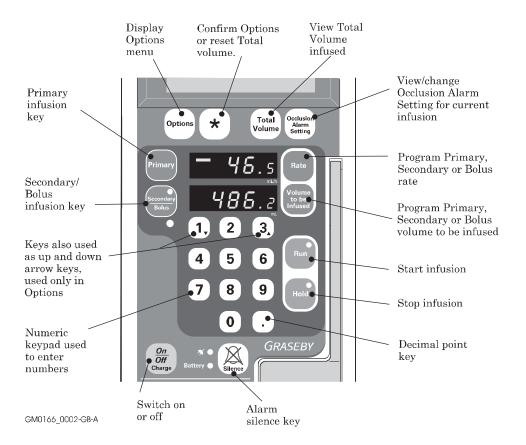
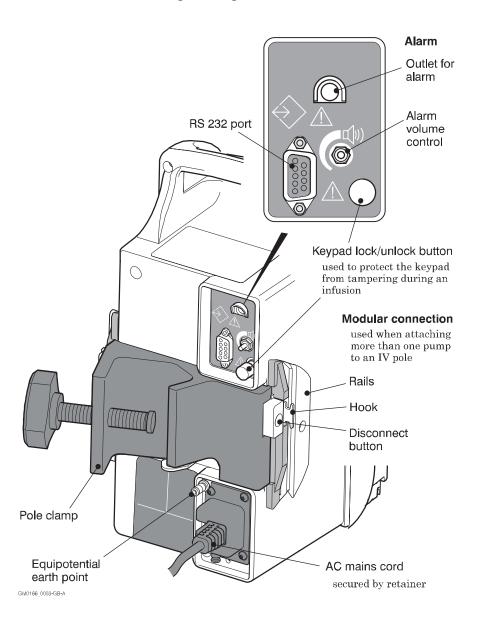


Programming keys



Rear of the pump



Switching the pump on and off

Before switching the pump on, visually check for any cracks on the case, or damage to any part of the pump or its connectors. Plug the AC mains cord into

an AC mains supply if possible. If necessary, the pump can be run on its internal batteries, see *Using the pump on batteries*, later in this chapter.

Switching on

To switch on the pump you can do either of the following:

- press the *On/Off* key
- open the front door by lifting the latch.

Note: If the pump is switched off and connnected to AC power and the saftey keypad lockout feature is active, the pump cannot be switched on via the keypad, see *Safety keypad lockout*, page 2-22.

Switch on in Quiet Pump mode

If you want to use the pump without any key clicks and also suppress the non-insistent alarms, you can switch on in "quiet pump" mode:

- 1. Press the *Silence* key and keep it pressed down.
- 2. Press the On/Offkey.

Note: Quiet Pump operation is cancelled when you turn off the pump.

Self test

When you switch it on, the pump carries out a series of tests to ensure that all components are functioning correctly. If any electrical or mechanical problems are detected, or if any potential problems are detected, then a

message is displayed and the alarm sounds. See *Chapter 4, Troubleshooting* for more details on handling alarms.

Message Display at Switch on

The messages displayed when you switch on the pump depend on which features have been enabled on the pump and whether or not it is connected to the AC mains supply.

If all the pump options have been enabled, the pump displays messages to provide you with the following information about itself:

- Pump Identifier
- Drug Label
- Primary Min Rate and Max Rate
- Primary Max VTBI
- Battery gauge (displayed only if the pump is disconnected from the AC mains supply)
- · Service due date.

After switching on

When the pump has completed its self tests, it is ready for you to program, load a cassette (see page 2-18), or start an infusion. You see a screen something like this:

Switching off

For safety reasons, the front door must be properly closed and any infusion must be on Hold before you switch off the pump.

- If the pump is running an infusion, press the *Hold* key;
- if the front door of the pump is open, close it with the latch;
- then press the On/Off key.

Using the pump on battery

The pump contains an internal rechargeable battery. However, in everyday use, the pump should be connected by its cord to a suitable AC mains supply, if one is available. The battery is then kept fully charged, and will continue to be charged whilst the pump is infusing.

The pump automatically uses the battery:

- if you switch on whilst the power cord is unplugged, or
- if the AC power fails whilst the pump is operating.

