



QuatroProbe QP 10
Magnetic bead extraction system

User Manual

Version : 1.2

IT IS IMPORTANT TO READ THIS MANUAL BEFORE USING THE QUATROPROBE

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1 INTRODUCTION



The QuatroProbe is a bench top automated system for extraction and purification of cells, proteins and nucleic acids using magnetic bead technology.

The QuatroProbe has a 12-position carousel in which four channel QuatroPak cartridges are placed. Reagents and wash solutions are added with mixing, magnetic bead capture, temperature and extraction of unwanted reagents all under automatic software control. The result is effective and efficient extraction of the target cell, protein or nucleic acid with in the plastic QuatroPak disposable cartridge.

The system design provides an efficient and truly “walk away” instrument with minimal set-up and shutdown steps.

Features:

- Rapid set-up for “ever ready” status - SPEED
- Compact footprint - CONVENIENCE
- Wide sample throughput per run - FLEXIBILITY
- Fully automatic “walk away” rapid extractions - SPEED
- Special single-use QuatroPak reaction cartridge – no other consumable required - CONVENIENCE
- Internal temperature control - EFFICIENCY
- Contamination issues are eliminated - EFFICIENCY
- Smart Card operation with no PC required - CONVENIENCE

2 SPECIFICATIONS

Instrument type:	Stand alone benchtop
Processing Capability:	4 to 48 samples per run
Processing Time:	Typically 50 minutes for 48 samples
Temperature Control:	Programmable from ambient to 50°C
Processing Volumes:	50ul to 8ml
Dispensing Mode and Accuracy:	Peristaltic pumps $\pm 2\%$
Software:	Embedded software + smart card
Power Supply:	460VAC 47-63Hz 4A rms @ 110V
Dimensions:	57(H) x 61(D) x 49(W) cm
Weight:	28kg

3 UNPACKING AND SETUP

On receipt please check for damage to exterior packaging. Remove packaging and ensure there are no damage to the instrument (and accessories), and no missing components. Contact your local distributor or Be Robotics Ltd. immediately if damage is evident or items missing.

Packing List:

1x	QP-10	QuatroProbe Automated Magnetic bead extraction system (110-240v 50/60Hz)
1x	SC6020	Smart Card (purging version)
1x	ML-10	Mains lead (UK unless otherwise specified)
1x	PF5710	Spare fuses 10A (pack of 2)
1x	RB5650	Set of plastic reagent bottles
1x	AS5410	Waste station seal
1x	QR5050	QuatroRak Magnetic Rack
1x	SC0001	Service Card

Always place the QuatroProbe in the pre-PCR Laboratory.

After unpacking the instrument, open the bubble door on the front.

Carefully remove packing foam underneath the carousel.

The packaging should be retained for any future transport of the instrument.

Inspect for transport damage and spin the carousel around gently. A resistance generated by the motor should be felt. No other effect, aural or visible, is normally observed.

Connect the mains lead to the mains lead socket on the back of the instrument

Close the bubble door

Switch 'On' the mains switch at the back of the instrument.

