KDS Allegro™ Peristaltic Pump System

USER'S MANUAL

KDS ALLEGRO™ PERISTALTIC PUMP SYSTEM

kdScientific

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KDS Allegro™ Peristaltic Pump System User's Manual

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General Information

SAFETY INFORMATION

Please read the following safety precautions to ensure proper use of your peristaltic pump. If the equipment is used in a manner not specified, the protection provided by the equipment may be impaired.

To Prevent Hazard or Injury:

USE PROPER POWER SUPPLY

The pump is supplied with an approved power supply and line cord. To maintain the safety integrity of the device, use only the following power supplies:

> **Globtek Inc.**
> Model: GTM – 21097 – 5048 – 18
> Output: 30V – 1.67A
> Input: 100–240V~50–60 Hz 0.6A

USE PROPER LINE CORD

Use only the specified line cord for this product and make sure line cord is certified for country of use. The operating voltage range for the KDS Allegro™ Peristaltic Pump System is 30 VDC. The universal power supply operating voltage range is 100-240 VAC, 50-60 Hz.

GROUND THE PRODUCT

This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making any connections to the input or output terminals of the product, ensure that the product is properly grounded.

MAKE PROPER CONNECTIONS

Make sure all connections are made properly and securely. Any signal wire connections to the unit must be no longer than 3 meters.

OBSERVE ALL TERMINAL RATINGS

Review the operating manual to learn the ratings on all connections.

AVOID EXPOSED CIRCUITRY

Do not touch any electronic circuitry inside of the product.

AVOID PINCH HAZARD

A pinch hazard may exist between the pusher block and end blocks. Avoid placing fingers between these points while the pump is running.

DO NOT OPERATE WITH SUSPECTED FAILURES

If damage is suspected on or to the product do not operate the product. Contact qualified service personnel to perform inspection.

ORIENT THE EQUIPMENT PROPERLY

Do not orient the equipment so that it is difficult to operate the disconnection device.

PLACE PRODUCT IN PROPER ENVIRONMENT

Review the operating manual for guidelines for proper operating environments.

OBSERVE ALL WARNING LABELS ON PRODUCT

Read all labels on product to ensure proper usage.

CAUTION Refer to Manual   *Protective Ground Terminal*

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WARRANTY AND REPAIR INFORMATION

⚠️ **CAUTION:** REFER TO SAFETY INFORMATION AND SETTING UP THE KDS Allegro™ Peristaltic Pump System BEFORE PLUGGING IN THE PUMP.

Manual Description

This manual is designed to provide all operational and program information required to operate and maintain the KDS Allegro™ Peristaltic Pump System. The functions and features are described in the Technical Specifications section.

Warranty

KD Scientific warranties this instrument for a period of one year from date of purchase. At its option, KD Scientific will repair or replace the unit if it is found to be defective as to workmanship or materials. This warranty does not extend to damage resulting from misuse, neglect or abuse, normal wear and tear, or accident. This warranty extends only to the original consumer purchaser.

IN NO EVENT SHALL KD SCIENTIFIC BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. Some states do not allow the exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. **THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR USE, OR OF ANY OTHER NATURE**. Some states do not allow this limitation on an implied warranty, so the above limitation may not apply to you.

If a defect arises within the warranty period, promptly contact **KD Scientific, 84 October Hill Road, Holliston, Massachusetts 01746** at 1–508-429-6809. Email address is info@kdscientific.com. Goods will not be accepted for return unless an RMA (returned materials authorization) number has been issued by our customer service department. The customer is responsible for shipping charges for non-warranty repairs. Please allow a reasonable period of time for completion of repairs or replacement. If the unit is replaced, the replacement unit is covered only for the remainder of the original warranty period dating from the purchase of the original device.

This warranty gives you specific rights, and you may also have other rights which vary from state to state.

Repair Facilities and Parts

KD Scientific stocks replacement and repair parts. When ordering, please describe parts as completely as possible, preferably using a part number obtained from our Customer Service department. If practical, enclose a sample part or sketch. We offer a complete reconditioning service.

Serial Numbers

All inquiries concerning our product should refer to the serial number of the unit, located on the rear panel.

Calibrations

All electrical apparatus are calibrated at rated voltage and frequency. KD Scientific recommends an annual calibration of the pump.

⚠️ **CAUTION:** For research use only. Not for clinical use on patients.

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Specifications

Tubing Size (inner diameter min/max)	0.8-8.0 mm (Allegro™ I, III); 0.8-4.8 mm (Allegro™ II)
Tubing Durometer Range (min/max)	55A-62A (Consult KD Scientific if using a higher durometer)*
Flow Rate (per channel, tubing dependent)	Please see tube size flow rate chart
Accuracy	± 1.0 % **
Display	4.3 in WQVGA TFT color display with touch screen
Non-Volatile Memory	Stores all settings
Connectors:	
Rs-485	IEEE-1394, 6 pos
USB	Type B
Input/Output (I/O)	15 pin D-Sub connector
Footswitch Connection	Mini phono jack
Pressure (max)	30 psi
Drive Motor	1.8° stepper motor
Motor Drive Control	Microprocessor with 1/16 microstepping
Step Rate:	
Minimum	27.5 sec/µstep (Allegro™ I, II & III)
Maximum	50 µsec/µstep (Allegro™ I); 60 µsec/µstep (Allegro™ II & III)
Maximum Rpm:	
Allegro™ I	375 RPM
Allegro™ II/Allegro™ III	312 RPM
Input Power	30 VDC, 1.67 A using approved Allegro™ power supply (included)
Input Power Connection	2.5 ID x 5.5 mm OD male plug
Power Supply	100-240 VAC, 50-60 Hz/30 VDC, 8 watts universal
Power Supply, use only a KD Scientific	Use only a KD Scientific approved power supply and line cord
Dimensions (Control Box) (W x D x H)	22.9 x 19.7 x 7.6 cm (9.0 x 7.75 x 3.0 in)
Dimensions (Pump Motor/Head) (W x D x H)	11.5 x 24.1 x 11.8 cm (4.5 x 9.5 x 4.63 in)
Weight 2.66 Kg (5.9 lbs)	Weight 2.66 Kg (5.9 lbs)
Operating Temperature	4°C to 40°C (40°F to 104°F)
Storage Temperature	-10°C to 70°C (14°F to 158°F)
Ingress Protection	IP32 (pump head & drive)
Storage Humidity	20% to 80% rh, non condensing
Method of Operation	Continuous forward/continuous reverse
Classification	Class I
Pollution	Degree 1
Installation	Category II
Supplier Name/Phone Number	KD Scientific, (508) 429-6809
Supplier Address	84 October Hill Rd, Holliston, MA 01746
Regulatory Certifications	CE, ETL (UL & CSA), CB Scheme, EU RoHS, WEEE
Safety Declarations	EN 61010-1; CB Scheme
EMC Declarations	IEC 61326-1

Allegro™ Specification Notes:

* The Allegro™ Peristaltic Pump System can run higher durometer tubing depending on the Allegro™ model and customer application. Please consult kd Scientific for additional information.

** Accuracy specification assumes user performance of tubing break-in and calibration.

KD Scientific pumps are for laboratory use only. They have not been approved by the FDA for clinical use on patients.

Specifications are subject to change.

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Controller Box
Operating Humidity vs Temperature

Note: As temperature increases, maximum allowable humidity decreases.

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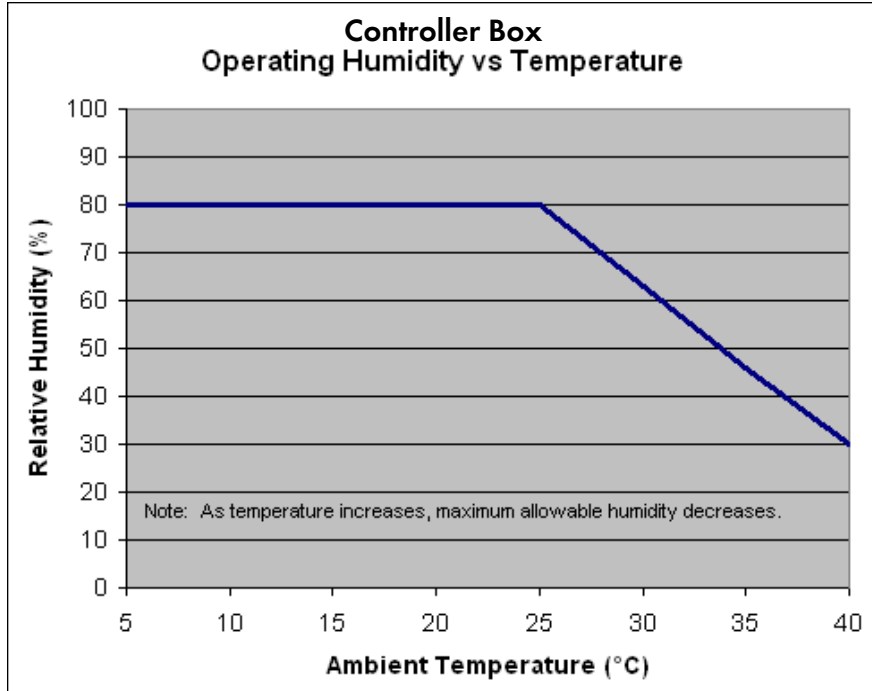
Product Overview

The KD Scientific Allegro™ Peristaltic Pump System is the next generation of peristaltic pumps. The system offers unparalleled ease of use through the high resolution color touch screen user interface. The full touch screen interface enables the user to quickly create configurations and recall them for easy use. The TFT color display presents all the pump operating parameters on an easy to view run screen.

The password feature prevents accidental configuration changes ensuring the program's integrity is retained. Programs can also be set to be started on a time delay for unattended operation.

An led light on the front panel makes it easy to see if the pump is running. Once the pump starts to run, the display shows the pump is running and the LED turns on. This will make it easy to see the pump's status.

The pumps are versatile and can be interconnected through the RS-485 interface. Allegro™ Peristaltic Pump System models can be mixed and matched in the daisy chain offering maximum flexibility. Up to 99 pumps can be linked together through the RS-485 interface. This interface is easy to use provided each pump is assigned its own unique pump address.

For limited laboratory space the Allegro™ Peristaltic Pump controller can be placed on its side to reduce the footprint. The display also tilts with the change to allow the user to operate the pump vertically. The pump heads can be stacked to save bench space.

Notifications and error messages are displayed for the user to acknowledge, eliminating any guesswork about problems.

Flow performance is optimized with a small step angle stepping motor. The tubing mechanism is easy to use and securely holds the tubing for smooth flow performance.

Advanced microstepping techniques are employed to further reduce the step angle to eliminate flow pulsation. A wide dynamic flow range can be programmed into the pump. Flow rates are selectable with user selected engineering units from L, ml, μl, nl and hours, minutes and seconds.

The superior design of the full metal chassis provides noise isolation and anti-vibration features for increased reliability.

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Easy external connections to a computer or other control devices are made through USB interface. Simple ASCII commands make communication with the pump easy. For direct control of the pump, the user can use the I/O interface (15pin Dsub). A trigger output and a trigger input in for external events such as a process parameter is met. The footswitch input will allow the control of the pump through an external device. The unit also has an output for run indication allowing connection to a remote light.

The forward/reverse dispensing programmable model Allegro™ offers maximum flexibility and capability for configuring and running different programs. Multiple programs of 50 steps each can be configured and stored in the unit, and recalled quickly with the touch of a button. The programs are identified with a 15 character alphanumeric name for easy identification and can be stored on the computer and downloaded at future dates. A relative clock is available to start and stop programs based on time. Extensive programming options allow the user to duplicate configurations, append one configuration to another, rename programs, delete programs, export programs to a PC or export a program to another pump. This feature can ensure consistency and accuracy of multiple pumps.

Preprogrammed profiles include Constant Rate and Ramp. These standard profiles make configuration easy to set up. If more complexity is needed the user can select from advanced programming options including:

- Time delays

- Repeating steps

- Stopping the pump

- Triggering the pumps TTL output

- Accepting an event input in such as a user touch

- Events can trigger the pump to dispense in forward or reverse

The pump Information/setup screen shows the pump's software version. The pump's alarm configurability includes alarms for near end of run (user selectable), completion of run, power up, keypad clicks and stall detection.

Pump Models

The Allegro™ Peristaltic Pump System is available in 3 different configurations.

Allegro™ I Peristaltic Pump System – Single channel pump head and controller.

Allegro™ II Peristaltic Pump System – Dual channel pump head and controller

Allegro™ III Peristaltic Pump System – Two stacked single channel pump heads and controller.

ALLEGRO™ PERISTALTIC PUMP SYSTEM TOUCHSCREEN BUTTON REFERENCE

The following buttons are part of the KDS Allegro™ Peristaltic Pump System software:

Settings: *Access the settings menu used to adjust the following parameters: Audible Alarms, Pusher Block Force, Display Brightness, etc.*

Fast Forward: *Rotates in the forward (infuse) direction (press & hold).*

Fast Reverse: *Rotates in the reverse (withdraw) direction (press & hold).*

Rate Increase: *Increases dispensing rate.*

Rate Decrease: *Decreases dispensing rate.*

Direction (RD): *Reverse direction.*

Direction (FD): *Forward direction.*

Accept: *Used to accept the parameters/settings on a screen and return to previous screen in the menu.*

Cancel: *Used to cancel any changes/entries on a screen and return to the previous screen in the menu.*

Set Delay Parameters: *Used to set the time values for delayed operation. This permits the pump to start automatically at a preset time interval.*

Set Delay Parameters: *Indicates the Delay Timer has been set. The pump will start automatically.*

Run Preview: *Access the Run Preview screen that shows a summary operating parameters.*

Run/Resume: *Used to Run or Resume a Program.*

Re-Run: *Clears counters/timers (except the Total Infused Volume counter) and runs the selected program from the beginning.*

Stop: *Used to stop running a Program.*

Reset: *Resets all counters/timers.*

Minimum Value Allowed: *Used to select minimum value allowed.*

Maximum Value Allowed: *Used to select maximum value allowed.*

Configure: *Used to set up the program.*

Back: *Used to call the Mode and Programs menu.*

Page Down: *Used to page down in a display list.*

Page Up: *Used to page up in a display list.*

Line Up: *Used to scroll up in a display list.*

Line Down: *Used to scroll down in a display list.*

Insert Step: *Used to insert a new Step in a Program while editing/creating the Program. The new Step is inserted after the Step that is currently selected.*

Delete Step: *Used to delete the selected Step in a Program while editing/creating the Program. To confirm deletion, you must select the Delete Step button a second time.*

Move Step Up: *Moves the currently selected Step in a Program up one position in the Program Order (e.g. Step 3 becomes Step 2).*

Move Step Down: *Moves the currently selected Step in a Program down one position in the Program Order (e.g. Step 2 becomes Step 3).*

Copy Step: *Creates a duplicate (copy) of the currently selected Step in a Program and inserts it as the last Step in the Program being created/edited.*

Password Protection Off: *Indicates that the pump is currently unlocked. Pressing the button twice locks the Touchpad.*

Password Protection On: *Indicates that the pump is currently locked. Press the button and enter password to unlock the Touchpad.*

File Options: *Access the File Options menu that is used to manage the list of Programs and to export Program information to an externally linked pump or to a connected computer.*

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Selecting An Item From a Menu List

Selecting items is easy with the Allegro™ Peristaltic Pump System.

Touch the item to select/highlight the item, then touch again to select it or press **ENTR** ✓

Canceling a Selection

Canceling selections is easy.

Press **BACK** ✗

Tubing Size Selection

Std. Tubing

L/S® 13	0.8 mm
L/S® 14	1.6 mm
	2.4 mm
L/S® 16	3.1 mm
	3.2 mm
	4 mm

1
PAGE ▲
LINE ▲
LINE ▼
PAGE ▼

Recalibrate pump with tubing change.

BACK ✗   ENTR ✓
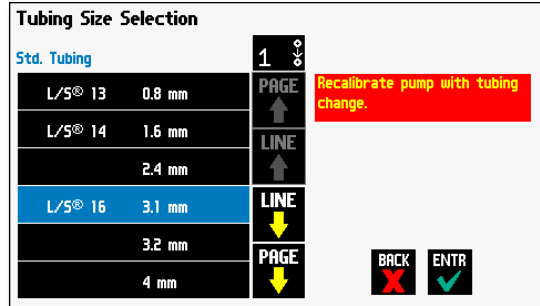
Messages

There are different types of messages. Error messages are shown in yellow.

- Critical
- Run–mode
- Program
- Set-up

Notices, alarms, confirming, and verified messages are show in green.

- Alarms
- Confirm
- Verified

Configuration

MODE	Dispense
TUBING	4.8 mm
RATE	250 ml/min
TARGET	5 L
CALIBRATE	

ERROR 101-Power to the pump was lost.

PRESS TO CLEAR ERROR

SETUP   DELAY

Program Configuration

Program Name
MY_PROGRAM_1

Tubing
4.8 mm

Step Definition
Step 1: Delay
Step 2: Constant Rate

NOTICE-Press Run to start the pump in: 2 seconds.

PRESS TO CLEAR MESSAGE

SETUP   DELAY

BACK   RUN ▶
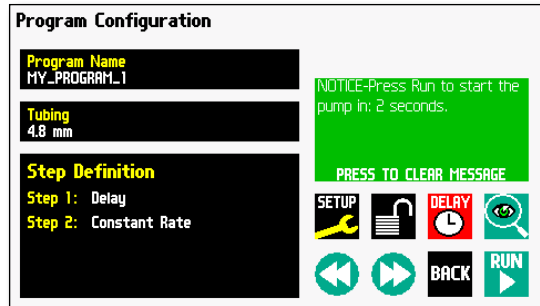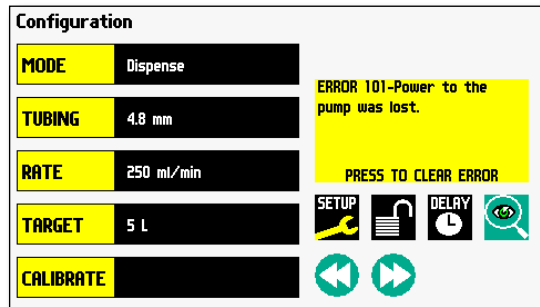
Entering Values

Entering new values is easy.

Set Dispense Rate

Dispense Rate   250   ml/min

7 8 9   MAX
        552.368 ml/min
4 5 6
        1.0229 ul/min
1 2 3
. 0 ⌫   MIN

BACK ✗   ENTR ✓

Use the keypad to enter the number

Decimal point

Backspace Key

Cancel and go back to the previous screen

Accept the value and go back up to the previous screen
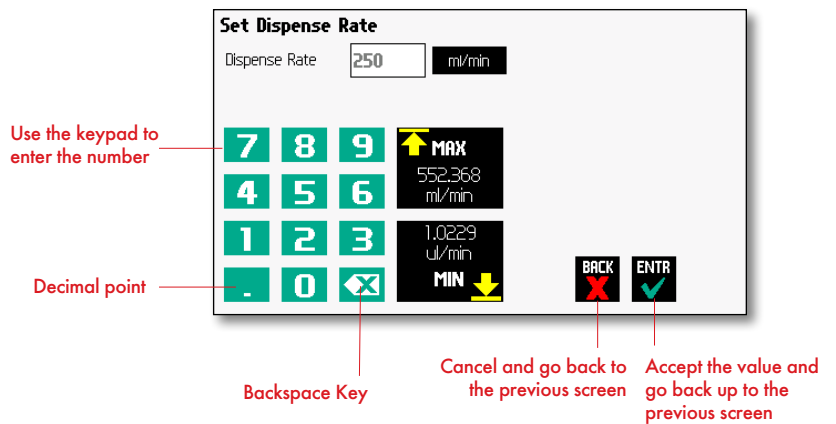
OPERATING INSTRUCTIONS

Run / Fault LED

Protective Antiglare

User Interface
Touchscreen
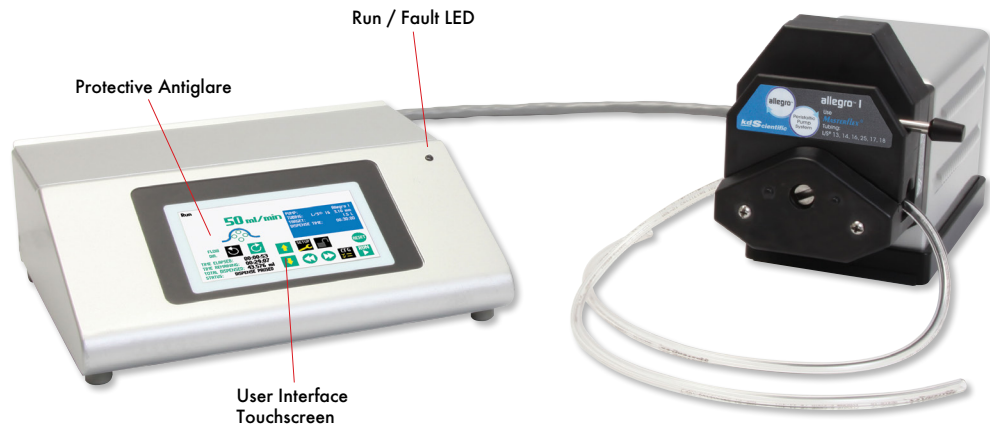
Allegro™ Peristaltic Pump shown above

Allegro™
head/driver
connection

Close up view of the Allegro™ Peristaltic Pump rear connections
(connections vary depending on model type)

Foot Switch

I/O Connector

Main Switch

RS-485 Connection

(Pump to Pump)

DC Power Input

USB Serial Input

(Type B)

*Power Source -

When powering a pump in a chain through an RS-485 cable, toggle switch to RS-485. Only one pump can be powered from the master through the RS-485.

