BRAINTREE SCIENTIFIC, INC.
LAB RESEARCH PRODUCTS

SAI 3D™ Syringe Pump

Operator's Manual

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Disclaimer

SAI Infusion Technologies

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1 - About This Manual

The SAI 3D Syringe Pump Operator's Manual is intended for use by trained laboratory professionals familiar with infusions and infusion pumps. This manual should be read and understood prior to using the SAI 3D™ Syringe Pump.

Notations used in this Manual:

- **Important information** is preceded by the word "**Note**" in boldface type.

BOLD ITALIC TEXT	Denotes text prompts as they appear on the pump's status display. For example, ***ML/HR*** is the text that appears on the bottom line of the status display when selecting the mL/hr infusion mode.
BOLD TEXT	Denotes the keys on the pump's keypad. For example, the text "press **123, CONFIRM"** means: press the keys labeled "1," "2," and "3," and then press the key labeled **"CONFIRM."**
(hh:mm)	Denotes hours and minutes. The left two digits represent hours, and the right two digits represent minutes.

- **Important precautions** are denoted by an exclamation point enclosed in a triangle, as shown below:

> **IMPORTANT:** Read and understand all operating instructions before using the SAI 3D™ Syringe Pump.

2 - Device Description

The SAI 3D™ Syringe Pump delivers reliable rates of infusion of standard intravenous solutions and is specifically designed for the pre-clinical research environment. **This pump is not intended for human use.** The SAI 3D™ Syringe Pump uses a standard programming regimen to infuse continuously or intermittently, and incorporates programmable rates of infusion from 0.01 to 438 mL/hr depending upon syringe manufacturer and size.

Standard disposable syringes from 1 mL to 60 mL may be used in the pump. Programming for infusion is accomplished by inputting values via the numeric keypad. The digital display prompts for data entry of syringe type, size, rate, and volume limits, and displays the pump status during the infusion. The pump may include optional WiFi communication features, which provide remote computer control and monitoring capabilities. An Ethernet (RJ-45) connector allows links between the pump and a host computer.

The SAI 3D™ Syringe Pump can be custom-configured to select key features that meet specific requirements. Configurable options include:

1. **Infusion mode selections**
2. **Syringe manufacturer, type, and size selections**
3. **Remote computer control**
4. **Keypad auto lock**
5. **Occlusion pressure sensitivity**
6. **Auto default to previous mode**
7. **Maximum infusion rates**
8. **Backlight**
9. **Audio range**

The selected options and the chosen configuration can easily be reviewed and changed to meet the requirements of a specific infusion.

The pump is powered by an AC charger (Part # E1800) & Cable (#E1801) or Power-Over-Ethernet (using cable #E1801). The pump also has an internal, rechargeable power supply.

3 - Precautions

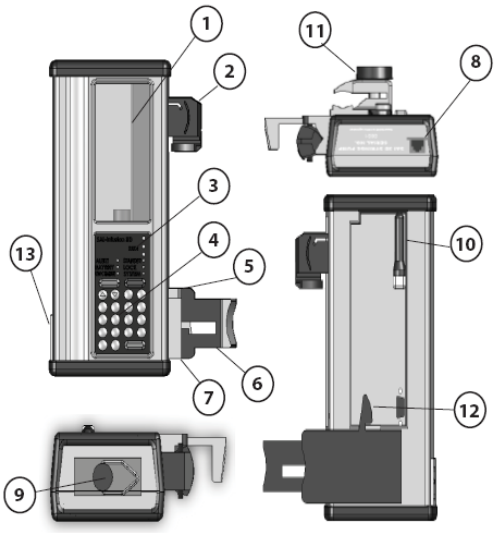
CAUTION: As with all electronic equipment, care must be exercised to avoid exposing this device to powerful sources of electromagnetic interference.
CAUTION: Do not operate the 3D Infusion Pump in the presence of flammable anesthetics, oxygen enriched, or explosive atmospheres.
CAUTION: Refer all service, repair, and calibration to SAI.
CAUTION: The charger port is to be used only with the SAI 3D™ Syringe Pump.

1. **Do not** expose the pump to strong electric or magnetic fields, X-rays, gamma rays, or other ionizing radiation.
2. **Do not** subject the pump to temperatures in excess of 104°F (40°C).
3. **Do not** sterilize the pump, i.e. autoclave, or EtO….
4. **Do not** use sharp or hard objects on the keypad.
5. When a ***LINE OCCLUDED*** alarm occurs, **REDUCE THE RESIDUAL PRESSURE IN THE SYRINGE BY RELEASING THE PLUNGER DRIVER.** If the pressure is not reduced prior to clearing the occlusion, an unintentional bolus delivery may occur when the occlusion is cleared. Causes for occlusion include kinked tubing, a clogged catheter, obstructed or closed stopcocks, etc. If foreign material is preventing movement of the pump mechanism, remove the material prior to resuming the infusion. Air in any infusion system could precipitate unwanted serious effects.
6. Be sure to **PURGE THE SYSTEM OF ALL AIR BEFORE ADMINISTERING ANY INFUSION**. Failure to follow this normal infusion procedure could precipitate serious consequences.
7. Be aware that there is a volume of fluid required to fill the connecting tubing and allow for this extra v volume of fluid when initially filling the syringe.
8. The START button must be pressed in MANUAL SCHEDULE mode to deliver each dose and continue the infusion regimen. Pressing any other key silences the audio portion of the DOSE DUE alarm and leaves the pump in Standby state, without starting a dose delivery.
9. Although extreme care has been taken in assembly, component selection, and quality control during manufacture of the SAI 3D Syringe Pump™, routine checks and maintenance procedures must be performed to ensure trouble free infusions.
10. When the pump is first turned on, verify that the Lamp Test is successful (see "Display, Battery, and Syringe Sensor Check" on 50.
11. All programming inputs & data should be verified before pressing START.
12. Wipe off spills immediately. Do not allow fluid or residues to remain on the pump.
13. A pump fault condition such as a 'repeated incorrect identification of syringe size' by Syringe Recognition may indicate that a syringe manufacturer has made a dimensional change. The pump should be removed from service as soon as possible, so that the problem can be investigated.
14. Incorrect syringe information may cause delivery errors. If the Size Override configuration option is enabled, an operator can manually override the Syringe Recognition feature.

4 - Simplified Instructions

Diagram of Pump Controls: Refer to the figure below for the location and description of the pumps operating controls. The item numbers shown in the figure are referenced throughout this operating manual.

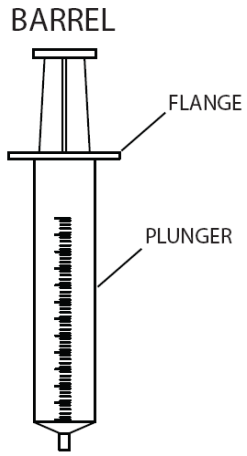
1. Status Display
2. Plunger Assembly (Finger Grip, Plunger Clamp, Plunger Driver)
3. Status Panel
4. Keypad
5. Flange Slot
6. Barrel Clamp
7. Cradle
8. Charger Port / Ethernet connection
9. IV Pole Loop
10. Antenna (Optional)
11. Pole Clamp
12. Barrel Clamp Release Lever
13. ON/OFF Switch



Simplified Instructions:

Note: Steps 1 and 2 can be performed after programming the pump if necessary (for example, if using **CUSTOM DILUTION** mode).

STEP 1	Attach an IV extension set to the syringe and manually purge the air from the filled syringe and tubing.
STEP 2	Mount the syringe on the pump. • Pull the plunger driver (**2**) out from the pump, slide it to the top of the pump, and release it. • Using the lever (**12**) on the rear of the pump, release the barrel clamp (**6**). • Place the syringe in the syringe cradle (**7**) and insure the syringe flange fits into the slot (**5**). • Firmly close the barrel clamp (**6**) against the syringe barrel. • Pull out the plunger driver (**2**), slide it down to cover the top of the syringe plunger, and push in firmly to capture syringe plunger.
STEP 3	Slide the **ON/OFF** switch (**13**) to the **ON** position.
STEP 4	Program the pump (see "Programming" on page).
STEP 5	Purge the syringe and tubing again to remove slack from the plunger driver. • Press **PURGE**, **START** to begin purging. Repeat if necessary. • Press **STOP** if necessary to stop purging.
STEP 6	Connect the IV extension set to the animal.
STEP 7	Press **START** to begin the infusion.



Programming:

STEP 1	At the **SELECT MODE** prompt, use ▲ or▼ as necessary to display the available infusion mode selections. Press **CONFIRM** to select an infusion mode.
STEP 2	Select the syringe manufacturer and size using ▲ or ▼ as necessary and complete the data entry by pressing **CONFIRM**.
STEP 3	Enter the remaining program data as required. The current field is the one that is flashing. • Press number keys to enter the desired value. • Press **CONFIRM** to complete the data entry.
STEP 4	To change programmed data: • Press ▲ or ▼ to move to the desired field. • Press **EDIT**. The current value flashes. • Press ▲ or ▼, or number keys to change the value. • Press **CONFIRM** to complete the data entry.
STEP 5	To program or edit the bolus size: • Press **BOLUS**, **EDIT**. • Set the bolus size using the number keys. • Press **START** to deliver a bolus, or **CONFIRM** to store the bolus size.
STEP 6	To clear the Total Delivered display: • Use ▲ or ▼ to move to the **TOTAL** mL field. • Press **EDIT**, **CLR** to reset the total to 0.00.

Programming the Continuous Infusion Modes:

Programming for each infusion mode proceeds in the sequence listed in the following order.

STEP 1	Select Mode.
STEP 2	Select Syringe Manufacturer.
STEP 3	Select Syringe Size.
STEP 4	Enter Infusion Rate in mL/hr or mL/min.
STEP 5	Enter Volume Limit in mL.
STEP 6	Enter Bolus Volume (or amount for dose units)

Continuous Infusion Modes					
	mL/hr mL/min	**Units/hr Units/min mUnits/hr mUnits/min**	**mcg/min mcg/hr mg/min mg/hr**	**mcg/kg/min mcg/kg/hr mg/kg/min mg/kg/hr**	**Custom Dilution**
STEP 1	Select mode, syringe manufacturer, syringe size.	Select mode, syringe manufacturer, syringe size.	Select mode, syringe manufacturer, syringe size.	Select mode, syringe manufacturer, syringe size.	Select mode, syringe manufacturer, syringe size.
STEP 2					Enter target rate in mL/hr.
STEP 3				Enter body weight in kg.	Enter body weight in kg.
STEP 4		Enter drug concentration in Units/mL.	Enter drug concentration in mg/mL.	Enter drug concentration in mg/mL.	Enter drug concentration in mg/mL.
STEP 5	Enter infusion rate in mL/hr or mL/min.	Enter dose in Units/hr, Units/min, mUnits/hr, or mUnits/min.	Enter dose in mcg/hr, mcg/min, mg/hr, or mg/min.	Enter dose in mcg/kg/hr, mcg/kg/min, mg/kg/hr, or mg/kg/min	Enter target dose in mcg/kg/min.
STEP 6					Enter final volume in mL.
STEP 7	Enter volume limit in mL.				See last Note below.
STEP 8	Enter bolus size in mL.	Enter bolus size in Units.	Enter bolus size in mg.	Enter bolus size in mcg/kg or mg/kg.	Enter bolus size in mcg/kg.