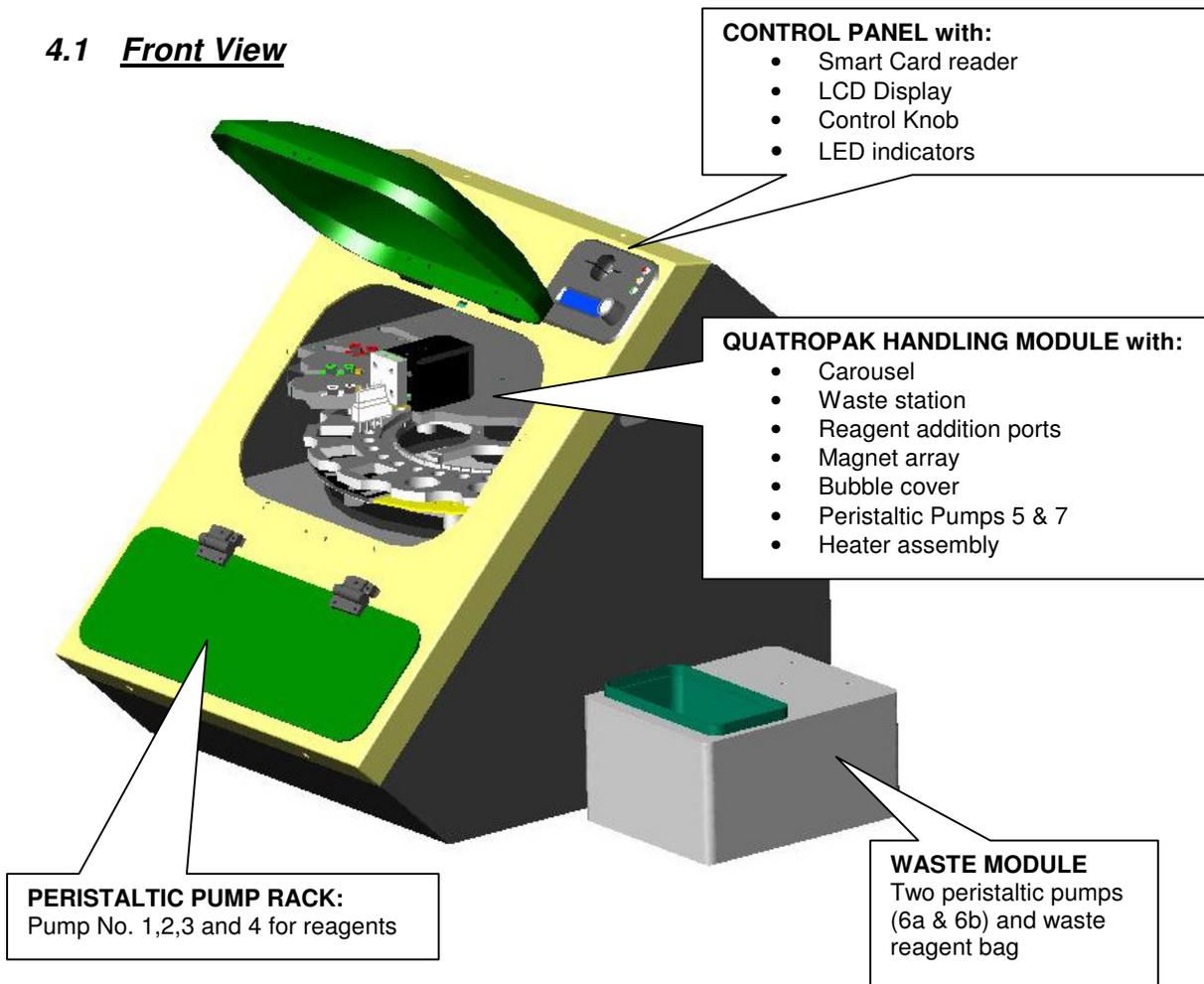
A number of initialization routines will automatically start and **System Check** is displayed on the LCD screen. This takes a few seconds only. Opening the bubble door during these routines will cause an audible alarm and the instrument to stop. The bubble door should be closed and the instrument will restart.

At the end of the initialization routine the LCD screen displays **Run Program** indicating the instrument has been checked and is ready.

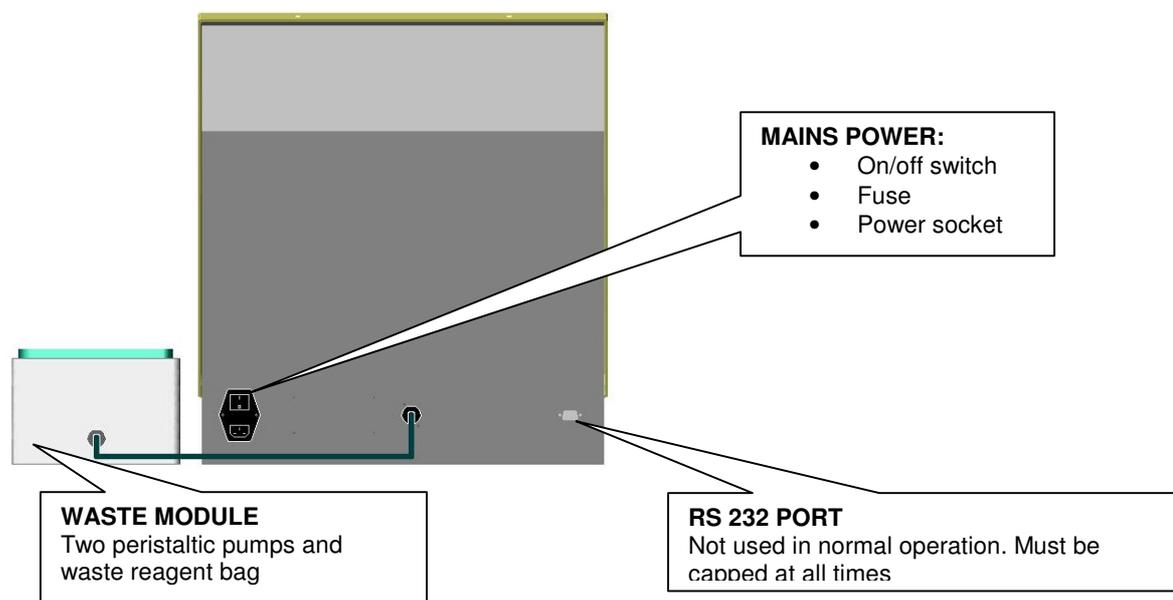
If a malfunction is detected, an error message will be displayed which requires the attention of a qualified service engineer.

