Demi Pump

Installation and Operation Guide

TELEDYNE ISCO
Everywhereyoulook™

Part #69-1263-234

Released: March 2017

Foreword

This instruction manual is designed to help you gain a thorough understanding of the operation of the equipment. Teledyne Isco recommends that you read this manual completely before placing the equipment in service.

Although Teledyne Isco designs reliability into all equipment, there is always the possibility of a malfunction. This manual may help in diagnosing and repairing the malfunction.

If a problem persists, call or e-mail Teledyne Isco technical support for assistance. Simple difficulties can often be diagnosed over the phone. For faster service, please have your serial number ready.

If it is necessary to return the equipment to the factory for service, please follow the shipping instructions provided by technical support, including the use of the **Return Material Authorization (RMA)** specified. **Be sure to include a note describing the malfunction.** This will aid in the prompt repair and return of the equipment.

Teledyne Isco welcomes suggestions that would improve the information presented in this manual or enhance the operation of the equipment itself.

Teledyne Isco is continually improving its products and reserves the right to change product specifications, replacement parts, schematics, and instructions without notice.

Contact Information

Customer Service

Phone:	(800) 228-4373	(USA, Canada, Mexico)
	(402) 464-0231	(Outside North America)
Fax:	(402) 465-3022	
Email:	IscoCSR@teledyne.com	

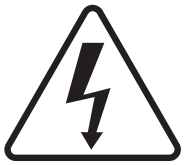
Technical Support

Phone:	Toll Free (800) 775-2965 (Syringe Pumps and Liquid Chromatography)
Email:	IscoService@teledyne.com
Return equipment to:	4700 Superior Street, Lincoln, NE 68504-1398

Other Correspondence

Mail to:	P.O. Box 82531, Lincoln, NE 68501-2531
Email:	IscoInfo@teledyne.com

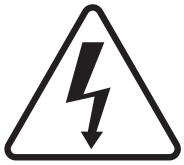
Warnings and Cautions



The lightning flash and arrowhead within the triangle is a warning sign alerting you to “dangerous voltage” inside the product.

The exclamation point within the triangle is a warning sign alerting you to important instructions in this manual.

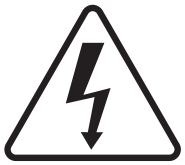
Symboles de Sécurité



Ce symbole signale la présence d’un danger d’électrocution.

Ce symbole signale l’existence d’instructions importantes relatives au produit dans ce manuel.

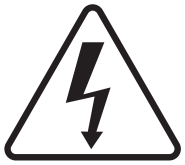
Warnungen und Vorsichtshinweise



Der gepfeilte Blitz im Dreieck ist ein Warnzeichen, das Sie vor „gefährlichen Spannungen“ im Inneren des Produkts warnt.

Das Ausrufezeichen in Dreieck ist ein Warnzeichen, das Sie darauf aufmerksam macht, daß wichtige Anleitungen zu diesem Handbuch gehören.

Advertencias y Precauciones



Esta señal alerta sobre la presencia de alto voltaje en el interior del producto.

Esta señal le advierte sobre la importancia de las instrucciones del manual que acompañan a este producto.

“To prevent damaging the instrument or injuring yourself, it is absolutely necessary that you understand everything in English, above all, technical terms, before operating the instrument. Otherwise, it is necessary for you to receive complete instruction from someone qualified who understands both the instrument and English very well.”

“Um eine Beschädigung des Gerätes oder eine Gefährdung des Anwenders zu vermeiden ist es notwendig, daß dieser vollstandig die englische Sprache und die technischen Bezeichnungen beherrscht. Oder der Anwender muß von einer Person eingeübt werden, die bereits vorher dieses Gerät bedienst hat.”

“Pour empêcher dommage à l’instrument ou blesser vous-même, il faut absolument que vous compreniez tout en anglais, surtout les termes techniques, avant d’actionner l’instrument. Autrement, il faut que vous receviez l’instruction parfaite d’une personne très compétente qui comprend bien les deux l’instrument et anglais.”

“Para prevenir cualquier daño en el instrumento o en el operador, es necesario que el usuario comprenda perfectamente el lenguaje inglés y las términos técnicos intrínsecos, o bien ser formado por una persona que haya trabajado ya previamente con este instrumento.”

“For a forhindre skade på instrumentet eller operatøren er det nødvendig at brukeren har full forståelse for det engelske sprak og tekniske uttrykk Ellers må brukeren få opplæring av en person, som kan engelsk, for instrumentet tas i bruk.”

“För att förhindra skade på instrumentet eller operatören, år det nötvändigt att användaren har fullständiga kunskaper i det engelska språket och dess tekniska termer, eller utbildas av en person, som tidigare brukat instrumentet.”

“For at undgå skade på produktet eller på brugeren er det nødvendigt at brugeren til fulde forstår det engelske sprog for at forstå den tekniske formulering i den engelske manual. I modsat fald skal brugeren modtage træning, inden apparatet tages I drift.”

Laitteelle tai käyttäjälle aiheutuvien vahinkojen välttämiseksi on tärkeää, että käyttäjä hallitsee englannin kielen ja englantilaiset tekniset termit tai on saanut käyttöopastuksen englantia osaavalta henkilöltä.

“Per evitare danni allo struménto od incidenti all’operatore, é necessario che l’utilizzatore abbia una completa conoscensza della lingua inglese oppure che venga istruita da una persona che abbia utilizzato precedentemente questo strumento.”

“Para impedir qualquer dano no aparelho ou ferimentos parao operador, é necessario que o utilizador tenha um conhecimento completo da lingua inglesa e dos respectivos termos técnicos, ou seja, treinado por uma pessoa que tenha esse conhecimento, antes de operar com este aparelho.”

“Για την αποφυγη βλαβης του οργανου ‘η τραυματισμου του χρηστη, ειναι απαραιτητο ο χρηστης να γνωριζει καλα την αγγλικα γλωσσα καθως και τους σχετικους τεχνικους ορους, η να εκπαιδευτει απο ατομο το οποιο εχει προνφουμενως εργαστει πανω στο οργανο αυτο.”

С цел да избегне повреда на апаратурата или нараняване на оператора е необходимо клиента добре да владее английски език и техчническата терминолгия, която е използувана в описанието или да бъде обучен от лице, което е вече работило с такъв апарат.

Figyelmeztetés! A készülék meghibásodásának valamint a kezelö sérülésének megelözése érdekében a felhasználónak feltétlenül értenie kell az angol nyelvet, ezen belül a müszaki kifejezéseket, vagy pedig a használatba vételt megelözöen a készülék kezelésében már gyakarlott személy által történö betanitás szükséges!

CAUTION:
Avoid spills! Liquids associated with this instrument may be classified as carcinogenic, biohazardous, flammable, or radioactive. Should these liquids be used, it is highly recommended that this application be accomplished in an isolated environment designed for these types of materials in accordance with federal state and local regulatory laws and in compliance with your organization's chemical/hygiene plan in the event of a spill.
In all cases, when using Teledyne Isco instrumentation, prudence and common sense must be used.

WARNING:
Pinch point. This symbol warns you that your fingers or hands will sustain serious injury if you place them between the moving parts of the mechanism near this symbol.

WARNING:
Avoid hazardous practices! If you use this instrument in any way not specified in this manual, the protection provided by the instrument may be impaired; this will increase your risk of injury.

CAUTION:
Liquids associated with this instrument may be classified as carcinogenic, biohazardous, flammable, or radioactive. Should these liquids be used, it is highly recommended that this application be accomplished in an isolated environment designed for these types of materials, in accordance with federal, state, and local regulatory laws, and in compliance with your company's chemical/hygiene plan in the event of a spill.
In all cases, when using Teledyne Isco instrumentation, prudence and common sense must be used.

AVIS: Éviter de répandre! Les liquides qui sont pompés dans cet instrument peuvent être cancérigènes, hasards biologiques, inflammables, ou radioactifs. Si vous devez utiliser ces liquides hasardeux, il est très recommandé que vous le faites à l'intérieur d'un environnement isolé conçu pour tels liquides. Cet environnement isolé devrait être construit selon les règlements fédéraux, provinciaux, et locaux, aussi que le plan de votre organisation qui concerne l'évènement d'un accident avec les matières hasardeuses. En tout cas, utilisez toujours l'instrumentation d'Isco avec prudence et sens commun.

ATTENTION:
Risque de pincement. Ce symbole vous avertit que les mains ou les doigts recevront une blessure sérieuse si vous les mettez entre les éléments en mouvement du mécanisme près de ce symbole.

ATTENTION:
Éviter les usages hasardeux! Si vous utilisez cet instrument d'une manière autre que celles qui sont specifiées dans ce manuel, la protection fournie par l'instrument peut être affaiblie; cela augmentera votre risque de blessure.

AVIS:
Les liquides qui sont analysés dans cet instrument peuvent être cancérigènes, hasards biologiques, inflammables, ou radioactifs.
Si vous devez utiliser ces liquides hasardeux, il est très recommandé que vous le faites à l'intérieur d'un environnement isolé conçu pour tels liquides.
Cet environnement isolé devrait être construit selon les règlements fédéraux, provinciaux, et locaux, aussi que le plan de votre organisation qui concerne l'évènement d'un accident avec les matières hasardeuses.
En tout cas, utilisez toujours l'instrumentation d'Isco avec prudence et sens commun.

Commonly Ordered Replacement Parts for the Demi Pump

Description	Part Number
Demi Pump with USB	60-1260-030
Demi Pump with RS232	60-1260-040
Stainless Steel Tubing:	
1/8” OD x 0.085” ID Stainless Steel Alloy	004-7302-25

Demi Pump

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Demi Pump

Section 1 Introduction

1.1 Overview

The Demi 2510S is a continuous flow syringe pump with active valves in a small package. This pump is ideal for any application where the pulsed flow of reciprocating pumps is not suitable. The Demi pump is a positive displacement pump that provides accurate flows up to 10 ml/min at 2,500 psi (180 bar) without the need for flow meter feedback. There is an interactive front panel with easy programming, real-time flow rate, and a pressure display.

This manual contains the following sections:

Section 1 *Introduction*

Section 2 *Fluid System Connections and Accessories*

Section 3 *Basic Programming and Operation*

Section 4 *Continuous Flow Introduction, Installation, & Operation*

Section 5 *MODBUS Configuration*

Section 6 *Serial Interface*

Section 7 *Pump Maintenance, Troubleshooting, and Servicing*

Appendix A *Replacement Parts*

Appendix B *Continuous Flow Introduction, Installation, and Operation*

1.2 Technical Specifications

Table 1-1 Demi Pump Technical Specifications

CYLINDER CAPACITY	2 cylinders-10 ml each
POWER REQUIREMENTS (Mains voltage line cord is a "Disconnect Device")	100 VAC, 117 VAC, 234 VAC
LINE FREQUENCY	50/60 Hz
DIMENSIONS (H x W x D)	41.2 x 24.9 x 30.0 cm (16.2 x 9.8 x 11.8 in)
FLOW RATE RANGE	0.2 – 10.00 mL/min (0.01 ml/min minimum settable)
FLOW RATE ACCURACY[a]	±1% of set point (≥ 0.2 ml/min, ≥ 150 psi)
DISPLACEMENT RESOLUTION	32 nl /step
PRESSURE RANGE	1-180 bar (10-2,500 psi)
PRESSURE FLUCTUATION (SWITCH OVER)	±60 PSI
WETTED MATERIALS	Nitronic 50, Nitronic 60, 316SST, 304L SST, Haynes 214, Hastelloy C276, PEEK, PTFE, Graphite Filled PTFE
PLUMBING PORTS	1/8" Valco
OPERATING TEMPERATURE	5-40 °C
WEIGHT	13.8 kg (30.5 lb)
STANDARDS CONFORMITY	CE
EXTERNAL COMMUNICATIONS SET 1	0-10 V, 4-20 mA, Ethernet/USB
EXTERNAL COMMUNICATIONS SET 2	0-10 V, 4-20 mA, RS232/485

a. Using water at constant pressure and constant temperature above ±60 psi pressure flux.

1.3 Unpacking

Teledyne Isco
Customer Service Dept.
P.O. Box 82531
Lincoln, NE 68501 USA

Phone: (800) 228-4373
(402) 464-0231
FAX: (402) 465-3022

E-mail:
IscoInfo@teledyne.com

After removing the pump and accessories from the shipping carton, examine them for signs of shipping damage. Be sure no internal parts have shaken loose in transit. If there is any shipping damage, file a claim with the delivering carrier immediately.