Programming the Timed Infusion Modes:

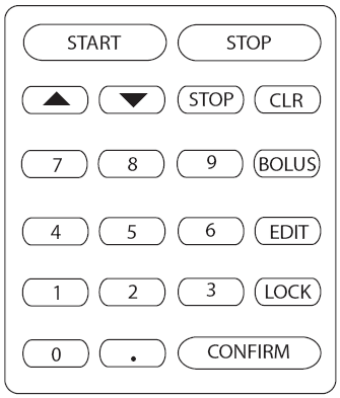
Programming for each infusion mode proceeds in the sequence shown in the following table, in top-to-bottom order.

Timed Infusion Modes			
	Single Dose	**Manual Schedule**	**Auto Schedule**
STEP 1	Select mode, syringe manufacturer, syringe size.	Select mode, syringe manufacturer, syringe size.	Select mode, syringe manufacturer, syringe size.
STEP 2	**INFUSE** field: enter dose in mL.	**INFUSE** field: enter dose in mL.	**INFUSE** field: enter dose in mL.
STEP 3	**OVER** field: Enter dose duration in hours and minutes (hh:mm).	**OVER** field: Enter dose duration in hours and minutes (hh:mm).	**OVER** field: Enter dose duration in hours and minutes (hh:mm).
STEP 4		**EVERY** field: Enter dose Interval in hours and minutes (hh:mm).	**EVERY** field: Enter dose Interval in hours and minutes (hh:mm).
STEP 5		**NEXT DOSE IN** field: Enter delay to start of first dose in hours and minutes (hh:mm). To start the first dose without delay, program **NEXT DOSE IN** field to **0:00**.	**NEXT DOSE IN** field: Enter delay to start of first dose in hours and minutes (hh:mm). To start the first dose without delay, program **NEXT DOSE IN** field to **0:00**.
STEP 6		When the **DOSE DUE** alarm occurs, press **START** to deliver one dose.	

5 - General Information

Technical Specifications	
Model:	SAI 3D™ Syringe Pump
Size:	approx. 4.75" x 2.6" x 10"
Weight:	approx. 3.2 lb. (1.45 kg)
Flow Rate Accuracy:	± 3% of full scale plunger travel (not including syringe tolerance)
Volume Accuracy:	± 3%, or 0.001" of travel, whichever is greater (not including syringe tolerance)
Syringes:	B-D® 1, 3, 5, 10, 20, 30, and 60 mL plastic Sherwood Monoject® 1, 3, 6, 12, 20, 35, and 60 Ml Terumo® 1, 3, 5, 10, 20, 30, and 60 mL
Flow Rate Range:	0.01 mL/hr to 438 mL/hr, depending on the syringe
Deliverable Volume:	Full syringe volume for 1-60 mL syringes
Data Display:	Self-prompting, multi-field LCD (Liquid Crystal Display)
Status Display:	Nine-LED (Light Emitting Diode) array
Power Requirement:	AC: 105-125V 60 Hz (battery charger) DC: internal rechargeable battery pack
Battery Operating Time:	~24 hours of operation at 1 mL/hr using a 60 mL syringe, following a charge of no less than 16 hours (without WiFi)
Temperature Range:	50°F to 104°F (10°C to 40°C); Delivery of high viscosity fluids at low temperatures is not recommended
Keypad:	Elastomeric type, with tactile feedback
Construction:	Water-resistant, high-impact plastic case with removable elastomeric protective Bumpers.

The Keypad:

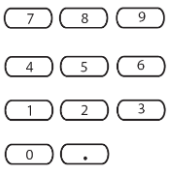


The keypad includes a standard set of number keys and decimal points (referred to in this document as digit keys), arrow keys, and various function keys.

Arrow Keys

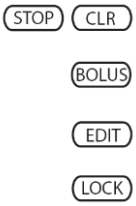
The up arrow key (▲) increases a number, selects a different field, or displays the next item in a list.
The down arrow key (▼) decreases a number, selects a different field, or displays the previous item in a list.

Digit Keys



The digit keys are used to enter numeric values directly.

Function Keys



The function keys activate specific functions.

Action Keys

The action keys start and stop the pump motor.

Confirm Key

The confirm key is used to complete a programming step, respond to a prompt, or display additional infusion program information.

The Status Panel:

RUN lights	• When the pump is in the Run state, one or more of the green RUN lights are on. • When the pump is infusing, the three RUN lights flash in a descending sequence. • When the pump is counting time until an infusion is to begin, only the top RUN light flashes. • When a bolus or purge is in progress, all three RUN lights flash simultaneously.
ALERT	The red ALERT light flashes during an alert or alarm. The status display and remaining status lights may display additional information.
BATTERY	When flashing, the red BATTERY light indicates that the battery charge is low. If the battery discharges significantly, the BATTERY light stays on constantly and the pump goes into a fail-safe alarm state.
ON CHARGE	The green ON CHARGE light indicates that the battery charger is plugged in.
STANDBY	The yellow STANDBY light flashes to indicate that the pump is in Standby state.
LOCK	The yellow LOCK light indicates that the keypad is locked.
SYSTEM	The red SYSTEM light indicates a malfunction. The pump cannot operate until the problem is corrected. The infusion must then be reprogrammed.

Operating States:

STANDBY STATE	When the pump is in Standby state, the infusion is stopped and the **STANDBY** light flashes. If the pump is left in Standby state for more than two minutes, a **PUMP IS IDLE** alert or alarm occurs.
RUN STATE	There are two run states: **Run Delivering state** and **Run Counting state.** • Run Delivering state: The infusion program is running and the pump is delivering an infusion. The three **RUN** lights flash in descending sequence. • Run Counting state: The infusion program counts time until the next dose is due, and the pump does not deliver an infusion. The top **RUN** light flashes. **Note:** Bolus and Purge operations are special infusion states. The **RUN** lights flash in unison when bolusing or purging in both Standby and Run states.

Data Display and Entry :

Numeric Data	Numbers are displayed in a right-justified format. A leading zero appears before decimal values when the field size permits. For example, the value ".12" is displayed as ***0.12***.
Time Data Fields	In time data fields, values are displayed right justified. Leading zero(s) are automatically entered if needed. For example, 1 minute is entered by pressing **1. CONFIRM** and is displayed as ***0:01***.
Automatic Decimal	If a number is entered without a decimal point, the pump automatically enters a decimal point to the right of the number when **CONFIRM** is pressed.
Flashing Data	The data within a field flashes to indicate that the field has been opened and is ready to be programmed or edited.
Flashing Indicators	The indicators for the current field flash. The current field is open for editing when **EDIT** is pressed.
Data Test	All entered data is tested when **CONFIRM** is pressed. If the entered value is too large or too small, the pump issues a ***PUMP LIMIT*** alert and substitutes the nearest acceptable value. Press **CONFIRM** to accept the value, or enter a different value.
Arrow Keys	Arrow keys can be used instead of individual digits for selecting predefined responses, incrementing or decrementing fields. In general, arrow keys cannot be used to initialize fields that have been cleared to dashes, except for syringe size and manufacturer fields.
Key Sounds	An audible click provides confirmation of each key press. The pump indicates an invalid key press by sounding a short beep. Simultaneous key presses are ignored.
Dashes	Dashes are displayed when a field is clear and open for programming. In general, digit keys must be used to enter a value in a dashed field. If an arrow key is pressed while dashes are displayed, the pump beeps and displays the message **USE DIGITS**.

Communication Features:

Some models provide remote control and monitoring capabilities. A standard RJ45 connector allows the connection between the pump and a computer. The cable allows an operator at a remote computer to control pump operations and to query the pump for data such as infusion totals, program values, and operational status. The remote control feature is a configurable option. See the SAI 3D Syringe Pump™ Programmer's Manual for details.

Note: Any model can be upgraded to wireless (WiFi) communications.

Infusion Modes:

The pump provides 18 infusion modes, which fall into two major categories: continuous and timed infusions. Continuous infusions deliver at a steady, programmed rate. Timed infusions deliver one or more equal doses according to a programmed schedule. The infusion modes are briefly described below. For more information, see "Detailed Instructions" on page 18.

Continuous Infusion Modes :

mL/hr and ml/min:	The rate of infusion is programmed in mL/hr or mL/min, depending on the mode selected. A volume limit can be programmed for these modes only.
Units/hr, Units/min, mUnits/hr and mUnits/min:	The research article concentration is entered in units/mL, and the dose is entered in Units/hr, Units/min, mUnits/hr or mUnits/min, depending on the mode selected. The pump automatically displays the effective rate in mL/hr.
mg/hr, mg/min, mcg/hr and mcg/min:	The research article concentration is entered in mg/mL, and the dose is entered in mg/hr, mg/min, mcg/hr or mcg/min, depending on the mode selected. The pump automatically displays the effective rate in mL/hr.
mg/kg/hr, mg/kg/min, mcg/kg/hr and mcg/kg/min:	The animal's body weight is entered in kg, the research article concentration is entered in mg/mL, and the dose is entered in mg/kg/hr, mg/kg/min, mcg/kg/hr, or mcg/kg/min, depending on the mode selected. The pump automatically displays the effective rate in mL/hr.
CUSTOM DILUTION:	In this mode, the pump is programmed for a continuous infusion and the research article concentration is adjusted for a target infusion rate and dose. The target rate is entered in mU/hr, the patient's body weight is entered in kg, the initial drug concentration is entered in mg/mL, the target dose is entered in mcg/kg/min, and the final volume is entered in mL. The pump calculates and displays the volume of drug (in mL) to be added to the infusion base solution to produce a final concentration that achieves the target rate and target dose. The final concentration is displayed when the infusion is initiated.

Timed Infusion Modes:

SINGLE DOSE:	In this mode, the pump is programmed to infuse a single dose over a specified period of time. The dose is entered in mL, and the time period is entered in hours and minutes.
MANUAL SCHEDULE:	In this mode, the pump is programmed to infuse a dose over a specified period of time, and to repeat the dose at specified intervals. The dose is entered in mL, and the time period and interval are entered in hours and minutes. The pump alerts the operator when a dose is due to start. The operator must then press **START** to initiate each dose.
AUTO SCHEDULE:	In this mode, the pump is programmed to infuse a dose over a specified period of time, and to repeat the infusion at specified intervals. The dose is entered in mL, and the time period and interval are entered in hours and minutes. Whereas ***MANUAL SCHEDULE*** mode requires the operator to press **START** to initiate each dose, ***AUTO SCHEDULE*** mode automatically starts each dose when it is due.

