate Handler

Column Adjust

Colum
n LED's

Pulse Adjust
(HT200 Only)

Latch

Back of the HT-200 Plate Handler

SN 0100-0003

Main Power
Switch

Power Cord
Socket

Fuse Holder

Color Coded
Banana Jacks

Operating Basics (continued)

Model HT-200 Plate Handler

1. **Select a plate size**
   a. Select 4 mm or 2 mm gap plate. For example, if currently using 4 mm cuvettes use a 4 mm plate
      i. The plate size should be selected according to the electric field desired, the desired volume of the sample, and the capabilities of the electroporator.

2. **Load Plate with Cells**
   a. Each column should be loaded with the same number of samples if possible.
      i. Load unused wells in a column with the same sample media at the same volume.

3. Connect the HT-200 Plate Handler to the color coded banana cable taking care to match the color of the cable to the color ring around the connector, and then plug the banana cable into the voltage output of the electroporator again matching the color polarity.

4. Place plate (HT 96) or the Adapter frame containing plate (HT 25) onto the plate handler so the plate matches the nest plate outline on the handler.

5. Close HT-200 Plate Handler lid firmly to latch. The front panel latch pops out when securely closed.
   a. When the lid is closed correctly, the LED for column 1 should flash.

6. Select appropriate column (1 to 12) to begin electroporation by using the column adjust buttons.
   a. The unit will default to column 1 when lid is closed.
   b. Pressing and holding the button allows the unit to rapidly advance through columns after a short pause.

7. Select appropriate number of pulses using the pulse adjust buttons. This is the number of pulses per column (pulse-setpoint DO NOT SET TO "0").
   a. The pulse adjust varies from 1 to 99.
   b. The unit will default to zero when first powered on.
   c. Pressing and holding the button allows the unit to rapidly advance through columns after a short pause.

Operating Basics (continued)

8. Configure the electroporator with the appropriate settings for voltage, pulse length, pulse interval and pulse number.

For the ECM 830 Generator (ECM 630 is a single pulse Generator and this does not apply)

*a. Set the electroporator for the total number of pulses.

i. To set the number of pulses per well use the following equation:

Number of pulses per well times the number of columns to be electroporated (count columns from the desired start location to 12). For example: For three pulses per well for 12 columns set the electroporator for 36 pulses.

ii. As the pulses are delivered the pulse counter on the handler will count down.

iii. When the pulse-count reaches zero, it will cycle and the pulse-count will then reset to the 'pulse-setpoint'. You will never actually see the 'zero' count because the unit cycles too quickly.

iv. The unit will automatically advance to the next column for the HT-200 Plate Handler.

b. The column LEDs will flash to indicate the active column. Once a column has been electroporated the LED remains steady until the cover is opened.

NOTE: Once the cover is opened the memory of pulsed columns if wiped out.

c. The unit will beep three (3) times when electroporation cycle is complete.

The ECM 830 squarewall electroporator has multiple pulsing capability. The ECM 630 is a single pulsing exponential delay electroporator.

Operating Basics (continued)

Model HT-100 Plate Handler

1. **Select a plate size**
   a. Select 4mm or 2mm gap plate. For example if currently using 4 mm cuvettes use a 4 mm plate
      i. The plate size should be selected according to the electric field desired, the desired volume of the sample, and the capabilities of the electroporator.

2. **Load Plate with Cells**
   a. Each column should be loaded with the same number of samples if possible.
      i. Load unused wells in a column with the same sample media at the same volume.

3. Connect the Model HT-100 to the color coded banana cable taking care to match the color of the cable to the color ring around the connector, and then plug the banana cable into the voltage output of the electroporator again matching the color polarity.

4. Place plate (HT 96) or the adapter frame containing plate (HT 25) onto the plate handler so the plate matches the nest plate outline on the handler.

5. Close HT-100 Plate Handler lid firmly to latch. The front panel latch pops out when securely closed.
   a. When the lid is closed correctly, the LED for column 1 should flash.

6. Select appropriate column (1 – 12) to begin electroporation by using the column adjust buttons.
   a. The unit will default to column 1 when lid is closed.
   b. Pressing and holding the button allows the unit to rapidly advance through columns after a short pause.

Operating Basics (continued)

7. Configure the electroporator with appropriate electrical settings.

For ECM 630 Generators (voltage, resistance and capacitance)

    a. Press pulse on the electroporator to initiate the pulse for that column, the plate handler will beep.

    b. The column LEDs will flash to indicate the active column. Once a column has been electroporated the LED will remain blinking until the cover is opened.

