



# BenchPro<sup>®</sup> 2100 MaxiCard<sup>™</sup> Plasmid Purification Instrument

For automated maxiprep purification of plasmid DNA

Catalog no. MC1001

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Manual part no. 25-1060

MAN0002684

User Manual



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# Unpacking the Instrument and Product Contents

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## Upon Receiving the Instrument

Examine the unit carefully for any damage incurred during transit. Any damage claims must be filed with the carrier. The warranty does not cover in-transit damage.

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## Unpacking Instructions

Follow the instructions below to unpack the BenchPro® 2100 instrument. The weight of the instrument is 20 pounds (9.1 kg).

1. Cut the plastic tape and remove the outer box.
  2. Remove the BenchPro® 2100 from the box and place on a flat surface.
  3. Remove any tape holding the reagent drawer.
  4. Verify the product contents as described below.
  5. Set up the BenchPro® 2100 as described on page 7.
- 

## BenchPro® 2100 Contents

The contents of the BenchPro® 2100 MaxiCard™ Plasmid Purification Instrument are listed below:

Component	Quantity
BenchPro® 2100 MaxiCard™ Plasmid Purification Instrument	1
AC/DC Switching Power Adapter with US, EU, UK, and AUS Input Plug	1
Waste Tray	2
Piercing device	1
Quick-disconnect house air fitting including 12 feet of tubing	1
Quick Reference Card (QRC)	1
Instruction Manual	1

See page 4 for specifications and description of the BenchPro® 2100 instrument, and page 7 for installing the instrument.

**Note:** Always use the instrument with the supplied power adapter or an equivalent adapter with the same rating that is certified for safety.

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## BenchPro® 2100 Maxi Plasmid Card & Reagent Tray

The BenchPro® Maxi Plasmid Card and Reagent Tray are used with the BenchPro® 2100 instrument for maxiprep purification of plasmid DNA from bacterial cells and are available separately (see page 27 for ordering information).

**Store the BenchPro® Maxi Plasmid Card and Reagent Tray at room temperature.**

<u>Product</u>	<u>Catalog. no.</u>
BenchPro® Maxi Plasmid Card and Reagent Tray	MC2001
<u>Contents</u>	
BenchPro® Maxiprep Cards	1 pack of 4
Cell Liners	1 pack of 4
Cell Liner Lids	1 pack of 4
Elution Tubes (2 mL)	1 pack of 4
Reagent Trays (filled with reagents)	4 trays

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*Continued on next page*

## Unpacking the Instrument and Product Contents, Continued

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### Reagent Tray Contents

Store the Reagent Tray with reagents at room temperature and do not freeze the Reagent Tray.

The reagents included in BenchPro® Reagent Tray are listed below:

Resuspension Buffer

Lysis Buffer

RNase A (2.4 mg/mL RNase A, 50 mM Tris-HCl pH 8.0, 10 mM EDTA)

Precipitation Buffer

TE Buffer (10 mM Tris HCl pH 8.0, 1.0 mM EDTA)

Wash Buffer

100% Isopropanol

Elution Buffer (100 mM Sodium acetate, pH 5.0, 1.5 M NaCl)

70% Ethanol in nanopure water

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### Intended Use

For research use only. Not intended for any animal or human therapeutic or diagnostic use.

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# Safety Information

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## Safety

Follow the instructions in this manual to ensure safe operation of the BenchPro® 2100 instrument. The BenchPro® 2100 instrument is designed to meet EN61010-1 Safety Standards. To ensure safe, reliable operation, always operate the BenchPro® 2100 instrument according to the instructions in this manual. Failure to comply with the instructions in this manual may create a potential safety hazard, and will void the manufacturer's warranty and void the EN61010-1 safety standard certification. Invitrogen (part of Life Technologies) is not responsible for any injury or damage caused by use of this instrument when operated for purposes for which it is not intended. All repairs and service should be performed by Invitrogen (part of Life Technologies).

**In an emergency, immediately turn the power switch Off and unplug the adapter and instrument.**

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## Additional Safety Information

See page 31 for additional safety information and explanation of symbols used on the instrument.

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# BenchPro<sup>®</sup> 2100 Instrument

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## Front View

The front view of the BenchPro<sup>®</sup> 2100 instrument.



## Rear and Side View

The rear and side view showing various parts of the BenchPro<sup>®</sup> 2100 instrument. The house air inlet is to connect to the house air supply as described on page 8. The DC inlet is used to connect to the power adapter. The fuse compartment contains the fuse that can be replaced as described on page 23. The USB port enables future firmware upgrades.

### Rear View



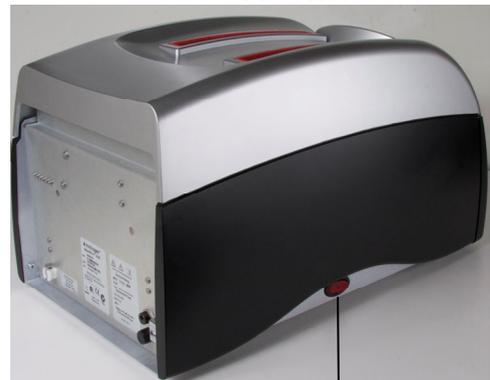
House air inlet

DC inlet

Fuse

USB

### Side View



Power switch

# Introduction

## About the BenchPro<sup>®</sup> 2100 Instrument

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### BenchPro<sup>®</sup> 2100

The BenchPro<sup>®</sup> 2100 MaxiCard™ Plasmid Purification Instrument is an automated bench-top instrument that uses electronic solenoid technology to control the transfer of on-board compressed air and vacuum to a disposable card for automated, easy, and reproducible maxiprep purification of high-quality plasmid DNA from *E. coli* in less than 90 minutes. The BenchPro<sup>®</sup> 2100 instrument allows parallel processing of up to two experimental samples.

The BenchPro<sup>®</sup> 2100 instrument is a complete walk-away maxiprep purification system that provides high-quality plasmid DNA using a series of capture and purification membranes. Each BenchPro<sup>®</sup> Maxiprep Card encompasses an entire plasmid purification protocol from the harvesting of cells to the final precipitation and elution of purified plasmid DNA with low endotoxin levels.

The BenchPro<sup>®</sup> 2100 instrument eliminates routine manual processing steps for maxiprep plasmid DNA purification while maintaining a similar performance to manual processing.

The purified plasmid DNA is ultrapure and suitable for a variety of downstream applications, including those requiring the highest purity (page 3):

See page 4 for details on various parts of the system.

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### System Components

The BenchPro<sup>®</sup> 2100 system consists of:

- BenchPro<sup>®</sup> 2100 instrument

The BenchPro<sup>®</sup> 2100 instrument provides a single, automated program to perform one or two maxiprep plasmid DNA preparations at a time from 125 mL of *E. coli* culture for maxipreps. The instrument is a simple, user friendly benchtop unit that is preprogrammed with maxiprep protocol and is used with an appropriate BenchPro<sup>®</sup> Maxiprep Card. See page 4 for details. Two Waste Trays are included with the instrument and supports the disposable Reagent Tray and reservoir inside the instrument drawer. A piercing device is also included with the instrument to pierce the foil seal covering the reagents.

- BenchPro<sup>®</sup> Maxiprep Card

The BenchPro<sup>®</sup> Maxiprep Card is a disposable card that is inserted into the slot on top of the BenchPro<sup>®</sup> 2100 instrument. The onboard pumps powered by vacuum and pressure, transfers cell culture and reagents from the tray to the card to run the complete maxiprep purification process.