POWER CONNECTIONS

1. Connect the 9 pin D-sub connector from the Allegro™ head/driver to the Remote Pump Connection located on the back of the touchscreen controller.

2. Plug the power supply into the pump.

3. Connect to a properly rated line cord. The Allegro™ Peristaltic Pump power supply has a DC power input connector on the rear of the unit. The operating range for the Allegro™ Peristaltic Pump System series is 100 – 240 VAC, 50-60 Hz.

4. Turn on the main power switch.

CAUTION: Do not connect to firewire ports on a computer. Damage may occur to the pump or computer.

TUBE LOADING

1. Turn off the Allegro™ Peristaltic Pump controller.
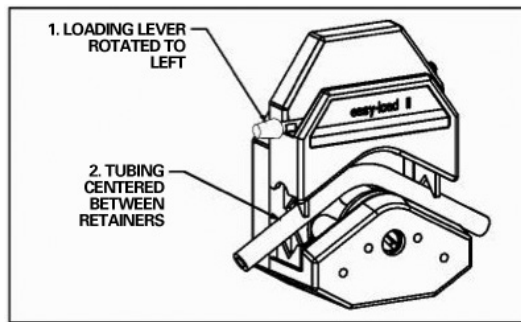
Figure 1: Open and Load Pump Head

> ⚠️ **CAUTION:** *Stop the drive when changing the tubing or its position in the rotor mechanism (the rotor is partially exposed when the LOADING LEVER is in the open position).*

2. Rotate the lever to the left to open the pump head.

3. Load the correct size tubing between the retainers.

Please use Masterflex L/S® tubing only. Center the tubing between the retainers as shown in Figure 1.

4. Rotate the lever to the right to close as shown in Figure 2.
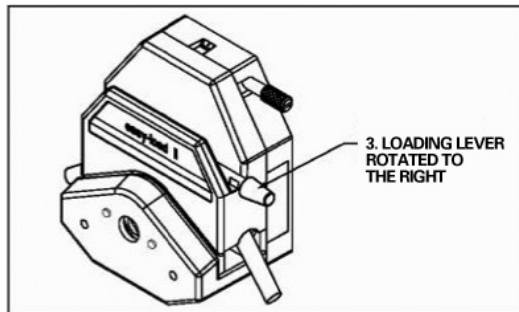
Figure 2: Close Pump Head

Note: The Allegro™ I single channel head is shown in Figure 1 & 2. The above instructions also apply to the dual channel head used on the Allegro™ II model and the two stacked single channel heads used in the Allegro™ III model.

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Configuring the KDS Allegro™ Peristaltic Pump System

The KDS Allegro™ Peristaltic Pump System program is easy to set up.

> **The Allegro™ Peristaltic Pump System is easily configured. When the unit is powered up, the Configuration Screen will be displayed.**

Select Mode   Select Tubing Manufacturer Size

Configuration

MODE	Dispense
TUBING	4.8 mm
RATE	250 ml/min
TARGET	5 L
CALIBRATE	

SETUP   DELAY

General Pump Parameter Set-Up

Preview Program Jumps to Run Screen

Select Flow Rates

Select Target Volume

Fast Reverse   Fast Forward

Press and hold to activate
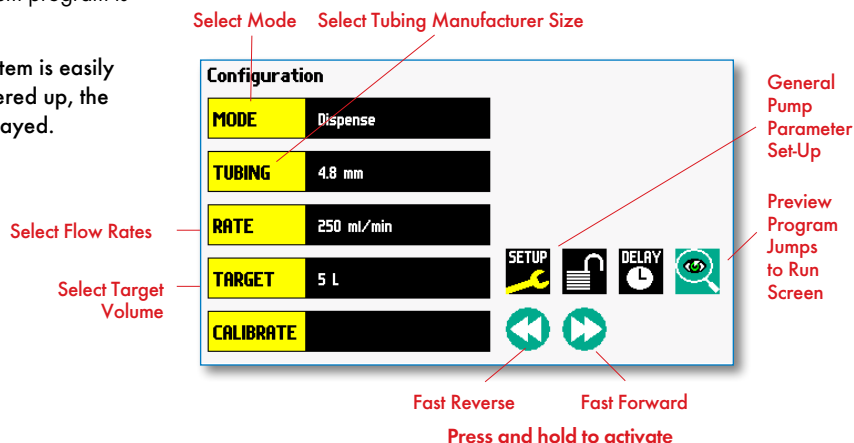
Pump Selection

The Allegro™ Peristaltic pump must be configured to run with the installed head configuration.

> **1) Select the Setup button to enter the Set-up menu.**

> **2) Choose the proper button for your pump type. Select I for the Allegro™ I, II for the Allegro™ II or III for the Allegro™ III.**

Set-up

Upgrade Software

Audible Alarms   Pump Info

Display Brightness 60%   Pump Address 2841   Allegro I II III

Set Password   Resume Run After Pwr Loss   BACK X   ENTR

Pump Type Selection
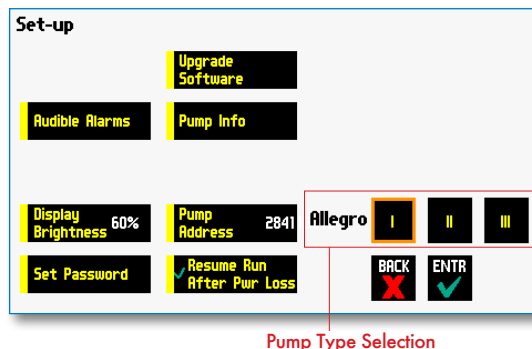
Mode Selection

Select MODE in the Configuration Display menu and the Mode Selection screen will be displayed.

The available modes are as follows:

Dispense Mode: Dispense mode is the main operating mode for the Allegro™ Peristaltic Pump System.

New Program: Program Mode allows the user to create automatic dispense programs and save them for later use.

Note: All created programs will be listed in the mode directory.

Mode Selection

New Program

Pump Mode
Dispense

MY_PROGRAM_1
Program

PETE'S_PROGRAM
Program

SETUP   FILE

ENTR

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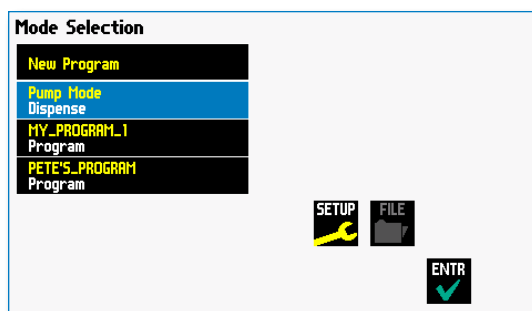
Tubing Selection

1. In the Configuration Display select the Tubing button. The Tubing Selection Screen will be displayed.

Configuration

MODE	Dispense
TUBING	3.2 mm
RATE	50 ml/min
TARGET	5 L
CALIBRATE	
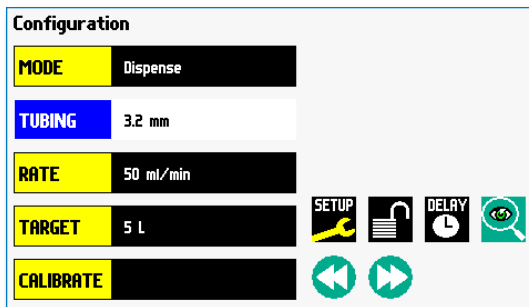
2. The Tubing Selection screen contains a Custom Tubing and Standard Tubing selection. Press the Standard Tubing button to select a predefined tubing size. Use the Line Up/Down and Page Up/Down buttons to scroll through the selections. Select the desired tubing and press Enter.
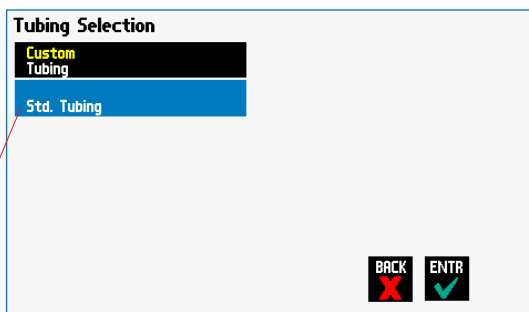
   Note: When changing tubing sizes, please recalibrate the tubing before using. Please see the Tube Calibration section of this manual.

Tubing Selection

Custom Tubing
Std. Tubing

Press

BACK ENTR

Tubing Size Selection

Std. Tubing

L/S® 13	0.8 mm
L/S® 14	1.6 mm
	2.4 mm
L/S® 16	3.1 mm
	3.2 mm
	4 mm

PAGE ↑
LINE ↑
LINE ↓
PAGE ↓

Recalibrate pump with tubing change.

Press

BACK ENTR
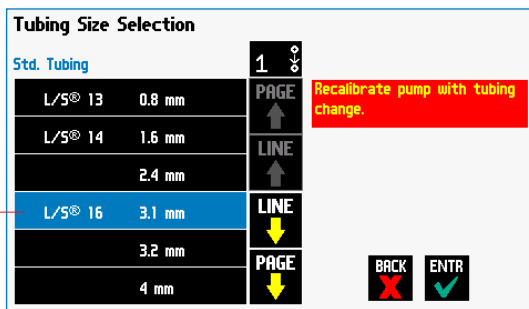
3. For a Custom Tubing size, use this selection.

Tubing Selection

Custom Tubing
Std. Tubing

Press to enter a custom tubing

BACK ENTR
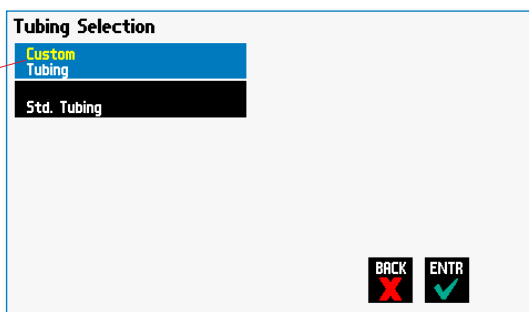
Custom Tubing Definition Display

Custom Tubing Definition

Inside Diameter 3.2 mm.

Press to enter the inside diameter of the tubing

7 8 9
4 5 6
1 2 3
. 0 ⌫

BACK ENTR

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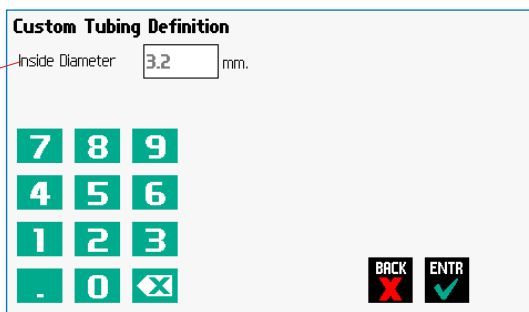
Combining Flow Channels

For Allegro™ II & Allegro™ III systems, the flow channels can be combined into a single output.

1. Toggle the Combined Flow Icon
   will change to:

2. When flow channels are combined, a note is added to the configuration and run screens.

Tubing Size Selection

Std. Tubing

L/S® 13	0.8 mm
L/S® 14	1.6 mm
	2.4 mm
L/S® 16	3.1 mm
	3.2 mm
	4 mm

1

PAGE
LINE
LINE
PAGE

Recalibrate pump with tubing change.

BACK   ENTR

Configuration

MODE	Dispense
TUBING	2CH. combined 4 mm
RATE	986.371 ml/min
TARGET	No target set
CALIBRATE	

SETUP   DELAY

Run

986.371 ml/min

PUMP: Allegro I
TUBING: 4.00 mm
TARGET: No target set
DISPENSE TIME: --
COMBINED: 2 channels

FLOW DIR.

SETUP

TIME ELAPSED: 00:00:00

TOTAL DISPENSED: 0 ul
STATUS: READY TO DISPENSE

CFG   RUN

Program Configuration

Program Name
III_BREAK_IN

Tubing   2CH. combined
6.4 mm   L/S® 17

Step Definition
Step 1: Ramp
Step 2: Ramp
Step 3: Stepped

Step 6: Constant Rate

SETUP   DELAY

BACK   RUN

III_BREAK_IN
  6 step(s)
Tubing   2CH. combined
  6.4 mm L/S® 17   Pump Allegro III

Step: 1   Ramp
4.65496 ul/min to 100 ml/min
for 00:02:30
Step: 2   Ramp
100 ml/min to 250 ml/min
for 00:02:30

CFG   RUN

Flow Rate Selection

1. In the Configuration Display enter the flow rate by pressing Rate on the Configuration screen. In this example we want to enter 150 ml/min.

Configuration

MODE	Dispense
TUBING	3.2 mm
RATE	50 ml/min
TARGET	5 L
CALIBRATE	

Press

SETUP   DELAY

2. To change the units, press the units.

Press to change the units

Set Dispense Rate

Enter the flow rate

Dispense Rate   150   ml/min

7 8 9   ↑ MAX
                245.497
                ml/min
4 5 6
                454.624
                nl/min
1 2 3
. 0 ⊠   MIN ↓   BACK ✗   ENTR ✓

Press to select the maximum flow rate for the tubing size selected

Press to select the minimum flow rate for the tubing size selected
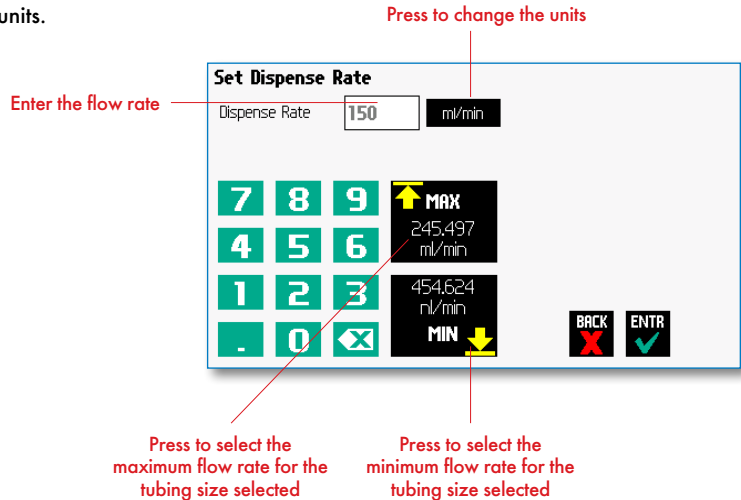
3. In the Units Selection Display select the volume and the time base.

Units Selection

Current selection: **ml/min**

L	Hr
ml	Min
ul	Sec
nl	

BACK ✗   ENTR ✓

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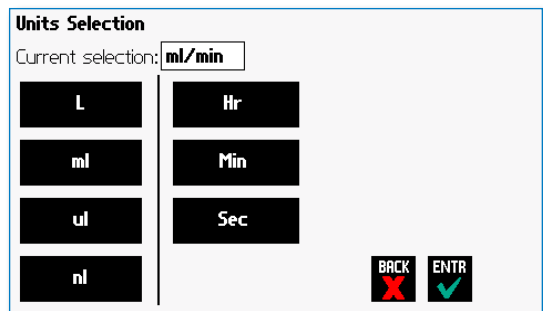
Target Volume/Time Selection

1. In the Configuration Display enter the target volume or time. In this example we want a volume of 5 L.

NOTE: *For time enter h:m:s. or press again to select secs. Time is accurate to +/- 0.01secs. Remember to enter the* **:**
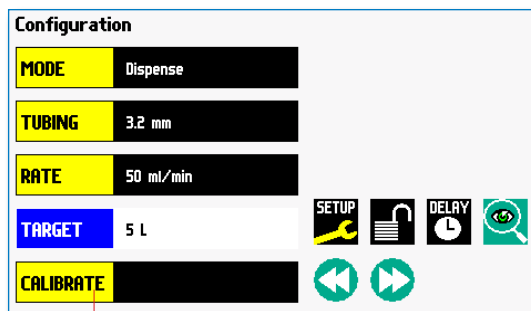
Configuration

MODE	Dispense
TUBING	3.2 mm
RATE	50 ml/min
TARGET	5 L
CALIBRATE	

SETUP DELAY

Press Here

2. To change the units, press the units.

Press to change the units

Set Target Volume or Time

Press to select target volume — ● Volume 5 L

Press to select target time — ● Time 0 secs

7 8 9
4 5 6
1 2 3
. 0 ⌫

BACK ENTR

3. In the Units Selection Display select the volume units.

Units Selection

Current selection: L

L
ml
ul
nl

BACK ENTR
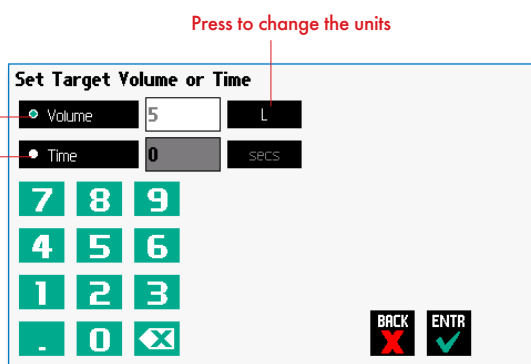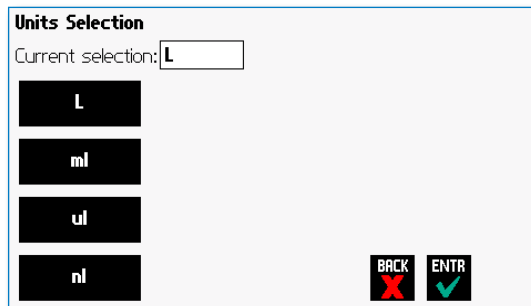
Flow Direction

1. The flow direction is set on the Run screen. Press the Run Preview button on the Configuration screen to enter the Run screen.

2. On the Run screen select the Reverse Direction button to run the flow in the reverse (counter clockwise) direction or select the right Forward Direction button to run the flow in the forward (clockwise) direction.

Run

250 ml/min

PUMP Allegro: 1
TUBING: 4.80 mm
TARGET: 5 L
DISPENSE TIME: 00:20:00

FLOW DIR.

TIME ELAPSED: 00:00:08
TIME REMAINING: 00:19:51
TOTAL DISPENSED: 34.0323 ml
STATUS: DISPENSE PAUSED

SETUP   RESET
CFG RUN
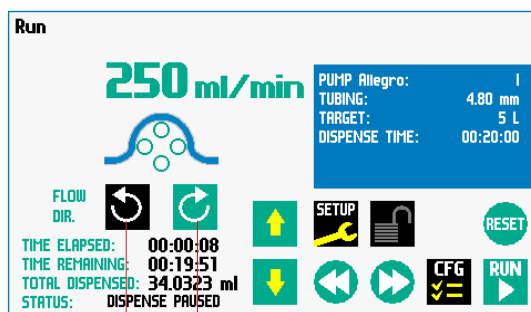
Reverse Direction button   Forward Direction button

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Tube Run-In

New tubing or tubing that has been idle for extended periods should be run-in prior to use. The pump comes standard with programs to complete this task. Any tube size that meets the diameter specifications for the appropriate pump head can be used.

1. From the Mode Selection screen, select the proper program for the head configuration of the pump.

   Please select program I_BREAK_IN for the Allegro™ I, II_BREAK_IN for the Allegro™ II or III_BREAK_IN for the Allegro™ III.

   Tubing Break-In Selections

   ```
   Mode Selection

   New Program
   Pump Mode
   Dispense
   I_BREAK_IN
   Program
   II_BREAK_IN
   Program
   III_BREAK_IN
   Program

   SETUP   FILE

   ENTR
   ```
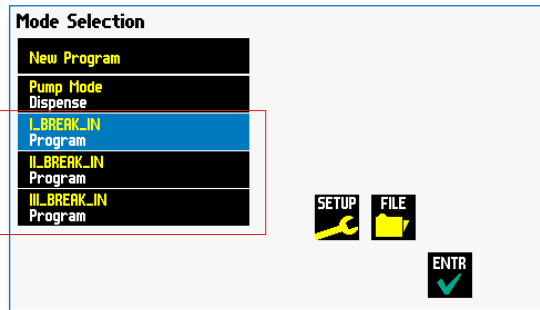
2. Once the proper tube break-in program is selected, the Program Configuration screen will open.

3. Select the Run button to start the break-in program. The program run time is 15 minutes.

   ```
   Program Configuration

   Program Name
   I_BREAK_IN

   Tubing
   8 mm   L/S® 18

   Step Definition
   Step 1:   Ramp
   Step 2:   Ramp
   Step 3:   Constant Rate

   Step 4:   Constant Rate

   SETUP         DELAY

   BACK   RUN
   ```
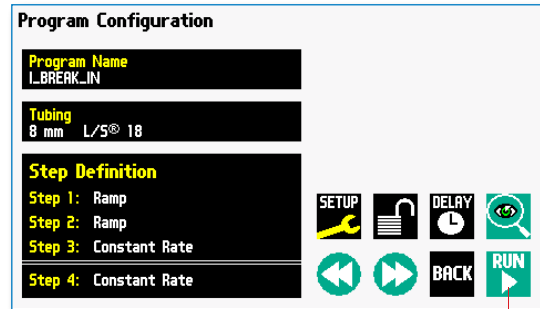
   Select Run to start the break-in program

> ✏️ **NOTE:** *Large diameter and/or high durometer tubing require lubrication of tubing. See Appendix E for ordering information.*

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Tube Calibration

Please use the following procedure to calibrate tubing. To achieve the best possible accuracy, the calibration procedure should be run before using the pump. Please note that the pumping direction for calibration is always forward.

