

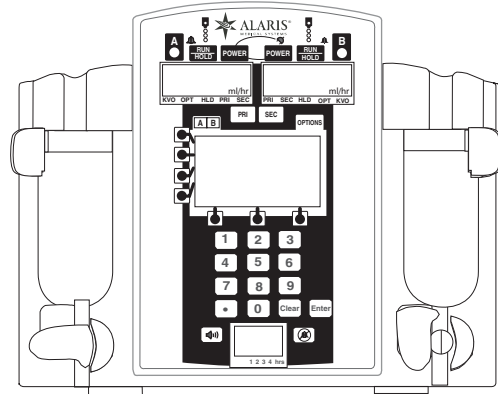
# Signature Edition®

## VOLUMETRIC INFUSION PUMPS

Model 7100 and 7200 (Adjustable Pressure capability)

Models 7130 and 7230

Models 7132 and 7232 (MIB capability)



*DIRECTIONS FOR USE*



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## About the Instruments

The Signature Edition® Infusion System includes Model 71XX and Model 72XX Volumetric Infusion Pumps, Model 71XX and Model 72XX Volumetric Infusion Pumps with MIB Capability, Model 71XX and Model 72XX Volumetric Infusion Pumps with Adjustable Pressure Capability, and AccuSlide® Flow Regulator administration sets.

- The single channel (Model 71XX) provides a full range of features in a small, easy-to-use, linear peristaltic pump.
- The dual channel (Model 72XX) offers the same features while providing two, independent infusion pumps in one instrument.

ALARIS Medical Systems® Infusion Pumps are intended for use in today's growing professional healthcare environment, including healthcare facilities, home care and medical transport that utilize infusion pumps for the delivery of fluids, medications, blood and blood products.

The ALARIS Medical Systems® Infusion Pumps covered in this document are indicated for continuous or intermittent delivery through clinically acceptable routes of administration; such as, intravenous (IV), intra-arterial (IA), subcutaneous, epidural, enteral and irrigation of fluid spaces.

The Signature Edition® Infusion System uses a wide variety of AccuSlide® Flow Regulator administration sets. The ALARIS®/IVAC® 72 Series sets are designed for use with the instruments as well as for gravity-flow, stand-alone use. The unique, patented AccuSlide® Flow Regulator has an integral flow control device that minimizes accidental free-flow when the set is removed from the instrument and provides accurate rate control during gravity administration.


The Signature Edition® Infusion System incorporates the **Dynamic Monitoring®** System, a versatile Intravenous Site Monitoring System for detection of both full and partial occlusions of the fluid pathway. This system includes both precision pressure sensing and continuously computed Flow Resistance. Flow Resistance measurement dramatically improves the clinician's ability to detect partial and full occlusions, particularly at low flow rates. Both Pressure and Flow Resistance monitoring modes feature numeric and bar graph displays of current values plus easily selectable trend graphs displaying up to twelve hours of monitored values. The **Pressure Mode** provides 1 mmHg display resolution, either manual or auto baseline setting, and a user adjustable alarm limit. The

## About the Instruments (Continued)

**Resistance Mode** provides two ranges and user alert limit adjustment to meet needs from neonatal to adult patients. Pressure mode and resistance monitoring modes (excluding High Resistance Monitoring mode) include **AutoRestartPlus** operation, to automatically continue the infusion if an occlusion is resolved during a 40 second self-check time. Many monitoring features and functions are configurable by qualified personnel to allow customization to meet specific needs.

The instruments are equipped with a **unique battery display** that provides the clinician continuous monitoring of battery time available, indicated in 15 minute increments. This information is displayed whether the instrument is turned on or not.

A **dual rate feature** allows the instruments to administer both primary and secondary solutions at separate flow rates and volumes. Using this feature, the clinician can select and start a program for secondary (piggyback) medication. Upon completion of the secondary dose, the instruments will automatically switch over to a primary rate. Both channels of the dual channel instrument can be programmed for primary and secondary operation.

The **panel lock feature** helps prevent tampering. A panel lock symbol (  ) is shown in the lower display when the panel lock is on, and no changes can be made from the front panel. The panel lock key is readily accessible, yet not obvious to unauthorized users.

**Optional modes** are easily accessed with the press of one key.

The **Drug-Specific Dose Rate Calculator** allows the clinician to select a drug name and calculate a volumetric or dose rate for continuous infusion. Once calculated, the instruments will display the drug name on the screen. A generic calculator is also provided for drug names not on the drug list.

The **Multi-Step program** allows a sequential program to deliver up to nine steps. Fluid volumes and delivery rates may be programmed for each step. The program may be entered based on Rate and Volume, or Volume and Time.


The **Multi-Dose program** allows the clinician to preprogram multiple infusions over a period of up to 24 hours. The fluid volume and delivery rate is repeated for each delivery. A delayed start feature may be programmed.

The **Loading Dose feature** allows the clinician to set up an initial infusion rate for a specific volume, automatically followed by a maintenance rate from the same container.

## About the Instruments (Continued)

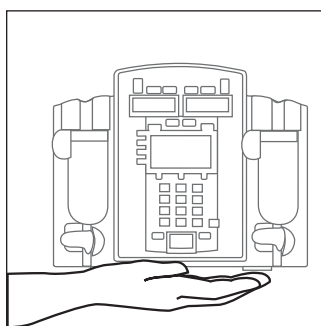
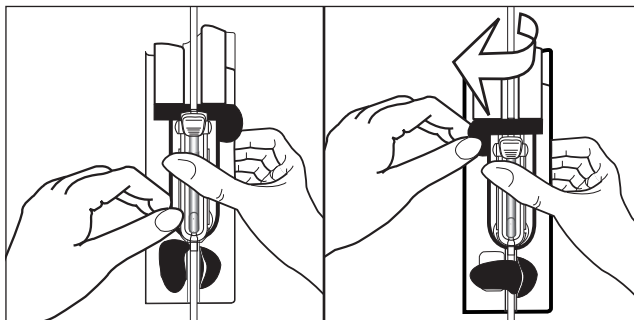
The optional **flow sensor kit** allows the clinician to be notified of empty fluid container(s) and/or if upstream occlusions are present.

The Model 7132 and Model 7232 instruments replace the RS-232 communications interface with the IEEE 1073 (Medical Information Bus, or MIB) communications interface.

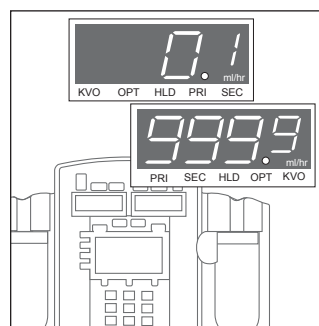
Qualified service personnel can configure many features of the instrument to meet specialized needs. The  symbol is used throughout this document to indicate the programmable features. See the *Specifications* section of this document for a list of the programmable features and the default settings. Refer to the Technical Service Manual for the procedure to set selected configuration parameters.

## Features

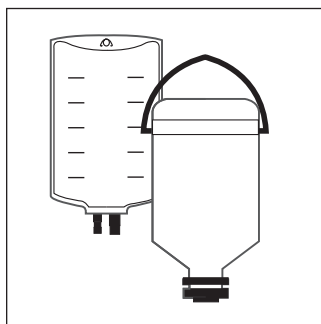
Simple two-step loading.



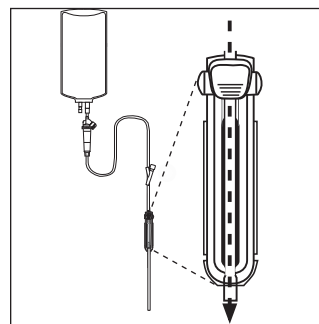
Lightweight and portable.



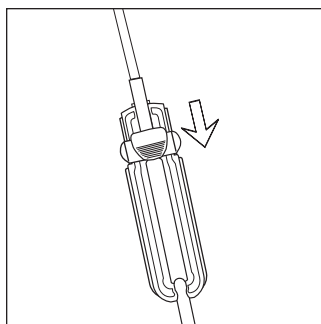
Rates from 0.1 to 999.9 ml/hr.



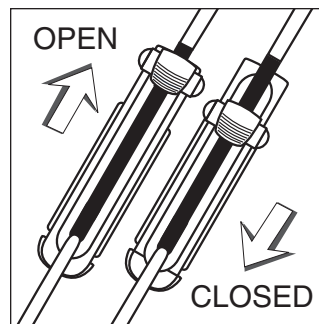
Delivery from multiple containers.



Easy gravity prime set for hospital-wide standardization.



Set-based anti-free-flow protection.



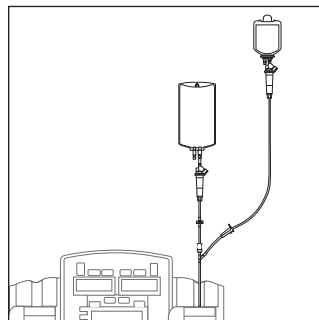
AccuSlide® Flow Regulator.



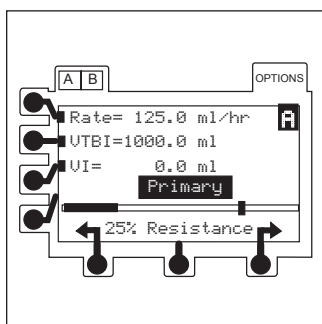
## Features (Continued)



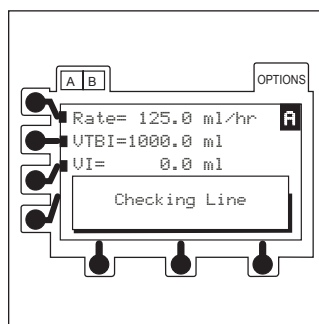
Automatic Keep-Vein-Open (KVO) mode.



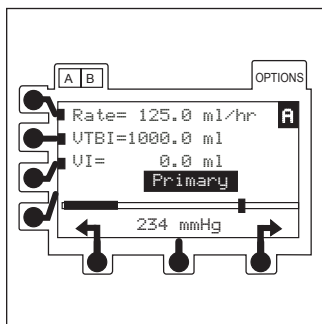
Dual rate for secondary delivery.



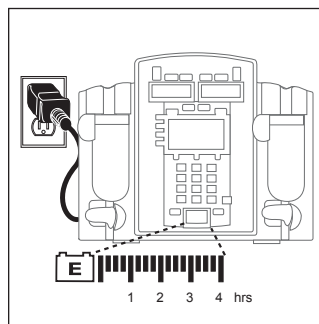
Dynamic Monitoring<sup>®</sup> System Resistance Mode.



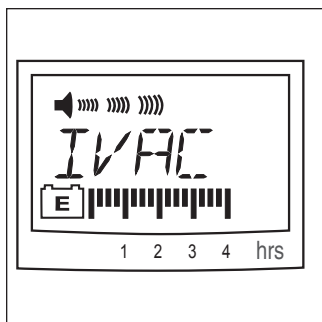
AutoRestartPlus operation.



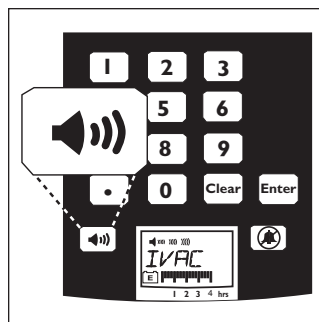
Dynamic Monitoring<sup>®</sup> System Adjustable Pressure Mode.



Automatic quick recharge of battery; 4 hours to 95% charge.



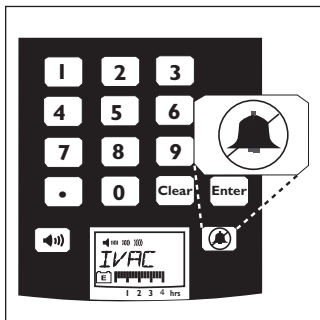
Battery status is continuously displayed in 15 minute increments.



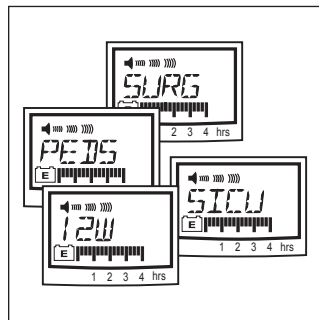
Adjustable audio volume.



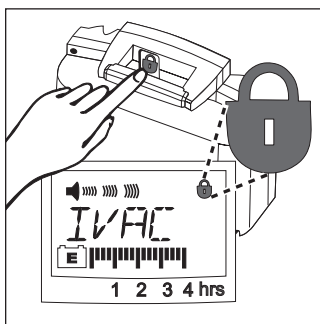
Features (Continued)



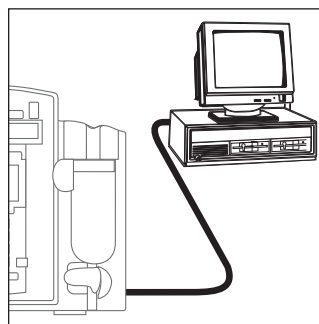
Temporary alarm and alert silence key.



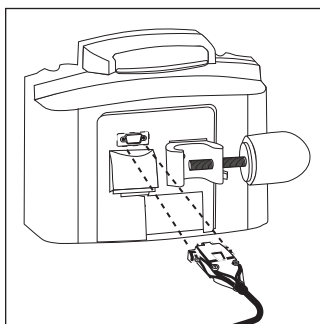
Customizable instrument ID label.



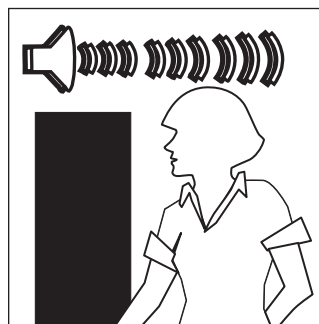
Panel lock helps prevent unauthorized changes.



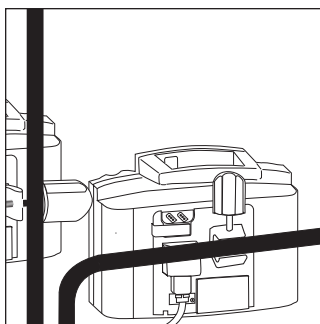
Computer monitoring capability.



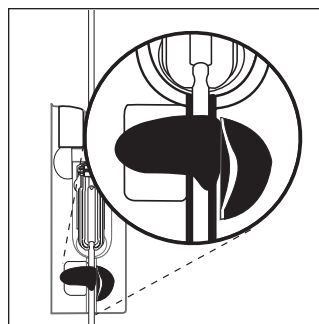
Learn/Teach configurations through external RS-232 communications connection.



Optional remote nurse call.



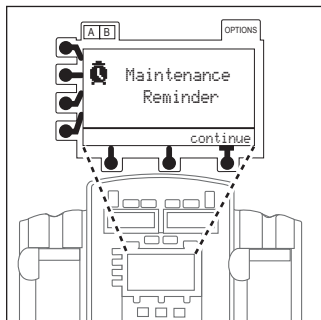
Rotating pole clamp.



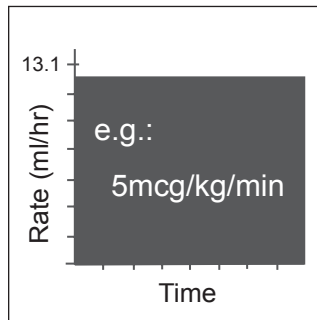
Configurable air-in-line detector.



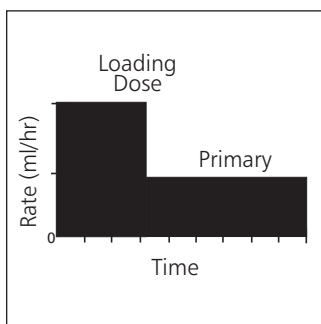
## Features (Continued)



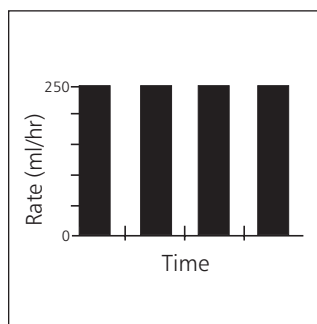
Periodic maintenance reminder.



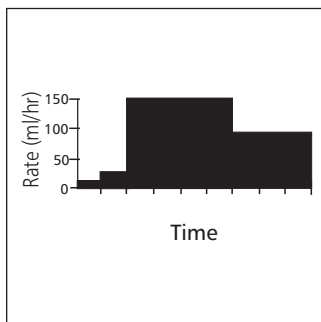
Dose Rate Calculator.



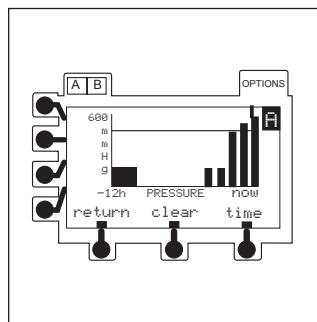
Loading Dose program.



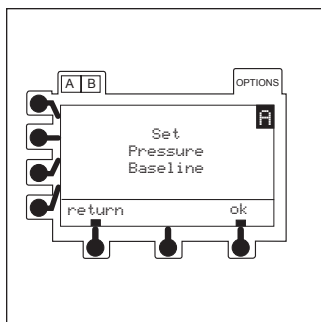
Multi-Dose programming.



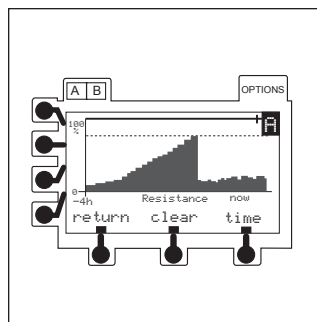
Multi-Step programming.



Dynamic Monitoring<sup>®</sup> System pressure trend graph.



Dynamic Monitoring<sup>®</sup> System manual pressure baseline.

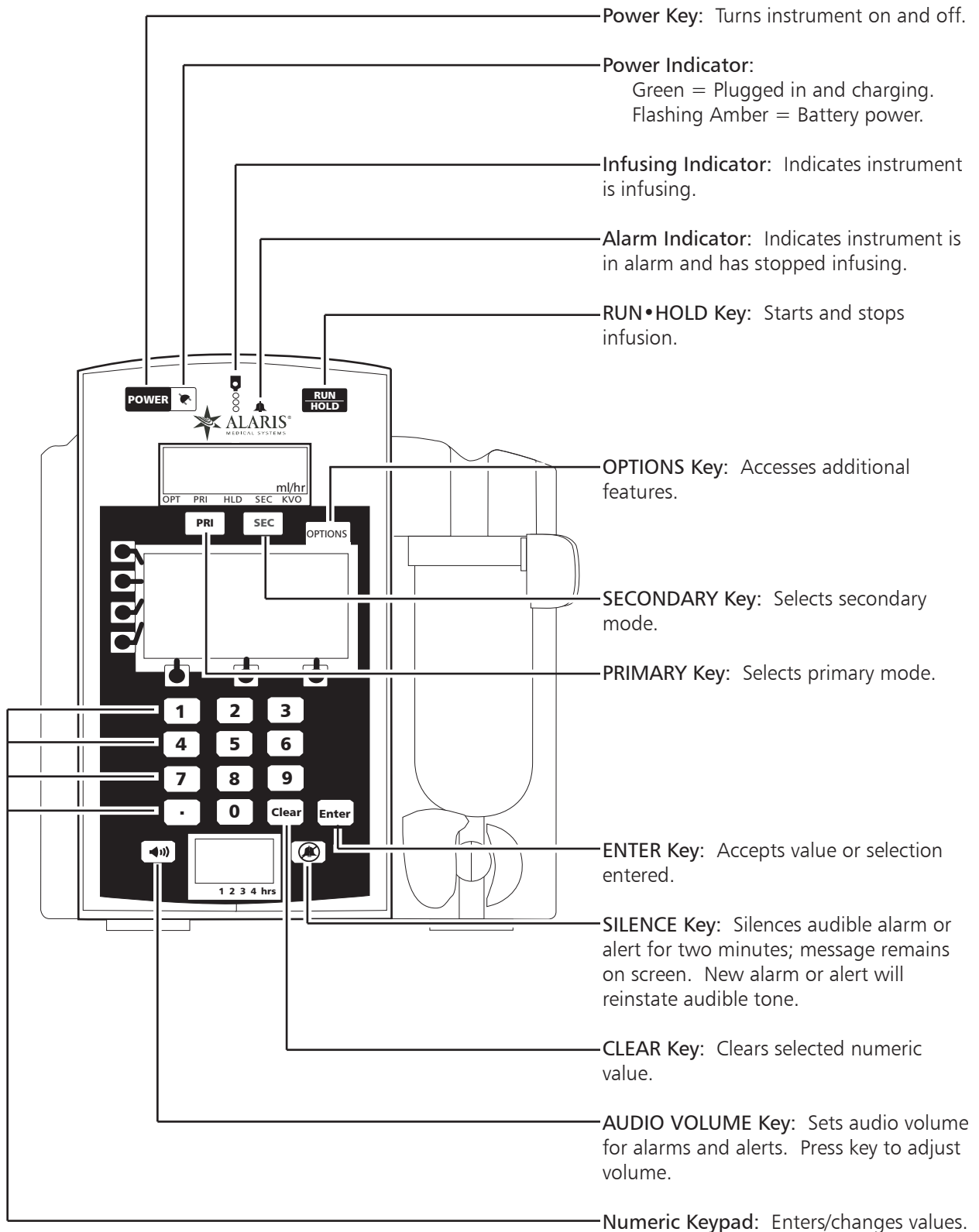


Dynamic Monitoring<sup>®</sup> System resistance trend graph.



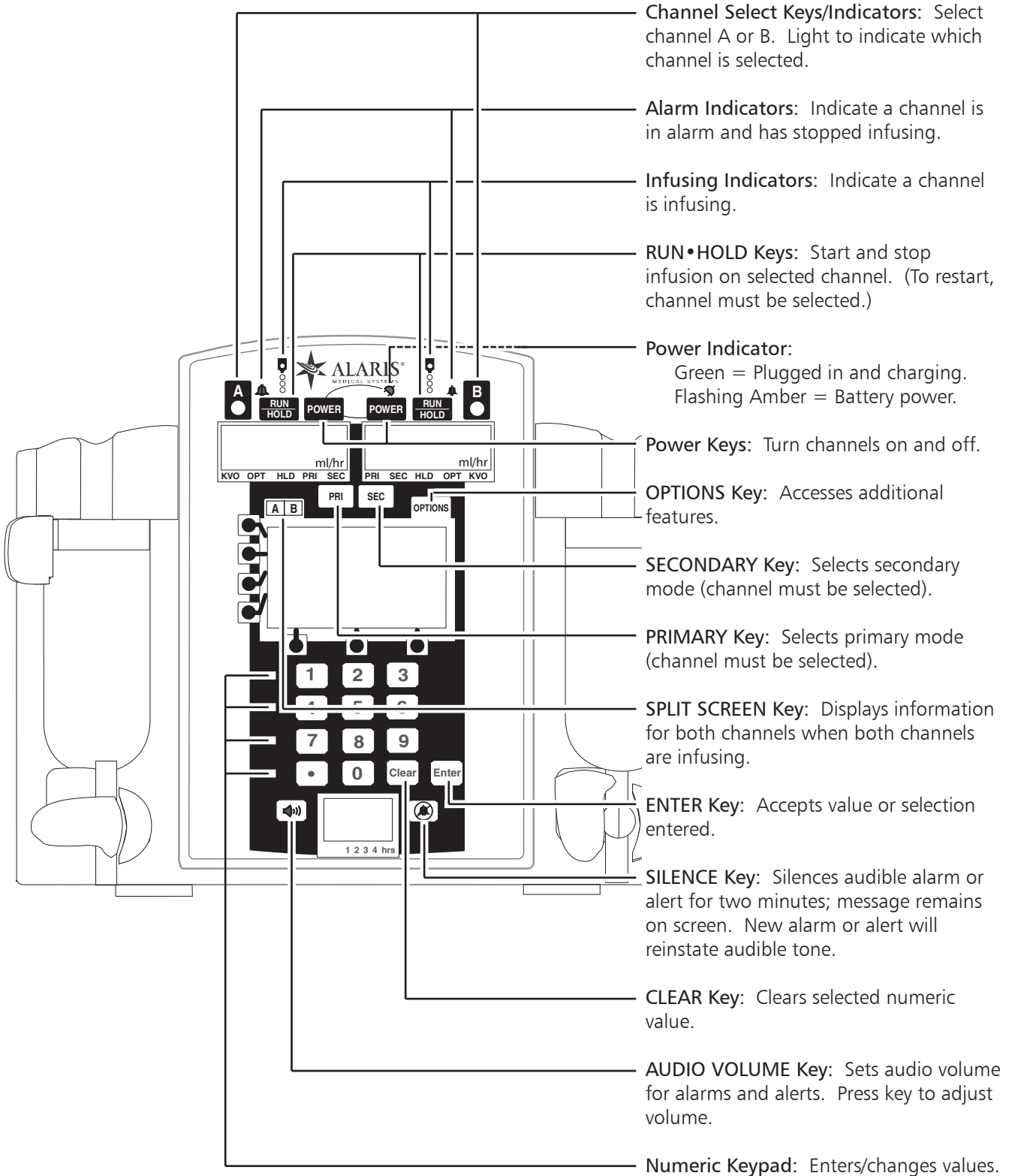
# Controls and Indicators

## Model 71XX



## Controls and Indicators (Continued)

### Model 72XX



## Displays

### Main Display

The Main Display is backlit for easy viewing. The backlight dims when operating on battery power as an energy-saving feature. Pressing any key automatically turns the backlight up again.

#### CAUTION

Appearance of lines and/or dots that remain on constantly when the device is powered on may indicate improper functioning of the Main Display. Although the instrument is functioning properly, return the instrument to qualified service personnel.

#### Channel Indicator *(dual channel only)*

Indicates which channel is currently selected.

#### Highlight

Indicates value is selected. Values must be highlighted to be changed.

#### Soft Keys

The keys on the side and bottom of the Main Display serve a variety of functions. What each key does is indicated by the text in the display at the time.

##### "Active" Soft Keys

Indicated by a "TICK" (■) mark next to the key.

1. Press an active key to highlight desired area in display.
2. Enter a value using numeric keypad.
3. Press **ENTER** to accept value highlighted.

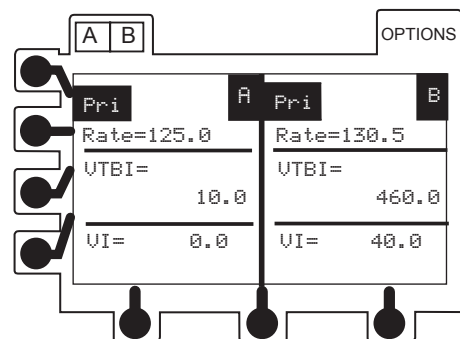
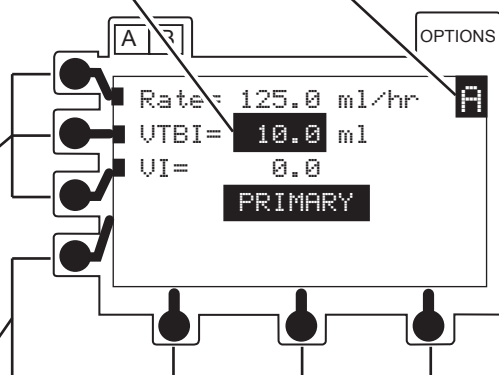
##### "Inactive" Soft Keys

Indicated by having no "TICK" marks at the left and bottom edges of the display.

#### Split Screen *(dual channel only)*

When both channels are infusing, the split screen showing programmed information is displayed after one minute.

Pressing **A|B** shows the split screen immediately.



## Displays (Continued)

### Rate Display(s)

The LED rate display is easily viewed from a distance.

#### Rate Display(s)

Indicates current infusion rate(s) in ml/hr. Flashes to indicate hold or alarm condition.



#### Model 71XX Status Bar

Indicates which mode the instrument is in: *Options, Primary, Hold, Secondary, or KVO.*

#### Model 72XX Status Bars

Indicate which mode each channel is in: *KVO, Options, Hold, Primary, or Secondary.*



### Lower Display

The lower LCD display is backlit for easy viewing. The display dims when operating on battery power, as an energy-saving feature.

#### Panel Lock Indicator

Displayed if panel lock is on.

#### Audio Volume Indicator

Indicates audio volume for alarms and alerts.

