Basic Operation of LabView Toolkit

With Teledyne Isco Syringe Pumps

TELEDYNE ISCO
Everywhereyoulook™

Technical Bulletin
TB06

Overview

The Teledyne Isco D Series pump can be remotely controlled by a computer through a built-in RS-232-C serial interface. This function is supported by the Teledyne Isco LabView™ toolkit.

The toolkit is a sample program capable of running one controller and one to three pumps. Its primary purpose is to provide an example to help the programmer start constructing custom programs for individual pump systems and applications. To modify the program in any way, you must have the complete **LabView Compiler**, available from LabView's manufacturer:

National Instruments Corporation
www.ni.com
Tel: (800) 531-5066
Fax: 512-683-8411
11500 N. Mopac Expwy
Austin, TX 78759-3504

Cabling for Serial Control

The cabling scheme for your system will depend on the number of instruments you need to control. The computer is always connected from the serial port to the serial port(s) of the D Series controller(s) it is controlling. Each controller is connected to its pumps in the normal fashion, *i.e.* the pump control cables are attached to the pump A, B, and C connectors on the rear panel of the pump controller. The cable you select to connect your network will depend on the type of serial port your computer has and the number of controllers you wish to connect.

Network communications are initiated by your computer.

One Controller

To connect one controller, use an AT-modem cable (Isco part #480-7996-00) to connect the 9-pin serial output port of the computer to the RS-232-C port on the rear of the controller, as shown in Figure 1. See Table1 for the wiring of this cable.

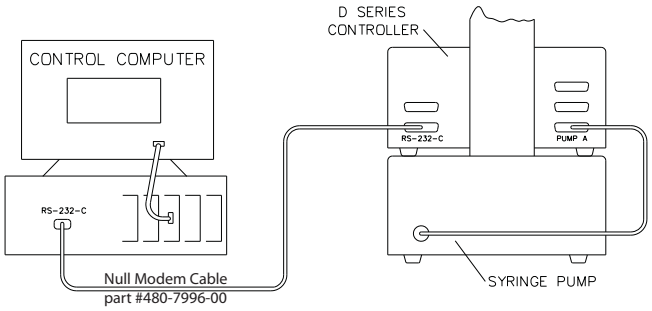


Figure 1: Serial network connection example
Single connection

With this configuration, your sample program is capable of:

- Constant flow
- Constant pressure
- Gradient

Table 1: Serial Cable Connections

DB-9 (Female)	DB25 (Male)
2	3
3	2
5	7
8	5

Two Controllers (Compiler required)

To connect two controllers in the network, use the 'Y' cable #68-1020-198, as shown in Figure 2.

> ☑ ***Note***
> In order for the network to operate properly, all instruments connected to the network must be turned on even if they are not being used.

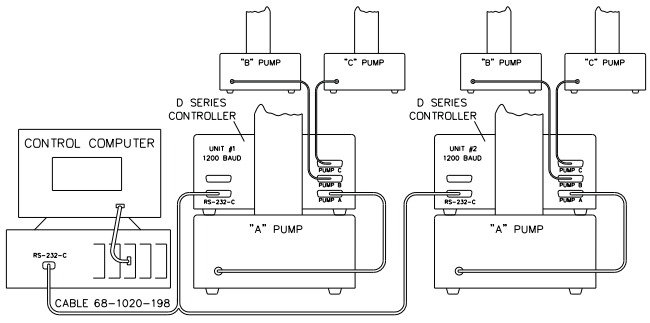


Figure 2: Serial network connection example
(Dual connection)

Three or More Controllers (Compiler required)

If additional instruments are to be connected in series, use the daisy chain cable, #68-1020-180. This cable is attached to the remaining connector on the 'Y' cable (Figure 2), and then to the RS-232-C connectors on the rear panels of the additional controllers.

User-Written Software

When designing software to control the D Series pumps, you must follow the DASNET communications protocol. DASNET allows a number of instruments to be controlled from a single RS-232-C serial port. Up to nine D Series controllers may share a single serial data channel, with each controller only accepting commands that are meant for it. Each pump controller can then control up to three pumps each.

DASNET

DASNET protocol converts your serial commands into a form recognizable to the Isco pump controller. Using a computer language such as BASIC or C, serial commands can be converted and sent to your controller.

Example programs written in BASIC and C can be found in Section 6 of your D Series user manual. Both programs, plus a DASNET serial driver in Visual C++, are available on the CD-ROM (part #60-1245-096) in the back of your printed manual.