1. From the Configuration screen, make appropriate selections for tubing size and flow rate and select the Calibrate button and the Calibration screen will open.

Select Calibrate when tubing and flow rate have been entered

Configuration

MODE	Dispense
TUBING	3.2 mm
RATE	10 ml/min
TARGET	1 L
CALIBRATE	

SETUP   DELAY
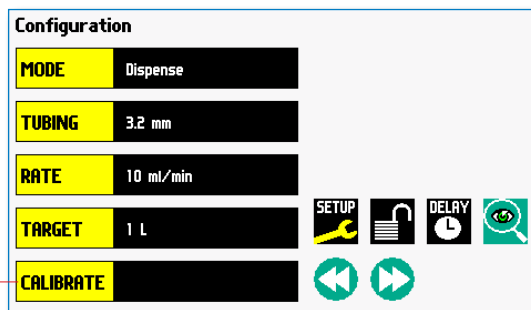
2. Insert appropriate tubing into Pump Head. Please see the previous section for tubing break-in procedure.

3. Insert tube inlet into supply fluid.

4. Press and hold the fast forward button to prime the tubing. Priming will stop when the

   button is released.

5. Insert tube outlet into a container to be placed on a scale. The weight to volume conversion for water is 1 gram = 1 ml.

6. Press the Run button. The drive will run until stopped by the user.

Calibration

Reset Calibration
to default setting

Enter Volume Delivered

NOTICE-Press Run to start the calibration. Recommended time is 1 minute.

PRESS TO CLEAR MESSAGE

Tubing : 3.2 mmn
Rate   : 10 ml/min
Volume : 0 ul

CFG   RUN
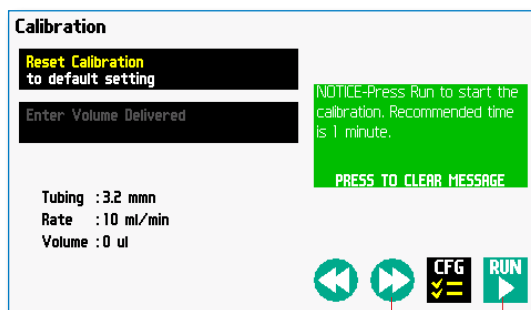
Select Fast Forward to prime the tubing

Select Run to start the calibration program

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7. Upon completion of the calibration run period, the 'Enter Volume Delivered' button will be activated. Please note the Volume reading listed under the Tubing and Rate information on the Calibration screen.

Calibration

Reset Calibration
to default setting

Enter Volume Delivered

Tubing : 3.2 mmn
Rate : 10 ml/min
Volume : 1.1301 ml
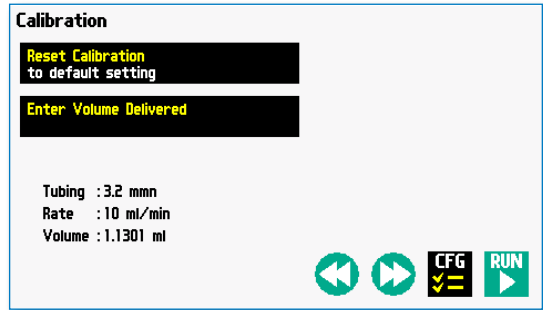
8. Select the Enter Volume Delivered button and enter the Volume as measured on your scale into the keypad and press Enter.

Enter Volume Delivered

Volume   1.131_   ml

7 8 9
4 5 6
1 2 3
_ 0 ⌫

BACK ENTR
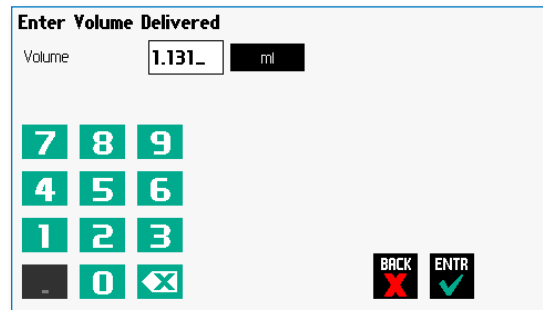
9. Press Enter on the Calibration screen to save the setting or select the Run button to start the procedure over again, or press the Reset Calibration button to reset to the Factory default value.

Calibration

Reset Calibration
to default setting

Enter Volume Delivered
1.131 ml Entered

NOTICE-Calibration Complete

PRESS TO CLEAR MESSAGE

Tubing : 3.2 mmn
Rate : 10 ml/min
Volume : 1.1301 ml

KDS Allegro™ Peristaltic Pump System User's Manual
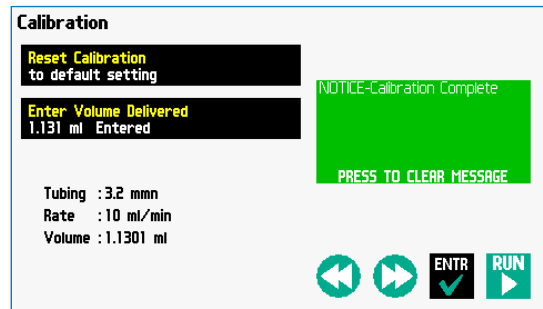
Previewing the Configuration

It is simple to view the Pump Configuration on the RUN display.

Press [icon] to view Pump Configuration

After you have verified the configuration.
Press [RUN] to run the displayed configuration.

Configuration

MODE	Dispense
TUBING	3.2 mm
RATE	50 ml/min
TARGET	5 L
CALIBRATE	
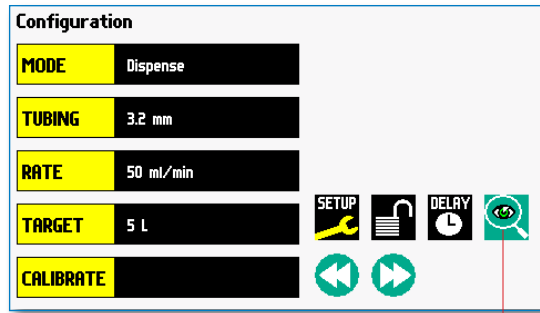
Press to preview configuration

Run

50 ml/min

PUMP Allegro:	1
TUBING:	3.20 mm
TARGET:	5 L
DISPENSE TIME:	01:40:00

FLOW DIR.

TIME ELAPSED:	00:00:00
TIME REMAINING:	01:40:00
TOTAL DISPENSED:	0 ul
STATUS:	READY TO DISPENSE
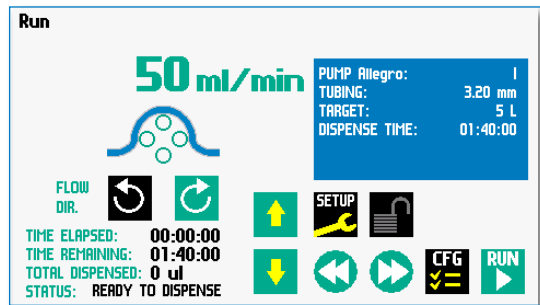
Configuring the Pump's General Parameters

The pump has basic parameters that should be configured during initial start-up. Once these parameters are entered they probably won't be changed.

To enter the set-up screen press [SETUP]

Configuration

MODE	Dispense
TUBING	3.2 mm
RATE	50 ml/min
TARGET	5 L
CALIBRATE	

KDS Allegro™ Peristaltic Pump System User's Manual
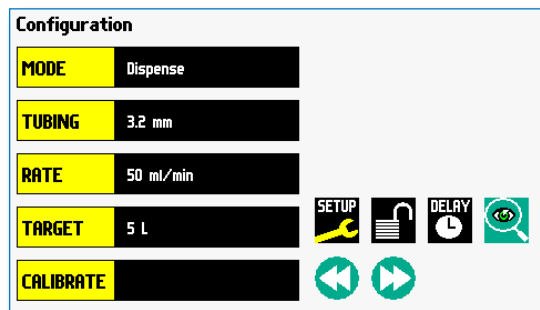
Setting the Audible Alarms

In the Set-up screen , press Audible Alarms.

Select the alarms, a check mark will indicate the alarms selected.

If these alarms are selected the pump will provide an audible alarm.

Accept the changes made by pressing and go back to the Set-up screen.

Cancel the changes made by pressing and go back to the Set-up screen.

Set-up

| Upgrade Software |
| Audible Alarms | Pump Info |

Press

| Display Brightness | 60% | Pump Address | 1 | Allegro | I | II | III |
| Set Password | Resume Run After Pwr Loss | BACK X | ENTR ✔ |

ENTR ✔

BACK X

End of Run – Alarm when the program is finished

Power Fail – Alarm when pump is power-cycled while running

Keypad Clicks – When the keypad is touched, the unit will provide audible feedback

Audible Alarms

| ✓ End of Run | Power Fail |
| Stall | Keypad Clicks |

Stall – Motor stalls

Near End of Run – When the volume dispensed is reached for the specified %

| Near End of Run | 75% |
| Mute All | BACK X | ENTR ✔ |

Mute All – No audible sounds
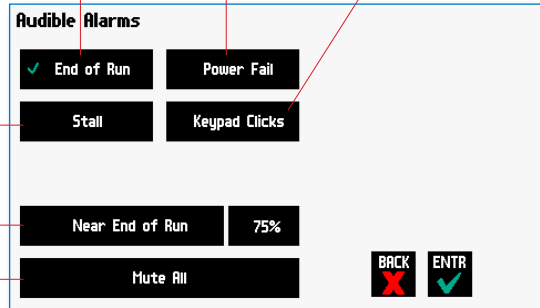
For Near End of Run Selection

Select the % volume dispensed. For example, if you select 80%, the pump will sound an alarm (3 short beeps) when the 80% of the volume is dispensed.

Accept the changes made by pressing and go back to the Set-up screen.

Cancel the changes made by pressing and go back to the Set-up screen.

Press to select % volume dispensed

Near End of Run
- 95%
- 90%
- 85%
- 80%
- 75%   Other Value
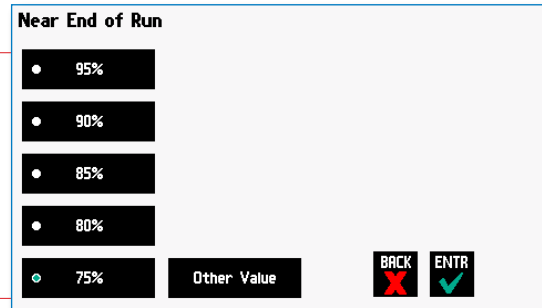
For a Custom %

Use this selection if the % is not listed.

Press Other Value to enter a custom %

Accept the changes made by pressing and go back to the Set-up screen.

Cancel the changes made by pressing and go back to the Set-up screen.

Near End of Run
- 95%
- 90%
- 85%
- 80%
- 75%   Other Value

Press to enter a custom %

Enter the percentage.

Accept the changes made by pressing and go back to the Set-up screen.

Cancel the changes made by pressing and go back to the Set-up screen.

Set Near End of Run Alarm

Percent Done   10_

7 8 9
4 5 6
1 2 3
0 ⊗
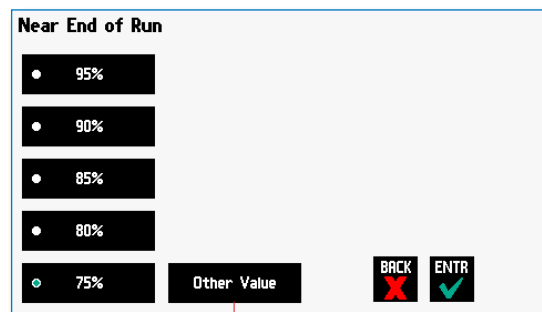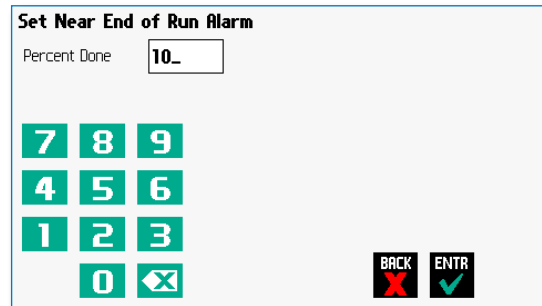
Locking the Touchscreen (Password Protection)

A touchscreen lock function can be enabled to prevent accidental operation or interruption of operation. Unlocking the touchscreen requires a password, defined by the user.

Set password →

Set-up

	Upgrade Software	
Audible Alarms	Pump Info	
Display Brightness 60%	Pump Address 1	Allegro I II III
Set Password	Resume Run After Pwr Loss	BACK ✗ ENTR ✓
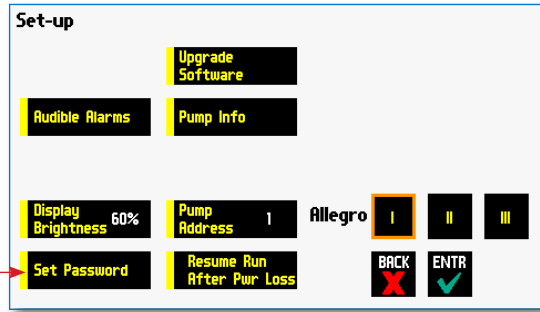
Setting the Password

To set the Password go to the Settings screen. Press the Set Password button.

Enter your desired password, up to 6 digits, and press the "ACCEPT" button.
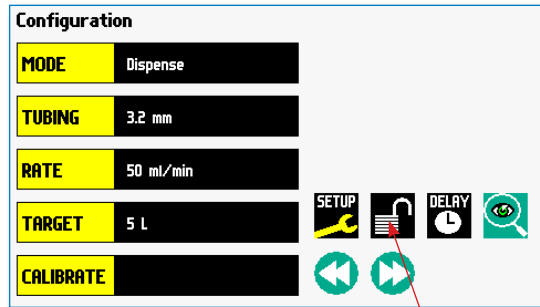
Turning the Touchscreen Lock on

Press the Lock button twice to lock the touchscreen.

Configuration

MODE	Dispense
TUBING	3.2 mm
RATE	50 ml/min
TARGET	5 L
CALIBRATE	

SETUP 🔓 DELAY 🔍

Password

Turning the Touchscreen Lock off

Press the "LOCK" button to bring up the Enter the Pump Password screen.

Enter your password and press the "ACCEPT" button.

Set The Pump Password

Pump Password   _

7	8	9
4	5	6
1	2	3
0	⌫	

BACK ✗   ENTR ✓
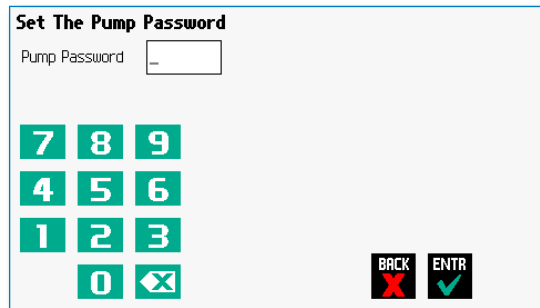
✏️ **NOTE:** *If you forget your password contact KD Scientific Technical Support at 508-429-6809.*

Configuration

MODE	Dispense
TUBING	3.2 mm
RATE	50 ml/min
TARGET	5 L
CALIBRATE	

SETUP 🔒 DELAY 🔍
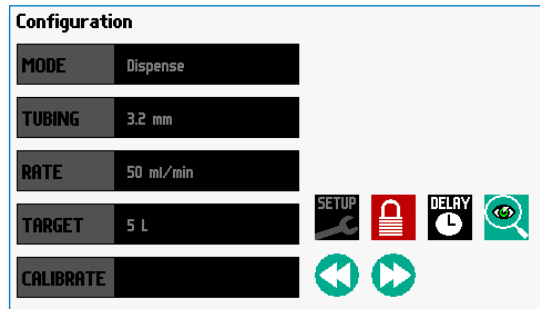
Setting Display Brightness

The backlight can be adjusted.

In the Set-up screen, select Display Brightness

Press to select % Display Brightness

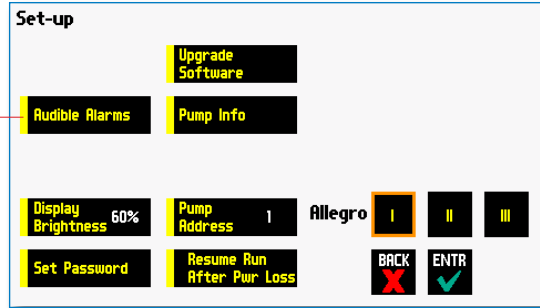Select the % Display Brightness. For example, if you select 80%, the brightness of the display will be 80% of the maximum.

Accept the changes made by pressing and go back to the Set-up screen.

Cancel the changes made by pressing and go back to the Set-up screen.

For a Custom Value

Use this selection if the % is not listed.

Press Other Value to enter a custom %

Enter the percentage.

Accept the changes made by pressing and go back to the Set-up screen.

Cancel the changes made by pressing and go back to the Set-up screen.

Set-up

Upgrade Software

Audible Alarms   Pump Info

Display Brightness 60%   Pump Address 1   Allegro I II III

Set Password   Resume Run After Pwr Loss   X ENTR

Press Here

Set Display Brightness

100%   50%
90%   40%
80%   30%
70%   20%
60%   Other Value   BACK ENTR
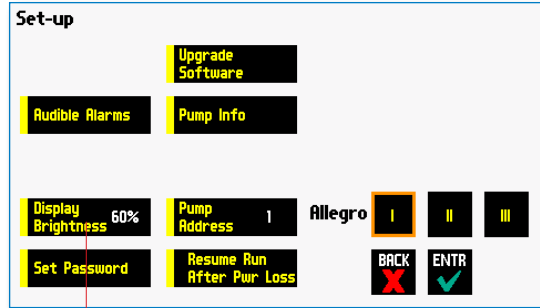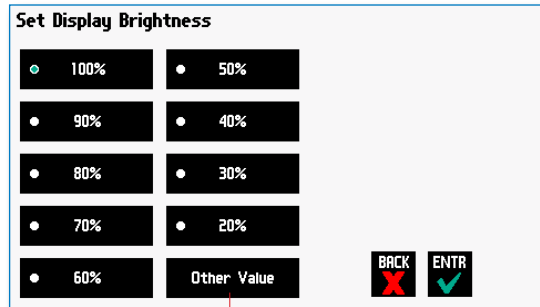
Press here for custom display brightness level

Set Display Brightness

Backlight   25_

7 8 9
4 5 6
1 2 3
0 ⌫   BACK ENTR

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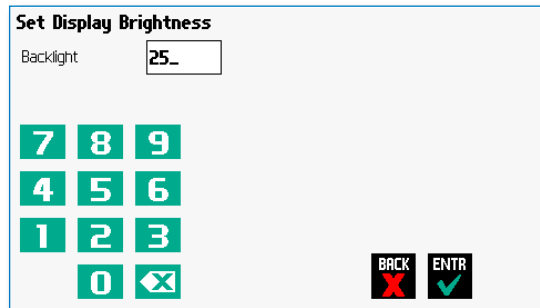
Setting the Pump Address

Up to 100 pumps can be linked together. Each pump can be given a unique address.

In the Set-up Screen press Pump Address. Valid entries are 00 to 99.

Enter the pump address.

Accept the changes made by pressing and go back to the Set-up screen.

Cancel the changes made by pressing and go back to the Set-up screen.

Set-up

Upgrade Software

Audible Alarms   Pump Info

Display Brightness 60%   Pump Address   1   Allegro   I   II   III

Set Password   Resume Run After Pwr Loss   BACK X   ENTR ✓

Press Here

Set Pump Address

Pump Address   _

7 8 9
4 5 6
1 2 3
   0 ⊠   BACK X   ENTR ✓
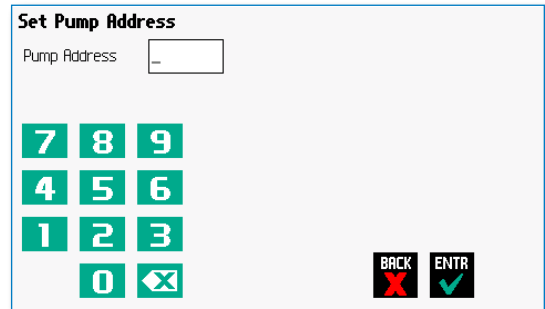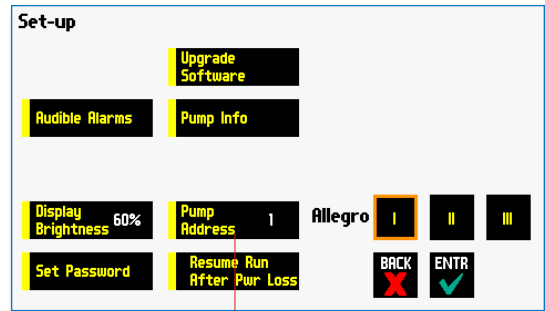
Resume Run on Power Loss

If Resume Run on Power Loss is selected the pump will power up running when power resumes.

