ALARMS

The Spectrum Pump will display alarms when specific conditions exist. Depending on the priority, these alarms can be an audible tone and/or an alarm message is displayed on the pump screen. The message states the reason for the alarm and contains prompts for clearing the alarm.

NOTE: The following alarms will utilize the drug audio alarm setting entered in the MDL Editor when the drug is selected at the pump: Inactivity; Air in line; Air Accumulation; Upstream Occlusion; Downstream Occlusion; Slide Clamp Closed; KVO; Bag Near Empty. (See Figure 65.)
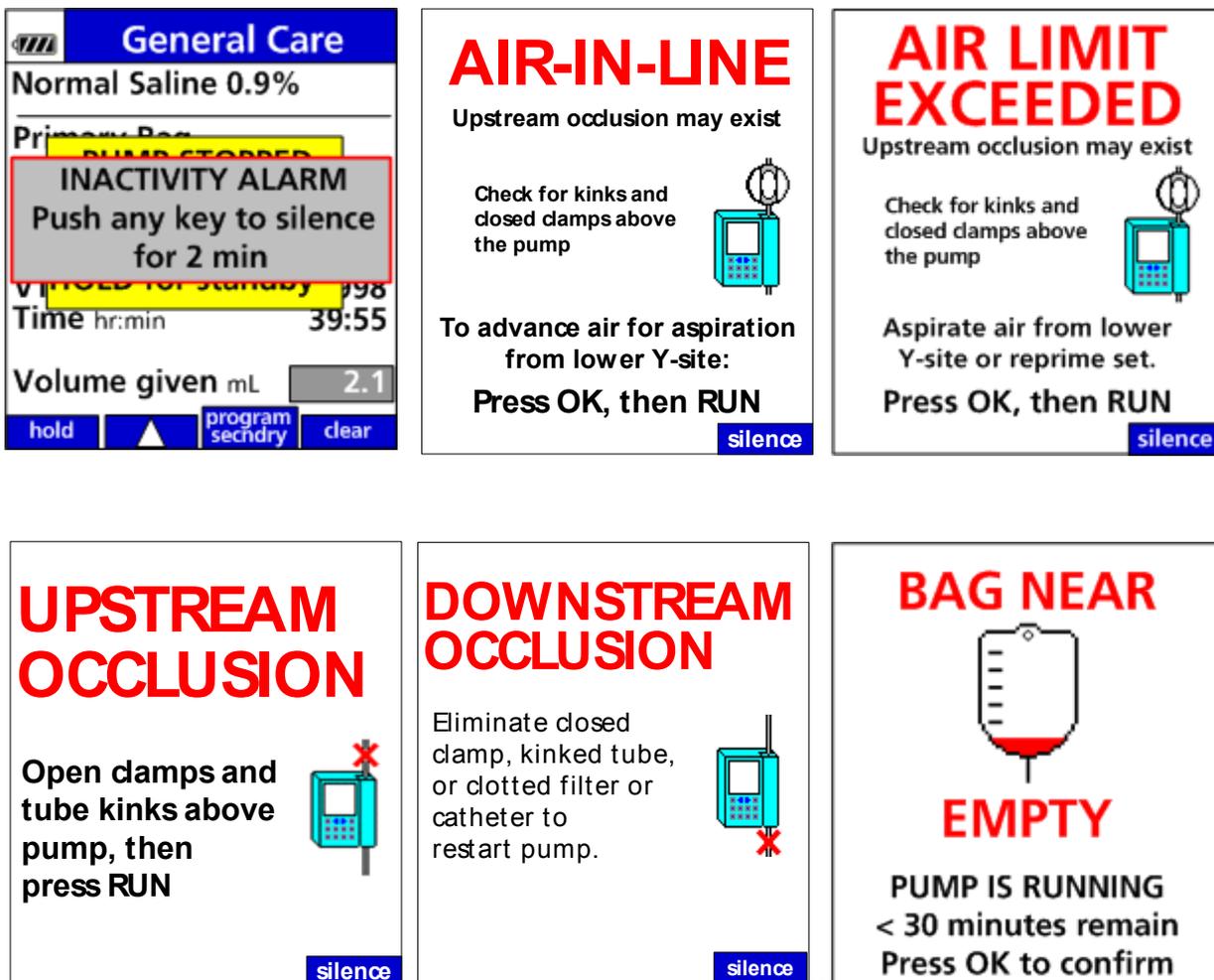

Figure 65. Example Alarms Messages.