Serial Control Check List

In order to build and operate a custom program for Isco syringe pumps, you must have the following:

1. Sample program (Isco LabView toolkit)*
2. LabView Compiler (purchased separately)
3. Connection cable(s)
   a. 1 controller: cable 480-7996-00
   b. 2 controllers: cable 68-1020-198
   c. 3 to 7 controllers: cables 68-1020-198 and 68-1020-180.
4. Source code (serial commands in computer language for DASNET conversion)
5. DASNET serial driver

*The toolkit comes with directories for two different versions of LabView. Copy the .zip files onto your computer.

The files within each directory are as follows:

\labview8.5	\labview5-8.2
CONTROL.LLB	CONTROL.LLB
DASNET.DLL	DASNET.DLL
DATA.LLB	DATA.LLB
ISCO1.LLB	ISCO1.LLB
ISCO2.LLB	ISCO2.LLB
ISCO3.LLB	ISCO3.LLB
MULTPUMP.LLB	MULTPUMP.LLB
PANEL.VI	PANEL.VI
README.DOC	README.DOC
SERIALIO.LLB	SERIALIO.LLB

Controller Setup

Once the system is properly connected, turn the pump, controller(s), and computer on. Then use the following procedure to place your controller(s) in serial control mode.

Press MENU > MORE (A) and select SERIAL (1).

☑ *Note*

Factory controller default settings are baud rate 9600 and unit ID #6.

Restore Defaults (if desired)

To restore defaults, press MENU, then SYSTEM RESET (5). **Resetting a system erases all programs and user settings.**

Change Defaults

1. Select the communication baud rate (between 300 and 57.6K) by pressing NEXT BAUD (A) until you reach the desired baud rate.

☑ *Note*

All units in the network must be set to the SAME baud rate.

2. Select an identification number for each controller (up to seven) by pressing NEXT ID # (B) until you reach the desired number.

☑ *Note*

Multiple controllers in a network must each have a different ID number.

If several units are being configured, place a label on the rear of each instrument listing the ID number and baud rate. This will help identify the controller in the future and prevent assigning the same ID number to two controllers or assigning an incorrect baud rate.

Verify Operation

To verify network operation, on your computer, open a terminal emulator program such as HyperTerminal and establish connection to the controller.

> ☑ ***Note***
>
> If you will be using multiple controllers daisy-chained to a single serial port, you must connect and test each controller one at a time.

1. Press MENU > MORE (A) > MORE (A), and select DIAGNOSTIC MENU (2).
2. Select SERIAL TEST (6).

The SENT value displayed will increment indefinitely until you exit the test by pressing any key. This same value should appear on your computer screen. If it does not, verify that you are using the correct serial port on the computer, and that the communication cables are properly connected and in working order.

Preparing LabVIEW for Pump Operation

1. On the computer, start the LabVIEW program.
2. On the left side of the screen, click RECONFIGURE (Reconfigure). The Reconfigure dialog screen appears:

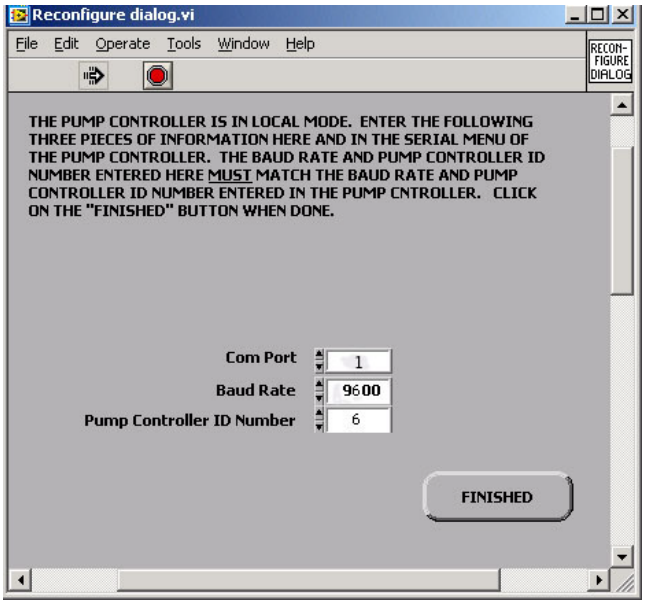


Figure 3: LabVIEW communication settings

3. Using the up/down arrows, ensure that the Baud Rate and Pump Controller ID Number match the settings on the pump controller SERIAL screen, and select the Com Port you are using. Click FINISHED to exit the screen.