       NOTE: Once the cover is opened the memory of pulsed columns if wiped out.

    c. Press the column select button to switch to the next column.

For ECM 830 Generators (voltage, pulse width, number of pulses)

    a. Set the electroporator for the total number of pulses

    b. Press pulse on the electroporator to initiate the pulse(s) for that column, the plate handler will beep.

    c. The column LEDs will flash to indicate the active column. Once a column has been electroporated the LED will remain blinking until the cover is opened.

       NOTE: Once the cover is opened the memory of pulsed columns if wiped out.

    d. Press the column select button to switch to the next column.

Plate handlers may be used with both types of HT plates (HT 96 and HT 25). The following will outline the steps needed to configure the unit for the type of plate being used.
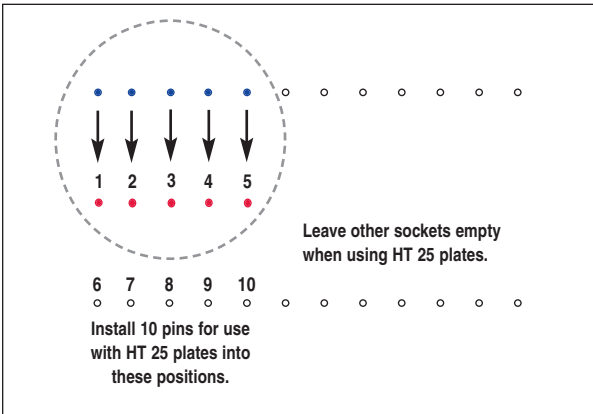
Advanced Operation: Programming

HT 25 Set-Up

1. Ensure the unit is unplugged and disconnected from the generator.

2. Open the lid of the unit.

3. Please remove the pins from the first five spaces (blue) into the middle five spaces (red) using green pliers provided or if you do no have them use standard needle nose pliers.

4. Carefully grasp the entire length of the gold pin using either the green pliers provided or standard needle nose pliers (be careful not to damage pins). Pull the pin straight out of the slot. Transfer the pin to one of the positions of the middle slots. To lock the pins in place you will use the handle of the green pliers provided or the rubber handle of standard needle nose pliers to push the pins flush with the plate handler lid. The pin will retract in and spring back out into place. Once you have finished transferring all five pins to the middle slots you will need to look to be sure they are all the same length. If not please push them flush with the lid again.

5. Reconnect to power and generator.

NOTE: Be sure not to select columns 6 – 12 while using the HT 25 set-up.
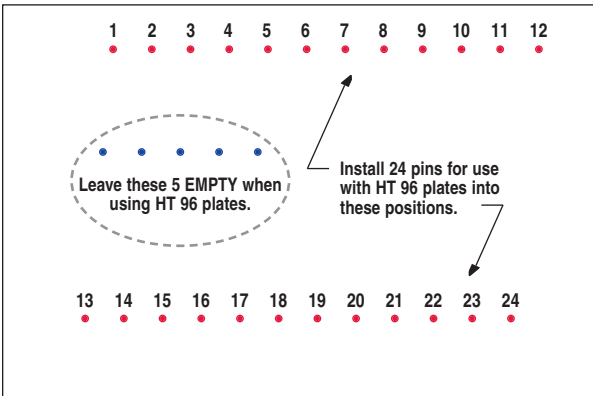

Diagram showing pin locations for the HT25.

Leave other sockets empty when using HT 25 plates.

Install 10 pins for use with HT 25 plates into these positions.

Advanced Operation: Programming
(continued)

HT 96 Set-Up

1. Ensure the unit is unplugged and disconnected from generator.

2. Open the lid of the unit.

3. Install pogo pins into the locations shown in red using the liers provided or use standard needle nose pliers, taking care not to damage the gold plating on the head of the pin.

4. Remove pins from the middle section (blue) using the pliers taking care not to damage the gold plating on the head of the pin.

5. Using the rubber handle of the needlenose pliers or the handle of the pliers provided to push the pins flush with the lid to lock them into place.

6. Pins should be the same height if inserted correctly. If they are not the same height, push them in again.

7. Plug in unit and reconnect to generator.

Diagram showing pin locations for the HT 96 set-up.