#### Computer Mode Indicator

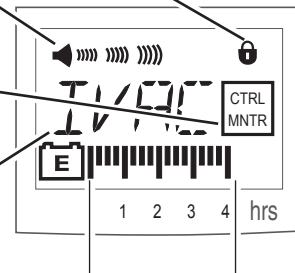
Displayed if instrument is in computer monitor mode.

#### Instrument ID Label

Characters are entered by qualified service personnel to identify configuration, "ownership", location, etc.

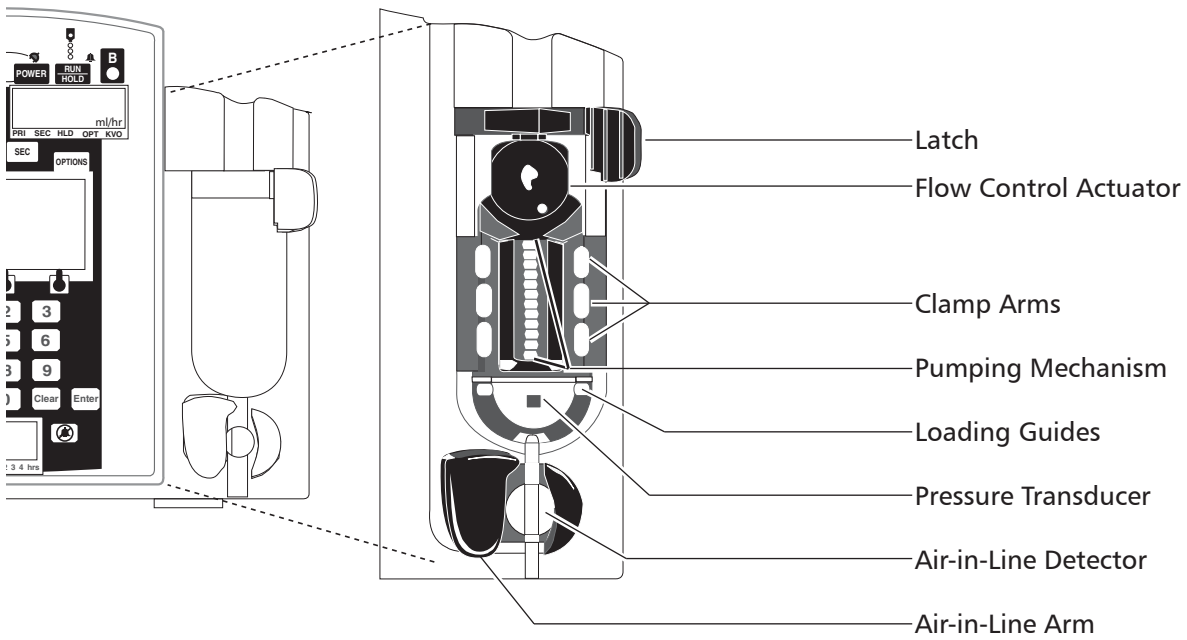
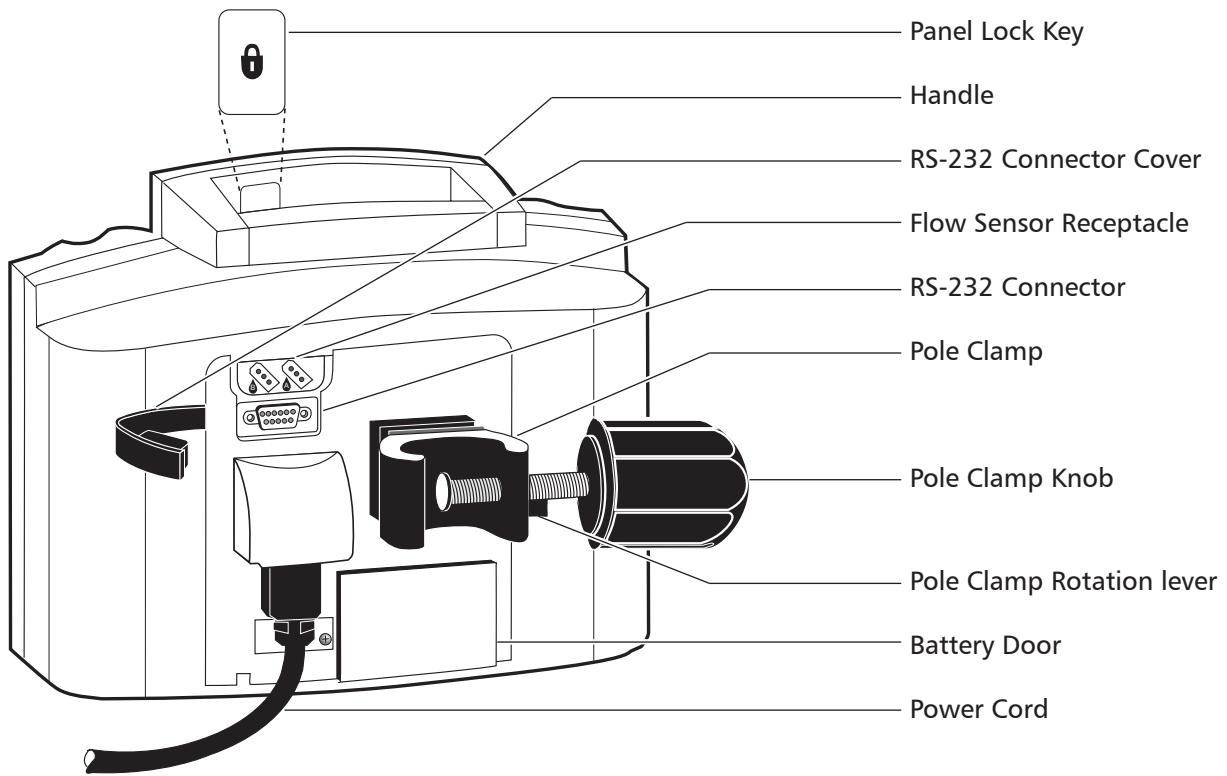
#### Battery Power Gauge

Indicates battery time remaining in 15 minute increments.



**NOTE:** The instrument label and battery gauge are always displayed even when the instrument is turned off.

## Around the Instruments





## Terms and Symbols



Alarm indicator.



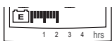
Attention: Refer to accompanying documentation.



Audio volume.



Battery fully charged.



Battery time remaining.



Consult operating instructions.



Explosion risk if used in presence of flammable anesthetics.



Flow sensor receptacle, channel A.



Flow sensor receptacle, channel B.



Infusing indicator.



Manufacturing Date: Number adjacent to symbol indicates month and year of manufacture.



Nurse Call



Panel lock.



Green = plugged in  
Flashing amber = battery power

PRI

Primary



Programmable feature.



RS-232 connector.

SEC

Secondary



Silence



Split screen (*dual channel instrument only*).

Transition Tone

A brief tone during transition from one mode to another.



Canadian Certification Mark: Products bearing this mark have been tested and certified in accordance with applicable Canadian electrical safety and performance standards (CSA C22.2 No. 125).



U.S. Certification Mark: Products bearing this mark have been tested and certified in accordance with applicable U.S. electrical safety and performance standards (UL 544).

VI

Volume infused.

VTBI

Volume to be infused.

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## Operational Precautions

### CAUTION

Federal (U.S.A.) law restricts this device to sale by or on the order of a physician.

### CAUTION

Prior to use, ALARIS Medical Systems recommends that users become familiar with the instrument, the administration sets and any accessories that may be used.

### WARNING

This instrument is designed to stop fluid flow under alarm conditions. Periodic patient monitoring must be performed to ensure the infusion is proceeding as expected. This instrument is a positive pressure delivery system capable of developing positive fluid pressures to overcome widely varying resistances to flow encountered in practice, including resistances to flow imposed by small gauge catheters, filters and intra-arterial infusions. It is neither designed nor intended to detect infiltrations and will not alarm under infiltration conditions.

### WARNING

Hospital personnel must ensure the compatibility of the drugs, as well as the performance of each instrument, as part of the overall infusion. Potential hazards include drug interactions, inaccurate delivery rates, inaccurate pressure alarms and nuisance alarms.

### WARNING

The use of positive displacement infusion devices ported together with gravity flow infusion systems into a common IV site may impede the flow of common "gravity only" systems, affecting their performance (hospital personnel must ensure the performance of the common IV site is satisfactory under these circumstances).

### WARNING

Each time the instrument is turned on, verify and/or set the monitoring mode, resistance alert and/or pressure alarm limit. If the monitoring mode, resistance alert and/or pressure alarm limit are not verified, the instrument may not be operating with the desired occlusion detection parameter(s).

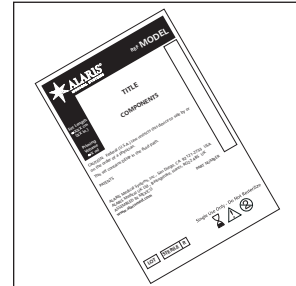
## Operational Precautions (Continued)

### Patient Precautions

To avoid possible injury to the patient, observe the following precautions:

#### Administration Sets

- Use only ALARIS®/IVAC® 72 Series administration sets. Use of any other set may cause improper instrument operation resulting in inaccurate fluid delivery.  
A list of approved administration sets recommended by ALARIS Medical systems for use with the Signature Edition® Volumetric Infusion Pump is provided on the Set Compatibility Card.
- Before operating the instrument, verify that the administration set is free from kinks and is installed correctly in the instrument.
- ALARIS®/IVAC® 72 Series administration sets are supplied with a sterile fluid path for one-time use only. Do not resterilize.



#### Artifacts

It is normal for infusion devices to produce nonhazardous currents when infusing electrolytes. These currents vary in proportion to the infusion device flow rate. When the ECG monitoring system is not functioning under optimal conditions, these currents may appear as artifacts, simulating actual ECG readings. To determine if ECG abnormalities are caused by patient condition or the ECG equipment, place the infusion device on hold. If the ECG readings become normal, the ECG equipment requires attention. Proper setup of the ECG equipment should eliminate these artifacts. Reference the appropriate ECG monitoring system documentation for instructions on setup and maintenance.

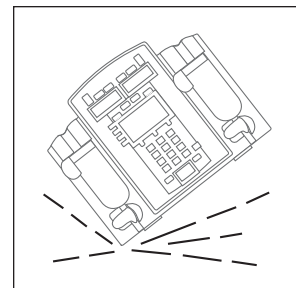


#### Contraindications

None known.

#### Dropping/Jarring

Should an instrument be dropped or severely jarred, it should be immediately taken out of service and inspected by qualified service personnel to ensure its proper function prior to reuse.



## Operational Precautions (Continued)

### Patient Precautions (Continued)

#### Epidural Administration

The instrument can be used for epidural administration of anesthetic and analgesic drugs. This application is only appropriate when using analgesics and anesthetics labeled for continuous epidural administration and catheters intended specifically for epidural use. Use only an ALARIS®/IVAC® 72 Series set, **without** a 'Y' connector or injection port, for epidural infusions. The instrument's secondary features must **not** be used when the instrument is being used for epidural administration of anesthetic and analgesic drugs.

- Epidural administration of anesthetic drugs: Use indwelling catheters specifically indicated for short-term (96 hours or less) anesthetic epidural drug delivery.
- Epidural administration of analgesic drugs: Use indwelling catheters specifically indicated for either short-term or long-term analgesic epidural drug delivery.

#### Parallel Infusions

There are no contraindications regarding the use of the Signature Edition® Infusion Pump with any other positive displacement infusion device when ported together into a common IV site location.

#### Radio Frequency Interference

- Operating the instrument near equipment which radiates high energy radio frequencies (electrosurgical/cauterizing equipment, portable radios, cellular telephones, etc.) may cause false alarm conditions. If this happens, reposition the instrument away from the source of interference or turn off the instrument and manually regulate the flow with the AccuSlide® Flow Regulator regulating clamp.
- The Model 180 flow sensor was designed for use at a standard head height of 24 inches. With the dual channel instrument, use of the 180 flow sensor at a greater distance from the instrument may result in radio frequency emissions exceeding the CISPR 11 standard. If this is a concern, either bring the 180 flow sensor to within 24 inches of the instrument or discontinue flow sensor use.

#### WARNING

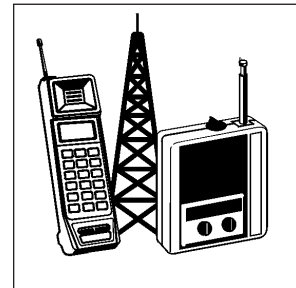
Epidural administration of drugs other than those indicated for epidural use could result in serious injury to the patient.

#### WARNING

It is strongly recommended that the infusion instrument, source container and administration set used for epidural drug delivery be clearly differentiated from those used for other types of administration.

#### WARNING

Use of accessories or cables other than those specified may result in degraded electromagnetic compatibility performance of this device.

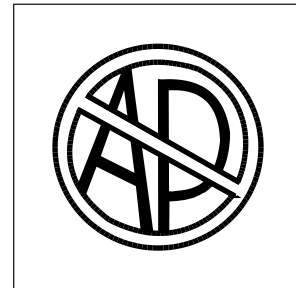


## Operational Precautions (Continued)

### User Precautions

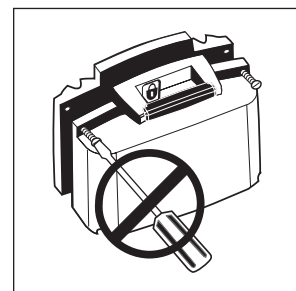
To ensure proper performance of the instrument and to reduce potential injury to the operator, observe the following precautions:

- The power cord must be connected to a properly grounded three-wire receptacle (“Hospital Grade”).
- Not for use in the presence of flammable anesthetics.
- Do not open the instrument case. There are no user-serviceable parts inside. The case should only be opened by qualified service personnel using proper grounding techniques. When the case is opened, an electrical shock hazard exists which can result in serious injury to persons and instrument component damage.



**◀ DANGER ▶**

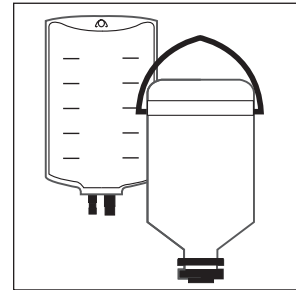
Explosion risk if used in the presence of flammable anesthetics.



## Preparing an Infusion

### Preparing Primary Solution Container

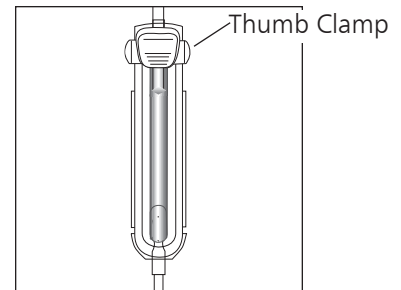
Prepare the primary solution container in accordance with the manufacturer's directions for use.



### Preparing Primary Administration Set

Use only an ALARIS®/IVAC® 72 Series administration set.

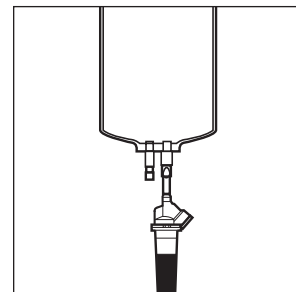
- Slide the AccuSlide® Flow Regulator thumb clamp down until an audible “click” verifies it is in fully closed position.



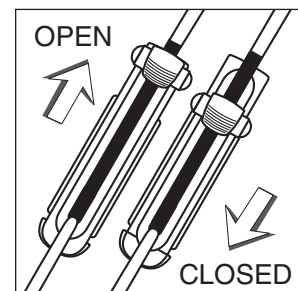
AccuSlide® Flow Regulator

- Spike solution container.
- Fill drip chamber to 2/3 full.

**NOTE:** Open the vent cap on the spike if the container requires venting.



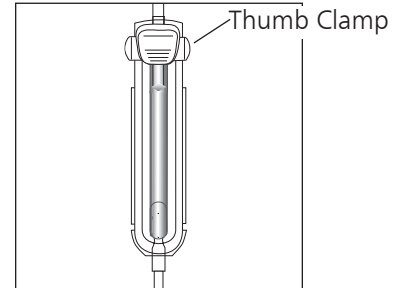
- Invert the AccuSlide® Flow Regulator.
- Slide the AccuSlide® Flow Regulator thumb clamp up to open position to prime set.
- Close the AccuSlide® Flow Regulator clamp when priming is complete. Verify no fluid is flowing.
- A gravity flow rate may be adjusted with the AccuSlide® Flow Regulator thumb clamp, if desired.



## Preparing an Infusion (Continued)

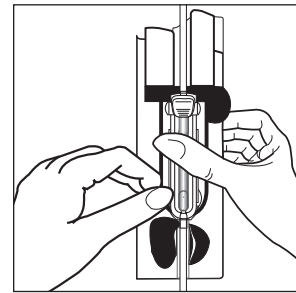
### Loading Primary Administration Set

1. Slide the AccuSlide® Flow Regulator thumb clamp down until an audible “click” verifies it is in fully closed position.



AccuSlide® Flow Regulator

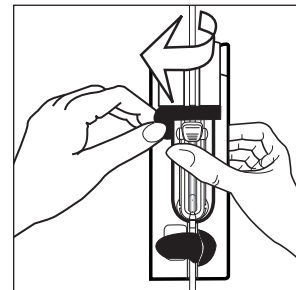
2. Using both hands, press top and bottom of the AccuSlide® Flow Regulator into instrument until it snaps into place.  
Verify the three gray “fingers” (clamp arms) on each side of pumping mechanism have engaged the AccuSlide® Flow Regulator.  
Let go of set. A properly loaded set should stay in instrument.



3. Press firmly just below blue thumb clamp on the AccuSlide® Flow Regulator with one hand while using other hand to close latch fully to left.

**NOTE:** If resistance is met while closing the latch, remove the set, verify the AccuSlide® Flow Regulator is fully closed and then reinstall the set.

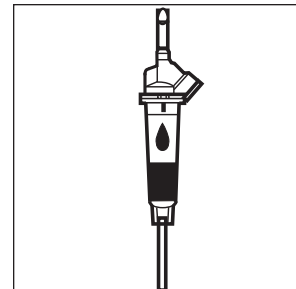
**NOTE:** Verify that the thumb clamp has moved to the open (up) position prior to starting the infusion.



#### WARNING

After set installation, verify no fluid is flowing through the administration set's drip chamber, to avoid free-flow.

4. Attach set to patient's vascular access device.
5. Verify flow from IV container after starting infusion.





## Start-Up Sequence

Press **POWER** to turn the channel on.

- Instrument will perform a self test.
- All indicators and displays will light momentarily.
- Instrument will beep.

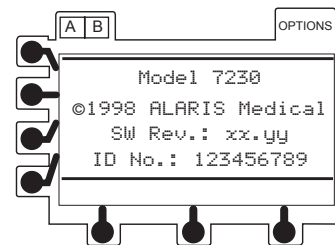
### WARNING

Each time the instrument is turned on verify and/or set the monitoring mode, resistance alert and/or pressure alarm limit. If the monitoring mode, resistance alert and/or pressure alarm limit are not verified, the instrument may not be operating with the desired occlusion detection parameter(s).

### CAUTION

Appearance of lines and/or dots that remain on constantly when the device is powered on may indicate improper functioning of the Main Display. Although the instrument is functioning properly, return it to qualified service personnel.

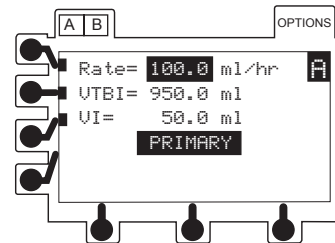
- System start-up page will be displayed.
- Mode indicator in status bar will be lit.
- Hold indicator in status bar will be flashing.



- When self test is complete, primary setup page is displayed. Instrument is ready for programming.

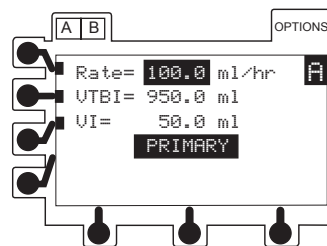
**NOTE:** Prerun prompts may appear if special operating modes were interrupted in the previous six hours. Refer to the Alarms, Alerts and Prompts section of this document to determine the appropriate action. The screen display may differ from that shown based on the defaults selected.

**NOTE:** Operating parameters (rate, VTBI, etc.) are retained in memory unless all power is lost (no AC and a depleted battery). A "Program Lost" message at power up indicates existing operating parameters have been erased.



## Primary Mode

1. Press **POWER** to turn channel on.
  - Primary setup page will appear.
  - Primary infusion rate will be highlighted.
2. If current primary infusion rate is appropriate, press **ENTER**.  
OR  
Use numeric keypad to enter a new infusion rate.  
Press **ENTER**.
  - Primary VTBI (volume to be infused) will be highlighted.

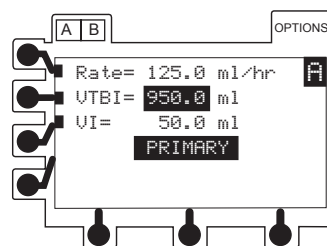


3. If current primary VTBI is appropriate, press **ENTER**.  
OR  
Use numeric keypad to enter a new VTBI. Press **ENTER**.
  - VI (volume infused) will be highlighted.

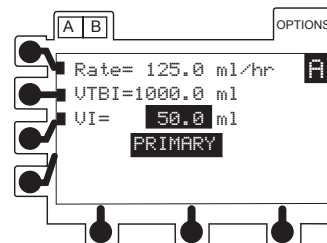
**NOTE:** If the flow sensor option is being used, VTBI can be turned OFF by selecting VTBI, pressing **CLEAR** and then **ENTER**.

OR

The primary VTBI can be deleted from the primary mode setup page (Programmable Features).

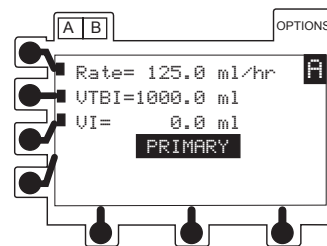


4. To clear VI, press **CLEAR** or 0 (zero key). Press **ENTER**.
  - Volume infused will be reset to 0.0 ml.



5. Verify programming parameters and then press channel's **RUN/HOLD** to start primary infusion.
  - Channel's infusing indicators will light.
  - Verify flow from IV container after starting infusion.

**NOTE:** Prerun prompts may appear if the start-up procedures were not completed. Refer to the Alarms, Alerts and Prompts section of this document to determine the appropriate action.



Making Changes During Primary Mode

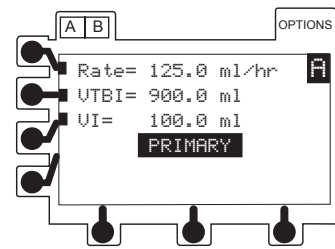
Select the desired channel (A/B), as necessary. The channel does not need to be on hold to change or clear the settings for Rate, VTBI or VI.

1. Press soft key for parameter you want to change.
  - Current value will be highlighted.

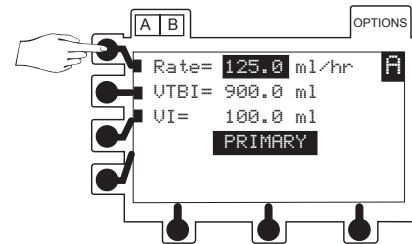
**NOTE:** If the flow sensor option is being used, VTBI can be turned OFF by selecting VTBI, pressing **CLEAR** and then **ENTER**.

OR

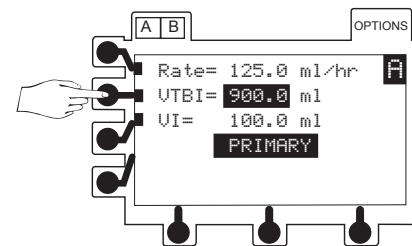
The primary VTBI can be deleted from the primary mode setup page (Programmable Features).



To Change Primary Infusion Rate:



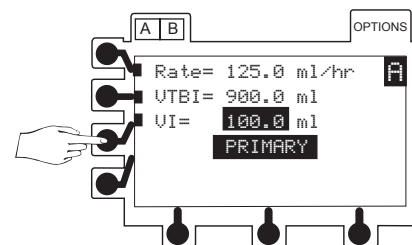
To Change Primary VTBI:



2. Use numeric keypad to enter a new value.
3. Press **ENTER** to accept new value.

To Clear Volume Infused:

1. Press **VI** soft key.
  - Current value will be highlighted.
2. Press **CLEAR** or 0 key to reset volume infused to 0.0 ml.
3. Press **ENTER** to accept new value.

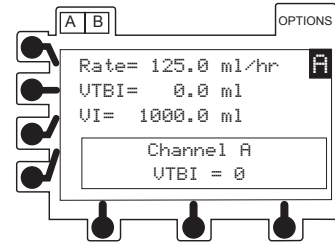
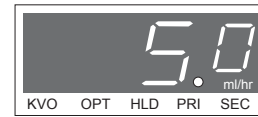


## KVO Mode

The KVO (keep-vein-open) mode automatically occurs when the primary VTBI has counted down to 0.0 ml. The channel switches to the preset KVO rate or remains at the current rate, whichever is less.



- The KVO rate is displayed in the rate LED display. The Main Display will continue to show the programmed infusion rate.
- KVO flashes in the infusion status bar.
- The KVO alert tone sounds.

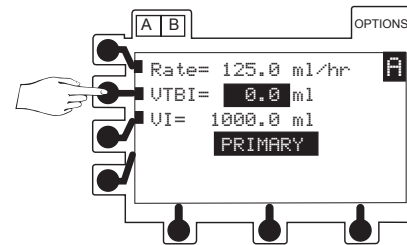
The **VTBI = 0** message and alert tone will continue until the channel is placed on hold.



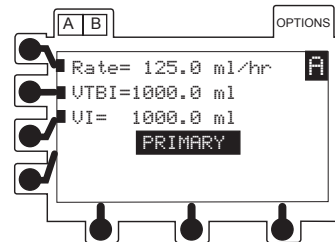
### To Resume Primary Operation from KVO

Select the desired channel, as necessary.

1. Press channel's  to place channel on hold.
2. Press **VTBI** soft key.
  - Primary VTBI will be highlighted.
3. Use numeric keypad to enter a new VTBI.
4. Press  to accept new value.



5. Press channel's  to resume primary infusion.

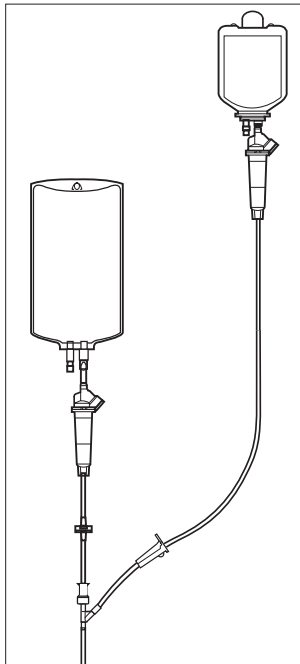


## Secondary Mode

This mode is designed to support automatic secondary infusions (“piggybacking”) in the same instrument channel. It can be used where a second, independent volume to be infused with an automatic rate change is useful. When the secondary VTBI reaches zero, a transition tone will sound (🔔 if the transition tone feature is enabled), **Secondary Complete** message will be displayed for a few seconds and the primary settings will automatically take effect. Both channels of a dual channel instrument can be programmed for primary and secondary operation.

When the device is programmed and delivering in the secondary mode, the primary infusion is temporarily stopped and fluid is drawn from the secondary container. Delivery from the primary container resumes when the fluid level in the secondary line is level with the fluid in the primary container.

**NOTE:** Prepare the secondary container and set. Lower the primary container using the hanger included with the secondary set. If a flow sensor is being used, it must be placed on the primary line.

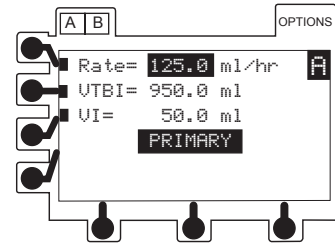


### WARNING

- Secondary applications require the use of a check valve set.
- The secondary solution container must be higher than the primary solution container.
- The secondary VTBI settings require consideration of such variables as factory overfill, medication additions, etc. Underestimating the volume will cause the remaining secondary solution to be infused at the primary rate; overestimating will result in the primary solution being infused at the secondary rate. Multiple doses from a single container are not possible.
- The clamp on the secondary set must be opened. If the clamp is not opened, the fluid will be delivered from the primary container.
- The secondary set must be primed prior to beginning the secondary infusion.