4 SYSTEM OVERVIEW

4.1 Front View



4.2 Back View



4.3 QuatroPak Handling Module



Consisting of:

- **Bubble cover:** Closed during instrument operation. Fitted with a detector to generate an audible signal and to stop the instrument if opened during operation.
- **12xQuatroPak position carousel.** The position marked P is for automatic priming or purging of reagents and should be checked and emptied periodically. The position marked W is for the wash station for probe cleaning
- Peristaltic Pumps 5 & 7

Injection ports:

A set of three, double injection ports are found above and to the left of the carousel centre. These are connected to peristaltic pumps Nos. 1 to 5. The injection port positions determine into which chamber of the QuatroPak the reagents are introduced. Regular changing of the injection tips is essential.

Peristaltic Pumps 5 & 7:

Housed on the inner cover on the top plate.

Waste Station:

An assembly with four probes connected to externally placed peristaltic pumps as a part of the waste module. The waste station automatically evacuates reagents from the chambers of QuatroPaks below and into the external waste container.

Magnet Array:

An array of strong magnets arranged underneath the QuatroPak reaction chambers. The magnets are positioned under the front left part of the carousel for $\frac{1}{4}$ of the circumference of the carousel.

Heater plate:

The remainder of the carousel circumference has a series of heater plates arranged below and in close proximity to any QuatroPaks above. The heater plates temperature range of 20 °C-150 °C is software controlled to achieve temperatures up to 70 °C in the QuatroPak. An LED is positioned on the back plate above the carousel and marked "heater indicator". The LED indicates when the heater is on and flashes if the heater is above 50 °C

4.4 Peristaltic Pump Assembly



This module houses four of the peristaltic pumps, and reagent bottles. Pumps 1, 2, 3 and 4 are used for transfer of liquid reagents to the QuatroPak handling module. All pumps can be purged manually using the control panel - as can pumps 5 & 7 in the QuatroPak Handling Module in 4.3 above - automatically by insertion of a special smart card or as a standard part of a chosen extraction protocol

4.5 Control Panel



The control panel accepts smart cards to program the QuatroProbe to perform a specific protocol. Each different protocol requires a separate smart card.

There is an LCD display showing instrument status, prompts and input requirements.

There is a single control knob which functions by turning or pressing.

5 ACCESSORIES

Catalogue No.	Item Description
ST5500	Reagent addition tips (pack of 12)
AS5410	Waste station seal
RB5650	Set of plastic reagent bottles (4x60ml, 1x250ml)
PT5910	Peristaltic pump tubing
SC6020	Smart Card (priming version)
QR5050	QuatroRak magnetic rack

6 CONSUMABLES

QuatroPak cartridges (pack of 12) are supplied in a custom box that can be used as a laboratory rack.

Each QuatroPak has four identical channels to accommodate four samples.

Each reaction channel has two mixing ball inserted.

7 ACCESSORIES AND CONSUMABLES SETUP

QuatroPak Disposable Cartridges	QuatroPaks are for single use only and should be disposed in accordance with health and safety regulations. QuatroPaks can be loaded with samples in the special delivery containers and then placed into the QuatroProbe carousel positions. At the end of the run QuatroPaks are unloaded and can be placed in the QuatroRak with magnetic attraction. Samples are then withdrawn for analysis.
Waste Station Seals	The seals should be replaced approximately every month under normal workload conditions.
Peristaltic Pump Tubes	Life expectancy of peristaltic tubes: Modern materials used in peristaltic pumps have a long life. The tubes should be replaced approximately every six months under normal workload conditions.
Reagent Addition Tips	The tips should be replaced according to the extraction protocol used or at least every week under normal workload conditions. When using reagent kits with tips included, the tips should be changed after every run e.g. high salt content buffers may cause blockages
Reagent Bottle	Supplied to use for priming pure water through the pumps – reagent bottles will be supplied with kits when ordered.
Purging Card	This card commands the QuatroProbe to perform a reagent wash + purge routine.
QuatroRak Magnetic Rack	A metal rack with locations for four QuatroPak cartridges and integral magnets for bead attraction.
Priming Bucket	A reservoir used to prime and contain reagents, and is placed in position labelled “P” on the carousel