NOTE: *This feature will only execute if the pump is running at the time when power is lost, and was running with no target set.*

In the Set-up screen,
select Resume Run After Power Loss

ENTR Accept the changes made and go back to the previous screen before Set-up mode was selected.

BACK Cancel and go back to the previous screen before Set-up mode was selected.
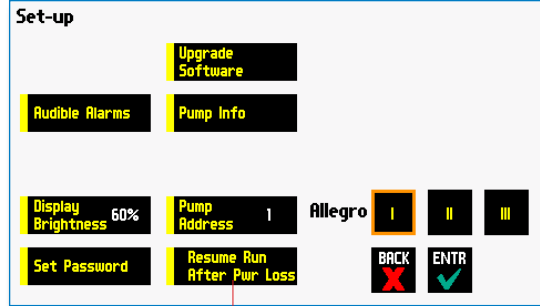
Press Here

NOTE: *Elapsed Timers and Total Infused Volume will be reset when power resumes. Counters and timers information prior to loss of power are lost*

Setting and Viewing Pump Information

The information on the pump's parameters are displayed in the Pump Information Screen.

In the Set-up screen, select Pump Information

The current information on the pump will be displayed.

- The Model type
- The Software Version
- The Current Pump Address

Accept the changes made by pressing and go back to the Set-up screen.

ENTR

Cancel the changes made by pressing and go back to the Set-up screen.

BACK

Press Here

Pump Information

Model Type	Peristaltic
Software Version	2.0.0
Pump Address	2

KDS Allegro™ Peristaltic Pump System User's Manual
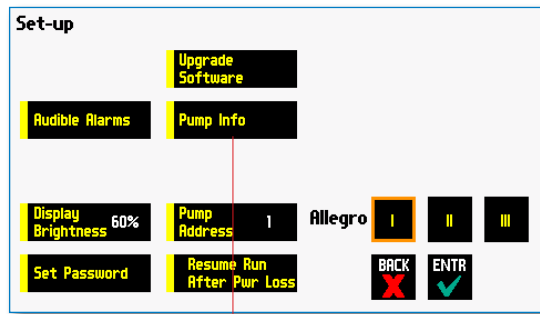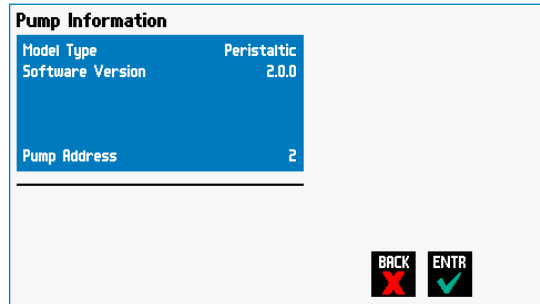
Operating the Pump

The Allegro™ Peristaltic Pump System is easy to operate because all the pump parameters are shown on the RUN Screen. Depending on the mode of the pump, different parameters will be shown on the display.

The Allegro™ Peristaltic Pump System Run Screen is shown below.

Press to go to Set-up screen
Press to go to Lock/Unlock on the touch screen

Current flow rate

250 ml/min

PUMP Allegro: I
TUBING: 4.80 mm
TARGET: 5 L
DISPENSE TIME: 00:20:00

Program settings

Indicates current flow direction

FLOW DIR.

Total elapsed time — TIME ELAPSED: 00:00:08
Total remaining time — TIME REMAINING: 00:19:51
Total volume dispensed — TOTAL DISPENSED: 34.0323 ml
Status of current pump operation — STATUS: DISPENSE PAUSED

SETUP

RESET

Press to reset Time and Volumes

CFG

RUN

Flow rate increase/decrease

Fast forward

Fast reverse

Press to Start/Stop the pump

Press to go to Configuration Screen

Running the Pump

Simply press the [RUN ▶] button to start the pump.

When the pump is running the [STOP] button is shown.

Press the [STOP] button to pause the program.
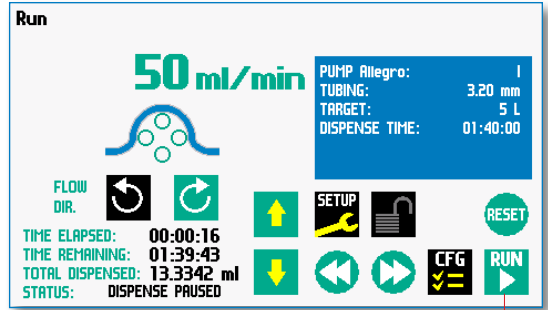
Press Here

✏️ **NOTE:** *The fast forward and fast reverse keys are not active (grayed out) when the pump is running.*
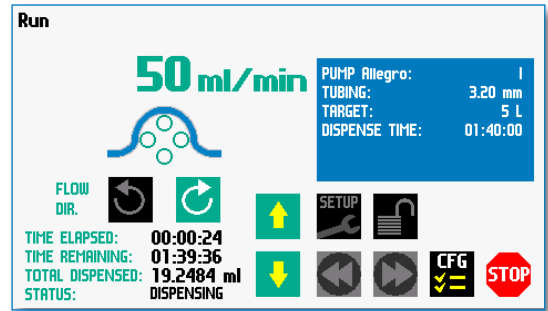
Custom Program Workflow

The following flow diagram describes the use of
a Custom Program:

```
┌─────────────────────────────┐
│      Select Program         │
└─────────────────────────────┘
              ↓
┌─────────────────────────────┐
│   Select Tubing & Size      │
│           OR                │
│   Create New Tubing Size    │
└─────────────────────────────┘
              ↓
┌─────────────────────────────┐
│   Review Program Steps      │
│  (Pump Operation Profiles)  │
└─────────────────────────────┘
              ↓
┌─────────────────────────────┐
│  Enter Pump Operation Profile│
│        Parameters           │
└─────────────────────────────┘
              ↓
┌─────────────────────────────┐
│   Validate Commands and     │
│      I/O Operations         │
└─────────────────────────────┘
```
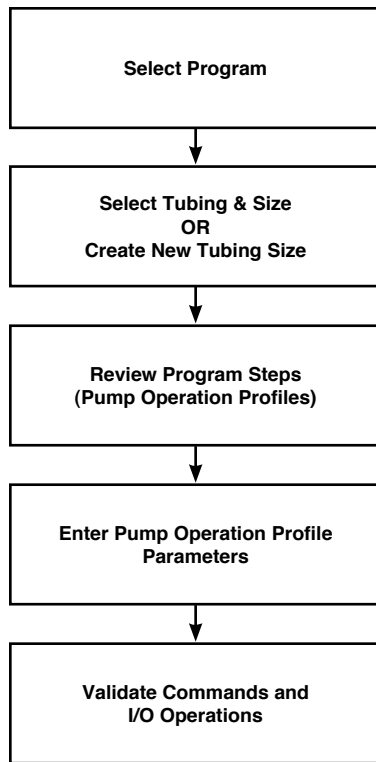
The software provides the user with a variety of prompts
and warnings to help guide the setup of programs. For
example, if a pump Program incorporates steps that
exceed the capacity of the defined tubing, the system will
prompt you that parameters are out-of-range. The system
also prompts users if required values are not entered.

> **NOTE:** *The pump will check the validity of parameters entered for each Step in the Program, but will not review the Program in its entirety to verify that it is logical and can be fully executed*

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Configuring Custom Programs

The Allegro™ Peristaltic Pump System offers the flexibility of configuring custom programs including multistep programs. The programs and steps can also be triggered to start and stop with events and external I/O, and user defined inputs.

Configuring a New Custom Program

To display the Mode Selection screen press Mode.

Select Mode

Configuration

MODE	Dispense
TUBING	4.8 mm
RATE	250 ml/min
TARGET	5 L
CALIBRATE	

SETUP   DELAY
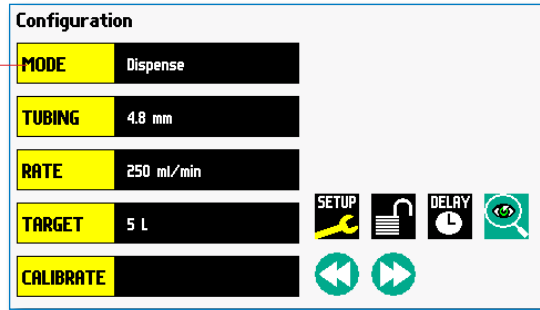
The Mode Selection screen will be displayed

Select New Program

Press

Custom Programs

View programs up a page   PAGE ↑

View the programs down a page   PAGE ↓

Views up the program   LINE ↑

Views down the program   LINE ↓

Mode Selection

New Program
Pump Mode Dispense
ALLEGRO_II_NR Program
A_MODE Program
I_BREAK_IN Program
II_BREAK_IN Program
III_BREAK_IN Program

PAGE ↑
LINE ↑
LINE ↓   SETUP   FILE
PAGE ↓   ENTR

KDS Allegro™ Peristaltic Pump System User's Manual
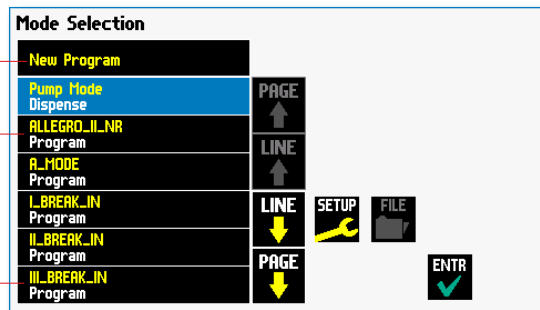
Configuring Custom Programs

The first thing to do on a custom program is to name the program.

> Enter any 15 character alphanumeric name
>
> Accept the new name **ENTR** ✓
>
> Go back to the Program Selection screen **BACK** ✗
>
> Select the Tubing Size
> (see page 17)
>
> To define the steps for the custom program press Step Definition

Below are some predefined steps including:

> **Constant Rate**- a single continuous rate of flow
>
> **Ramped Rate** - a linearly changing flow rate between a starting and ending flow rate
>
> **Stepped Rate** - an evenly changing flow rate between a starting and ending flow rate
>
> **Pulsed Rate** - an oscillating flow rate varying between a starting and target flow rate

In addition to these you can repeat, in a program as well as send signals to external devices or react to signals received from external devices. This package of pumping profiles and commands provides users with an extremely broad array of applications that can be easily configured with complex external programming.

Programs can be edited and saved under a new name, allowing them to be simply edited to fit another application. Steps can be copied, moved, inserted or deleted.

Step Definition

KDS Allegro™ Peristaltic Pump System User's Manual
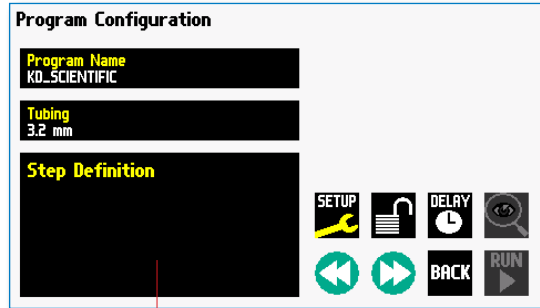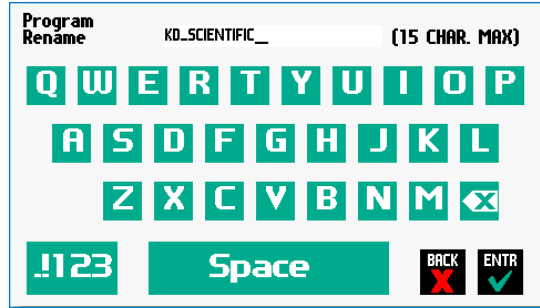
Setting A Delay

You can set the KDS Allegro™ Peristaltic Pump System to run after a delay. This delayed run function allows you to set up all the parameters for operation, then have the pump start unattended after a specified amount of time.

SETTING A DELAY FOR PROGRAM OPERATION:

1. From the program configuration screen, choose the Set Delay button to enter the Set Delay Screen.

2. Enter the desired Time using the keypad.

3. If the Units of your Time are not correct for your application, select the Units button to toggle between sec (seconds) and hh:mm:ss (hours:minutes:seconds). To use the hh:mm:ss option, enter your time value in hours, minutes, and seconds, separating each value with a colon. You can enter a value up to 99:99:99.

4. When the desired values are entered, choose the Accept button to save your changes and return to the Program Configuration screen. When a Time Delay value is active, the Time Delay Parameters button is displayed in Red on the screen to alert the user that a delay has been set.

5. Press the Run button to activate the Delay.
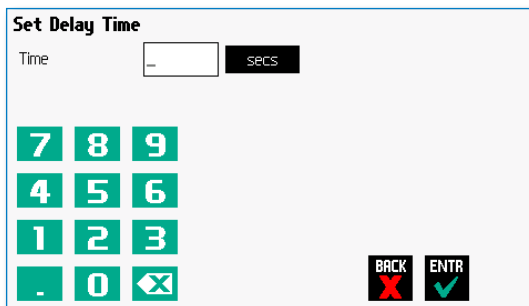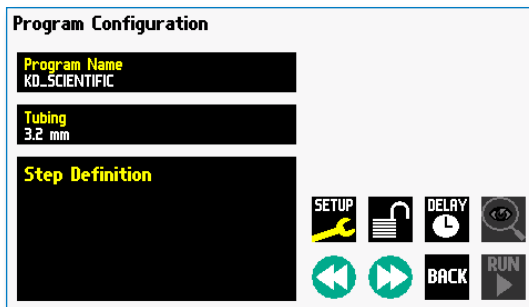
Set Delay Time screen
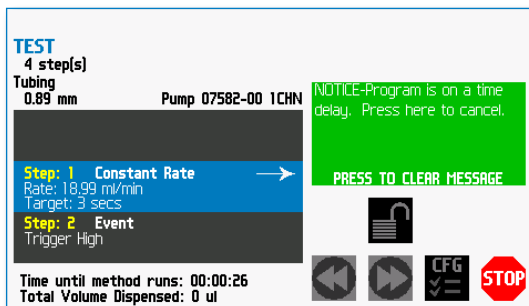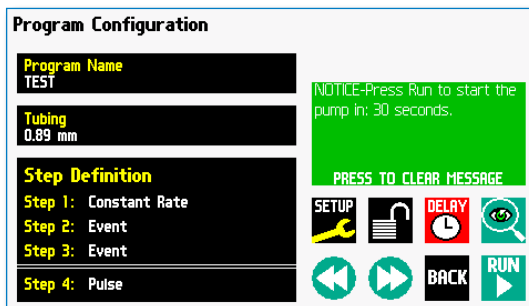
Quick Start run screen with a Time Delay Set

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Creating a Custom New Program

The following flow diagram outlines the basic steps you will follow to create a new Program:
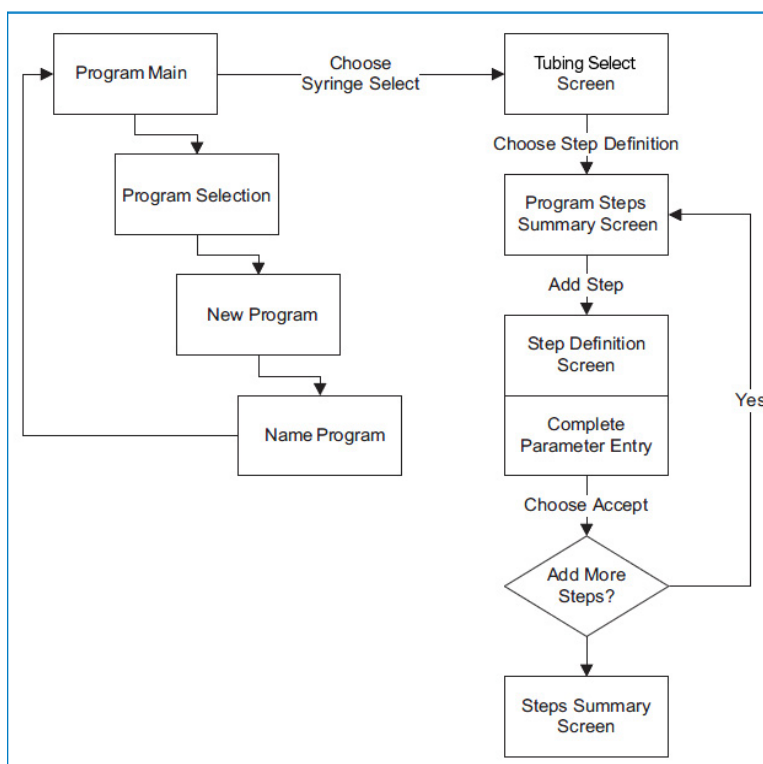
New User-Defined Program creation workflow

TO CREATE A NEW USER-DEFINED PROGRAM

1. From the Program Configuration or Programs screen, choose the Program Select button to enter the Program Selection screen.

2. Select New Program then choose Accept or press New Program again.

3. On the Program Name screen, type the name of your Program using the onscreen keyboard. Choose the Symbols/Numbers button .?123 to display the list of available numbers and symbols that can be included in the Program Name. To switch the keyboard back to letters mode, choose the Letters button (ABC).

4. When you have entered the desired name for your Program, choose the Accept button to go to the Program Configuration screen. Your new Program will now be listed in the Program Name button.

5. Choose the Tubing Select button and complete the description of the tubing by following the procedure outlined previously in the Tubing Selection section of this Guide.
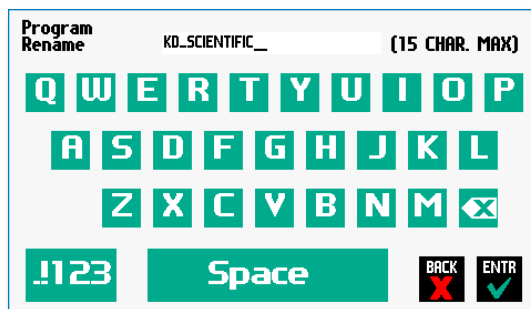
New Program Name Entry screen showing letter keys. To view numbers/symbols, choose the use button in the lower left corner
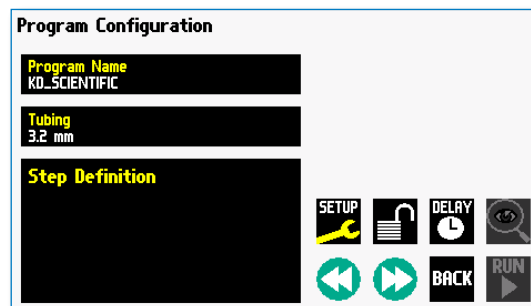
TO CREATE A NEW USER-DEFINED PROGRAM (CONTINUED)

6. To begin creating Pump Control Profile Steps, choose the Step Definition button to enter the Step Definition screen.

Step Definition

Program:
KD_SCIENTIFIC

INS STEP   MOVE ▲   COPY STEP
DEL STEP   MOVE ▼   ENTR ✓
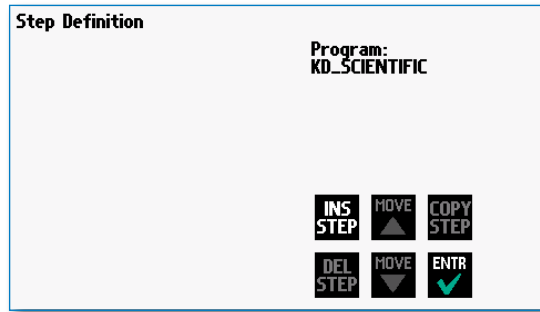
7. To add a Step to your Program, choose the Insert Step button to access the Select Profile for Step screen. The available options include Constant Rate, Ramp, Stepped, Pulse and Advanced Options.

Select Profile for Step 1

Constant Rate   Ramp
Stepped   Pulse

Advanced Options   BACK ✗
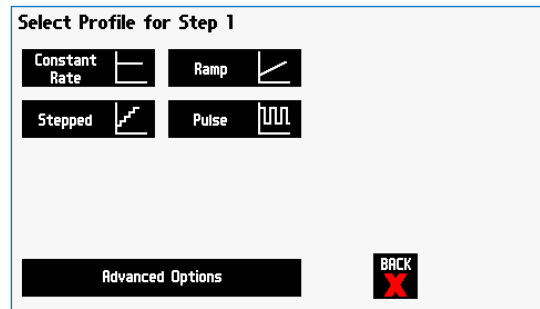
8. Selecting the Advanced Options button will allow you to access additional Program Step options. The Available advanced option steps are Go To, Delay, Repeat, Link, Stop, I/O (out) Trigger, I/O (in) Event and I/O (out) Event Link.

9. Choose the Program Step type that you want to add to the Program. If you choose a pumping profile (e.g. Constant Rate, Ramp, etc.) you will be taken to the Step Definition screen for the selected Program.
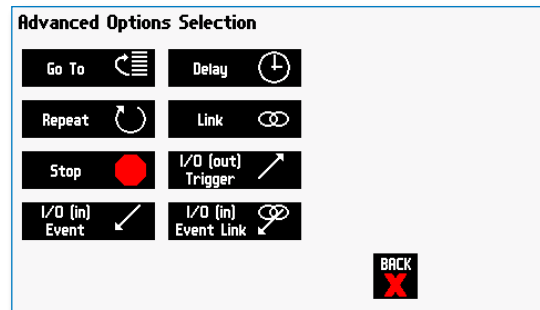
10. Complete the parameter entry applicable to the selected Pump Operation Profile; follow the detailed instructions supplied in the Pump Operation Profiles (Existing and User-Defined Programs) section later in this Guide.