Syringe Data Table :

This table shows the performance ranges for infusion delivery parameters, which are a function of the syringe dimensions.

Infusion Rate Ranges:

Syringe Manufacture	Syringe Size (mL)	Minimum Flow Rate (mL/hr)	Maximum Flow Rate (mL/hr)
B-D® Plastic	1	0.01	11
	3	0.02	38
	5	0.03	74
	10	0.1	107
	20	0.1	188
	30	0.1	241
	60	0.1	366
MonoJect®	1	0.01	11
	3	0.02	41
	6	0.03	83
	12	0.1	126
	20	0.1	208
	35	0.1	285
	60	0.1	366
Terumo®	1	0.01	11
	3	0.02	41
	5	0.03	87
	10	0.1	129
	20	0.1	210
	30	0.1	276
	60	0.2	438

6 - Detailed Instructions

This section provides detailed descriptions of the seven basic steps required to operate the pump:

Note: Steps 1 and 2 can be performed after programming the pump if necessary (for example, if using CUSTOM DILUTION mode).

STEP 1	Attach an appropriate extension set to the syringe and manually purge the air from the filled syringe and tubing.
STEP 2	Mount the syringe on the pump.
STEP 3	Slide the **ON/OFF** switch (7) to the "on" position (refer to figure on the following pages).
STEP 4	Program the pump.
STEP 5	Purge the syringe and tubing again to remove slack from the plunger driver.
STEP 6	Connect the extension set to the patient.
STEP 7	Press **START** to begin the infusion.

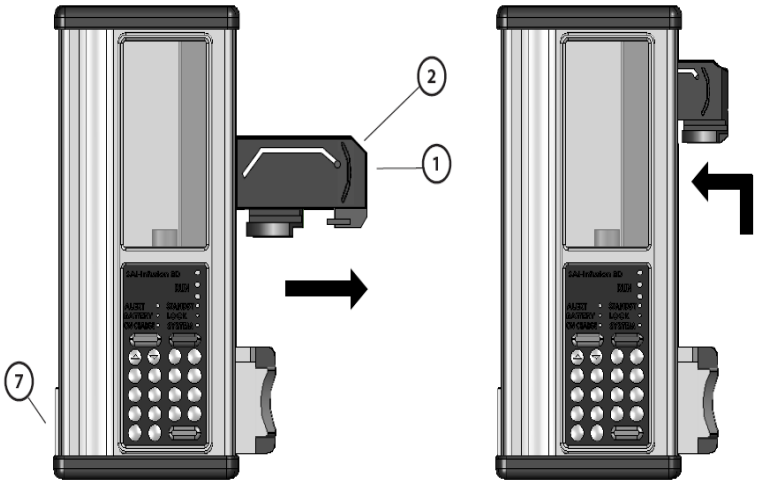
Preliminary Operations:

- **Purge**:

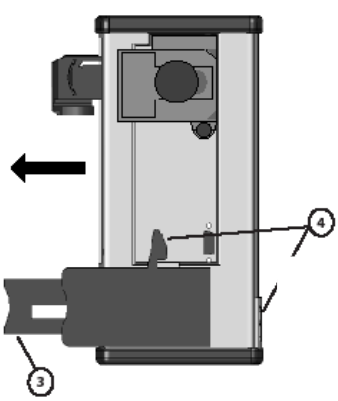
STEP 1	Attach a fluid line or extension set to a pre-filled syringe
STEP 2	Disconnect the cap and disengage any stopping mechanism from the tubing.
STEP 3	Purge until you see a fluid droplet form at the end of the tubing.
STEP 4	Replace any sterile caps which may have been removed at the end of the tubing.

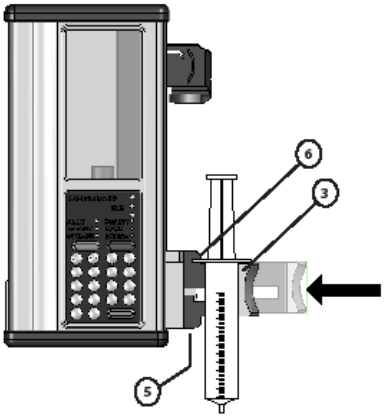
- **Placing Syringe on Pump**:

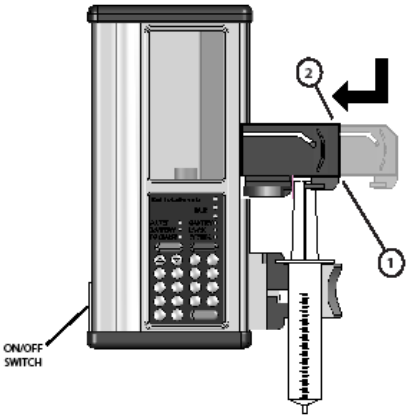
STEP 1	Take hold of GRIP (1) on the PLUNGER DRIVER (2) and extend it all the way out.
STEP 2	Slide the PLUNGER DRIVER to the far end of the pump and release.



STEP 3	Open the BARREL CLAMP (3) by moving the BARREL CLAMP RELEASE mechanism (4).
STEP 4	Place the syringe so it is centered in the V of the CRADLE (5), assuring the flange of the syringe is securely fitted into the FLANGE SLOT (6).
STEP 5	Depress the BARREL CLAMP (3) firmly with the heel of the hand so that it securely holds the barrel of the syringe.
STEP 6	Re-grasp the FINGER GRIP (1) on the PLUNGER DRIVER (2) and extend it all the way out. Slide the DRIVER down to the syringe plunger and release.
STEP 7	Push the PLUNGER CLAMP in firmly to capture the syringe plunger.





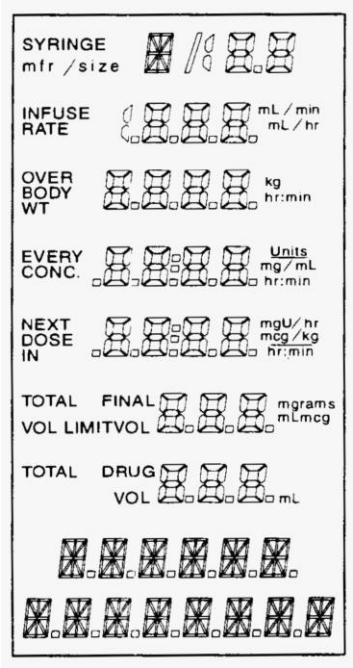


• Turn the Pump On and Off :

• The **ON/OFF** switch is near the bottom on the left side. Slide the switch up to the **ON** position to turn on the pump.

Note: Alert messages such as: ***CHECK BARREL***, ***CHECK FLANGE***, *or* ***CHECK PLUNGER*** may be displayed if the syringe is not mounted properly. Reposition the syringe to correct any issues. If more than one issue is present, a ***CHECK SYRINGE*** alert or alarm message will be displayed instead.

• Slide the switch down to the **OFF** position to turn the pump off.



Check the Lamp Test:

When the power switch has been put in the ON position, a function test begins automatically. This includes the Light Function Test, which triggers the illumination of the status LED's and the display LCD. Make sure that all the lights light-up and that all parts of the display are readable. See related "Check of Charge, Display and Syringe Sensor Check" on page 50.

Holding the **STOP** key will freeze the LCD panel of lights on, to give you more time to verify functionality. The Light Test will end when you release the **STOP** key.

The battery voltage will be displayed in the text field immediately following completion of the Lamp Test.

An audible beep will sound to indicate the completion of the Light Test.

Programming the 3D Pump:

You may begin programming the pump once the preliminary operations have been completed. See “Additional Functions and Operations" on page 36.

Continuous Rate Programming:

In the **mL/hr** and **mL/min** modes, the pump will deliver at a constant rate. You may program a volume limit in either of these modes.

STEP 1	Select the desired infusion mode at the ***SELECT MODE*** ▲▼ prompt, using ▲ or ▼ to display the selections available. Select the desired infusion mode by pressing **CONFIRM**.
STEP 2	Syringe manufacturer and size is selected by using ▲ or ▼ and **CONFIRM** keys as necessary.
STEP 3	Enter the constant infusion rate in mL/hr or mL/min.
STEP 4	Press **CONFIRM**.

- **Volume Limit**

You may configure the pump to stop when a desired volume has been delivered by configuring the pump using the Volume Limit option. This option is only available in the continuous delivery rate modes.

Enter the desired volume limit. When the delivery begins, the VOL LIMIT field displays the volume remaining until the programmed volume limit is reached. The pump stops when the **VOL LIMIT** field reaches zero.

Temporarily disable the Volume Limit feature by programming zero (0) in the **VOL LIMIT** field.

- **Bolus in constant delivery Modes***

If you wish to deliver a bolus in **mL/hr** or **mL/min** delivery mode:

1. Press **BOLUS** to display programming option.
2. Press **EDIT**, then set the bolus size (in mL) by using the numbered keys.
3. Press **CONFIRM** to store the size of the bolus and return to the normal display. The bolus infusion rate is automatically set to the current delivery rate.

***See "Bolus Function" on page 38 for more information on bolus delivery.
Note: For mL/min mode, the bolus rate is displayed in mL/min. For all other modes, it is displayed in mL/hr.

- **Programming Notes**

1. The size of the syringe will determine the minimum and maximum infusion rates attainable. See "Syringe Rate Data Table" on page 17 for rate range details.
2. Pressing **CONFIRM** during delivery briefly displays additional program data.
3. You must enter the syringe size before a bolus can be programmed, edited or delivered.

Programming Units/hr, Units/min, mUnits/hr, and mUnits/min Modes:

In these modes, the pump runs at a programmed, constant rate but the infusion is programmed in terms of research article concentration and dose.

STEP 1	At the ***SELECT MODE*** ▲▼ prompt, use ▲ or ▼ to display the available options. Press **CONFIRM** to select the desired infusion mode.
STEP 2	Select the syringe manufacturer and size by pressing ▲ or ▼ and **CONFIRM** as required.
STEP 3	Enter the research article concentration (***CONC.***) at the ***ENTER CONCENTR*** prompt, in Units/mL. Press **CONFIRM**.
STEP 4	At the ***ENTER DOSE*** prompt, enter the dose in Units/hr, Units/min, mUnits/hr, or Units/min (mUnits = milliUnits) and press **CONFIRM** to **complete** the data entry. The pump will automatically calculate and displays the infusion rate in mL/hr.

- **Bolus in Units/hr, Units/min, mUnits/hr, and mUnits/min Modes**

Bolus size is entered in Units or mUnits and the pump will automatically calculate the volume of the bolus in mL and display both values. Bolus rate is displayed in mL/hr. See "Bolus Function" on page 38 for more details.