8 GENERAL INFORMATION

8.1 Environmental Conditions

Power Source: Electrical power source at AC 110v, 1000VA and 60Hz

Installation site: The QuatroProbe is intended for indoor use only and should not be subjected to large variations in temperature and humidity. In general, typical laboratory conditions are acceptable.
The QuatroProbe should be placed on a flat stable surface

8.2 Cleaning

The QuatroProbe may be used with potentially infectious biological samples. Observe standard laboratory safety practices at all times.

Cleaning of the QuatroProbe should be performed regularly using proprietary decontaminants followed by water an appropriate detergent. Normally, cleaning of the carousel and fixed tray below is most important:

- Use an appropriate detergent to clean surrounding surfaces.
- Use a cloth, dampened in detergent and wipe all areas in and around the peristaltic pumps and the reagent bottle area.
- Use the same technique to wash all parts that could come in contact with any accidental spillage.

8.3 Safety

The QuatroProbe meets the protection requirements laid down in the European Council directive 89/336/EEC on electromagnetic compatibility and carries a CE mark.

9 INSTRUMENT OPERATION

9.1 Overview

The QuatroProbe ON/OFF mains switch is located on the back of the instrument.

The QuatroProbe is operated by a single knob on the control panel on the front of the instrument. The control knob functions by turning clockwise or anticlockwise or by pressing down.

Turning	The control knob clockwise or anticlockwise will change a screen display: <ul style="list-style-type: none"> • to the next or previous screen display, or • to display either "Yes" or "No", or • to select a number e.g. no. of QuatroPaks
Pressing	the control knob indicates acceptance of the display message

The BUBBLE DOOR should be closed whenever the instrument is self-checking or running. The instrument will detect if the door is open and generate an audible signal to alert the user. The instrument will stop during self-checking or pause during a run (press control knob to restart the run). The following screen will be displayed:

**Please close the
bubble door**

Indicates the bubble door must be closed

**PROGRAM PAUSED
Restart Program**

Prompt to restart the program by pressing control knob

Please refer to software flowcharts in the appendix section of this manual (chapter 13 page 20) for further information.

9.2 Switching on

When switching on the QuatroProbe at the mains switch on the back of the instrument, it will perform a self-check routine. This routine checks basic software and mechanical functions.

**— Bee Robotics —
QuatroProbe**

Displays the welcome screen for 2 seconds

Then the instrument performs a system self-check:

**— QuatroProbe —
System Check**

For about 10 seconds

Notes: in the event of a problem during the last run (power failure or error), a message is displayed before the system check as a reminder.

Refer to the section "Last run information screen" chapter 10.4 page 18.

At the end of the system check:



Indicates the main menu is now available

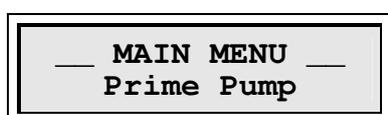
9.3 Main Menu Functions

The main menu is available following the system check routine after switching on the QuatroProbe



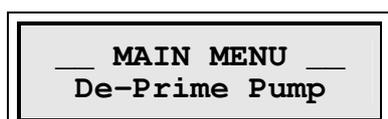
This is the default setting and is used to run programs

Turn Control Knob



This setting allows the reagent lines to be washed/primed with reagent prior to running tests

Turn Control Knob



This setting is used for reversing any of the peristaltic pumps to empty reagent lines back into the reagent bottles

9.4 Priming / De-Priming Routines

It is recommended, as good practice:

- to wash the instrument pumps before every work session e.g. morning
- to purge the instrument pumps after completion of the work session e.g. late afternoon

9.4.1 Manual control

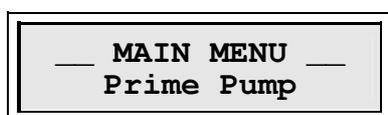
The peristaltic pumps can be manually primed and de-primed using the control knob:

- | | |
|-------------|---|
| Priming: | <ul style="list-style-type: none"> • From Main Menu • From Pause Program |
| De-Priming: | <ul style="list-style-type: none"> • From Main Menu • From Pause Program Menu |

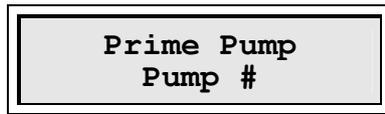
Care with Prime Function: Release the dispenser tip(s) and place in an empty tube, container or above the Priming QuatroPak.