11. When you have completed all parameter entries on the Step Definition screen or completed the required entries for Advanced Options, choose the button to save your changes and return to the Program Steps Summary screen.

12. Repeat items 7-10 in this procedure to include additional Steps in the Program.

13. When you are done adding all required Steps to the Program, choose the Enter button to return to the Program Main screen.

Advanced Options Selection

Go To   Delay
Repeat   Link
Stop   I/O (out) Trigger
I/O (in) Event I/O (in) Event Link

BACK ✗

NOTE: When adding a Step to a Program, the Step is added after the currently selected Step (i.e. the Step that is highlighted in blue)

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Modifying an Existing User-Defined Program

Once you have created a Program or have reviewed an Existing Program, you may have a need to modify the structure of the Program (i.e. the types of Steps and Commands included, not just changes in the operating parameters for a specific Step. The following procedures will help you to efficiently modify a stored Program.

CHANGING THE ORDER OF STEPS IN A PROGRAM

1. From the Program Configuration screen, choose the Step Definition button to enter the Program Steps Summary screen.
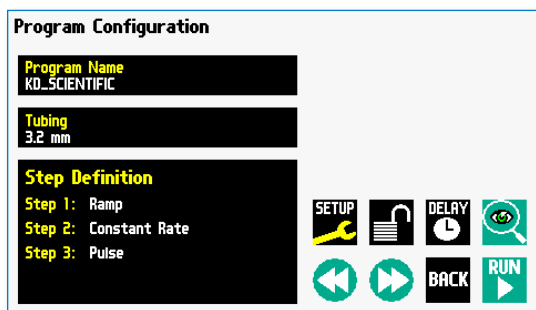
2. Highlight (select with a single touch) the Step for which you want to change the order.

3. Choose the Move Step Up or Move Step Down button, as required, to move the Step into the position that you want it executed.
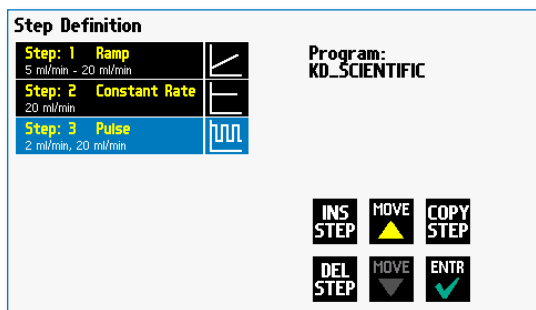
DELETING A STEP FROM A PROGRAM

1. From the Program Configuration screen, choose the Step Definition button to enter the Program Steps Summary screen.

2. Highlight (select with a single touch) the Step that you want to delete.

3. Choose the Delete Step button. The application will display a warning message in the Message Area asking you to confirm your deletion request
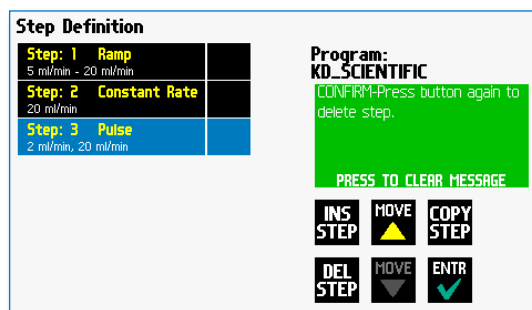
Delete Program Step showing confirmation message on the screen

4. To confirm the deletion, choose the Delete Step button again. The Step is removed and you are returned to the Program Steps Summary screen.

Defining Program Step Parameters

This section of the User Guide describes each of the available functions available for use in KDS Allegro™ Peristaltic Pump System Existing and User-Defined Programs. The information in this section is designed to help you set the individual parameter values in each of the Program Step options and to properly use the Advanced Options commands.

The information that follows is organized into two sections:

- Pump Operation Profiles

- Advanced Options (Commands and I/O)

PUMP OPERATION PROFILES

The KDS Allegro™ Peristaltic Pump System Existing Programs and all User-Defined Programs use Pump Operation Profiles as part of the Programs controlling the pump. These profiles are combined with a tubing selection and any Commands or Input/Output triggers to create a complete Program. The following sections describe each profile along with instructions for setting up the profile.
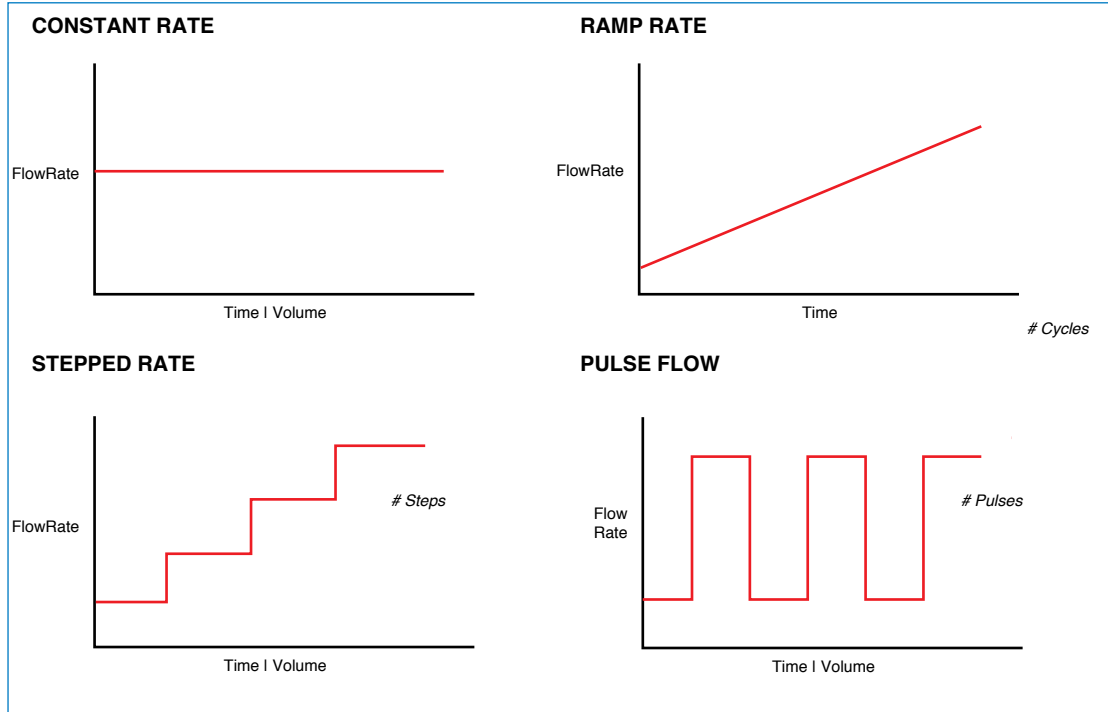
Pump Operation Profiles available on the KDS Allegro™ Peristaltic Pump System.

Constant Rate Profile

The Constant Rate profile is used to run the pump at a defined flow rate and for a specific pumping mode (infuse or withdraw) up to a target volume or for a defined time period.

Flow Rate

Target Time or Total Volume Point

STOP

Time | Volume

Constant Rate Pump Operation Profile
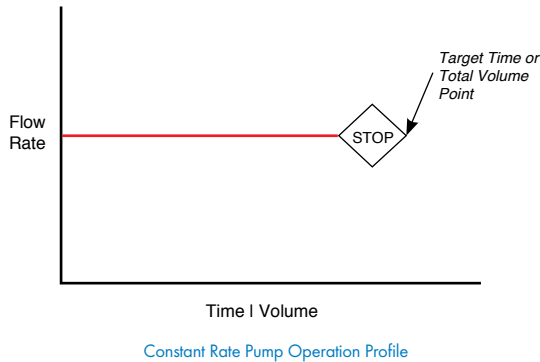
When creating or editing a Constant Rate profile, you will define three primary operating parameters:

- The Flow Mode defining the direction of flow: forward or reverse

- The Flow Rate to define the rate of uptake or dispensing

- The Target Volume or Run Time that determine how long the pump will operate at the set rate

When creating or editing a Constant Rate profile, you can set the rate in L, ml, μl or nl units of volume using sec, min or hr as the units of time. The system automatically calculates a minimum and maximum flow rate based on the tubing size selected or custom-defined. The min/max values are made available as button selection options on the Rate screen.

Step # 2, Constant Rate

Direction   Forward →

Rate
20 ml/min

Volume
1 L

BACK ✗   ENTR ✓
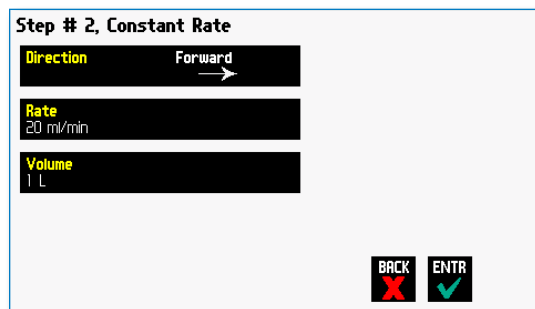
Constant Rate Profile Setup Screen

TO SET UP/EDIT A CONSTANT RATE PROFILE:

1. From the Step Definition screen for a Constant Rate profile, choose the Direction button to toggle the Flow Mode between Infuse and Withdraw operation.

2. Choose the Rate button to enter the Set Rate screen.

3. Enter the flow rate value desired using the keypad or select the Minimum Rate or Maximum Rate button.

4. If the Units of Rate are not correct for your application, choose the Units button.

5. On the Units Selection screen, select the unit of measure (L, ml, μl, nl or pl) and the unit of time (sec, min, hr) as appropriate, then choose 'ENTR' to confirm your selections.

6. When all parameters are correctly set on the Set Rate screen, choose 'ENTR' to confirm your settings and return to Constant Rate Definition screen.

7. Choose the Volume button to enter the Set Volume or Time screen.

8. On the Set Volume or Time screen, select the Volume or Time button, as desired.

9. Enter the desired value using the keypad, or select the Maximum Volume button.

10. If the Units of Volume/Time are not correct for your application, choose the Units button to the right of the parameter entry box. For the Units of Volume, this choice takes you to the Units Selection screen. For the Units of Time option, this choice will toggle the button between sec (seconds) and h:m:s (hours:minutes:seconds). To use the h:m:s option, enter your time value in hours, minutes and seconds, separating each value with a colon.

11. If you are changing the Units of Volume, on the Units Selection screen, select the unit of measure (ml, μl, nl or pl) as appropriate, then choose 'ENTR' to confirm your selection.

12. When all parameters are correctly set on the Set Target Volume or Time screen, choose 'ENTR' to confirm your settings and return to the Constant Rate Definition screen.

13. Choose 'ENTR' again to return to the Step Definition screen.

Ramp Profile

The Ramp Rate profile is used to create a linearly increasing or decreasing flow rate for a single pumping mode (infuse or withdraw) over the course of a defined time period.

Ramp Rate Pump Operation Profile

When creating or editing a Ramp Rate profile, you will define three primary operating parameters:

- The Flow Mode defining the direction of flow: forward or reverse

- The Flow Rate at the beginning and end of the pumping cycle

- The Target Time that determines the total length of time over which the ramp will be calculated

During a Ramp Rate profile, the KDS Allegro™ Peristaltic Pump System varies the flow rate linearly between the starting rate and ending rate over the full time period entered. A Ramp Rate profile can be applied to an increasing or decreasing rate application.

When creating or editing a Ramp Rate profile, you can set the rate in L, ml, μl, nl or pl units of volume using sec or h:m:s (hours:minutes:seconds) as the units of time. The system automatically calculates a minimum and maximum flow rate based on the tubing selected or custom-defined. The min/max values are made available as button selection options on the Ratescreen.

TO SET UP/EDIT A RAMP RATE PROFILE:

1. From the Step Definition screen for a Ramp Rate profile, choose the Direction button to toggle the Flow Mode between Forward and Reverse operation.
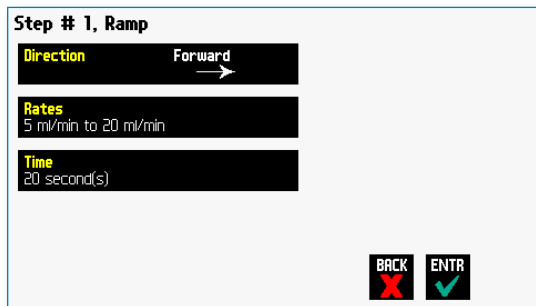
Step Definition screen for a Ramp Rate profile

2. Choose the Set Start & End Rate button to enter the Set Start & End Rates screen.

Set Start and End Rates screen

3. Select the Start Rate button (it should be selected by default as indicated by the active data entry box to the right of the button). Enter the flow rate value desired using the keypad or select the Minimum Rate or Maximum Rate button.

4. If the Units of Rate are not correct for your application, choose the Units button.

5. On the Units Selection screen, select the unit of measure (L, ml, μl or nl) and the unit of time (sec, min, hr) as appropriate, then choose 'ENTR' to confirm your selections.

6. Repeat Steps 3 to 5 for the End Rate by selecting the End Rate button and continuing data entry.

7. When all parameters are correctly set on the Set Rate screen, choose 'ENTR' to confirm your settings and return to Ramp Definition screen.

8. Choose the Time button to enter the Set Time screen.

9. Enter the desired Time value using the keypad.

10. If the Units of Time are not correct for your application, select the Units button to toggle between sec (seconds) and h:m:s (hours:minutes:seconds). To use the h:m:s option, enter your time value in hours, minutes and seconds, separating each value with a colon.

11. When all parameters are correctly set on the Set Target Time screen, choose Accept to confirm your settings and return to the Ramp Definition screen.

12. Choose Accept again to return to the Step Definition screen.

NOTE: *Ramps ≤ 2 seconds from min to max rates may cause motor stalls.*

Stepped Profile

The Stepped Rate profile is used to create an increasing or decreasing flow rate that varies in a series of equal steps between a starting and ending flow rate.
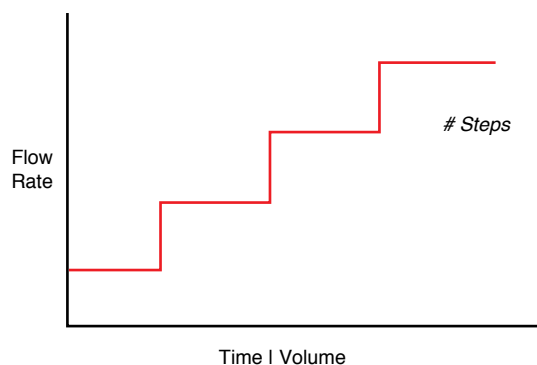
Stepped Rate Pump Operation Profile

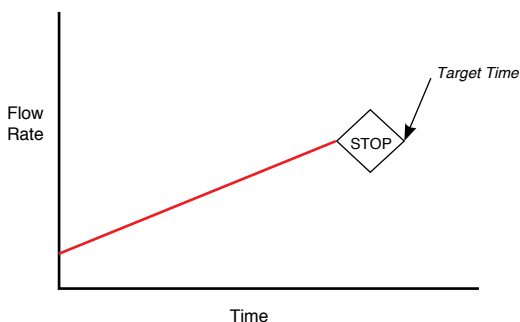When creating or editing a Stepped Rate profile, you will define four primary operating parameters:

- The Flow Mode defining the direction of flow: forward or reverse

- The Flow Rate at the beginning and end of the pumping cycle

- The Target Time that determines the total length of time over which the stepped profile will be calculated

- The Number of Steps that will be created in the profile

During a Stepped Rate profile, the KDS Allegro™ Peristaltic Pump calculates a series of equal rate increases that will vary the flow from the starting value to the ending value. You enter the Number of Steps you want to use. The Target Time defines the total length of pumping time, with the Target Time value divided equally into each stepped rate. A Stepped Rate profile can be applied to an increasing or decreasing rate application.

When creating or editing a Stepped Rate profile, you can set the rate in L, ml, µl or nl units of volume using sec or h:m:s (hours:minutes:seconds) as the units of time. The system automatically calculates a minimum and maximum flow rate based on the syringe selected or custom-defined. The min/max values are made available as button selection options on the Set screen.

TO SET UP/EDIT A STEPPED RATE PROFILE:

1. From the Stepped Definition screen for a Stepped Rate profile, choose the Direction button to toggle the Flow Mode between Infuse and Withdraw operation.
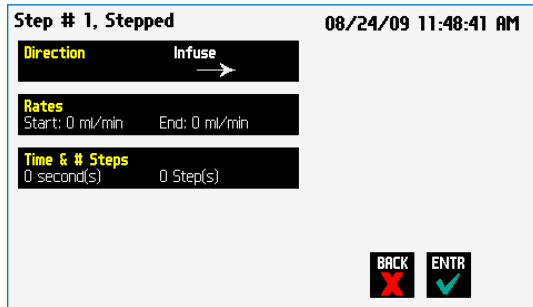
Step Definition screen for a Stepped Profile

2. Choose the Rates button to enter the Set Start and End Rates screen.
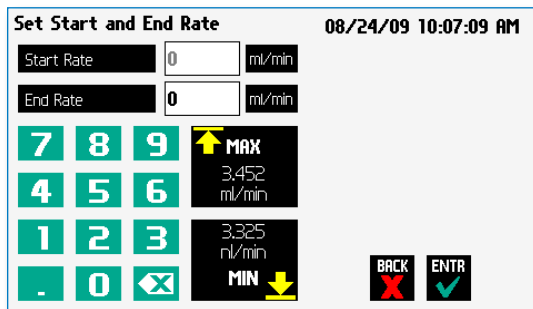
Set Start and End Rate screen

3. Select the Start Rate button (it should be selected by default as indicated by the active data entry box to the right of the button). Enter the flow rate value desired using the keypad or select the Minimum Rate or Maximum Rate button.
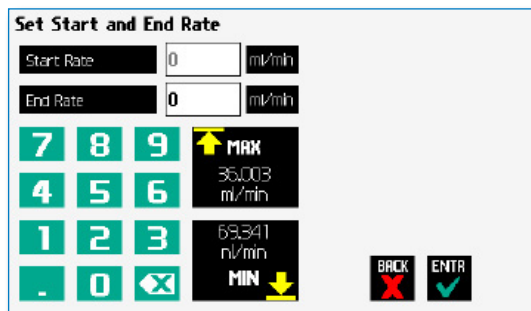
4. If the Units of Rate are not correct for your application, choose the Units button.

5. On the Units Selection screen, select the unit of measure (ml, μl, nl or pl) and the unit of time (sec, min, hr) as appropriate, then choose Accept to confirm your selections.

6. Repeat Steps 3 to 5 for the End Rate by selecting the End Rate button and continuing data entry.

7. When all parameters are correctly set on the Set Start and End Rate screen, choose Accept to confirm your settings and return to Stepped Definition screen.

8. Choose the Time and # Steps button to enter the Set Time & Steps screen.

9. Select the Total Time button (it should be selected by default as indicated by the active data entry box to the right of the button). Enter the desired value using the keypad.

10. If the Units of Time are not correct for your application, select the Units button to toggle between sec (seconds) and h:m:s (hours:minutes:seconds). To use the h:m:s option, enter your time value in hours, minutes and seconds, separating each value with a colon.

11. Select the Number of Steps button and enter the desired value using the keypad.

12. When all parameters are correctly set on the Set Time and Steps screen, choose Accept to confirm your settings and return to the Stepped Definition screen.

Pulse Profile

The Pulse Rate profile is used to create an oscillating infusion or withdrawal profile that varies between a starting flow rate and a second rate that can be either or higher or lower than the start rate. The flow rate is constant within each segment of the pulsed flow profile and the user defines the total number of repetitions (pulses) for the oscillating pattern. Each segment of the profile must be set to run for either a specific length of time or to deliver a set volume.
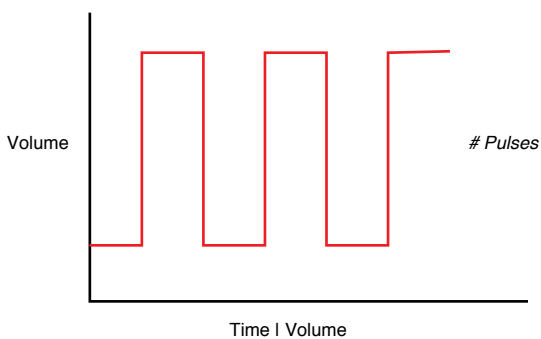
Pulse Rate Pump Operation Profile

When creating or editing a Pulse Rate profile, you will define four primary operating parameters:

- The Flow Mode defining the direction of flow: forward or reverse

- The Flow Rate to be used at each level of the pulsed profile within the pumping cycle

- The length of Time that each segment of the profile will run or the specific Volume to be infused/withdrawn during each segment of the profile

- The Number of Pulses (repetitions) that will be executed during the pumping cycle

During a Pulse Rate profile, the KDS Allegro™ Peristaltic Pump calculates a series of equal length pumping stages at two user-defined flow rates: a starting rate and a "pulse" rate. You enter the Number of Pulses (repetitions) that you want to use, along with how you want the system to calculate the length of each stage — by time or by volume pumped. A Pulse Rate profile can be applied to pulses that are higher in rate or lower in rate than the starting flow rate.

When creating or editing a Pulse Rate profile, you can set the rate in L, ml, μl or nl units of volume using sec, min or hr as the units of time. The system automatically calculates a minimum and maximum flow rate based on the syringe selected or custom-defined. The min/max values are made available as button selection options on the Set Pulse Ratesscreens.