- BenchPro<sup>®</sup> Reagent Tray

All buffers and appropriate volumes required for a maxiprep purification of plasmid DNA are supplied in the sealed BenchPro<sup>®</sup> Reagent Tray. A disposable Cell Liner with lid is included with the tray for adding bacterial cell culture.

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## About the BenchPro<sup>®</sup> 2100 Instrument, Continued

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**System Overview** The BenchPro<sup>®</sup> 2100 instrument performs automated maxiprep plasmid DNA purification from bacterial cell culture using electronic solenoid technology and anion-exchange chromatography developed by Invitrogen.

To use the BenchPro<sup>®</sup> 2100 system, you will:

1. Grow 125 mL of overnight bacterial culture in LB medium with the appropriate antibiotic.
2. Assemble the Reagent Tray and Cell Liner on the Waste Tray. Add the cell culture to the Cell Liner.
3. Insert the BenchPro<sup>®</sup> Maxiprep Card in one of the instrument slots.
4. Select and run the purification protocol.

During the automated maxiprep purification protocol, the appropriate amounts of reagents are pumped to the card as well as incubation steps are performed based on the protocol. Using a series of capture and purification membranes, *E. coli* cells are harvested, lysed, and the lysate is clarified. The cleared lysate is passed through an anion exchange membrane. Under the binding conditions, the negatively charged phosphates on the backbone of the DNA interact with the positive charges on the surface of the membrane such that plasmid DNA remains bound to the membrane while RNA, proteins, carbohydrates and other impurities are washed away with wash buffer. The plasmid DNA is eluted under high salt conditions. The eluted DNA is desalted and concentrated with an alcohol precipitation step and the final purified plasmid DNA is collected in the elution tube placed in the reagent tray.

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### Features

Important features of the BenchPro<sup>®</sup> 2100 system are listed below:

- User-friendly BenchPro<sup>®</sup> 2100 instrument design with a disposable BenchPro<sup>®</sup> Maxiprep Card for easy, automated maxiprep plasmid DNA purification
  - Ability to perform simultaneous processing of up to two samples
  - High-quality purified plasmid DNA suited for mammalian transfections as well as other downstream applications (page 3)
  - Capable of purifying plasmid DNA from a variety of plasmids sizes ranging from 3 kb to 20 kb size
  - No cross contamination between samples as reagents for each sample are isolated
  - Provides consistent, reliable results comparable to manual processing
  - Built-in safety features in the instrument enhance user safety
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## About the BenchPro<sup>®</sup> 2100 Instrument, Continued

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### **Downstream Applications**

The purified plasmid DNA is ultrapure and suitable for downstream applications, including those requiring the highest purity, such as:

- Transfection of mammalian cells
  - Automated and manual DNA sequencing
  - PCR amplification
  - *In vitro* transcription
  - Bacterial cell transformation
  - Cloning
  - Labeling
- 

### **Purpose of the Manual**

This manual provides the following information:

- Details and specifications on the BenchPro<sup>®</sup> 2100 instrument and BenchPro<sup>®</sup> Maxiprep Card
  - Unpacking and installing the BenchPro<sup>®</sup> 2100 instrument
  - Operating the BenchPro<sup>®</sup> 2100 instrument with a disposable BenchPro<sup>®</sup> Maxiprep Card
  - Cleaning and maintaining the BenchPro<sup>®</sup> 2100 instrument
  - Troubleshooting
  - Safety information
-

## Description of Parts

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### BenchPro<sup>®</sup> 2100 Instrument

The BenchPro<sup>®</sup> 2100 instrument is a benchtop, automated maxiprep plasmid DNA purification system capable of processing up to two experimental samples. The BenchPro<sup>®</sup> instrument is used with a BenchPro<sup>®</sup> Maxiprep Card and Reagent Tray that delivers the reagents from the reagent tray to the card for sample processing based on the maxiprep protocol.

See page viii for a front and rear view of the instrument.

The front view of the BenchPro<sup>®</sup> 2100 instrument identifying various parts is shown below.



### Reagent Drawer Unit

The Reagent Drawer Unit contains the reagent tray assembly (see page 6 for details) and waste tray that are used to assemble the reagents for use with the protocol.

### Card Slots

Each instrument contains 2 card slots to insert the disposable BenchPro<sup>®</sup> Cards (see next page for details on the card) into the unit. There is no need to use both cards at the same time. You can use only 1 card or up to 2 cards at a time.

**Do not insert anything (fingers, pipette, or liquid) into the card slots as it may damage the unit.**

### Digital Display with Functional Keys

The Digital Display along with the functional keys is used to operate the instrument.

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## Description of Parts, Continued

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### BenchPro® Maxiprep Card

The BenchPro® Maxiprep Card is a disposable, plastic card with embedded membranes and card sippers. The BenchPro® Maxiprep Card is used with the BenchPro® 2100 instrument for automated maxiprep plasmid DNA purification (see figure below).

The BenchPro® Maxiprep Card aspirates reagents sequentially from the Reagent Tray reservoirs to complete the standard maxiprep protocol. The waste solutions are directed to a Waste Tray and the used Cell Liner.

BenchPro® Maxiprep Cards are available separately (page 27). Always store the BenchPro® Maxiprep Card in the supplied box to prevent any damage to the card sippers. To avoid damaging the card:

- Do not drop the card or bend the card sippers.
- Always handle the card from the top side (away from the card sippers).
- Do not add any solution to the card.

**Note:** If you accidentally damage the BenchPro® Maxiprep Card, you can purchase additional cards separately (see page 27 for ordering information).



#### Card Sippers

The card sippers are plastic tips attached to the card and inserted into the reagents in the Reagent Tray. During the procedure, the tips aspirate various reagents into the card and also dispense waste. The spacing of tips is aligned well with the reagents in the tray. The card is supplied with attached sippers. Do not use the card if the sippers are damaged.

#### Card Alignment Guide

The Card Alignment Guide allows you to position the card properly into the slot so the tips are aligned correctly into the reagents in the tray.

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## Description of Parts, Continued

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### Reagent Drawer Unit

The Reagent Drawer Unit contains the Waste Tray and Reagent Tray assembly (see figures below) that will supply the reagents for the protocol.

The Waste Trays and piercing device are supplied with the instrument. The Reagent Tray is available separately with the BenchPro® Maxiprep Card (page 27).