   The LabVIEW control screen appears. **Refer to Figure 5** on the following page for all of the controls described in the following sections.
4. In the upper left corner of the LabVIEW screen, click the Start button ( ).

   Below the pump symbol, the STATUS and PUMP MODEL boxes now display the program status and pump information (Figure 4).
5. The blue buttons on the left side just above the STATUS label should now read **INDEPENDENT** and **REMOTE**. If not, click on them and select INDEPENDENT and REMOTE from their dropdown menus.

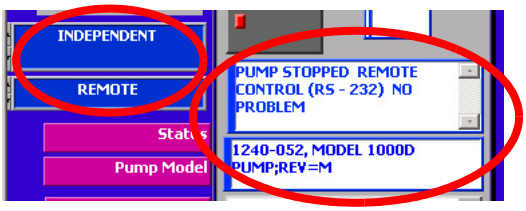


Figure 4: Status, Pump Model, and Mode Indicators

The pump controller screen should now display the word REMOTE in the lower left corner:

See the following pages for basic LabVIEW settings and commands.

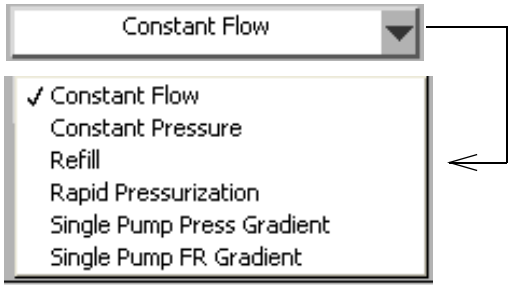
CPx	X.XXX mL/MIN	XXXXX PSI	XX.XXXXL
RUNNING			XX:XX:XX
XX PSI			A XXX.XX mL
REMOTE			

Basic Settings and Commands

Some basic selections available in the sample program are shown in Figure 5.

Pump Mode

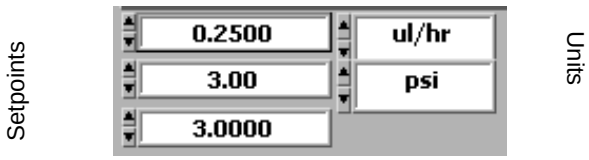
To set the Pump Mode, click the arrow (just below the Pump Model box) and select from the dropdown list.



Setpoints

Enter or select setpoints for Flow Rate, Pressure, and Refill Rate by clicking the up/down arrows next to the value, or by typing in a specific value.

Select the units of measure for flow rate and pressure by clicking the up/down arrows next to the units shown.



Start/Stop

Start or stop each pump by clicking the large button at the bottom of the column. The button shows the status of the pump.