Compare the contents of the boxes with the enclosed packing slip. If there are shortages, contact Teledyne Isco immediately.

1.4 Controls and Indicators

Programming and setup are performed using the keypad on the front panel. The front panel is shown in Figure 1-1 and described in Table 1-2. Table 1-3 explains the key functions.

The rear panel has several connectors, described in Table 1-4, and shown in Figure 1-3.

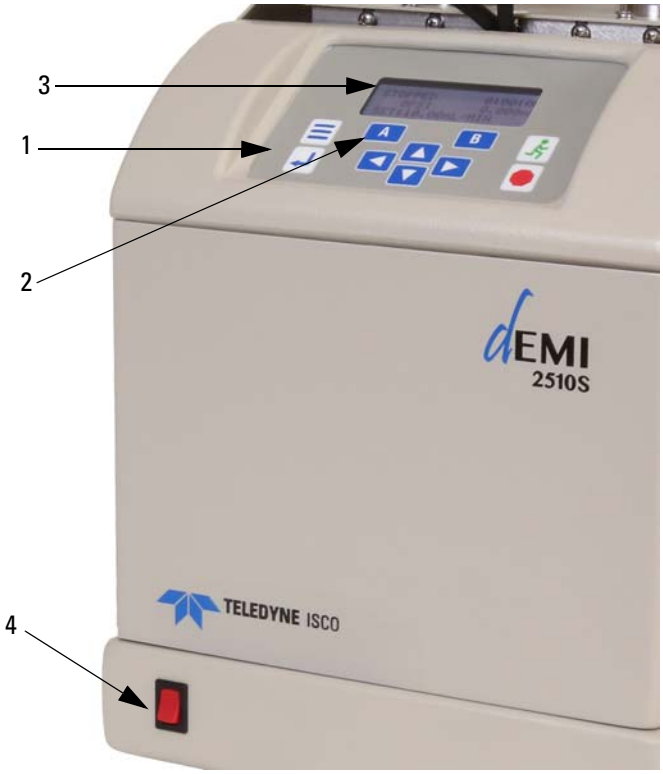


Figure 1-1 Front panel of the Demi

Table 1-2 Front Panel of the Demi

Item No. on Figure 1-1	Type	Description
1	Programming keypad	Used to program the pump.
2	Softkeys	Labeled A and B; used to select menu items displayed directly above them.
3	Liquid crystal display	20 characters x 4 lines.
4	Mains power switch	Disconnects power from the pump circuits.

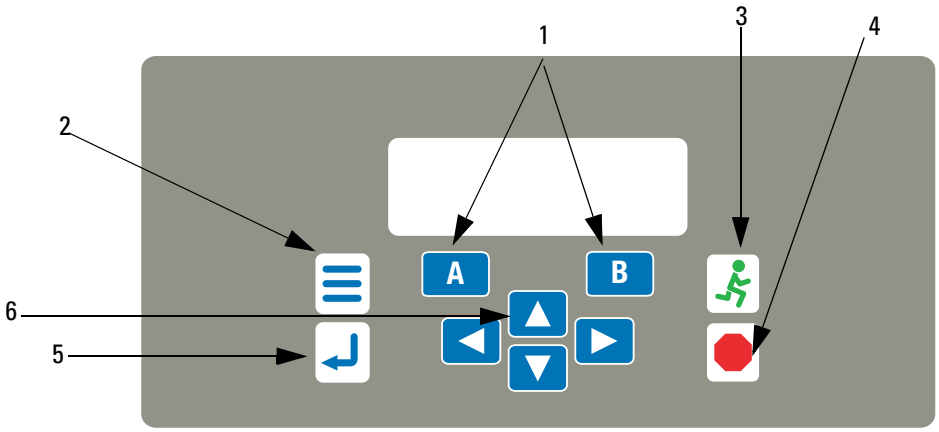


Figure 1-2 Demi pump key functions

Table 1-3 Pump Controller Key Functions

Item No. on Figure 1-2	Key	Description
1	A, B	Softkeys used to select the display options.
2	MENU	Accesses software to set operational modes, units, and other operational parameters.
3	RUN	Starts the selected mode of operation.
4	STOP	Stops the pump or exits menu structures without saving any changes.
5	ENTER	Accepts the current setting changes in the menu. Most menus with optional settings also have the softkey 'A' labeled 'Select' which performs the same function as this key.
6	ARROW KEYS	These keys are used to select menu options and enter values when setting parameters.

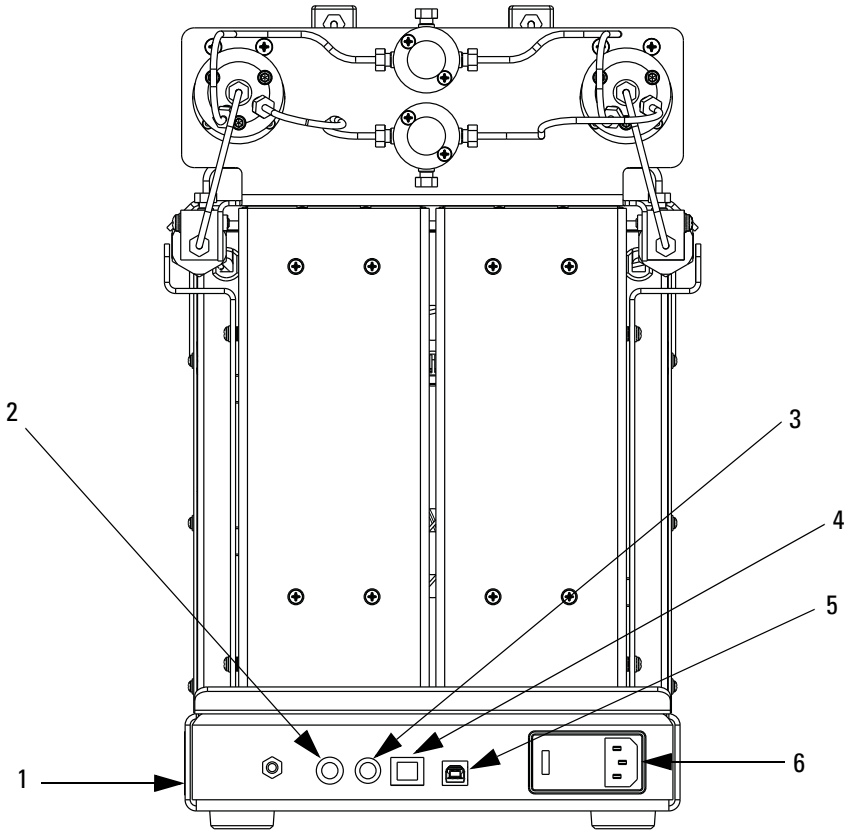


Figure 1-3 Demi pump rear panel connectors for USB/Ethernet

Table 1-4 Demi Pump Rear Panel Connectors for USB/Ethernet

Item No. on Figure 1-3	Connector	Description
1	SERIAL TAG	This tag indicates the serial number on the side of the instrument.
2	ANALOG/DIGITAL OUTPUT	Outputs either 0-10V or 4-20mA control signals depending on factory configuration. Also provides 4 TTL signal outputs to control accessories.
3	ANALOG/DIGITAL INPUT	Accepts either 0-10V or 4-20mA control signals depending on factory configuration. Also accepts 2 TTL signal inputs to control pump operation (external RUN/STOP).
4	ETHERNET	This RJ-45 connector allows external control of the pump through a TCP/IP interface. Refer to Section 7 for Ethernet pin connections.
5	USB	This USB type B connector allows external control of the pump. Refer to Section 8 for USB pin connections.
6	MAINS/FUSES	IEC power connector with fuse cartridge and EMI filter. Replace with same type: (“T” time delay fuses) 1 – 1 Amp fuse for 100/117 volt operation 2 – 0.5 Amp fuses for 234 volt operation

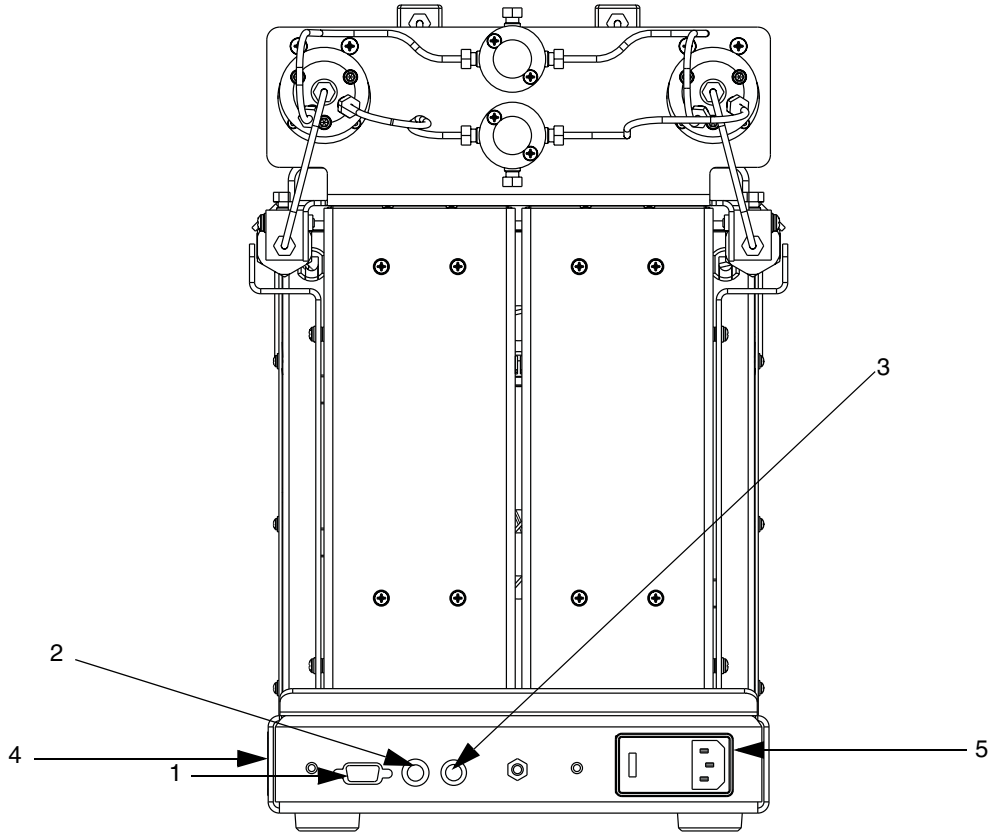


Figure 1-4 Demi pump rear panel connectors for RS-232/RS485

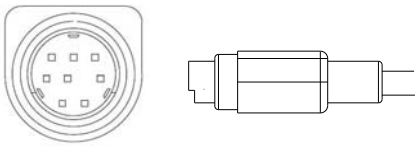
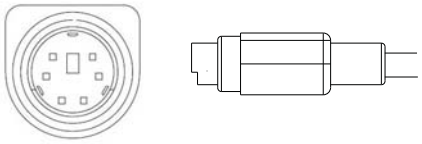
Table 1-5 Demi Pump Rear Panel Connectors for RS-232 / RS-485

Item No. on Figure 1-3	Connector	Description
1	RS-232/RS-485	This serial port connector may be used with an RS-232 or RS-485 cable to place the pump under remote control. Refer to Section 8 for RS-232 and Section 7 for RS-485 pin connections.
2	ANALOG/DIGITAL OUTPUT	Outputs either 0-10V or 4-20mA control signals depending on factory configuration. Also provides 4 TTL signal outputs to control accessories.
3	ANALOG/DIGITAL INPUT	Accepts either 0-10V or 4-20mA control signals depending on factory configuration. Also accepts 2 TTL signal inputs to control pump operation (external RUN/STOP).
4	SERIAL TAG	This tag indicates the serial number on the side of the instrument.
5	MAINS/FUSES	IEC power connector with fuse cartridge and EMI filter. Replace with same type: (“T” time delay fuses) 1 – 1 Amp fuse for 100/117 volt operation 2 – 0.5 Amp fuses for 234 volt operation

The Demi Pump uses 1/8" standard Valco fittings for all ports. A gland nut and single ferrule compress onto the tubing when assembled, and once the ferrule is seated it cannot be easily removed from the tubing. Pipe tape is not used with these fittings. This pump can readily be connected to your existing system with a Valco fitting on one end of a piece of tubing, and the fitting of your choice on the other end of the tubing. Fittings other than the inlet and outlet ports on the two Tee adapters should not need to be adjusted except when performing repairs.