- **Programming Notes**

  - The available test article concentration range is from 0.01 Units/mL to 9999 Units/mL. The dose limits are determined by the test article concentration and syringe selection. See "Syringe Rate Data Tables" on page 17 for minimum and maximum infusion rates.

  - Once the infusion has been started you are not allowed to change the (**CONC)**.

  - Pressing **CONFIRM** during delivery will display additional program data, briefly.

  - The test article concentration (***CONC.*)** must be entered prior to the programming, editing, or delivering of a Bolus.

Utilizing the mg/hr, mg/min, mcg/hr, and mcg/min Modes:

The pump runs at a constant delivery rate and the infusion is programmed in based on research article concentration and dose.

STEP 1	Use the ▲ and ▼ keys at the ***SELECT MODE*** ▲▼ prompt to display the available infusion mode selections and press **CONFIRM** to select mg/hr, mg/min, mcg/hr or mcg/min.
STEP 2	Select the appropriate syringe manufacturer and size by using ▲ or ▼ and **CONFIRM** as required.
STEP 3	Enter the research article concentration (***CONC.*)** in mg/mL and press **CONFIRM.**
STEP 4	Enter the dose in mg/hr, mg/min, mcg/hr or mcg/min, and press **CONFIRM**. The pump will automatically calculate and display the appropriate rate in mL/hr.

- **Bolus in mg/hr, mg/min, mcg/hr, and mcg/min Modes**

Bolus size is entered as an amount, mg or mcg, and the pump calculates the bolus volume in mL and displays both values. The rate is displayed in mL/hr. For more details refer to "Bolus Function" on page 38.

- **Programming Notes**

  - The drug concentration range is from 0.0001 Units/mL to 9999 Units/mL. The dose limits are determined by the research article concentration and syringe selection. See "Syringe Rate Data Tables" on page 17 for infusion rate ranges.

  - Once the infusion has been initiated the ***CONC.*** field cannot be changed.

  - Additional program data may be displayed briefly by pressing **CONFIRM.**

  - The research article concentration (***CONC.***) must be programmed before a bolus can only be programmed, edited, or delivered.

Utilizing mg/kg/hr, mg/kg/min, mcg/kg/hr, and mcg/kg/min Modes:

The pump runs at a programmed, constant rate, and the infusion is programmed based on body weight, research article concentration and dose.

STEP 1	Select the appropriate mode at the ***SELECT MODE*** ▲ ▼ prompt and use ▲ or ▼ to display the mode selections. Press **CONFIRM** to select the appropriate mode.
STEP 2	Select the syringe manufacturer and size in the same manner, using ▲ or ▼ and **CONFIRM.**
STEP 3	Enter the animal body weight (BODY W1) in kg and press **CONFIRM**.
STEP 4	Enter the research article concentration (***CONC.***) in mg/mL and press **CONFIRM.**
STEP 5	Enter the dose in mg/kg/hr, mg/kg/min, mcg/kg/hr or mcg/kg/min, and press **CONFIRM.** The pump calculates and displays the rate in mL/hr.

- **Bolus in mg/kg/hr, mg/kg/min, mcg/kg/hr, and mcg/kg/min Modes**

In mg/kg/hr and mg/kg/min modes, the bolus dose is entered in mg/kg. In mcg/kg/hr and mcg/kg/min modes, bolus size is entered in mcg/kg. The pump calculates the bolus volume in mL and displays both values. Bolus rate is displayed in mL/hr. See "Bolus Function" on page 38 for more details.

- **Programming Notes**

  - The body weight range is from 0.01 to 200.0 kilograms (kg). The research article concentration range is from 0.0001 mg/mL to 100.0 mg/mL. The concentration range may be further limited for very large or small body weights. The dose limits are determined by the research article concentration and syringe selection. See "Syringe Rate Data Tables" on page 17 for infusion ranges.

  - Once the infusion has been started the **CONC.** and **BODY WT** entries cannot be changed.

  - Additional program data may be displayed by pressing **CONFIRM** during delivery.

  - The research article concentration (***CONC.***) must be entered before a bolus can only be programmed, edited, or delivered.

Utilizing CUSTOM DILUTION Mode:

The pump runs at a constant rate and the infusion is entered, based on target rate, body weight, initial concentration, target dose, and final volume. The pump automatically calculates and displays the test solution volume to be mixed with sufficient diluent to yield the final volume. The final concentration is displayed when a bolus or infusion is initiated.

STEP 1	At the ***SELECT MODE*** ▲ ▼ prompt, use ▲ or ▼ to display the available infusion mode selections. Press **CONFIRM** to select the CUSTOM DILUTION mode.
STEP 2	Use ▲ or ▼and **CONFIRM** as required to select the syringe manufacturer and size.
STEP 3	Enter the target rate (***RATE***) in mL/hr. Press **CONFIRM** to complete the data entry.
STEP 4	Enter the animal body weight (***BODY WT***) in kg. Press **CONFIRM** to complete the data entry.
STEP 5	Enter the initial research article concentration (***CONC.***) in mg/mL and press **CONFIRM**.

STEP 6	Enter the target dose (***DOSE***) in mcg/kg/min and press **CONFIRM.**
STEP 7	Enter the final volume (***FINAL VOL***) in mL and press **CONFIRM**.
STEP 8	In the ***DRUG VOL*** field, the pump displays the volume of research solution that must be mixed with diluent to yield the final volume. The text field displays ***DRUG VOL***. Press **CONFIRM** to acknowledge the research solution volume.
STEP 9	Mix the indicated research solution volume (***DRUG VOL***) with sufficient diluent to produce the final dosage volume (***FINAL VOL***).
STEP 10	Attach an extension line to the syringe and manually purge all air.
STEP 11	Mount the syringe.
STEP 12	Perform a purge operation to fully engage the plunger driver.
STEP 13	Press **START**. The new final concentration will be displayed.

- **Bolus in CUSTOM DILUTION Mode**

The bolus dose is programmed in mcg/kg. The pump calculates the bolus volume in mL. Bolus rate is displayed in mL/hr. See "Bolus Function" on page 38 for more details.

- **Programming Notes**

Once the ***DRUG VOL*** value has been **CONFIRM**ed, the target rate field (***RATE***) will be updated to display the actual infusion rate. (This value is usually very close to, or the same as the target rate.)

The program data fields all remain displayed and available for editing until an infusion or bolus is started. At that point, the pump replaces the original research solution concentration (***CONC***.) with the final dosage concentration, and clears the fields containing the final volume (***FINAL VOL*)** and the drug volume (***DRUG V0L***). The rate of infusion, body weight and dose remain displayed. Press **CONFIRM** to briefly display the hidden program data (original solution concentration, final volume, and research solution volume).

Target rate (***RATE***) limits are determined by the syringe selection and Rate Range configuration (see "Syringe Rate Data Tables" on page 17 for individual syringe rate ranges). The body weight range is from 0.01 to 200.0 kilograms (kg). The research article concentration range is from 0.0001 mg/mL to 100.0 mg/mL. The concentration range may be further limited for very large or small body weights. Target dose limits are determined by the drug concentration and syringe selection. The Final Volume range is from 30 mL to 250 mL.

Once the infusion is started the ***CONC.*** and ***BODY WT*** fields cannot be edited. The pump must be fully programmed before a bolus can only be programmed, edited, or delivered.

Utilizing SINGLE DOSE Mode:

SINGLE DOSE mode delivers a programmed volume of research solution over a specified period of time. The infusion is programmed as dose volume and dose duration.

STEP 1	Using the ▲ or ▼ key, display the available mode selections and press **CONFIRM** to select the desired mode.
STEP 2	Select the syringe manufacturer and size Using ▲ or ▼ and **CONFIRM.**
STEP 3	Enter the dose volume (***INFUSE***) in mL and press **CONFIRM.**
STEP 4	Enter the dose duration (***OVER***) in hours and minutes and press **CONFIRM.**

- **Programming Notes**

  - Time is always displayed in standard time notation: the two digits to the left of the colon show hours, the two digits to the right show minutes.

  - Editing the ***INFUSE*** field or the ***OVER*** field will result in a new infusion. As a reminder, ***DOSE CANCELED*** is displayed briefly.

> **Example:** Program the pump to infuse 5 mL over 5 minutes, using a B-D 30 mL syringe. Stop the infusion when the ***TOTAL ML*** field shows that about 2mL have been delivered.
>
> Now edit the ***OVER*** field to 6 minutes (note that ***DOSE CANCELED*** appears for a few seconds), and start the infusion.
>
> When the pump stops, after 6 minutes, about 7 mL will have been delivered; 2 mL from the original infusion, and 5 mL from the edited infusion.

  - If the Dose Complete Alarm option has been configured, the pump will produce a ***DOSE COMPLETE*** alarm once the infusion volume has been delivered.

- This delivery mode does not allow for bolus dosing.
- Press **CONFIRM** to display additional programming data.

Programming MANUAL SCHEDULE Mode:

Doses repeated at regular intervals may be initiated manually utilizing the **MANUAL SCHEDULE** mode. The infusion is programmed as dose volume, dose duration, and the time from the start of one dose to the beginning the next.

MANUAL SCHEDULE mode may also be used to delay to the start of the first dose, allowing for a delay before infusions begin.

STEP 1	Choose the desired infusion mode at the ***SELECT MODE*** ▲ ▼ prompt.
STEP 2	Select the syringe manufacturer and size using the ▲ or ▼ key and **CONFIRM**.
STEP 3	Enter the volume to infuse (***INFUSE***) in mL and press **CONFIRM**.
STEP 4	Enter the duration of the infusion (***OVER***) in hours and minutes and press **CONFIRM**.
STEP 5	Enter the time from the start of one dose to the start of the next dose (***EVERY***) in hours and minutes and press **CONFIRM**.
STEP 6	Enter the delay, the interval from when **START** is pressed until the first dose becomes due (***NEXT DOSE IN***), then press **CONFIRM**. To begin infusing the first dose immediately, enter **0:00.**

- **Dose Due**

Note: To begin infusing each dose, **START** must be pressed.

The ***NEXT DOSE IN*** field shows the time remaining until start of the next dose. When the next dose is due (00:00), the pump flashes the **ALERT** and **STANDBY** lights, beeps continuously, and displays ***DOSE DUE***. Press **START** to begin infusing.

When the pump is signaling dose due, pressing any key other than **START** silences the beeping, turns off the ***DOSE DUE*** prompt and **ALERT** light, and leaves the pump in Standby. Pressing any key but START but will not begin the infusion.

- **"Counting Time" Display**

The top **RUN** light only, flashes when the pump is counting down the time until the next scheduled dose. The three **RUN** lights flash in a descending sequence, while the pump is infusing.

- **Programming Notes**

  - For MANUAL SCHEDULE mode, it is recommended that the Idle Alarm feature be configured, and that the Auto Lock feature not be configured.