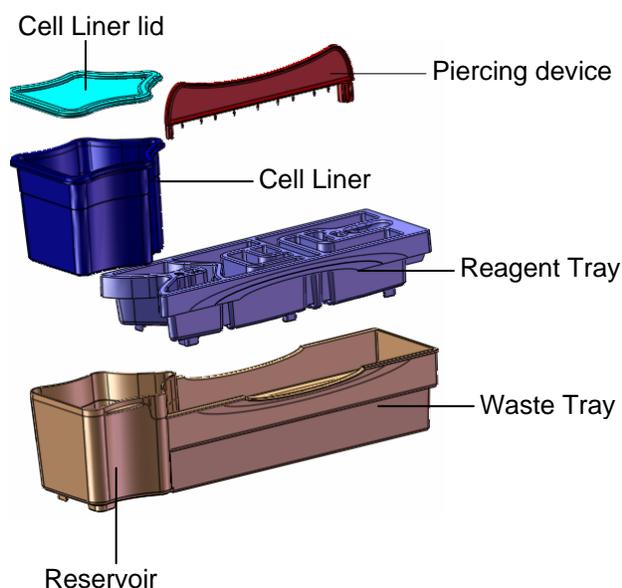
The Reagent Tray Assembly is composed of:

- Waste Tray that holds the Reagent Tray and Cell Liner
- Reagent Tray containing the appropriate volume of reagents for the maxiprep plasmid DNA purification protocol and includes an elution tube
- Cell Liner and Cell Liner Lid to hold the cell sample
- Piercing device to pierce the foil seal covering the Reagent Tray to allow card sippers access to the reagents during the purification protocol

Instrument with Reagent Drawer open



Reagent Tray Assembly



## Methods

### Installing the BenchPro<sup>®</sup> 2100

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#### Important

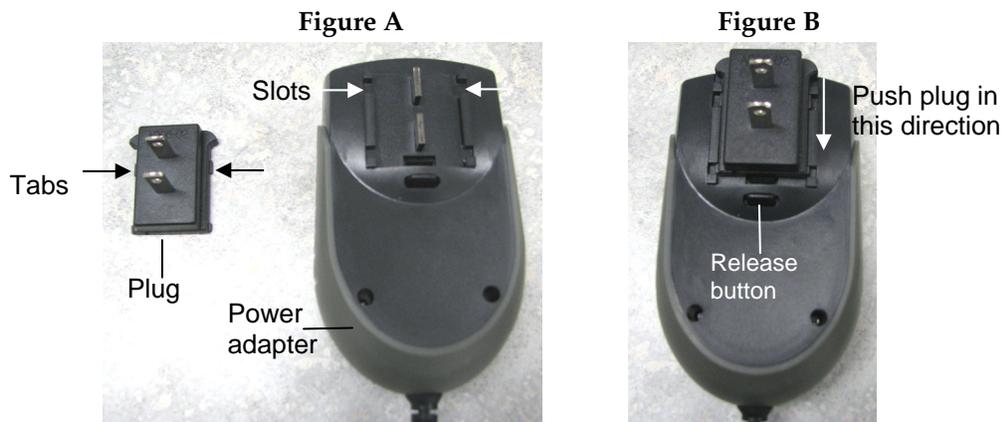
Since the proper functioning of the BenchPro<sup>®</sup> 2100 instrument is dependent on house air supply, follow these recommendations for input house air supply to obtain the best results:

- Ensure that the input air supply from house air or an external compressor is regulated to 80–100 psi (550 to 690 kPa) and the inlet flow rate is at least 3 CFM.
  - Input air should be clean and dry with a maximum dew point of 5°C. If more than one instrument is operating off a single air source, ensure the input air supply is regulated to 95–100 psi (620–690 kPa).
  - You can only operate up to 4 instruments off a single house air supply line. See page 20 for details.
- 

#### Attaching the Power Adapter

1. Check the 3 input plugs supplied with the instrument power adapter to ensure that one of the plugs is compatible with the local socket format.
2. Attach the appropriate input plug to the power adapter prior to use by aligning the small tabs on each side of the plug with the two small slots in the power adapter (Figure A).

Push down slightly on the plug and push the plug towards the cable end of the power adapter until the plug snaps into place (Figure B).



**Note:** To release the input plug, press the release button on the adapter and slide out the plug.

3. Place the BenchPro<sup>®</sup> 2100 instrument on a level laboratory bench. Keep the area around the instrument clear to ensure proper ventilation of the unit.
4. **For your safety:** Position the instrument properly such that the **power** switch located on the left side and the DC inlet located on the rear of the unit (page viii) is easily accessible.
5. Ensure the power switch is in the **Off** position (page viii).
6. Attach the cable end of the power adapter to the DC inlet on the instrument. Connect the adapter with the input plug into the electrical outlet.

**Note:** Always use the instrument with the supplied power adapter or an equivalent adapter with the same ratings that is certified for safety.

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## Installing the BenchPro® 2100, Continued

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### Connecting to House Air Supply

1. Connect the free end of the supplied flexible tube (1/4" OD, 1/8" ID) to the regulated house air supply.

Since the house air connectors can vary, examples of a few connector types and how to connect the tube to the house air connectors are shown in the **Appendix** on page 20.

**Important:** You can only operate up to 4 instruments off a single house air supply line. See page 20 for details.

2. Insert the quick disconnect fitting on the other end of the tube into the air inlet connector on the back of the instrument to establish the house air connection to the instrument (Figure A).

To disconnect the input air line, press down on the metallic release latch (Figure B).

Figure A



Air inlet 80-100 psi  
(550 to 690 kPa)

Figure B



Quick-disconnect house  
air fitting with tubing

You are ready to use the BenchPro® 2100 instrument. See page 9 for the details.

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### Using the Instrument for the First Time

If you are using the BenchPro® 2100 instrument for the first time, you may wish to clean the Waste Tray with a mild detergent before use (see page 16 for cleaning and maintenance of parts). Allow the tray to dry before starting the protocol. Be sure to place the tray back properly in the instrument before use.

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## General Guidelines

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### Recommended Cards

To use the BenchPro<sup>®</sup> 2100 instrument for maxiprep plasmid DNA purification, you need to purchase the BenchPro<sup>®</sup> Maxiprep Card separately from Invitrogen. Ordering information is on page 27. **Do not** use any other cards with the unit.

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To obtain the best results, follow these recommendations:

- Wear gloves during handling the card or assembling the reagents.
  - Maintain a sterile environment when handling DNA to avoid any contamination from DNases.
  - Ensure that no DNase is introduced into the sterile reagents supplied with the kit.
  - Always use the BenchPro<sup>®</sup> 2100 instrument with BenchPro<sup>®</sup> Maxiprep Card for best results.
  - **Be sure to remove the caps of elution tubes and pierce the foil seal on the Reagent Tray with the piercing device prior to closing the reagent drawer.**
  - Discard the card and waste contents appropriately after use. **Do not reuse the card.**
- 



### Important

- You can insert one or two BenchPro<sup>®</sup> Maxiprep Cards depending on the number of samples that you wish to process. If you are loading only 1 card, ensure that the reagent tray is loaded in the same row as the card.
  - **Always load the Reagent Tray with the foil seal pierced and elution tube without a cap in the Reagent Tray to allow the card sippers to draw the solution into the card.**
  - Always load the reagent tray assembly before inserting the card into the instrument.
-

# Using BenchPro<sup>®</sup> 2100

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## Materials Needed

You will need the following items. Ordering information is on page 27.

- BenchPro<sup>®</sup> Maxiprep Card and Reagent Tray (includes reagents, elution tube, Cell Liner, and Cell Liner Lid)
  - 125 mL overnight culture of transformed *E. coli* cells
- 

## Bacterial Cultures

Grow transformed *E. coli* cells overnight in LB (Luria-Bertani) medium with the appropriate antibiotic. The bacterial culture should have a cell density of approximately  $10^9$  cells/mL or an optical density of 2.0–2.4 at 600 nm ( $OD_{600}$ ). Use a bacterial culture in transition between exponential phase and stationary phase.

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## Plasmid Type and Copy Number

The BenchPro<sup>®</sup> 2100 system allows purification of a variety of plasmid sizes ranging from 3 kb to 20 kb.

Use a high copy number plasmid to obtain a good yield of plasmid DNA. High copy-number plasmids typically yield 2–6  $\mu$ g DNA/mL LB culture grown overnight.