## Secondary Mode (Continued)

1. Press channel's **POWER** to turn channel on.
  - Primary setup page will appear.
  - Verify primary settings are appropriate.



**NOTE:** If programming a secondary from a running primary, place the channel on hold and then proceed.

### WARNING

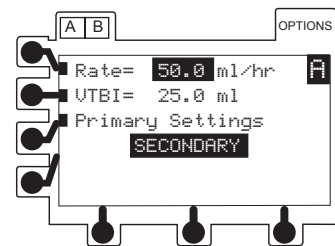
Do not access the secondary key until first confirming the primary program.

2. Press **SEC**.
  - Secondary setup page will appear.
  - Secondary infusion rate will be highlighted.
3. If current secondary infusion rate is appropriate, press **ENTER**.

OR

Use numeric keypad to enter a new infusion rate. Press **ENTER**.

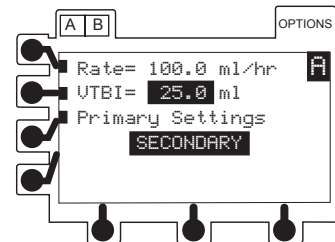
- Secondary VTBI (volume to be infused) will be highlighted.



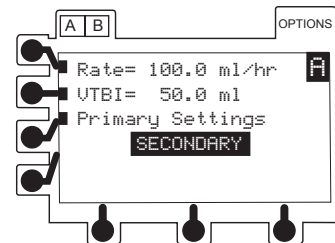
4. If current secondary VTBI is appropriate, press **ENTER**.

OR

Use numeric keypad to enter a new VTBI. Press **ENTER**.



5. Press channel's **RUN HOLD** to start secondary infusion.
  - Channel's infusing indicators will light.
  - When secondary infusion is complete, instrument automatically switches to primary infusion parameters.



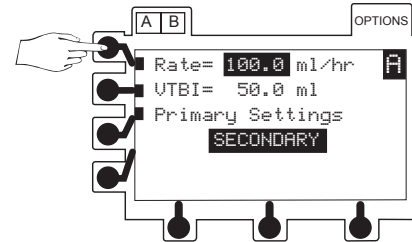
## Secondary Mode (Continued)

### Making Changes During Secondary Mode

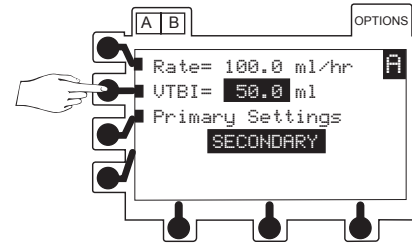
Select the desired channel, as necessary. The channel does not need to be on hold to change the settings for Rate or VTBI.

1. Press soft key for value you want to change.
  - Current value will be highlighted.

To Change Secondary Infusion Rate:



To Change Secondary VTBI:

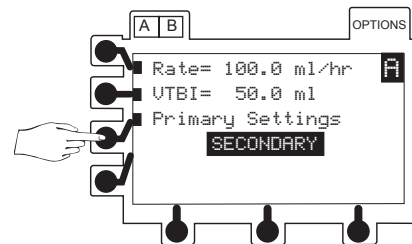


2. Use numeric keypad to enter new value.
3. Press **ENTER** to accept new value.

### To View or Change Primary Settings During Secondary Mode

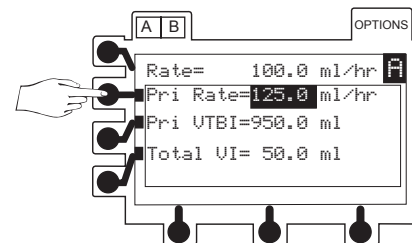
Select desired channel, as necessary.

1. Press **Primary Settings**.
  - Primary rate (**Pri Rate**), primary volume to be infused (**Pri VTBI**) and total volume infused (**Total VI**) will be displayed.
  - Display will return to normal secondary page after six seconds.



2. Press **Pri Rate**, **Pri VTBI**, or **Total VI** to:
  - “freeze” display
  - highlight value

To Change Primary Infusion Rate:



## Secondary Mode (Continued)

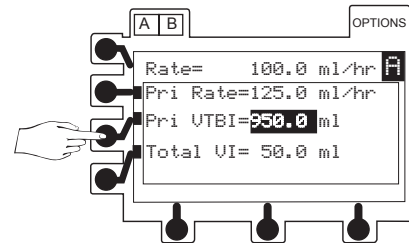
### To View or Change Primary Settings During Secondary Mode (Continued)

**NOTE:** If the flow sensor option is being used, VTBI can be turned OFF by selecting VTBI, pressing **CLEAR** and then **ENTER**.

OR

The primary VTBI can be deleted from the primary mode setup page (Programmable Features).

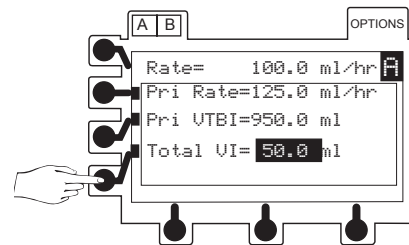
### To Change Primary VTBI:



3. Use numeric keypad to enter new value(s).
4. Press **ENTER** to accept new value(s).

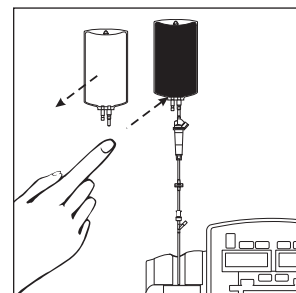
### To Clear Volume Infused:

1. Press **VI** soft key.
  - Current value will be highlighted.
2. Press **CLEAR** or 0 (zero key) to reset volume infused to 0.0 ml.
3. Press **ENTER** to accept new value.
  - Display will return to normal secondary page after six seconds.



## Changing Primary Solution Container

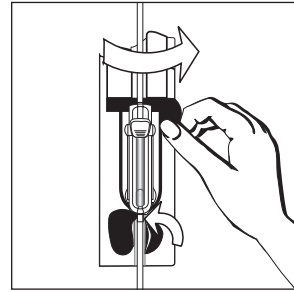
1. Place channel on hold.
2. Remove empty solution container.
3. Spike new container.
  - Ensure drip chamber is filled to 2/3 full.
4. Press **VTBI** soft key.
5. Use numeric keypad to enter a new VTBI. Press **ENTER**.
6. Press channel's **RUN/HOLD** to restart infusion.





## Unloading Set

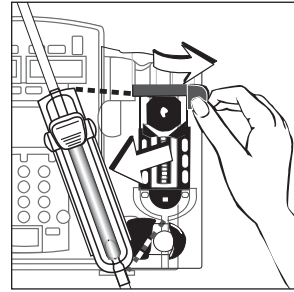
1. Place channel on hold.
2. Open latch.
  - The AccuSlide® Flow Regulator will automatically close to prevent accidental free-flow.



3. Press lightly against open latch.
  - Set will be ejected from instrument.

### WARNING

To prevent free-flow, verify the AccuSlide® Flow Regulator is closed when the set is removed from the instrument.

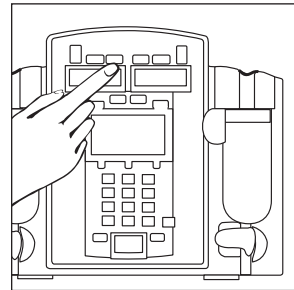


4. Close latch(es) whenever instrument is not in use.
5. Turn off power, as necessary.

## Powering Off

Press and hold channel's **POWER** until display turns off.


- Current monitoring mode, resistance alert and/or pressure alarm limit will be retained in memory for six hours.



## Alarms, Alerts and Prompts

There are three types of displayed messages.

**ALARM** — instrument or channel problem.

- infusion stops
-  icon illuminates
- alarm tone sounds
- rate LED display flashes
- message appears in Main Display

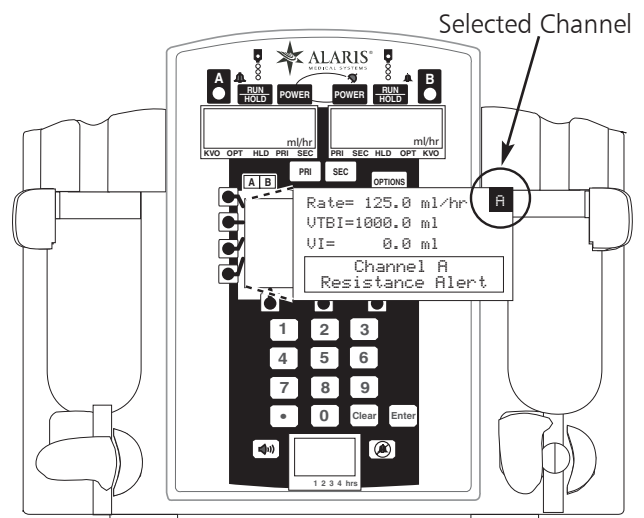
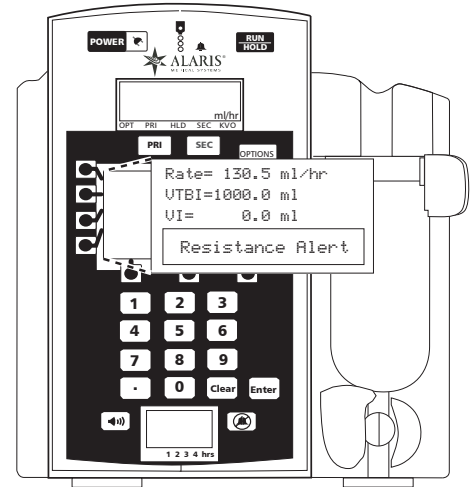
**ALERT** — may indicate a change in infusion status.

- channel continues to operate
- alert tone sounds
- message appears in Main Display

**PROMPT** — infusion status not changed.


Start-up procedures were not completed or an invalid key was pressed.

**NOTE:** When using the dual channel instrument, some messages will also display “Channel A” or “Channel B”, to indicate which channel is affected. Always verify the channel is selected before making any changes.
















Messages are listed alphabetically on the following pages, with a probable cause and suggested remedy next to each one. Use this section in conjunction with the appropriate clinical practice or hospital procedure.

## Alarms, Alerts and Prompts (Continued)

MESSAGE	PROBABLE CAUSE	REMEDY
<b>ACCUMULATED AIR IN LINE</b>  Alarm <b>hold</b> soft key active	Air detector has detected multiple small bubbles.  Air-in-Line Reset feature is off.	Press <b>hold</b> . Open latch to remove set. Clear air per hospital protocol. Reinstall set. Press  to resume infusion.
<b>ACCUMULATED AIR IN LINE</b>  Alarm <b>reset</b> soft key active	Air detector has detected multiple small bubbles.  Air-in-Line Reset feature is on.	Evaluate air in set. Remove air. <b>OR</b> If air bubbles are clinically insignificant, you may press <b>reset</b> , then press <b>run</b> to resume infusion.
<b>Air In Line</b> Prompt	Air detector has detected air prior to starting infusion or is in poor contact with set.	Verify set is loaded correctly. Prime and reload set or remove air. Reshape tubing to ensure optimum contact with sensor.
<b>AIR IN LINE</b>  Alarm <b>hold</b> soft key active	Air detector has detected an air bubble larger than configured threshold tolerance.  Air-in-Line Reset feature is off.	Press <b>hold</b> . Open latch to remove set. Clear air per hospital protocol. Reinstall set. Press  to resume infusion. At flow rates of 1.0 ml/hr and below, check for upstream occlusion.
<b>AIR IN LINE</b>  Alarm <b>reset</b> soft key active	Air detector has detected an air bubble larger than configured threshold tolerance.  Air-in-Line Reset feature is on.	Evaluate air in set. Remove air. <b>OR</b> If air bubbles are clinically insignificant, you may press <b>reset</b> , then press <b>run</b> to resume infusion. At flow rates of 1.0 ml/hr and below, check for upstream occlusion.
<b>BATTERY DEPLETED (Plug In)</b>  Alarm	Battery is too low to operate instrument.	Plug power cord into an AC outlet immediately. Press <b>run</b> or  to resume infusion.
<b>Battery Low</b> Alert	Battery has 30 minutes or less of charge remaining.	Plug power cord into an AC outlet as soon as possible.











## Alarms, Alerts and Prompts (Continued)

MESSAGE	PROBABLE CAUSE	REMEDY
<p><b>Both A &amp; B Not Running</b>                      Prompt                      Dual channel instrument only.</p>	<p> was pressed, but both channels are not infusing.</p>	<p>Both channels must be infusing for split screen feature to operate.</p>
<p><b>CHANNEL MALFUNCTION</b>   Alarm                      Dual channel instrument only.</p>	<p>Channel malfunction.</p>	<p>Turn channel off and then on. If problem persists, do not use channel. Contact qualified service personnel.</p>
<p><b>Channel Not On</b>                      Prompt                      Dual channel instrument only.</p>	<p>Channel's  or  was pressed, but channel is not on.</p>	<p>Channel must be turned on to view or change settings.</p>
<p><b>Checking Line</b>                      Alert</p>	<p>Flow has been obstructed.   AutoRestartPlus feature is on.</p>	<p>AutoRestartPlus must be on for downstream occlusion alerts. (AutoRestartPlus not required for upstream occlusion alerts). Check administration set for probable cause (kinked tubing, clogged filter, etc.).</p>
<p><b>Complete Entry</b>                      Alert</p>	<p> was not pressed to accept a new value.</p>	<p>Press  to confirm entry or press  twice to return to previous settings.</p>
<p><b>NOTE:</b> Channel will operate as previously programmed until  is pressed.</p>		
<p><b>Complete or OK Setup</b>                      Prompt</p>	<p> was pressed before setup was completed or okayed.</p>	<p>Complete setup. Press <b>ok</b>.</p>
<p><b>Computer Control Released</b>                      Alert</p>	<p>Control of instrument has been released from host computer (<i>RS-232 configuration only</i>).   Computer Link feature is in control mode.</p>	<p>Reestablish or discontinue computer control mode, as appropriate.</p>
<p><b>COMPUTER LINK FAILURE</b>   Alarm</p>	<p>RS-232 connection to computer was disrupted.   Computer Link feature is in monitor mode.</p>	<p>Check RS-232 connections.                      Clearing this alarm automatically puts instrument in monitor mode. Reestablish infusion.</p>






## Alarms, Alerts and Prompts (Continued)

MESSAGE	PROBABLE CAUSE	REMEDY
<b>Dose Complete</b> Alert	A dose delivery has just been completed.   Multi-Dose Alert feature is on.	Channel will automatically switch to timer (⌘).  If Dose Complete Alert Option is activated, press <b>cancel alert</b> to silence audio signal.
<b>Dose Out of Range</b> Prompt	Calculated dose is outside allowable range.	Verify and reenter settings.
<b>Dose Rate Running</b> Prompt	 or  was pressed while running in Dose Rate program.	Channel must be on hold to change modes.
<b>Entry Invalid</b> Prompt	An invalid value was entered during programming.	Press  or 0 key to clear entry. Enter appropriate value.
<b>FLOW SENSOR UNPLUGGED</b>  Alarm	Flow sensor is unplugged from back of instrument.	Plug flow sensor into flow sensor receptacle.
<b>HOLD TIME EXCEEDED</b>  Alarm	Channel has been on hold for two minutes and no keys have been pressed (on either channel if dual channel).	Press <b>hold</b> to return to hold mode.
<b>INSTRUMENT MALFUNCTION</b>  Alarm	Instrument malfunction. For a dual channel instrument, neither channel is functional.	Turn instrument off and then on. If problem persists, do not use instrument. Contact qualified service personnel.
<b>Instrument Self-Check Is Due Please Eject the Set</b> Prompt	Instrument/channel has not performed self-check within programmed interval.	If set is loaded: Eject set, wait five seconds and then reload set.  If <u>no</u> set is loaded: Load and then eject set. Wait five seconds and then reload set.
<b>Invalid Entry Rate Out of Range</b> Prompt	Instrument has calculated a rate less than 0.1 ml/hr.	Verify and reenter settings.
<b>KEY STUCK</b>  Alarm	A key is stuck or was held down too long.	Release key. Turn instrument off (both channels if dual channel instrument) and then on. If problem persists, do not use instrument. Contact qualified service personnel.








## Alarms, Alerts and Prompts (Continued)

MESSAGE	PROBABLE CAUSE	REMEDY
<b>LATCH OPEN</b>  Alarm	Latch was opened during an infusion.	Check for proper set installation. Close latch. Press <b>run</b> .
<b>LATCH OPEN</b> Prompt	Latch is open (prior to starting an infusion).	Close latch <b>fully</b> to left.
<b>Load Dose Complete</b> Alert	Loading Dose program has just been completed.	Channel will automatically switch to primary infusion.
<b>Load Dose Running</b> Prompt	 or  was pressed while running in Loading Dose program.	Channel must be on hold to change modes.
<b>Maintenance Reminder</b> Prompt	Periodic maintenance interval has elapsed.   Maintenance Reminder feature is on.	Notify your Biomedical Engineering department. If desired, press <b>continue</b> to temporarily bypass reminder.
<b>Multi-Dose Running</b> Prompt	 or  was pressed while running in Multi-Dose program.	Channel must be on hold to change modes.
<b>Multi-Step Complete</b> Alert	Multi-Step program has just been completed.	Channel will automatically switch to KVO infusion.
<b>Multi-Step Running</b> Prompt	 or  was pressed while running in Multi-Step program.	Channel must be on hold to change modes.
<b>New Baseline Set</b> Prompt	A new Manual Pressure Baseline has successfully been set.   Manual Pressure Baseline feature is on.	Baseline will remain set until a new manual baseline is set, instrument is turned off or latch has been opened.
<b>No Numeric Entries</b> Prompt	A numeric key was pressed during nonnumeric selection.	Wait several seconds for popup to finish. Press <b>ok</b> to approve all displayed information.  <b>OR</b> Press  to view available unit selections.

## Alarms, Alerts and Prompts (Continued)







MESSAGE	PROBABLE CAUSE	REMEDY
<p><b>NO UPSTREAM FLOW DETECTED</b></p> <p> Alarm</p>	<p>Flow has been obstructed between container and instrument when using a flow sensor.</p>	<p>Check to see if container is empty, flow sensor is mispositioned or clouded, tubing is kinked or air vent is closed. Verify correct set connections and open fluid path. Press <b>run</b> to restart infusion.</p>
<p><b>NOTE:</b> <i>Infusing fluids which form smaller drops through a 60 drops/ml set at high rates may result in a "No Upstream Flow Detected" alarm. (This is because the small, rapidly falling drops form a continuous stream which does not trigger the flow sensor). In this event, unplug the flow sensor from the instrument.</i></p>		
<p><b>OCCLUSION DOWNSTREAM</b></p> <p> Alarm No pressure reading displayed.</p>	<p>Flow has been obstructed between instrument and patient.</p>	<p>Check administration set for probable cause (kinked tubing, clogged filter, etc.). Press <b>run</b> to restart infusion.</p>
<p><b>OCCLUSION DOWNSTREAM</b></p> <p> Alarm Pressure reading displayed.</p>	<p>Pressure in IV line has exceeded Adjustable Pressure Limit due to elevated resistance in delivery path.</p>	<p>Check administration set for probable cause (kinked tubing, closed stopcock, high resistance catheter, etc.). Press <b>run</b> to restart infusion.</p>
<p><b>Occlusion Downstream</b></p> <p>Prompt</p>	<p>A very high pressure exists in fluid line while baseline is being set.</p> <p> Pressure Baseline feature is on.</p>	<p>Remove source of high pressure and repeat setting of pressure baseline.</p>
<p><b>OCCLUSION UPSTREAM</b></p> <p> Alarm</p>	<p>Flow has been obstructed between fluid container and instrument.</p>	<p>Check administration set for probable cause (kinked tubing, closed clamp, etc.). Press <b>run</b> to restart infusion.</p>
<p><b>Ok Entry</b></p> <p>Prompt</p>	<p>User has attempted to go to another page before pressing <b>ok</b>.</p>	<p>Verify selection and press <b>ok</b>.</p>
<p><b>Panel Locked</b></p> <p>Prompt</p>	<p>A key was pressed.</p> <p> Panel lock feature is on.</p>	<p>Turn panel lock off to access panel controls. Panel lock key is located behind handle.</p>
<p><b>Place on Hold to Change</b></p> <p>Prompt</p>	<p>A key was pressed during KVO.</p>	<p>Channel must be on hold to make changes.</p>

## Alarms, Alerts and Prompts (Continued)



MESSAGE	PROBABLE CAUSE	REMEDY
<p><b>Place on Hold to Set Pressure Baseline</b></p> <p>Prompt</p>	<p>SET PRESSURE BASELINE function has been selected while running.</p> <p> Pressure Baseline feature is on.</p>	<p>Place instrument on hold before performing manual SET PRESSURE BASELINE operation.</p>
<p><b>Press and Hold Key to Turn Off</b></p> <p>Prompt</p>	<p> was pressed.</p>	<p>Press and hold  until display turns off.</p>
<p><b>Pressure Unstable Cannot Set Baseline</b></p> <p>Prompt</p>	<p>Excessive variation in pressure due to motion, flow from other instruments or blood pressure prevents accurate setting of pressure baseline.</p> <p> Pressure Baseline feature is on.</p>	<p>Reduce or temporarily remove sources of variation while performing manual baseline setting operation.</p>
<p><b>PRIMARY FLOW DETECTED DURING SECONDARY</b></p> <p> Alarm</p>	<p>Instrument detected flow from primary container during secondary infusion.</p> <p><b>NOTE:</b> <i>Alarm can only occur when using optional flow sensor.</i></p>	<p>Verify:</p> <ul style="list-style-type: none"> <li>• Flow sensor is on primary line.</li> <li>• Primary set has check valve.</li> <li>• Secondary infusion is complete (underfilled solution container).</li> <li>• Secondary set fluid path is not blocked.</li> <li>• Secondary settings are correct.</li> </ul> <p>Press <b>run</b> to restart infusion.</p>
<p><b>Pri Running</b></p> <p>Prompt</p>	<p> or  was pressed while channel was running in primary mode.</p>	<p>Channel must be on hold to change modes.</p>
<p><b>Program Lost Re-Enter Settings</b></p> <p>Prompt</p>	<p>Instrument detected a memory or power failure. Existing operating parameters have been erased.</p>	<p>Press <b>continue</b> and reenter all infusion settings.</p> <p><b>NOTE:</b> <i>Programmable features are not affected.</i></p>
<p><b>Rate Out of Range</b></p> <p>Prompt</p>	<p>Calculated rate is outside allowable range. (Arrows point up or down, depending on whether over or under rate range.)</p>	<p>Verify and reenter settings.</p>



## Alarms, Alerts and Prompts (Continued)

MESSAGE	PROBABLE CAUSE	REMEDY
<b>Resistance Alert</b> Alert	IV line resistance has reached preset alert level.   Resistance Alert feature is on.	Check downstream line and site. Raise resistance alert level, if appropriate.
<b>Return To Dose Rate?</b> Prompt	Channel was turned off during a Dose Rate program within last six hours.	Press <b>yes</b> to return to Dose Rate program or press <b>no</b> to return to primary setup page.
<b>Return To Loading Dose?</b> Prompt	Channel was turned off during a Loading Dose program within last six hours.	Press <b>yes</b> to return to Loading Dose program or press <b>no</b> to return to primary setup page.
<b>Return To Multi-Dose?</b> Prompt	Channel was turned off during a Multi-Dose program within last six hours.	Press <b>yes</b> to return to Multi-Dose program or press <b>no</b> to return to primary setup page.
<b>Return To Multi-Step?</b> Prompt	Channel was turned off during a Multi-Step program within last six hours.	Press <b>yes</b> to return to Multi-Step program or press <b>no</b> to return to primary setup page.
<b>Return to Secondary?</b> Prompt	Channel was turned off during secondary infusion within last six hours.	Press <b>yes</b> to return to secondary mode or press <b>no</b> to return to primary setup page.
<b>Secondary Complete</b> Alert	Secondary delivery has just been completed.	Channel will automatically switch to primary infusion settings.
<b>Sec Running</b> Prompt	 or  was pressed while channel was running in secondary mode.	Channel must be on hold to change modes.
<b>Select Channel</b> Prompt Dual channel instrument only.	A key was pressed but no channel has been selected.	Press  or  and then continue with editing.
<b>Set Must Be Loaded</b> Prompt	The AccuSlide® Flow Regulator segment is not loaded in selected channel during a manual pressure baseline setting operation.   Pressure Baseline feature is on.	Load the AccuSlide® Flow Regulator segment in selected channel. Repeat manual pressure baseline setting.



## Alarms, Alerts and Prompts (Continued)

MESSAGE	PROBABLE CAUSE	REMEDY
<b>Set Out</b> Prompt	The AccuSlide® Flow Regulator segment is not installed correctly.	Reinstall the AccuSlide® Flow Regulator segment.
<b>SET OUT</b>  Alarm	Set has been removed during an infusion.	Reinstall set. Press <b>run</b> .
<b>Set Pressure Baseline</b> Prompt	Set Pressure Baseline has been selected in options mode.	Press <b>ok</b> to set Pressure Baseline or press <b>return</b> to go to Primary Setup page.
<b>Set Pri VTBI</b> Prompt	A primary VTBI was not programmed.	Enter a primary VTBI.
<b>Set Pri VTBI &gt; Loading Dose VTBI</b> Prompt	Loading Dose VTBI entered is greater than primary VTBI.	Raise primary VTBI or lower Loading Dose VTBI, as appropriate.
<b>SETUP TIME EXCEEDED</b>  Alarm	Instrument has been turned on but no keys have been pressed for ten minutes.	Press <b>hold</b> to return to hold mode.  Instrument will turn off if left in alarm more than five minutes.  If an audio alarm remains on, turn instrument on and then off.
<b>Stop Timer to Change</b> Prompt	An invalid key was pressed while timer was running in Multi-Dose program.	Wait several seconds for popup to finish. Press <b>stop timer</b> to make changes.
<b>Time Out of Range</b> Prompt	Programmed step time exceeds 24 hours and 59 minutes, or is less than one minute.	Verify and reenter settings.
<b>Timer Running</b> Prompt	<input type="button" value="PRI"/> or <input type="button" value="SEC"/> was pressed while timer was running in Multi-Dose program.	Wait several seconds for popup to finish. Press <b>stop timer</b> to make changes.
<b>VTBI = 0</b> Alert	VTBI has counted down to zero. Channel is in KVO mode.	Put channel on hold to reenter a primary VTBI. Change solution container, if necessary.  OR Terminate infusion.

**NOTE:** All features and options are shown enabled in this section. The optional features illustrated may not have been enabled on your instrument.

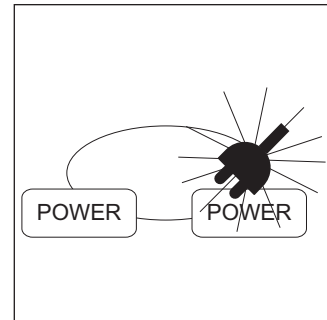
## Battery Management System

The Battery Management System incorporates features which enhance battery maintenance in order to maximize the life of the battery, reduce associated costs and increase instrument availability. The system provides:

- A green  that lights when instrument is plugged in.
- An amber  that flashes when instrument is operating on battery power.
- Automatic battery power if instrument is unplugged or in the event of a power failure.
- A low battery alert indicating battery depletion is imminent, beginning at least 30 minutes prior to a **BATTERY DEPLETED** alarm.

Maximum battery capacity, as well as gauge accuracy, is reached after several charge/discharge/recharge cycles. For best results, fully charge, discharge and recharge the battery before putting the instrument into service.

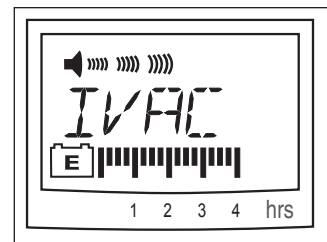
Battery run time may be affected by the operating mode, rate, monitoring options and back pressure.



## Battery Power Gauge

The gauge indicates approximate battery run time remaining in 15 minute increments under current operating conditions. It is located in the lower display and is always on. Always check the remaining battery run time after starting an infusion. The gauge updates for each program change while infusing.

**NOTE:** The gauge accuracy is based on the last refresh cycle and is affected by the number of charge/discharge/recharge cycles.

