

ReaXus Reciprocating Pump Constant Pressure Firmware

Overview

The ReaXus Reciprocating Pump can be ordered with either Constant Flow or Constant Pressure firmware pre-installed. The firmware must be changed when converting between Constant Flow and Constant Pressure. Any existing ReaXus pumps can have either software version downloaded using the USB cable and a computer as described in Technical Bulletin TB42 *Updating ReaXus Reciprocating Pump Firmware*.

The operation and programming of the ReaXus Pump in constant pressure mode is somewhat different than constant flow mode. The operating differences are described in this technical bulletin.



Figure 1: ReaXus Reciprocating Pump

Note

Pressure Limit Information:

- Under some conditions the pump may not reach the set pressure. If this occurs locate the Flow Rate Set Point and increase the maximum flow rate setting.

-Under other conditions, the pump may overshoot the high pressure limit and stall before the set pressure can be achieved. If this occurs then the flow setting should be decreased. If lowering the flow setting does not prevent the sudden stall then adjust the PID setting.

PID (Pressure-Integral Derivative):

The PID settings are user settable and effect the system pressure control around the set point. The default settings are:

- P=2000
- I=200
- D=200

For improved/smooth response, particularly at higher flow rates, the recommended starting point for settings are as follows:

- P=10000
- I=1000
- D=1000

Follow the Power-Up Configuration section, then the Constant Pressure PID Setup section in this bulletin for the procedure for changing the PID settings.

Quick Start

After the pump is powered up, press the MENU key to switch between the status LED's located on the front panel. The first LED is the FLOW RATE MAXIMUM set point and repeatedly press this menu key until the PRESS LED is solidly lit.

- The pressure setting can be changed by pressing the UP or DOWN arrow key.
- Pressing RUN will start the pump.

Status LEDs

FLOW	When lit (solid), the display shows flow rate set point in mL/min.
FLOW	When blinking, the display shows current flow rate in mL/min.
PRESS	When lit (solid), the display shows constant pressure set point in psi, bar, or MPa.
PRESS	When blinking, the display shows current system pressure in psi, bar, or MPa.
HI PR	When lit, the display shows the user-set upper pressure limit in psi, bar, or MPa.
LO PR	When lit, the display shows the user-set lower pressure limit in psi, bar, or MPa.
RUN	When lit, this indicates that the pump is running.
FAULT	When lit, a pressure or leak fault has occurred.
LEAK	Not used.

Menu Screens

- **Flow Rate Set Point / Maximum Flow Rate:** Displays the maximum allowable flow rate in milliliters per minute. The ReaXus pump will vary the flow rate up to this value in order to maintain a steady operating pressure. This value may be adjusted by using the up and down arrow keys, or the appropriate serial commands.
- **Flow Rate Readout:** Displays the current flow rate in mL/min.
- **Constant Pressure Set Point:** Displays the constant pressure mode target pressure in psi (or bar or MPa). The ReaXus pump will vary the flow rate in order to maintain this value. This value

may be adjusted by using the up and down arrow keys, or the appropriate serial commands.

- Refer to the “Constant Pressure Commands” on page 3 for a list of commands used to tune the PID algorithm used for constant pressure control.
- Refer to the “Power-Up Configurations” on page 2 for configuring the PID from the front keypad display.
- **Pressure Readout:** Displays the current system pressure in psi (or bar or MPa), as read by a pressure sensor within the pump cabinet.
- **Upper Pressure Limit:** Displays the upper pressure limit for the pump. This value may be adjusted by using the up and down arrow keys, or the appropriate serial commands. When the system pressure exceeds the upper pressure limit, an upper pressure fault will be triggered, and the pump will stop. In some cases, there may be a small amount of headroom between the system pressure and the upper pressure limit which will trigger a fault. This condition may also cause a delayed fault. In these cases, it may be advantageous to set the limit to a slightly higher value.
- **Lower Pressure Limit:** Displays the lower pressure limit for the pump. This value may be adjusted by using the up and down arrow keys, or the appropriate serial commands. When the system pressure is below the lower pressure limit, a lower pressure fault will be triggered, and the pump will stop. There is a delay between the start of the pump and the monitoring of the pressure for the low pressure fault. This delay is typically 20 pump strokes.

Power-Up Configurations

On power-up, press and hold the MODE button to access the PUMP SETUP MENU. The LED display will briefly show “SETUP”, and then enter the pump setup menu.

Each setup parameter includes a TITLE screen followed by a VALUE screen. Within the pump setup menu, use the MODE button to cycle forward through the menu screens; use the PRIME button to cycle in reverse.

While a changeable value is displayed, use the UP and DOWN arrow buttons to modify the value. Depending on the pump model, certain values may not be changeable.

To exit the pump setup menu and save all changes, press the RUN/STOP button.

Note

These changes will NOT be saved until the RUN/STOP button is pressed; exiting the pump setup menu by turning the instrument power off will discard all changes.