<u>Plasmid Copy Number</u>	<u>Maxiprep</u>
High-copy number plasmid	100–125 mL

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Refer to the Chemical Safety section in this manual (page 33) for proper handling and disposal of reagents.

- Some of the reagents in the kit contain hazardous chemicals. Treat all reagents supplied in the kit as potential irritants.
  - For your protection, always wear a laboratory coat, disposable gloves, and eye protection when handling the kit and reagents.
  - Dispose of cell culture samples as biohazardous waste.
- 

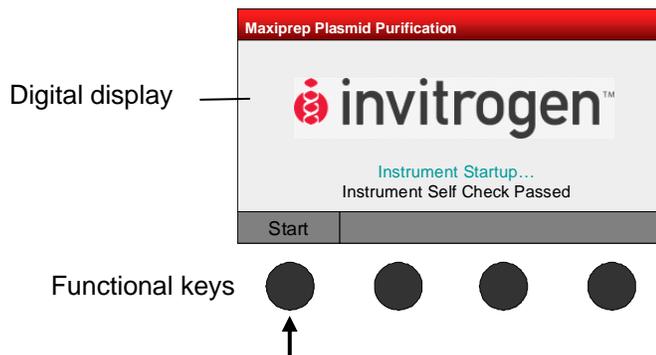
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# Using BenchPro<sup>®</sup> 2100, Continued

## Starting the Instrument

1. Press the power switch (located on the left side of the unit, page viii) to turn **ON** the BenchPro<sup>®</sup> 2100 instrument.

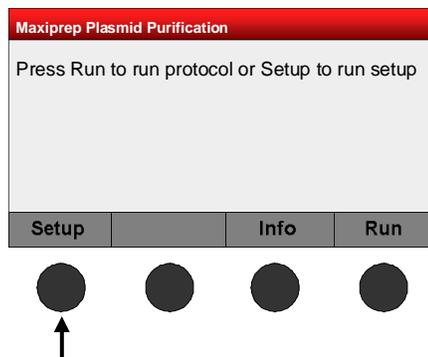
The valves in the instrument begin to run and the digital display starts to show the status check screen (the screen/display takes a few seconds to stabilize).



Once the status check is complete (air pressure and vacuum reach nominal values as indicated on the display), press the **Start** function key to display the protocol setup screen.

2. Press the **Setup** function key to set up the instrument for maxiprep purification.

**Note:** If you are an experienced user and have already set up the Reagent Tray, sample, and card, press **Run** to start the protocol.



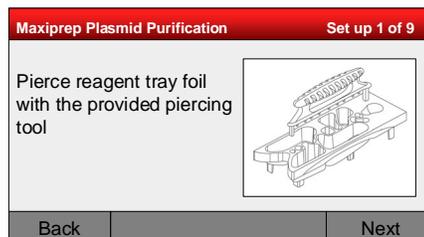
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# Using BenchPro<sup>®</sup> 2100, Continued

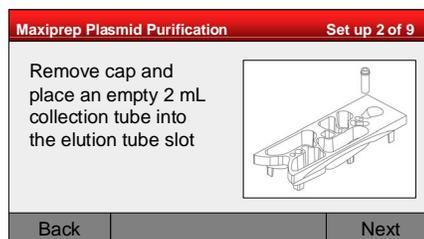
## Performing Maxiprep Plasmid DNA Purification

The onscreen prompts show instructions to set up the instrument for 1 maxiprep purification. To perform 2 maxiprep purifications, perform the indicated step twice.

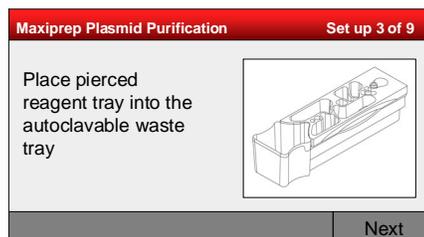
1. Remove a Reagent tray foil seal with piercing device supplied with the instrument. Press **Next**.



2. Uncap and label the supplied elution tube (2 mL). Place the labeled tube into the elution tube slot in the tray. Press **Next**.



3. Open the drawer unit and remove the Waste Tray. Place the Reagent Tray in the Waste Tray slot and press slightly to ensure the tray is aligned and flush with the slot. Press **Next**.



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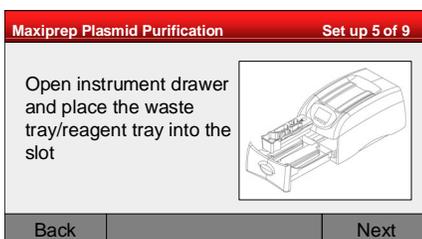
# Using BenchPro<sup>®</sup> 2100, Continued

## Performing Maxiprep Plasmid DNA Purification, Continued

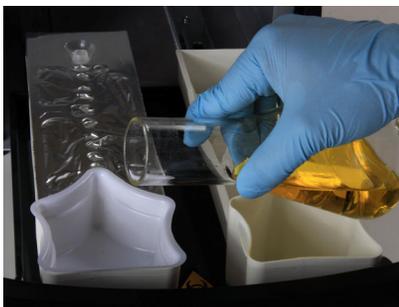
4. Place the Cell Liner in the Waste Tray reservoir slot. Press **Next**.



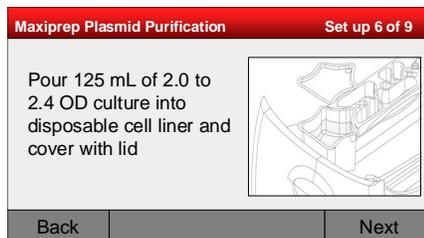
5. Open the drawer unit and place the Waste Tray with Cell Liner and Reagent Tray into the instrument. Press **Next**.



6. Add up to 125 mL of overnight bacterial culture into the Cell Liner.



Place the Cell Liner Lid on the reservoir. Press **Next**.



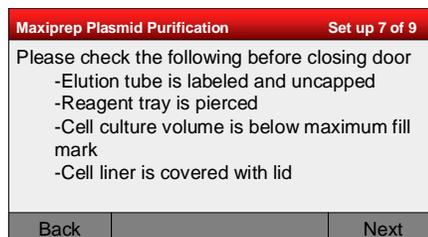
**Note:** There is an opening in the lid for the card sippers to aspirate the cell culture into the card for processing.

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## Using BenchPro<sup>®</sup> 2100, Continued

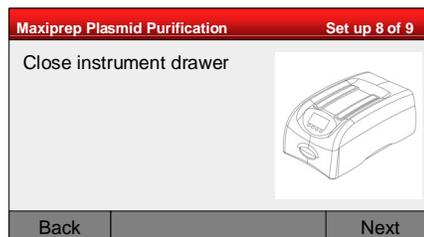
### Performing Maxiprep Plasmid DNA Purification, Continued

7. Ensure that you completed Steps 1–6. If you have accidentally missed a step, press **Back** and perform the missed step. Press **Next**.



**Note:** If you wish to perform 2 maxiprep purifications, ensure that a second set of Waste Tray containing the pierced Reagent Tray, and Cell Liner with culture and Lid is loaded in the drawer.

8. Gently close the drawer unit of the instrument. Press **Next**.



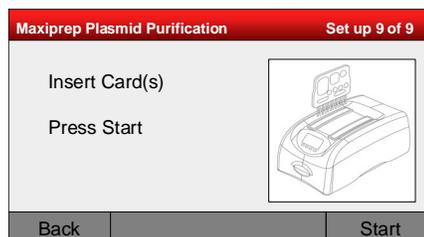
**Note:** Once the card is inserted (Step 9), you cannot open the drawer.