1.4.1 Cabling

Cable part numbers are listed in the following chart:

Analog/digital output cable (8-pin DIN connector) 	P/N 480654300
Analog/digital input cable (6-pin DIN connector) 	P/N 480454300

⚠ CAUTION

Never make any cable connections while the pump is powered ON.

1.5 Preliminary Checkout

After removing the unit from the shipping container, place it on a convenient workspace; then follow this brief test of the pump's operation:

☑ *Note*

Preliminary checkout of the pump is performed without fluid in the pump.

⚠ CAUTION

Always maintain clearance behind the pump such that the MAINS power cord can be unplugged at any time.

1. Plug in the power cord.

2. Toggle the power switch on the front of the unit. The display will momentarily show the software revision and then display the main RUN screen.
3. When initially turned on, the unit should be stopped and display the current pressure offset. The displayed pressure will most likely be other than 0 psi.
4. Press the MENU key and the display will show menu 1 of 4.
5. Press the RIGHT ARROW key twice to display menu 3 of 4.
6. The display should show the selection arrow next to PRESS UNITS. If not, press the UP or DOWN arrow keys to highlight PRESS UNITS.
7. Press the 'A' (SELECT) soft key. The display toggles to select the pressure units. Initially it will probably be set to PSI.
8. Press the 'A' (TOGGLE) soft key to toggle between PSI and BAR. When the pressure units you desire are displayed, press the 'B' (BACK) soft key to set the system units.
9. Press the 'B' (EXIT) key to exit the menu.
10. Observe that the pressure displayed is in the units you selected.
11. At the main RUN screen, press the UP and DOWN arrows, and observe the flow rate displayed changes. When the desired flow rate is displayed, press the 'A' (ACCEPT) soft key within three seconds to set the flow rate. The flow rate can be changed whether the pump is running or not.

☑ Note

If you encountered any problems during the preliminary check-out, please contact the Teledyne Isco Service Department.

☑ Note

In the event of an emergency, turn off the Mains power switch or unplug the unit, either of which will cause the pump to immediately stop.

Demi Pump

Section 2 Fluid System Connections and Accessories

2.1 Introduction

This section discusses general fluid system connections, and the installation of fluid connection accessories, temperature and pressure control accessories, and optional kits and attachments.

⚠ DANGER

RISK OF INJURY. THIS EQUIPMENT PRODUCES HAZARDOUS PRESSURES. USE APPROPRIATE TUBING AND CONNECTIONS AS INSTRUCTED.

2.2 Fluid System Connections

Take care to follow the tips provided to ensure safety and proper operation.

2.2.1 Fitting Assembly

All fluid fittings on the Demi pump are made using 1/8" Valco® zero dead volume ferrules and gland nuts. A gland nut and single ferrule compress onto the tubing when assembled, and once the ferrule is seated it cannot be easily removed from the tubing. Pipe tape is not used with these fittings. This pump can readily be connected to your existing system with a Valco fitting on one end of a piece of tubing, and the fitting of your choice on the other end of the tubing. Fittings other than the inlet and outlet ports on the two Tee adapters should not need to be adjusted except when performing repairs

Figure 2-1 Valco fitting

1. Cut the tubing end squarely. Keep the tube as straight as possible for at least one inch (25mm) from the end to the end of the tube, as this will make it easier to install the ferrules.
2. Do not leave burrs on the ends of the tubing.

3. Insert a gland nut onto the tube with the threaded portion closer to the end of the tube, as shown above.
4. Insert a Valco ferrule onto the tube, with the coned end closer to the end of the tube. Push the ferrule onto the tube about 1/4" from the end of the tube.
5. Insert the tube into the fluid port, ensuring the tube bottoms inside the port.
6. While holding the tube into the port, thread the gland nut into the port.
7. Hold the tubing firmly against the bottom of the port, and tighten the gland nut 1/4 turn beyond finger-tight.
8. Pull on the tubing to make sure it is secure. If the tubing comes out, remove the gland nut and perform steps 2-7 again.
9. Pressurize the fitting with a suitable liquid and check for leaks. If the fitting is leaking, tighten the gland nut about 1/8 turn more.
10. When properly compressed, there will be about .09" (2mm) of tubing protruding from the end of the ferrule, and the ferrule will be crimped onto the tubing. A crimped ferrule should not move or rotate on the tube.
11. Avoid turning the gland nut too tight, as the gland nut may twist off. If the fluid leak cannot be stopped after tightening the gland nut, remove the fitting and repeat the steps with a new gland nut and ferrule.

☑ *Note*

Avoid cross threading the fittings when assembling. Damaging the port by cross threading will require the replacement of the component with the port.

2.2.2 Tubing Requirements

The tubing must be cut squarely to prevent possible problems. Square ends are easier to insert through the ferrule, and will decrease dead volume.

Purchased Cut Tubing

Electrochemically machined steel tubing should be used throughout the plumbing system. Electrochemically machined tubing has flat, burr-free ends, and is free of cutting residues. This tubing is available pre-cut through many chromatographic supply distributors in assorted lengths.

Cutting the Tubing

Purchase a tubing cutter designed to handle steel tubing.

For quick fixes, the tubing may also be cut by hand.

⚠ CAUTION

Wear goggles to perform the following procedure.

Tools required: Fine jewelers file, goggles, and two pairs of pliers

1. Using the jewelers file, score the tubing around its entire circumference.

2. Secure the tubing with pliers on either side of the score line with approximately 1.5mm between each pair of pliers and the score line. Do not squeeze the tubing too tightly, as this will flatten or deform its exterior.
3. Bend the tubing back and forth to crack it at the score line.
4. It may be necessary to deburr the outer tubing ends with the file. Make sure the tubing ends are clean and the inner bore is clear before installing the cut tube.

> ☑ ***Note***
>
> It is often impossible to remove a burr that blocks the inner bore.

2.3 Removing the Pump Cylinder

1. Press the MENU key. The display should show menu 1 of 4.
2. The selection arrow should be pointing to the RUN SETUP option. If not, press the up and down arrows until the RUN SETUP option has the selection arrow adjacent to it.
3. Press the 'A' (SELECT) soft key to open the RUN SETUP option.
4. Note the current setting for this option.
5. Press the 'A' (TOGGLE) soft key to toggle the display until EMPTY ONLY is displayed.
6. Press the 'B' (BACK) soft key to exit the option.
7. Press the 'B' (EXIT) soft key to exit the setup menu.
8. Press the RUN key and wait for the unit to stop.
9. Disconnect the fluid fittings from the cylinder caps. It is not necessary or desirable to remove the cylinder cap from the cylinder.
10. Press the MENU key. The display should show menu 1 of 4.
11. The selection arrow should be pointing to the RUN SETUP option. If not, press the up and down arrows until the RUN SETUP option has the selection arrow adjacent to it.
12. Press the 'A' (SELECT) soft key to open the RUN SETUP option.
13. Press the 'A' (TOGGLE) soft key to toggle the display until REFILL ONLY is displayed.
14. Press the 'B' (BACK) soft key to exit the option.
15. Press the 'B' (EXIT) soft key to exit the setup menu.
16. Press the RUN key and wait for the unit to stop.
17. Using a 9/64" hex wrench, remove the four cap screws at the base of the cylinder.
18. Gently pull the cylinder and cap assembly up and straight off.

2.3.1 Reinstalling the Cylinder

Use care when installing the cylinder to avoid damaging the seal.

1. Apply a suitable fluid (such as IPA) to the seal to help lubricate the seal during installation.
2. Orient the cylinder and cap assembly over the opening in the top of the unit. It is not necessary to remove the cylinder cap from the cylinder.
3. While maintaining the cylinder orientation aligned with the seal and the cylinder opening in the unit, gently push the cylinder down into position. The cylinder flange will bottom with the opening in the unit when the cylinder is fully down.
4. Orient the collar on the cylinder to align the threaded holes.
5. Loosely install the cap screws in the collar and finger-tighten them.
6. Holding the cylinder cap with your fingers, rotate the cylinder clockwise (when viewed from above) until the port is toward the rear of the unit.
7. Install the fluid fitting from the transducer into the port in the cylinder cap. Rotate the cylinder slightly while attaching this fitting to prevent cross threading the gland nut in the port. Finger-tighten the gland nut.
8. Using a 9/64" hex wrench, tighten the four cap screws at the base of the cylinder to 12-16 in-lbs. (1.3-1.8 N-m).
9. Tighten the fluid fitting 1/4 turn beyond finger-tight.
10. Turn the unit on, and check for fluid leaks, tightening fittings as necessary.

2.4 Seal Options for Demi

The pump contains two seals, a backup ring, and a wear ring. These parts are available in a seal replacement kit (60-1249-134) or as a piston rebuild kit (60-1249-137).

Cylinder cap seal – creates the pressure seal between the cylinder and the cylinder cap

Piston seal – This is the main seal in the pump. It seals the pressure between the piston and the cylinder

Backup ring – This ring supports the piston seal when pressure is applied.

Wear ring – The wear ring holds the piston assembly properly away from the cylinder wall to avoid metal to metal contact between the piston and the cylinder.

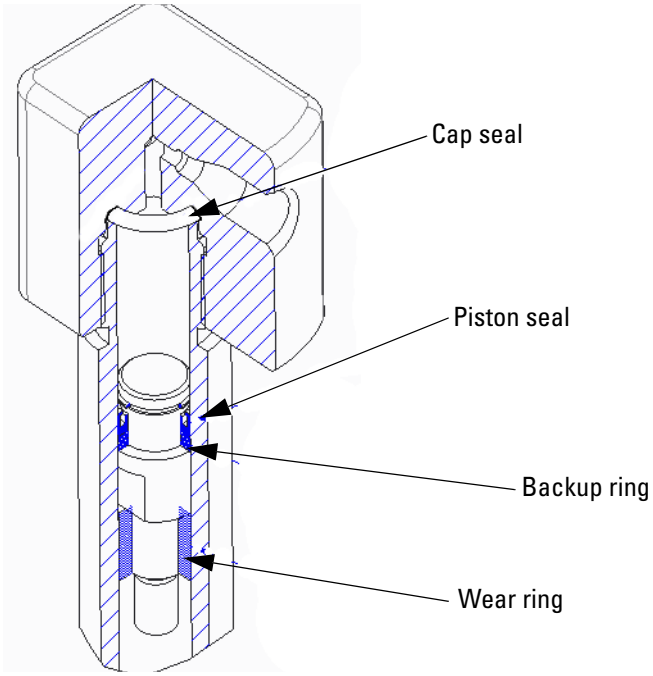


Figure 2-2 Inside the pump cylinder: wetted materials

The standard seals for each pump model satisfy the requirements of most applications.

Demi Pump

Section 3 Basic Programming and Operation

3.1 Introduction

This section will familiarize you with operating the pump.

Operating parameters are entered via the keypad on the front panel of the pump.

3.2 General Controller Information

The following information is intended to familiarize you with operation. Once you have become familiar with the keypad and the main menu, you will find it easy to direct the pumping operations required for your applications.

3.2.1 Rates, Units of Measure, and Limits

To allow pump operation to be tailored to your application, the flow rate units may be set by the user.

The pump also allows user settable refill, as well as the pump delivery flow rate.

The system protection limits may also be set by the user.

3.2.2 Programming Screens

The programming screens are divided into separate menus. These menus are accessed when different features are being programmed.