For instance Priming from Main Menu:

Turn Control Knob:



Indicates manual prime pump menu selected

Press Control Knob:

Indicates Pump number # selected for priming

Press Control Knob:

By pressing the control knob, the selected pump is primed.
By releasing the control knob, the selected pump is stopped.

Turn Control Knob:

Turn knob to select another pump for priming.

Turn Control Knob:

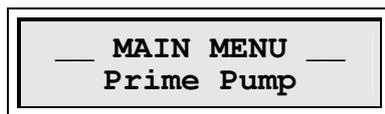
To cancel the priming, select following screen:



Indicates ready to return to the previous menu

Press Control Knob:

The system will return to the previous menu, Main menu in this case:



9.4.2 Automatic Purging/Cleaning

Use the instrument **PURGE card** supplied for Purging/Cleaning Peristaltic Pumps:

- Place an empty Priming QuatroPak in the P position of the QuatroProbe carousel. TAKE CARE - DO NOT OVERFILL QUATROPAK WHILST PURGING
- Place peristaltic pump inlet tubes in a container of molecular grade water. If gross contamination is suspected or evident then a surfactant should be used to wash the system.
- Insert "PURGE card" and run the program, indicating one QuatroPak when requested. The QuatroProbe will automatically purge all peristaltic pumps into the priming QuatroPak, and then reverse all pumps to expel all liquid.

9.5 Run Program

To run a program, select "Run Program" from the main menu:

```

  _ MAIN MENU _
  Run Program
  
```

Press Control Knob:

```

  _ PROGRAM SETUP _
  Insert Pgm. card
  
```

Insert appropriate Program Smart Card

Press Control Knob:

Remark: If no program card inserted, an audible signal is heard and the red LED is lit.

```

  _ PROGRAM SETUP _
  Load QuatroPaks
  
```

Load QuatroPaks required for processing onto the carousel

Press Control Knob:

```

  _ PROGRAM SETUP _
  No. QuatroPaks: xx
  
```

Select number of loaded QuatroPaks by turning the knob

Press Control Knob:

```

  _ PROGRAM SETUP _
  Load Reagents
  
```

Load reagents onto pump rack and ensure that inlet tubes of each pump to be used is in correct bottle

Press Control Knob:

```

  _ PROGRAM SETUP _
  Start Program
  
```

Ready to start the program

Press Control Knob:

The bubble door guard is activated and the bubble door must be closed. If not, the message "Please close the bubble door" is displayed.

The program then automatically starts

```

  PROGRAM STARTING
  Initialization
  
```

The program starts first by initializing the QuatroProbe

At the end of the initialisation, the LCD display shows:

PROGRAM STARTING
Carousel scan

Carousel scanning to check loading.

If the carousel loading is correct, the instrument starts the extraction process and the LCD display shows:

PROGRAM RUNNING

Indicates the program is running The second line may display run status e.g. BINDING or ELUTION

Remark: if carousel loading is incorrect the operator is prompted to correct it. Refer to paragraph "Carousel scanning flowchart" page 22.

Notes:

It is possible to return to main menu during the program **setup** (e.g. if wrong number of QuatroPaks have been entered into the system) by pressing the control knob for more than 1 second. The display will then show:

Long Push Control Knob for 1 second

Return Main Menu
No

Prompt to return to the program setup menu

By pressing the control knob, the system returns to the program setup menu.

Turn Control Knob:

Return Main Menu
Yes

Prompt to return to the main menu

By pressing the control knob, the system returns to the main menu. Alternatively, turning the control knob selects the "Yes" or "No" prompts.

Press Control Knob:

MAIN MENU
Run Program

Back to the main menu

9.6 Pausing Program

During a run, the program can be paused by pressing the control knob for at least 1 second:

Long Push Control Knob for 1 second

Pause Program ?
No

Prompt to continue the program

Pressing the control knob, the system returns to the “Program running” display.

Turn Control Knob:



Prompt to pause the program

By pressing the control knob, the system pauses the program.

Press Control Knob:



Indicates program pausing is in progress

When the program is paused:



Prompt to restart the program

Please note during pause some instrument functions will not pause and will continue e.g. pump priming/de-priming and heater

Press Control Knob:

The bubble door guard is activated and the door must be closed. If not, the message “Please close the bubble door” is displayed.