9. Remove the BenchPro<sup>®</sup> Maxiprep Card from the package and insert the card into a slot in the BenchPro<sup>®</sup> 2100 instrument such that the tips are inserted into the reagents placed in the reagent tray.

Use the Card Alignment Guide to ensure the card is placed correctly in the slot. When the **first** card is placed correctly in the slot, you will hear a click indicating that the door lock is engaged.

Press **Start**.

**Note:** Avoid holding the cards by the card sippers as it can damage the card.



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## Using BenchPro<sup>®</sup> 2100, Continued

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### Performing Maxiprep Plasmid DNA Purification, Continued

10. Press **Run** on the protocol set up screen to begin the protocol. The protocol begins and various steps of the protocol are displayed on the screen.



**Note:** You will not be able to open the drawer unit once the protocol begins. Any waste generated during the protocol is collected in the Cell Liner (after cell culture is removed) and in the cavity of the Waste Tray.

11. When the protocol is complete, the display shows **Protocol Complete**. Proceed to **Unloading BenchPro<sup>®</sup> 2100**, next page.

### Aborting the Protocol

1. To cancel the protocol, press the **Abort** function key. The protocol stops when the Abort key is activated and the cards are released.
2. If the protocol is aborted during a run, the card and reagent tray cannot be reused. After aborting the protocol, follow the prompts on the screen to clean up before starting another run.

**Note:** If the protocol stops due to an external power failure, an error screen is displayed.

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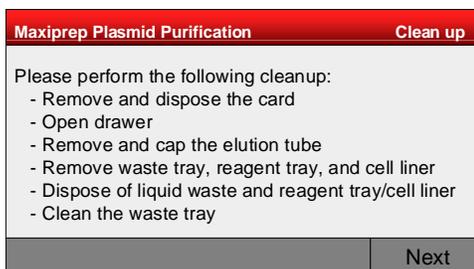
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## Using BenchPro® 2100, Continued

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### Unloading BenchPro® 2100

1. Once the Protocol Complete screen is displayed, press **Next** to view the Clean up screen.



2. At the end of the run, remove the card from the slot and discard the card appropriately. **Do not reuse the card.**  
**Note:** You will not be able to open the drawer unit until the card is removed.
3. Open the drawer unit to remove the elution tube containing purified plasmid DNA. Cap the elution tube and store the plasmid DNA at  $-20^{\circ}\text{C}$  or use DNA for the desired downstream application.  
To avoid repeated freezing and thawing of DNA, store the purified DNA at  $4^{\circ}\text{C}$  for immediate use or aliquot the DNA and store at  $-20^{\circ}\text{C}$  for long-term storage.
4. Remove used Reagent Tray and Cell Liner, and discard appropriately. Any waste generated during the protocol is collected in the Cell Liner and Waste Tray cavity. Discard waste solution appropriately.
5. If needed, you can remove Waste Tray to wash and/or autoclave.
6. To run another protocol, press the **Next** function key to return to the initial protocol setup screen.
7. Load a new Reagent Tray and Cell Liner. Add cell culture and insert a new card. Start the protocol as described previously. There is no cooling period required between runs.
8. If you are not using the instrument, turn **OFF** the power switch located on the left side of the unit.

---

### Cleaning and Maintenance

- Clean the surface of the BenchPro® 2100 instrument with a damp cloth. **Do not** use harsh detergents or solvents to clean the unit.
- Clean the bottom of the instrument drawer with a light spray of 70% ethanol and then wipe the ethanol with a paper towel.
- Clean the Waste Tray with a diluted bleach solution (10%) and/or autoclave.

For any other repairs and service, contact Technical Support (page 28). **Do not** perform any repairs or service on the BenchPro® 2100 instrument to avoid damaging the unit.

---

# Troubleshooting

Problem	Cause	Solution
<b>Instrument Problems</b>		
No power (the digital display remains blank when the power is turned on)	Power cord is not connected	Check DC power cord connections at both ends. Use the correct cords. Ensure the correct plug for your local socket is used.
Error code displayed	--	Make a note of the error code and see the list of error codes on page 19.
Inlet pressure error	House air not connected or house air connector is closed	Ensure that the instrument is connected to house air outlet and the house air supply valve is open.
Accidentally missed adding cell culture	--	Be sure to confirm that you have added the reagents in the correct order <b>prior to starting</b> the protocol. If the protocol has started and you accidentally missed adding the culture, abort the protocol prior to the 65-minutes remaining mark. Then, remove the cards, open the drawer, and add the bacterial culture to the Cell Liner. If cell culture is added to the Cell Liner but you missed adding the Reagent Tray, abort the run and discard the Cell Liner with the culture. Restart the run using a new card, Reagent Tray, and Cell Liner with culture.
Card is difficult to insert	Card is not oriented correctly	Use the Card Alignment Guide to ensure the card is placed correctly in the slot. When the card is placed correctly in the slot, you will hear a click.
	Reagent tray has foil seal or capped tube	Make sure that the elution tube is uncapped and the foil seal on the reagent tray is pierced when placed in the Waste Tray.

*Continued on next page*

## Troubleshooting, Continued

Plasmid DNA Quality Problems		
Problem	Cause	Solution
Low DNA yield	Incomplete lysis	Decrease the amount of starting material used. Use the appropriate recommended starting culture volume based on the copy number of the plasmid.
	Poor quality of starting material	Be sure to process sample immediately after collection or store the sample at appropriate temperature. The yield and quality of DNA isolated depends on the starting material.
	Expired or damaged card used	Be sure to use BenchPro® Maxiprep Card before the expiration date printed on the card. Handle the card carefully and keep any unused cards in the original package to avoid any damage to the card.
	Low copy plasmid used or the plasmid size is not suitable for the purification system	Use only high copy plasmid. Use bacterial cell cultures containing plasmids in the recommended 3–20 kb size range.
No DNA recovered	Accidentally missed uncapping the elution tube or tube not loaded at the correct position	Be sure to load and uncap the elution tube prior to starting the purification protocol.
DNA is sheared or degraded	Purified DNA repeatedly frozen and thawed	Aliquot purified DNA and store at 4°C (short-term) or –20°C (long-term). Avoid repeated freezing and thawing.
	DNA contaminated with DNases	Maintain a sterile environment while working ( <i>i.e.</i> , wear gloves and use DNase-free reagents).
Accidentally missed loading the elution tube or tube not loaded at the correct position	--	If you are loading only one card, ensure that the reagent tray and tubes are loaded in the same row as the card to avoid any sample loss. If you accidentally started the run without adding the elution tube, abort the protocol as described on page 15.

## BenchPro<sup>®</sup> 2100 Error Codes

Error	Message	Action
Hardware ERROR!	A leak has been detected in the system	Fix Leak and Cycle Power.
	Inlet pressure out of range	Check inlet pressure.
	Vacuum out of range	Unit needs servicing, contact Technical Support (page 28).
	Pressure out of range	Unit needs servicing, contact Technical Support (page 28).
	Valve failed pressure decay test	Unit needs servicing, contact Technical Support (page 28).
	Valve failed vacuum decay test	Unit needs servicing, contact Technical Support (page 28).
	Valve failed pressure POST test. Valve = *	Unit needs servicing, contact Technical Support (page 28).
	Valve failed vacuum POST test. Valve = *	Unit needs servicing, contact Technical Support (page 28).
Warning	No card detected	Insert a card and restart protocol.
	Please close door and restart protocol	--

\*valve number

## Appendix A

### Connecting to Different Types of House Air Outlets

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#### Introduction

Since the house air outlets can vary, examples of a few house air connector types and how to connect the supplied flexible tube to the house air connectors are described below.