Silencing an Alarm

To silence the audio tone for an alarm, press the **SILENCE** soft key or any key on the keypad. This silences the alarm tone for 2 minutes. If the alarm has not been cleared after 2 minutes, the alarm tone will resume.
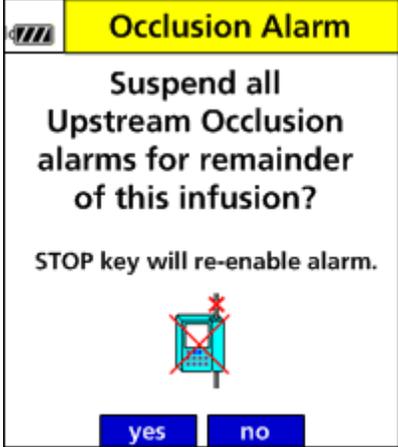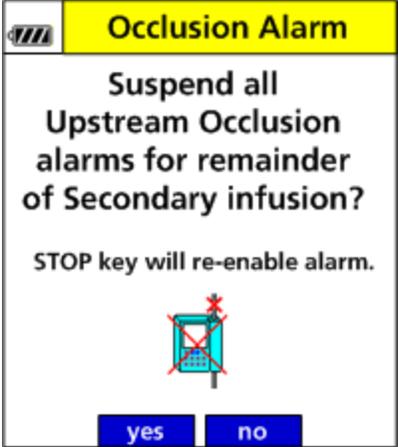
Clearing an Alarm

To clear an alarm, follow all of the prompts and instructions in the alarm message. The alarm clears after you have corrected the alarm condition and followed all of the prompts.

Alarm Messages

Alarm	Action
AIR-IN-LINE	Check for kinks in tubing or closed clamps above the pump that may result in an upstream occlusion. Evaluate tubing for presence of air. Press **OK** and then press **RUN** to advance small bubbles past the air detector. Each press of **RUN** advances approximately 0.1 mL. Use a syringe to aspirate air from the lower Y injection site or re-prime the set.
AIR LIMIT EXCEEDED	The pump will alarm when greater than approximately 1 mL of accumulated air has been detected in 15 min.
AUDIO	The audio alarm may be silenced for 2 minutes by pressing any key. Audio level alarm is set in the Drug Library. Audio level alarm settings include; use pump setting, low, medium, and high.
BATTERY MISSING	Battery not detected. Confirm that the Battery is properly installed and securely latched into the pump.
DEPLETED BATTERY	The Battery is fully depleted and unable to power the pump. To recharge the Battery and continue the infusion, plug the pump's AC Power Adaptor into an AC outlet. Confirm that the adaptor's Power Cord Connector is attached to the pump.
DOOR NOT FULLY CLOSED / SET OUTSIDE CHANNEL	The pump's door has not closed and latched correctly. Close the roller clamp below the pump. Then open the door by inserting the slide clamp into the keyhole. Re-load the IV set following the on screen prompts. Once the IV set has been loaded properly, close the pump's door ensuring both door latches shut securely.