Switching on using the battery

When you switch on the pump, if it is being powered by internal battery:

- you need to hold down the On/Off
 key to turn the pump on. If the pump
 is operating on the AC mains
 supply, it switches on
 instantaneously when you touch the
 On/Offkey;
- there is a short pause whilst the pump carries out the Battery Test and displays the Battery Gauge screen to indicate the current battery capacity:

++++++ LOW battery FULL Note: The battery is always tested when the pump is switched on, even though the Battery Gauge is not displayed during Dose-Rate Calculation, DRC Recovery or Rate Taper infusion start up.

Testing the battery

At any time when operating on battery, you can check the battery capacity by carrying out the Battery Test described in *Chapter 3, Options*.

Operating using the battery

During operation of the pump on battery:

- the yellow Battery indicator is lit
- the Message Display light turns off if the pump is left on Hold, unless you have set the 'Backlight on' option, described in Chapter 3, Options.

Low battery

When you switch on the pump, and during operation, the pump warns you when the battery capacity is low. If you see the yellow Battery indicator flashing whilst the pump is infusing, you should plug the power cord into the AC mains supply as soon as possible.

Low battery alarms

When approximately one hour of operation remains, the pump sounds an alarm and displays this message:

If you see this message, plug the power cord into the AC mains supply as soon as possible.

If you decide that you must continue to use the pump on battery, another alarm sounds approximately half an hour before it is fully discharged.

This message is displayed:

It is essential that the pump is plugged into the AC mains supply at this point.

Recharging the battery

To charge the battery, plug the power cord into the AC mains supply.

It takes approximately 10 hours to recharge a completely depleted battery.

Capacity

A new, fully charged battery will operate the pump for approximately 6 hours at 100 mL/h (99.9 mL/h on Micro 505).

The battery may discharge more quickly if the battery has aged and is in a poor condition even though it was recently charged.

Pump in storage

You should connect the pump to the AC mains supply to charge the battery every three months, even when the pump is not in service. This helps to maintain the life of the battery.

WARNING: Correct management of battery charging, as described in this documentation is essential to ensure that the pump can operate on battery for the time specified. Failure to do so may result in compromised function of the product or patient injury.

Sounds on the Volumetric

The Volumetric pump makes a 'click' sound as you press each key. It also sounds an audio alarm to alert you to a condition that requires attention on the pump: either an insistent (three-tone) or non-insistent (two-tone) alarm. The click and non-insistent alarm do not

sound if the pump is switched on in Quiet Pump mode. See next page. As a further safety feature, the Volumetric emits a high-pitched system alarm to indicate a problem requiring the attention of a Graseby Medical qualified technician.

Audio alarm

When the Volumetric pump requires attention, it uses an audio alarm to indicate that there is a problem.

Whilst sounding the alarm, it also displays a message to explain the problem. A full list of all the alarm messages, their possible causes and how to solve the problem is explained in *Chapter 4, Troubleshooting*.

This section explains the different types of alarm sounds made by the pump.

You may hear three types of alarm from the Volumetric:

- insistent
- non-insistent
- continuous (backup alarm).

Insistent alarm

This type of alarm indicates that fluid delivery has stopped, or cannot be started. It alerts you to a condition that must be corrected before the infusion can be started, or continued, for example if an occlusion is detected.

The insistent audio alarm consists of three tones: two high-pitched and one low-pitched, repeated at two-second intervals. To silence an insistent alarm, press the *Silence* or *Hold* key. The alarm will recur unless you correct the problem as described in *Chapter 4, Troubleshooting*. This chapter describes each alarm, its cause and action to take.

Non-insistent alarm

This type of alarm alerts you to a condition that needs attention, but has not caused the infusion to stop. For example, you hear a non-insistent alarm if the pump is running on batteries and the batteries are low, or if the infusion has switched to a KVO

The non-insistent audio alarm consists of two tones, one high-pitched and one low-pitched, repeated at two-second intervals. To silence this type of alarm:

- press the Silence or Run key to silence the alarm without stopping fluid delivery;
- press the *Hold* key to silence the alarm and stop fluid delivery.

Note: In Quiet Pump mode, there is no audio alert for certain non-insistent alarms. See the next page for more details.