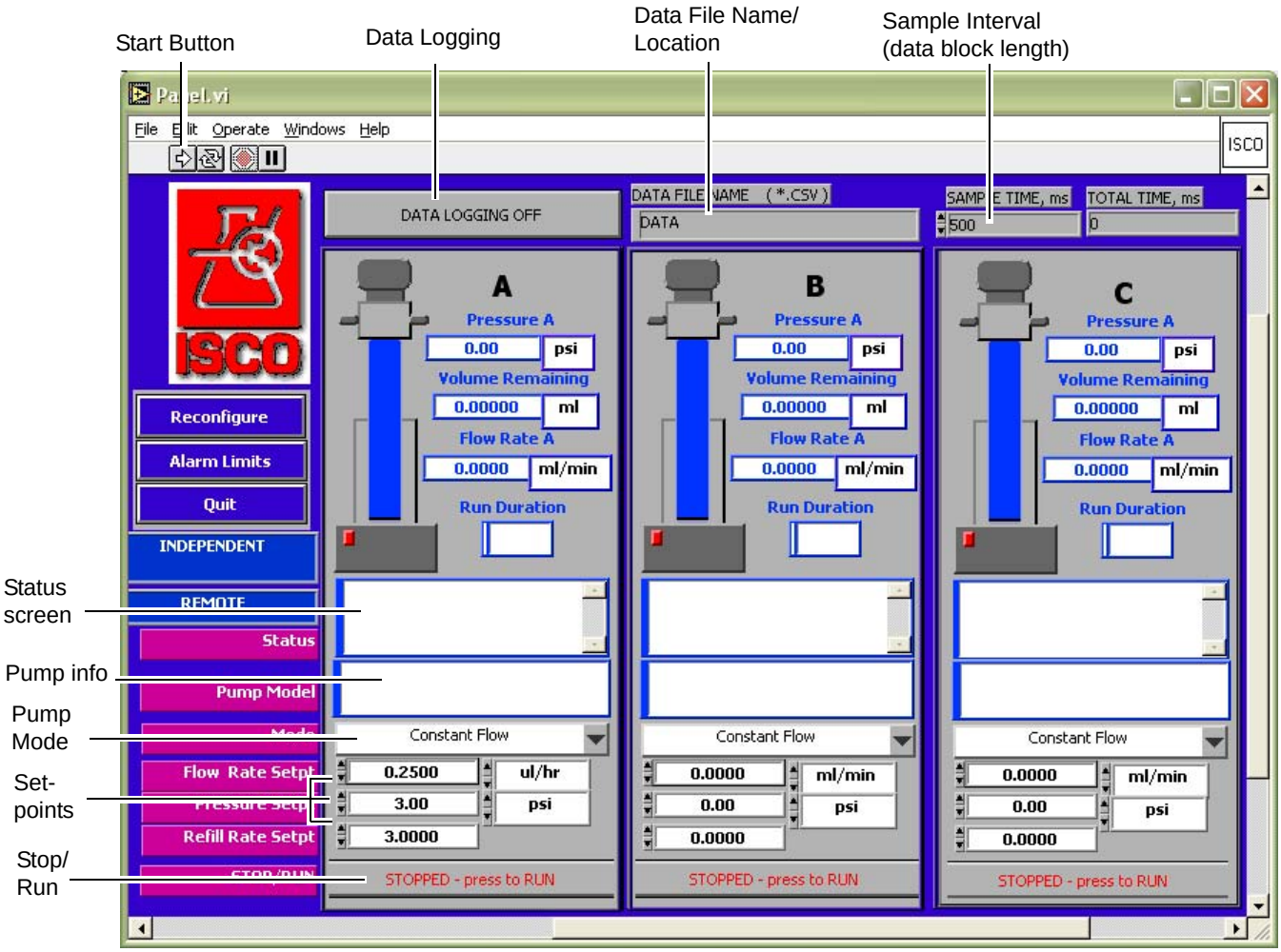


Figure 5: LabVIEW control screen

Data Viewing and Logging

The sample program is capable of logging data from the connected pumps. Data strings and files are exported from the controller as an ASCII text string of comma-separated values.

Terminal program: Current pump data – To retrieve current pump information using the terminal emulator program, use the command "G" for pressure and analog inputs (example in Figure 6, below), or use the command "G&" for the same information plus flow rates, units, operation status, and more.

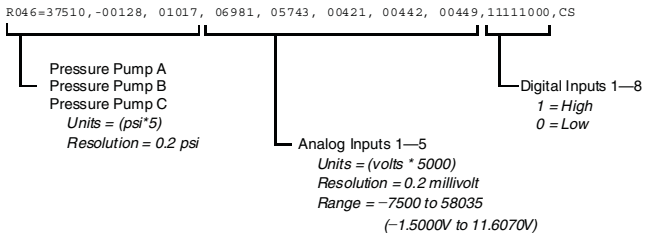


Figure 6: Exported data in ASCII text string

> ☑ ***Note***
>
> For a complete discussion of exported ASCII strings, refer to the **D Series manual, Section 6,** under **"Get Status Command."**

LabVIEW: Logged data files – The computer must be actively connected to the pump system in order to log pump data.

Data File name/location – The default location for the data file will be the directory in which the program is located. If a different location is desired, type the

full path into the field below DATA FILE NAME (the file name may also be changed if desired).

DATA FILE NAME (*.CSV)
DATA

Sample interval (data block length) – The default interval for data sampling is 500ms, and is adjusted by typing in a new value or clicking the up/down arrows under SAMPLE TIME, MS (uppder right corner of LabVIEW screen). If TOTAL TIME is left at zero (0), data will be recorded from the start time until the pumps are disconnected or DATA LOGGING is turned off.

SAMPLE TIME, ms	TOTAL TIME, ms
500	0

Start data logging – To begin logging, click the DATA LOGGING button. The button shows the status as either ON or OFF.

DATA LOGGING OFF > DATA LOGGING ON

View data – The logged data files can be viewed in tabular format using a spreadsheet program. The default filename is data.csv. An example of an exported .CSV file is shown in Figure 7, followed by an explanation of each column.