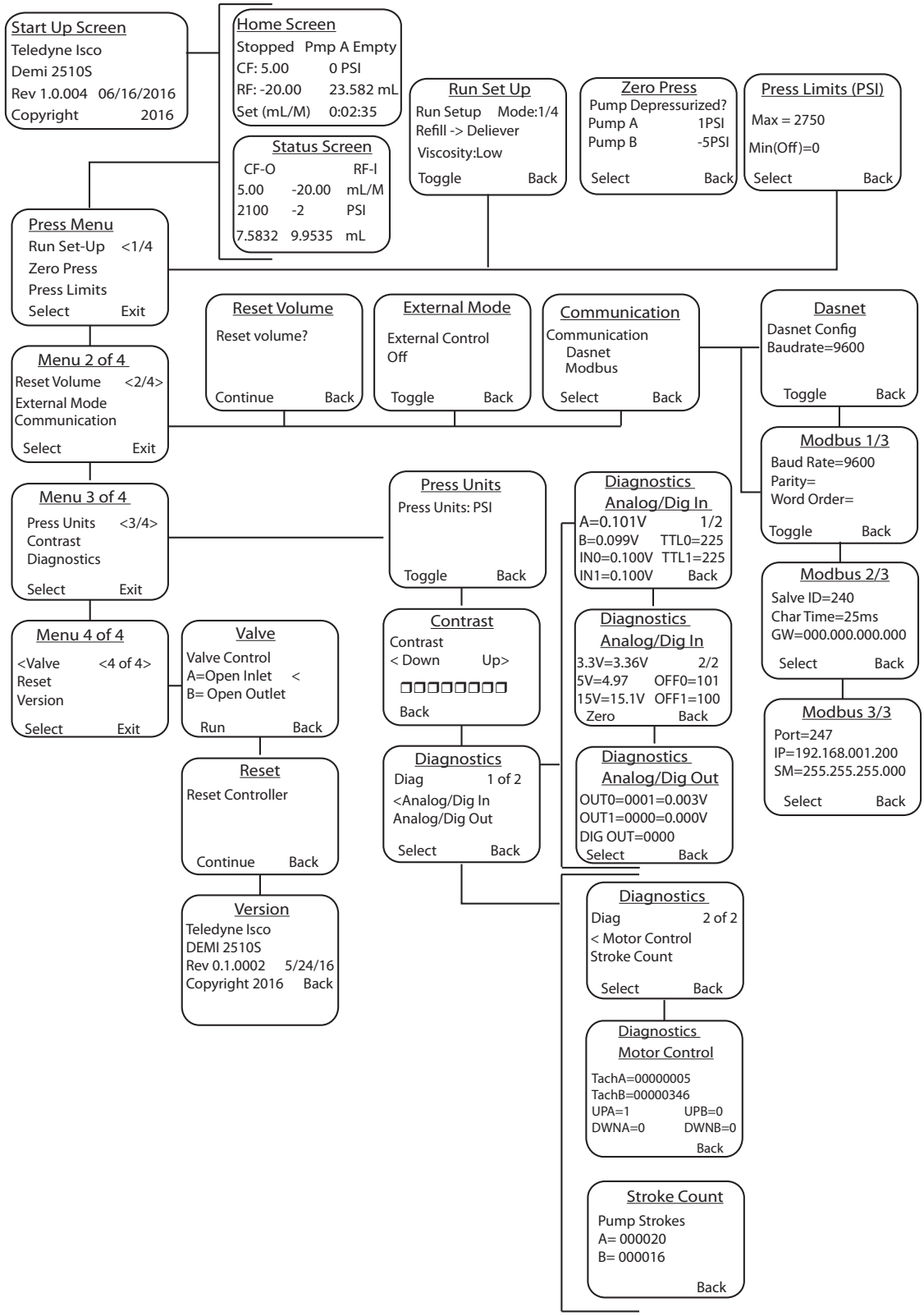


Figure 3-1 Programming Screens

3.2.3 Demi Screens

There are four main menu screens. Access Menu 1 by pressing the MENU key from either the HOME or STATUS screen. To move forward and back between Menus 1, 2, 3 and 4, press the LEFT/RIGHT arrows.

Use the UP/DOWN arrows to move the cursor between the three menu options and use the enter key or 'A' key to select it. Selecting a menu option displays the programming parameters for that option in the corresponding submenu screen.

Start Up Screen

The START UP screen displays the pump family (Demi) and model number on the second row. The software revision number and date are displayed on the third row.

Teledyne Isco	
Demi 2510S	
Rev 1.0.004	06/16/2016
Copyright	2016

Home Screen

The HOME screen displays the current system status, pump status, system pressure, flow rate set points, and run time. The pump system status and any errors for either pump are displayed in the top right corner.

The system status is displayed in the top left corner and any pump or system errors are displayed in the top right corner. The system status can be RUNNING, STOPPED or DWELLING.

The system run timer is displayed in the bottom right corner. This measures the time the entire operational sequence has been running.

The system pressure is displayed below the system status and indicates the pressure of the pump that is currently delivering fluid.

The total volume delivered is displayed below the system run timer.

The delivery flow rate setpoint is preceeded by "CF:" which stands for Constant Flow. The refill flow rate setpoint is preceeded by "RF:" which stands for refill. The units for both setpoints is in mL/minute. The allowable range for the delivery setpoint is 0 to 10.00 mL/min and the allow range for the refill setpoint is 0 to -20.00 mL/min.

The flow rate setpoints are the only settable parameter on this screen and are selected by pressing the left or right arrow keys and a new entry is made by pressing and holding either the up or down arrow key. The new setpoint entry is only accepted after either the enter key or softkey "A" is pressed. Any new entries must be accepted within three seconds of pressing the arrow keys or the entry will revert to the current operational setpoint.

Stopped	Pmp A Empty
CF:5.00	0 PSI
RF: -20.00	23.582 mL
Set (mL/M)	0:02:35

Status Screen

The left column displays four data fields for different operational parameters of pump A and the right column shows the same data fields for pump B.

- The top row displays the pump mode abbreviated to two letters and the valve state abbreviated to one letter seperated by a dash. The pump mode can be CF (Constant Flow), CP (Constant Pressure), RF (Refill), or DW (Dwell). The valve state can be O (Outlet), C (Closed), or I (Inlet).
- The second row displays the current flow rate of each pump.
- The third row displays the current pressure at each pump.
- The bottom row displays the volume remaining in each pump. After powering the system on, this parameter is not initialized until the pump has refilled completely (homed).

A:CF-O	B:RF-I
5.00	-20.00 mL/M
2100	-2 PSI
7.5832	9.9535 mL

Press Menu (Menu 1 of 4)

Navigate the menu using the up/down arrow keys on the keypad selecting an option with either the A or Enter key. The B key will bring the user back to the Home Screen/Status Screen. The left/right arrow key will bring the user to Menu 4 of 4/Menu 2 of 4 respectively.

- **Run Set-Up**: Takes the user to the Run Set Up screen, which sets up how the pumps will run.
- **Zero Press**: Takes the user to the Zero Press screen, which allows the user to depressurize both pump A and B.
- **Press Limits**: Takes the user to the Press Limits screen, which allows the user to set the Maximum and Minimum allowed pressure for the system.

<Run Setup	<1/4>
Zero Press	
Press Limits	
Select	Exit

Run Setup

The second row displays the current mode of operation. The four modes are different combinations of emptying, refilling, and continuously delivering.

- REFILL→DELIVER will refill both pumps and then begin the continuous flow delivery sequence.
- EMPTY →REF →DEL will empty both pumps, refill both pumps, and then begin the continuous flow delivery sequence.
- REFILL ONLY will refill both pumps.
- EMPTY ONLY will empty both pumps

The third row displays the viscosity setting:

- The HIGH setting allows a longer dwell period than the LOW setting at the completion of an empty or refill sequence.

Run Setup	Mode: 1/4
Refill ->Deliver	
Viscosity: Low	
Toggle	Back

Zero Press

Allows the user to zero out the pressure signal offset for the selected pumps. The UP/DOWN arrow keys to indicate your selection and then using either the A or Enter key to select it. The B key will bring the user back to the Press Menu screen. The pump being zeroed must be depressurized and should have its port open to atmosphere.

- **Pump A**: Zero pump A
- **Pump B**: Zero pump B

Pump Depressurized?	
Pump A <	1 PSI
Pump B	-5 PSI
Select	Back

Press Limits

The user can set the pressure limits for the system within this menu utilizing the up/down arrow keys to move the indicator between Maximum and Minimum. After pressing the A or Enter key the user can use the up/down arrow keys to then change the

selected pressure value and then use either the A or Enter key to save the value, otherwise the B key will ignore the change. When a value is not being changed, the B key will bring the user back to the Press Menu screen.

- **Max Press**: Set maximum pressure
- **Min Press**: Set minimum pressure

Pressure Limits (PSI)	
Max=	2750
Min (Off)	0
Select	Back

Menu 2 of 4

Navigate the menu using the up/down arrow keys on the keypad selecting an option with either the A or Enter key. The B key will bring the user back to the Home Screen/Status Screen. The left/right arrow key will bring the user to Press Menu and Menu 3 of 4 respectively.

- **Reset Volume**: Takes the user to the Reset Volume screen, which allows the user to reset the total volume transferred.
- **External Mode**: Takes the user to the External Mode screen.
- **Communication**: Takes the user to the Communication screen, where the user can set up either Dasnet or MODBUS configurations.

Reset Volume	<2/4>
External Mode Communication	
Select	Exit

Reset Volume

Prompts the user if they want to continue or not with resetting the total volume the system has delivered since the last reset, the A key will reset and the B key will bring the user back to Menu 2 of 4.

Reset Volume?	
Continue	Back

External Mode

The second row displays the current external control setting for the back panel analog inputs.

- The OFF setting will ignore any external inputs.
- The ON DELIVER ONLY setting will only read analog input 0 and apply the reading to the Constant Flow delivery setpoint.

- The ON DELIVER+REFILL setting will read both analog input 0 and analog input 1 and apply those readings to the Constant Flow delivery setpoint and the refill setpoint, respectively.
  - For a Demi unit configured for 0 – 10 V input voltage control each setpoint will range from 0.00 mL/min with a 0 V input to the maximum setting with a 10 V input (10.00 mL/min delivery or -20.00 mL/min refill).
  - For a Demi unit configured for 4 – 20 mA input current control each setpoint will range from 0.00 mL/min with a 4 mA input to the maximum setting with a 20 mA input (10.00 mL/min delivery or -20.00 mL/min refill).

Eternal Control	Off
Toggle	Back

Communication

Navigate the menu using the up/down arrow keys on the keypad selecting an option with either the A or Enter key. The B key will bring the user back to Menu 2 of 4.

- **Dasnet**: Brings user to the menu for configuring Dasnet.
- **MODBUS**: Brings user to the menu for configuring both MODBUS RTU and MODBUS TCP

Communication	
<Dasnet	
MODBUS	
Select	Back

- **Dasnet**

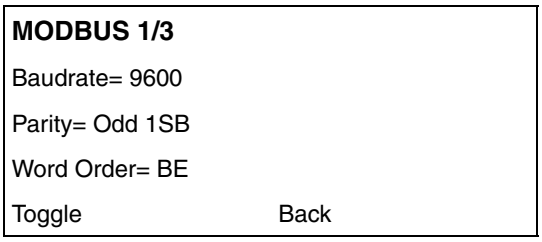
Pressing the A key on this screen will toggle the baud rate for Dasnet communications. The B key will bring the user back to the Communication screen.

Dasnet	
Dasnet Config	
Baudrate=9600	
Toggle	Back

- **MODBUS (Menu 1 of 3)**

Navigate the menu using the up/down arrow keys on the keypad selecting an option with either the A or Enter key. The B key will bring the user back to the Communication Screen. The left/right arrow key will bring the user to MODBUS 2 of 2 in an RS232 system or MODBUS 3 of 3/MODBUS 2 of 3 in a USB system.

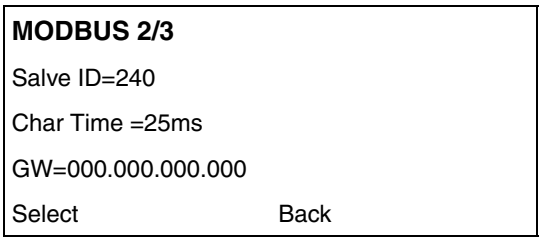
- **Baudrate**: The A or Enter key with the cursor on this line will toggle the baud rate between the allowed values.
- **Parity/SB**: The A or Enter key with the cursor on this line will toggle the Parity from Odd, Even, or None and the Stop Bit from one to two.
- **Word Order**: The A or Enter key with the cursor on this line will toggle the Word Order between Big Endian and Little Endian.



MODBUS Menu 2 of 3

Navigate the menu using the up/down arrow keys on the keypad selecting an option with either the A or Enter key. The B key will bring the user back to the Communication Screen. The left/right arrow key will bring the user to MODBUS in a RS232 system or to MODBUS/MODBUS 3 of 3 in a USB system.