Ordering information from McMaster-Carr ([www.mcmaster.com](http://www.mcmaster.com)) is included.

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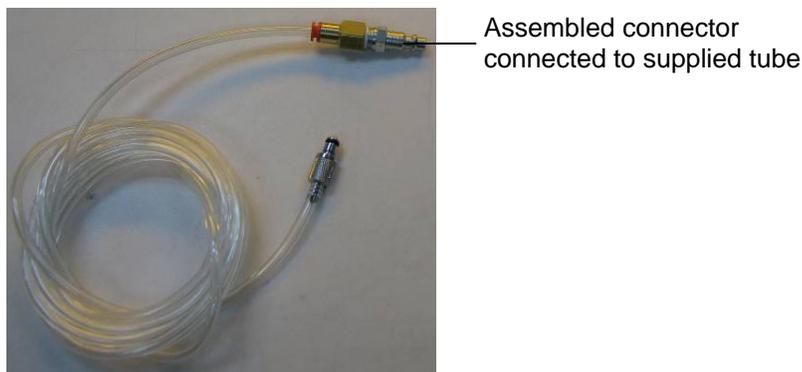
#### Quick Disconnect House Air Outlet

If the house air outlet is a standard quick disconnect, then use Item 1 (McMaster Cat. no. 6534K46) and Item 2 (McMaster Cat. no. 5111K667) to connect the instrument's ¼" tubing to the quick disconnect house air outlet.

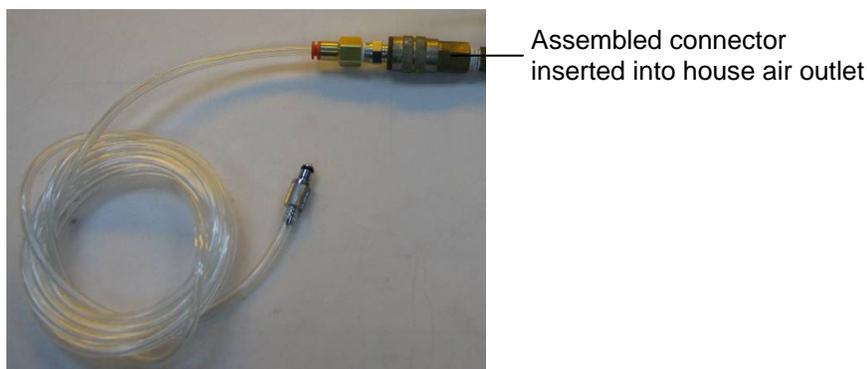
1. Assemble Item 1 and Item 2 to create the connector.



2. Attach the bare end of the supplied flexible tube to the push to connect to the end of the assembled connector from Step 1.



3. Insert the male end of the assembled connector into the existing house air outlet.



4. Insert the quick disconnect fitting on the other end of the flexible tube into the air inlet connector on the back of the instrument (see page 8).
  5. Test to ensure the proper house air pressure is maintained.
- 

*Continued on next page*

## Connecting to Different Types of House Air Outlets, Continued

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### Tube House Air Outlet

If the house air outlet is 1/4" diameter tube, then use Item 3 (McMaster Cat. no. 5111K468) to connect to the existing 1/4" OD tubing of the instrument.

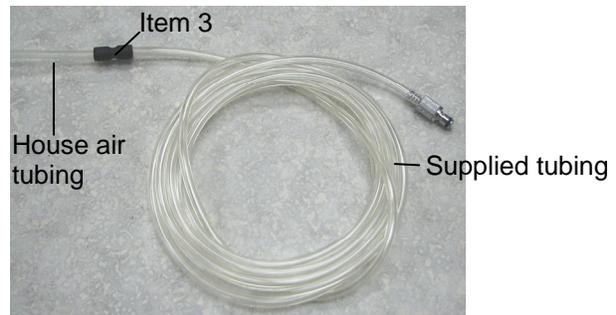
If the house air outlet is 3/8" diameter tube, then use Item 4 (McMaster Cat. no. 9087K65) to connect to the existing 1/4" OD tubing of the instrument.

1. Connect one end of the connector to the house air outlet tubing and the other end of the connector to the supplied flexible tube. See figures below.

**Item 3**



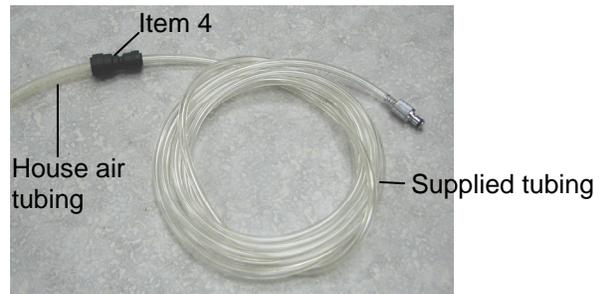
**Item 3 connected to supplied tubing and house air outlet**



**Item 4**



**Item 4 connected to supplied tubing and house air outlet**



2. Insert the quick disconnecter fitting on the other end of the flexible tube into the air inlet connector on the back of the instrument (see page 8).
3. Test to ensure the proper house air pressure is maintained.

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*Continued on next page*

## Connecting to Different Types of House Air Outlets, Continued

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### Connecting Multiple Instruments

If you wish to connect multiple BenchPro® 2100 instruments to a single house air outlet line, use Item 5 (McMaster Cat. no. 5779K34) to tee-off from the main supply tubing to each instrument. If needed, additional ¼" OD, 1/8" ID flexible tubing can be purchased separately (McMaster Cat. no. 5108K43).

See figures below for details.

**Important:** You can only operate up to 4 instruments off a single house air supply line.

#### Item 5 connector



Item 5

Three instruments connected to a single house air supply line using Item 5.



# Replacing the Fuse

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## Replacing the Fuse

For additional fuses, contact Technical Support (page 28).

Instructions are provided below to replace the 250 V, 2.0 A fuse for the main power socket.

1. Turn **off** the main power switch at the left side of the instrument and detach the power cord from the rear of the instrument.
  2. Open the fuse compartment located on the rear of the instrument by pressing in and rotating the knob  $\frac{1}{4}$  turn counter-clockwise.
  3. Pull the fuse holder out of the compartment and inspect the fuse. If the fuse is burned or there is a break in the fuse element, replace the 250 V, 2.0 A fuse with the identical type fuse.
  4. Place the fuse holder back into the compartment, press in the knob and rotate the knob clockwise until the knob clicks into place.
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# Repackaging the Instrument

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## Repackaging and Storage

If you need to send the instrument to Invitrogen for repair or warranty issues, or you wish to transport the instrument to another location, repackage the unit as follows:

1. Turn **off** the main power switch at the left side of the instrument and detach the power cord from the rear.
  2. Secure the drawer unit with a tape.
  3. Place the instrument in the original box including the original packing foam.
  4. Tape the box securely and place appropriate shipping labels for shipping the unit to Invitrogen. Always transport the box with the unit in the **upright** position.
  5. If the unit is not to be used for extended periods of time, store the repackaged unit in an upright position at 15°C to 40°C.
-

# Product Specifications

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## BenchPro® 2100 Specifications

### Environmental Conditions

Input Power:	DC 12 V, 2.5 A
Installation site:	Indoor use only. Pollution degree 2 environments
Altitude:	Up to 2,000 meters*
Operating Temperature:	15–30°C
Maximum Relative Humidity:	80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C

### Specifications

Instrument Type:	Processor unit with 2 slots
Sample Processing:	1 to 2 samples/batch
Processing Time:	~90 minutes
Dimensions:	13 inches (w) × 20.8 inches (d) × 11.7 inches (h)
Weight:	20 pounds (9.1 kg)
Built-in Features:	Digital display, light LED

The BenchPro® 2100 instrument including the BenchPro® Maxiprep Card is compatible with standard nonhazardous laboratory reagents. The Waste Tray is reusable and can be autoclaved.