> ☑ **Note**
>
> Column headings have been added to Figure 7 below to identify the data; the actual exported file contains no identifying headings.
> The spreadsheet has been split in order to fit it the Pump B, Pump C, and System data on this page.

An explanation of the data under each heading is on the following page.

Time Sample Interval	Pressure			Analog Inputs					Digital	Pump A				
	Pump A	Pump B	Pump C	A	B	C	D	E	In	Flow Rate	Volume	Status	Control Status	Problem Status
100	-152	-152	-228	64	90	42	5007	93	11111001	0	0	S	L	B
200	-152	-152	-228	64	90	42	5007	93	11111001	0	0	S	L	B
300	-152	-152	-227	65	90	42	5007	94	11111001	0	0	S	L	B
400	-152	-152	-228	65	90	42	5008	94	11111001	0	0	S	L	B
500	-152	-152	-228	65	90	42	5008	93	11111001	0	0	S	L	B
600	-151	-152	-228	65	90	42	5007	94	11111001	0	0	S	L	B
700	-151	-151	-228	64	90	42	5008	94	11111001	0	0	S	L	B
800	-152	-152	-228	64	90	42	5008	93	11111001	0	0	S	L	B
900	-152	-152	-228	64	90	42	5007	93	11111001	0	0	S	L	B
1000	-151	-152	-228	64	90	42	5007	93	11111001	0	0	S	L	B
1100	-152	-152	-228	64	90	42	5007	94	11111001	0	0	S	L	B
1200	-152	-152	-227	64	90	42	5008	94	11111001	0	0	S	L	B
1300	-152	-152	-228	64	90	42	5008	93	11111001	0	0	S	L	B
1400	-151	-152	-227	65	90	42	5008	93	11111001	0	0	S	L	B
1500	-152	-152	-228	64	90	42	5008	93	11111001	0	0	S	L	B
1600	-152	-152	-227	64	90	42	5008	93	11111001	0	0	S	L	B
1700	-152	-152	-228	64	91	42	5008	93	11111001	0	0	S	L	B
1801	-152	-152	-227	64	90	42	5008	93	11111001	0	0	S	L	B
1900	-151	-152	-228	64	90	42	5008	93	11111001	0	0	S	L	B

(CONTINUATION)

Pump B					Pump C					System		
Flow Rate	Volume	Status	Control Status	Problem Status	Flow Rate	Volume	Status	Control Status	Problem Status	Flow Rate	Pressure	Vol
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0
0	1E+08	S	L	N	0	17408	S	L	N	0	-306	0

Figure 7: Example of exported data table

See next page for explanation of data under each heading

Explanation of Exported Data Table

Figure 7 identifies this data, while the following section explains each type of data in more detail.

Time Sample Interval

Data blocks are by default set to 500ms; this interval can be adjusted to another value.

Units = ms

Pressure

Pressure is shown separately for each pump.

Units = psi x 5

Resolution = 0.2 psi

Analog Inputs

Analog input values 1-5 (A through E) appear in their respective columns.

Units = volts x 5,000

Resolution = 0.2 millivolt

Range = -7,500 to 58,035 (-1.5V to 11.607V)

Digital

Digital input data is for factory use only.

Pump A / B / C

Pump status information is shown separately for each pump.

Flow Rate – Units = Liters/min. x 10E10
Resolution = 0.1 nanoliter/min.

Volume – Units = Liters x 10E9
Resolution = 1 nanoliter

Operation –

S = Pump stopped

R = Pump running

F = Refilling

H = Hold (clock stopped)

E = Equilibrating

Control –

L = Local

R = Remote

E = External

Problem –

– = No problem

E = Empty cylinder

B = Cylinder at bottom

O = Overpressure

U = Under pressure

M = Motor failure

System

Flow Rate – Either multi-pump or Pump A:
Units = Liters/minute x 10E10
Resolution = 0.1 nanoliter/minute

Pressure – Either multi-pump or Pump A:
Units = psi x 5
Resolution = 0.2 psi

Volume Total – Continuous flow or modifier mode:
Units = Liters x 10E6

Last modified October 16, 2012

Teledyne Isco
P.O. Box 82531, Lincoln, Nebraska, 68501 USA
Toll-free: (800) 775-2965 • Phone: (402) 464-0231 • Fax: (402) 465-3001
E-mail: IscoService@teledyne.com