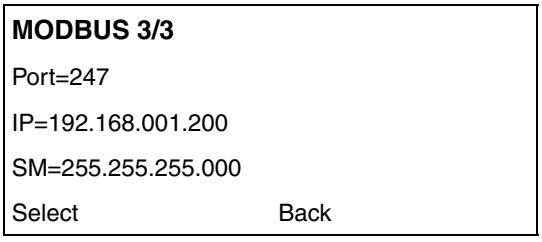
- **Slave ID**: The A or Enter key with the cursor on this line will allow the user to use the up/down arrow keys to change the Slave ID of the device, pressing A or Enter to accept the value.
- **Char Time**: The A or Enter key with the cursor on this line will allow the user to use the up/down arrow keys to change the character time of the device, pressing A or Enter to accept the value.
- **GW**: (For MODBUS TCP only) With the cursor on this line, the left/right arrow key will allow the user to select which part of the Default Gateway to change. The A or Enter key will select the value where the cursor is located and the up/down arrow key will then allow the user to make changes hitting A or Enter to accept the set value.



MODBUS Menu 3 of 3 (MODBUS TCP Only)

Navigate the menu using the up/down arrow keys on the keypad selecting an option with either the A or Enter key. The B key will bring the user back to the Communication Screen. The left/right arrow key will bring the user to MODBUS 2 of 3/MODBUS respectively.

- **Port**: With the cursor on this line, the A or Enter key will allow the user to use the up/down arrow keys to change what port the device is on, pressing A or Enter again to accept the set value.
- **IP**: With the cursor on this line, the left/right arrow key will allow the user to select which part of the IP address to change. The A or Enter key will select the value where the cursor is located and the up/down arrow key will then allow the user to make changes. Press the A or Enter key to accept the set value.
- **SM**: With the cursor on this line, the left/right arrow key will allow the user to select which part of the Subnet Mask to change. The A or Enter key will select the value where the cursor is located and the up/down arrow key will then allow the user to make changes. Press the A or Enter key to accept the set value.



Menu 3 of 4

Navigate the menu using the up/down arrow keys on the keypad selecting an option with either the A or Enter key. The B key will bring the user back to the Home Screen/Status Screen. The left/right arrow key will bring the user to Menu 2 of 4/Menu 4 of 4 respectively.

- **Press Units**: The A or Enter key with the cursor on this line will display the Press Units screen.
- **Contrast**: The A or Enter key with the cursor on this line will display the Contrast screen.
- **Diagnostics**: The A or Enter key with the cursor on this line will display the Diagnostics screens.

< Press Units	<3/4>
Contrast	
Diagnostic	
Select	Exit

Press Units

Pressing the A or Enter key on this screen will toggle the pressure units. The B key will return the user to Menu 3 of 4.

Press Units: PSI	
Toggle	Back

Contrast

The left/right arrow keys on this screen adjust the screen contrast. The A key will reset to the default value and the B key will return the user to the Menu 3 of 4 screen.

Contrast	
<Down	UP>
❒❒❒❒❒❒❒	
Back	

Diagnostics

- Diagnostics 1 of 2:
  Allows selection of either the analog/digital input submenu or the analog/digital output submenu.

Diag	1 of 2
<Analog/Dig In	
Analog/Dig Out	
Select	Back

- Diagnostic Analog/Dig In 1 of 2:
  "A" and "B" are the voltage input readings for each pressure transducer. "IN0" and "IN1" are the voltage input readings for each analog input. All four of these readings are scaled to the voltage range of the analog to digital converter (0.1 – 3.2 V). "TTL0" and "TTL1" display time-averaged variables for the digital input states. The range for these variables is 0-255. Zero indicates a steady logic low over time and 255 indicates a steady logic high over time.

A=0.101V	1/2
B=0.099V	TTL0=255
IN0=0.101V	TTL1=255
IN1=0.100V	Back

- Diagnostics – Analog/Dig In 2/2:
  "3.3V", "5V", and "15V" are the voltage readings of the internal voltage supply rails. "OFF0" and "OFF1" display the external analog input offset values in units of millivolts. The offset values can be reset by selecting them with the up and down arrow keys and then pressing the A key. Each analog input has pulldown resistors to give 0 V at the back panel connector with no external voltage applied.

3.3V=3.36V	2/2
5V=4.97V	OFF0=101<
15V=15.1V	OFF1=100
Zero	Back

- Diagnostic Analog/Dig Out:
  "OUT0" and "OUT1" are the analog outputs displayed both in digital and voltage representations. The digital range is 0 – 4095 and the voltage range is 0 – 10.248 V. The analog outputs can be set manually by selecting them with the up and down arrow keys, pressing the enter key or A key, and then pressing the up or down arrow keys to adjust the digital output value. "DIG OUT" is a binary representation of the digital output states. The four bits represent digital outputs 0,1,2 and 3 from left to right. A zero indicates that the open collector output is logic low and a one indicates that it is logic high.

OUT0=0001=0.003V	
OUT1=0000=0.000V	
DIG OUT=0000	
Select	Back

- Diagnostics 2 of 2:
  Allows selection of either motor control submenu or stroke count submenu.

Diag	2 of 2
Motor Control <	
Stroke Count	
Select	Back

- Diagnostic Motor Control:
  - "TACHA" and "TACHB" are the digital values that represent the total number of tachometer counts from the current piston position from the bottom of the cylinder for each pump. After powering the system on, these parameters are not initialized until each given pump has refilled completely (homed).
  - "UPA", "DWNA", "UPB" and "DWNB" are the digital states of the optical interrupter flags for each pump. The "UP" flags are for at the top of the piston travel range (cylinder empty), and the "DWN" flags are at the bottom of the piston travel range (cylinder full). A zero indicates that the flag is not interrupted and a one indicates that the flag is interrupted.

TachA=00000005	
TachB=00000346	
UPA=0	UPB=0
DWNA=0	DWNB=0
	Back

Stroke Count

- Diagnostics Stroke Count:
  "A" and "B" are the total stroke counts for each pump. A stroke is counted each time a pump refills into the bottom interrupter flag during the continuous flow delivery sequence.

Pump Strokes
A=000020
B=000016

Menu 4 of 4

Navigate the menu using the up/down arrow keys on the keypad selecting an option with either the A or Enter key. The B key will return the display to the HOME SCREEN/STATUS Screen. The left/right arrow key will display Menu 3 of 4/Menu 1 of 4 respectively.

- **Valve**: With the cursor on this line, the A or Enter key will display the VALVE screen where the valve position can be modified.
- **Reset**: With the cursor on this line, the A or Enter key will display the RESET screen, where the pump can be reset to original settings.
- **Version**: With the cursor on this line, the A or Enter key will display the VERSION screen, where the version is shown.

< Valve	<4/4>
Reset	
Version	
Select	Exit

Valve

This menu allows the user to modify the current position of the respective valves, using the up/down arrow keys to select which valve to toggle the position of and the A or Enter key to actually change the valve position. The B key will return Menu 4 of 4.

- A = Toggle the position of valve A.
- B = Toggle the position of valve B.

Valve Control	
A=Open Inlet	
B=Open Outlet	
Run	Back

Reset

Prompts the user if they want to continue or not with resetting the pump to default values, the A key will reset and the B key will return to Menu 4 of 4.

Reset Controller	
Continue	Back

Version screen

Displays the version of code currently on the pump, the B key will return to Menu 4 of 4.

Teledyne Isco	
Demi 2510S	
Rev 0.1.0002	05/24/2016
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3.3 External Control

The serial interface allows you to control the pump operation from an IBM-PC or compatible. The options are either RS-232 or USB (DASNET), RS-485(MODBUS RTU), or Ethernet (MODBUS TCP).

For more information See Section 6 *Serial Interface* (RS-232, USB) or Section 5 *MODBUS Configuration* (MODBUS RTU, MODBUS TCP).

3.4 External Control: Analog

The Demi syringe pump has two analog input channels that can accept either 0-10V or 4-20mA signals depending on the factory configuration. Analog Input 0 controls the system delivery flow rate set point (CF) and spans from 0 to 10 mL/min. Analog Input 1 controls the system refill flow rate set point (RF) and spans from 0 to -20 mL/min.

3.4.1 Wire connections

Two wires are required for analog control. The analog common or ground wire should be connected to pin 6 (green) on the 6 pin DIN connector. Pin 3 ANALOG IN 0 (red) will set the delivery flow rate of the system. Pin 4 ANALOG IN 1 (orange) will set the refill flow rate of the system.

☑ *Note*

For the 4-20ma input option the negative output wire connects to the analog ground DIN pin 6. The positive connects to pin 7 (flow rate) and pin 8 (refill flow rate) on the 8 pin DIN connector.

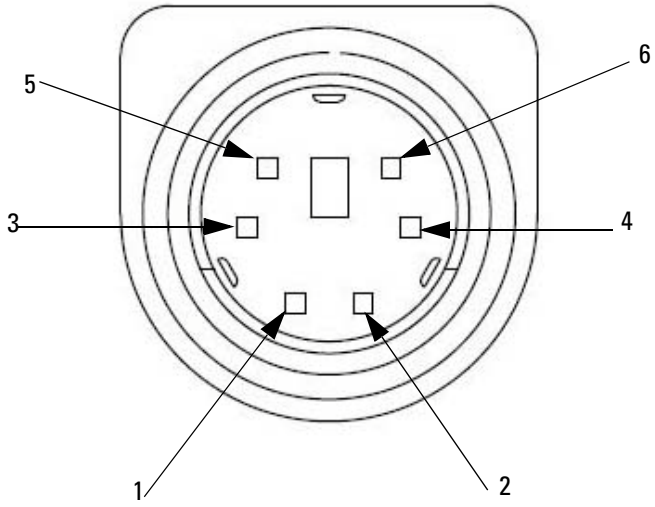


Figure 3-2 DIN (Input) Connector

Pin	Color	Function
1	Black	TTL IN 0 (RUN/STOP)
2	Brown	TTL IN 1 (REFILL)
3	Red	ANALOG IN 0
4	Orange	ANALOG IN 1
5	Yellow	DIG GND
6	Green	ANLG GND

3.5 Remote RUN/STOP

The Demi syringe pump has two TTL input channels to control the RUN/STOP function and REFILL function. The input channels operate at a 5-volt level and can be controlled by switch contact closure or TTL input. Both channels are pulled high internally.

- TTL input channel 0 controls the remote RUN/STOP function of the pump system. When TTL input 0 transitions from low to high the system will run (equivalent to pressing the RUN key). When TTL input 0 transitions from high to low the system will stop (equivalent to pressing the STOP key). The RUN and STOP keys are still functional when using the remote RUN/STOP function.
- TTL input channel 1 controls the remote REFILL function of the pumps system which runs the system in "REFILL ONLY" mode. It is activated when TTL input 1 transitions from low to high. This sequence can only be actived while the system is stopped.

3.5.1 Wire Connections

Each of the two TTL input channels requires two connections. The digital common or ground wire for both input channels should be connected to pin 5 DIG GND (yellow) on the 6-pin DIN connector. Pin 1 RUN (black) is the positive connection for RUN/STOP (channel 0). Pin 2 REFILL (brown) is the positive connection for the REFILL input (channel 1). See Figure 3-2.

3.6 Analog Output

The Demi syringe pump has two analog output channels that can be either 0-10V or 4-20mA signals depending on the factory configuration. Analog Output 0 varies with the system pressure and spans from zero pressure to the programmed maximum pressure limit. Analog Output 1 varies with the system delivery flow rate and spans 0 – 10 mL/min.

3.6.1 Wire Connections

Each of the two analog output channels requires two connections. The analog common or ground wire for both output channels should be connected to pin 6 ANLG GND (green) on the 8-pin DIN connector. Pin 7 ANLG OUT 0 (blue) is the positive connection for the system pressure signal. Pin 8 ANLG OUT 1 (violet) is the positive connection for the system flow rate signal. See Figure 3-3.

