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REV	CHANGE DESCRIPTION	ECO #	INITIALS	DATE
A	Release	-	SLF	05/21/15
B	Add information for constant pressure pumps.	10824	SLF	12/11/15
C	Added power-up setup menu.	10853	DEL	01/27/16

1.0 Overview

This document describes in detail the **Control Board** that is supplied with *Next Generation Pumps and Pump Kits*. The Control Board provides user-interface capabilities for the Motor Drive Board, SSI pumps and pump kits, including communications and front-panel display.

Next Generation printed circuit assemblies are constructed in 2-board or 3-board sets (below) and are identified with serial number labels starting with **TL** or **TM** (located on mounting bracket). The **Control Board** can be found on both board sets, as shown in *Figure 1*.



Figure 1 – Next Generation 2-Board and 3-Board Sets

Standalone Next Generation pumps have a two-character class identifier prefix (i.e. **M1-**, **MX-**, **LS-**, **LD-**, **LU-**, **PR-**, & **CP-**Class). They can also be identified by their serial number “**V**” prefix (e.g. **V0123456**).

Standalone Next Generation pumps are available in a variety of configurations. Below are two examples of their appearance:



Figure 2 – Next Generation Standalone Pumps

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The RS-232 and Micro USB ports can be accessed on the back panel of standalone Next Generation pumps.

The Control Board is used for:

- RS-232 and USB user-communications.
- RS-485 communication interface with Motor Drive Board.
- LED keypad display control.
- Programming via USB, including Motor Drive Board.

2.0 Control Board Construction

Figure 3 gives an overview of the key components and connection points for the Control Board.

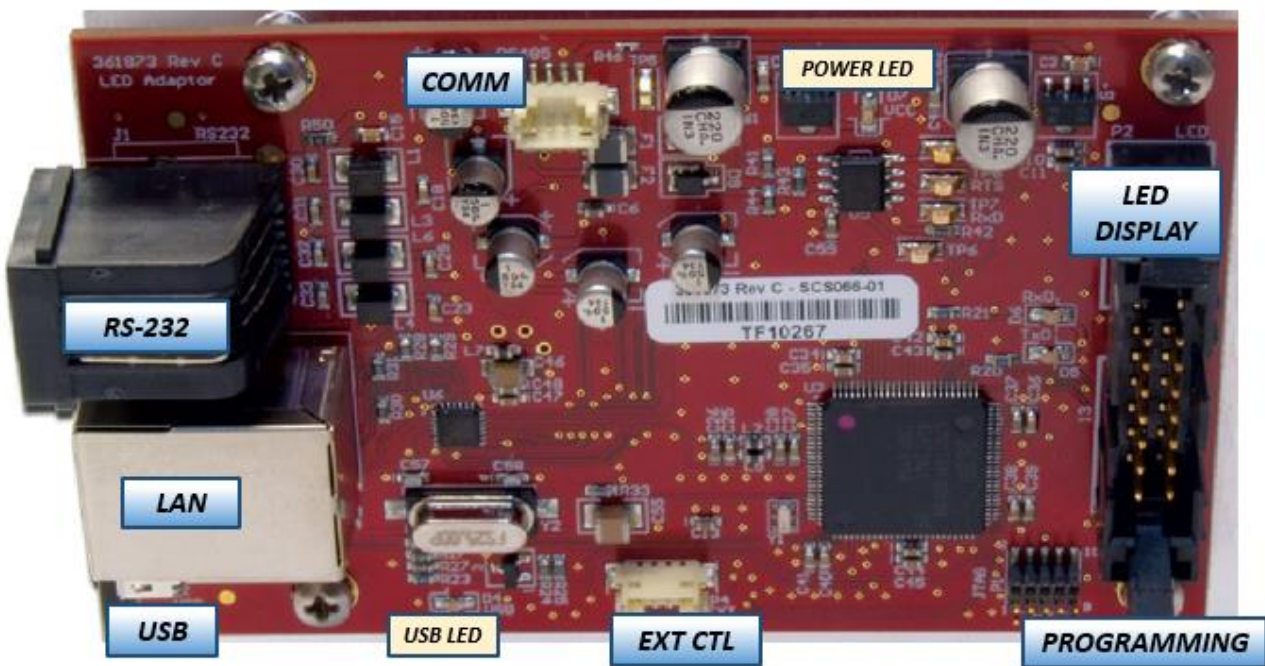


Figure 3 – Control Board Connections

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3.0 LED Front Panel Connection

Pump control may be accomplished through a front panel keypad, as shown below.