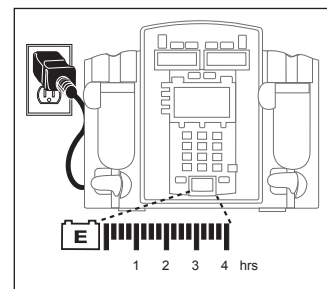


## Battery Recharge

The battery recharges whenever the instrument is plugged into an AC outlet.

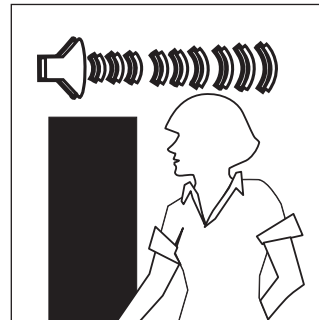
Qualified service personnel can replace the battery when charging capacity gets too low.

**NOTE:** All batteries gradually lose their capacity to hold a charge over time and use.



## Nurse Call

If your instrument is equipped with the optional nurse call feature (not available with MIB configuration), alarms and some alerts from the instrument will be relayed to the hospital's existing nurse call system. No operating features of the instrument are changed. The instrument will alarm with or without the nurse call installed.



### To Activate the Nurse Call Feature

1. Plug nurse call cable into  on instrument back panel.

**NOTE:** A false remote alarm may occur if the nurse call plug is not properly inserted.

2. Press channel's **POWER**.
  - Instrument will beep briefly to signal proper operation.
3. Plug nurse call cable into nurse call system.
4. Operate instrument as described in this document.
  - All alarms and some alerts will activate nurse call system. Following alerts will not activate nurse call system:

**Checking Line**  
**Load Dose Complete**  
**Secondary Complete**


### If an Alarm Occurs

1. Go to instrument.
2. Use Alarms, Alerts and Prompts section of this document to determine cause and appropriate corrective action.
3. Reset your nurse call system, as required.

**NOTE:** Disconnecting the nurse call cable from the wall or turning off the instrument will activate the nurse call system. Disconnecting the nurse call cable from the instrument will not activate the nurse call system.





## Panel Lock

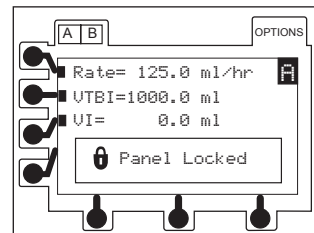
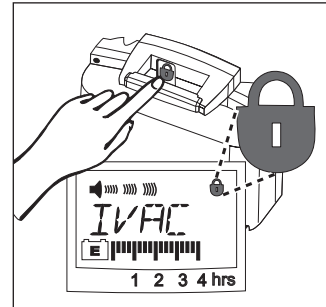
The panel lock feature helps prevent unauthorized changes of any instrument settings, including turning the instrument off.

The panel lock key, , is located behind the handle.

### To Turn Panel Lock Feature On

Press and hold  until  appears in lower display.

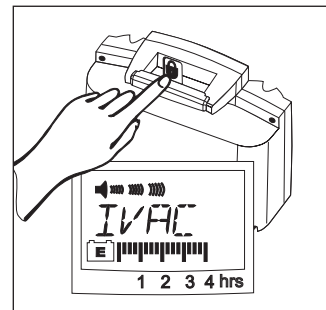
- Dual channel instrument only: ,  and  keys can be used to view settings.
-  **Panel Locked** appears in Main Display if any other key is pressed.



### To Turn Panel Lock Feature Off

Press and hold  until  in lower display disappears.

**NOTE:** To make changes or respond to an alarm, the panel lock must be turned off.

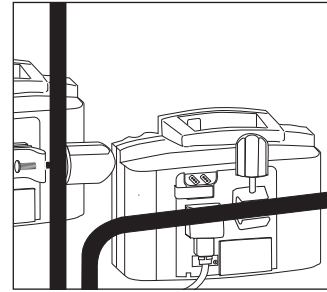


## Pole Clamp

The uniquely designed pole clamp adapts to a wide variety of surfaces (such as, poles, bed rails) to provide greater versatility and to simplify transports. It features:

- 360° rotation in 90° increments
- ergonomically designed knob
- accommodates diameters from 15 to 35 millimeters
- no restrictions for pole mounting except physical space

**NOTE:** When using multiple instruments, care should be taken to evenly distribute the instruments to ensure stability.

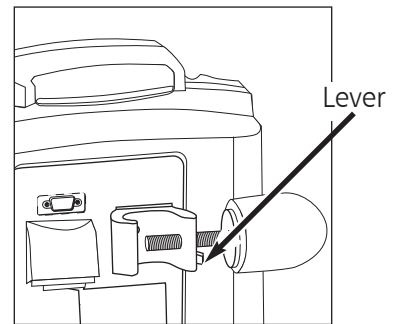


### WARNING

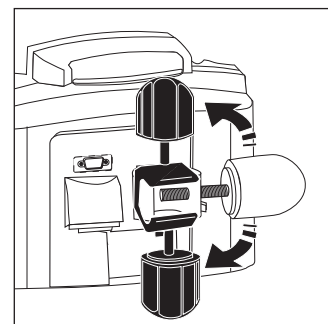
To ensure proper occlusion detection, DO NOT operate the instrument tilted back more than 45° from the upright position.

## To Change Pole Clamp Orientation

1. Press and hold rotation lever.



2. Reposition clamp.
3. Release lever at desired position.





## Air-in-Line and Accumulated Air-in-Line

The Air-in-Line Detection System provides clinicians the ability to detect inappropriate amounts of air in the IV line. The instrument is configurable to allow single bubble plus accumulated air detection. Accumulated air detection is based on measurement of the average percentage produced by small air bubbles passing the detector.

Air is detected by a pair of sensors located just below the AccuSlide® Flow Regulator. One of these is located in an arm which rotates into position as the latch is closed.

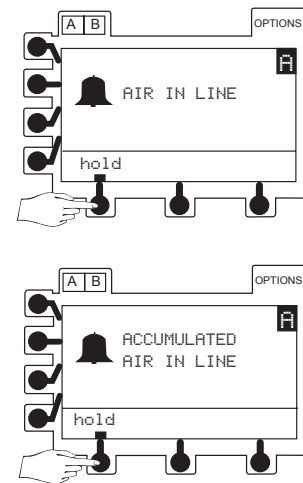
Qualified biomedical personnel may configure one of four possible sensitivity levels. The instrument is also configurable to permit the operator to clear (reset) any air registered in the instrument's memory.

**NOTE:** Ensure that the tubing is properly inserted into the air detector to avoid false alarms. The tubing may be reshaped to ensure optimum contact with the sensors.

 will not start infusion if any air is detected by the sensor.

### Single or Accumulated Air Bubble Detection (NO Reset Feature)

1. Press **hold** to place channel on hold.





2. Remove air per hospital protocol.

**NOTE:** Opening the latch or turning the channel off will clear air memory.

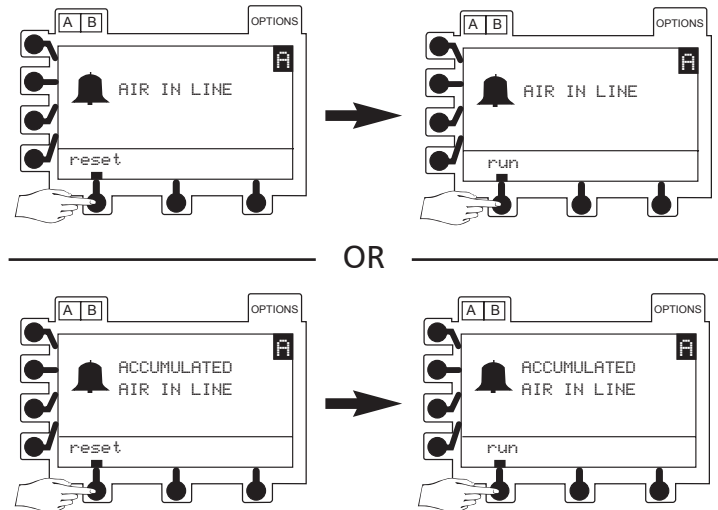
3. Reinstall set and then press  to resume infusion.



### Single or Accumulated Air Bubble Detection (Reset Feature Available)

If air volume is clinically insignificant, press **reset** soft key or  key, followed by **run** soft key or  key to resume infusion.

- A new bubble will again trigger alarm.



### Dynamic Monitoring® System

The Dynamic Monitoring® System provides the clinician the ability to monitor downstream pressure or resistance, allowing rapid detection of full and partial occlusions. Resistance monitoring eliminates the impact of patient elevation and flow rate to provide the most direct assessment of patency. Components of this system are:

- **Monitoring Options:** to select IV line/site monitoring modes of resistance, high resistance, and adjustable or fixed pressure.
- **AutoRestartPlus** feature: allows instrument to automatically resume operation when specific instrument operating conditions are met.
- **Adjustable Pressure Alarm:** to provide an early warning of increases in downstream pressure.
- **Adjustable Resistance Alert:** to provide an early warning of increases in downstream flow resistance.
- **Trend Graph:** to display downstream pressure or flow resistance over time.
- **Pressure Baseline:** to increase accuracy of pressure measurements.



 Monitoring Options

IV lines, catheters and applications create various levels of resistance to flow. Monitoring mode options are available to meet each clinical need.

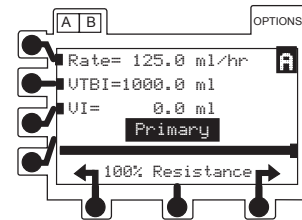
- **Resistance:** designed to monitor IV line/site resistance providing optimum sensitivity. Used for larger catheter sizes.
- **High Resistance:** designed to monitor IV line/site resistance with optimum sensitivity where higher resistance catheters are used.
- **Adjustable Pressure:** designed to monitor IV line/site pressure and provide user adjustable pressure alarm limits. Used for Precision Flow mode or for high resistance systems; such as, infusion through transducers, into dialysis systems and through highest resistance catheters.
- **Pressure:** designed to monitor IV line/site pressure and alarm based on a fixed pressure limit.
- **Precision Flow:** in fixed and adjustable pressure modes, the Signature Edition® System provides enhanced flow continuity, minimizing hemodynamic changes for a large volume infusion instrument (at rates below 50 ml/hr only).

**NOTE:** The pressure limit may be reduced (clipped) if the pressure in the line is high or changing. This results in the pressure limit being lowered from the selected setting. If this occurs, first try to remove or reduce the downstream pressure. Following that, try to reload the set, wait 15 to 30 seconds and then perform a Set Pressure Baseline operation. The pressure baseline may need to be set a second time, after the pressure readings have stabilized. If this does not work, the set could be the cause of this clipping.

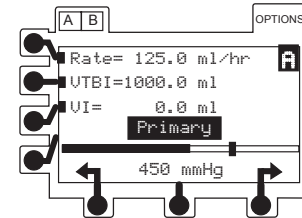
**NOTE:** For dual channel instruments, select the desired channel as necessary. The bar graph and numeric displays are not available when the split screen is displayed.

► To Select One of Three Options:

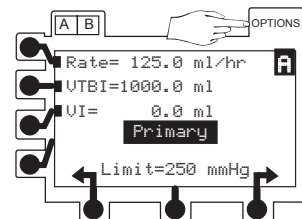
1. Press **OPTIONS**.
  - Options page will appear.



Resistance Monitoring



Pressure Monitoring

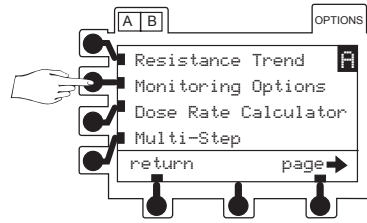


 Monitoring Options (Continued)

► To Select One of Three Options: (Continued)

2. Press **Monitoring Options**.

- Monitoring Options page will appear.

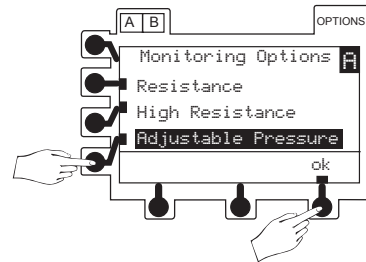


3. Press **Resistance**, **High Resistance**, or **Adjustable Pressure**.

- If pressure limit adjustment is available, selection will read **Adjustable Pressure**; otherwise, it reads **Pressure**.

4. Press **ok**.

- Display will automatically return to normal operating page.



**NOTE:** While the channel is on, the selected option, resistance alert and pressure alarm thresholds will remain in effect until changed by the operator. After the instrument has been off for more than six hours, the channel will return to the default option and thresholds which were set by a qualified service personnel.

**WARNING**


Each time the instrument is turned on verify and/or set the monitoring mode, resistance alert and/or pressure alarm limit. If the monitoring mode, resistance alert and/or pressure alarm limit are not verified, the instrument may not be operating with the desired occlusion detection parameter(s).

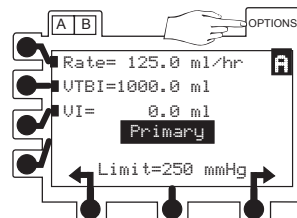
 Monitoring Options (Continued)

► If Adjustable Pressure Option is Selected:

- Pressure alarm limits may be adjusted using keys located below arrow symbols. (See Adjustable Pressure Alarm section.)

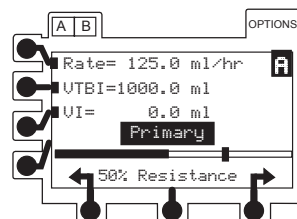
**NOTE:** Maximum pressure limit settings may be configured by qualified service personnel.

- Pressure system accuracy can be enhanced by ensuring no occlusion or other pressure source exists in IV line when activating .
- **Set Pressure Baseline** option enhances pressure system and displays real-time pressure readings.



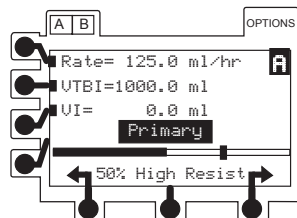
► If Resistance Option is Selected:

- **% Resistance** message is displayed below bar graph display while infusing.
- Resistance alert limit may be adjusted using keys located below arrow symbols.



► If High Resistance Option is Selected:

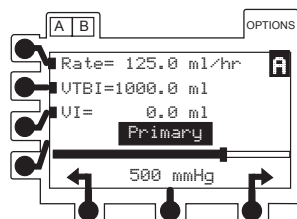
- **% High Resist** message is displayed below bar graph display while infusing.
- High Resistance alert limit may be adjusted using keys located below arrow symbols.



► Detection of Downstream Occlusions:

A very wide range of normal flow resistances may be encountered to meet diverse clinical applications. The appropriate monitoring mode should be selected to optimally monitor the IV site.

When using the Adjustable Pressure monitoring mode, a pressure alarm limit may be selected, in 25 mmHg increments, from 25 mmHg to the maximum configured pressure limit. When measured pressure exceeds this level, an **OCCLUSION DOWNSTREAM** condition exists.



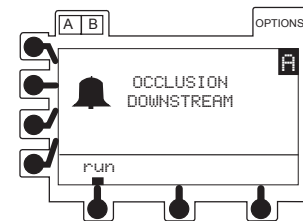
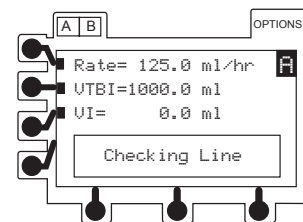
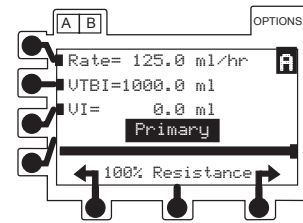
 Monitoring Options (Continued)

► Detection of Downstream Occlusions: (Continued)

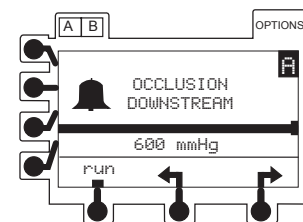
When using the Resistance or High Resistance monitoring mode, an **OCCLUSION DOWNSTREAM** condition is detected when the measured resistance reaches 100% of scale. For the Resistance mode, 100% results from a resistance producing 2 mmHg per ml/hr of flow. For the High Resistance mode, 100% results from a resistance producing 6 mmHg per ml/hr flow. An **OCCLUSION DOWNSTREAM** condition will also be detected when a fixed pressure limit is exceeded. This limit may be set, by qualified service personnel, from 1 mmHg to 600 mmHg.

In either case, one of the following will occur:

- If **AutoRestartPlus** feature is on, instrument will notify clinician with a **Checking Line** message and audible tone. (See **AutoRestartPlus** section for further details.)
- If **AutoRestartPlus** feature is off, instrument will notify clinician with an **OCCLUSION DOWNSTREAM** alarm.



Resistance and High Resistance Monitoring



Pressure Monitoring

 Monitoring Options (Continued)

► Detection of Upstream Occlusions:

If the flow pathway between the fluid container and the AccuSlide® Flow Regulator is obstructed due to kinked tubing, a closed clamp or an improperly installed set, then an **UPSTREAM OCCLUSION** condition exists.

Depending on where the upstream path is occluded, flow may continue for a fraction of a ml before the **UPSTREAM OCCLUSION** alarm is produced. At high infusion rates, the instrument will take relatively little time to alarm. At low infusion rates, a longer time will elapse before the instrument detects the condition and alarms. In either case, some flow continues from the instrument during the time prior to the alarm, due to the elastic behavior of the tubing between the occlusion site and the pumping mechanism.

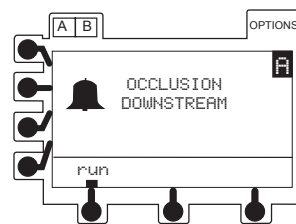
If an **UPSTREAM OCCLUSION** alarm does occur, investigate and remedy the cause. Ensure that the upstream flow path (tubing, etc.) is free of obstructions, that any clamp is open and that the blue flow control on the AccuSlide® Flow Regulator is in the open (up) position before resuming the infusion.

When the instrument detects an Upstream Occlusion condition, it will present the message **UPSTREAM OCCLUSION**, sound the audio alarm and stop infusion. In certain conditions, the upstream alarm system may briefly pause the instrument and present the **Checking Line** message for ten seconds to confirm or rule out the presence of an occlusion. If the occlusion condition is determined not to exist, flow will resume and no alarm is produced.

 AutoRestartPlus

The AutoRestartPlus feature provides the ability to automatically continue an infusion if downstream resistance or pressure measurements indicate that an occlusion condition has cleared within a 40 second **Checking Line** period (excluding High Resistance monitoring mode). If the condition is not cleared, the **OCCLUSION DOWNSTREAM** alarm occurs and infusion is stopped until manually restarted.

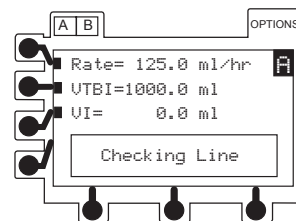
**NOTE:** In the High Resistance monitoring mode the **Checking Line** alert may result in an **OCCLUSION DOWNSTREAM** alarm, even if the occlusion has been cleared.



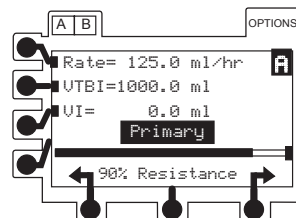
 AutoRestartPlus (Continued)

The **Checking Line** message and tone are presented whenever a resistance or pressure measurement exceeds its alarm threshold.

- In Resistance monitoring modes, the **Checking Line** period is caused by a measured resistance of 100% or a pressure level exceeding a configured threshold. This pressure threshold is separate from the Pressure mode threshold.

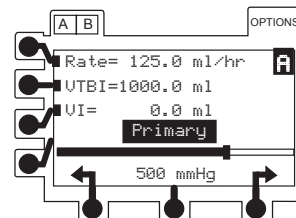



If resistance measurements initiate the **Checking Line** condition, the channel will continue infusing in order to determine if the measured flow resistance has changed. In the Resistance monitoring mode, if the measured flow resistance falls to any value below 100%, the channel will resume normal operating conditions automatically (excluding High Resistance monitoring mode).



In a Resistance monitoring mode, pressure measurements initiate the **Checking Line** period when the pressure exceeds the configured limit. If the pressure falls to less than one-third of the configured limit within 40 seconds, normal flow resumes.

- In the Pressure monitoring mode, the **Checking Line** period is caused by pressure exceeding the alarm limit. If the pressure falls to less than one-third of the alarm limit within 40 seconds, normal flow resumes. The Adjustable Pressure mode allows the operator to control the pressure alarm limit.





Qualified service personnel can turn off this feature or program from 1 to 9 restarts. In the High Resistance monitoring mode, restarts do not occur for resistance measurements. After the programmed number of restarts has occurred, the channel will immediately alarm **OCCLUSSION DOWNSTREAM** when pressure or flow resistance conditions indicate an occlusion. The programmed number of restarts become available again when  or the soft key labeled **run** is pressed.

 Resistance Alert

The Resistance Alert provides an early warning of increasing flow resistance of the IV line/site. The Resistance Alert marker can be set from 0% to 100% of scale in 5% increments.

Qualified service personnel can turn this Alert feature on or off and set a power-on default alert level.

► To Set Alert Marker:

Press either  or  soft key to numerically display present alert level marker. Vertical line on resistance bar graph visually indicates alert level.

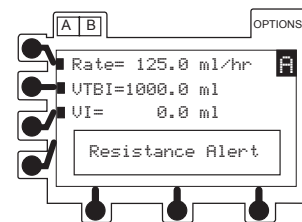
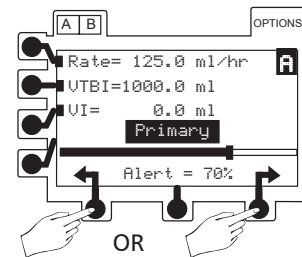
- Each additional press of either arrow soft key will increase or decrease alert level marker and numeric value by 5%.

► If Flow Resistance Exceeds Alert Level Marker:

The instrument will notify the clinician with a **Resistance Alert** message and alert tone.

The channel will continue to infuse and the message and tone will continue until one of the following occurs:



- Resistance of IV line/site falls below Alert level marker.
- Resistance Alert level marker is increased above current measured resistance value.
- Resistance rises to 100%, initiating a **Checking Line** or **OCCCLUSION DOWNSTREAM** condition.



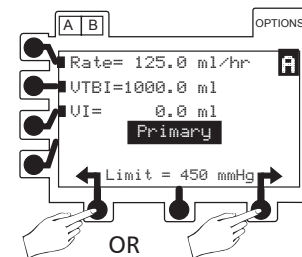
 Adjustable Pressure Alarm

In the Adjustable Pressure monitoring mode, the pressure alarm limit may be varied from 25 mmHg to 600 mmHg, in 25 mmHg increments. Qualified service personnel can turn the adjustment feature on or off and set a default alarm level.

► To Set Alarm Limit Marker:

Press either  or  soft key to numerically display present alarm limit.

- Each additional press of either arrow key will change alarm limit by 25 mmHg in corresponding direction.



 Adjustable Pressure Alarm (Continued)






► If Pressure Exceeds Pressure Alarm Limit:

Instrument will notify clinician.

- If AutoRestartPlus is active and restarts are available, a visual and audio **Checking Line** alert will occur. (Refer to AutoRestartPlus description.)

Otherwise, an **OCCCLUSION DOWNSTREAM** alarm occurs and channel stops infusing.

► Pressure Monitoring using Automatic Baseline Calibration:

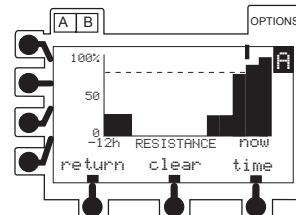
- Each activation of  will automatically establish a pressure baseline. First activation of  will set maximum baseline. Subsequent activations of  will allow baseline to decrease but not increase above maximum baseline.
- For an accurate pressure measurement ensure that, prior to activation of , pressure has not built up in IV line due to either occlusion or flow from other instruments through a common catheter.
- When loading a set connected to a small diameter catheter, wait at least five seconds after loading set before activating . This will allow pressure generated by loading process to dissipate and sensor to stabilize. (Very small PICC catheters; such as, 28 gauge/1.2 French, may require 60 seconds or more for stabilization.)
- When multiple instruments are infusing through a common small diameter catheter, pressure measurement accuracy can be optimized by temporarily stopping all infusions, then restarting all instruments beginning with instrument delivering at lowest rate.
- For additional measurement accuracy and real-time pressure display, pressure baseline may be manually set. See Pressure Baseline description.



 Resistance Trend Graphs

In Resistance and High Resistance monitoring modes, a trend graph displays flow resistance over time. Trend graphs of 15 minutes, 1 hour, 4 hours and 12 hours are available during normal operation. Qualified service personnel can turn this feature off or on.

Downstream Occlusions, which occur in Pressure or Resistance modes, will be indicated by a vertical tick mark at the top of the trend screen.

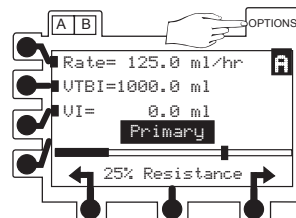


► To View Resistance Mode Trend Graphs:

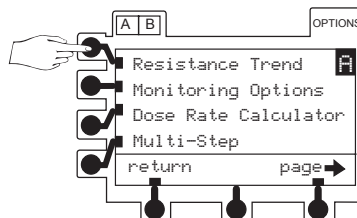
**NOTE:** For dual channel instruments, select the desired channel, as necessary. The trend graph is not available while the split screen is displayed.

**NOTE:** After the instrument has been off for more than six hours, trend graphs are cleared and the time base is reset to 15 minutes.

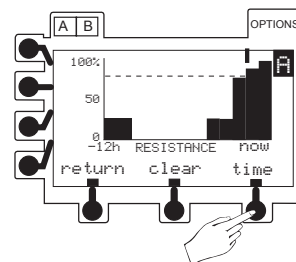
1. Press **OPTIONS**.
  - Options page will appear.



2. Press **Resistance Trend**.
  - A trend graph will appear.



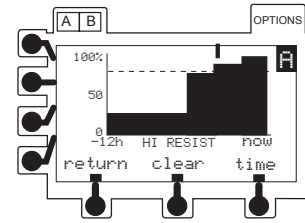
3. Press **time** to change graph time frame.
  - A dashed horizontal line represents current optional resistance alert level.
  - Gaps in graph may indicate noninfusing conditions; such as, turned off, on hold, in alarm, etc.



 Resistance Trend Graphs (Continued)

► To View Resistance Mode Trend Graphs: (Continued)

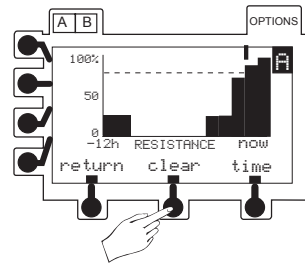
- If channel has been placed in Pressure Monitoring mode for some portion of a trend graph window, resistance data is not available and zero values are plotted.
- A bar at top of graph indicates an occlusion.



**NOTE:** When viewing Resistance Trend Graphs in the High Resistance mode, *HI RESIST* will be displayed under the graph.

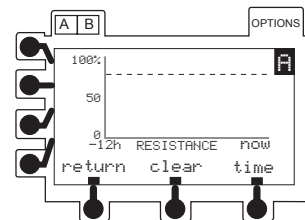
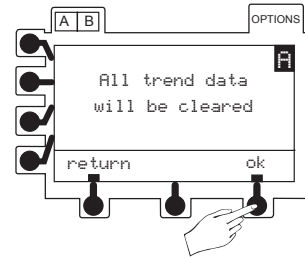
► To Clear Resistance Trend Graphs:

1. Press **clear** to clear graphed data.



2. Press **ok**.

- All data will be cleared from graphs.





 Resistance Trend Graphs (Continued)

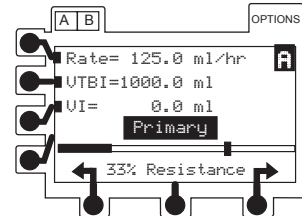
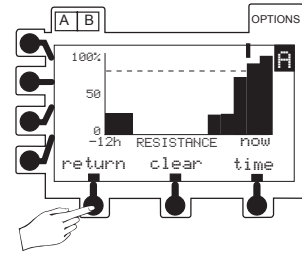
► To Return to Normal Operating Screen:

Press **return**.

- Normal operating screen will appear.

**NOTE:** Any of the following events will also turn off the trend graph.

- Pressing  (dual channel instrument only).
- Pressing .
- An alarm.
- Dual channel instrument Trend Graphs will disappear after one minute and be replaced with a split screen display if both channels are infusing.