Continuous - backup alarm

In addition to the insistent and noninsistent operational alarms, the Volumetric pump has a fail-safe backup alarm system. This has a distinctive high-pitched tone:

 should the audio alarm system fail, then the pump sounds the backup alarm, with a 1.5 second pause between alarm tones; should an electromechanical system failure occur, the pump sounds the backup alarm continuously.

If you hear the backup alarm sounding, you should immediately remove the pump from the patient and have it repaired by a Graseby Medical qualified technician.

Quiet Pump mode

In some circumstances, it may be desirable to operate the Volumetric without the associated sounds.

For safety reasons, you cannot turn off the insistent or continuous alarms, but if necessary you can operate the pump without the key-press 'click' sound and certain non-insistent alarms. This is called a 'Quiet Pump' infusion.

To run a 'Quiet Pump' infusion:

- 1. Ensure that the pump is turned off.
- Press Silence and keep it held down.
- 3. Turn on the pump with *On/Off.*The keypad click and non-insistent alarm sound is now off. The pump remains in Quiet Pump mode until you switch off and then on again.

Silent alarms in Quiet Pump mode

When running the pump in Quiet Pump mode, certain alarms associated with a Secondary infusion are silent. The alarm is silent in the following circumstances:

- when the pump automatically switches from Secondary to Primary when the Secondary infusion is complete;
- when you program the Secondary infusion, but press the *Primary* key then the *Run* key without running the Secondary infusion;
- when you press Run to start the Secondary infusion with the Volume to be Infused set to zero.

Alarms and computer control

If a pump is being run under computer control, you can silence it from the computer. However, you must resolve the problem causing the alarm on the pump.

WARNING: If a backup alarm sounds, the pump should be immediately removed from the patient and sent to be repaired by a Graseby Medical qualified technician. Failure to do so may cause patient injury or death.

Setting up a Primary Infusion

To set up and run a Primary infusion the main steps are:

- attach the pump to the IV pole, described on page 2-5;
- set the Options for the infusion if appropriate, particularly Rate or VTBI Limits if they are enabled as described on page 2-15;
- prepare the solution;
- · prime the administration set;
- load the administration set into the pump;
- · program the infusion;
- start the infusion.

Prepare the solution

Using an aseptic technique, prepare the solution container and prime the administration set following the instructions provided with the set. As a guide:

- Remove the solution container from its packaging and remove the cap from the fluid outlet.
- Remove the administration set from its packaging and close the roller clamp.
- Remove the cap from the spike on the administration set and insert the spike into the fluid outlet on the solution container.
- 4. Hang the container with the administration set on the IV pole and ensure that the container is the correct height above the pump.

WARNING: Correct entry of data is essential in order to ensure that the intended infusion is performed. Before confirming any displayed data when setting up an infusion, you should ensure that it is correct. Failure to do so may result in compromised function of the product, patient injury or user injury.

Height of solution container above the pump

If necessary, adjust the height of the pole so that the bottom of the solution container is between 15 cm and 30 cm (between 6 inches and 12 inches) above the top of the pump

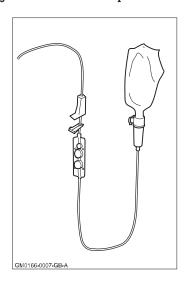
On Model 500, 30 cm (12 inches) may be required for rates over 500 mL/h.

On both Model 500 and Micro 505, 30 cm (12 inches) may be required when using thick solutions and/or 60 drops/mL sets.

Note: A thick solution in this case may be certain cytotoxic agents, lipid-based fluids and other viscous solutions, for example Total Parenteral Nutrition.

Prime the administration set - Example

You must always follow the *Instructions* for *Use* that accompany the administration set to be primed. This section shows an example to explain the basic priming steps to be carried out on an administration set without a bi-directional check valve, filter, injection site or c-clamp.



- Squeeze the drip chamber and fill until it is at least one third full. The drip chamber may fill completely during loading and/or an infusion. This will not adversely affect the fluid delivery or the operation of the pump.
- 2. Hold the cassette inverted, so that the roller clamp is above the cassette, as shown here.
- Slowly open the roller clamp to allow the solution to flow through and prime the cassette and the line. You can control the flow by moving the roller clamp as necessary.
- 4. When the entire set is primed, close the roller clamp.

With the solution container hanging on the IV pole and the administration set spike inserted into the container, prime the administration set as follows:

WARNING: Remove any air to prevent air embolism. The presence of air within the infusion can result in complications resulting in patient injury or death.