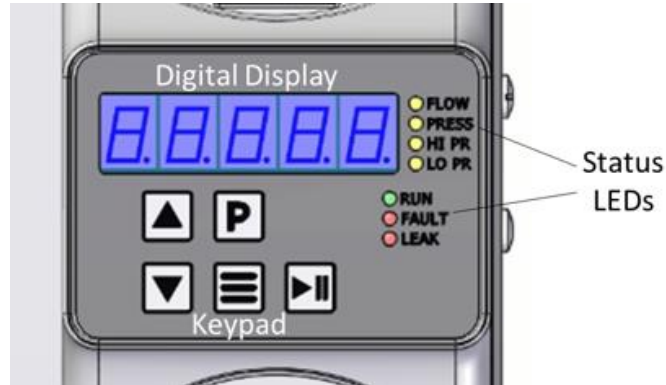


Figure 4 – Front Panel Display

The 5-digit display shows the pump flow rate (mL/min), actual flow rate, system pressure (psi, bar, or MPa), set pressure, upper pressure limit, or lower pressure limit when operating (depending on version ordered). Choice of display is selected with the MODE key.

3.1 Keypad



RUN/STOP button - alternately starts and stops the pump.



UP-ARROW button - increases the displayed parameter.



DOWN-ARROW button - decreases the displayed parameter.



PRIME button – the pump will run at a flow rate suitable for priming the pump. To exit prime mode, either press the PRIME button again, or press the RUN/STOP button.



MODE button – for **constant flow** models, this button cycles through the flow rate set-point, current pressure, upper pressure limit, and lower pressure limit. For **constant pressure** models, this button cycles through the flow rate set point/maximum flow rate, the current flow rate readout, the constant pressure set point, the current pressure readout, the upper pressure limit, and the lower pressure limit. A status LED to the right of the digital

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display indicates which mode is active. NOTE: If the pump does not have pressure monitoring, this button will be disabled.

Fast and Slow Button Repeat:

If the UP-ARROW or DOWN-ARROW button is held down for more than approximately one half of a second, the button press will repeat at a slow rate. Once slow button repeat has begun, fast button repeat can be initiated by using a second finger to press down the second arrow button. Switching back and forth between repeat speeds can be accomplished by pressing and releasing the second arrow button while keeping the first arrow button held down.

3.2 Status LEDs

Constant Flow Status LEDs

- FLOWWhen lit, the display shows flow rate in mL/min.
- PRESS.....When lit, the display shows system pressure in psi, bar, or MPa.
- HI PRWhen lit, the display shows the user-set upper pressure limit in psi, bar, or MPa.
- LO PRWhen lit, the display shows the user-set lower pressure limit in psi, bar, or MPa.
- RUNWhen lit, this indicates that the pump is running.
- FAULT.....When lit, a pressure or leak fault has occurred.
- LEAK.....When lit, a leak has been detected.

Constant Pressure Status LEDs

- FLOWWhen lit (solid), the display shows flow rate set point in mL/min.
- FLOWWhen blinking, the display shows current flow rate in mL/min.
- PRESSWhen lit (solid), the display shows constant pressure set point in psi, bar, or MPa.
- PRESSWhen blinking, the display shows current system pressure in psi, bar, or MPa.
- HI PRWhen lit, the display shows the user-set upper pressure limit in psi, bar, or MPa.
- LO PRWhen 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.
- LEAKWhen lit, a leak has been detected.

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3.3 Menu Screens

Constant Flow Menu Screens

The menu screens can be accessed by repeatedly pressing the MODE button on constant flow pumps and cycling through them in the following order:

Flow Rate Set Point

Displays the current set flow rate in mL/min. This value can be changed by using the up and down arrows.