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Alarm	Action
DOOR OPEN	Slide clamp is inserted into the keyhole and opens the door while the set is loaded. Close the roller clamp. Follow display prompts.
DOWNSTREAM OCCLUSION	Eliminate a closed clamp, kinked tubing, positional catheter, clotted catheter, clogged IV filter or other sources of occlusion below the pump.
DOWNSTREAM PRESSURE LIMIT - RESET SETTING	The downstream pressure limit differs from Care Area default (set in the Drug Library). Select **YES** to reset or **NO** to keep the current setting.
INACTIVITY ALARM	The pump has been inactive for 2 minutes and no action has been taken. Follow the on screen prompts and resume or restart the pump by pressing **RUN**.
IN STOP - SLIDE CLAMP CLOSED	Open slide clamp and press **RUN** (or unload set).
LOW BATTERY	The low battery alarm threshold has been reached. Plug the AC Power Adaptor into the pump and into the AC source outlet as soon as possible to recharge the Battery.
PRIMARY INFUSION COMPLETE	The Primary Infusion Volume To Be Infused (VTBI) has counted down to zero. The pump is running at a Keep Vein Open rate (KVO rate) or the actual infusion rate, whichever is lower. The Drug Library default KVO rate is set at 1mL/hr in the Drug Library.
SECONDARY INFUSION COMPLETE	The Secondary VTBI has counted down to zero. A secondary infusion with Secondary Callback enabled will run at the pump's default KVO rate of 1 mL/hr. If Secondary Callback is disabled when Secondary VTBI has counted down to zero, the pump will automatically transition back to the previously programmed primary rate.
SLIDE CLAMP CLOSED	Open slide clamp and press **RUN** or reload the set.
SYSTEM ERROR	An internal fault has been detected. Some faults can be cleared by either cycling power (off, then on) or by turning the power off, disconnecting the battery, reconnecting it several seconds later and pressing the **ON** key. If neither procedure clears the fault, return the pump for service.
UPSTREAM OCCLUSION	Eliminate the occlusion or flow restriction by checking for an upstream (above pump) closed clamp, kinked or collapsed IV tubing outside the pump, closed burette valve and malfunctioning or closed IV set or burette air vent. Press **RUN** to start infusion. Verify patency by confirming drop rate is consistent with programmed rate.

Alarm	Action
UPSTREAM OCCLUSION ALARM SUSPENSION	A drug or fluid that produces micro-bubbles in solution can cause nuisance upstream occlusion alarms. This is most likely associated with certain drugs identified as "effervescent" and also with cold fluids that are warming during infusion. A drug configuration in the Drug Library allows the clinician to temporarily suspend the upstream occlusion alarm on the pump if the clinician considers the alarm to be a nuisance. The suspension prompt appears after two consecutive upstream occlusion alarms and a positive confirmation on the check flow display screen. (See Figure 66.)

This dialog allows the user to suspend the alarm for the currently programmed infusion. The alarm will automatically be enabled when:

1. The **STOP** key is pressed.
2. The Door is opened.
3. The Infusion Transitions from Secondary to Primary.
4. Any alarm condition that stops the pump and the pump is turned **OFF** and then back **ON.**

⚠ **WARNING:** Upstream Occlusion Alarm Suspension feature should not be used when delivering critical drugs where the risk of flow stoppage due to undetected upstream occlusions outweighs that of flow interruption due to nuisance upstream occlusion alarms.

⚠ **WARNING:** Upstream Occlusion Alarm Suspension feature should not be used for drugs delivered in RIGID containers since the flow restrictions caused by lack of proper container venting may be difficult to recognize when troubleshooting an alarm condition.

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Alarm	Action
UPSTREAM OCCLUSION ALARM SUSPENSION (**Continued**)	*NOTE:* Upstream Occlusion Suspension feature is enabled by default in the Drug Library for BASIC mode. ⚠️ **WARNING:** Upstream Occlusion Alarm Suspension feature should only be used after the operator visually observes positive line flow. **Figure 66.** Upstream Suspension Prompts for Primary and Secondary Infusions.
VERY LOW BATTERY	Less than ½ of the low battery capacity remains. The AC Power Adaptor should be plugged in immediately. The tutorial to check the AC Power Adaptor will automatically begin (see "APPENDIX F - Low / Very Low Battery Tutorial" section, beginning on page 109).