  - Time is always displayed in standard time notation.

  - Press **STOP** to halt any ongoing infusion at any time. All **RUN** light(s) will go off, the **STANDBY** light will begin flashing, and the ***TOTAL ML*** field stops increasing in value. Press **START** to continue the infusion.

> **Note**: Pressing **STOP** during the infusion will affect the ***NEXT DOSE IN*** time field in two ways, depending on the pump's status at the time.
>
> If **STOP** is pressed while the pump is infusing a dose (the three **RUN** lights are flashing in sequence), the ***NEXT DOSE IN*** field will stop counting down, until **START** is pressed again. This feature allows the schedule to be delayed while ensuring delivery of the full dose.
>
> If **STOP** is pressed while the pump is counting down the time to the next dose (only the top **RUN** light is flashing), the ***NEXT DOSE IN*** field will continue to count down while the pump is stopped. This feature allows editing during idle time, without altering the overall schedule. The ***DOSE DUE*** alarm will not sounds but when **START** is pressed, delivery will begin immediately.

  - If either the ***INFUSE*** field or the ***OVER*** field is edited, the pump treats the result as a new infusion. As a reminder, ***DOSE CANCELED*** appears for a few seconds.

  - Pressing **CONFIRM** during the infusion briefly displays additional program data.

  - Bolus operation is not available in this mode.

Utilizing AUTO SCHEDULE Mode :

Doses repeated at regular intervals may be initiated automatically as a timed infusion utilizing the **AUTO SCHEDULE** mode. By programming dose volume, dose duration, and the time from the beginning of one dose to beginning of the next, each infused dose may be initiated automatically.

AUTO SCHEDULE mode also includes a delayed start function allowing a timed delay before the first infusion begins.

STEP 1	Use the ▲ or ▼ keys at the ***SELECT MODE*** ▲ ▼ prompt to display the infusion mode selections and press **CONFIRM**.
STEP 2	Select the syringe manufacturer and size by using ▲ or ▼ and **CONFIRM**.
STEP 3	Enter the dose volume (***INFUSE***) in mL. Press **CONFIRM** to complete the data entry.
STEP 4	Enter the dose duration (***OVER***) in hours and minutes. Press **CONFIRM** to complete the data entry.
STEP 5	Enter the interval (***EVERY***) in hours and minutes. This is the time from the start of one dose to the start of the next dose. Press **CONFIRM** to complete the data entry.
STEP 6	Enter the delay (***NEXT DOSE IN***), then press **CONFIRM**. This is the time interval from when **START** is pressed until the first dose becomes due. Enter 0:00 to begin infusing the first dose immediately.

- **Dose Initiation**

The ***NEXT DOSE IN*** field on the display shows the time remaining until the next dose is due to be delivered. When this time counts down to 0:00, the pump automatically begins infusing the dose.

- **"Counting Time" Display**

The three **RUN** lights flash in a descending sequence while the pump is infusing. Only the top **RUN** light flashes when the pump is counting time between scheduled doses.

- **Programming Notes**

  - All time displays use standard notation.

  - The programmed delivery can be stopped at any time by pressing **STOP**. The **RUN** light(s) then turn off, the **STANDBY** light begins flashing, and the ***TOTAL ML*** field stops counting up. Press **START** to continue the infusion program.

▪ Pressing **STOP** affects the ***NEXT DOSE IN*** time field in two different ways, depending on the pump's infusion status at the time:

1. If **STOP** is pressed while the pump is infusing a dose (the three **RUN** lights are flashing in sequence), the ***NEXT DOSE IN*** field will stop counting down, until **START** is pressed again. This feature allows the schedule to be delayed while ensuring delivery of the full dose.
2. If **STOP** is pressed while the pump is counting down the time to the next dose (only the top **RUN** light is flashing), the ***NEXT DOSE IN*** field will continue to count down while the pump is stopped. This feature allows editing during idle time, without altering the overall schedule. If a dose becomes due while the pump is stopped, delivery of the dose will begin immediately when **START** is pressed.

▪ If either the ***INFUSE*** field or the ***OVER*** field is edited, the pump reacts as if it is a new infusion. ***DOSE CANCELED*** will appear briefly as notification.

Note: Press **CONFIRM** to display additional program data. Bolus is not available in this mode.

7 - General Programming Information:

Data Entry:

Programming data is input using the digit keys.

A value can be changed by pressing ▲ or ▼ or replaced by pressing **CLR** and entering a new value, prior to confirming an entry by pressing **CONFIRM**. A value that automatically appears, as a result of selecting a protocol, can be changed by pressing ▲ or ▼ or can be replaced by simply entering a new value.

Selecting a Field:

The indicator for a field that is selected will flash on the pump's status display. Use the ▲ or ▼key to select the next field or to edit this field, press **EDIT.** Once a field has been selected for editing, the indicator ceases to flash and the value to be edited begins to flash.

Editing in Standby:

All modes except CUSTOM DILUTION modes: Almost all program data can be changed (edited). The exception is: **The drug concentration (*CONC.*) and animal body weight (*BODY WT*) fields cannot be edited once an infusion or bolus has begun.**

To edit a programmed field:

1. Use ▲ or ▼ to select the field to be changed.

2. Press **EDIT** and use the ▲ or ▼ key and the numbered keys to enter the new value. Press **CONFIRM** to enter.

CUSTOM DILUTION mode:

To make a change to syringe manufacturer, syringe size, target rate, body weight or initial concentration before a value is entered for final volume:

STEP 1	While dashes are displayed in the ***FINAL VOL*** field, press **CONFIRM.**
STEP 2	Select the field to be changed by using the ▲ or ▼ keys.

STEP 3	Press **EDIT** and use ▲ or ▼ and the digit keys as necessary to enter the new value. Press **CONFIRM** to enter.
STEP 4	Use ▲ or ▼ to return to the ***FINAL VOL*** field.
STEP 5	Press **EDIT** and use ▲ or ▼ and the numbered keys as to enter the final volume. Press CONFIRM to enter change.
STEP 6	Finish programming for Custom Dilution mode.

Only the syringe manufacturer and size, target dose, and final volume fields may be edited once the final volume and research article volume have been programmed, prior to the pump initiating an infusion or bolus delivery. To make a change to one of these fields:

STEP 1	Select the ***FINAL VOL*** field using the ▲ or ▼ keys.
STEP 2	Press **CLR** to change the ***FINAL VOL*** fields to dashes
STEP 3	Press **CONFIRM**.
STEP 4	Use ▲ or ▼ to select the field to be changed.
STEP 5	Press **EDIT**. Use ▲ or ▼ and the digit keys as necessary to enter the new value. Press **CONFIRM** to verify entry.
STEP 6	Use ▲ or ▼ to return to the ***FINAL VOL*** field.
STEP 7	Press **EDIT** and use the ▲ or ▼ key and numbered keys to enter the final volume. Press **CONFIRM** to complete.

Once the pump is in the Run state or a bolus is delivered, only syringe manufacturer and size, target dose, and total delivered may be edited.

- **Programming Notes:**
  - For maximum accuracy, select the smallest syringe that will contain the entire ***DRUG VOL***.
  - Once it has been programmed, the ***DRUG VOL*** field may not be edited.

Editing in Run State:

The fields that can be edited while the pump is in Run state are listed below:

Mode	Fields
mL/hr, mL/min	***RATE, TOTAL ML***
SINGLE DOSE, MANUAL/ AUTO SCHEDULE	***TOTAL ML***
CUSTOM DILUTION	***DOSE, TOTAL ML***
All other modes	***RATE, DOSE, TOTAL ML***

The ***TOTAL ML*** field can be cleared while the infusion is running. (The ***TOTAL ML*** field is a data display, and cannot be edited.)

Cancelling an Edit:

If a field has been opened for editing, pressing **EDIT** again restores the previous value. The pump will briefly display ***EDIT CANCELED*** .

Number Out of Range:

Every programmable field is limited to a particular range of allowed values. The range depends on the syringe used, drug concentration, and other factors. Attempting to program a value outside the allowable range results in a ***PUMP LIMIT*** alert. The pump will beep and substitute the nearest allowable value. To accept the value press **CONFIRM**, or program a new value.

Data Test:

Whenever a data field is edited, the pump tests the remaining data fields for allowable range limits. If there is a conflict, the affected fields are cleared to dashes, and the first cleared field is opened for editing. As each cleared field is reprogrammed, the next cleared field (if any) is automatically opened. All cleared fields must be reprogrammed before the infusion can be started.

8 - Additional Functions and Operations

Purge Function:

Manually purge the syringe and IV extension set *before* mounting the syringe on the pump to remove air bubbles. Perform the Purge function *after* the syringe is mounted on the pump, to eliminate potential slack and thus ensure prompt fluid delivery once the infusion is initiated.

The "Purge Delivery Table" on page 36 lists the amount of fluid delivered in one complete Purge cycle, if there were no slack in the drive mechanism. Use these values for calculating the volume of excess fluid to draw into the syringe to ensure the target volume will be available for dosing after purging.

The Purge function is only allowed in Standby state:

STEP 1	After the pump has been programmed, press **STOP** to put the pump in Standby.
STEP 2	Press **PURGE**. The normal display is temporarily replaced by a display showing the purge rate in mL/hr, and the message ***PURGE READY***.
STEP 3	Press **START** to begin delivering the fixed purge volume. ***PURGE RUNNING*** is displayed while in progress. The normal Standby state display will resume, and the text field will briefly notify the operator ***PURGE COMPLETE***.
STEP 4	Repeat steps 2 and 3 as often as necessary until a steady drip at the end of the tubing is observed.

Note: If **START** is not pressed within 10 seconds, the purge function will be canceled and the pump will revert to Standby state. Once a steady drip of fluid is flowing, the purge can be stopped by pressing **STOP,** to conserve infusate.

Purge Delivery Table:

Syringe Manufacturer	Syringe Size (mL)	Approximate Purge Volume (mL)	Purge Rate (mL/hr)	Purge Rate (mL/min)
B-D® Plastic	1	0.02	11	0.19
	3	0.08	38	0.63
	5	0.15	74	1.2
	10	0.22	107	1.7
	20	0.39	188	3.1
	30	0.5	241	4.0
	60	0.75	366	6.1
Monoject®	1	0.02	11	0.19
	3	0.09	41	0.68
	6	0.17	83	1.3
	12	0.26	126	2.1
	20	0.43	208	3.4
	35	0.59	285	4.7
	60	0.75	366	6.1
Terumo®	1	0.02	11	0.19
	3	0.08	38	0.69
	5	0.15	74	1.4
	10	0.22	107	2.1
	20	0.39	188	3.5
	30	0.5	241	4.6
	60	0.75	366	7.3

NOTE*:* Purge volume and rate information shown applies to pumps configured for Rate Range = H (High).

NOTE: Purge volumes are approximately the amount delivered in a single complete purge delivery, without slack in the drive system.