 Pressure Trend Graphs

In Pressure Monitoring mode, a trend graph displays monitored pressure over time. Trend graphs of 15 minutes, 1 hour, 4 hours and 12 hours are available during normal operation. Qualified service personnel can turn this feature off or on.

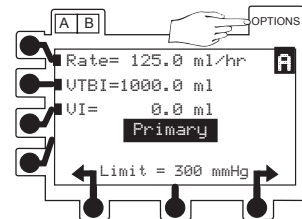
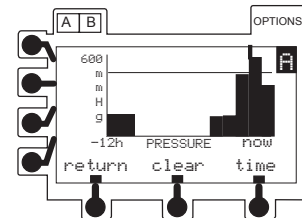
Downstream Occlusions, which occur in Pressure or Resistance modes, will be indicated by a vertical tick mark at the top of the trend screen.

► To View Pressure Mode Trend Graphs:

**NOTE:** For dual channel instruments, select the desired channel, as necessary. The trend graph is not available while the split screen is displayed.

**NOTE:** After the instrument has been off for more than six hours, trend graphs are cleared and the time base is reset to 15 minutes.

1. Press .
  - Options page will appear.

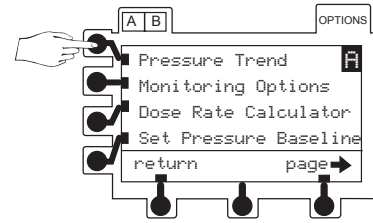


 Pressure Trend Graphs (Continued)

► To View Pressure Mode Trend Graphs: (Continued)

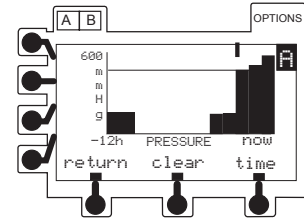
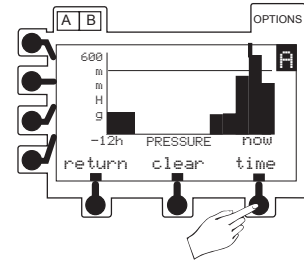
2. Press **Pressure Trend**.

- A trend graph will appear.



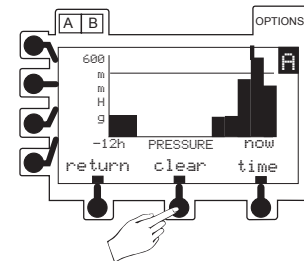
3. Press **time** to change graph time frame.

- A solid horizontal line represents current pressure alarm limit level.
- Gaps in graph may indicate noninfusing conditions; such as, turned off, on hold, in alarm, etc.
- If channel has been placed in a Resistance Monitoring mode for some portion of a trend graph window, pressure data is not available and zero values are plotted.



► To Clear Pressure Trend Graphs:

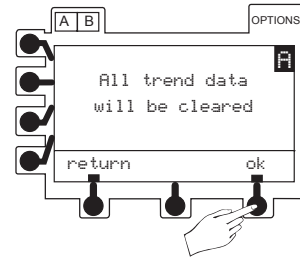
1. Press **clear** to clear graphed data.



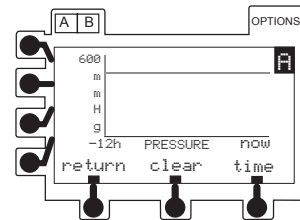
 Pressure Trend Graphs (Continued)

► To Clear Pressure Trend Graphs: (Continued)

2. Press **ok**.

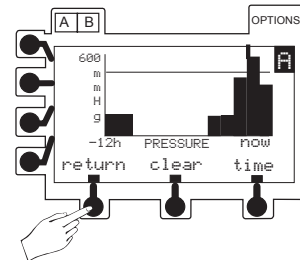


- All data will be cleared from graphs.





► To Return to Normal Operating Screen:

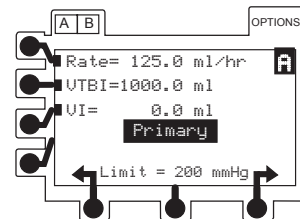
Press **return**.




- Normal operating screen will appear.

**NOTE:** Any of the following events will also turn off the trend graph.

- Pressing  (dual channel instrument only).
- Pressing .
- An alarm.
- Dual channel instrument Trend Graphs will disappear after one minute and be replaced with a split screen display if both channels are infusing.




 Pressure Baseline


The Pressure Baseline feature increases the accuracy of the pressure display, pressure trend graph, **OCCLUSSION UPSTREAM** and **OCCLUSSION DOWNSTREAM** alarms, and provides real-time bar graph and numeric display of line pressure.

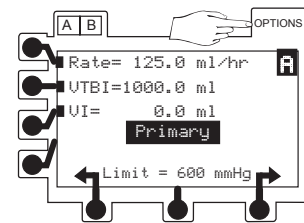
Qualified service personnel can turn this feature off or on.

► To Manually Set Pressure Baseline While Operating in Adjustable Pressure Mode:

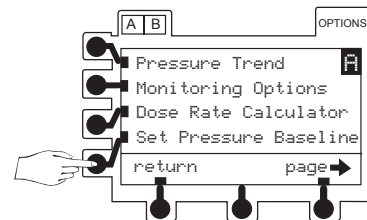
**NOTE:** For dual channel instruments, select the desired channel as necessary. The pressure bar graph is not shown when the split screen display is active.

1. Press channel's  key to place channel on hold. (All infusions through line must be on hold.)

2. Press .
  - Options screen will appear.

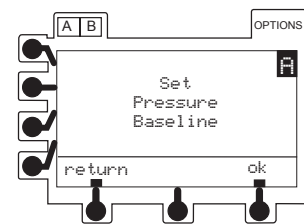


3. Press **Set Pressure Baseline**.



- **Set Pressure Baseline** screen will appear.

**NOTE:** To return to the normal screen without setting the baseline, press **return**.

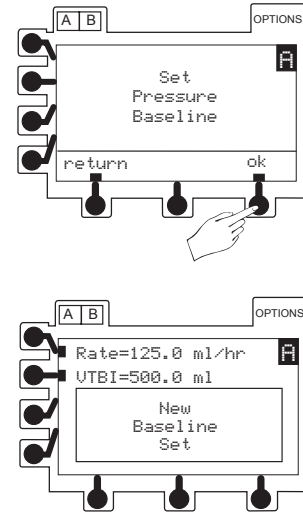


4. Verify no pressure, due to occlusion or other infusions through a common line, are present in IV line at this time.

 Pressure Baseline (Continued)

► To Manually Set Pressure Baseline While Operating in Adjustable Pressure Mode: (Continued)

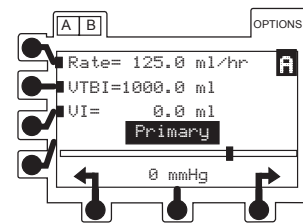
5. Press **ok**.



6. Press  to start infusion.

**NOTE:** The auto pressure baseline calibration will remain in effect until the instrument is turned off, the latch is opened, the set is reloaded, or the Pressure Baseline function is performed again. Setting the manual baseline overrides the auto baseline until the instrument is turned off, the latch is opened, set is loaded, or another manual baseline is set.

**NOTE:** Setting a manual Pressure Baseline displays a real-time bar graph and numeric pressure readings. The vertical line on the pressure bar graph visually indicates the pressure limit.





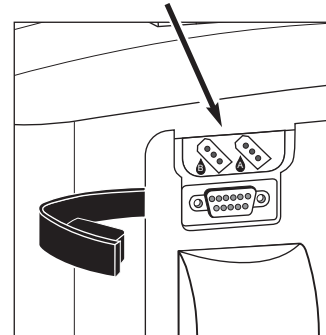
## Flow Sensor

The optional Flow Sensor notifies users of empty containers and/or upstream occlusions. A handle cap accessory is available for storing the flow sensor when not in use.

**NOTE:** If a flow sensor is not connected to the instrument, ensure protective plugs are installed at the connector site to prevent entry of foreign material.

1. Plug a Model 180 Flow Sensor into applicable channel connector on back of instrument.

Flow Sensor Connectors

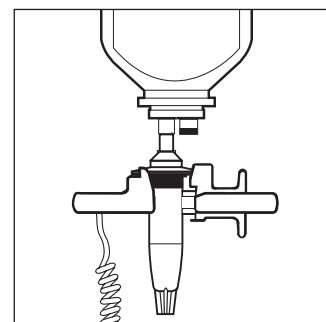


2. Attach flow sensor to upper portion of drip chamber.
  - When using flow sensor, correct placement is essential for proper operation. Drip chambers of some administration sets have a flange at top to which flow sensor can be attached. Attachment on flange will ensure proper placement.

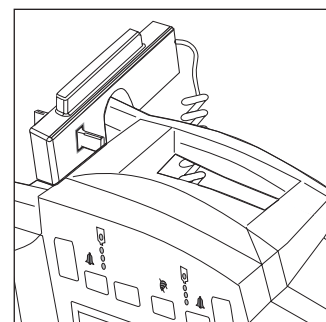
Upper surface of flow sensor should be slightly below drop-forming orifice but above level of fluid in drip chamber.

Ensure fluid level in drip chamber is at fill line and sensor optics are clean. **Fluid level in drip chamber must be checked/re-established after each empty container condition.**

- When using flow sensor option while ambulating or transporting a patient from one area to another, use care to avoid excessive swinging of solution container(s).



3. Attach flow sensor to instrument handle when not in use.





## Flow Sensor (Continued)

**NOTE:** The flow sensor should be routinely cleaned with warm water while actuating the slider, then dried thoroughly.

**NOTE:** See the “Radio Frequency Interference” information in the Precautions Section.

**NOTE:** Infusing fluids which form smaller drops, through a 60 drops/ml set, at high rates may result in a “No Upstream Flow Detected” alarm. (This is because the small, rapidly falling drops form a continuous stream which does not trigger the flow sensor.) In this event, unplug the flow sensor from the instrument.

### CAUTION

Do not use solvents or cleaning agents. Damage to plastic parts of the flow sensor could occur.

## Drug Specific Dose Rate Calculator (DRC)

This feature allows the clinician to select a drug name to calculate a volumetric rate or a dose rate for continuous drug infusions and is based on parameters such as drug dosage, patient weight, concentration, etc. Once calculated, the instrument will display the drug name selected on the infusion screen. Generic calculation (**Drug?**) is provided for drugs not available on the drug list.

When the DRC VTBI has counted down to 0.0 ml, the channel will switch to the preset KVO rate or remain at the current rate, whichever is less.

Qualified service personnel can turn the Dose Rate Calculator feature on or off, and limit the list of drug names available.

### Facts About DRC

- The patient weight, drug concentration and diluent volume cannot be changed while infusing. Changes to any of these items while on hold will recalculate the volumetric rate to maintain the dose rate.
- All drug names are generic, and when necessary, they are abbreviated. Dual channel instrument only: Drug names longer than ten letters are abbreviated if displayed on the split screen.
- The **Drug?** selection can be used for calculating when a particular drug name is not available on the drug list.
- When a drug amount is greater than 10,000 units (Un), a K is used to indicate a value multiplied by 1,000 (for example, 1,000,000 = 1,000K).
- DRC cannot be used in conjunction with secondary or other operating modes.

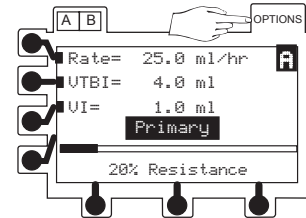
### WARNING

Ensure the correct entry of all drug calculation infusion parameters. Consult the drug manufacturer’s labeling for information concerning appropriate administration techniques and dosages.

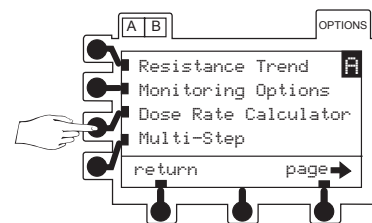
## To Enter a New Program

Select the desired channel, as necessary. The channel must be infusing in the primary mode or on hold in the primary mode, secondary mode, or a Loading Dose program.

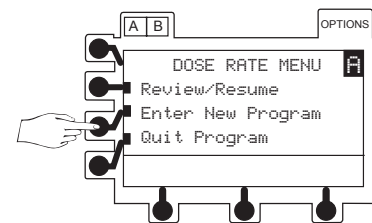
1. Press **OPTIONS**.
  - Options page will appear.



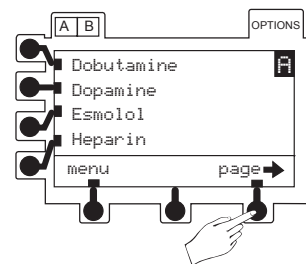
2. Press **Dose Rate Calculator**.
  - DOSE RATE MENU will appear.



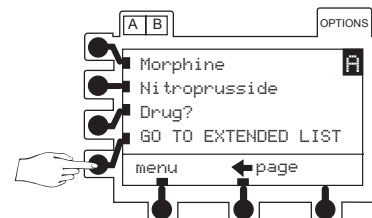
3. Press **Enter New Program**.
  - A list of drug names will be displayed.



4. Press **← page** or **page →** to view additional drug name selections.



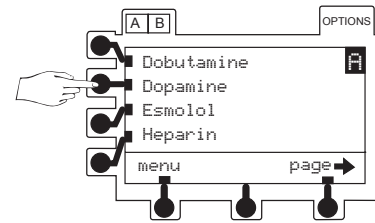
5. Press **GO TO EXTENDED LIST** (if shown) to view full list of drug names.
  - If desired drug name is listed, proceed to step 6.
  - If desired drug name is not listed, proceed to step 11.



To Enter a New Program (Continued)

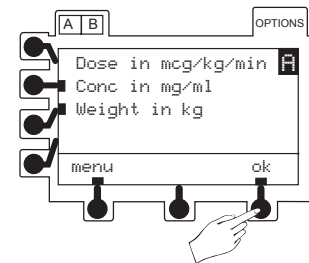
► To Program DRC With a Listed Drug Name:

6. Press soft key next to a drug name to select it.
  - Appropriate dose units for selected drug will be displayed. Dose units cannot be changed.




7. Press **ok** to approve all displayed information and advance to first setup page (step 16).

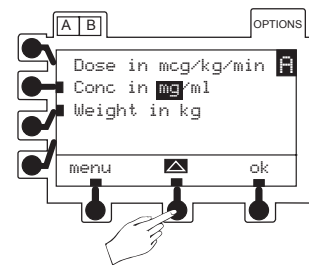
OR (step 8)



8. To change concentration, height, or weight units, press soft key next to a unit to select it.
  - Weight or height unit selections will be displayed only if appropriate for drug selected.

-  soft key will appear.

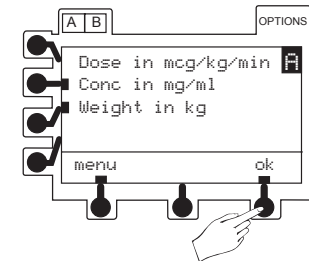
9. Press and release  to scroll through units available. Press **ENTER** when correct unit is displayed.



*Concentration: mcg, mg, gm, Un, mUn, or mEq*  
*Weight: kg or lb*  
*Height: cm or inches*

10. Press **ok** to approve all displayed information and advance to first setup page (step 16).

- To calculate volumetric rate, proceed to step 16.
- To calculate dose rate, proceed to step 20.



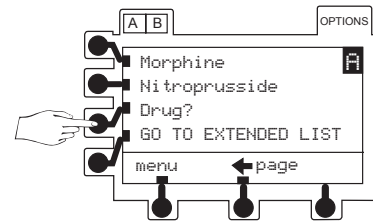
To Enter a New Program (Continued)

► To Program DRC When Drug Name is Not Listed:

11. Press **Drug?** to use generic dose calculation feature.

- Dose units will be displayed.
- First segment will be highlighted.

Press **ok** at any time to approve all displayed information and advance to first setup page.



12. If dose unit is appropriate, press **ENTER**.

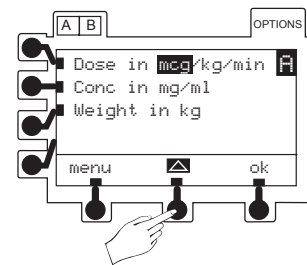
OR

Press and release  to scroll through units available.

Press **ENTER** when correct unit is displayed.

- Concentration unit will be highlighted.

Repeat steps for other two dose unit segments.



**NOTE:** Day\* is defined as continuous delivery for 24 hours per day.

**Dose Units:** mcg, mg, gm, Un, mUn, or mEq  
- kg or m<sup>2</sup>  
- min, hr, or day\*

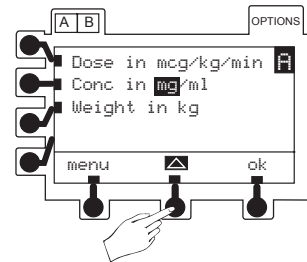
13. If concentration unit is appropriate, press **ENTER**.

OR

Press and release  to scroll through units available.

Press **ENTER** when correct unit is displayed.

- Weight or height unit selections will be displayed only if appropriate for dose unit selected.



**Concentration:** mcg, mg, gm, Un, or mEq

To Enter a New Program (Continued)

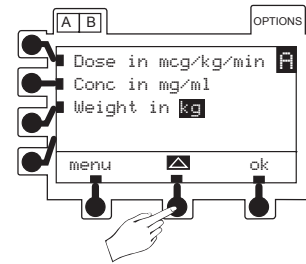
► To Program DRC When Drug Name is Not Listed:  
(Continued)

14. If weight or height unit is appropriate, press **ENTER**.

OR

Press and release  to scroll through units available.

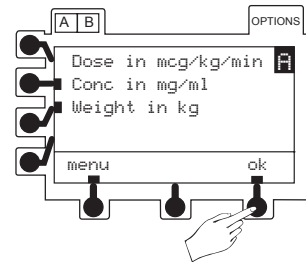
Press **ENTER** when correct unit is displayed.



*Weight: kg or lb  
Height: cm or inches*

15. Press **ok** to approve all displayed information and advance to first setup page.

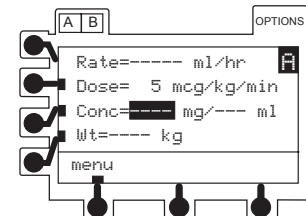
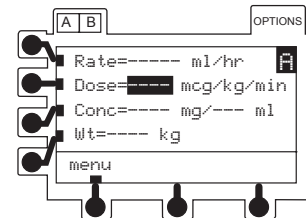
- To calculate volumetric rate, proceed to step 16.
- To calculate dose rate, proceed to step 20.



► To Calculate Volumetric Rate:

16. Use numeric keypad to enter dose rate. Press **ENTER**.

- Concentration will be highlighted.

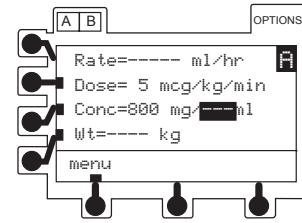


To Enter a New Program (Continued)

► To Calculate Volumetric Rate: (Continued)

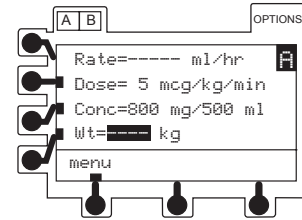
17. Use numeric keypad to enter concentration. Press **ENTER**.

- Diluent volume will be highlighted.



18. Use numeric keypad to enter diluent volume. Press **ENTER**.

- If applicable, patient weight and/or height will be highlighted.

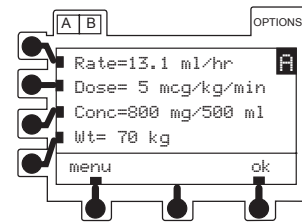


19. Use numeric keypad to enter weight and/or height. Press **ENTER**.

- Instrument will automatically calculate and display volumetric infusion rate in ml/hr.

**NOTE:** ↑↑↑↑↑ or ↓↓↓↓↓ will appear if a calculated value is outside the display's range.

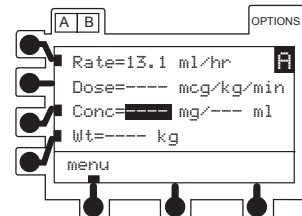
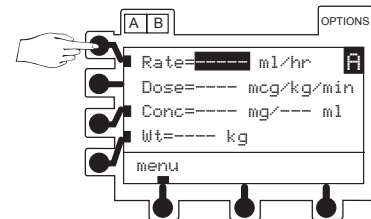
- Use soft key to highlight value you want to change.
  - Use numeric keypad to enter value.
  - Press **ENTER** to accept change.
- Proceed to step 24.



► To Calculate Dose Rate:

20. Press **Rate** to move highlight to volumetric rate. Use numeric keypad to enter rate. Press **ENTER**.

- Concentration will be highlighted.

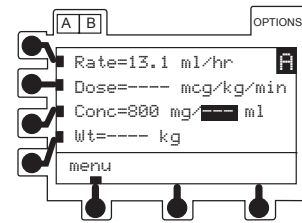


To Enter a New Program (Continued)

► To Calculate Dose Rate: (Continued)

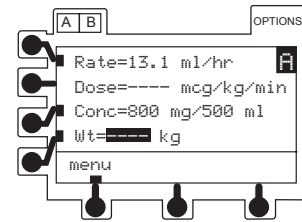
21. Use numeric keypad to enter concentration. Press **ENTER**.

- Diluent volume will be highlighted.



22. Use numeric keypad to enter diluent volume. Press **ENTER**.

- If applicable, patient weight and/or height will be highlighted.

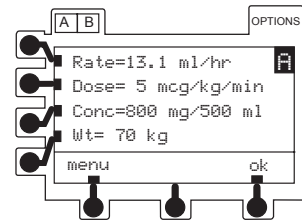


23. Use numeric keypad to enter weight and/or height. Press **ENTER**.

- Instrument will automatically calculate and display dose rate.

**NOTE:** ↑↑↑↑↑ or ↓↓↓↓↓ will appear if a calculated value is outside the display's range.

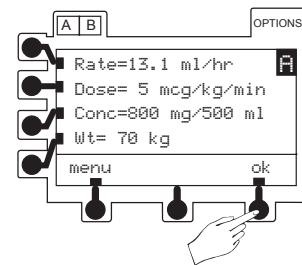
- Use soft key to highlight value you want to change.
- Use numeric keypad to enter value.
- Press **ENTER** to accept change.



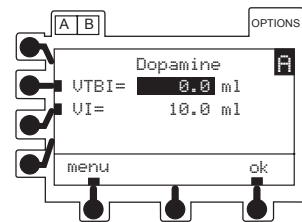
- Proceed to step 24.

24. Verify all values and units. Press **ok** to approve all calculated and displayed information.

**NOTE:** If the channel is running in the primary mode while setting up the calculation, proceed to step 28.



- Next setup page will appear.
- VTBI will be highlighted.



To Enter a New Program (Continued)

► To Calculate Dose Rate: (Continued)

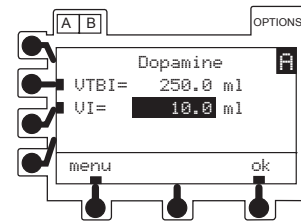
25. Use numeric keypad to enter VTBI value. Press **ENTER**.

**NOTE:** If the flow sensor option is being used, Dose Rate VTBI can be turned off by selecting VTBI, then pressing **CLEAR**.

OR

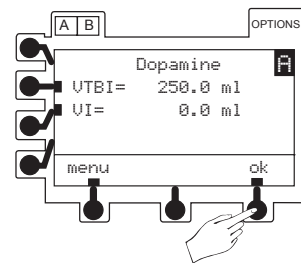
Dose Rate VTBI can be deleted from VTBI/VI screen and main hold page (Programmable Features).

- VI will be highlighted.

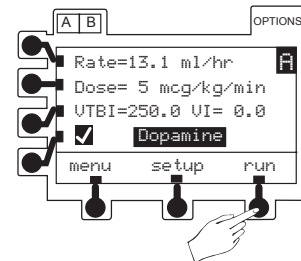


26. To clear VI, press **CLEAR** or 0 (zero key). Press **ENTER**.

27. Press **ok** to approve all displayed information and advance to main hold page.



28. Press **RUN HOLD** or **run** to start infusion.



Making Changes During DRC Program

Select the desired channel, as necessary. The channel does not need to be on hold to change volumetric rate, dose rate, or VTBI, to clear the VI or to view more information.

**NOTE:** The instrument will recalculate the program values if the volumetric or dose rate, drug amount, diluent volume, weight, or height are changed.

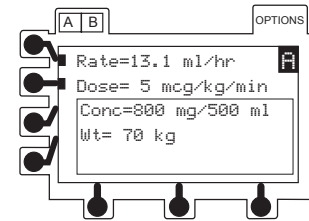
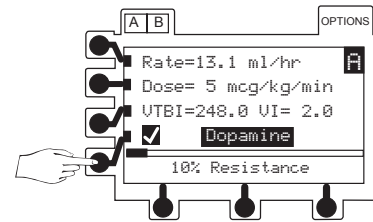


Making Changes During DRC Program (Continued)

► To View More Information on Dose Rate Setup:

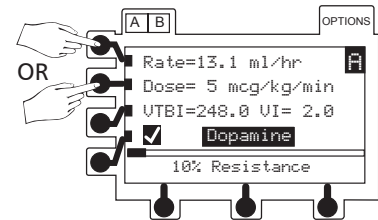
Press .


- Additional Dose Rate setup information will be displayed for a short interval.




► To Change Volumetric Rate or Dose Rate:

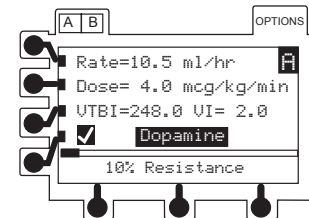
1. Press **Rate** or **Dose** to highlight value.



2. Use numeric keypad to enter new value. Press .

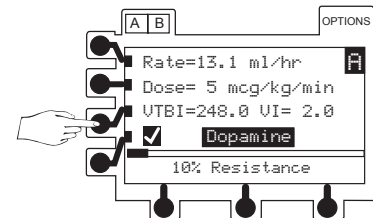
- New/recalculated value takes effect as soon as  is pressed.

**NOTE:** ↑↑↑↑ or ↓↓↓↓ will appear in the dose field if rate titration causes the calculated dose value to be outside the display's range. Recheck the entered parameters.



► To Change VTBI:

1. Press **VTBI** to highlight value.



**Making Changes During DRC Program (Continued)**

► **To Change VTBI: (Continued)**

- Use numeric keypad to enter new value. VI will temporarily disappear. Press **ENTER**.

**NOTE:** If the flow sensor option is being used, Dose Rate VTBI can be turned off by selecting VTBI and then pressing

**CLEAR**.

OR

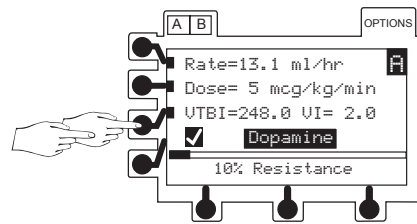
Dose Rate VTBI can be deleted from VTBI/VI screen and main hold page (Programmable Features).

► **To Clear VI:**

- Press **VTBI** soft key twice to move highlight to VI.

OR

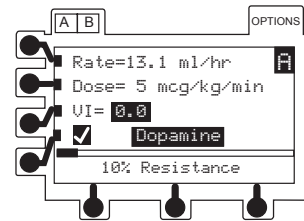
Press **VTBI** soft key and then press **ENTER**.



- Press **CLEAR** or 0 (zero key).

- VTBI will temporarily disappear and VI will be highlighted.

Press **ENTER**.

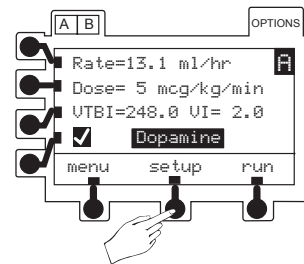


► **To Change Weight or Height:**

**NOTE:** Any change to the weight or height will recalculate the volumetric rate to maintain dose rate.

- Press **RUN HOLD** to place channel on hold.

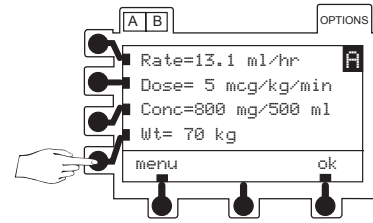
- Press **setup** to return to setup page.