Indicates the program is restarting

Remark: a carousel loading scan is also performed at this stage

When the program has restarted:



Indicates the program is running

9.7 Cancelling Program

During a run, the program can be cancelled by pressing the control knob for at least 2 seconds:

Long Push Control Knob for 2 seconds:



Prompt to continue the program

By pressing the control knob, the system returns to the “Program running” display. It should be noted that the screen initially shows the pause menu for 1 second followed by the cancel menu.

Turn Control Knob:

Cancel program ?
Yes

Prompt to cancel the program

By Pressing the control knob, the system cancels the program.

Press Control Knob:

CANCELLING
PROGRAM

Indicates the cancelling of the program is in progress

When the program is cancelled:

— MAIN MENU —
Run Program

Back to the main menu

9.8 Completion of Extraction Process

When the extraction is completed the display shows:

END PROCESSING
Press CTRL. knob

Indicates the extraction is completed

The orange LED is lit with an audible signal.

Press Control Knob:

Unload QuatroPak
Paks No.x to x

Prompt to unload the QuatroPaks

Press Control Knob:

Unload Reagents

Prompt to manually unload reagents

Press Control Knob:

Load cleaning
reagents

Prompt to manually load and connect cleaning reagents

Notes: refer to section “Priming / De-Priming Routines” (chapter 9.4 page 11) for de-priming / washing routine.

Press Control Knob:

Start cleaning ?
Press CTRL. knob

Prompt to start cleaning process

Press Control Knob:

Program
restarting

*Program restarts and initiates cleaning cycle.
Remark: a carousel loading scan is also performed at
this stage*

Press Control Knob:

PROGRAM RUNNING

Cleaning cycle in progress

END OF PROGRAM
Press CTRL. knob

*Indicates the cleaning cycle is complete. The pause LED
flashes and an audible signal is heard*

Press Control Knob:

Unload
QuatroProbe

*Extraction and cleaning process complete.
All reagents and QuatroPaks must be removed*

Press Control Knob:

— MAIN MENU —
Run Program

Back to the main menu

It is recommended, as good practice, to remove the program card from the control panel.
The QuatroProbe can now be switched off.

10 TROUBLESHOOTING

10.1 Error Messages overview

In the event of a system failure or fault the QuatroProbe will alert the user as follows:

- The red ERROR LED on the control panel will be illuminated.
- An audible signal will be heard.
- The LCD screen on the control panel will display an error message described below.

10.2 SYSTEM ERROR messages

In the event of a system error, one of the following messages will be displayed:

_ SYSTEM ERROR _
Smart Card Fault

Indicates a corrupted/invalid smart card

_ SYSTEM ERROR _
Waste station

Indicates an obstruction to the normal motion of the waste station probably due to QuatroPak misplacement

_ SYSTEM ERROR _
Carousel fault

Indicates an obstruction to normal motion of the carousel probably due to QuatroPak misplacement

The above are fatal errors and the QuatroProbe run has to be aborted.

10.3 RUNTIME ERROR message

In the event of a runtime error, the following message will be displayed:

RUNTIME ERROR
Code: ###-###-###

Indicates there is a runtime error

In this event please note the error code and contact Bee Robotics Ltd. or the supplier's technical service support. The QuatroProbe run has to be aborted.

10.4 Last run information screen

In the event of an error during the previous run, a message is displayed as a reminder before the System Check, after switching on the QuatroProbe:

Either:

INFO. LAST RUN:
POWER FAILURE

Indicates there was a power failure during the last run and the program could not be completed. The test batch has to be discarded

Or:

INFO. LAST RUN:
GENERATED ERROR

Indicates there was an error during the last run. It is advisable to contact a service engineer.

Press Control Knob:

The instrument performs a system check as usual:

QuatroProbe
System Check

11 LIMITED WARRANTY

Please note the serial number of the QuatroProbe (found on the back of the instrument) below for future reference

SERIAL No.

Warranty

Bee Robotics Ltd. warrants that each product described herein will be free from defects in materials and workmanship for a period of one year from the date of delivery. Bee Robotics Ltd. agrees, as its sole responsibility under this limited warranty, and upon prompt notice of the defect, to repair or replace any product found to be defective within the warranty period.