Pressure Readout

Displays the current system pressure in psi, 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 upper pressure limit and the system pressure which actually triggers the fault, which may cause the fault to appear to be delayed. In these cases, it may be advantageous to set the limit to a slightly lower 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.

Constant Pressure Menu Screens

The menu screens can be accessed by repeatedly pressing the MODE button on constant pressure pumps and cycling through them in the following order:

Flow Rate Set Point / Maximum Flow Rate

Displays the maximum allowable flow rate in mL/min. The CP-Class 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.

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Flow Rate Readout

Displays the current flow rate in mL/min.

Constant Pressure Set Point

Displays the constant pressure mode target pressure. The CP-Class 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 Command section in Appendix A of the CP-Class Manual for a list of commands used to tune the PID algorithm used for Constant Pressure control. Refer to the Power-Up Configuration section below for configuring the PID from the front keypad display.

Pressure Readout

Displays the current system pressure in psi, 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 upper pressure limit and the system pressure which actually triggers the fault, which may cause the fault to appear to be delayed. In these cases, it may be advantageous to set the limit to a slightly lower 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.

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4.0 RS-232 Serial Communication

The Control Board features user communication with a host PC or other device via an RJ12 (6P6C) RS-232 serial communication interface. For detailed information on communication with SSI pumps, refer to the document *Serial Pump Control for Next Generation SSI Pumps*.

Baud Rate:	9,600
Data Bits:	8
Parity:	NONE
Stop Bits:	1

5.0 USB Communication

The Control Board features user communication with a host PC or other device via a micro-B USB 2.0 connection. For detailed information on communication with SSI pumps, refer to the document *Serial Pump Control for Next Generation SSI Pumps*. The USB LED D4 (*Figure 3*) illuminates when the Control Board is connected to a host via USB.

6.0 USB Programming

The Control Board allows the user to update the pump firmware via the USB port. To access the bootloader and download new firmware, hold both the up arrow and down arrow buttons on the LED keypad while turning the pump on. The LED display will show 'LoAd' and the pump will be ready to receive the firmware update in the form of a binary file.

Alternatively, the bootloader may be accessed via the serial commands 'QQ' followed by 'XB7'.

After the bootloader has been accessed and the pump has been connected via USB to a PC, the pump will display as a USB mass storage device, and the existing binary file may be deleted and replaced with the desired firmware update file. Accessing the bootloader does not erase the existing firmware.

For detailed information on updating firmware, refer to the document *Next Generation Firmware Update Procedure*.

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7.0 Motor Drive Board Connection

The Control Board connects to the Motor Drive Board through a single connection, which provides both power and RS-485 communications. POWER LED D7 (**Figure 3**) illuminates when the Control Board is powered.

Designator:	P3
Connector Type:	Hirose DF13-4S-1.25C (housing) Hirose DF-13-2630SCFA (pin)
Pin 1:	Power +
Pin 2:	Power -
Pin 3:	Data +
Pin 4:	Data -

8.0 Power-Up Functions

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 that 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. 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.

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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, as shown in the table below.

PUMPED LIQUID	DISPLAY 2 ACRONYM	SOLVENT SELECT NUMBER
Acetonitrile	ACn	46
Hexane	C6H14	167
Isopropanol	IPA	84
Methanol	CH3OH	121
Tetrahydrofuran (THF)	C4H8O	54
Water	H2O	46

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). While enabled, the leak detector creates a leak warning (default) or leak fault (configurable with LM2 command) when a leak is detected.

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). Refer to Appendix A for additional details.

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. Refer to Appendix A for additional details.

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Constant Pressure PID Setup:

The next 3 setup parameters displayed are the PID parameters used by Constant Pressure pumps, denoted by the title screens “PID-P”, “PID-I”, and “PID-D”. For Constant Flow pumps, the value screens will display off.

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 rest restores the instrument to its original factory settings. A reset automatically occurs when the firmware is updated.

END OF DOCUMENT