Making Changes During DRC Program (Continued)

► To Change Weight or Height: (Continued)

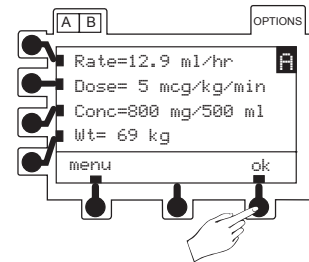
3. Press **Wt** or **Ht**.



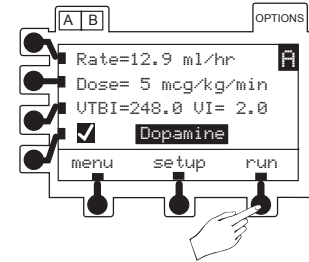
4. Use numeric keypad to enter new value. Press **ENTER**.

- Recalculated volumetric rate will be displayed.

5. Press **ok** to approve all displayed information and advance to main hold page.




6. Press **RUN/HOLD** or **run** to resume infusion.

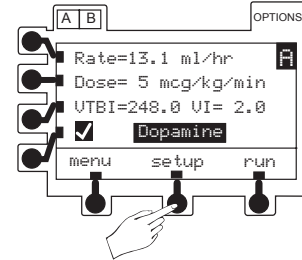



Making Changes During DRC Program (Continued)

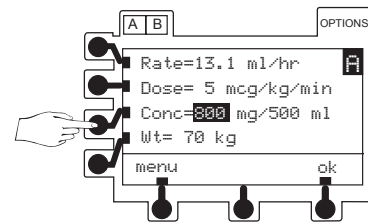
► To Change Concentration:


**NOTE:** Any change to the drug amount or diluent volume will recalculate the volumetric rate to maintain dose rate.

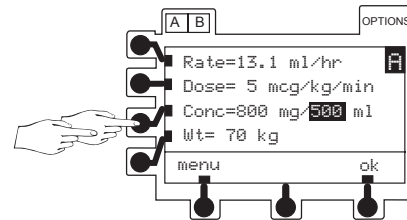
1. Press  to place channel on hold.
2. Press **setup** to return to setup page.



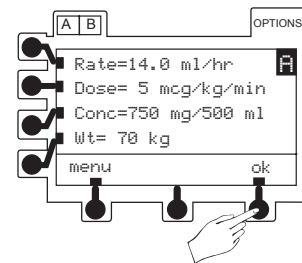
3. Press **Conc** once to select concentration value. Press **Conc** twice to move highlight to diluent value or press **Conc** and then .



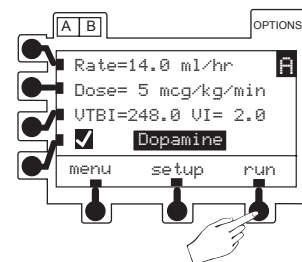
4. Use numeric keypad to enter new value. Press .
  - Recalculated volumetric rate will be displayed.



5. Press **ok** to approve all displayed information and advance to main hold page.



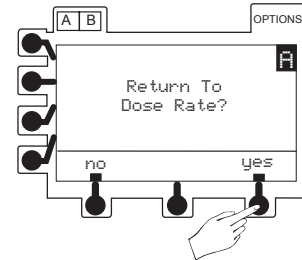
6. Press  or **run** to resume infusion.



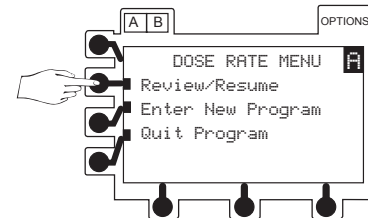
### Resuming an Interrupted DRC Program

The channel will retain its place in the program up to six hours if the instrument is turned off. After six hours, the channel will restart at the primary mode setup page.

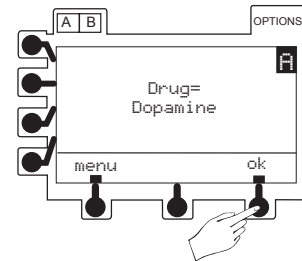
1. Press **POWER**.
  - **Return to Dose Rate?** page will appear.
2. Press **yes**.
  - Pressing **no** will return to primary setup page. Verify settings prior to resuming an infusion.



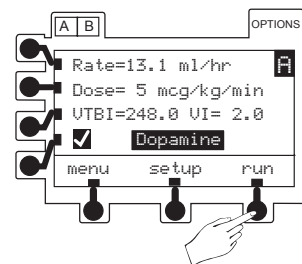
3. Press **Review/Resume** to access setup parameters.



4. Press **ok** to verify drug being infused and advance through Dose Rate setup pages.



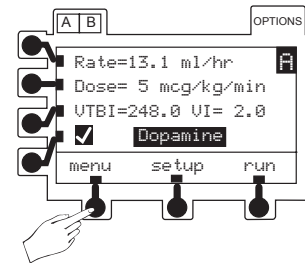
5. Press **RUN HOLD** or **run** to resume infusion from main hold page.



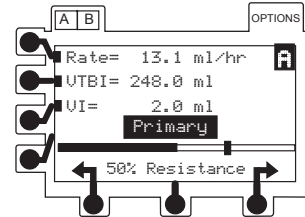
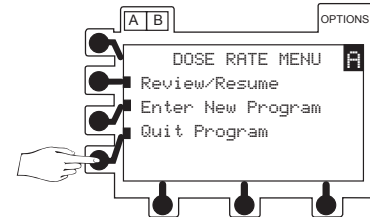
To Quit DRC Program

Channel must be on hold.

1. Press **menu**.



2. Press **Quit Program** to return to primary setup page.



 Multi-Step Program

This feature allows a sequential drug delivery program (up to nine steps) to be set, delivering volumes of fluid at different rates during each step. This allows the clinician to set up the instrument parameters once and deliver a step profile, eliminating the need to change the rate and VTBI after each step of the infusion.

The infusion may be programmed in either **Rate and Volume** or **Volume and Time**.

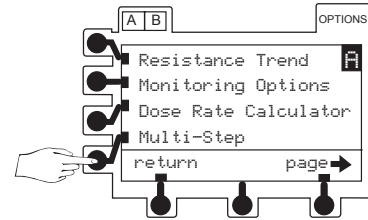
At completion of the last programmed step, the channel will switch to the preset KVO rate or remain at the current rate, whichever is less.

Qualified service personnel can turn the Multi-Step feature on or off.

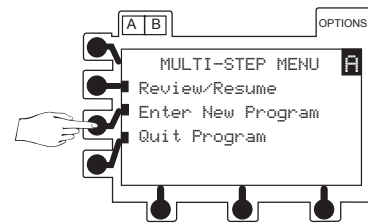
**To Enter a New Program**

Select the desired channel, as necessary. The channel must be on hold in the primary mode, secondary mode, or a Loading Dose program.

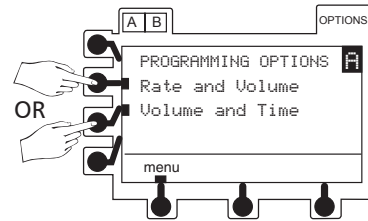
1. Press **OPTIONS**.
  - Options page will appear.
2. Press **Multi-Step**.
  - **MULTI-STEP MENU** will appear.



3. Press **Enter New Program**.

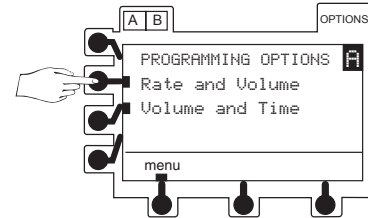


4. Press a soft key to select setup method.
  - If **Rate and Volume** is selected, instrument will calculate step infusion time. Proceed to step 5.
  - If **Volume and Time** is selected, instrument will calculate rate. Proceed to step 10.

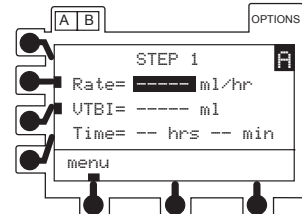


➤ **To Program by Rate and Volume:**

5. Press **Rate and Volume**.



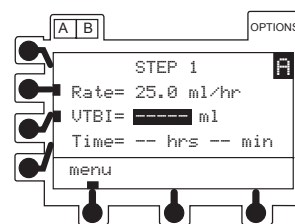
- **STEP 1** of infusion profile will be displayed.
- Rate will be highlighted.



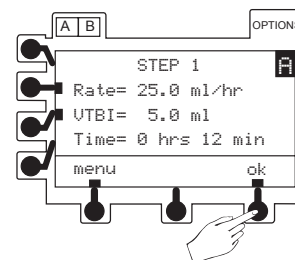
To Enter a New Program (Continued)

► To Program by Rate and Volume: (Continued)

6. Use numeric keypad to enter rate. Press **ENTER**.
  - VTBI will be highlighted.



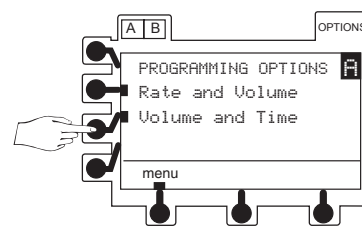
7. Use numeric keypad to enter VTBI. Press **ENTER**.
  - Instrument will automatically calculate and display time in hours and minutes.
8. Press **ok** to approve all displayed information and advance to **STEP 2** of infusion profile.



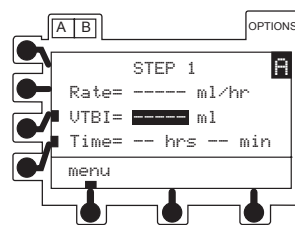
9. Repeat steps 6 through 8 to set up each additional step of infusion profile, then proceed to step 16.

► To Program by Volume and Time:

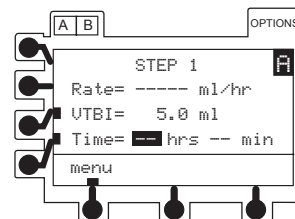
10. Press **Volume and Time**.



- **STEP 1** of infusion profile will be displayed.
- VTBI will be highlighted.



11. Use numeric keypad to enter VTBI. Press **ENTER**.
  - Time (hours) will be highlighted.

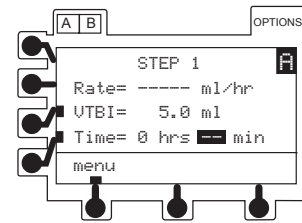




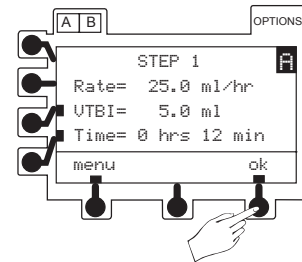
To Enter a New Program (Continued)

► To Program by Volume and Time: (Continued)

12. Use numeric keypad to enter hours. Press **ENTER**.
- Time (minutes) will be highlighted.

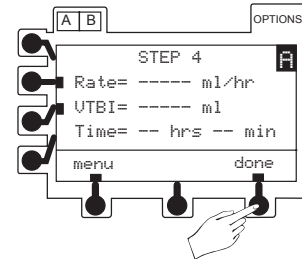


13. Use numeric keypad to enter minutes (0-59) if desired. Press **ENTER**.
- Instrument will automatically calculate and display volumetric rate.

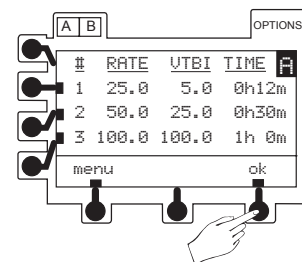


14. Press **ok** to approve all displayed information and advance to **STEP 2** of infusion profile.
15. Repeat steps 10 through 13 to set up each additional step of infusion profile, then proceed to step 16.

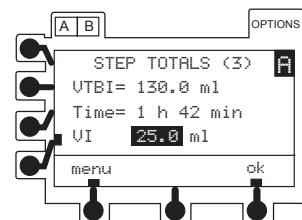
16. When all steps have been entered and **ok'd**, press **done**.
- Review page(s) will display three profile steps at a time.



17. Press **ok** to approve and advance through review page(s).



18. Press **CLEAR** or 0 (zero key) to clear VI if desired. Press **ENTER**.

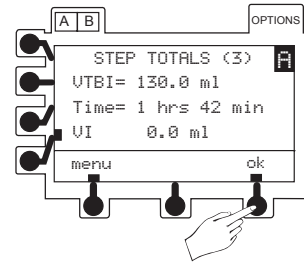


## Multi-Step Program (Continued)

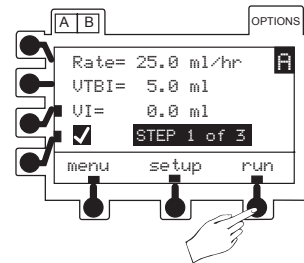
### To Enter a New Program (Continued)

#### ► To Program by Volume and Time: (Continued)

19. Press **ok** to approve STEP TOTALS page.
  - Main hold page will be displayed.



20. Press **RUN HOLD** or **run** to start Multi-Step infusion program.

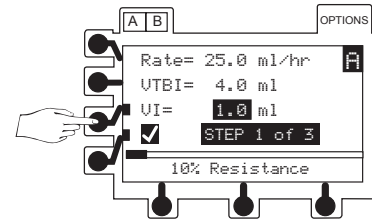


### Making Changes During Multi-Step Program

Select the desired channel, as necessary. The channel does not need to be on hold to clear the VI or to view the totals remaining.

#### ► To Clear Volume Infused:

1. Press **VI**.

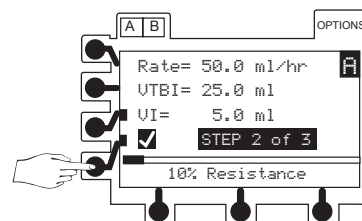


2. Press **CLEAR** or 0 (zero key).
3. Press **ENTER**.

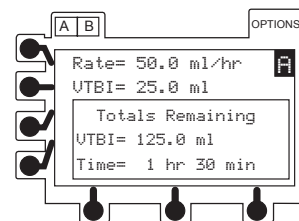
**Making Changes During Multi-Step Program (Continued)**

► To View Totals Remaining in Multi-Step Program:

Press .



- Time and VTBI remaining in Multi-Step program will be displayed for a short interval.



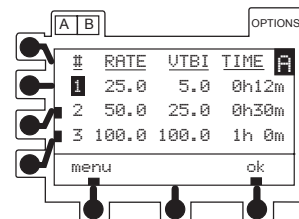
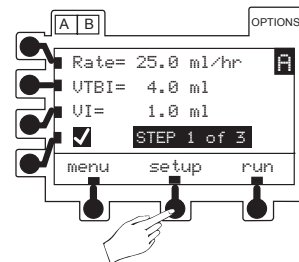
► To View or Edit Multi-Step Program:

The channel must be on hold to view or edit the steps in the program.

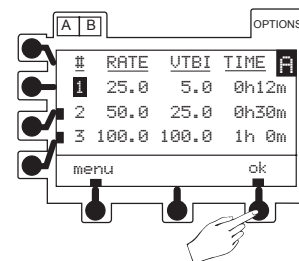
1. Press  to place channel on hold.

2. Press **setup** to return to review page(s).

- A tick mark (■) next to a step on review page(s) indicates it has not started.
- Only steps having a ■ can be edited.
- Completed steps or a step in progress will not have a ■.
- A step number in progress will be highlighted.



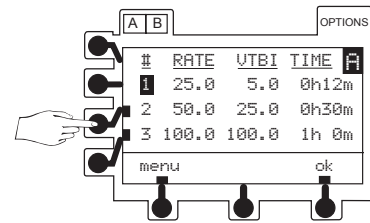
3. Press **ok**, if desired, to advance through review page(s) of program.



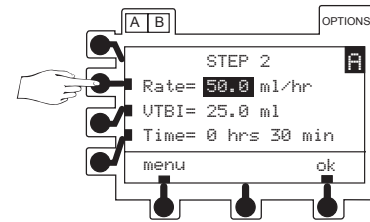
**Making Changes During Multi-Step Program (Continued)**

► To View or Edit Multi-Step Program: (Continued)

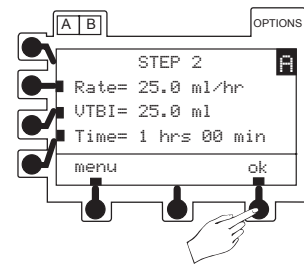
4. Press a soft key to select a step for editing.
  - Step setup page will be displayed.



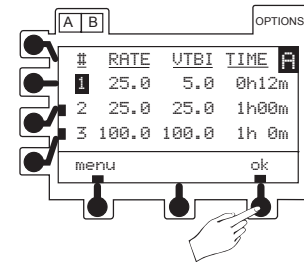
5. Press a soft key to select value for editing.
6. Use numeric keypad to enter new value. Press **ENTER**.



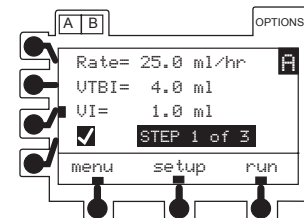
7. Press **ok** when programming is complete, to return to review page(s).



8. Press **ok** to approve review page(s) and **STEP TOTALS** page.



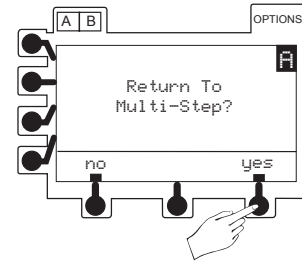
9. Press **RUN/HOLD** or **run** to resume infusion.



**Resuming an Interrupted Program**

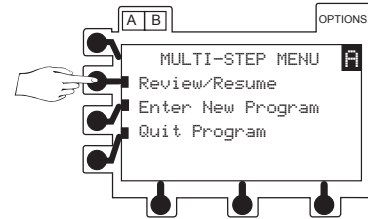
The channel will retain its place in the program up to six hours if the instrument is turned off. The program can be restarted from **STEP 1** or resumed where it left off. After six hours, the channel will restart in the primary mode.

1. Press **POWER**.
  - **Return to Multi-Step?** page will appear.
2. Press **yes**.
  - Pressing **no** will return to primary setup page.



**NOTE:** Verify all settings prior to resuming an infusion.

3. Press **Review/Resume**.
  - **STEP In Progress** page will appear.

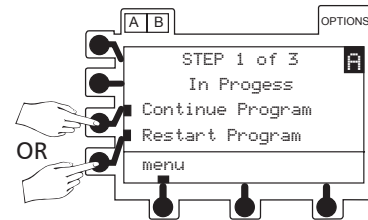


4. Press **Continue Program** to resume program from point of interruption.

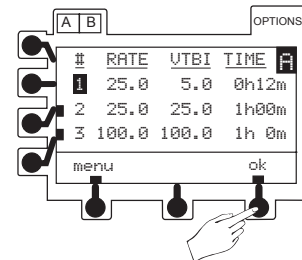
OR

Press **Restart Program** to restart program at beginning of **STEP 1**.

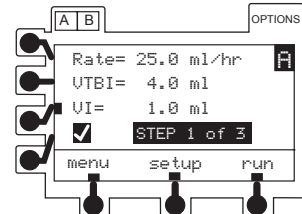
- Review page(s) will appear.



5. Press **ok** to approve review page(s) and **STEP TOTALS** page.



6. Press **RUN HOLD** or **run** to continue or restart program.

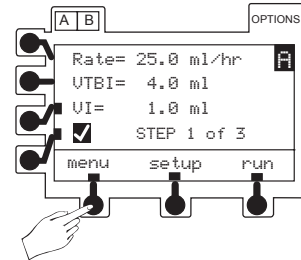


## Multi-Step Program (Continued)

### To Quit Multi-Step Program

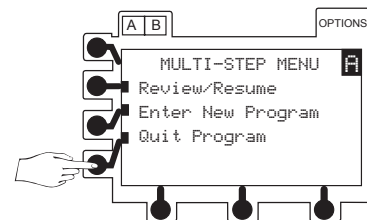
The channel must be on hold.

1. Press **menu**.



2. Press **Quit Program** to return to primary setup page.

**NOTE:** Primary setup page parameters may be different from the **MULTI-STEP MENU**. Verify all parameters prior to resuming infusion.



## Multi-Dose Program

This feature permits the clinician to preprogram 1 to 24 infusions with the same rate and volume, over a period of up to 24 hours.

This feature also offers a delayed start option up to 8 hours and a Dose Complete Alert Option to alert the clinician of the completion of each dose delivered.

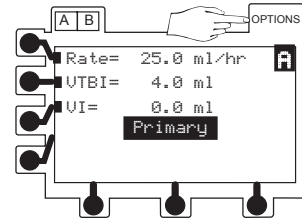
This program requires another infusing line to keep the vein open between programmed doses since there is no KVO infusion between doses or following program completion.

Qualified service personnel can turn the Multi-Dose and Dose Complete Alert Option features on or off.

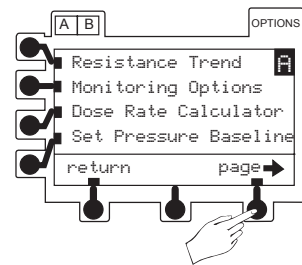
To Enter a New Program

Select the desired channel, as necessary. The channel must be on hold in the primary mode, secondary mode, or a Loading Dose program.

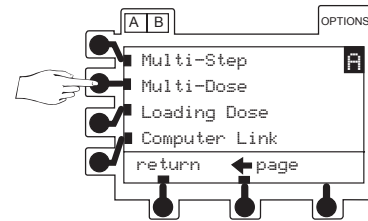
1. Press **OPTIONS**.
  - Options page will appear.



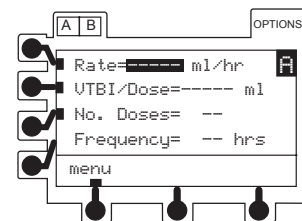
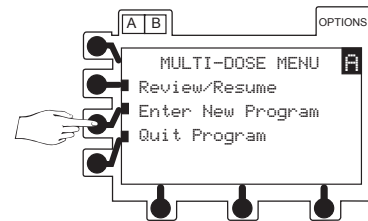
2. Press **← page** or **page →**, as necessary to view additional selections.



3. Press **Multi-Dose**.
  - **MULTI-DOSE MENU** page will appear.

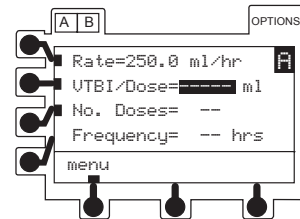


4. Press **Enter New Program**.
  - Setup page will appear.
  - Infusion rate will be highlighted.

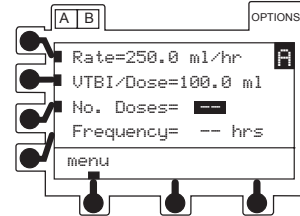


To Enter a New Program (Continued)

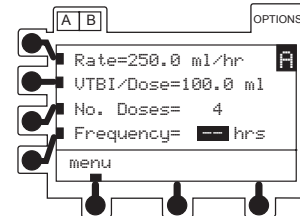
5. Use numeric keypad to enter infusion rate. Press **ENTER**.
  - VTBI/Dose (volume to be infused per dose) will be highlighted.



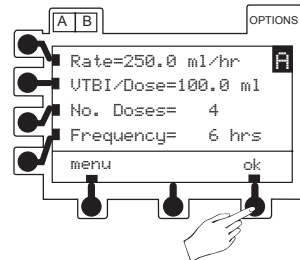
6. Use numeric keypad to enter VTBI/Dose. Press **ENTER**.
  - Number of doses to be given will be highlighted.



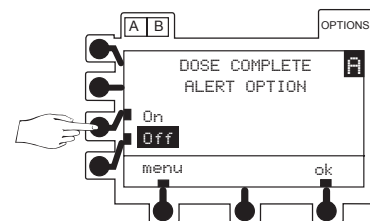
7. Use numeric keypad to enter number of doses. Press **ENTER**.
  - Dose frequency will be highlighted.



8. Use numeric keypad to enter dose frequency (time interval from start of one dose until start of next). Press **ENTER**.
9. Press **ok** to approve all information.
  - If Dose Complete Alert Option is enabled, **DOSE COMPLETE ALERT OPTION** page will appear.



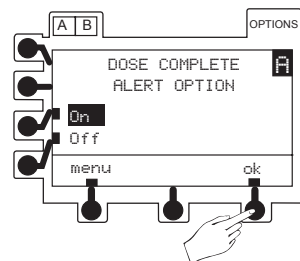
10. Use soft keys to select **On** or **Off**.



11. Press **ok** to advance to time until first dose page.

**NOTE:** All doses must be programmed to start within 24 hours.

- To start first dose immediately, proceed to step 12.
- To delay start of first dose, proceed to step 15.

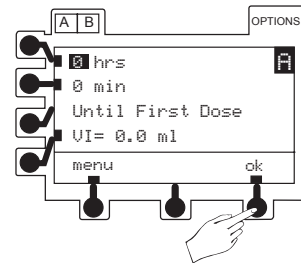




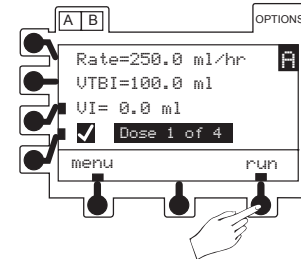
To Enter a New Program (Continued)

► To Start First Dose Immediately After Programming:


12. A displayed time of 0 hours, 0 minutes identifies that first dose will start immediately after programming.
13. Press **ok** to approve and advance to main hold page.

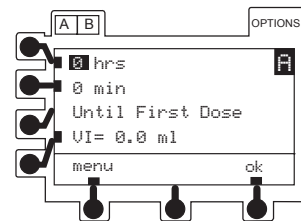



14. Press  or **run** to start infusion.

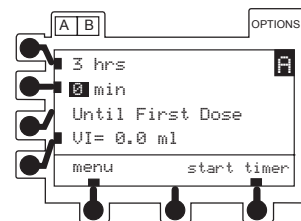


► To Delay Start of First Dose:

15. Use numeric keypad to enter number of hours until first dose. Press .
  - Number of minutes will be highlighted.



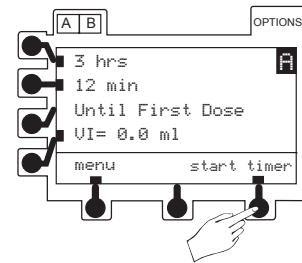
16. Use numeric keypad to enter number of minutes (0 to 59) until first dose. Press .



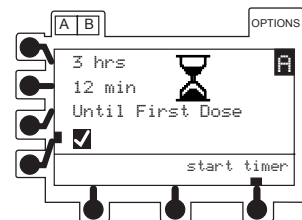
To Enter a New Program (Continued)

► To Delay Start of First Dose: (Continued)

17. Press **start timer** to advance to timer hold page.



- Hourglass icon will flash to indicate timer is counting down to start of dose.
- Dose will automatically start its infusion when timer reaches 0 hours, 0 minutes.



18. Press  to see Multi-Dose programmed information.

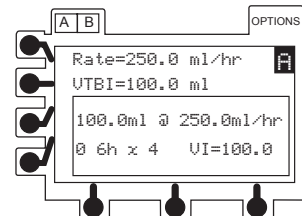
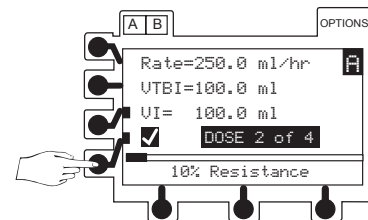
Making Changes During Multi-Dose Program

Select the desired channel, as necessary. The channel does not need to be on hold to view more information.

► To View More Information on Multi-Dose Setup:

Press .

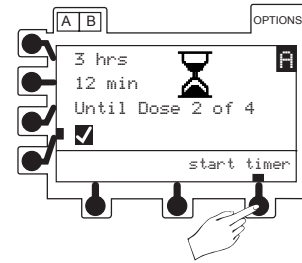
- Additional Multi-Dose setup information will be displayed for a short interval.