\*At high altitudes, air supply flow rates may be reduced (especially if an external compressor is used). When operating at high altitudes, ensure the input air pressure and flow rates meet the specifications listed on page 7.

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## BenchPro® Maxiprep Card Specifications

The BenchPro® Maxiprep Cards are used with the BenchPro® 2100 instrument and are available separately (page 27). For details on the BenchPro® Maxiprep Cards, see page 5.

Card Dimensions:	21.5 cm × 19.5 cm
Card Materials:	ABS
Card Tip Dimensions:	0.65 cm × 6 mm

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## Waste Tray Specifications

The Waste Tray is used with the BenchPro® 2100 instrument. For details on the BenchPro® Reagent Tray, see page 6.

Tray Dimensions:	23 cm × 8 cm
Tray and Reservoir Materials:	Polypropylene
Reservoir Volume:	125 mL
Piercing device:	16 cm × 4.5 cm, polycarbonate

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*Continued on next page*

## Product Specifications, Continued

### System Specifications

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Specifications	High copy
Starting culture volume	100–125 mL <sup>†</sup>
Elution Volume	~1.0 mL
Expected DNA Yield*	~750 µg
Endotoxin**	<10 EU/µg
O.D. <sub>260/280</sub>	>1.8

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<sup>†</sup>Volume is based on culture grown in LB medium and not TB or 2x YT medium.

\*DNA yield depends on plasmid copy number, type and size, bacterial strain, and growth conditions.

\*\*Endotoxin levels vary depending on bacterial strain, growth medium, and growth conditions.

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## Accessory Products

### Additional Products

The following products are for use with the BenchPro® 2100 instrument and are available separately from Invitrogen.

For more information, visit [www.invitrogen.com](http://www.invitrogen.com) or contact Technical Support (page 28).

Product	Quantity	Catalog no.
BenchPro® Maxi Plasmid Card and Reagent Tray	1 kit	MC2001
BenchPro® 2100 MaxiCard™ Piercing Device	1 each	MC3001
BenchPro® 2100 MaxiCard™ Waste Tray	1 pack (2 trays)	MC4001
Quant-iT™ DNA Assay Kit, High Sensitivity	1000 assays	Q33120
Quant-iT™ DNA Assay Kit, Broad-Range	1000 assays	Q33130
Qubit® Fluorometer	1 each	Q32857
Luria Broth Base (Miller's LB Broth Base)®, powder	500 g 2.5 kg	12795-027 12795-084
Ampicillin Sodium Salt, irradiated	200 mg	11593-027
Carbenicillin, Disodium Salt	5 g	10177-012

### E-Gel® Agarose Gels and DNA Ladders

E-Gel® Agarose Gels are bufferless pre-cast agarose gels designed for fast, convenient electrophoresis of DNA samples. E-Gel® agarose gels are available in different agarose percentages and well formats.

A large variety of DNA ladders is available from Invitrogen for sizing DNA. For more details on these products, visit our website at [www.invitrogen.com](http://www.invitrogen.com) or contact **Technical Support** (page 28).

# Technical Support

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## Web Resources



Visit the Invitrogen Web site at [www.invitrogen.com](http://www.invitrogen.com) for:

- Technical resources, including manuals, vector maps and sequences, application notes, SDSs, FAQs, formulations, citations, handbooks, etc.
  - Complete technical support contact information
  - Access to the Invitrogen Online Catalog
  - Additional product information and special offers
- 

## Contact Us

For more information or technical assistance, call, write, fax, or email. Additional international offices are listed on our web page ([www.invitrogen.com](http://www.invitrogen.com)).

### Corporate Headquarters:

5791 Van Allen Way  
Carlsbad, CA 92008 USA  
Tel: 1 760 603 7200  
Tel (Toll Free): 1 800 955 6288  
Fax: 1 760 602 6500  
E-mail: [tech\\_support@invitrogen.com](mailto:tech_support@invitrogen.com)

### Japanese Headquarters:

LOOP-X Bldg. 6F  
3-9-15, Kaigan  
Minato-ku, Tokyo 108-0022  
Tel: 81 3 5730 6509  
Fax: 81 3 5730 6519  
E-mail: [jpinfo@invitrogen.com](mailto:jpinfo@invitrogen.com)

### European Headquarters:

Inchinnan Business Park  
3 Fountain Drive  
Paisley PA4 9RF, UK  
Tel: +44 (0) 141 814 6100  
Tech Fax: +44 (0) 141 814 6117  
E-mail: [eurotech@invitrogen.com](mailto:eurotech@invitrogen.com)

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## SDS

Safety Data Sheets (SDSs) are available at [www.invitrogen.com/sds](http://www.invitrogen.com/sds).

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## Certificate of Analysis

The Certificate of Analysis provides detailed quality control and product qualification information for each product. Certificates of Analysis are available on our website. Go to [www.invitrogen.com/support](http://www.invitrogen.com/support) and search for the Certificate of Analysis by product lot number, which is printed on the box.

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## Purchaser Notification

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**Limited Use Label  
License No. 5:  
Invitrogen  
Technology**

The purchase of this product conveys to the buyer the non-transferable right to use the purchased amount of the product and components of the product in research conducted by the buyer (whether the buyer is an academic or for-profit entity). The buyer cannot sell or otherwise transfer (a) this product (b) its components or (c) materials made using this product or its components to a third party or otherwise use this product or its components or materials made using this product or its components for Commercial Purposes. The buyer may transfer information or materials made through the use of this product to a scientific collaborator, provided that such transfer is not for any Commercial Purpose, and that such collaborator agrees in writing (a) not to transfer such materials to any third party, and (b) to use such transferred materials and/or information solely for research and not for Commercial Purposes. Commercial Purposes means any activity by a party for consideration and may include, but is not limited to: (1) use of the product or its components in manufacturing; (2) use of the product or its components to provide a service, information, or data; (3) use of the product or its components for therapeutic, diagnostic or prophylactic purposes; or (4) resale of the product or its components, whether or not such product or its components are resold for use in research. For products that are subject to multiple limited use label licenses, the terms of the most restrictive limited use label license shall control. Life Technologies Corporation will not assert a claim against the buyer of infringement of patents owned or controlled by Life Technologies Corporation which cover this product based upon the manufacture, use or sale of a therapeutic, clinical diagnostic, vaccine or prophylactic product developed in research by the buyer in which this product or its components was employed, provided that neither this product nor any of its components was used in the manufacture of such product. If the purchaser is not willing to accept the limitations of this limited use statement, Life Technologies is willing to accept return of the product with a full refund. For information about purchasing a license to use this product or the technology embedded in it for any use other than for research use please contact Out Licensing, Life Technologies, 5791 Van Allen Way, Carlsbad, California 92008 ; Phone (760) 603-7200 or e-mail: [outlicensing@lifetech.com](mailto:outlicensing@lifetech.com)

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## Purchaser Notification, Continued

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### **BenchPro® 2100 Warranty**

Invitrogen, part of Life Technologies warrants to the original purchaser ("Purchaser") that the BenchPro® 2100 instrument ("instrument") will be free from defects in materials and workmanship for a period of one (1) year from the date of delivery. Invitrogen agrees, as its sole responsibility under this limited warranty, and upon prompt notice of a defect, to repair, replace or refund purchase price, at its discretion, any instrument discovered to be defective within the warranty period. This warranty does not include repair, replacement, or refund necessitated by accident, abuse, neglect, misuse, unauthorized repair, or modification of the instrument.