WARNING: Use only Graseby Medical administration sets with this product. Failure to do so may result in compromised system accuracy leading to complications resulting in patient injury or death.

WARNING: To avoid over infusion, do not prime the infusion line when the administration set is connected to the patient. Over infusion can result in patient injury or death.

Load the cassette into the pump

With the administration set primed and the solution container hanging on the IV pole, you can load the cassette into the pump as follows:



The safety clip on the administration set is marked with arrows to indicate the correct direction for insertion.

The pump is marked with a diagram showing the position of the safety clip slot.

- 1. Open the door of the pump by raising the latch.
- With the flat side of the cassette towards you, and the roller clamp below the cassette, match the four holes in the corners of the cassette with the four metal pins inside the pump.
- Press the cassette into place and run your finger down the cassette to ensure that it is flat and correctly fitted.
- Slide the safety clip up to the base of the cassette and push it fully inward, into its slot.
- 5. Close the door, pushing the latch into place.

Setting the Occlusion Alarm

When you switch the pump on, the Occlusion Alarm setting is always the same, and is defined by the Technician Menu configuration setting.

Before an infusion, always check, and if necessary, change the setting to suit the infusion by pressing the *Occlusion Alarm Setting* key. Continue pressing the key until you see the setting you want. Never use a *Low* setting with high infusion rates.

For full details, see *Change the Occlusion Alarm setting*, on page 2-24.

See the *Specification* section at the end of this manual for details on the pressure values for High, Medium and Low settings.

WARNING: The Occlusion alarm level must be checked before starting an infusion to ensure that it is appropriate for the infusion. Failure to do so may result in an unacceptably slow time to Occlusion alarm, resulting in patient injury or death.

Primary infusion setup

Once the solution is ready and the cassette is loaded into place in the pump, check that the Primary indicator is lit. If not, press the *Primary* key.

Max Rate 750 Press * when set



0mL 00h 00m Press * to clear



MEDIUM Occlusion Alarm Settin9



46.5



500.a



1.4 mL this infusion



WARNING: The Occlusion alarm level must be checked before starting an infusion to ensure that it is appropriate for the infusion. Failure to do so may result in an unacceptably slow time to Occlusion alarm, resulting in patient injury or death.

- If Min and Max Rates and Max VTBI are enabled on the pump, ensure they are appropriate for the infusion by pressing the *Options* key. To find out more see page 2-15.
- If the infusion is for a new patient, or if you need to clear the totals for this patient, press *Total Volume* then press *.
- 3. Press the *Occlusion Alarm Setting* key to display the current setting and continue pressing if necessary to set an appropriate level.
- Press the *Rate* key then use the keypad to enter the infusion rate in mL/h.
- Press the *Volume to be Infused* key then use the keypad to enter the volume in mL.

Ensure that the Rate and Volume to be infused are correct for this Primary infusion then open the roller clamp. Inspect the fluid path for kinks, a closed clamp, or any other upstream obstructions.

6. Press the *Run* key to start the infusion.

WARNING: Prior to starting an infusion, inspect the fluid path for kinks, a closed clamp or other obstructions. Failure to do so may result in the infusion not being delivered correctly, resulting in patient injury or death.

During the infusion

This section explains the main activities you may want to carry out once you have started the infusion.

When the infusion is running, you can:

- see the progress of the infusion from the information shown on the different displays on the pump;
- change the infusion rate;
- lock the keypad to provide security on the pump;

- display the drug label (if this feature is enabled);
- stop the infusion.

If you press *Hold* to stop the infusion, you can:

- change the occlusion alarm setting (see page 2-24);
- set up and start a Secondary infusion (see page 2-26).

If the infusion will not start running

This will only occur if you have one or more of the following features enabled on the Technician menu:

- · Min and Max Rate;
- · Max VTBI.

If you have entered a rate which is outside the set limits, or a VTBI which is greater than the maximum, when you press *Run* you see the message:

Preset Limits Exceeded

and an alarm sounds. The Rate or VTBI display also changes to the one used before you programmed the infusion.

If this happens, you should:

- 1. Silence the alarm.
- Check the Rate or VTBI display to see which has changed to find out which limit has been exceeded.