The limited warranty is not applicable to: (1) abnormal wear and tear (2) abuse, unreasonable use, improper installation, mistreatment, or neglect (3) damage caused by equipment or system with which the product is used (4) damage caused by modification or repair not made or authorised by Bee Robotics Ltd., or (5) theft, vandalism, fire, water or other peril. Product may not be returned without proper authorisation from Bee Robotics Ltd.. Cost of transportation, removal, or reinstallation of the equipment will be paid by the purchaser. This warranty and the remedies set forth herein are exclusive and in lieu of all other express or implied (including any implied warranties or merchantability or fitness for a general purpose), and no other representations or claims shall be binding on or obligate Bee Robotics Ltd. in any way. In no event will Bee Robotics Ltd. be liable for any special, incidental, or consequential damages resulting from use or malfunction of this product or the equipment or system with which it is used, loss of revenue, or cost of replacement of goods.

12 IMPORTANT SAFEGUARDS

Please read this manual carefully before using the QuatroProbe and make it accessible to all users. Failure to comply with the instructions in this manual will void the manufacturer's warranty and may pose a risk to the user.

IN AN EMERGENCY IMMEDIATELY TURN THE POWER OFF AND UNPLUG FROM POWER SOURCE.

Avoid touching the QuatroProbe with wet hands as it may cause an electrical shock. Do not attempt to disassemble the QuatroProbe.

There are no user serviceable parts within the QuatroProbe. Repairs and servicing must be carried out by trained service personnel only.

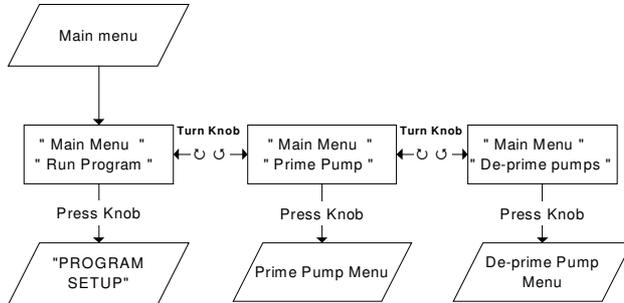
ALWAYS FOLLOW ACCEPTED HEALTH AND SAFETY PROCEDURES



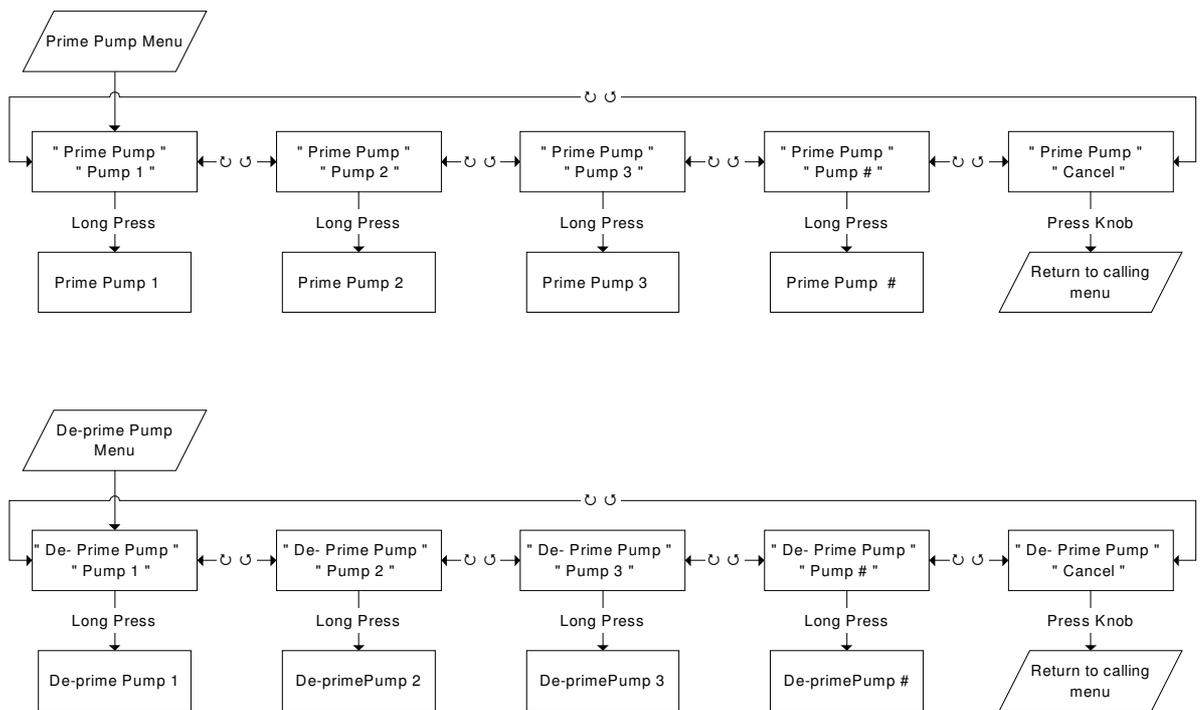
As part of the WEEE EU directives, this instrument should be returned to the manufacturer for dismantling at the end of its life