NOTE: The volume of purged fluid is not added to the amount in the ***TOTAL mL*** field.

Bolus Function:

A bolus is a fixed dose which may be programmed and delivered, either during an infusion or while the pump is in Standby. The operator may program the rate of bolus infusion, and the bolus size, either in terms of dose or volume.

- **Bolus Units:**

Infusion Mode	Bolus Size Units
mL/hr, mL/min	mL (milliliters)
Units/hr, Units/min, mUnits/hr, mUnits/min	Units
mg/hr, mg/min, mcg/hr, mcg/min	mg (milligrams)
mg/kg/hr, mg/kg/min, CUSTOM DILUTION	mg/kg (milligrams of drug per kilogram of animal body weight)
mcg/kg/hr, mcg/kg/min	mcg/kg (micrograms of drug per kilogram of animal body weight)
SINGLE DOSE, MANUAL SCHEDULE, AUTO SCHEDULE	Bolus not allowed

- **Bolus Size Limits:**

The minimum programmable bolus size is approximately the same as the minimum deliverable volume. The maximum programmable bolus size is the lesser of:

- The syringe size (the entire syringe may be programmed as a single bolus).
- 9999 Units, 9999 mg, 9999 mg/kg or 9999 mcg/kg (depending on the selected mode).

- **Bolus Editing:**

The bolus size can be edited both during and after a bolus has been programmed. A bolus may also be edited during an infusion without interrupting normal delivery.

STEP 1	Press **BOLUS** to display the ***PRESS EDIT TO EDIT BOLUS SIZE*** prompt.
STEP 2	Press **EDIT** to open the field.
STEP 3	Use ▲ or ▼ or the digit keys to modify the value as necessary, and press **CONFIRM** to enter. The pump will then display ***BOLUS READY***.

STEP 4	Press **START** to begin bolus delivery immediately or press **CONFIRM** to save the data and return to the normal display.

Repeating a Bolus Delivery:

To repeat a bolus delivery:
1. Press **BOLUS** to display the bolus size.
2. Press **START.**

Changing the Syringe:

The syringe may be replaced when the pump is in the Standby state. Mount the replacement syringe on the pump. If the replacement syringe does not have the same barrel size as the currently programmed syringe:

1. The pump displays ***VERIFY (NAME)*** where "name" refers to the syringe manufacturer previously programmed in.

Select the correct syringe manufacturer by using ▲ or ▼ as needed to and press **CONFIR**M.

2. The pump displays ***VERIFY (SIZE)*** where "size" is the new syringe size recognized by the pump.

Press **CONFIRM** after verifying that the pump is displaying the correct syringe size.

Note: Changing syringe size may invalidate the contents of other fields (e.g. ***VOL LIMIT***). In such cases, the pump will clear the affected field(s), which require reprogramming prior to infusion continuation.

If the pump displays one of the following alert or alarm messages: ***CHECK BARREL, CHECK FLANGE***, or ***CHECK PLUNGER***, the syringe has been improperly mounted. Re-mount the syringe to correct the problem. If multiple mounting errors are sensed, ***CHECK SYRINGE*** is displayed instead.

Lock and Auto Lock Functions:

The Lock function reduces risk of accidental key activations by disabling all keys except **LOCK** and makes it convenient to program the pump, in advance, by disabling the audio portion of the ***PUMP IS IDLE*** alarm.

Press **LOCK** to activate the Lock function. Press **LOCK** a second time to restore normal pump operation. The ***LOCK*** indicator light remains on while the pump is locked.

Note: The pump cannot be place in ***LOCK*** when experiencing a ***LINE OCCLUDED*** alarm.

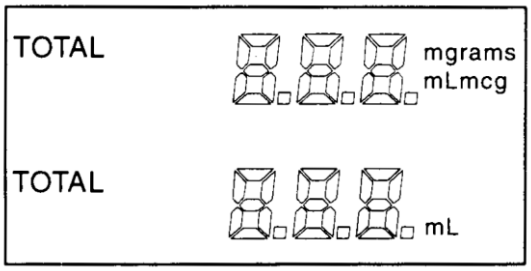
If the pump has been configured to enable the Auto Lock feature, the Auto Lock feature automatically Locks the pump two minutes after the last key is pressed. This feature is only available while the pump is in Run.

The keypad is automatically unlocked when the pump enters Standby State because of an alarm.

The Total Delivered Display:

The Total Delivered display indicates the accumulated total volume (in mL) that has been delivered. Some infusion modes also show the total delivery in other units, such as mcg, mg, or grams.

The Total Delivered value cannot be programmed, only cleared (reset to zero). To clear the total delivered field, press ▲ or ▼ to move to the amount displayed in the ***TOTAL mL*** field. Press **EDIT** then **CLR**, when the indicators flash, to clear the display. Once the Total Delivered display is reset to zero, the previous amount delivered value cannot be restored.



Note: Purge volumes are not included in the total delivered. Purge volumes should not be infused. Totals are rounded up to the digit furthest right. When the accumulated total exceeds 999, the field will diplay the limit error code, ***EEE***.

Expanded Data Display:

The status display generally displays only the most important infusion information. The pump will temporarily display additional program, syringe, and battery voltage information by pressing C**ONFIRM** when the pump is fully programmed.

Press CONFIRM a second time to restore the normal display. If no key is pressed, the normal display resumes in a few seconds.

Backlight Feature:

The status display backlight is lit whenever the pump power is on and the charger is connected. The ***SET BACKLITE*** configuration option offers control of the backlight when the charger is not connected.

9 - Configuration

The SAI 3D pump can be custom-configured to meet particular needs, or to simplify infusion programming. Contact SAI for details.

Configuration Review:

The Configuration Review feature allows the pump's configuration to be examined without risk of accidental alteration. This feature is activated by entering the code number **123** at the ***SELECT MODE*** ▲ ▼ prompt. The error beeps that occur when **123** is entered are provided only to discourage tampering and may be ignored at this time.

Date and Time Display:

After entering **123**, the date and time are briefly displayed. The time is displayed in standard notation (***HH.MM***).

Software and Configuration Version Display:

Next, the software version, factory configuration, and configuration checksum numbers are briefly displayed. The four character checksum uniquely identifies the current configuration. Rapid comparison of configurations between two pumps is easily achieved using the checksum number. The checksum field allows a high-confidence rapid comparison of configurations between two pumps.

Example: Software Version Display 7.01.05 Config A1

Reviewing Configuration Options:

Review the configurable options organized within several individual groups. Each group may be opened and reviewed by confirming **Y** (yes) at the prompt or skipped by scrolling to **N** (no) with the ▲ or ▼ keys and pressing **CONFIRM**.

To review the options within the displayed group, press **CONFIRM** to accept the pending ***Y*** response. The text field will display only the options that are configured. Continue pressing **CONFIRM** to scroll through each additional option. When the last option within a group has been displayed, the next option group prompt is displayed.

The following table shows the configuration groups and the options within each group:

Configuration Review Table

GROUP PROMPT	GROUP SELECTIONS		
VIEW LIBRARY	NONE		
VIEW MODES	ML/HR ML/MIN UNITS/HR UNITS/MIN MUNITS/HR MUNITS/MIN	MG/HR MG/MIN MCG/HR MCG/MIN MG/KG/HR MG/KG/MIN	MCG/KG/HR MCG/KG/MIN CUSTOM DILUTION SINGLE DOSE MANUAL SCHEDULE AUTO SCHEDULE
VIEW SYRINGES	B-D	MONOJECT	TERUMO
VIEW DEFAULTS	DFAULT LIBRARY DFAULT PROTOCOL	DFAULT MODE DFAULT MFR	
VIEW MISC	REMOTE CONTROL LIBRARY SIZE OVERRIDE	PSI RANGE AUDIO RANGE RATE RANGE	AUTO LOCK SET BACKLITE ENABLE DB9 PORT
VIEW ALERTS	IDLE ALARM NEAR END	BOLUS COMPLETE DOSE COMPLETE	VOLUME LIMIT

Note: Inactive options are not shown in the Configuration Review mode.

Modes Group (*VIEW MODES*):

This group of configurable options displays the name of each enabled infusion mode. Each listing shows only the mode name (for example ***ML/HR***) in the text field. For a complete list of infusion modes, see the "Configuration Review Table" on page 43.

Syringes Group (*VIEW SYRINGES*):

This group displays the enabled syringe sizes for each enabled syringe manufacturer. For each enabled manufacturer, the pump displays a ***VIEW*** and the manufacturer's name. To begin reviewing the enabled syringe sizes for that manufacturer, press **CONFIRM** to accept the ***Y*** response.

Syringe size descriptions are displayed in the text field. Press **CONFIRM** to view each additional syringe.

To skip a manufacturer, change the ***Y*** to ***N*** using ▲ or ▼and press **CONFIRM**. Available manufacturer names and sizes are listed in the "Syringe Tables" on page 17.

Alerts Group (*VIEW ALERTS*):

- **Idle Alarm**

  This option enables the pump to issue a continuous audible alarm when ***PUMP IS IDLE***. The pump beeps 15 times at two minute intervals when a ***PUMP IS IDLE*** condition occurs if this option is disabled.

- **Near End Alert** (**NEAR END**)

  This option enables the pump to issue an alert during an infusion as an expected ***VOL LIMIT*** or ***EMPTY*** alarm is approached. The option allows for the specification of the number of minutes prior to the approaching ***VOL LIMIT*** alarm and the number of beeps that the NEAR END alert will be issued.

  The form of a Near End alert display is ***xxMIN VOL LIM, xxMIN EMPTY*** . The value **xx** is the configured number of minutes. The first and second forms apply to impending ***VOLUME LIMIT*** or ***EMPTY*** conditions. Press **CONFIRM** to view the current settings.

- **Bolus Complete Alert** (**BOLUS COMPLETE**)

  This option enables the pump to issue an alert when a bolus completes.

- **Dose complete Alarm** (**DOSE COMPLETE**)

  This option enables the pump to alarm when a dose is completed in SINGLE DOSE mode.

- **Volume Limit Alarm** (**VOLUME LIMIT**)

  The Volume Limit feature triggers an alarm after the pump has delivered a pre-programmed volume of research solution. This option applies to mL/hr and mL/min modes only. With this option enabled, a ***NEAR END*** alert occurs when the Volume Limit will be reached within the preconfigured time period, at the current rate of infusion. See "Near End Alert" on page 44.

Terminating Configuration Review:

When the last configuration group option has been reviewed, the pump automatically restarts the Light Test. Turn the pump off at any time to cancel the Configuration Review.

Custom Configuration:

The pump can be reconfigured as often as desired. While no special tools are needed, the configuration should be changed only by authorized personnel.