- 3. Check the prescription.
- Check the Min and Max Rate and Max VTBI settings by pressing the Options key until each is displayed.
- 5. Make corrections as necessary.
- 6. Press *Run* to start the infusion.

Infusion information displays

Message Display

The Message Display starts at zero and counts up in mL to show the volume infused so far, for example:

Rate display and Pumping indicator

The Rate display shows the infusion rate. The Pumping indicator is a horizontal line located at left of the Rate display.



The indicator moves to show that the solution is being infused. The speed of

the Pumping indicator is approximately proportional to the infusion rate.

Volume to be Infused display

The Volume to be Infused display initially shows the programmed volume. During the infusion, it counts down to show the volume remaining for this infusion.



Original volume to be infused

To find out the original programmed Volume to be Infused, add the amount in the Volume to be Infused display to the amount in the Message Display.

Running Rate Change (Rate titration)

Whilst the pump is running, you can change the infusion rate. For example, you may need to adjust the initial rate once the infusion is established.

You can also stop the infusion and then change the rate, but the ability to change without stopping the delivery of the solution is especially important with some drugs, for example, vasoactive drugs.

You can carry out a running rate change on Primary or Secondary infusions.

Once the infusion has started, to enter a running rate change:

- 1. Press Rate.
- 2. Enter the new rate using the numeric keypad.
- 3. Press Run within 10 seconds.

If you do not complete the rate change within 10 seconds, an alarm sounds and the rate reverts to the previous running rate, followed by a message to tell you the change has not been completed.

If rate limits are enabled, and you enter a rate that is outside those set, an alarm sounds and you see:

The pump continues at the previous rate. Silence the alarm and check the current settings using the *Options* key. If you need to change the rate limit, you must first put the pump on hold.

Security on the pump

To prevent any tampering with the keypad during the infusion, there are two ways to secure the keypad:

- · manual locking
- · automatic locking.

Manual keypad locking

This safety feature is always available on the pump, whether or not the automatic keypad locking feature is enabled.

To lock the keypad during an infusion, press the grey Keypad lock button on the rear of the pump. The Message Display confirms that the keypad is locked:

If you touch any of the keys on the keypad once it is locked, the pump redisplays the message.

Safety keypad lockout

The saftey keypad lockout is only active when operating the pump on AC power. It allows the user to 'lockout' the keypad, so that after setting up the pump for use, it is ready for infusion at a later time.

To set the saftey keypad lockout, switch the pump off and connect to an AC power supply. Then press the keypad lock button once. If you now attempt to switch the pump on, the keypad is locked out and the pump inactive. The pump can only be switched on by:

- pressing the keypad lock once and then switching the pump on using the On/Off key
- or by opening the door.

If the AC power supply is removed during the 'lockout', the feature is abandoned, pressing the On/Off key switches the pump on. If the AC power is removed and reconnected without any user interface with the pump, the lockout remains active. When the pump is used on battery power this feature is inactive.

Automatic keypad locking

Before starting the infusion, you can enable the Autolock Keypad feature in the Technician Menu.

With Autolock Keypad enabled, the keypad locks automatically if you leave the pump untouched for one minute.

If you touch a key, the Message Display reminds you that the keypad has been locked:

Unlocking the keypad

To unlock the keypad once it is locked, press the grey Keypad lock button on the rear of the pump:

- for a manually locked keypad, press the button once;
- for an automatically locked keypad, press the button twice.

To silence alarm with keypad locked

If the pump is sounding an alarm whilst the keypad is locked, you must:

- first unlock the keypad with the button on the rear of the pump,
- then press the *Silence* key.

Display the Drug Label

The pump may be configured, in the Technician Menu, to display the Drug List.

If the Drug List is enabled, you can display the Drug Label that was last selected using the *Options* key.

To display the Drug label on the Message Display for two seconds:

press the * key.

For more information on Drug Labels, see *Chapter 3, Options*.

Stop the infusion

To stop the infusion at any time:

· press the Hold key.

If an occlusion is detected

If an occlusion is detected, the *Run* light remains lit, but the Pumping indicator stops. The pump does not give an occlusion alarm immediately, but only alarms if the occlusion pressure continues to exceed the occlusion threshold for 10 seconds. This helps to avoid nuisance occlusions.