TO SET UP/EDIT A PULSE RATE PROFILE:

1. From the Pulse Definition screen for a Pulse Rate profile, choose the Direction button to toggle the Flow Mode between Infuse and Withdraw operation.
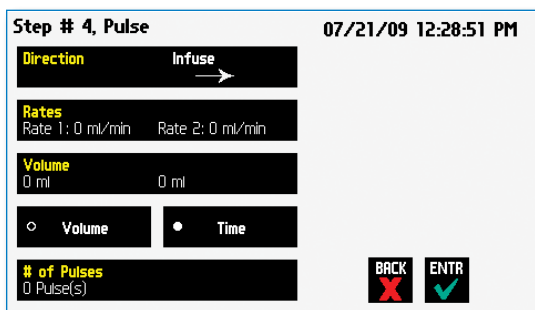
Step Definition screen for a Pulse Profile
with Volume mode selected

2. Choose the Rates button to enter the Set Pulse Rates screen.

3. Select the Rate 1 button (it should be selected by default as indicated by the active data entry box to the right of the button). Enter the flow rate value desired using the keypad or select the Minimum Rate or Maximum Rate button.

4. If the Units of Rate are not correct for your application, choose the Units button.

5. On the Units Selection screen, select the unit of measure (L, ml, μμl or nl) and the unit of time (sec, min, hr) as appropriate, then choose Accept to confirm your selections.

6. Repeat Steps 3 to 5 for the second flow rate by selecting the Rate 2 button and continuing data entry.

7. When all parameters are correctly set on the Set Pulse Rates screen, choose Accept to confirm your settings and return to Pulse Definition screen.

8. Select the Volume or Time button with indicator to determine how the pump cycle length will be managed. Volume calculates each cycle stage by pumping for the length of time needed to pump the specified volume. Time manages each cycle stage by pumping for the amount of time specified.

9. Depending on whether you have selected the Volume or Time button in the preceding step, choose the Time or the Volume button to enter the Set Pulse Times or the Set Pulse Volumes screens.

Set Pulse Times screen used to define the length of time
the pump will operate at each pulse step level

10. If you selected Set Time, continue with Step 11. If you selected Set Volume, proceed to Step 14.

11. On the Set Pulse Times screen, select the Time 1 button (it should be selected by default as indicated by the active data entry box to the right of the button). Enter the desired value using the keypad. Repeat for Time 2.

12. If the Units of Time associated with Time 1 or Time 2 are not correct for your application, select the Units button associated with either parameter to toggle between sec (seconds) and h:m:s (hours:minutes:seconds). To use the h:m:s option, enter your time value in hours, minutes and seconds, separating each value with a colon.

13. When both Time parameters are set to the correct values, choose the Accept button to return to the Pulse Definition screen. Continue with Step 17.

14. On the Set Pulse Volumes screen, select the Volume 1 button (it should be selected by default as indicated by the active data entry box to the right of the button). Enter the desired value using the keypad. Repeat for Volume 2.

15. If the Units of Volume associated with Volume 1 or Volume 2 are not correct for your application, choose the Units button associated with either parameter to enter the Units selection screen. Select the unit of measure button (ml, μμl, nl, pl) applicable to your application, then choose the Accept button to return to the Set Pulse Volumes screen.

16. When both Volume parameters are set to the correct values, choose the Accept button to return to the Pulse Definition screen.

17. Select the # of Pulses button to enter the Set # Pulses screen.

18. On the Set # Pulses screen, enter the desired value using the keypad, then choose the Accept button.

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Delay

The Delay Command is used to insert a time delay in a procedure. You can program a time delay between 0.2 seconds up to 99:99:99 (99 hours, 99 minutes, 99 seconds).

TO INSERT A TIME DELAY IN A PROGRAM:

1. From the Program Main screen, choose Step Definition to enter the Step Definition screen.

2. Highlight (select once) the Program Step that nyou want the time delay to follow.

3. Choose the Insert Step button to access the Program Steps Menu screen.

4. Choose Advanced Options to enter the Set Advanced Options screen.

5. Choose Delay to enter the Set Delay Time screen.
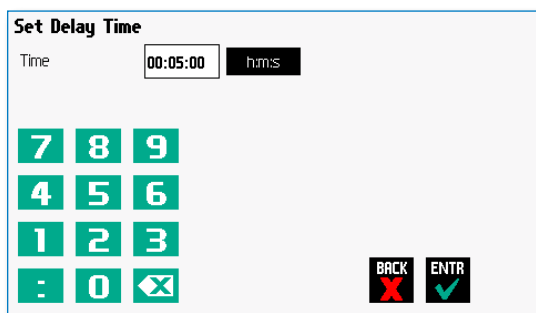
Advanced Options Set Delay Time screen

6. Enter the desired Time using the keypad.

7. If the Units of Time associated with Time are nnot correct for your application, select the Units button to toggle between sec (seconds) [0.2 seconds minimum allowable value] and h:m:s (hours:minutes:seconds). To use the h:m:s option, enter your time value in hours, minutes and seconds, separating each value with a colon. You can enter a value up to 99:99:99.

8. When your Time entry is correct, choose the Accept button to insert the Delay Step in the Program and return to the Step Definition screen.

Repeat Step

> **NOTE:** *Do not use nested loops (repeat within a repeat)*

The Repeat Command is used to repeat Steps in a procedure a defined number of times. To use this Command, you will tell the application what Steps you want to Repeat and how many times you want them repeated. The Repeat Step command creates a "jump" back to a specific Step in a Program that executes the defined Step plus all following Steps up to the Repeat command (i.e. it creates a Program loop).

When defining a Repeat jump in a Program, the Command targets the Step sequence position and not the function that currently occupies that position. For example, if you create a Repeat jump to Step 4 in a Program (currently a Ramp Pump Operation Profile) and subsequently move a Constant Rate profile into the Step 4 position, the Repeat jump will then connect to the Constant Rate operation and not to the Ramp operation.

TO INSERT A STEP REPEAT SEQUENCE IN A PROGRAM:

1. From the Program Main screen, choose Step Definition to enter the Step Definition screen.

2. Highlight (select once) the Program Step that you want the repeat step to follow.

3. Choose the 'INS STEP' button to access the Program Steps screen.

4. Choose Advanced Options to enter the Set Advanced Options screen.

5. Choose Repeat to insert the Repeat Step function into the Program.

6. Select the Step(s) you would like to repeat from by selecting the Step button twice or selecting once and then choosing Accept.
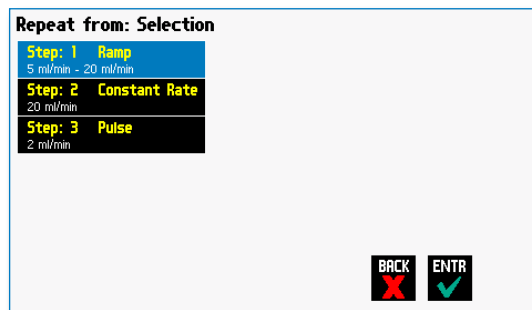
Advanced Options Repeat Step screen. Choosing Repeat brings you to a listing of the available steps in the Program

7. Enter the number of repeats using the keypad then choose the Accept button to save your change and return to the Step Definition screen.

> **NOTE:** *This command creates a loopback to the designated Step in a Program, executing the selected Step, plus all subsequent Steps up to the point of insertion of the Repeat command. For example, if the Repeat command is set to repeat Step 2 one time, the system will loop back to Step 2 and execute both Steps 2 and 3 one additional time.*

Stop

The Stop Command is used to instruct the pump to stop operation. This Command can be used in conjunction with I/O Events to control pump operation based on external events.

TO INSERT A STOP COMMAND IN A PROGRAM:

1. From the Program Main screen, choose Step Definition to enter the Step Definition screen.

2. Highlight (select once) the Program Step that you want the Stop Command to follow.

3. Choose the 'INS STEP' button to access the Program Steps Menu screen.

4. Choose Advanced Options to enter the Set Advanced Options screen.

5. Choose Stop to insert the Stop Command into the Program.

KDS Allegro™ Peristaltic Pump System User's Manual
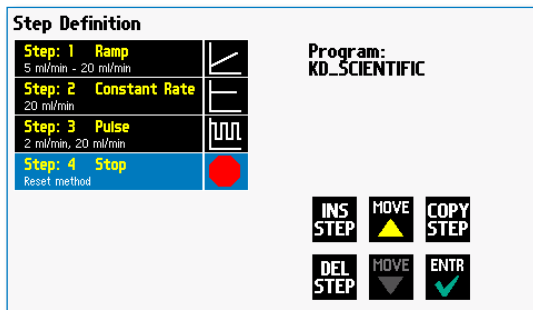
I/O EVENT TRIGGERS

The KDS Allegro™ Peristaltic Pump System permits easy connection to external I/O devices via a variety of interfaces, including a built-in 15-pin D-sub connector. The KDS Allegro™ Peristaltic Pump System software incorporates simple commands for incorporating I/O controls into your pump Programs. Integrated commands for control of an external valve, multi-pump synchronization, and general trigger signals are integrated in the software. The following procedure describes the use of the Advanced Options I/O commands. Following the procedure is a description of the selection menu options for each of the I/O command types. Details for the electrical connection controls and pin-out description for the 15-pin User I/O Connector are provided in Appendix D of this manual.

The KDS Allegro™ Peristaltic Pump System manages trigger events through specific pins on the I/O Connector port on the back of the pump. The following details define pin logic:

- Triggers are communicated via Pin 4 or Pin 5.

- Valve control signals are communicated via Pin 8.

- Pump synchronization commands are communicated via Pin 6.

- Event signals are communicated via Pin 2.

I/O (OUT) Trigger

The I/O (OUT) Trigger command is used to send a signal to an external device when the Step in the Program is reached.

Trigger

Trigger 1	Trigger 2
Synchronize	Valve
Valve On	Valve Off
Valve Auto	

BACK X   ENTR ✓
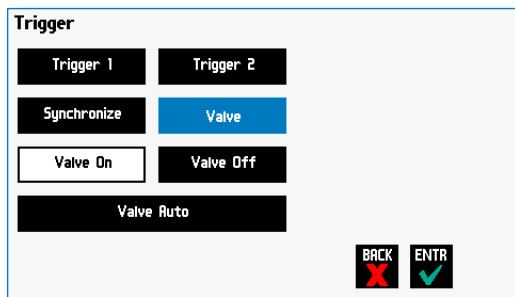
I/O (OUT) Trigger Advanced Options menu

The following options are available when setting an I/O (OUT) Trigger command:

- **Trigger 1:** Specifies output via the Trigger 1 (Pin 4) port. When selected, you must also specify whether the signal to be sent is High Signal or Low Signal.

  – **High Signal:** Sets the output signal to logic high.
  – **Low Signal:** Sets the output signal to logic low.

- **Trigger 2:** Specifies output via the Trigger 2 (Pin 5) port. When selected, you must also specify whether the signal to be sent is High Signal or Low Signal.

  – **High Signal:** Sets the output signal to logic high.
  – **Low Signal:** Sets the output signal to logic low.

- **Synchronize:** Select this to send a signal via Pin 6 to a connected pump to trigger activity. When selected, you must define whether the desired action is to start a forward or reverse activity.

  – **Forward (CW):** Defines the rising edge signal to trigger a forward action.
  – **Reverse (CCW):** Defines the falling edge signal to trigger a reverse action.

Trigger

Trigger 1	Trigger 2
Synchronize	Valve
Forward (CW)	Reverse (CCW)

BACK X   ENTR ✓
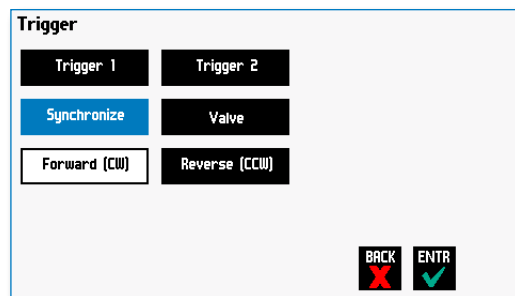
- **Valve:** The pump automatically sends signals (via pin 8) to activate/de-activate when the pump changes direction. Use this feature to break that feature and gain control of valve operation.

  – **Valve On:** Activates the valve.
  – **Valve Off:** De-Activates the valve.
  – **Valve Auto:** Returns pump to automatic valve control mode.

TO INSERT AN I/O (OUT) TRIGGER COMMAND:

1. From the Program Main screen, choose Step Definition to enter the Step Definition screen.

2. Highlight (select once) the Program Step that you want the I/O (OUT) Trigger to follow.

3. Choose the 'INS STEP' button to access the Program Steps Menu screen.

4. Choose Advanced Options to enter the Select Advanced Options screen.

5. Choose the I/O (OUT) Trigger button to enter the Trigger Step Definition Screen.

6. Set your Trigger settings by choosing the appropriate option from the following sub-procedures:

   a. To send a Trigger signal to an external device via Pin 4, select the Trigger 1 button. To send a Trigger signal via Pin 5, select the Trigger 2 button (selection will highlight in blue). Then select whether the signal will be High or Low by selecting the appropriate button (selection will highlight in white).

   b. To send a trigger signal to an external valve, select Valve. Then select whether the trigger will actuate (on button) or close (off button) by selecting the appropriate button. This overrides the default 'Valve Auto' which means the valve is controlled by direction change. The valve will default back to 'Auto' after leaving the program Run screen.

   c. To send a synchronization signal to a connected pump, select Synchronize. Then select whether you want to start an infusion action (Start Infuse button) or a withdraw action (Start Withdraw button) by selecting the appropriate button.

7. Choose the Accept button to save your changes and return to the Step Definition screen.

> **NOTE:** When using triggers, the first step in your program should define the trigger starting level (High or Low). You may then use the trigger command to change the level as desired for your Program.

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Operating the KDS Allegro™ Peristaltic Pump System

I/O (IN) Event

The I/O (IN) Event command is used to have the pump pause and wait for a signal from an external device or for a manual user input at the touchscreen. These external signals are communicated via Pin 2 on the 15-pin I/O Connector port.

I/O (IN) Event Advanced Options menu

The following options are available when setting an I/O (IN) Event command.

- **Input High-to-Low:** Sets the pump to wait for a logic low input signal falling edge.

- **Input Low-to-High:** Sets the pump to wait for a logic high input signal rising edge.

- **User Press:** Sets the pump to wait for manual input from the user at the touchscreen (screen touch).

TO INSERT AN I/O (IN) EVENT COMMAND:

1. From the Program Main screen, choose Step Definition to enter the Step Definition screen.

2. Highlight (select once) the Program Step that you want the I/O (IN) Event to follow.

3. Choose the 'INS STEP' button to access the Program Steps Menu screen.

4. Choose Advanced Options to enter the Select Advanced Options screen.

5. Choose the I/O (IN) Event button to enter the Event Step Definition Screen.

6. Select either Input High, Input Low or User Press, as appropriate.

7. Choose the Accept button to save your changes and return to the Step Definition screen.

I/O (IN) Event Link

The I/O (IN) Event Link command is used to have the pump jump to a linked program if the signal is received. The external signals are communicated via Pin 2 on the 15-pin I/O Connector.
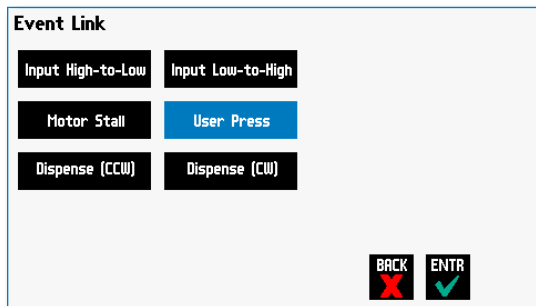
Advanced Options I/O (IN) Event Link Selection Screen

The following options are available when setting an I/O (IN) Event Link command. This command requires that you have a program set with the specific actions (steps) you want to perform if the event occurs so that you can choose the Program name being linked by this command.

- **Input High-to-Low:** Will link to the desired program upon a logic low input signal falling edge.

- **Input Low-to-High:** Will link to the desired program upon a logic high input signal rising edge.

- **User Press:** Will link to the desired program upon a manual input.

- **Motor Stall:** Will link to the desired program upon a Motor Stall event.

- **Withdraw:** Will link to the desired program upon a Withdraw activity.

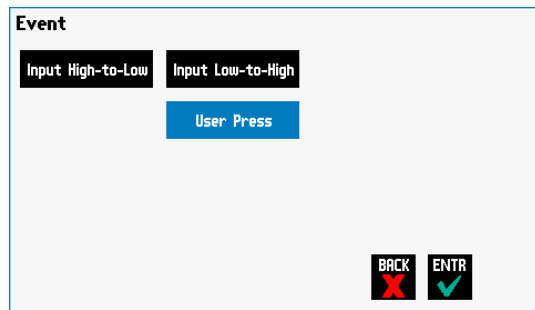- **Infuse:** Will link to the desired program upon an Infuse activity.

TO INSERT AN I/O (IN) EVENT LINK COMMAND:

1. From the Program Main screen, choose Step Definition to enter the Step Definition screen.

2. Highlight (select once) the Program Step that you want the I/O (IN) Event Link command to follow.

3. Choose the 'INS STEP' button to access the Program Steps Menu screen.

4. Choose Advanced Options to enter the Select Advanced Options screen.

5. Choose the I/O (IN) Event Link button to enter the On Event Step Definition Screen.

6. Select the desired Event type that you want to have the event associated with from the options available (Input Low, Input High, User Press, Motor Stall, Withdraw, Infuse).

7. After selecting the desired option in the On Event screen, choose Accept to access the Program List selection screen. Choose the Program name to jump to. To use this command, you must have defined a linkable Program.

8. Choose the Accept button to save your changes and return to the Step Definition screen.

> **NOTE:** *Since the 'on event' will cause a jump (link) to a different program, be cautious not to use embedded links in your program programming.*

MANAGING ALLEGRO™ PERISTALTIC PUMP SYSTEM PROGRAMS

All Existing and User-Defined Programs are stored in the Program List for ongoing use. Over time, you may want to manage previously created Programs to keep your Program List easy to navigate. In addition, the KDS Allegro™ Peristaltic Pump System pumps allows you to export Program information to an externally connected pump or to a computer that will be used to control operation. This section of the Guide describes the file management facilities available on the KDS Allegro™ Peristaltic Pump System.

> **NOTE:** *The program management procedures outlined in this section are not available for non-programmable programs.*

> **NOTE:** *The program management procedures outlined in this section are not available for basic pump models (Infuse Only, Withdraw/Infuse, etc.).*

Saving a Copy of a Program

Follow these instructions to save a copy of a Program under a new name:

1. From Program Configuration screen, choose the Program Name button to enter the Mode Selection screen.

2. From the list of available Programs, select (press once) the Program you want to save a copy of, then choose the File Options button to enter the File Options screen.

3. Choose Save As/Copy to access the Program Name Entry screen. The current Program Name will be displayed in the text entry box.

4. On the Program Name screen, type the new name for your Program using the onscreen keyboard. Choose the Symbols/Numbers button '.?123' to display the list of available numbers and symbols that can be included in the Program Name. To switch the keyboard back to letters mode, choose the Letters button 'ABC' . [15 characters maximum]

5. When finished entering the new Program Name, choose Accept to save your changes and return to the File Options screen.

6. Choose 'BACK' to return to the Mode Selection screen.

Renaming a Program

Follow these instructions to rename a previously saved Program:

1. From the Program Configuration screen, choose the Program Name button to enter the Program Mode screen.

2. From the list of available Programs, select (press once) the Program you want to rename, then choose the File Options button to enter the File Options screen.

3. Choose Rename Program to access the Program Name Entry screen. The current Program Name will be displayed in the text entry box.

4. On the Program Name screen, type the new name for your Program using the onscreen keyboard. Choose the Symbols/Numbers button '.?123' to display the list of available numbers and symbols that can be included in the Program Name. To switch the keyboard back to letters mode, choose the Letters button 'ABC' . [15 characters maximum]

5. When finished entering the new Program Name, choose Accept to save your changes and return to the File Options screen.

6. Choose 'BACK' to return to the Program Selection screen.

Appending A Program

Follow these instructions to Append a previously created Program into a new Program:

1. From the Program Configuration screen, choose the Program Name button to enter the Mode Selection screen.

2. From the list of available Programs, select (press once) the Program you want as the base Program.

3. Choose the File Options button to enter the File Options screen.

4. Choose Append to access the Program to Append screen.

5. Choose (press twice) the Program you would like to Append (attach) to your base Program. The pump will return you to the File Options screen and display a confirmation that the Program was copied.

6. Choose 'BACK' to return to the Mode Selection screen.

Deleting A Program

Follow these instructions to delete a previously saved Program:

1. From the Program Configuration screen, choose the Program Name button to enter the Mode Selection screen.

2. From the list of available Programs, select (press once) the Program you want to delete, then choose the File Options button to enter the File Options screen.

3. Choose Delete Program. The application will display a warning message in the Message Area asking you to confirm your deletion request.

4. Choose Delete Program again to confirm the deletion and return to the Mode Selection screen.

ALLEGRO™ PERISTALTIC PUMP SYSTEM PROGRAM EXPORT AND IMPORT

The Allegro™ Peristaltic Pump System pump permits the daisy chaining of multiple pumps, as well as integration with/control by an external computer through USB. To facilitiate operation in these modes, the Allegro™ Peristaltic Pump System application software includes a variety of commands designed to simplify the export/import of Programs between the pump and external devices. This section outlines the use of these commands.