Factory Standard Configuration:

The factory standard configuration is:

MODES	ML/MIN	ML/HR	MUNITS/MIN
	MUNITS/HR	UNITS/MIN	UNITS/HR
	SINGLE DOSE	MANUAL SCHEDULE	AUTO SCHEDULE
	MCG/MIN	MCG/HR	MG/MIN
	MG/HR	MCG/KG/MIN	MCG/KG/HR
	MG/KG/MIN	MG/KG/HR	CUSTOM DILUTION
MANUFACTURERS AND SIZES	B-D® 1, 3, 5, 10, 20, 30, 60 mL Plastic Monoject® 1, 3, 6, 12, 20, 35, 60 mL Terumo® 1, 3, 5, 10, 20, 30, 60 mL		
DEFAULTS	All enabled		
MISC	PSI RANGE = M (Medium) AUDIO RANGE = H (High) RATE RANGE = H (High) BACKLITE = 2 MINUTES		
ALERTS	IDLE ALARM enabled MINALERT= 10, 5 (10 Minutes, 5 Beeps) DOSE COMPLETE enabled VOLUME LIMIT enabled		

10 - Pump Maintenance

Power Supply

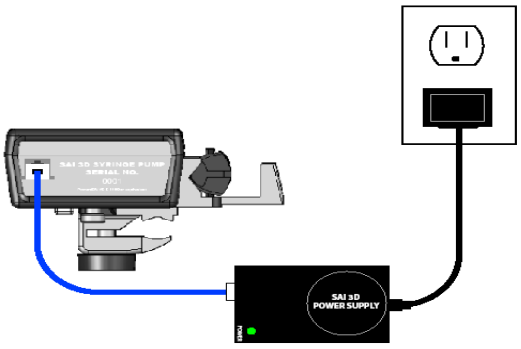
The Power Over Ethernet (POE) connection / plug is designed to:

- Distribute electric power to the pump
- Connect to wired PC data communication
- Charge the pump's internal battery pack

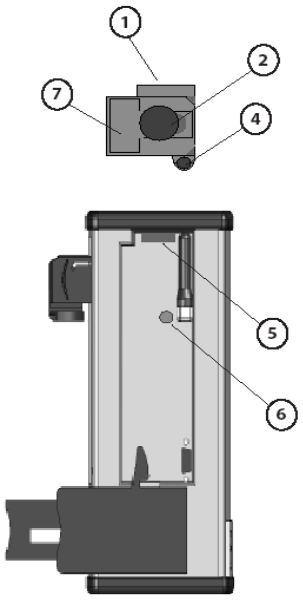
The SAI 3D pump is designed for indoor use and performs best in controlled environmental conditions.

- Do not store, charge and use it in extreme conditions such as direct exposure to sun and hot or cold temperatures.
- Avoid any temperature shock and for best performance allow a minimum of half hour temperature conditioning before use.

⚠ **Use only "SAI 3D Series" chargers or other accessories that are labeled specifically for use with the SAI 3D Syringe Pumps. The standard Power Supply for use in the USA and Canada is part number: E-1800.**



IV Pole Clamp:



A detachable, adjustable pole clamp is supplied with the pump, allowing it to mount to a vertical or horizontal IV pole.

Mount the pole clamp to the pump by sliding the clamp in place on the back of the pump (1) and tighten the set screw (4) in to the threads that align with the set screw (6). This operation does not require tools.

Turn the KNOB (2) counterclockwise to open the jaws of the clamp to attach the pump to an IV pole. Turn the clamp knob clockwise to close it. Hand tighten only.

Routine Cleaning and Disinfection of the Pump:

Use mild dilute soap and water sparingly on a damp cloth or cotton swabs to clean or disinfect the exterior of the pump and the rubber bumpers, which may be removed prior to cleaning. All surfaces should be dried before re-mounting the rubber bumpers.

Routine Periodic Maintenance of the Pump

Checks prior to use

The pump's performance check is strongly recommended prior to use and before programming an infusion. If the pump fails any part of the check, remove it from service.

1. Apply gentle back pressure to the plunger driver and check for slippage.

2. Verify that the plunger assembly moves freely through its full travel and returns to a fully closed position without assistance. The plunger driver should travel freely through its full range of motion.

3. Check that the barrel clamp locks properly, and opens and closes freely when the barrel clamp is released.

4. If Pump is connected to power, check that:
   4.1. The **POE** cable is connected to the pump and also to the power supply. Ensure that the sockets are clean and fully engaged.
   4.2. The power supply is connected to the power outlet.
   4.3. The **ON CHARGE** light is ON.

Battery Voltage Check

To display the battery voltage, press **CONFIRM** after the pump is fully programmed. A charged battery displays a voltage of approximately 7.0 volts. The voltage should be at least 6.9 V if the pump is to be operated on internal (battery) power.

Note: Battery voltage display is only an approximate indication of the battery's remaining charge. If its voltage is less than 6.1 volts, the charge remaining in the battery is minimal. The pump may operate on battery again, only after full battery charge which is equivalent on the display reading between 6.9V and 7.2V.

Battery- Charge, Maintenance, and Replacement

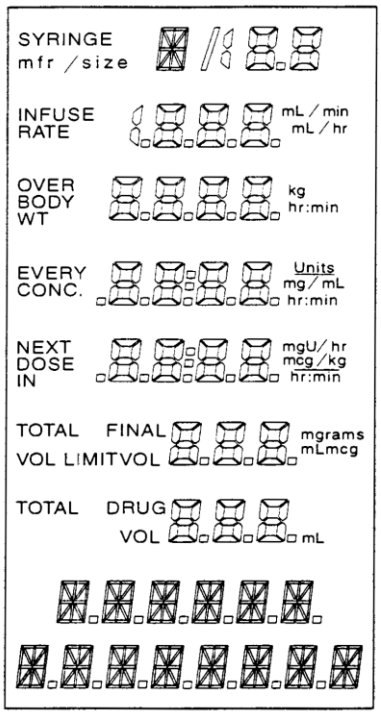
The SAI 3D Syringe pump is equipped with a battery pack, which is capable of maintaining an uninterrupted performance if the POE cable is unplugged for a **limited time**.

The service life of rechargeable batteries is based on many factors, including usage, frequency of charging and discharging. The SAI 3D Syringe pump may function without battery replacement for up to two years.

For best battery performance it is recommended that the battery pack be fully charged at least once every 2 months. To minimize the chances of experiencing a problem with the rechargeable battery, replacement is advisable before their service life expired.

It is recommended the SAI 3D Syringe pump be placed on a 12 month scheduled maintenance cycle. The rechargeable battery should be replaced every 24 months.

Check of Charge, Display, and Syringe Sensor Check:



STEP 1	Insure the barrel clamp is closed and no syringe is mounted.
STEP 2	Lamp Test: Press and hold the STOP key during the normal power-up. Verify that all numerals, digits and decimal points are legible.
STEP 3	The Status Panel lights should illuminate during the Lamp Test. **Note:** If the AC adaptor or POE is plugged in, the **ON CHARGE** light will be on before, during and after the lamp test.
STEP 4	After lights are verified release the **STOP** key.

Note: Make sure the plunger rod, flange and barrel capture mechanisms are free if the ***CHECK BARREL, CHECK FLANGE*** or ***CHECK PLUNGER*** is displayed. One of the syringe mounting sensors may require service if these ***CHECK*** alarms persist.

Power the pump off and on. If one of the ***CHECK*** alarms is repeated and no syringe is in the pump and the barrel clamp and plunger clamp are closed, remove the pump from service.

Check Keypad:

STEP 1	Press every key except ▲, ▼, after the pump completes the power-up Lamp Test. Pressing each key should result in a short beep.
STEP 2	There should be no response if two or more keys are pressed at the same time.
STEP 3	There should be only one beep when pressing and holding any key (except ▲, ▼, **START**, **STOP**, and **CONFIRM**).
STEP 4	There should be no response to the second key when holding any key pressed (except ▲, ▼, **START**, **STOP**, and **CONFIRM**).
STEP 5	The **START** and **STOP** keys will sound repeated beeps while each of these keys is held down. If the **START** key is held down for a prolonged period of time a failsafe alarm will occur.

Resolution of Pump Difficulties:

Variations in syringe dimensions may cause problems associated with recognition of a particular syringe size or manufacturer. Either ***LINE OCCLUDED*** alarm or the inability to completely empty certain syringes are symptoms. Application of tape, paper stickers, or labels on the syringe, may increase the apparent diameter of the syringe barrel, which can impair the accuracy of the Syringe Recognition system.

Improperly mounted syringes can also cause Syringe Recognition problems. Extreme clamping force can crush the syringe barrel, may induce in an erroneous barrel diameter reading.

Obstructions to prevent proper fluid flow can be corrected by checking that the IV extension set tubing (extension line) is not pinched.

Improperly centering the syringe in the barrel clamp cradle can cause ***CHECK BARREL*** messages.

If the pump fails to operate as described, contact SAI at:

Strategic Applications Inc.
Phone: 847.356.0321
Fax: 847.356.0382

11 - Audible and Visual Alerts and Alarms

Important conditions cause the pump to provide audio and visual Alerts and Alarms that notify the operator when the following conditions occur:

Alerts: Alerts are conditions which require the operator's attention. The following indications occur:

- The pump beeps
- The **ALERT** light flashes
- The pump continues to operate
- The front panel and status lights may display additional information

Alarms: Immediate action is required in order to proceed with an operation. The following indications occur:

- The pump beeps
- The **ALARM** light flashes
- The pump stops delivering the infusion
- The front panel and status lights may display additional information

Failsafe Alarms: Safe operation of the device may be affected by a malfunction which has occurred. The pump goes into a "failsafe shutdown." The following indications occur:

- The pump beeps
- The **SYSTEM** lights continuously
- The pump cannot be restarted and stops delivering the infusion. After the problem is corrected the infusion must be reprogrammed
- The display may light and additional information is shown on the front panel
- To clear the alarm the pump must be turned off and back on

To access instructions on correcting aforementioned alert or alarm conditions, refer to the charts on the following pages if any of the conditions occur.