Leave these 5 EMPTY when using HT 96 plates.

Install 24 pins for use with HT 96 plates into these positions.

Appendix A: Troubleshooting

Error Alarms

The plate handler will enter a fault mode if an additional pulse(s) is detected. In the fault mode the beeper sounds for 5 seconds and the column LEDs flashes 5 times to alert the user that a pulse was delivered to the instrument while no columns were selected. No energy is delivered to the plate in this mode.

Please contact Harvard Apparatus, BTX Technical Service at any of the numbers listed on the following page in the event of any failure.
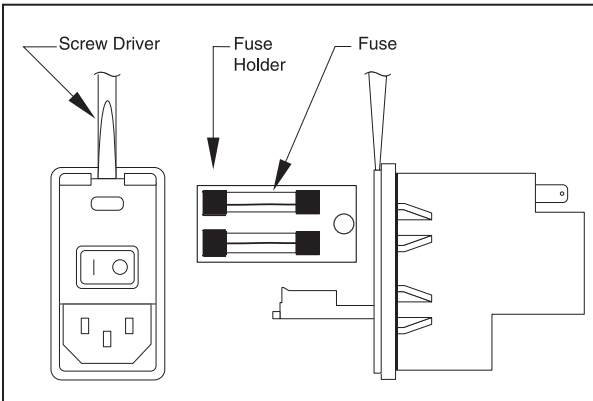
Appendix B: Maintenance

WARNING
Do not attempt maintenance while the
Plate Handler is plugged into an electroporator.

Clean the Plate Handler body with a soft cloth or tissue. If necessary, moisten the cloth or tissue with a dilute detergent or alcohol solution.

- Never touch contacts when the unit is connected to an electroporator.

- Do not install replacement gold contacts using metal instruments. These may scratch the gold plating on them.

- Serious liquid ingress repair should be left to the factory. Serious is more the 1mL of conductive solution poured into the front or back openings of the nest plate.

Fuse Replacement
Turn off power and disconnect power cord from power module. Use straight blade screwdriver to pry open access door of power module. Remove fuse holder, remove fuse(s) from holder, replace fuse(s), and replace fuse holder into module. Use only 250 V fuse of specified type and rating (5 x 20 mm, 0.50 A SLO-BLO)

Appendix C: Accessories and Replacement Parts

Part Number	Description
45-0411	HT 25/200 System Includes ECM® 830, HT-200 Plate Handler, (6) HT 25 Electroporation Plates
45-0421	HT 96/200 System Includes ECM® 830, HT-200 Plate Handler, (2) 96 well plates
45-0422	HT 96/100 System Includes ECM® 630, HT-100 Plate Handler, (2) 96 well plates
45-0452	96-Well Disposable Electroporation Plates, 4 mm, 250 µl, pkg. of 1 (Model HT-P96-4)
45-0450	96-Well Disposable Electroporation Plates, 2 mm, 125 µl, pkg. of 1 (Model HT-P96-2)
45-0462	25-Well Disposable Electroporation Plates, 4 mm, 250 µl, pkg. of 1 (Model HT-P25-4)
45-0463	25-Well Disposable Electroporation Plates, 4 mm, 250 µl, pkg. of 6 (Model HT-P25-4P)
45-0466	25-Well Disposable Electroporation Plates, 2 mm, 125 µl, pkg. of 1 (Model HT-P25-2)
45-0467	25-Well Disposable Electroporation Plates, 2 mm, 125 µl, pkg. of 6 (Model HT-P25-2P)
45-0468	Replacement pins, pkg. of 25
45-0469	Replacement pins, pkg. of 100
45-0465	HT 25 Adapter for Plate Handler
45-0052	ECM® 830 Generator Only
45-0051	ECM® 630 Generator Only
45-0400	HT-100 Plate Handler, Manual Switching, with Cables
45-0401	HT-200 Plate Handler, Auto Switching, with Cables
45-0059	Enhancer 3000® with interface box, oscilloscope, communicators model and cables.
5012-017	Pliers for Changing Pins from 96-Well Format to 25 amd back

BTX®

HARVARD APPARATUS

The Electroporation Experts

84 October Hill Road • Holliston MA, 01746

Phone:	**508.893.8999**
Toll Free:	**800.272.2775 (U.S. Only)**
Fax:	**508.429.5732**
E-mail:	**techsupport.btx@harvardapparatus.com**
Web:	**www.btxonline.com**