However, the pump monitors any temporary occlusions, and if such occlusions persist, then the occlusion alarm is generated.

If an occlusion is detected when the occlusion alarm is set to Low, the pump alarms immediately.

If an occlusion alarm occurs

If an occlusion alarm occurs, immediately clamp the line to the patient. Then inspect the fluid pathway to determine what has caused the obstruction.

Change the Occlusion alarm setting

You can check the current occlusion alarm setting when an infusion is running if you press the *Occlusion Alarm Setting* key. You can change the setting if you first put the infusion on *Hold*, see steps in opposite column.

When you switch the pump on, the Occlusion Alarm setting is always the same, and is defined by the Technician Menu configuration setting. You should set the alarm to be appropriate for the infusion before pressing *Run*.

The occlusion alarm setting determines the amount of back pressure allowed before the pump alarms. There are three possible settings: Low, Medium or High.

When an occlusion alarm occurs, the pumping mechanism backs off to reduce down-line pressure and bolus potential (bolus potential is approximately 0.3 mL regardless of the rate and the administration set used).

Whilst the pump is infusing, particularly at higher infusion rates, or with thick solutions (see Note opposite), or with small diameter cannulas, you may see the following alarm message:

Occlusion below pump

WARNING: If using a blood pressure cuff above the patient's venipuncture site take extra care in setting the Occlusion alarm pressures. Failure to do so may result in unnecessary Occlusion alarms, resulting in patient injury or death.

If there is no obvious reason for the alarm, the message may occur because you have not selected an appropriate Occlusion Alarm Setting for the infusion. If this is the case, you may want to change the Occlusion Alarm Setting.

To change the Occlusion Alarm Setting during an infusion, whether or not an alarm has occurred:

- Press Hold to silence the alarm if necessary, and stop the infusion.
- Press the Occlusion Alarm Setting key once to display the current setting.
- Press the Occlusion Alarm Setting key repeatedly to display the available settings.
- 4. When the correct setting is displayed, press *Run*.

Note: A thick solution may be certain cytotoxic agents, lipid-based fluids and other viscous solutions, for example Total Parenteral Nutrition.

Approximate Occlusion alarm settings

Low 2 psi, 103 mmHg, 13.5 kPa Medium 5 psi, 259 mmHg, 34.5 kPa High 10 psi, 517 mmHg, 68.9 kPa

WARNING: The Occlusion detection system measures downline back pressure in the administration set, but does not detect infiltration. In accordance with local protocol, you must periodically inspect the patient's infusion site for signs of infiltration. Failure to do so may result in an unacceptably slow time to Occlusion resulting in patient injury or death.

Ending the Primary infusion

The pump warns you that the infusion is complete when the Primary Volume to be Infused reaches zero.

At this moment, the pump sounds a two-tone alarm. You can decide to:

- silence the alarm and stop the infusion - press the *Hold* key
- silence the alarm and continue to infuse at the KVO Rate - press the Silence key (see details below).

KVO infusion

If you press *Silence* to stop the alarm, the pump continues to infuse at the KVO (Keep Vein Open) rate. The KVO rate is shown on the Rate display.

Depending on how the pump is configured, the KVO rate may be:

- the default KVO rate of 3.0 mL/h,
- the programmed infusion rate if that was less than 3.0 mL/h;
- the KVO rate specified for this pump, see Specifying a different KVO Rate, below.

The Message Display shows "KVO", as well as the combined Primary and KVO volume infused, for example:

The pump continues to infuse at the KVO rate. After six minutes, the two tone alarm sounds again, as a reminder that the KVO infusion is still running. You can decide to:

- silence the alarm and stop the infusion - press the *Hold* key
- silence the alarm and continue to infuse at the KVO Rate - press the Silence key.

Specifying a different KVO rate

If the 'KVO Rate Entry' option has been enabled in the Technician Menu, you can use the *Options* key to specify a KVO rate, before you start the infusion.

When you set the KVO rate you can go to a maximum of 10 mL/h (on a 500 pump) or 3mL/h (on a 505 pump) or the Max Primary Rate if one is also enabled and set below these limits.

If the programmed infusion rate is less than the set KVO rate, when the pump goes into KVO, it will continue pumping at the programmed lower rate.

For full details on how to set the KVO rate, see *Chapter 3, Options*.