13 APPENDIX

13.1 Main Menu flowchart



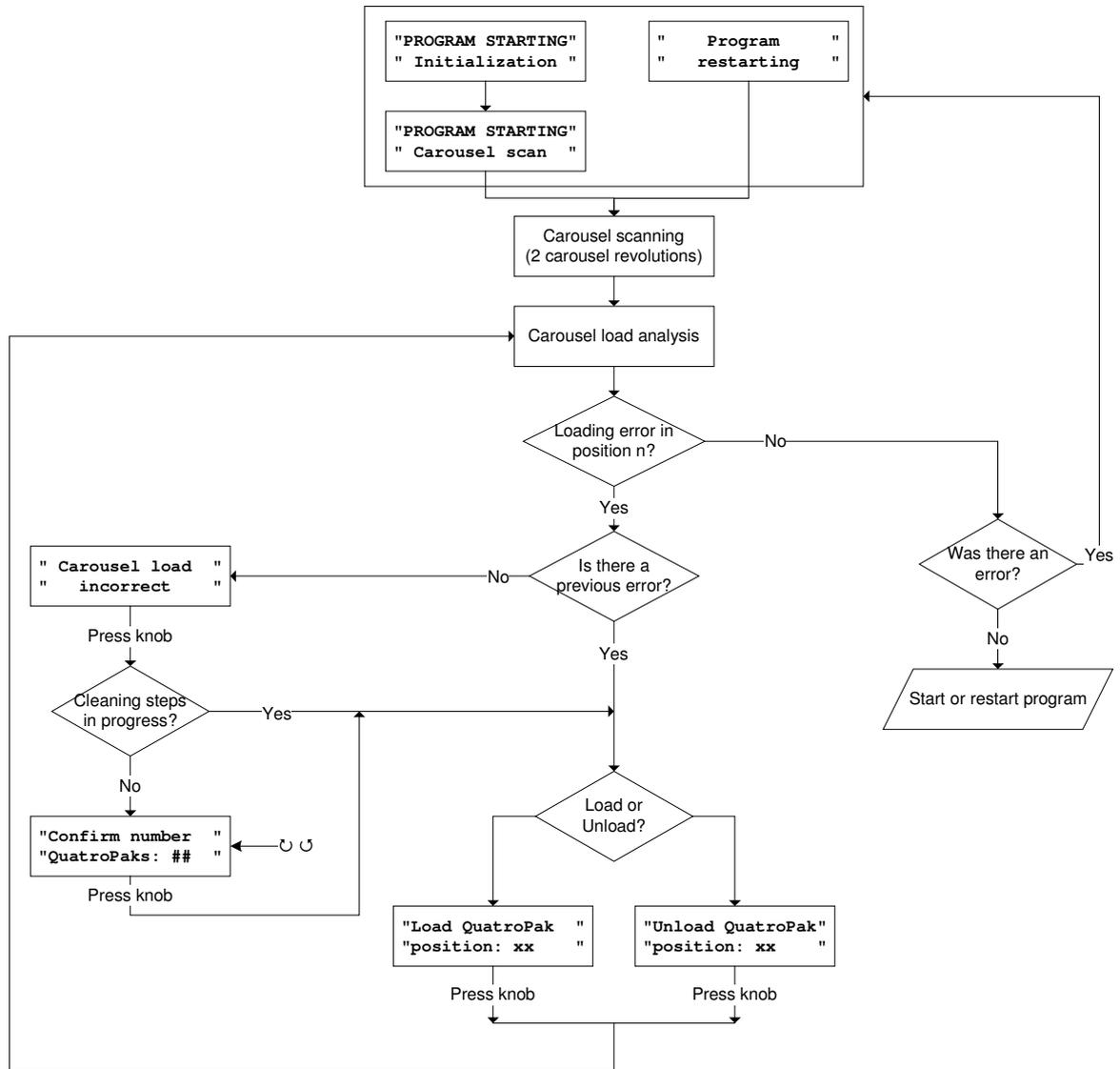
13.2 Prime and De-prime Menu flowchart



13.3 Run Program flowchart



13.4 Carousel scanning flowchart



13.5 Completion of Extraction Process Flowchart