> **NOTE:** Do not attempt to Export/Import Programs while the pump is running.

> **NOTE:** Do not change screens while Importing/Exporting a program.

> **NOTE:** For additional details on the physical interfaces used to connect the KDS Allegro™ Peristaltic Pump System to external devices, refer to the External I/O Connections section in the Appendices.
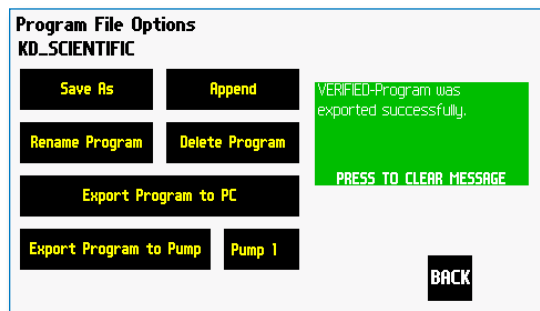
Export Program confirmation screen showing successful export

TRANSFER A PROGRAM BETWEEN PUMPS

Follow these instructions to transfer a Program between two KDS Allegro™ Peristaltic Pump System pumps.

1. Connect two pumps together via an RS-485 (firewire type) cable and set the address on the first pump to '00' using the Set Pump Address command in the Settings menu.

2. Set the address on the second pump to something other than '00' using the Set Pump Address command in the Settings menu.

3. From the Program Main screen, choose Program Select then choose the Program you would like to export.

4. Choose the File Options button.

5. Choose the Pump button and enter the address for the pump you would like to receive the Program.

6. Choose Export Program to Pump.

7. The pump will display a confirmation message in the Message Area on the screen when the export is complete. Note that long Programs may take a few seconds to export.

8. Before disconnecting the pumps, verify that the Program was successfully exported by choosing Program Select from the Program Main screen on the destination pump, then browse the available Programs to verify that the exported Program is shown in the menu.

EXTERNAL PUMP CONTROL

The Allegro™ Peristaltic Pump System can be controlled by a terminal communication program. KD Scientific provides a Pump Control program on the CD that came with the unit. The Program Manager software and user manual can be found in the Pump Applications directory on this CD.

PUMP CHAIN COMMANDS

The Pump Chain commands allow all pump control information to be managed from an external computer source. These commands can also be used to control a series of pumps (up to 100) from a single computer interface.

KDS Allegro™ Peristaltic Pump System commands are communicated to the pump via the USB port interfaces through a terminal program such as the Pump Control program found on the Allegro™ Peristaltic Pump CD. In using the Pump Chain commands, you will need to assign each pump in the pump chain a unique address, using the Set Pump Address command in the Settings menu. The address range is from 00 to 99. This address value is used to identify which pump is to receive a command and which pump is responding. The first pump in the chain, the one connected to the computer, must use address 0 (zero). Configure each pump with its assigned address and baud rate as described in the Pump Settings section of this guide.

> **NOTE:** *Once communication is established, if you manipulate the touchscreen, you must reestablish communications to the PC (<CR> will do this)*

> **NOTE:** *System commands and start/stop commands can be executed from program or mode configuration screens. For parameter commands (rate, dia, vol, etc) it is necessary to execute from the Configuration Run screen.*

> **NOTE:** *To maximize communication speed [as fast as 50 ms rate changes]: (a) prefix commands with the @ symbol to turn off GUI updates (ex: @frate 100 u/m) (b) use the 'NVRAM off' command to turn off writes of rate to memory.*

Pump Chain Commands

KDS Allegro™ Peristaltic Pump commands are entered via the USB port with a terminal program such as our Pump Control program, or by using a controlling computer.

Commands may be abbreviated to the first four letters, i.e. address would be abbreviated addr. A space must follow the command if arguments are included.

Every line of the response from a pump with a nonzero address is prefixed by the two digit pump address (prefixed with a 0 if necessary) followed by a colon. No colon is used to separate the pump address from the prompt however.

In the command list below, the following convention is used:

{ }	Required parameter
[ ]	Optional parameter
|	Separator between parameter choices
#	Numeric value without preceding zeros
###	Numeric value with preceding zeros
#-#	A range of values
<cr>	Carriage return
<lf>	Line feed
<sp>	Space
[prefix]	Pump address prefix in the format #: if the pump address is not zero
<prompt>	Prompt (see below)

The following prompts are returned after a command is executed:

:	The pump is idle
>	The pump is going forward direction
<	The pump is going reverse direction
*	The pump stalled
T*	The target was reached

If the pump is in poll mode, an XON character is added after the prompt.

If the pump address is nonzero, the pump address is prefixed to the prompt without a colon.

In the following list of commands:

The pump address is prefixed to every response line followed by a colon.

<lf>[##]<prompt> is the response unless otherwise noted.

Error messages

Error messages are displayed if the entered command cannot be executed for some reason. The error message will take up two lines with the first line being the message type and the second line describing the error itself. The second line may be up to 80 characters long.

Command errors

Command errors are displayed when the command is unrecognized, entered in the wrong mode, or the state of the pump keeps the command from executing (i.e. using the FRUN command if a limit switch is active).

The command error has the following format:

<lf>[##:]Command error:<cr>

<lf>[##:]<sp><sp><sp>{error message}<cr>

<lf>[##]<prompt>

Argument errors

Argument errors are displayed when a command argument is unrecognized or out of range. The argument in question will be displayed except in the case of missing arguments.

The argument error has the following format:

<lf>[##:]Argument error: [bad argument]<cr>

<lf>[##:]<sp><sp><sp>{error message}<cr>

<lf>[##]<prompt>

System commands

ADDRESS

Sets or displays the pump address. Valid range is 0 to 99.

Command format:

address [0-99]

Query response:

<lf>[##:]Pump address is #<cr>

<lf>[##]<prompt>

NOTE: *Pumps with an address of 0 are masters, and pumps with an address between 1 and 99 are slaves.*

CATALOG

Displays a catalog of programs stored in the pump.

Command format:

cat

Query response:

<lf>[##:]Program name   Size<cr>

<lf>[##:]———— —–<cr>

<lf>[##:]{program name}   #<cr>
This line is repeated for each file on the disk

<lf><lf>[##:]# file(s) using # steps<cr>

<lf>[##]<prompt>

NOTE: *The file size is the number of steps in the program plus one for the file information header.*

The last line shows the number of files and the total number of steps being used on the disk.

CONFIG

Sets or displays pump configuration.

Command format:

Config [{config designation}|{value}]

NOTE: *After changing the configuration, the pump must be power cycled.*

PROGRAM

Deletes a program, stored in the pump.

Command format:

delprogram {program}

DIM

Sets or displays the brightness level in percent. Valid range is 0 to 100. Note that specifying 0 will turn the backlight off so that the screen will not be visible.

Command format:

dim [0-100]

Query response:

<lf>[##:] #%<cr>

<lf>[##]<prompt>

ECHO

Sets or displays the USB echo state. Valid states are on or off.

Command format:

echo [on|off]

Query response:

<lf>[##:] OFF<cr>

<lf>[##]<prompt>

or:

<lf>[##:] ON<cr>

<lf>[##]<prompt>

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LOAD

Loads a method or displays the currently loaded method.

Command format:

    load

    load {method name}

    load qs i

Query response:

    <lf>[##:]Quick Start - Infuse Only (qs i)<cr>

    <lf>[##]<prompt>

or:

    <lf>[##:]{method name}<cr>

    <lf>[##]<prompt>

FREE

Displays the number of program steps available in memory.

Command format:

    free

Query response:

    <lf>[##:]#steps used<cr>

    <lf>[##:]#steps free<cr>

    <lf>[##:]#total steps<cr>

    <lf>[##]<prompt>

The number displayed is a 4-digit number, right justified and padded with spaces.

FTSWITCH

Sets or displays the footswitch setting. The footswitch may be used in a toggle on or off mode (momentary), a press to run mode (falling), or a release to run mode (rising).

Command format:

    ftswitch [mom|rise|fall]

Query response:

    <lf>[##:]Momentary<cr>

    <lf>[##]<prompt>

    or:

    <lf>[##:]Active high<cr>

    <lf>[##]<prompt>

    or:

    <lf>[##:]Active low<cr>

    <lf>[##]<prompt>

POLL

Sets or displays the polling mode state. In polling mode, prompts are inhibited if they aren't generated by a typed command. Valid states are on or off.

Command format:

    poll [on|off]

Query response:

    <lf>[##:]OFF<cr>

    <lf>[##]<prompt>

or:

    <lf>[##:]ON<cr>

    <lf>[##]<prompt>

TILT

Calibrates tilt sensor.

Command format:

    tilt

Query response:

    <lf>[##:]Calibrating the tilt sensor...<cr>

    <lf>[##:]Tilt calibration value is #<cr>

    <lf>[##]<prompt>

VER

Displays the short version string.

Command format:

    ver

Query response:

    <lf>[##:]Allegro 2.#.#<cr>

    <lf>[##]<prompt>

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VERSION

Displays the full version string.

Command format:

   version

Query response:

   <lf>[##:]Firmware: v#.#.#<cr>

   <lf>[##:]Pump address: #<cr>

   <lf>[##:]Serial number: C ######<cr>

   <lf>[##:]Device ID: ########<cr>

   <lf>[##]<prompt>

Run commands

FRUN

Runs the pump in the forward direction. Configuration Run screen mode only.

Command format:

   frun

CHGDIR

Runs the pump in the opposite direction. Configuration Run screen only.

Command format:

   chgdir

RUN

Simulates a key press of the run button located in the lower right corner of the screen.

Command format:

   run

STOP / STP

Stops the pump.

Command formats:

   stop

   stp

RRUN

Runs the pump in the CCW direction. Configuration Run screen mode only.

Command format:

   rrun

Rate commands

CRATE

Displays the current rate that the motor is running at. A valid response is returned only in dynamic situations (if the motor is running). Configuration Run screen mode only.

Command format:

   crate

Query response:

   <lf>[##:]forward at # xl/xxx<cr>

   <lf>[##]<prompt>

or:

   <lf>[##:]reverse at # xl/xxx<cr>

   <lf>[##]<prompt>

DIAMETER

Sets or displays the tubing diameter in mm. Configuration Run screen mode only.

Command format:

   diameter [{tubing diameter}]

Query response:

   <lf>[##:]#.#### mm<cr>

   <lf>[##]<prompt>

FRAMP

Sets or displays the dispensing (forward direction) rates while ramping. Configuration Run screen mode only.

Command format:

   framp [{start rate} {start units} {end rate} {end units} {ramp time in seconds}]

Query response:

   <lf>[##:]Ramp not set up.<cr>

   <lf>[##]<prompt>

or:

   <lf>[##:]# xl/xxx to xl/xxx in # seconds<cr>

   <lf>[##]<prompt>

GANG

Sets or displays the channel count

Command format:

gang [{channel count}]

Query response:

<lf>[##:]#channels <cr>

<lf>[##]<prompt+>

RRAMP

Sets or displays the dispensing (reverse) rates while ramping. Configuration Run screen mode only.

Command format:

rramp [{start rate} {end rate} {rate units} {ramp time in seconds}]

Query response:

<lf>[##:]Ramp not set up.<cr>

<lf>[##]<prompt>

or:

<lf>[##:]# xl/xxx to xl/xxx in # seconds<cr>

<lf>[##]<prompt>

NOTE: *To clear a ramp, use CTTIME command.*

RATE

Sets or displays the dispensing rate. Configuration Run screen mode only. The rate argument may be replaced by "max" or "min" to set the maximum or minimum rate, respectively. "lim" may be used to display the range limits.

Command format:

rate [max|min|lim|{rate} {rate units}]

Query response:

<lf>[##:]# xl/xxx<cr>

<lf>[##]<prompt>

or:

<lf>[##:]# xl/xxx to # xl/xxx<cr>

<lf>[##]<prompt>

Volume commands

CFVOLUME

Clears the dispensed volume in forward direction. Configuration Run screen mode only.

Command format:

cfvolume

CTVOLUME

Clears the target volume. Configuration Run screen mode only.

Command format:

ctvolume

CVOLUME

Clears all volumes. Configuration Run screen mode only.

Command format:

cvolume

CRVOLUME

Clears the dispensed (reverse) volume. Configuration Run screen mode only.

Command format:

crvolume

FVOLUME

Displays the dispensed (forward) volume. Configuration Run screen mode only.

Command format:

fvolume

Query response:

<lf>[##:]# xl<cr>

<lf>[##]<prompt>

TVOLUME

Sets or displays the target volume. Configuration Run screen mode only.

Command format:

tvolume [{target volume} {volume units}]

Query response:

<lf>[##:]Target volume not set<cr>

<lf>[##]<prompt>

or:

<lf>[##:] # xl<cr>

<lf>[##]<prompt>

RVOLUME

Displays the dispensed (reversed) volume. Configuration Run screen mode only.

Command format:

rvolume

Query response:

<lf>[##:]# xl<cr>

<lf>[##]<prompt>

Time commands

CFTIME

Clears the dispensed (forward) time. Configuration Run screen mode only.

Command format:

cftime

CTIME

Clears all times. Configuration Run screen mode only.

Command format:

ctime

CTTIME

Clears the target time. Configuration Run screen mode only.

Command format:

cttime

CRTIME

Clears the dispensed (reversed) time. Configuration Run screen mode only.

Command format:

crtime

FTIME

Displays the dispensed (forward) time. Configuration Run screen mode only.

Command format:

ftime

Query response:

<lf>[##:]# seconds<cr>

<lf>[##]<prompt>

or:

<lf>[##:]##:##:##<cr>

<lf>[##]<prompt>

TTIME

Sets or displays the target time. Configuration Run screen mode only.

Command format:

ttime [{target time}]

Query response:

<lf>[##:]Target time not set<cr>

<lf>[##]<prompt>

or:

<lf>[##:]# seconds<cr>

<lf>[##]<prompt>

or:

<lf>[##:]##:##:##<cr>

<lf>[##]<prompt>

RTIME

Displays the dispensed (reversed) time. Configuration Run screen mode only.

Command format:

rtime

Query response:

<lf>[##:]# seconds<cr>

<lf>[##]<prompt>

or:

<lf>[##:]##:##:##<cr>

<lf>[##]<prompt>

Digital I/O commands

INPUT

Reads and displays the trigger input port status.

Command format:

    input

Query response:

    <lf>[##:]Low.<cr>

    <lf>[##]<prompt>

or:

    <lf>[##:]High.<cr>

    <lf>[##]<prompt>

OUTPUT

Sets the level on one of the output ports.

Command format:

    output {1} {high|low}

SYNC

Sets the level on the sync port.

Command format:

    sync {high|low}

Internal commands

STATUS

Displays the raw status for use with a controlling computer.

Command format:

    status

The output is in three integer fields and one flag field, all separated by spaces and terminated by a carriage return / linefeed pair. The first integer is the current rate in femtoliters per second. The second integer is the infuse time in milliseconds. The time has a granularity of 1 millisecond. The third integer is the infused volume in femtoliters. All three values are for the current direction.

The flag field consists of six flags.

- Flag one is the motor direction and will be "F or f" if the pump is forward direction and "r or R" if the pump is reverse direction. If the letter is lower case, the pump motor is idle. If upper case, the pump motor is running.

- Flag two is the limit switch status. The Allegro™ pumps do not have limit switches, so "." is displayed.

- Flag three is the stall status and will be "S" if the pump has stalled. Otherwise it will be ".".

- Flag four is the trigger input state and will be "T" if high and "." if low.

- Flag five is the direction port state and will be "F" for forward and "R" for reverse.

- Flag six is the target reached status. It will be "T" if the target time or volume was reached and "." if not.

ERROR CODES

NOTE: *Error and Alarm text are shown in a yellow box whereas Notice, Confirm and Verified are shown in a green box.*

Run Mode Errors:	Error 1XX
Set-up Errors:	Error 2XX
Program Errors:	Error 3XX
Critical Errors:	Error 4XX

Run Mode Errors

ERROR 101- Power to the pump was lost.

ERROR 102- The A/D convertor is not working.

Set-up Errors

ERROR 201- Backlight setting out of range, 10 to 100

ERROR 202- Alarm setting out of range, 1 to 99

ERROR 203- Force percentage out of range, 1 to100.

ERROR 204- Pump address out of range, 0 to 99.

ERROR 205- Pump number out of range, 1 to 99.

ERROR 207- Tubing diameter out of range, 0.1 mm to 99 mm.

ERROR 210- Forward Rate out of range.

ERROR 211- Reverse rate out of range.

ERROR 212- Tubing diameter is out of range.

ERROR 213- Target volume exceeds tubing volume.

ERROR 214- Target time exceeds tubing volume.

ERROR 215- Total volume exceeds tubing capacity.

ERROR 216- Volume is less than the minimum value.

ERROR 217- Motor has stalled.

ERROR 218- Program needs a rate.

ERROR 219- Program needs infuse and withdraw rates and a target volume.

Program Errors

ERROR 301- Delay time out of range, must be at least 0.20 seconds.

ERROR 302- Number of steps must be between 2 and 500.

ERROR 306- Download to remote pump incomplete.

ERROR 307- Tubing size and flow rate not compatible, cannot set motor speed.

ERROR 308- File exists.

ERROR 310- Not all fields have been set.

ERROR 311- Rate is out of range.

ERROR 312- Time is out of range.

ERROR 313- Volume is out of range.

ERROR 314- First rate is out of range.

ERROR 315- Second rate is out of range.

ERROR 316- First time is out of range.

ERROR 317- Second time is out of range.

ERROR 318- First volume is out of range.

ERROR 319- Second volume is out of range.

ERROR 320- The pulse count is 0.

ERROR 321- Bad memory sector in step #%d. Step was deleted.

ERROR 322- Volume exceeds tubing capacity in step #%d.

ERROR 323- Incompatible rate vs. tubing size in step #%d.

ERROR 324- Repeat count is 0.

Critcal Errors

ERROR 401-	Forward rate could not be saved to disk. Contact factory.
ERROR 402-	Reverse rate could not be saved to disk. Contact factory.
ERROR 403-	Program step could not be saved to disk. Contact factory.
ERROR 404-	Program could not be read from disk. Contact factory.
ERROR 405-	Program step could not be read from disk. Contact factory.

Notice

NOTICE-	Screen locked. Press the lock button to unlock.
NOTICE-	Deleting program.
NOTICE-	Importing new program: %s...
NOTICE-	Exporting step #%d...
NOTICE-	Checking program.
NOTICE-	Program is on a time delay. Press here to cancel.
NOTICE-	Waiting for screen press.
NOTICE-	Waiting for an event.
NOTICE-	Copying a program.
NOTICE-	Verify rates and target.
NOTICE-	Reverse complete, press to clear alarm.
NOTICE-	Forward complete, press to clear alarm.

Confirm

CONFIRM-	Press the lock button again, to lock the screen.
CONFIRM-	Press button again to delete this program.
CONFIRM-	Press button again to delete step.

Verified

VERIFIED-	Program was copied.
VERIFIED-	Program was exported successfully.
VERIFIED-	Added step #%d...
VERIFIED-	Program was successfully imported.

Alarm

ALARM-	Pump is due for maintenance.

APPENDIX A: ALLEGRO™ PERISTALTIC PUMP SYSTEM TUBING OFFERINGS

KDS Allegro™ Peristaltic Pump System User's Manual

Tubing Ordering Information

Order #	Tubing Size	Tubing ID	Description

C-Flex® Ultra

Characteristics
C-Flex® Ultra is a transparent tubing comprised of a silicone like material with the
chemical compatibility of Tygon®.
Formulation: Thermoplastic elastomer. Styrene-ethylene-butylene modified block coploymer with silicon oil.

Application Compatibility
Acids: Good • Alkalies: Good • Organic Solvents: No • Viscous Fluids: Fair
Sterile Fluids: Excellent

Order #	Tubing Size	Tubing ID	Description
785601	L/S® 14	1.6 mm (0.06 in)	7.6 m (25 ft)/pk
785602	L/S® 16	3.1 mm (0.12 in)	7.6 m (25 ft)/pk
785603	L/S® 25	4.8 mm (0.19 in)	7.6 m (25 ft)/pk
785604	L/S® 17	6.4 mm (0.25 in)	7.6 m (25 ft)/pk
785605	L/S® 18	7.9 mm (0.31 in)	7.6 m (25 ft)/pk

FDA Viton®

Characteristics
FDA Viton® is an opaque, black tubing perfect for food applications where FDA compliance is required. Resistant to corrosives, solvents and oils at elevated temperatures.
Formulation: Thermal set rubber. Viton® B (67% fluorine).

Application Compatibility
Acids: Excellent • Alkalies: Excellent • Organic Solvents: Test First
Viscous Fluids: Good Sterile Fluids: Fair

Order #	Tubing Size	Tubing ID	Description
785606	L/S® 13	0.8 mm (0.03 in)	7.6 m (25 ft)/pk
785607	L/S® 14	1.6 mm (0.06 in)	7.6 m (25 ft)/pk
785608	L/S® 16	3.1 mm (0.12 in)	7.6 m (25 ft)/pk
785609	L/S® 25	4.8 mm (0.19 in)	7.6 m (25 ft)/pk
785610	L/S® 17	6.4 mm (0.25 in)	7.6 m (25 ft)/pk
785611	L/S® 18	7.9 mm (0.31 in)	7.6 m (25 ft)/pk

Tygon® ELFL

Characteristics
Tygon® ELFL is a clear tubing with long life and broad chemical resistance.
Formulation: Thermoplastic. PVC based material with plasticizer. Firm transparent material.