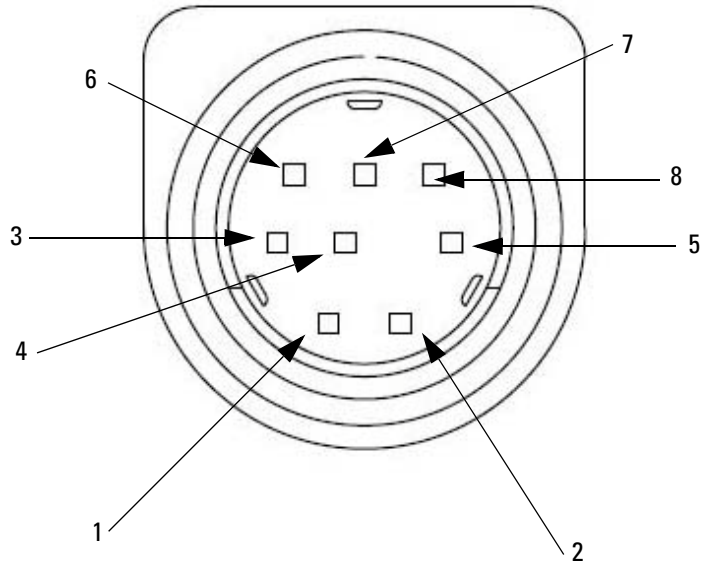


Figure 3-3 DIN (Output) Connector

Pin	Color	Function
1	Black	For Future Use
2	Brown	For Future Use
3	Red	For Future Use
4	Orange	For Future Use
5	Yellow	DIG GND

6	Green	ANLG GND
7	Blue	ANLG OUT 1
8	Violet	ANLG OUT 2

Demi Pump

Section 4 Continuous Flow Introduction, Installation, & Operation

4.1 Introduction

A Demi continuous flow pumping system is a complete system. This pump has two cylinders that provide flow from one while the other is refilling. The switching valves are integral with the unit, and there is no external controller. The unit is a complete, self-contained package.

In any syringe pump continuous flow system, a flow irregularity occurs when the delivery is changed from one pump module to the other. This flow irregularity can be measured as a pressure fluctuation. Teledyne Isco pressure fluctuation at switchover is at ±60 psi.

4.2 Continuous Flow Electric Valves

The Demi pump comes standard with continuous flow electric valves. These provide the best positive valve closure. Since these are standard with the Demi pump, no additional hardware is required for their use.

4.3 Continuous Flow

Once your Demi pump has been properly installed and you have ensured that fluid connections are leak free, the system is ready for operation. No special operating programming is required to operate the pump in continuous flow mode.

☑ *Note*

Teledyne Isco convention is to name the pumps as “pump A” being the cylinder on the left when facing the front of the unit and “pump B” being the cylinder on the right.

☑ *Note*

The Demi pump cannot be operated in Independent Mode. Independent Mode is defined as a state where the two cylinders can be operated independently or treated as two single cylinder pumps.

When initially starting the Demi pump, there may be air in the cylinder and tubing. This air can be purged from the unit by supplying a working fluid to the inlet, directing the outlet fluid to waste, and running the pump through several cycles without restriction on the delivery. Failure to purge the air out of the system before using the pump may introduce significant unwanted air into your apparatus. It is your responsibility to determine if this air in your system is objectionable.

The Demi pump operates in a 'continuous flow' mode, meaning that the working fluid will be delivered at a constant flow rate (within the specification limits) for as long as the pump is running and the supply reservoir is available. This is accomplished by one cylinder delivering the fluid flow at a constant rate while the other cylinder is refilling and stabilizing at system pressure. When the first cylinder becomes close to empty, the flow is transferred to the other cylinder; and the first cylinder refills and stabilizes. This cycle is repeated indefinitely.

4.4 Back Pressure Regulation

The back pressure regulator option from Teledyne Isco reduces flow noise and improves pump performance at pressures less than 3.5 bar. Two back pressure regulators are available:

- 7 bar, part#209-9012-22
- 5 bar, part#209-9012-21

Fittings to connect the tubing to the regulators are supplied.

Demi Pump

Section 5 MODBUS Configuration

5.1 Overview

MODBUS is a simple command/response mechanism to read from and write to specific memory locations called *registers*. A register is a holding place for a piece of digital information within the equipment. For more information on MODBUS, please refer to the following documents which can be found on the www.modbus.org website: Modbus Application Protocol Vol. 1 and Modbus Over Serial Line Vol. 1[2] and Modbus Messaging on TCP/IP.

The Isco Demi pump supports the MODBUS RTU and MODBUS TCP/IP protocols.

> **Note**
>
> The choice of MODBUS RTU or MODBUS TCP/IP must be made at the time of purchase. A unit with MODBUS RTU will not have provisions for MODBUS TCP/IP, nor will a unit with MODBUS TCP/IP have provisions for MODBUS RTU. Converting a unit from one MODBUS protocol to the other is not supported.

5.1.1 MODBUS RTU

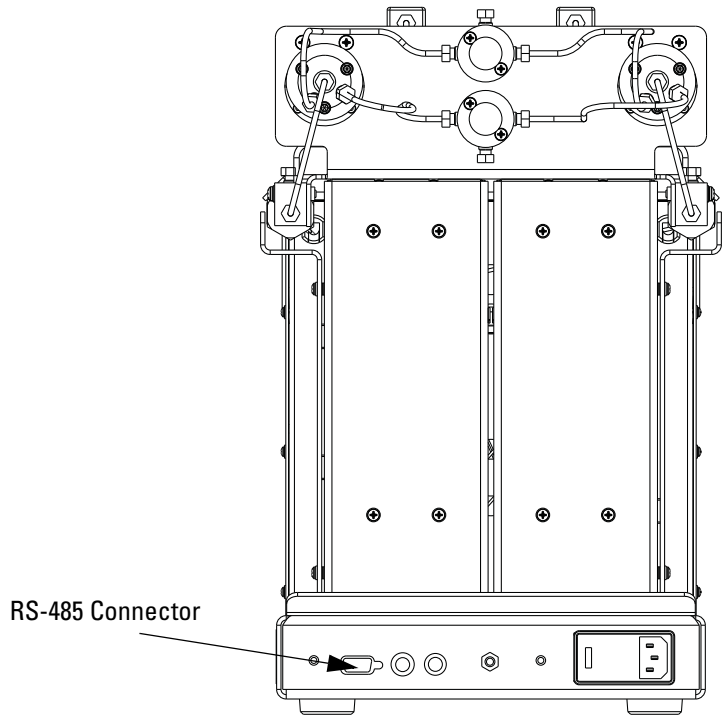


Figure 5-1 Back panel of Demi with RS232/RS485

The MODBUS RTU protocol implementation uses a 2-wire RS-485 connection. The RS-485 connections are located on the DB9 connector labeled RS-232/RS-485. The matching connection is a D-Subminiature 9-pin standard plug, such as an AMP part #5745988-6 from an electronic parts supplier.

MODBUS RTU Pin Out DB-9	
Pin 1 RS485A	A or +
Pin4 RS485B	B or –
Pin9 DSGND	GND

⚠ WARNING

Connecting devices to energized circuits may cause personal injury or property damage. Power must be removed from the pump before connecting external devices.

5.1.2 MODBUS TCP/IP

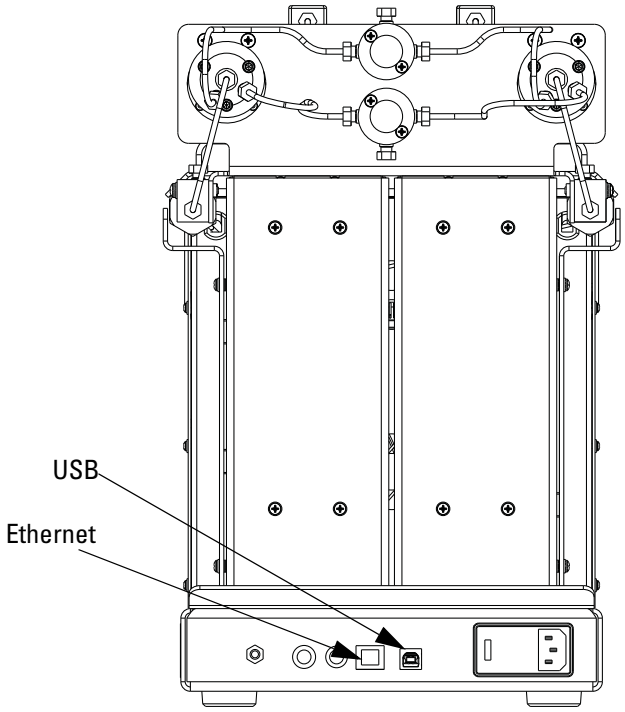


Figure 5-2 RJ 45 Connection with USB/Ethernet

The MODBUS TCP/IP protocol implementation uses an ethernet connection. The ethernet connections are located on the optional RJ45 connector labeled USB/Ethernet.

5.1.3 MODBUS Configuration Options

To access the MODBUS configuration settings:

1. Turn power ON and wait for startup screen to close.
2. Press the STOP key.
3. Press the MENU key.
4. Press the RIGHT ARROW key once to access Menu 2 of 4.
5. Press the DOWN ARROW key twice to place the selection arrow beside the COMMUNICATION option.
6. Press the SELECT key.
7. Press the DOWN ARROW key once to place the selection arrow beside the MODBUS option.
8. Using the UP/DOWN and LEFT/RIGHT keys, select your setting choices as shown in Tables 5-1 or 5-2.
9. Press BACK to return to the COMMUNICATION screen.

Table 5-1 MODBUS TCP/IP Configuration Options

Item	Description
IP Address	Internet protocol address of device (Default when reset 192.168.1.200)
Subnet Mask	Subnet mask (Default 255.255.255.0)
Gateway	Gateway (Default 0.0.0.0)
Port	TCP port (Default 502)

Table 5-2 MODBUS RTU Configuration Options

Item	Value	Description
Baud Rate	300, 1200, 2400, 4800, 9600	Communication Speed (Default 9600)
Slave ID	1-247	Device address (Default 1)
Parity	Even 1 Stop Bit, Odd 1 Stop Bit, None 1 Stop Bit, None 2 Stop Bit	Communication parameters (Default Even 1 Stop Bit)
Word Order	Big Endian, Little Endian	Word order for 32-bit integers and IEEE-754 floating point numbers. Big Endian: AB CD; Little Endian CD AB. (Default Big Endian)
Character Time	Min: Baud Rate dependent Max: 999ms	Time to transmit single character t1. Used to calculate inter frame and inter character space t1.5, t3.5 (50 m sec default)

Table 5-3 Supported MODBUS Function Codes

Function Code	Description
01	Read Discrete Output Coils
03	Read Analog Output Holding Registers
05	Write Single Discrete Output Coil
15	Write Multiple Discrete Output Coils
16	Write Multiple Analog Output Holding Registers

Table 5-4 Exception Responses

Exception Code	Name	Description
01	Illegal Function	Function code received is not supported.
02	Illegal Data Address	Data address received is not an allowable address.
03	Illegal Data Value	A value contained in the query data field is not an allowable value for the addressed location. This may indicate a fault in the structure of the remainder of a complex request, such that the implied length is incorrect. Does NOT mean data value is outside the expectation of the controller.

Table 5-5 Coils

Register	Address	Type	Size	Description
00001	0	R/W	1 BIT	0: Stop Pump 1: Run Pump
00002	1	R/W	1 BIT	1: Zero pressure sensor offset for Pump A
00003	2	R/W	1 BIT	1: Zero pressure sensor offset for Pump B
00004	3	R/W	1 BIT	1: Reset total volume delivered
00005	4	R/W	1 BIT	1: Set Run Configuration to Refill before delivery
00006	5	R/W	1 BIT	1: Set Run Configuration to Purge then refill before delivery
00007	6	R/W	1 BIT	1: Set Run Configuration to Refill only
00008	7	R/W	1 BIT	1: Set Run Configuration to Purge only
00009	8	R/W	1 BIT	0: Disable External Operation 1: Enable External Operation
00010	9	R/W	1 BIT	For future use
00011	10	R/W	1 BIT	1: Pressure Units = BAR

Table 5-5 Coils (Continued)

Register	Address	Type	Size	Description
00012	11	R/W	1 BIT	For future use
00013	12	R/W	1 BIT	1: Pressure Units = PSI
00014	13	R	1 BIT	0: Transducer connected 1: Transducer disconnected
00015	14	R	1 BIT	1: Valve Error
00016	15	R	1 BIT	1: System is overpressure
00017	16	R	1 BIT	1: System is underpressure
00018	17	R	1 BIT	1: Motor Failure

Table 5-6 Holding Registers

Register	Address	Read/ Write	Type	# of Registers	Description	Units
40001	0	R/W	FLOAT	2	Delivery flow rate set point	ml/min
40003	2	R/W	FLOAT	2	Refill flow rate set point	ml/min
40005	4	R/W	FLOAT	2	Maxium pressure set point	PSI, BAR
40007	6	R/W	FLOAT	2	Minimum pressure set point	PSI, BAR
40009	8	R	FLOAT	2	System pressure	PSI, BAR
40011	10	R	FLOAT	2	System flow rate	ml/min
40013	12	R	FLOAT	2	Total volume delivered	ml
40015	14	R	FLOAT	2	Analog voltage input Digital/Analog Input 3 (IN0)	V or mA
40017	16	R	FLOAT	2	Analog voltage input Digital/Analog Input 4 (IN1)	V or mA
40019	18	R	FLOAT	2	Run time	s
40021	20	R	FLOAT	2	Stroke count for cylinder A	
40023	22	R	FLOAT	2	Stroke count for cylinder B	
40025	24	R/W	FLOAT	2	Position of Valve A	
40027	26	R/W	FLOAT	2	Position of Valve B	
40101	100	R	FLOAT	2	Software Major Rev	
40103	102	R	FLOAT	2	Software Minor Rev	
40105	104	R	FLOAT	2	Software Micro Rev	
40107	106	R	FLOAT	2	Unit identification	

☑ ***Note***

Pressure and flow rate based on user selected units.