- **Firmware Identification:** The first setup parameter displayed is the instrument firmware identification, denoted by the title screen “F-Id”. Press the MODE button to advance the menu screen to display the firmware part number.
- **Firmware Version:** The next setup parameter displayed is the instrument firmware version, denoted by the title screen “Ver”. Press the MODE button to advance the menu screen to display the firmware version.
- **Flow Compensation:** The next setup parameter displayed is the flow rate compensation, denoted by the title screen “Cal”. Press the MODE button to advance the menu screen to display the flow rate compensation value, a number between 85.0 and 115.0 which represents the amount of compensation affecting the running speed of the pump, in percentage. This needs to be adjusted when calibrating the pump for the delivery of a measured amount of liquid.
 - The nominal value is 100.0, and indicates that the pump is running at 100.0% of the intended speed, meaning there is no secondary adjustment.
 - A value of 98.7 means the pump is running 1.3% slower than nominal; a value of 106.4 means the pumps is running 6.4% faster than nominal.
- **Motor Stall Detector:** The next setup parameter displayed is the motor stall detector, denoted by the title screen “Stall”. Press the MODE button to advance the menu screen to display the motor stall detector state, either on (enabled) or off (disabled). While enabled, the motor stall detector creates a motor stall fault when the motor rotation is not properly detected.
- **Solvent Select:** The next setup parameter displayed is the Solvent Select feature, denoted by the title screen “S-Sel”. Press the MODE button to advance the menu screen to display the currently selected solvent, or OFF if this feature is disabled. Solvent Select allows the pump to produce accurate flow rates for various solvents. This feature is not available in the constant pressure software.
- **Leak Detector:** The next setup parameter displayed is the leak detector, denoted by the title screen “Drip”. Press the MODE button to advance the menu screen to display the leak

detector state, either on (enabled) or off (disabled). This feature is not currently used.

- **Analog Input Mode:** The next setup parameter displayed is the analog input mode, denoted by the title screen “Input”. Press the MODE button to advance the menu screen to display the currently selected analog input mode, either voltage (0-10Vdc) or current (4-20mA).
- **Analog Input Enable/Override:** The next setup parameter displayed is the analog input enable/override, denoted by the title screen “An-En”. Press the MODE button to advance the menu screen to display the analog input enable/override state, either on (enabled) or off (disabled). While enabled, the analog input enable/override allows the analog input to be used without the need to wire the enable line on the external control connector.
- **Constant Pressure PID Setup:** The next 3 setup parameters displayed are the PID settings used only by the constant pressure pumps. The title screens are denoted by “PID-P”, “PID-I”, and “PID-D”.

Note

As a reminder, pressing the MENU key will advance to the next parameter. Pressing the UP and DOWN arrow keys will change the value. When the settings are changed, press the RUN key to store the values.

- **Serial Baud Rate:** The next setup parameter displayed is the serial baud rate, denoted by the title screen “Baud”. Press the MODE button to advance the menu screen to display the current baud rate, either 9600 or 19200. Note that the RUN/STOP button must be used to exit the pump setup menu and save all changes; changes made to the baud rate will then become effective on the next power cycle.
- **Pressure Smoothing Filter:** The next setup parameter displayed is the pressure smoothing filter, denoted by the title screen “P-Avg”. Press the MODE button to advance the menu screen to display the pressure smoothing filter value, a number between 0 and 16 which represents how much smoothing is applied to the pressure signal. Higher values denote increased smoothing.

Non-volatile Memory Reset

On power-up, press and hold the UP arrow button perform an instrument reset. The LED display will briefly show “reset”, and then enter the normal pump operating menu. A reset restores the instrument to its original factory settings. A reset automatically occurs when the firmware is updated

Constant Pressure Commands

The following serial port commands are active ONLY for ReaXus pumps with constant pressure software. All other instruments will respond with error message Er/.

Command	Response	Description	Example
PS	OK,PS:<target>/	Pressure Setpoint: returns the target pressure.	OK,PS:05000/
PG	OK,PG:<p_gain>/	Proportional Gain: returns the CP algorithm P term.	OK,PG:02000/
IG	OK,IG:<i_gain>/	Integral Gain: returns the CP algorithm I term.	OK,IG:00500/
DG	OK,DG:<d_gain>/	Derivative Gain: returns the CP algorithm D term.	OK,DG:0075/
PSxxxxx	OK,PS:<target>/	Pressure Setpoint: sets the target pressure.	OK,PS:05000/
PGxxxxx	OK,PG:<p_gain>/	Proportional Gain: sets the CP algorithm P term.	OK,PG:02000/
IGxxxxx	OK,IG:<i_gain>/	Integral Gain: sets the CP algorithm I term.	OK,IG:00500/
DGxxxxx	OK,DG:<d_gain>/	Derivative Gain: sets the CP algorithm D term.	OK,DG:0075/

Released October 14, 2016

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