Application Compatibility
Acids: Good • Alkalies: Good • Organic Solvents: No • Viscous Fluids: Excellent
Sterile Fluids: Good

Order #	Tubing Size	Tubing ID	Description
785612	L/S® 13	0.8 mm (0.03 in)	7.6 m (25 ft)/pk
785613	L/S® 14	1.6 mm (0.06 in)	7.6 m (25 ft)/pk
785614	L/S® 16	3.1 mm (0.12 in)	7.6 m (25 ft)/pk
785615	L/S® 25	4.8 mm (0.19 in)	7.6 m (25 ft)/pk
785616	L/S® 17	6.4 mm (0.25 in)	7.6 m (25 ft)/pk
785617	L/S® 18	7.9 mm (0.31 in)	7.6 m (25 ft)/pk

Tygon® E-Food

Characteristics
Tygon® E-FOOD is a clear tubing designed especially for food products. The bore is smooth and the tubing is non-toxic.
Formulation: Thermoplastic. PVC based material with plasticizer. Firm transparent material.

Application Compatibility
Acids: Good • Alkalies: Good • Organic Solvents: No • Viscous Fluids: Excellent Sterile Fluids: Fair

Order #	Tubing Size	Tubing ID	Description
785618	L/S® 13	0.8 mm (0.03 in)	15.2 m (50 ft)/pk
785619	L/S® 14	1.6 mm (0.06 in)	15.2 m (50 ft)/pk
785620	L/S® 16	3.1 mm (0.12 in)	15.2 m (50 ft)/pk
785621	L/S® 25	4.8 mm (0.19 in)	15.2 m (50 ft)/pk
785622	L/S® 17	6.4 mm (0.25 in)	15.2 m (50 ft)/pk
785623	L/S® 18	7.9 mm (0.31 in)	15.2 m (50 ft)/pk

Tubing Size	Tubing ID	Maximum Flow Rate
Allegro™ I		
L/S® 13	0.8 mm (0.03 in)	15 ml/min
L/S® 14	1.6 mm (0.06 in)	60 ml/min
L/S® 16	3.1 mm (0.12 in)	240 ml/min
L/S® 25	4.8 mm (0.19 in)	540 ml/min
L/S® 17	6.4 mm (0.25 in)	960 ml/min
L/S® 18	7.9 mm (0.31 in)	1500 ml/min
Allegro™ II		
L/S® 13	0.8 mm (0.03 in)	10 ml/min
L/S® 14	1.6 mm (0.06 in)	40 ml/min
L/S® 16	3.1 mm (0.12 in)	160 ml/min
L/S® 25	4.8 mm (0.19 in)	360 ml/min
Allegro™ III		
L/S® 13	0.8 mm (0.03 in)	10 ml/min
L/S® 14	1.6 mm (0.06 in)	40 ml/min
L/S® 16	3.1 mm (0.12 in)	160 ml/min
L/S® 25	4.8 mm (0.19 in)	360 ml/min
L/S® 17	6.4 mm (0.25 in)	640 ml/min
L/S® 18	7.9 mm (0.31 in)	1000 ml/min

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APPENDIX B: TUBE BREAK-IN PROGRAMS

The break in programs are installed on the pump.
They are also located on the CD that ships with the pump.
KD Scientific may change the programs so are shown here
for reference only.

Allegro™ I: "I_BREAK_IN"

1. Ramp	→	minimum flow to 300 ml/min	2½ min.
2. Ramp	←	300 to 650 ml/min	2½ min.
3. Constant	→	700 ml/min	5 min.
4. Constant	←	800 ml/min	5 min.

Allegro™ II: "II_BREAK_IN"

1. Stepped→5	minimum to 10 µl/min	1 min.
2. Stepped←5	10 to 50 µl/min	2 min.
3. Ramp →	50 µl/min to 10 ml/min	3 min.
4. Ramp ←	10 to 200 ml/min	3 min.
5. Stepped→15	200 to 800 ml/min	5 min.
6. Constant→	850 ml/min	3 min.
7. Constant←	1700 ml/min	3 min.

Allegro™ III: "III_BREAK_IN"

1. Ramp →	minimum to 100 ml/min	2½ min
2. Ramp ←	100 to 250 ml/min	2½ min.
3. Stepped→15	500 to 1000 ml/min	2½ min.
4. Stepped←15	900 to 1500 ml/min	2½ min.
5. Constant→	1700 ml/min	5 min.
6. Constant←	1700 ml/min	5 min.

APPENDIX C: EXTERNAL CONNECTIONS

User I/O Connector Specifications

<table>
<tr><td style="background:#1a2a4a;color:white">Pin Assignments</td></tr>
</table>

1. **Direction control input**

   Rising edge sets pump to forward

   Falling edge sets pump to reverse

2. **Trigger Input**

   Event trigger – falling edge triggers a program event

3. **Footswitch Input (or Timer)**

   Settable to work as:

   -Momentary switch closure to ground or TTL Logic Low; falling edge toggles between states (run/stop)

   -Starts on rising edge, stops on falling edge

   -Starts on falling edge, stops on rising edge

4. **Trigger 1 Output**

   TTL Logic Output-Default = Low Control thru program or serial comm

5. **Trigger 2 Output**

   TTL Logic Output-Default = Low Control thru program or serial comm

6. **Sync Output**

   TTL Logic Output –
   Rising Edge = Start Forward
   Falling Edge= Start Reverse

7. **Direction Output**

   TTL Logic Output –
   High = Reverse
   Low = Forward

8. **Valve Output (controls voltage only)**

   TTL Logic Output –
   High = Valve Actuated
   Low = Valve Off

   Note: Valve follows motor direction, when valve is set to Auto.

9-13. **Signal Return / Ground**

14. **Run Indicator Voltage**

    +5V through a 470 ohm resistor (connect to LED Anode)

15. **Run Indicator Output**

    TTL Logic Output, active low (low = run) (connect to LED Cathode)

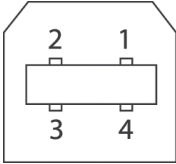All Inputs are pulled high to +5 Vdc through a 10k resistor All Outputs are at TTL Logic Levels. Pulse duration should be 0.1s minimum.


User I/O Connector Specifications

<table>
<tr><td style="background:#1a2a4a;color:white">Electrical Specifications</td></tr>
</table>

Inputs:	$V_{IH} \geq 2V$	$I_{IH} \leq 20\mu A$
	$V_{IL} \leq 0.4V$	$I_{IL} \leq 0.5mA$

Outputs:	$V_{OH} \geq 3.8V$	$I_{OH} \leq 6mA$
	$V_{OL} \leq 0.4V$	$I_{OL} \leq 6mA$
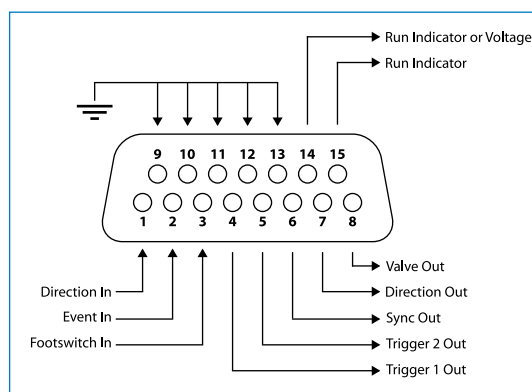
Utilizing the USB Interface

Mating Face

| Pin #	Signal
1	+5V
2	- Data
3	+ Data
4	GND

USB VIRTUAL COMMPORT DRIVER INSTALLATION

When you connect the KDS Allegro™ Peristaltic Pump System pump to a computer via USB for the first time, Windows will seek to install a driver for communication. The following section details the installation of the Virtual CommPort Driver supplied with the KDS Allegro™ Peristaltic Pump System Pump.

1. Connect the pump to the computer via USB. Open the control panel and select System and Security and then System. Click Device Manager on the left hand menu.
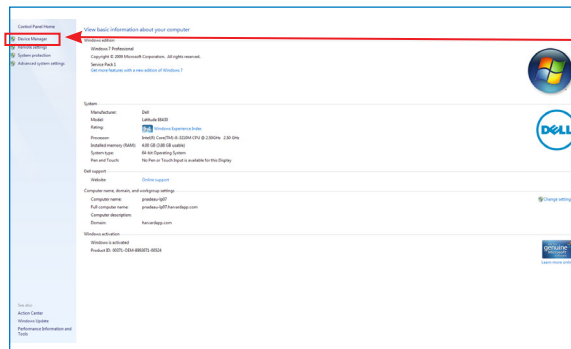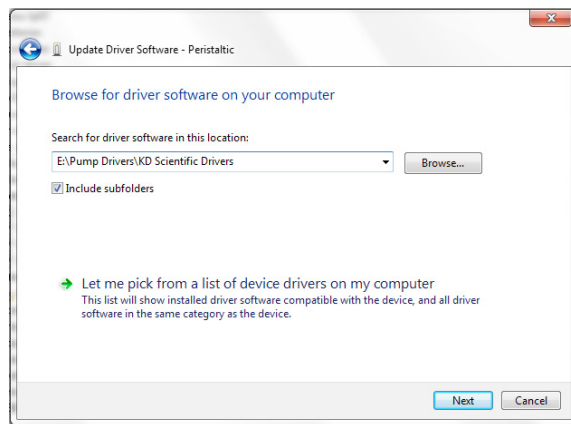
2. Two Flash Update Applications will be displayed in the device manager, under Other Devices. Right click on either of the flash update applications and select Update Driver Software.
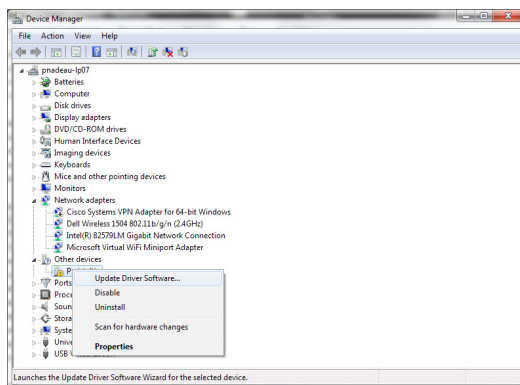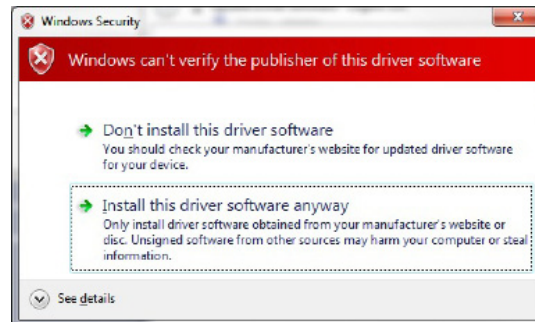
## USB VIRTUAL COMMPORT DRIVER INSTALLATION (CONTINUED)
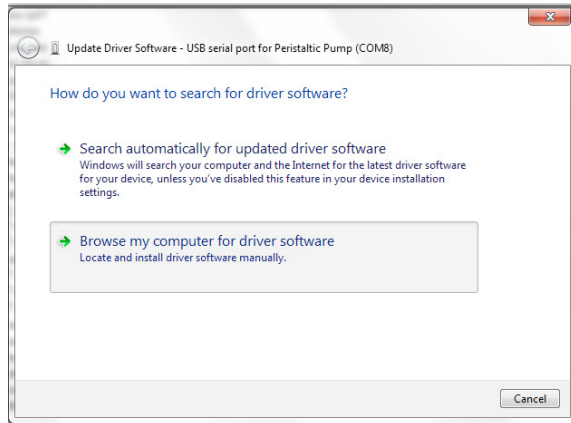
3. Select Browse my computer for driver software.

4. Click Browse and navigate to the pump drivers folder located on the CD supplied with the pump. Select the file KDS Scientific USB-CDC.inf. Make sure the Include Subfolders box is checked and then click Next.

5. If a warning message regarding the driver publisher is displayed, choose Install this driver software anyway.
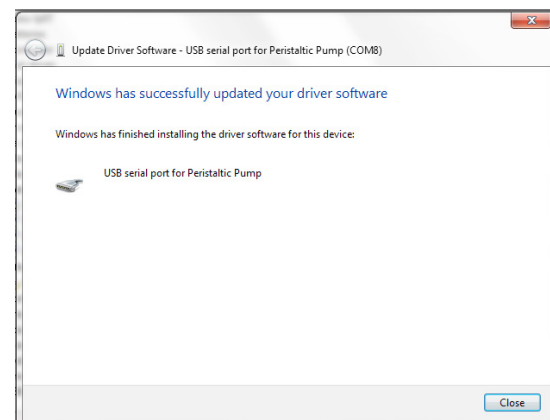
6. Click Close after the software has been successfully installed.

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RS-485

> ⚠️ **CAUTION:** DO NOT CONNECT TO FIREWIRE PORTS ON A PC. DAMAGE MAY OCCUR TO PUMP AND/OR PC.

Mating Face

Pin #	RS-485 In Signal	RS-485 Out Signal	Notes
1	PWR IN	PWR OUT (+30V)*	* Protected by resettable fuse
2	GND	GND	
3	RS-485 A	TIED TO PIN 4**	** 100 Ω, ½ w to GND termination
4	RS-485 B	TIED TO PIN 3**	
5	TIED TO PIN 6**	RS-485 A	
6	TIED TO PIN 5**	RS-485 B	

RS-485 In/Out - IEEE-1394 Sockets

Daisy-Chaining via RS-485

> ✏️ **NOTE:** When applying power to pumps in a daisy chain, apply power to the last group in the chain first and work backwards.

> ✏️ **NOTE:** When removing power, be aware that power removed from a stand-alone unit will cause power to be removed from all RS-485 powered units deriving power from that stand-alone unit.

> ✏️ **NOTE:** Power may be removed from any group of pumps, except the first group, without affecting communications "downstream"

> ✏️ **NOTE:** Each pump in the daisy-chain must have a unique address. The first pump must be set to address 00.

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APPENDIX D: MAINTENANCE

Maintenance

KDS Allegro™ Peristaltic Pump System pumps require no special maintenance other than keeping them clean by avoiding accidental spills of pumped material.

To clean the exterior surfaces, use a lint-free cloth to remove loose dust. Use care to avoid scratching the clear display window. For more efficient cleaning, use a soft cloth dampened [not soaked] with water, an aqueous solution of 75% isopropyl alcohol, or a mild detergent.

kdScientific

## Upgrading Allegro™ Peristaltic Pump System Software

> **NOTE:** *Prior to upgrading, users will need to install the KDS Allegro™ Peristaltic Pump System USB driver as well as the bootloader driver file (KDS Allegro™ Peristaltic Pump System-Bootloader.inf). Reference "**USB Virtual Comport Driver Installation**".*

1. Upload the latest software version to your desktop (format is filename.srec).

2. Disconnect all I/O devices and then connect the pump to PC using a USB cable.

3. On the Set up screen of the pump, press the Upgrade Software button twice to enter "Boot Loader Mode".
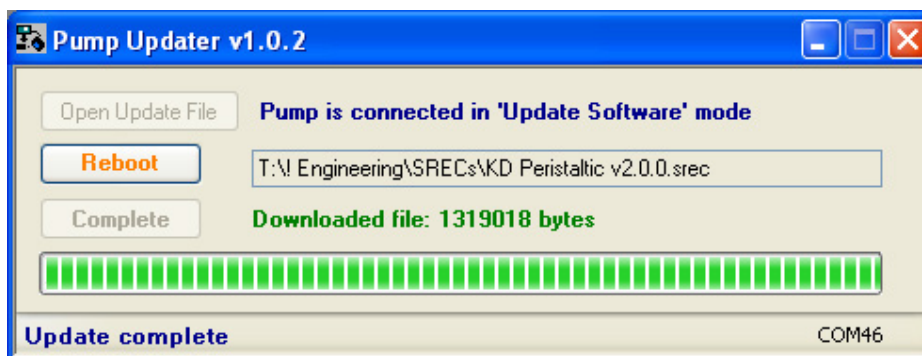
> **NOTE:** *To exit boot loader mode without upgrading the software, power cycle the pump.*

4. From the CD provided with the pump, open the Allegro™ Peristaltic Pump System Pump Updater Application.
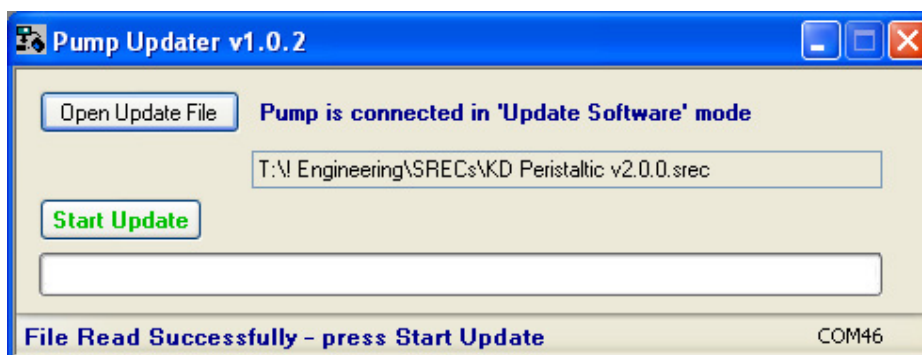
5. Click Open Update File and browse to the file previously saved on your desktop and click Open.

6. Click Start Update.

7. After the update is complete, press Reboot to power cycle the pump.

KDS Allegro™ Peristaltic Pump System User's Manual

TROUBLESHOOTING

1. Infusion Accuracy

To ensure infusion accuracy always use new tubing and measure tubing bore diameter and enter actual dimensions in millimeters (mm) using the Custom Tubing entry option. Additionally, make sure that the guide rods and lead screw are properly lubricated.

> ✏️ **NOTE:** *It is recommended that you save your programs periodically by uploading them to a PC.*

KDS Allegro™ Peristaltic Pump System Display Error Messages

2. Motor Stalled

This indicates that the pusher block travel has been impeded. This may be caused by the tubing plunger hitting bottom, a kink in the tubing (occlusion), tubing plunger binding or any situation requiring more force to the head of the tubing than the pump is capable of delivering. To restart the pump, remove the cause of stalling and/or increase the force setting, then press RUN. The pump will continue the interrupted procedure where it stopped.

3. Out of Range

A value was entered or encountered in a pump program that was beyond the pump's limits.

4. Power Failure Notification

If power to the pump is interrupted during operation, an alarm will sound to alert the user to the interruption. When power is restored, an onscreen message is displayed to indicate the interruption.

5. Unit Won't Power Up

Verify the the Power Source Switch on the rear of the pump is set to DC-IN if powering through power supply or RS-485 if powering in a chain.
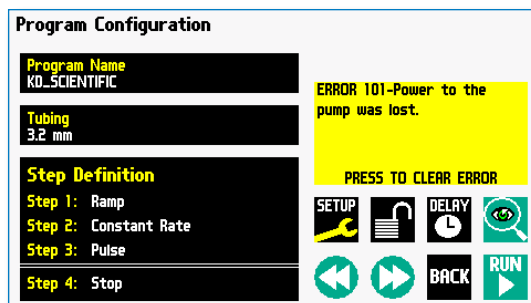
The KDS Allegro™ Peristaltic Pump System Pump will notify you of a power failure with a message when power is restored
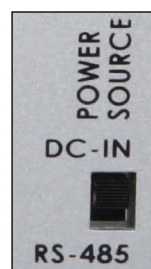
APPENDIX E: ORDERING INFORMATION

Note: To order, choose one head/driver configuration and one controller

Item No.   **Description**

PUMP HEAD / DRIVER MODULE / CONTROLLER MODULE

785501	Allegro™ I Peristaltic Pump System, Single Channel Thin Wall Tubing Head, Drive and Controller
785502	Allegro™ II Peristaltic Pump System, Dual Channel Thin Wall Tubing Head, Drive and Controller
785503	Allegro™ III Peristaltic Pump System, Two Stacked Single Channel Thin Wall Tubing Heads, Drive and Controller
785521	Allegro™ Touch Controller Only
785511	Allegro™ I Head/Driver Only
785512	Allegro™ II Head/Driver Only
785513	Allegro™ III Head/Driver Only

ACCESSORIES

Accessories

7855XX	Tubing – Please See APPENDIX A, PUMP SYSTEM TUBING TABLE
785531	Allegro™ I Pump Head with installation Hardware (Converts Allegro™ I System to Allegro™ III System)
785542	Allegro™ Stacking Base, vertically stacks two Allegro™ head/drive units
788304	RS485 Pump to Pump Communication, .5 m
788305	RS485 Pump to Pump Communication, 2 m
788306	USB Cable PC to Pump Communication, 2 m
788307	USB Cable PC to Pump Communication, 5 m
788326	Line Cord US 115 V, with Power Supply
788327	Line Cord European, with Power Supply
788328	Line Cord UK, with Power Supply
788313	Adapter D Sub 15 to Terminal Block
780225	Footswitch with Phono Jack Plug
788355	Lubricant for Tubing

KDS Allegro™ Peristaltic Pump System User's Manual

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