Alerts:

Message	Cause	Correction
BOLUS COMPLETE (may be accompanied by 2 beeps and flashing **ALERT** light)	The bolus is complete.	None.
CHARGE IS LOW (10 beeps, flashing **BATTERY** light)	Backup battery pack requires charging. This alert repeats every 15 minutes if a charger is not connected, or the backup battery is not charging.	Attach the AC charger or POE. The alert self-cancels when the battery charge reaches the normal operating range. The alert may repeat once or twice after the charger is connected if the battery voltage is very low.
CHECK BARREL (single beep)	The syringe is not properly seated in the cradle or the barrel clamp is not fully closed on the syringe barrel.	Insure that the syringe flange is in the barrel clamp flange slot and the syringe is centered in the barrel clamp cradle. Use the heel of the hand to press the barrel clamp firmly against the syringe to ensure proper seating. When the syringe is properly mounted motor movement is allowed.
CHECK FLANGE (single beep)	The flange slot does not have a seated syringe flange.	Remount the syringe. Insure the syringe is in the barrel clamp cradle and is centered. The syringe flange should be in the barrel clamp flange slot. Use the heel of the hand to press the barrel clamp firmly against the syringe to ensure proper seating. When the syringe is properly mounted motor movement is allowed.
CHECK PLUNGER (single beep)	The syringe has not been captured by the plunger mechanism.	Grasp the finger grip on the plunger driver and pull it all the way out. Slide the driver down until it contacts the syringe plunger and push the driver in firmly. When the syringe is properly mounted motor movement is allowed.
CHECK SYRINGE (single beep and Standby light flashes)	More than one of the syringe mounting points (flange, barrel, plunger) are not correctly positioned.	Ensure that the flange, barrel, and plunger are mounted correctly. When the syringe is properly mounted motor movement is allowed.

Message	Cause	Correction
DATA MISSING (single beep)	**START**, **PURGE**, or **BOLUS** was pressed when the program information was incomplete.	Enter the data required.
FINISH EDITING (single beep)	A field is open for editing while pressing **START**, **PURGE**, or **BOLUS**.	Finish the editing.
KEYPAD LOCKED (single beep)	Lock function is active and one has pressed a key.	Unlock the keypad by pressing **LOCK**
LOAD SYRINGE (single beep)	An infusion is attempted without having a syringe in place. The syringe detection sensors (three) have failed.	Manually purge then mount a syringe. The pump requires service if the alert continues.
NO LIBRARY (single beep)	No libraries exist and ***VIEW LIBRARY*** was selected.	Press **CONFIRM** to proceed to ***VIEW MODES***.
NOT ALLOWED (single beep)	The bolus feature was not allowed by the selected protocol when the **B0LUS** key was pressed.	Use the ***NONE*** protocol library selection or the ***NONE*** protocol selection (if available) if the bolus feature is required.
OUT OF RANGE (single beep)	With the current combination of syringe, body weight, and drug concentration, no bolus is possible.	If the bolus feature is required, use a different syringe or drug concentration.
PUMP IS IDLE (15 beeps and ALERT light flashes)	Occurs if there is no key press within 15 seconds after the infusion is stopped or the pump has been in Standby state for at least 2 minutes.	**PUMP IS IDLE** alert self-cancels the Lock function suppresses the audio portion of this alert. **Note:** ***PUMP IS IDLE*** message will still appear if the keypad is locked, but there will be no beeps.
PUMP LIMIT (single beep)	The pump's acceptable range is outside what has been attempted to be programmed.	Press **CONFIRM** to accept displayed value, or enter a different value and press **CONFIRM**. The pump displays the nearest acceptable value.
SIZE MISMATCH (single beep)	The detected syringe size is different from the programmed syringe size.	Press **CLR** if necessary and reprogram the syringe manufacturer and size. Check to be sure the correct manufacturer has been programmed.

Message	Cause	Correction
SIZE UNKNOWN (single beep)	The selected manufacturer syringe size cannot be identified.	Press **CLR** if necessary and reprogram the syringe manufacturer and size. Check to be sure the correct manufacturer is available. Ensure that the barrel clamp is fully closed.
USE DIGITS (single beep)	Attempt to use ▲ or ▼ to initialize a field containing dashes that requires digits.	Use digit keys.
VERIFY AGAIN (single beep)	The programmed syringe size is different from the detected syringe size.	Press **CONFIRM** to complete size override or press either ▲ or ▼ to change size.
<***xx MIN EMPTY*** or <***xx MIN VOLUME LIMIT*** or <***xx MIN*** (protocol) (configurable number of beeps. **ALERT** light flashes until syringe is empty or volume limit is reached)	Approximately xx minutes remains at the present rate of infusion, until the syringe will be empty or the volume limit will be reached. The protocol name will be displayed instead of ***END*** or ***VOLUME LIMIT***, if a protocol has been selected.	When the plunger driver is moved back or when a filled syringe is installed, the alert is reset. Silence the audio portion of the alert by pressing any key. **Note:** Since this function is sensitive to variations in syringe dimensions, the exact timing of this alert may vary.

Alarms:

Message	Cause	Correction
CHECK BARREL (continuous beeps and flashing **ALERT** light)	The syringe barrel is not properly seated in the cradle or the pump has detected that the barrel clamp is not fully closed on the syringe barrel during motor movement.	Insure that the syringe is centered in the barrel clamp cradle, and that the syringe flange is in the barrel clamp flange slot. Pressing any key silences the audio portion of the alarm. Use the heel of the hand to press the barrel clamp firmly against the syringe to ensure proper seating. When the syringe is properly mounted motor movement is allowed.
CHECK FLANGE (continuous beeps and flashing **ALERT** light)	During motor movement the pump has detected that the syringe flange is not seated in the flange slot.	Insure the syringe is centered in the barrel clamp cradle. Verify the syringe flange is in the barrel clamp flange slot. Remove the syringe and remount it, if necessary. Pressing any key silences the audio portion of the alarm. Use the heel of the hand to press the barrel clamp firmly against the syringe to ensure proper seating. When the syringe is properly mounted motor movement is allowed.
CHECK PLUNGER (continuous beeps and flashing **ALERT** light)	The plunger capture mechanism has not detected a captured syringe during motor movement.	Pressing any key silences the audio portion of the alarm. Pull on the plunger driver all the way out by grasping the finger grip. Push the driver down until it contacts the syringe plunger firmly. When the syringe is properly mounted motor movement is allowed.
CHECK SYRINGE (continuous beeps and flashing **ALERT** light)	At least two of the three: flange, barrel, plunger syringe mounting points are not correctly positioned.	Ensure that flange, barrel, and plunger are mounted correctly. Pressing any key silences the audio portion of the alarm. When the syringe is properly mounted motor movement is allowed.
DOSE COMPLETE (continuous beeps and flashing **ALERT** light)	The programmed dose is completed. (Single Dose Infusion Mode only)	Silence the alarm by pressing any key.

Message	Cause	Correction
DOSE DUE (continuous beeps and flashing **ALERT** light)	The next dose is due to be delivered because the ***NEXTDOSE IN*** timer has reached 0:00, and. (Manual Schedule Infusion Mode only)	Press **START** to deliver the scheduled dose. Pressing any key silences the audio portion of the alarm.
EMPTY (continuous beeps and flashing **ALERT** light)	The syringe is empty.	Release and slide the plunger driver back at least 1.6 inches (4 cm) to reset the alarm. Pressing any key silences the audio portion of the alarm. **Note:** a ***LINE OCCLUDED*** alarm may occur before the ***EMPTY*** alarm due to variability in syringe dimensions. **Option:** without resetting ***EMPTY*** condition, the infusion may be restarted. The **ALERT** light will continue flashing and the pump will continue to display ***EMPTY***. The infusion will remain on until **STOP** is pressed or a ***LINE OCCLUDED*** alarm occurs.
FINISH EDITING (continuous beeps and flashing **ALERT** light)	An infusion is in progress and the Rate or Dose field is being edited, while there has been no key press for 15 seconds.	Complete editing. Pressing any key silences the audio portion of the alarm.
LINE OCCLUDED (continuous beeps and flashing the **ALERT** light)	There is excess plunger force which may include an occlusion or a line constriction.	Pressing any key silences the audio portion of the alarm. Immediately check for kinked tubing, empty syringe, clogged catheter, etc. as the pump automatically stops with this alarm. Look for foreign material preventing movement of the pump mechanism. RELIEVE RESIDUAL SYRINGE PRESSURE BY RELEASING THE PLUNGER DRIVER. An unintentional bolus may occur if the plunger driver is not released, when the blockage is cleared. The message clears when the infusion is successfully restarted.

Message	Cause	Correction
PUMP IS IDLE (continuous beeps and flashing **ALERT** light)	Occurs if there is no key press within 15 seconds after the infusion is stopped or the pump has been in a Standby state for at least 2 minutes.	Pressing any key silences the audio portion of the alarm. The Lock function suppresses the audio portion of this alarm. **Note:** If the keypad is locked, there will be no beeps, but the ***PUMP IS IDLE*** message still appears.
VOLUME LIMIT (continuous beeps and flashing **ALERT** light)	The volume limit programmed has been reached.	Pressing **START** or initiating a bolus resets the Volume Limit field Pressing any key silences the audio portion of the alarm.

Critical Failsafe Alarms:

Pump operation cannot be assured if failsafe alarms occur. Once the problem has been corrected the infusion can be restarted, after reprogrammed pump. Clear the alarm by turning off the pump.

Message	Cause	Correction
(ERROR CODE) (continuous two-tone audio, **SYSTEM** light on)	The pump has detected an internal error.	Take the pump out of service. Make a note of all displayed error codes and the conditions prior to the error because repair is required. **Note:** In some cases, there may not be a legible error code display.
CHARGE DEPLETED (continuous two-tone audio **SYSTEM** and **BATTERY** lights on)	The backup power pack voltage is below minimum operating level.	Recharge the pump backup power supply by connecting the charger for a minimum of 16 hours.
FUSE FAILURE (continuous two-tone audio, **SYSTEM** and **BATTERY** lights on)	The pump has detected a fuse failure.	Take the pump out of service. Repair is required.
POWER FAULT (continuous, two-tone long beeps, **SYSTEM** and **BATTERY** lights on)	There is a fault in the charging system or the pump's internal power supply is out of tolerance.	Take the pump and charger out of service. Repair is required.

12 - Warranty and Service Information

Warranty:

SAI warrants that the equipment shall be free from defects in material and workmanship when delivered to the original purchaser. SAI's sole obligation shall be limited to repair or replacement at SAI's option and expense, of the defective part or unit for a period of one year following the date of initial delivery. The applicable period for batteries is limited to a period of 12 months following the date of initial delivery.

The warranty extends only to the original purchaser and is not assignable or transferable, and shall not apply to auxiliary equipment or disposable accessories. SAI's commitment to repair or replace the product will be null and void if this product is used contrary to the directions for use contained in the labeling. SAI will assume no responsibility for incidents which may occur if the product is not used in accordance with product labeling.

Service Information:

While under SAI Warranty, Service Agreement (optional), or lease agreement, the instrument must not be opened by unauthorized personnel.

For service and repair information for this product, call the SAI Service Center at 1-847-356-0321.

Shipping costs for all units returned to SAI shall be paid for by the customer. The unit must be packed in its original container or in a container that will provide adequate protection during shipment. To ensure prompt return, the SAI Service Center must be notified before shipping any unit for repair. When calling, please be prepared to provide the product code number and serial number of the unit. A service authorization number will be issued and should accompany all communications. A brief written description of the problem should be attached to the instrument when it is returned for service.

SAI will not be responsible for unauthorized returns or for units damaged in shipment due to improper packing.

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