Demi Pump

Section 6 Serial Interface

6.1 Overview

The Teledyne Isco Demi pump can be remotely controlled by a computer through a built-in RS-232-C serial or USB interface.

You can write your own custom program to control Isco syringe pumps using any format, such as BASIC or C++. This section provides the syntax and responses for serial commands. Simplified examples of programs are also provided. Writing programs for serial control requires substantial knowledge of the software language used, so Isco does not provide support for developing your own programs.

6.2 Network Control and Communication

Network communications are always initiated by the network controller, which is typically a computer. Messages from the instruments are in response to messages from the network controller. All information on the network is transmitted as groups of ASCII characters called frames. The message frames contain the origin of the message, the destination of the message, and a checksum to verify the validity of the message.

Each instrument is provided with a method of selecting a baud rate. It is also important that each unit's baud rate is set to the same speed. Possible baud rates are **1200** and **19200**. Other baud rates of 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 are supported by the Demi pump, but are not part of the Teledyne Isco defined communications standard.

Electrical standards are RS-232-C; connector pin usage is outlined in Table 6-1. Characters consist of 1 start bit, 8 data bits (low order first with 8^{th} bit always set to zero), and 1 stop bit. There is no parity bit used. All characters will be printable ASCII characters. Control characters (0-1FH) are ignored except for carriage return (0DH).

The baud rate can be changed from the default values through the MENU key. Select COMMUNICATION under the menu; and adjust the values using the softkeys.

⚠ WARNING

Connecting devices to energized circuits may cause personal injury or property damage. Power must be removed from the pump before connecting external devices.

Table 6-1 External Control Connector Serial Pin Connections

Name	Use
PIN 2 TXD Transmit	Serial interface data output. Standard RS-232-C signal levels.
PIN 3 RXD Receive	Serial interface data input. Standard RS-232-C signal levels.
PIN 5 COMMON (Ground)	Signal common for all signals.
PIN 8 CTS	Clear to send output.

6.3 USB Interface

The Isco Demi syringe pump controller may include an optional USB interface. The USB connections are located on the pump controller rear panel labeled USB/Ethernet. The drivers for the

USB can be downloaded from:

http://www.isco.com/support/updates.asp

The connector is a standard USB B-type.

⚠ WARNING

Connecting devices to energized circuits may cause personal injury or property damage. Power must be removed from the pump before connecting external devices.

Connect the 9-pin serial output port of the computer to the RS-232-C port (Figure 6-1). With this configuration, your sample program is capable of constant flow.

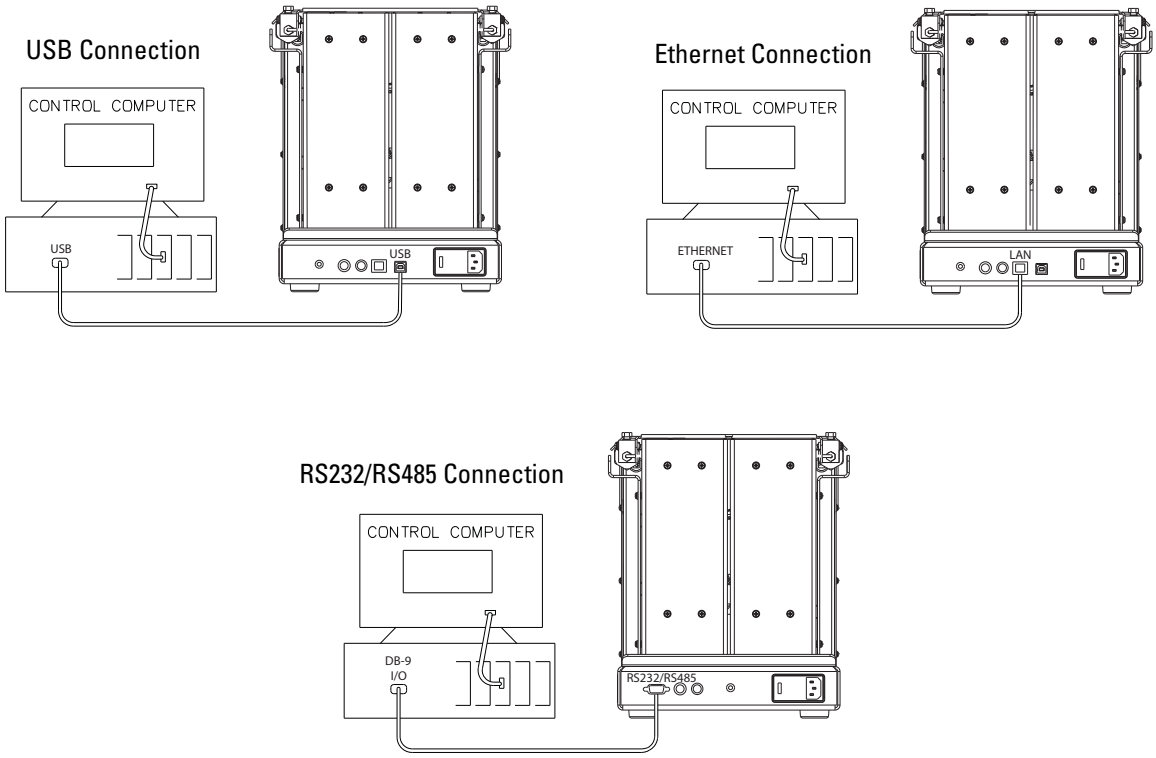


Figure 6-1 Three options for external connection connections

6.4 Controller Setup

Once the system is properly connected, turn the pump, and computer on. Factory default settings are baud rate 9600 and unit ID #7.

> ☑ ***Note***
>
> The unit ID of the Demi pump is '7' and cannot be changed.

6.4.1 To Restore Defaults

To restore defaults, press MENU > LEFT ARROW> RESET. **Resetting a system erases all user settings.**

6.4.2 Change Defaults

1. Press Menu > RIGHT ARROW > COMMUNICATION > DASNET > BAUDRATE

> ☑ ***Note***
>
> All units in the network must be set to the SAME baud rate.
>
> 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.

6.5 Serial Commands for the Demi Pump

Table 6-2 is a list of the serial commands recognized by the pump. These commands are the message part of the DASNET protocol. The operand always follows the equals sign. The REMOTE command must be sent once, before any command that changes the operation of the pump will be accepted.

> ☑ ***Note***
>
> When setting a value, the serial command will always be followed by an equal sign.

Table 6-2 Serial Commands

Command	Description
ANALOG0	Status of the analog voltage input on Digital/Analog Input 3
ANLAOG1	Status of the analog voltage input on Digital/Analog Input 4
CONFIG	Returns the Run Configuration. See *Press Menu (Menu 1 of 4) page 3-5* for additional information.
CONFIG=#	Enter # to designate the Run Configuration: See *Press Menu (Menu 1 of 4) page 3-5* for additional information. 1. Refill before delivery 2. Purge then refill before delivery 3. Refill only 4. Purge only
FLOW	Returns the actual system flow rate in ml/min
GET	Gets the system information. R019=00001,00002,00003,00004,00005,00006,0007,0008,0009 CS 00001=A pump Tach. wheel count 00002=B pump Tach. wheel count 00003=A pump Flow rate set point 00004=B pump Flow rate set point 00005=A pump actual flow rate 00006=B pump actual flow rate 00007=A pump actual pressure 00008=B pump actual pressure 00009=System actual pressure
IDENTIFY	Returns the model of the pump as well as the internal pump program software revision
LIMITS	Returns the pressure limits
MAXPRESS	Returns the maximum pressure set point.
MAXPRESS=#	Enter # to designate the maximum pressure set point

Table 6-2 Serial Commands (Continued)

Command	Description
MINPRESS	Returns the minimum pressure set point
MINPRESS=#	Enter # to designate the minimum pressure set point
PRESS	Returns the system pressure
REFILL	Returns the refill flow rate limit in ml/min
REFILL=#	Enter # to designate refill rate in ml/min. Format is XX.XX ml/min with leading and trailing zeros optional
RUN	Initiates pumping
SETFLOW	Returns the flow rate set point in ml/min
SETFLOW=#	Enter # to designate deliver rate in ml/min. Format is XX.XX ml/min with leading and trailing zeros optional
STATUS	Returns with status of the system. May be any combination of responses listed below. STATUS=STOP /RUN PROBLEM= OVER PRESSURE / UNDER PRESSURE / MOTOR FAILURE / VALVE FAILURE / TRANSDUCER FAILURE / FLAG FAILURE / CF FAILURE / POSITION ERROR
STATUSA	Returns the status of the specified pump/valve, listed below are possible responses.
STATUSB	PUMP MOTOR FAILURE / PUMP POSITION ERROR / VALVE STALL ERROR / VALVE MOVING ERROR / PUMP TRANSDUCER FAILURE / PUMP FLAG FAILURE / PUMP POOR FILL / NO ERROR
STOP	Stops the drive motor
STROKE	Returns the stroke count for both cylinders. Refer to Section 7.1.1 for additional information
UNITS	Returns the pressure units
UNITS=	Enter the desired pressure units after the equal sign. Acceptable values are: PSI, BAR
VOL	Returns the total volume delivered
VOL RESET	Resets the total volume delivered to zero
VPOSA VPOSB	Returns the position of the valve
VPOSA=#	Moves the valve to the specified position
VPOSB=#	1 Valve Outlet 2 Valve Closed 3 Valve Inlet
ZEROA	“Zeros” the pressure sensor offset
ZEROB	

6.5.1 Error Messages

If an error occurs in a message, one of the following responses will be sent. The format of an error message is "PROBLEM=_____." Refer to Table 6-3.