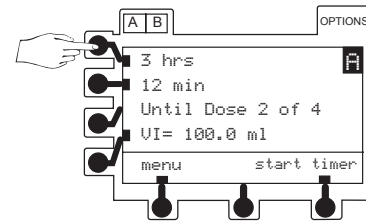
**Making Changes During Multi-Dose Program (Continued)**

► To Change Time Interval Until Next Dose:

1. Press **stop timer**.

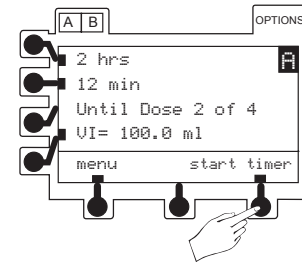


2. Press a soft key to select a value for editing.



3. Use numeric keypad to enter new value. Press **ENTER**.

4. Press **start timer** when editing is complete.

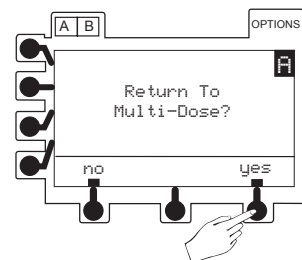


**Resuming an Interrupted Multi-Dose Program**

The channel will retain its place in the program up to six hours if the instrument is turned off and the program can be resumed where it left off. After six hours, the channel will restart in the primary mode. Primary mode settings may be different from those in the previous Multi-Dose program.

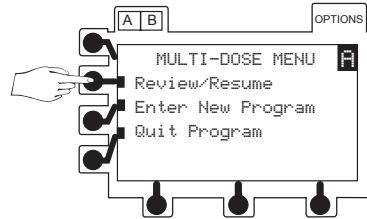
1. Press **POWER**.
  - **Return to Multi-Dose?** page will appear.
2. Press **yes**.
  - Pressing **no** will return to primary setup page.

**NOTE:** Verify all settings prior to resuming an infusion.



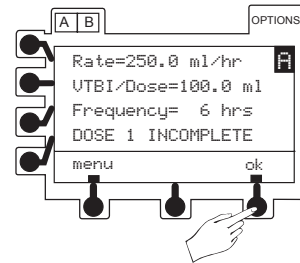
**Resuming an Interrupted Multi-Dose Program (Continued)**

3. Press **Review/Resume** to access setup parameters.
  - If infusion was in progress when interrupted, proceed to step 4.
  - If infusion was not in progress when interrupted, proceed to step 6.

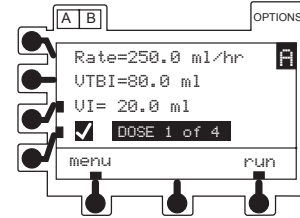


► If Infusion was in Progress When Interrupted:

4. Press **ok** to approve and advance to main hold page.

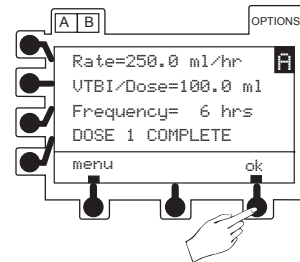


5. Press  or **run** to resume infusion.

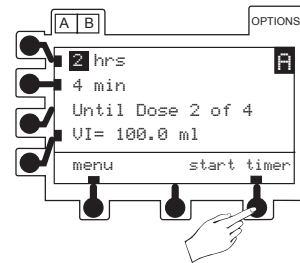


► If Infusion Was Not in Progress When Interrupted:

6. Press **ok**.



7. Edit time to delivery of next dose, as necessary.
8. Press **start timer** to begin timer's countdown to delivery of next dose.

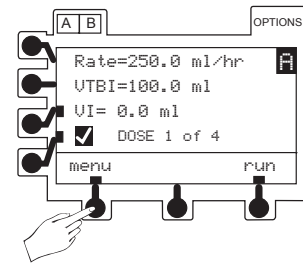


## Multi-Dose Program (Continued)

### To Quit Multi-Dose Program

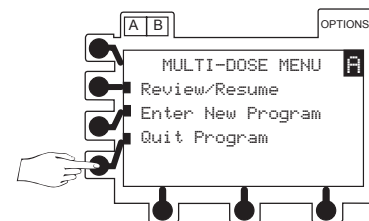
The channel must be on hold or the last dose complete.

1. Press **menu**.




2. Press **Quit Program** to return to primary setup page.

**NOTE:** Primary setup page parameters may be different from those of the Multi-Dose program. Verify all settings prior to resuming an infusion.



## Loading-Dose

This feature allows the clinician to set up an initial infusion rate for a specific volume, automatically followed by a maintenance rate (primary settings) from the same container. The primary VTBI and VI include the Loading Dose volumes. When the Loading Dose VTBI reaches zero, a transition tone will sound ( if the transition tone feature is enabled), **Load Dose Complete** message will be displayed for a few seconds, and the primary settings will automatically take effect.

Qualified service personnel can turn the Loading Dose feature on or off.

**NOTE:** Verify the primary mode parameters prior to accessing the Loading Dose option.

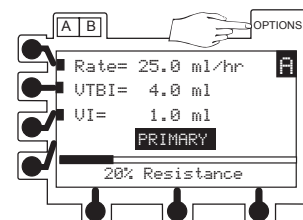
### WARNING

This mode is useful for loading a medication prior to the start of a continuous infusion or delivering fluid challenges. This feature is for delivery from primary containers only. Using this feature with two separate containers may result in unintended flow rates.

### Entering a New Program

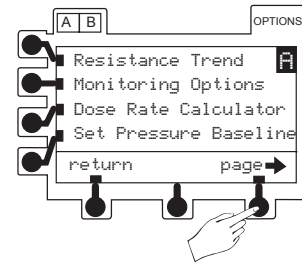
Select the desired channel, as necessary. The channel must be on hold in the primary or secondary mode.

1. Press **OPTIONS**.
  - Options page will appear.

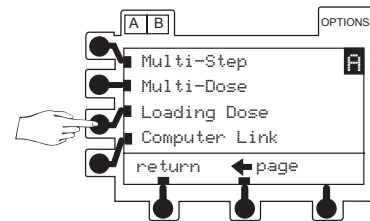


Entering a New Program (Continued)

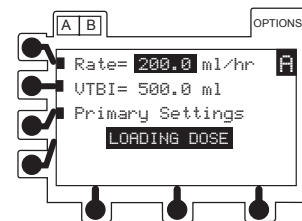
- Press **← page** or **page →**, as necessary to view additional selections.



- Press **Loading Dose**.
  - Loading Dose infusion rate will be highlighted.

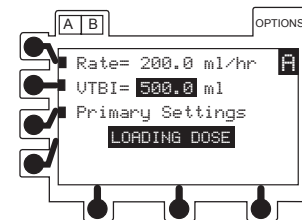


- If current value is appropriate, press **ENTER**.  
 OR  
 Use numeric keypad to enter a new infusion rate and press **ENTER**.
  - Loading Dose VTBI will be highlighted.



- If current value is appropriate, press **ENTER**.  
 OR  
 Use numeric keypad to enter a new VTBI and press **ENTER**.

**NOTE:** The Loading Dose VTBI must be less than the primary VTBI.



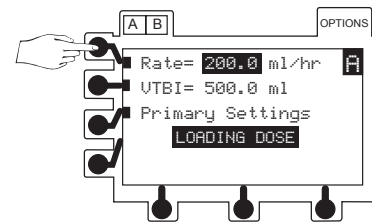
- Press **RUN HOLD** to start Loading Dose infusion.

### Making Changes During Loading Dose Program

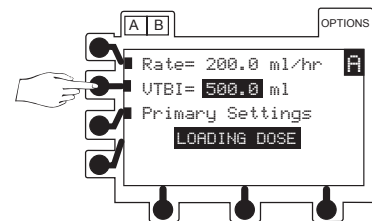
Select the desired channel, as necessary. The channel does not need to be on hold to change settings for Loading Dose Rate or VTBI.

1. Press soft key for value you want to change.
  - Current value will be highlighted.

To Change Loading Dose Infusion Rate



To Change Loading Dose Volume To Be Infused

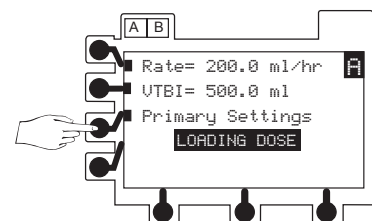


2. Use numeric keypad to enter new value.
3. Press **ENTER** to accept new value(s).

### To View or Change Primary Settings During Loading Dose Infusion

► Select desired channel, as necessary.

1. Press **Primary Settings**.
  - Primary rate (**Pri Rate**), primary volume to be infused (**Pri VTBI**) and total volume infused (**Total VI**) will be displayed.
  - Display will return to normal **Loading Dose** page after six seconds.

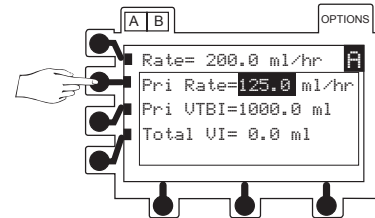


**To View or Change Primary Settings During Loading Dose Infusion (Continued)**

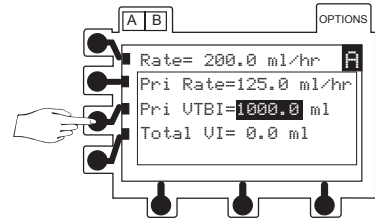
► Select desired channel, as necessary. (Continued)

2. Press **Pri Rate**, **Pri VTBI** or **Total VI** to:
  - “freeze” display
  - highlight value

To Change Primary Rate During Loading Dose Infusion



To Change Primary VTBI During Loading Dose Infusion



**NOTE:** If the flow sensor option is being used, VTBI can be turned off by selecting VTBI, pressing **CLEAR** and then **ENTER**.

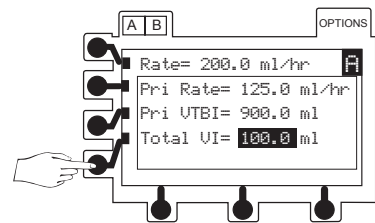
OR

Primary VTBI can be deleted from the primary mode setup page (Programmable Features).

3. Use numeric keypad to enter a new value.

► To Clear Total Volume Infused During Loading Dose Infusion:

4. Press **Total VI** to highlight value.



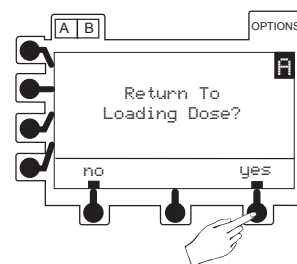
5. Press **CLEAR** or 0 (zero key) to reset volume infused to 0.0 ml.
6. Press **ENTER** to accept new value(s).
  - Display will return to normal **LOADING DOSE** page after six seconds.



### Resuming an Interrupted Loading Dose Program

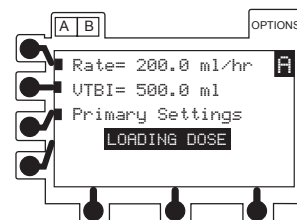
The channel will retain its place in the program up to six hours if the instrument is turned off. After six hours, the channel will restart in the primary mode. Primary mode parameters may be different from those in the Loading Dose program.

1. Press **POWER**.
  - **Return to Loading Dose?** page will appear.
2. Press **yes**.
  - Pressing **no** will return to primary set up page.



**NOTE:** Verify all parameters prior to resuming an infusion.

3. Verify primary settings prior to resuming Loading Dose program.
4. Press **RUN HOLD** to resume infusion.



### RS-232 Computer Link (Models 7100, 7200, 7130 and 7230)

The optional Computer Link feature allows a hospital computer to interact with the instrument. The computer cannot start or stop the instrument, set the rate, or make any change in status. If the feature is off, the computer cannot communicate with the instrument. Available Computer Link options are:

- **Monitor mode**, which allows the computer to only receive information from the instrument.
- **Control mode**, which allows the computer to send information to the instrument's display. This information (for example, drug being infused) will be displayed every five seconds.

**NOTE:** To assure continued electromagnetic compatibility performance, the communications cable attached to the instrument should be no longer than one meter, have fully shielded connector housings, and have a 100% coverage braid/foil shield attached to the connector housings around the signal conductors with the cable jacket.

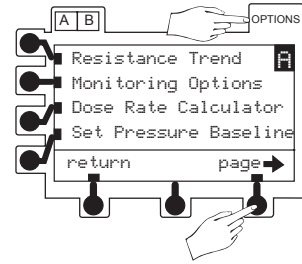
Qualified service personnel can turn the Computer Link feature on or off.

#### WARNING

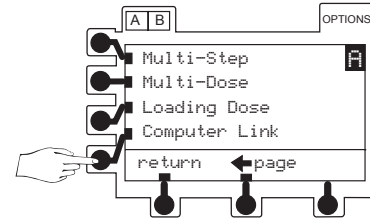
Use of accessories or cables other than those specified may result in degraded electromagnetic compatibility performance of this device.

To Connect to a Computer

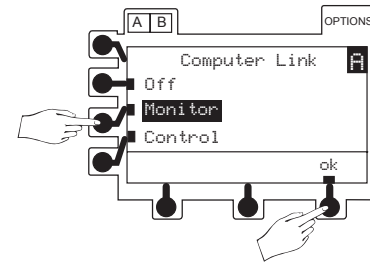
- Press **OPTIONS**.
  - Options page will appear.
 Press **← page** or **page →**, as necessary to view additional selections.




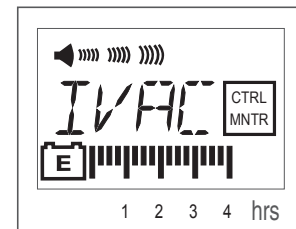
- Press **Computer Link**.
  - Computer Link page will appear.



- Press **Monitor** or **Control**.
- Press **ok**.



- Connect an RS-232 cable from hospital computer to  on instrument's back panel.
  - While instrument is waiting for a connection:
    - Control mode - **CTRL** flashes
    - Monitor mode - **MNTR** appears at connection
  - If communication is interrupted
    - Control mode - **CTRL** flashes until alarm is answered
    - Monitor mode - **MNTR** flashes for 60 seconds

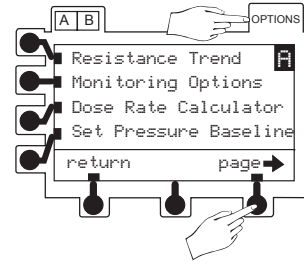


**NOTE:** *MNTR* or *CTRL* will remain in the lower display once the mode is selected and communication with the computer has been established.

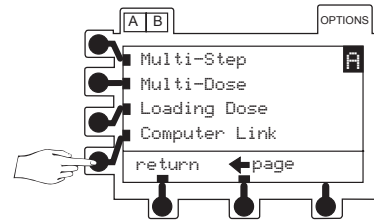
## RS-232 Computer Link (Continued)

### To Disconnect from a Computer

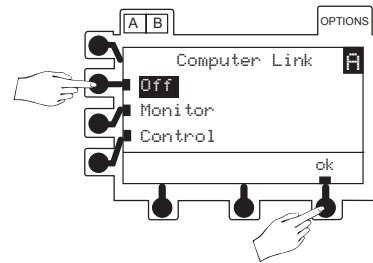
- Press **OPTIONS**.
  - Options page will appear.
- Press **← page** or **page →**, as necessary to view additional selections.



- Press **Computer Link**.
  - Computer Link page will appear.



- Press **Off**.
- Press **ok**.



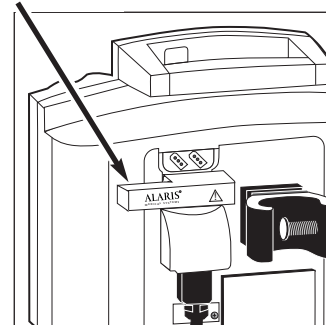
## IEEE 1073 (MIB) RS-232 Computer Link (Models 7132 and 7232 only)

The IEEE 1073 (Medical Information Bus or MIB) computer link feature allows a hospital computer to interact with the instrument. The computer cannot start or stop the instrument, set the rate, or make any change in status.

This link allows the computer to receive information from the instrument and to send information to the instrument's display. This information (such as, drug being infused) will be displayed every five seconds.

There are no configurable options.

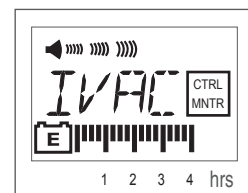
MIB Connector



### Operation

The communications cable may be connected or disconnected at any time without affecting instrument operation.

**MNTR** will remain in the lower display while the communication link is active.



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## Specifications

<b>Administration Sets:</b>	Use only ALARIS®/IVAC® 72 Series administration sets.	
<b>Alarms:</b>	Accumulated Air In Line Air In Line Battery Depleted Channel Malfunction Computer Link Failure Flow Sensor Unplugged Hold Time Exceeded Instrument Malfunction	Key Stuck Latch Open No Upstream Flow Detected Occlusion Downstream Occlusion Upstream Primary Flow Detected During Secondary Set Out Set Up Time Exceeded
<b>Battery:</b>	<p>Rechargeable nickel cadmium. A single channel instrument will operate for 4 hours nominal and a dual channel instrument will operate for 3 hours nominal, under the following conditions:</p> <ul style="list-style-type: none"> <li>• new, fully charged battery</li> <li>• ambient room temperature, 74±3°F (23±2°C)</li> <li>• resistance monitoring modes</li> <li>• rate, 100 ml/hr (sum of channels) or at the Intermediate rate of 25 ml/hr (each channel)</li> </ul> <p>Battery run time is affected by operating mode, rate, monitoring options and back pressure. (See Battery Management System section of this document.)</p>	
<b>Case:</b>	Impact and flame resistant plastic	
<b>Critical Volume:</b>	Maximum incremental volume in case of single point failure will not exceed 1.0 ml at 999.9 ml/hr.	
<b>Dimensions: (Nominal)</b>	<u>71XX</u>	<u>72XX</u>
<i>Depth*</i>	5.0 in/12.7 cm	5.0 in/12.7 cm
<i>Height</i>	8.6 in/21.8 cm	8.6 in/21.8 cm
<i>Power Cord</i>	10 ft/3 m	10 ft/3 m
<i>Weight**</i>	6.6 lb/3.0 kg	8.4 lb/3.8 kg
<i>Width</i>	7.6 in/19.3 cm	10.7 in/26.7 cm
	* Without pole clamp.	** Without power cord.

## Specifications (Continued)

### Downstream Occlusion:

#### *Time to Alarm*

Time to Detect Downstream Occlusion (minutes)		Monitoring Options			
		Pressure		Resistance and High Resistance	
Threshold Settings		25 mmHg	600 mmHg	100% 25 mmHg	100% 600 mmHg
1 ml/hr	Maximum	1.2	75	1.2	7
	Typical	0.6	30	0.6	4
25 ml/hr	Maximum	0.3	25	0.3	3
	Typical	0.1	1	0.1	1

When the occlusion alarm pressure limit is set to the maximum threshold setting, the maximum infusion pressure generated into a hard occlusion at 25 ml/hr is  $11.6 \pm 3.9$  psi.

#### *Bolus Volume*


Bolus Volume Released Upon Correcting Downstream Occlusion (ml)		Monitoring Options			
		Pressure		Resistance and High Resistance	
Threshold Settings		25 mmHg	600 mmHg	100% 25 mmHg	100% 600 mmHg
1 ml/hr	Maximum	0.5	0.5	0.5	0.5
	Typical	<0.1	0.3	<0.1	<0.1
25 ml/hr	Maximum	0.5	0.5	0.5	0.5
	Typical	<0.1	0.3	<0.1	0.3

Testing performed using IV set model 72003, at  $68 \pm 8^\circ\text{F}$  ( $20 \pm 4^\circ\text{C}$ ).

### Environmental Conditions:

	<u>Operating</u>	<u>Storage</u>
<i>Atmospheric Pressure</i>	700 to 1060 hPa	500 to 1060 hPa
<i>Relative Humidity</i>	20 to 90% Noncondensing	5 to 95% Noncondensing
<i>Temperature Range</i>	50 to 104°F (10 to 40°C)	-40 to 140°F (-40 to 60°C)

### Flow Rate Range:

0.1 to 270.0 ml/hr in 0.1 ml/hr increments (secondary mode)  
0.1 to 999.9 ml/hr in 0.1 ml/hr increments (all other modes) 

### Ground Current Leakage:

Tested to UL 544 and CSA C22.2 No. 125 for medical and dental equipment.

### KVO Flow Range:

0.1 to 20.0 ml/hr in 0.1 ml/hr increments 

### Mode of Operation:

Continuous

### Power Requirements:

100-240 V~, 50/60 HZ (40 watts), 3-wire grounded system  
Class 1 with Internal Power Source

## Specifications (Continued)

**Rate Accuracy:** For rates greater than 1 ml/hr, up to 999.9 ml/hr:  $\pm 5\%$ , 95% of the time with 95% confidence, under the conditions listed below.

For rates equal to or less than 1 ml/hr:  $\pm 6.5\%$ , 95% of the time with 95% confidence, under the conditions listed below.

**Rate Accuracy Test Conditions:**

Infusion rate range: 0.1 to 999.9 ml/hr

Head height: 24 inches

Test solution: distilled water

Environment temperature:  $68 \pm 8^\circ\text{F}$  ( $20 \pm 4^\circ\text{C}$ )

Back pressure: 0 psi

Needle: 18 gauge

Set Model: 72003

Minimum collection volume: 6 ml

### CAUTION

Variations of head height, back pressure, time, monitoring mode option, pump tilt or any combination of these may affect rate accuracy. Factors that can influence head height and back pressure are: IV set configuration, IV solution viscosity and IV solution temperature. Back pressure may also be affected by catheter type. Refer to **Appendix - Trumpet and Start-up Curves** for data on how certain factors influence rate accuracy.

**Volume Infused Range:** 0.0 to 9999.9 ml in 0.1 ml increments

**Volume To Be Infused Range:** 0.1 to 9999.9 ml in 0.1 ml increments (primary and dose rate modes)  
0.1 to 999.9 ml in 0.1 ml increments (all other modes)



## Programmable Features

The following features can be customized by qualified service personnel.

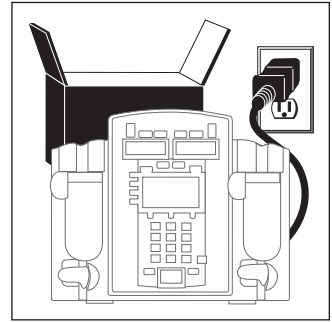
<u>Feature</u>	<u>Options</u>	<u>Default</u>
<b>Air in Line:</b>		
Air-in-Line Accumulator	On/Off	On
Air-in Line Alarm Threshold	50, 100, 200, or 500 mL	100 mL
Air-in-Line Reset Feature	On/Off	Off
<b>Audio:</b>		
Transition Tone	On/Off	On
Volumes	Low/Med/Hi    Med/Hi    Hi	Low/Med/Hi
<b>Computer Link (RS-232 Configuration Only):</b>		
Baud Rate	300/600/1200/1800/2400/4800/9600	9600
Mode	Control/Monitor/Off, Monitor/Off, Off	Off
Parity	Even/Odd/ None	None
<b>NOTE:</b> Models 7132/7232 have only 9600 (Baud Rate), Monitor (mode), and None (Parity) as options and defaults.		
<b>Dynamic Monitoring:</b>		
AutoRestartPlus	0 (Off) /1 to 9	3
Manual Pressure Baseline	On/Off	On
Monitoring Options	Resistance/High Resistance/Pressure	Pressure
Pressure Alarm	Adjustable/Fixed	Adjustable
Pressure Display	On/Off	On
Pressure Limit, Initial (Configuration Mode: Def Alarm)	25-600 mmHg	600 mmHg
Resistance Alert	On/Off	On
Resistance Alert Level	0-100%	100%
Resistance Display	On/Off	On
Resistance Pressure Setting	1-600 mmHg	600 mmHg
Trends	On/Off	On
Instrument ID	9 digits	000000000
Instrument Label	4 alpha-numeric	IVAC
KVO Rate	0.1 - 20.0 ml/hr	5.0 ml/hr
Languages	English/Canadian French	English
<b>Maintenance:</b>		
Maintenance Interval	1-52 wks	52 wks
Maintenance Reminder	On/Off	On
<b>Optional Modes:</b>		
Dose Rate Calculator	On/Off	On
Loading Dose	On/Off	On
Multi-Dose	On/Off	Off
Multi Dose Alert	On/Off	Off
Multi-Step	On/Off	Off
Panel Lock	On/Off	On
<b>Pressure Sensor</b>		
Self Check Interval	1-52 wks	12 weeks
Rate, Maximum	0.1 - 999.9 ml/hr	999.9 ml/hr
VTBI	On/Off (Flow Sensor use)	On



## Unpacking


1. Remove instrument from its carton.
2. Plug instrument into an AC outlet a minimum of 24 hours prior to use.
  - Maximum battery capacity, as well as gauge accuracy, is reached after several charge/discharge/recharge cycles. For best results, fully charge, discharge and recharge battery two or three times before putting instrument into service.
3. Perform Periodic Inspections as indicated in Inspection Requirements section of this document.

See the Programmable Features section of this document for a list of the configurable features. Complete programming instructions are in the Technical Service Manual.

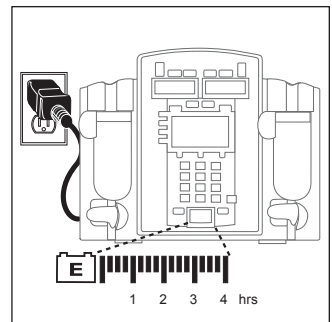


## Storage

Plug the instrument into an AC outlet during storage to ensure a fully charged battery when needed.

-  (AC indicator light) will be green whenever instrument is plugged in.

Close the latch(es) whenever the instrument is not in use.



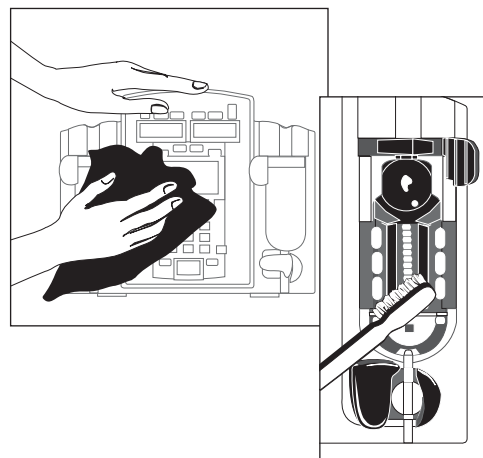
## Cleaning

1. Unplug power cord from AC outlet before cleaning.
2. Verify RS-232 connector is covered. Do not spray fluid directly into any connector.
3. Use a soft cloth dampened with warm water and a mild, nonabrasive cleaning solution.
  - A soft-bristled brush may be used to clean narrow areas.
  - Use light pressure when cleaning pressure transducer and air-in-line detector areas of pumping channels.
  - Acceptable cleaning solutions (*use per manufacturers' instructions*):
    - Warm water
    - Vesphene®
    - Manu-Klenz® (*cleaning only*)
    - 10% Bleach Solution (*1 part bleach to 9 parts water*)
4. Flow sensor should be routinely cleaned by running warm water over it while actuating slider, and then thoroughly dried.

- DO NOT** use solutions containing aromatic solvents (naphtha, paint thinner, etc.), chlorinated solvents\* (Trichloroethane, MEK, Toluene, etc.), alcohol, or phosphoric acid.
- DO NOT** use hard or pointed objects or pressurized sprays to clean any part of instrument.
- DO NOT** steam autoclave, EtO sterilize, or immerse instrument.
- DO NOT** use pressurized sprays on instrument.

### CAUTION

DO NOT SPRAY onto or immerse the instrument in fluids. Cleaning solutions should be applied to the instrument with a soft cloth.



### CAUTION

Do not use solvents or cleaning agents. Damage to plastic parts of the flow sensor could occur.

\* Excluding 10% bleach solution in water.

## Inspection Requirements

To ensure the instrument remains in good operating condition, both regular and periodic inspections are required.

**Regular inspections** consist of a visual inspection for damage and cleanliness, and performing the procedure described in the Start-Up Sequence section of this document before each usage of the instrument. Regular inspections are not covered under any contract or agreement offered by ALARIS Medical Systems and must be performed by the user.

**Preventive maintenance inspections** are recommended at the indicated intervals.

The preventive maintenance inspections listed are recommended in accordance with ALARIS Medical Systems® requirements and guidelines. Customers within the United States and Canada should note that these inspections are also intended to complement the intent of the Joint Commission on the Accreditation of Healthcare Organizations' requirements.

For detailed instructions on performing preventive maintenance inspections and maintenance, refer to the Technical Service Manual and supplemental service bulletins. A service agreement may be obtained from ALARIS Medical Systems for the performance of all required periodic inspections.

For more information, see the Service Information section of this document or contact ALARIS Medical Systems® Customer Service at (800) 482-4822.

### WARNING

Failure to perform these inspections may result in improper instrument operation. Instruments are tested and calibrated before they are packaged for shipment. To ensure proper operation after shipment, it is recommended that an incoming inspection be performed by your facility before putting the instrument into use.