Preventing Nuisance Alarms

Check the following items to prevent nuisance alarms:

- Remove all air from IV sets. While priming, invert and tap air from all Y injection sites and back check valves.
- Do not administer extremely cold or hot solutions. Warm solutions to room temperature before use to help prevent nuisance upstream occlusion or air-in-line alarms caused by out-gassing of micro bubbles.
- Effervescent, foamy or frothy solutions can result in nuisance upstream occlusion alarms.
- Invert (do not shake) IV bags that need to be mixed.
- Fill drip chambers half way.
- Do not load pumped-on IV set tubing in the pumping channel or in the air and occlusion detector areas.
- Use only compatible IV sets as labeled and identified on the SIGMA pump.
- Keep the tubing channel clean and dry.
- Avoid empty IV containers by properly setting VTBI values.
- Plug in pump's AC Power Adaptor to maintain battery charge.
- Use the medium or high DS (downstream) Pressure Limit setting at flow rate settings above 500 mL/hr to avoid downstream nuisance alarms that are created by IV set pulsation.

Managing Bolus before Occlusion (Downstream) Release

Managing unintended small bolus releases when clearing downstream occlusions

When a downstream occlusion alarm occurs, pressure and a small volume of <0.98 mL of fluid (the "bolus") builds up between the pump and the point of occlusion. When it might be harmful to infuse the bolus into the patient, simultaneously withdraw 0.9 mL of fluid from the lower Y injection site of the IV set and eliminate the source of the occlusion.

Battery Warning Levels

The pump provides three warning levels as the battery capacity decreases while operating on battery power. These levels are:

- Low Battery
- Very Low Battery
- Battery Depleted

There is ample time between the alarms for the pump to be plugged into main power. The trouble-shooting tutorial also automatically pops up on the pump screen to guide the user through the process. See "APPENDIX F - Low / Very Low Battery Tutorial" section, beginning on page 109.

If the pump is not plugged in, the battery continues to slowly discharge even if the pump is turned off.

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Low Battery

When the battery is low, the pump sounds a triple-beep audio alarm every 5 seconds. Press **OK** to temporarily suspend this alarm. While suspended, the Low Battery status will be indicated in the alert bar and a tone will be generated once every five minutes to remind the operator of the Low Battery status. (See Figure 67.)

Figure 67. Low Battery Alarm.

If the pump is not plugged in or the alarm is not acknowledged after 2 minutes, the alarm volume increases and the troubleshooting tutorial automatically begins.

When the Low Battery warning initiates, a minimum of 30 minutes of runtime remains.

Very Low Battery

If the battery level drops below the low-battery level, the message changes to Very Low Battery and begins to flash. The back light also dims to reduce battery usage. (See Figure 68.)
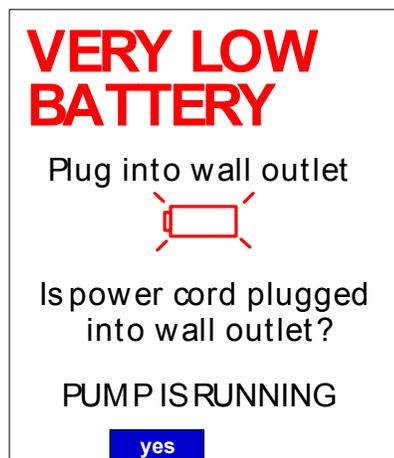

Figure 68. Very Low Battery Alarm.

The troubleshooting tutorial starts automatically.

When the Very Low Battery warning initiates, a minimum of 15 minutes of runtime remains.

Battery Depleted

If the battery level drops below the Very Low Battery level, the message changes to Battery Depleted. (See Figure 69.)

Figure 69. Battery Depleted Alarm.

The pump will stop running. If the pump is not plugged in within 3 minutes, the pump will shut itself off.

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