In the event that Invitrogen determines that the instrument is in need of repair and not replacement, this Standard Warranty includes replacement parts and labor for the instrument. This Standard Warranty does not include shipment of the instrument to and from service location or travel cost of service engineer, the costs of which shall be borne by the Purchaser.

**This Warranty and the remedies set forth herein are exclusive and in lieu of all other express or implied warranties (including implied warranties of merchantability, fitness for a particular purpose and non-infringement), and no other warranties shall be binding upon Invitrogen. In no event shall Invitrogen be liable for any special, incidental or consequential damages resulting from the use or malfunction of this instrument or the system With which it is used, even if such damages could be anticipated by Invitrogen.**

To obtain service during the warranty period, contact Invitrogen Technical Support for further instruction.

#### **OUT OF WARRANTY SERVICE**

Contact Invitrogen Technical Support. We will be happy to assist you by phone at no charge. Repair service, if needed, will be billed depending on the parts replaced and labor hours needed to repair your instrument. You will be billed for shipment of the instrument to the recommended service facility.

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# Appendix B: Safety

## Symbols on the Instrument

### Symbols on Instrument

The following table describes the symbols displayed on the instrument.

Symbol	Description
	Denotes direct current.
 Caution	The <b>Caution</b> symbol denotes a risk of safety hazard. Refer to accompanying documentation.
	Placed on disposable card to denote single usage.
	<b>DANGER!</b> High voltage. Indicates the presence of an electrical shock hazard and to proceed with appropriate caution.
	Indicates a protective grounding terminal that must be connected to earth ground before any other electrical connections are made to the instrument.
	Biohazard.
	<b>Do not dispose of this product as unsorted municipal waste.</b> Follow local municipal waste ordinances for proper disposal provisions to reduce the environmental impact of waste electrical and electronic equipment (WEEE).
	The CE mark symbolizes that the product conforms to all applicable European Community provisions for which this marking is required. Operation of the BenchPro <sup>®</sup> 2100 instrument is subject to the conditions described in this manual. The protection provided by the instrument may be impaired if the instrument is used in a manner not specified by Invitrogen.
	A CSA mark with the indicators "C" and "US" means that the product is certified for both the U.S. and Canadian markets, to the applicable U.S. and Canadian standards.

## General Instrument Safety

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### Moving and Lifting the Instrument



**WARNING! PHYSICAL INJURY HAZARD.** Use this product only as specified in this document. Using this instrument in a manner not specified in the user manual may result in personal injury or damage to the instrument.

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### Operating the Instrument

Ensure that anyone who operates the instrument has:

- Received instructions in both general safety practices for laboratories and specific safety practices for the instrument.
  - Read and understood all applicable Safety Data Sheets (SDSs). See **About SDSs** on page 33.
- 

### Cleaning or Decontaminating the Instrument



**CAUTION!** Using cleaning or decontaminations method other than those recommended by the manufacturer may compromise the safety or quality of the instrument.

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# Chemical Safety

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## Chemical Hazard Warning



**WARNING! CHEMICAL HAZARD.** Before handling any chemicals, refer to the Safety Data Sheet (SDS) provided by the manufacturer, and observe all relevant precautions.

All chemicals in the instrument, including liquid in the lines, may be potentially hazardous. Always determine what chemicals have been used in the instrument before changing reagents or instrument components. Wear appropriate eyewear, protective clothing, and gloves when working on the instrument.

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## General Safety Guidelines

To minimize the hazards of chemicals:

- Read and understand the Safety Data Sheets (SDSs) provided by the chemical manufacturer before you store, handle, or work with any chemicals or hazardous materials.
  - Minimize contact with chemicals. Wear appropriate personal protective equipment when handling chemicals (for example, safety glasses, gloves, or protective clothing). For additional safety guidelines, consult the SDS.
  - Minimize the inhalation of chemicals. Do not leave chemical containers open. Use only with adequate ventilation (for example, fume hood). For additional safety guidelines, consult the SDS.
  - Check regularly for chemical leaks or spills. If a leak or spill occurs, follow the manufacturer's cleanup procedures as recommended in the SDS.
  - Comply with all local, state/provincial, or national laws and regulations related to chemical storage, handling, and disposal.
- 

## Waste Disposal

If potentially hazardous waste is generated when you operate the instrument:

- Characterize (by analysis if necessary) the waste generated by the particular applications, reagents, and substrates used in your laboratory.
- Ensure the health and safety of all personnel in your laboratory.
- Ensure that the instrument waste is stored, transferred, transported, and disposed of according to all local, state/provincial, and/or national regulations.

**IMPORTANT!** Radioactive or biohazardous materials may require special handling, and disposal limitations may apply.

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# Electrical Safety and Electromagnetic Compatibility (EMC) Standards

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## Power

 **DANGER! ELECTRICAL SHOCK HAZARD.** Severe electrical shock can result from operating the instrument without its instrument panels in place. Do not remove instrument panels. High-voltage contacts are exposed when instrument panels are removed from the instrument.

 **DANGER! ELECTRICAL HAZARD.** Grounding circuit continuity is vital for the safe operation of equipment. Never operate equipment with the grounding conductor disconnected. Use properly configured and approved line cords for the voltage supply in your facility. Plug the system into a properly grounded receptacle with adequate current capacity.

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## U.S. and Canadian Safety Standards

This instrument has been tested to and complies with standard UL 61010A-1, "Safety Requirements for Electrical Equipment for Laboratory Use, Part 1: General Requirements."

This instrument has been tested to and complies with standard CSA 1010.1, "Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements."

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## European Safety and EMC Standards



### Safety

This instrument meets European requirements for safety. This instrument has been tested to and complies with standards

EN 61010-1:2001, "Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements."

EN 61010-2-081, "Particular Requirements for Automatic and Semi-Automatic Laboratory Equipment for Analysis and Other Purposes."

### EMC

EN 61326-1:2006 "Electrical equipment for measurement, control and laboratory use

Part 1 General EMC requirements." (Group 1, Class A)

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## Australian EMC standards



This instrument has been tested to and complies with standard AS/NZS 2064, "Limits and Methods Measurement of Electromagnetic Disturbance Characteristics of Industrial, Scientific, and Medical (ISM) Radio-frequency Equipment."

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**Corporate Headquarters**

5791 Van Allen Way  
Carlsbad, CA 92008

T: 1 760 603 7200

F: 1 760 602 6500

E: [tech\\_support@invitrogen.com](mailto:tech_support@invitrogen.com)

For country-specific contact information, visit our web site at [www.invitrogen.com](http://www.invitrogen.com)