### Regular Inspections

<u>PROCEDURE</u>	<u>FREQUENCY</u>
Cleaning	As required
Inspect for Damage:	
Case	Each usage
Communication Cable	Each usage
Power Cord	Each usage
Start-Up Sequence	Each usage

### Preventive Maintenance Inspections

<u>PROCEDURE</u>	<u>FREQUENCY</u>
Battery Refresh Cycle	12 months
Flow Stop Test	12 months
Functional Test	12 months
Ground Current	
Leakage Test	12 months
Ground Resistance Test	12 months
Pressure Calibration	12 months
Rate Accuracy Calibration	12 months
Regular Inspection	12 months
Reset Time	12 months

## Service Information

**NOTE:** *If the instrument shows evidence of damage in transit, notify the carrier's agent immediately. Do not return damaged equipment to the factory before the carrier's agent has authorized repairs.*

If the instrument fails to respond as described in this document and the cause cannot be determined, do not use the instrument. Contact qualified service personnel.

Within the United States, application and service information may be obtained by writing to ALARIS Medical Systems at:

ALARIS Medical Systems, Inc  
9190 Activity Road  
San Diego, California 92126  
ATTN: Instrument Service

Within the United States and Canada, information or assistance may be obtained by calling one of the following toll-free numbers:

In United States:	<b>(800) 482-4822</b>
In Canada: <i>Eastern</i>	<b>(800) 908-9918</b>
<i>Western</i>	<b>(800) 908-9919</b>

Outside the United States and Canada, service information, applications, and manuals may be obtained by contacting your local ALARIS Medical Systems® Service Department or distribution center.

When submitting any request for service, include:

- a description of difficulty experienced
- instrument settings
- administration set/lot number
- solution(s) used
- message displayed at time of difficulty

If it is necessary to return the instrument for service, obtain a return authorization number prior to shipment. Carefully package the instrument (preferably in the original packaging), reference the return authorization information, and return it to the appropriate service or distribution center. ALARIS Medical Systems does not assume any responsibility for loss of, or damage to, returned instruments while in transit.

Dispose of instruments as appropriate per national and local environmental regulations or contact ALARIS Medical Systems.

## WARRANTY

ALARIS Medical Systems, Inc., (hereinafter referred to as "ALARIS Medical Systems") warrants that:

- A. Each new ALARIS Medical Systems Signature Edition® instrument, excluding the battery, is free from defects in material and workmanship under normal use and service for a period of two (2) years from the date of delivery by ALARIS Medical Systems to the original purchaser.
- B. The battery and each new accessory are free from defects in material and workmanship under normal use and service for a period of ninety (90) days from the date of delivery by ALARIS Medical Systems to the original purchaser.

If any product requires service during the applicable warranty period, the purchaser should communicate directly with ALARIS Medical Systems headquarters (San Diego, CA) to determine the appropriate repair facility. Except as provided otherwise in this warranty, repair or replacement will be carried out at ALARIS Medical Systems expense. The product requiring service should be returned promptly, properly packaged and postage prepaid by purchaser. Loss or damage in return shipment to the repair facility shall be at purchaser's risk.

In no event shall ALARIS Medical Systems be liable for any incidental, indirect or consequential damages in connection with the purchase or use of any ALARIS Medical Systems product. This warranty shall apply solely to the original purchaser. This warranty shall not apply to any subsequent owner or holder of the product. Furthermore, this warranty shall not apply to, and ALARIS Medical Systems shall not be responsible for, any loss or damage arising in connection with the purchase or use of any ALARIS Medical Systems product which has been:

- (a) repaired by anyone other than an authorized ALARIS Medical Systems service representative;
- (b) altered in any way so as to affect, in ALARIS Medical Systems' judgment, the product's stability or reliability;
- (c) subjected to misuse or negligence or accident, or which has had the product's serial or lot number altered, effaced or removed;

or

- (d) improperly maintained or used in any manner other than in accordance with the written instructions furnished by ALARIS Medical Systems.

This warranty is in lieu of all other warranties, express or implied, and of all other obligations or liabilities of ALARIS Medical Systems, and ALARIS Medical Systems does not give or grant, directly or indirectly, the authority to any representative or other person to assume on behalf of ALARIS Medical Systems any other liability in connection with the sale or use of ALARIS Medical Systems products.

ALARIS MEDICAL SYSTEMS DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE OR APPLICATION.

See packing inserts for international warranty, if applicable.

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## Trumpet and Start-Up Curves

### DESCRIPTION AND EXPLANATION OF TRUMPET AND START-UP CURVES

In this instrument, as with all infusion systems, the action of the pumping mechanism and variations in individual administration sets cause short-term fluctuations in rate accuracy. The following graphs show typical performance of the system for both Pressure and Resistance Modes in two ways:

1. the accuracy during various time periods over which fluid delivery is measured (trumpet curves), and
2. the delay in onset of fluid flow when infusion commences (start-up curves).

Product operation is not affected by the selection of Resistance or High Resistance at 0.1, 1.0 and 25 ml/hr; therefore, High Resistance graphs are not included.

Trumpet curves are named for their characteristic shape. They display discrete accuracy data averaged over particular time periods or "observation windows", not continuous data versus operating time. Over long observation windows, short-term fluctuations have little effect on accuracy, as represented by the flat part of the curve. As the observation window is reduced, short-term fluctuations have greater effect, as represented by the "mouth" of the trumpet. Knowledge of system accuracy over various observation windows may be of interest when certain drugs are being administered. Because the clinical impact of short-term fluctuations on rate accuracy depends on the half-life of the drug being infused and on the degree of intravascular integration, the clinical effect cannot be determined from the trumpet curves alone. Knowledge of the start-up characteristics should also be considered.

The start-up curves represent continuous flow rate versus operating time for two hours from the start of the infusion. They exhibit the delay in onset of delivery due to mechanical compliance and provide a visual representation of uniformity. Trumpet curves are derived from the second hour of this data.

### FLOW CHARACTERISTICS UNDER VARYING DELIVERY CONDITIONS

#### Effects of Pressure Variations

Under conditions of +100 mmHg pressure, the Signature Edition® Infusion System typically exhibits a long-term accuracy offset of approximately -1.4% from mean values.

Under conditions of +300 mmHg pressure, the Signature Edition® Infusion System typically exhibits a long-term accuracy offset of approximately -1.5% from mean values.

Under conditions of -100 mmHg pressure, the Signature Edition® Infusion System typically exhibits a long-term accuracy offset of approximately -0.8% from mean values.

Resulting trumpet observation points typically track those of accuracy; therefore, no significant change in short-term variations result under these pressure conditions.

#### Effects of Negative Solution Container Heights

With a negative head height of -0.5 meters, the Signature Edition® Infusion System typically exhibits a long-term accuracy offset of approximately -5.8% from mean values.

Resulting trumpet observation points typically track those of accuracy; therefore, no significant change in short-term variations result under negative head height conditions.

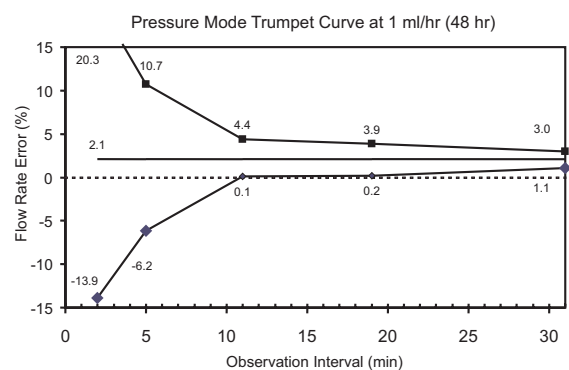
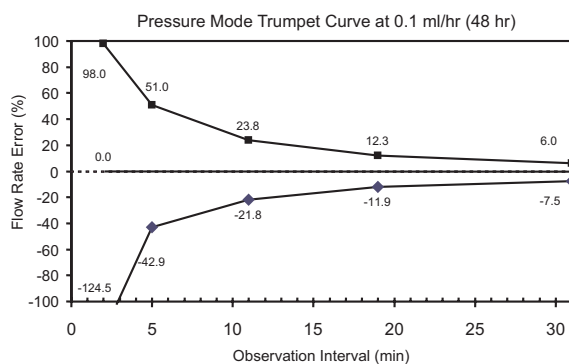
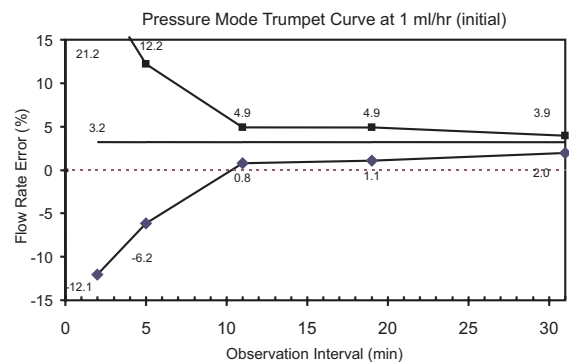
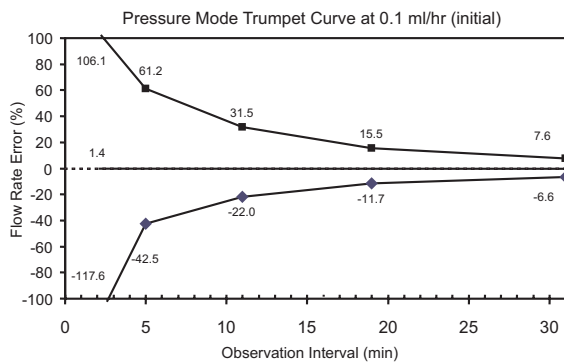
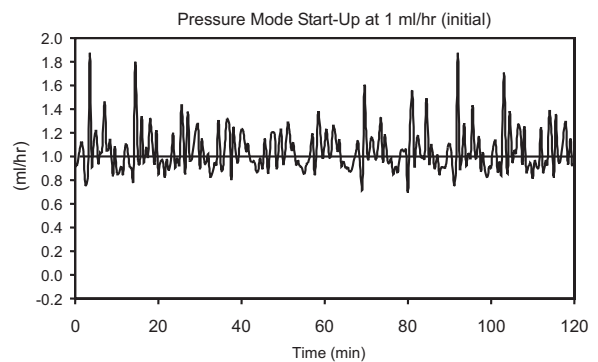
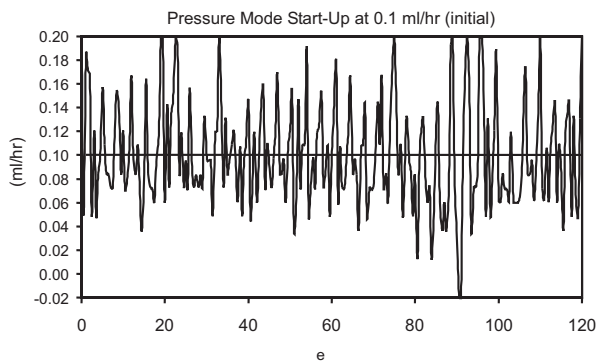
#### Effects of Rate

For applications where flow uniformity is a concern, use of the Pressure Mode at rates of 1.0 ml/hr or above is recommended.

**NOTE:** Tests conducted in accordance with IEC 60601-2-24, "Particular requirements for safety of infusion pumps and controllers" and AAMI ID26-1998 "Medical electrical equipment - Part 2: Particular requirements for the safety of infusion pumps and controllers", using AccuSlide® Model 72003 Administration Sets.

# Trumpet and Start-Up Curves (Continued)

## Pressure Mode



**NOTE:** The plot range has been increased to  $\pm 100\%$ , to allow visualization of the graph.

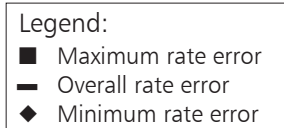
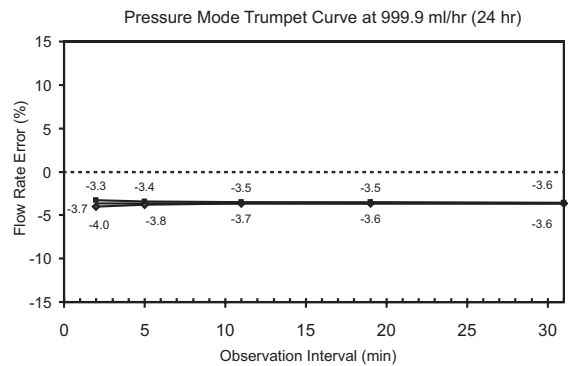
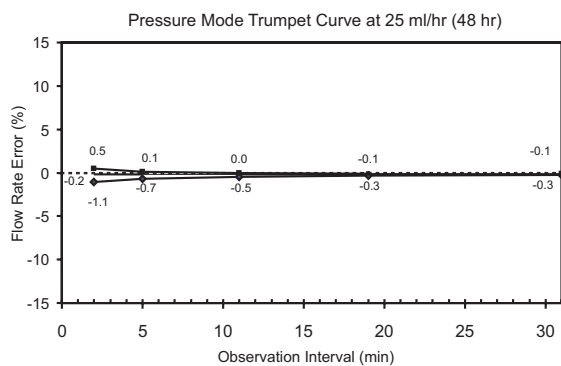
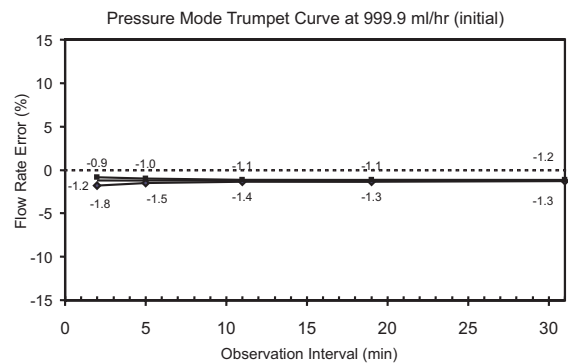
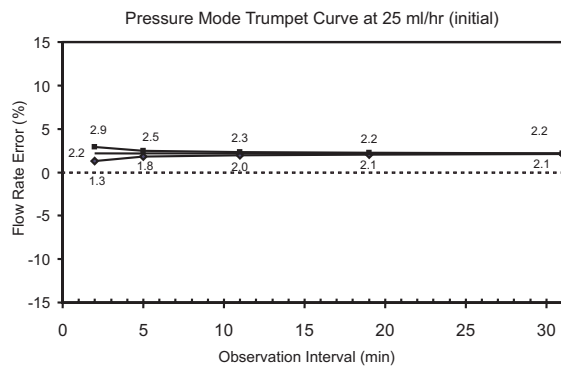
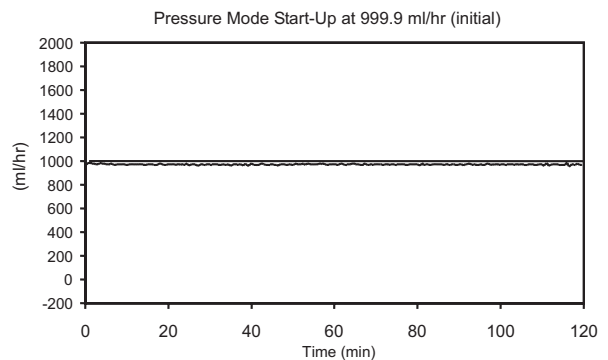
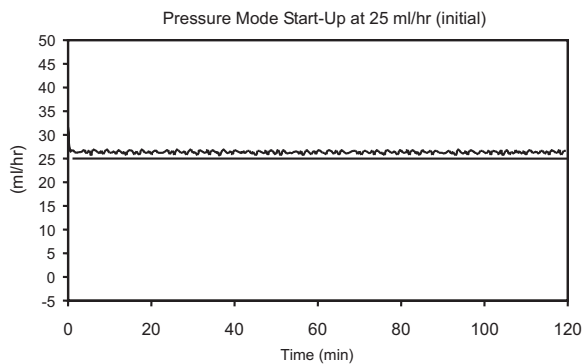
Legend:

- Maximum rate error
- Overall rate error
- ◆ Minimum rate error



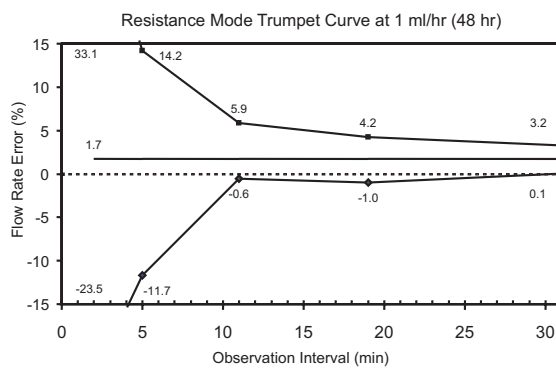
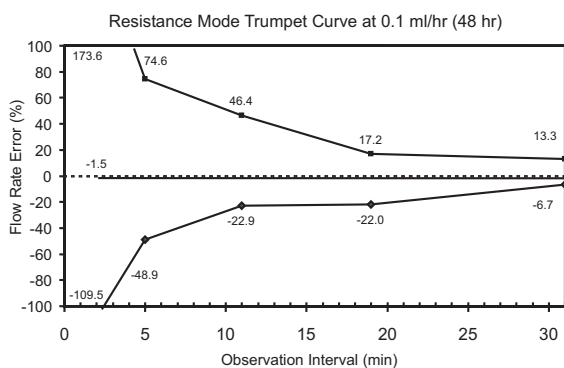
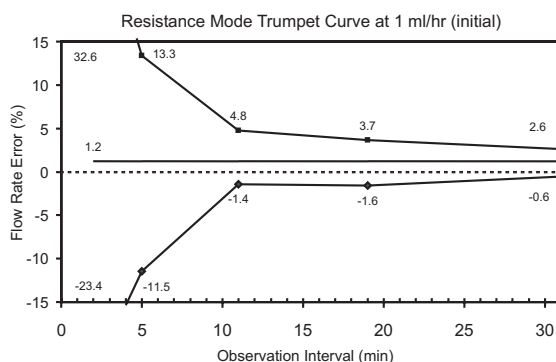
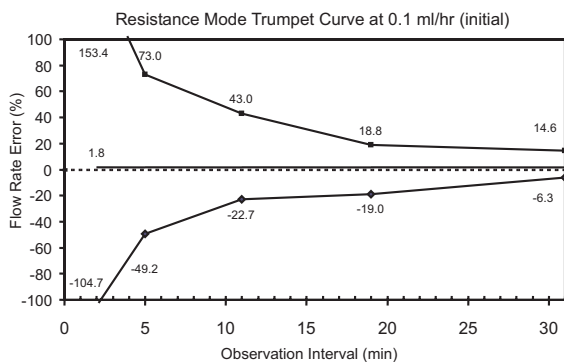
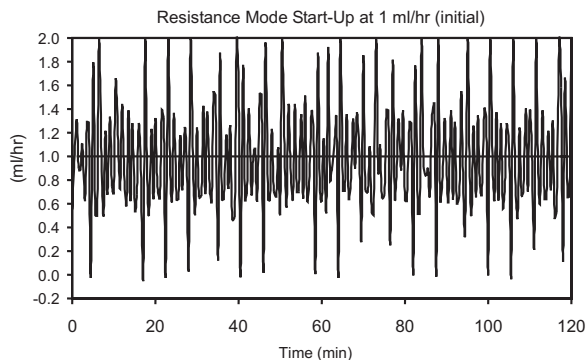
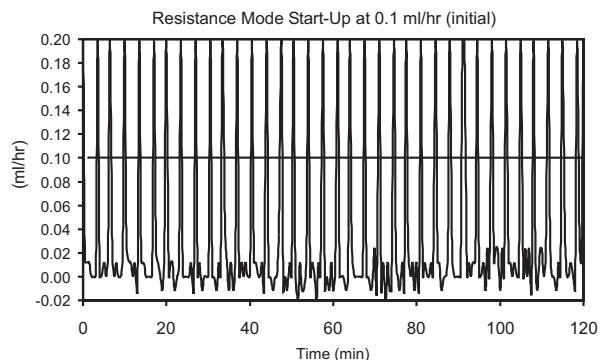
# Trumpet and Start-Up Curves (Continued)

## Pressure Mode (Continued)



# Trumpet and Start-Up Curves (Continued)

## Resistance Mode

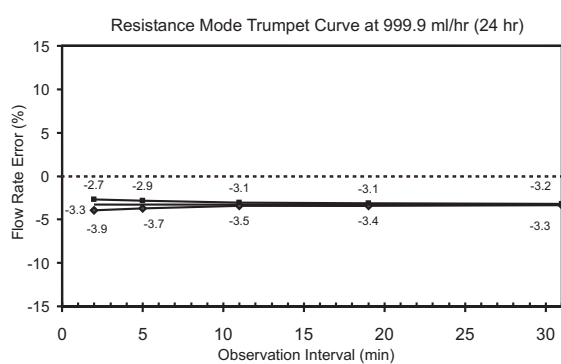
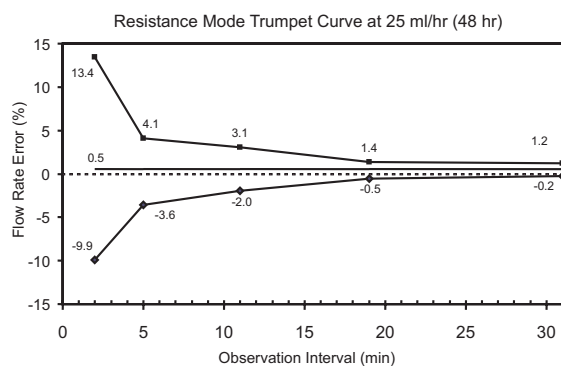
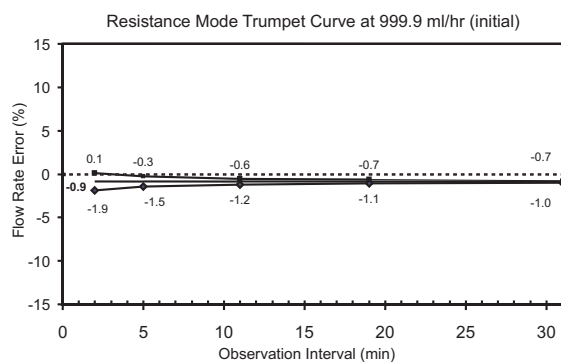
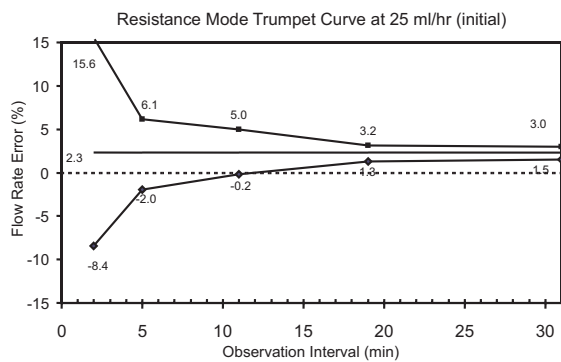
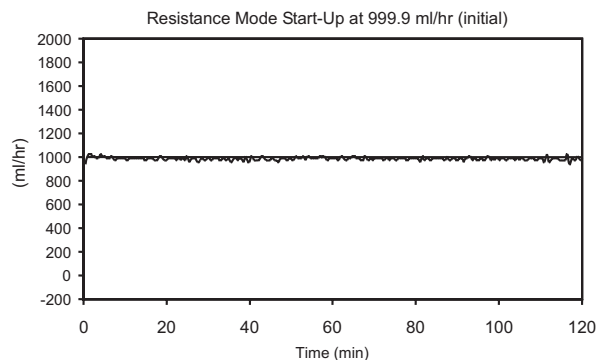
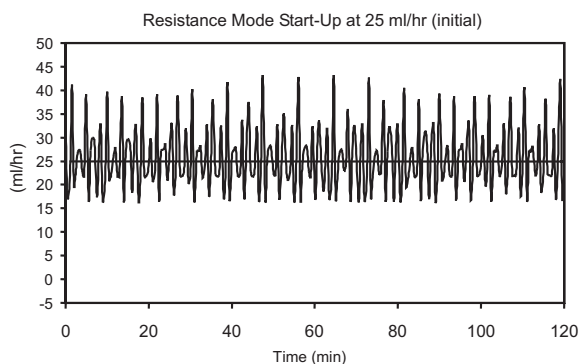


**NOTE:** The plot range has been increased to  $\pm 100\%$ , to allow visualization of the graph.

- Legend:
- Maximum rate error
  - Overall rate error
  - ◆ Minimum rate error

# Trumpet and Start-Up Curves (Continued)

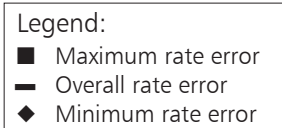
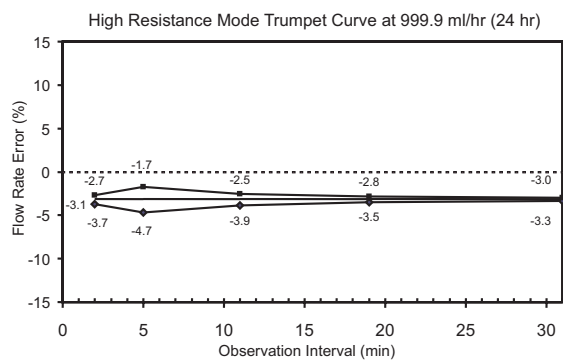
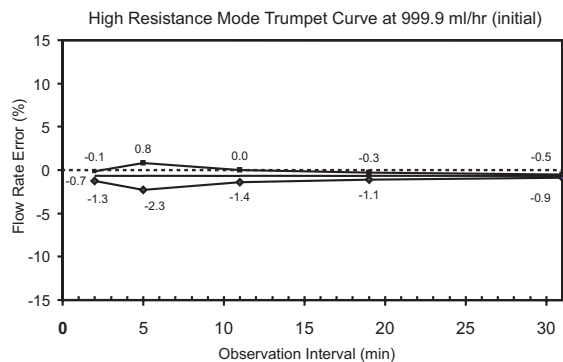
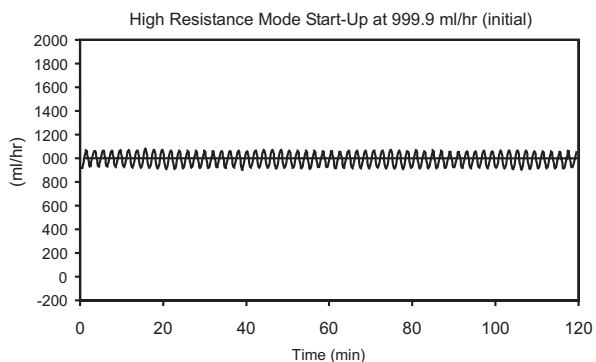
## Resistance Mode (Continued)



Legend:  
 ■ Maximum rate error  
 — Overall rate error  
 ◆ Minimum rate error

# Trumpet and Start-Up Curves (Continued)

## High Resistance Mode







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U.S. Patent Nos.: 4,534,756; 4,898,576; 5,087,245; 5,096,385; 5,534,691; 5,537,853; 5,542,826; 5,563,347; 5,568,912; 5,575,632; 5,601,420; 5,603,613; 5,609,576; 5,712,795; 5,716,194; 5,719,761; 5,827,223; D367,527; D367,528; D371,194; Canada Patented/Breveté: 78,376; 78,377; 78,378; 1,219,497; 1,279,800; 2,199,156; 2,199,631; France Brevet Nos.: 121,931; 248,632; 387,724; 431,310; 612,004; 951,426; 951,427; 951,428; Germany D.B.P. Nos.: 612,004; M9,501,995.2; M9,501,996.0; M9,501,997.9; P3,482,620.3; P3,778,211.8-08; P69,004,833.5-08; P690,244,923; Great Britain Patent Nos.: 121,931; 248,632; 387,724; 431,310; 612,004; 2,045,812; 2,045,813; 2,045,814; Hong Kong Nos.: HK1,006,005; HK1,006,006; HK1,006,041; Japan Patent No.: 特許番号; 登録第1,003,444号; 登録第1,003,445号; 登録第1,006,528号; 1,743,342; 1,924,062; 特許第2,553,557号; 特許第2,802,171号; 特許第3,025,018号; 特許第3,025,019号; Switzerland: 122,210; 122,211; 122,212; 248,632; 328,162; 328,163; 387,724; +EP0,121,931. Other U.S. and Foreign Patents Issued and Pending.