Table 6-3 Error Messages

Error	Description
PROBLEM=INVALID COMMAND	The command sent was not recognized by the pump.
PROBLEM=INVALID OPERAND	The operand (character(s) following the = sign) is missing or is incorrect; *e.g.*, the number was too large.
PROBLEM=PUMP RUNNING	The command sent is only valid when the pump is stopped.
PROBLEM=OVERPRESSURE PROBLEM=UNDERPRESSURE	Sent in response to a high or low pressure limit condition.
PROBLEM=CYLINDER EMPTY	Sent when the pump cylinder is empty.
PROBLEM=CYLINDER FULL	Sent when the pump cylinder is full.
PROBLEM=MOTOR FAILURE	The pump motor has a failure
PROBLEM=POSITION ERROR	The pump motor has a position error
PROBLEM=VALVE FAILURE	One of the valves has failed to move correctly
PROBLEM=TRANSDUCER FAILURE	The pressure transducer is not sending the system a good transducer voltage
PROBLEM=FLAG FAILURE	One of the limit flags (empty, full) is not working correctly

6.6 DASNET Protocol

Table 6-4 Example of a Visual C++ Program to Demonstrate Conversion of Pump Commands to DASNET Frames

```
// Dasnet.cpp : Defines the entry point for the console application.
// A 'C,C++' example of DASNET serial control
//Written in VC++ 2010
#include "stdafx.h"
#include <windows.h>
#include<stdio.h>
#include<conio.h>
#include<string.h>

void commOpen(int port, long speed);
void conv_das(char *, char *);
void dgets(char *);
void dputs(char *);
void comm_putc(char);
int comm_getc(void);

char unitnum;
HANDLE hCom;
DCB dcbSerialParams;

int _tmain(int argc, _TCHAR* argv[]) // console application
{
int commport;
long speed;
char in[512],out[512];

printf("Enter Unit ID=");
scanf_s("%d",&unitnum);
printf("Enter Comm port=");
scanf_s("%d",&commport);
printf("Enter Baud Rate=");
scanf_s("%ld",&speed);
fflush(stdin);  //clear stdin buffer
commOpen(commport,speed);
while(1)
```

Table 6-4 Example of a Visual C++ Program to Demonstrate Conversion of Pump Commands to DASNET Frames (Continued)

```
{
   _cputs("\n\rString(Q TO Quit) >>>");
   gets_s(in,200);
   _strupr_s(in);  /*convert to upper case */
   if(in[0]=='Q') break;
   conv_das(in,out);
   _cputs("Dasnet Output >>>");
   puts(out);
   dputs(out);
   _strset_s(out,256,0);
   dgets(out);
   printf("Dasnet Response>>%s\n",out);
   }
CloseHandle(hCom);
printf("Comm intr released\n");
}

void conv_das(char *in, char *out)
{
unsigned sum;
char *c_ptr;

c_ptr=out;
*out++=unitnum+0x30;  /* put id first */
*out++='R';

if (!strcmp(in,"R")) // just a “R CS” message
  {*out++=' '; *out++=0x00;}
else
  sprintf_s(out,255,"%3.3X%s",strlen(in),in);

for (sum=0 ; *c_ptr; c_ptr++)
   sum+=*c_ptr;

sum=(0x100 - sum) & 0x0FF;         /* get check sum */
sprintf_s(c_ptr,255,"%2.2X",sum);
}
void dgets (char *buffer)
{
    char * ptr;
    DWORD dwBytesRead = 0;
    ptr = buffer;
    while (1)
    {
    char buf[2];
```

Table 6-4 Example of a Visual C++ Program to Demonstrate Conversion of Pump Commands to DASNET Frames (Continued)

```
        /* get char if there                    */
    if(!ReadFile(hCom, buf, 1, &dwBytesRead, NULL))
              {//error occurred. Report to user.}
       *buffer=buf[0];
if (*buffer++ == 0x0d && ptr!=buffer || dwBytesRead==0)
        {
        *buffer = 0;
        break;
        }
     }
}

void dputs(char *out)
{
int n;
DWORD dwBytesRead = 0;
int count=0;

n=strlen(out);
// start of packet
if(!WriteFile(hCom, "\r", 1, &dwBytesRead, NULL))
                    {//error occurred. Report to user.}
// data
if(!WriteFile(hCom, out, n, &dwBytesRead, NULL))
                    {//error occurred. Report to user.}
//end of packet
if(!WriteFile(hCom, "\r", 1, &dwBytesRead, NULL))
                    {//error occurred. Report to user.}
}

void commOpen(int port, long speed)
{
TCHAR szComPort[20];

        if (port < 10)
          wsprintf(szComPort, _T("COM%d"), port);
        else
          wsprintf(szComPort,_T("\\\\.\\COM%d"),port);
hCom = CreateFile(szComPort,
         GENERIC_READ|GENERIC_WRITE, // desired access should be read&write
         0,
```

Table 6-4 Example of a Visual C++ Program to Demonstrate Conversion of Pump Commands to DASNET Frames (Continued)

```
// COM port must be opened in non-sharing mode
         NULL,                        // don't care about the security
         OPEN_EXISTING,
         // IMPORTANT: must use OPEN_EXISTING for a COM port
         0,
         // usually overlapped but non-overlapped for existance test
         NULL);
         // always NULL for a general purpose COM port

        if (INVALID_HANDLE_VALUE == hCom)
          {
               printf("\nComm %d port not available",port);
               Sleep(2000);
               exit(1);
          }
        else
        {
             printf("\nComm %d port available ",port);
             dcbSerialParams.DCBlength=sizeof(dcbSerialParams);

             if (!GetCommState(hCom, &dcbSerialParams))
                    {
                    //error getting state
                    printf("Error getting Comm Port state");
                    Sleep(2000);
                   exit(1);
}
switch(speed)
{
```

Table 6-4 Example of a Visual C++ Program to Demonstrate Conversion of Pump Commands to DASNET Frames (Continued)

```
                    case 19200:

                         dcbSerialParams.BaudRate=CBR_19200;
                         break;
                    case 38400:
                         dcbSerialParams.BaudRate=CBR_38400;
                         break;
                    case 57600:
                         dcbSerialParams.BaudRate=CBR_57600;
                         break;
                                  case 115200:
                         dcbSerialParams.BaudRate=CBR_115200;
                         break;
                    default:
                   case 9600:
                         dcbSerialParams.BaudRate=CBR_9600;
                         break;
               }
            dcbSerialParams.ByteSize=8;
            dcbSerialParams.StopBits=ONESTOPBIT;
            dcbSerialParams.Parity=NOPARITY;
            if(!SetCommState(hCom, &dcbSerialParams))
                  {
                  //error setting serial port state
                  printf("Setting Comm port state failed");
                           Sleep(2000);
                  exit(1);
                  }
            //timeouts
                              COMMTIMEOUTS timeouts={0};
            timeouts.ReadIntervalTimeout=100;
            timeouts.ReadTotalTimeoutConstant=100;
            timeouts.ReadTotalTimeoutMultiplier=100;

            if(!SetCommTimeouts(hCom, &timeouts))
                  {
                  //error occureed. Inform user
printf("Setting Comm port timeouts failed");
```

Table 6-4 Example of a Visual C++ Program to Demonstrate Conversion of Pump Commands to DASNET Frames (Continued)

```
Sleep(2000);
                    exit(1);
                    }
             }
printf("\nComm intr installed");
}

int comm_getc ()
{
DWORD dwBytesRead = 0;
char buf[2];

buf[0]=0;
if(!ReadFile(hCom, buf, 1, &dwBytesRead, NULL))
             {//error occurred. Report to user.}
return buf[0];
}

void comm_putc(char outchar)
{
DWORD dwBytesRead = 0;
char out[2];
out[0]=outchar;
if(!WriteFile(hCom, out, 1, &dwBytesRead, NULL))
                    {//error occurred. Report to user.}
}
```

There are three types of operation within the network: network controller, master, and slave. A computer typically serves as the network controller. It supervises all data flow on the network. It also polls each unit which initiates data transfer and commands.

☑ Note

The network controller (typically a PC) should not be confused with the pump controller. The network controller is used in addition to the pump controller.

The slave unit simply responds to commands accordingly. The Demi pump functions as a slave unit. These functions may be combined in one unit; i.e., a computer can function as both a network controller and a master.

All data transfers are in a frame format. When the network controller polls an instrument, it will start to respond within 200 ms. If it does not reply, it will be polled again. If after three attempts

at polling it does not reply, it will be dropped from the polling rotation. When the instrument does respond, the polling rotation does not advance until an error-free transfer has occurred.

The frame format for data transfers from the network controller is as follows:

destination\acknowledgement\message source \length\message\checksum\[CR]

- The **destination** is the 1-digit unit identification number of the instrument to receive the message.
- **Acknowledgment** is one character to indicate the success of the previous transmission. There are three possibilities: (1) E means error, resend the message immediately (E is sent by the network controller only. Other units signify errors by not replying; causing the controller to resend the message). (2) B means busy, resend message at next poll. (3) R signifies previous message was received.
- **Message source** is the unit ID of the unit that originated the message. If there is no message, this location is a space (20H).
- **Length** is the length of the message in 2 digit, hexadecimal format. Maximum length is 256, with 256 being represented by a 00. This field is eliminated if there are no messages.
- **Message field** is the area where the actual information is located. The maximum length is 256 characters long.
- **Checksum** is also a 2 digit hexadecimal number. This number, when added to all the previous characters in the message (excluding control characters), will result in a sum. If there are no errors, the result of modulo 256 division of this sum should be 0.

Examples

Frame is R304STOPD1[CR] =

(R) (3) (0) (4) (S) (T) (O) (P)
52H + 33H + 30H + 34H + 53H + 54H + 4FH + 50H + D1H = 300H

300H MODULO 256 = 00

It is important to note that all characters are converted to the ASCII equivalent and added, except for the checksum. The two characters of the checksum are converted to hexadecimal numbers and concatenated to form a single two-digit number. This number is then converted to its ASCII equivalent and added to the end of the message.

Hexadecimal Format Using MODULO

Step 1: **22FH = 52H + 33H + 30H + 34H + 53H + 54H +4FH + 50H**

Step 2: **2FH = 22FH ·/· 100H**

Modulo

```
      2R2FH
100H ) 22FH
     −200H
     -----
       2FH
```

Step 3: **D1H = 100H − 2FH**

Step 4: Convert D1H to ASCII (Hex) and put at end of message.

Step 5: Put a "CR" (0DH) at the end of message for end of frame.

Decimal Format Using MODULO

Step 1: **559 = 82 + 51 + 48 + 52 + 83 + 84 + 79 + 80**

Step 2: **47 = 559 ·/· 256**

Modulo

```
      2R47
256 ) 559
     −512
     ----
       47
```

Step 3: **209 = 256 − 47**

Step 4: Convert 209 to ASCII (Hex) and put at end of message.

Step 5: Put a "CR" (13) at the end of message for end of frame.

Hexadecimal Format Using NO MODULO

Step 1: **22FH = 52H + 33H + 30H + 34H + 53H + 54H + 4FH + 50H**

Step 2: **FED1H = 100H − 22FH**

Step 3: **D1H = FED1H & offH**

Step 4: Convert D1H = to ASCII (Hex) and put at end of message.

Step 5: Put a "CR" (0DH) at the end of message for end of frame.

Decimal Format Using NO MODULO

Step 1: **559 = 82 + 51 + 48 + 52 + 83 + 84 + 79 + 80**

Step 2: **−303 = 256 − 559**

Step 3: **209 = 303 & 255**

Step 4: Convert 209 into ASCII (Hex) and put at end of message.

Step 5: Put a "CR" (13) at the end of message for end of frame.

The carriage return "CR" signifies end of frame.

The format for frames sent from the unit to the network controller is as follows:

acknowledgement\message destination
\length\message\checksum\[CR]

All the parameters are as previously described except message destination. Message destination is the 1-digit identification number of the unit that the message is sent to.

An example of a typical data exchange is summarized below. For illustration, we will assume the network consists of a computer serving as a combination network controller and master. There will be one slave unit; a Model 260D pump. Details on the pump message format are in section 6.5. The computer will be unit #0, and the pump will be unit #6.

Network Controller and Master Unit #0

[CR]1R 5D[CR]

> ☑ ***Note***
>
> A [CR] must start the network. The controller is checking for the presence of unit #1 but will get no response in 200 ms because there is no unit 1.

Network Controller and Master Unit #0

1R 5D[CR]
Still no response.

Network Controller and Master Unit #0

1R 5D[CR]
Still no response, so unit 1 will be dropped from the poll.

Network Controller and Master Unit #0

2R 5C[CR]
Checks for unit 2 but will get no response in 200 ms because there is no unit 2.

Network Controller and Master Unit #0

2R 5C[CR]
Still no response.

Network Controller and Master Unit #0

2R 5C[CR]
Still no response, so unit 2 will be dropped from the poll.

This way units 3-6 will be checked and dropped from the poll.

Network Controller and Master Unit #0

6R 58[CR]
Check for presence of unit 6.

Unit 7

R 8E[CR]
Unit 7 responds.

Network Controller and Master Unit #0

7R 57[CR]
Since unit 7 does not exist, it will be dropped from the polling scheme.

Network Controller and Master Unit #0

7R008IDENTIFY85[CR]
The master verifies the fact that unit 6 is a Model ___D. In this example, the master and the network controller are a single unit. If they were separate units, the master would send the inquiry to the network controller; then the network controller would send the message to the slave unit the next time it is polled. The slave would respond with the message to the network controller. The next time the master is polled, the message would be relayed. The same sequence would occur with all messages. Since the master and the network controller are combined in this example, the relaying of messages is not necessary.

Unit 6

R027SERIES=1240-02__, Model ___D PUMP, REV __XX[CR]
The pump responds with identity and software revision letter. (In this example 02__ would be 021; Model ___D would be 260D; REV __ signifies the software revision, XX would be replaced by the correct checksum, which is B4.)

Network Controller and Master Unit #1

6R006REMOTE16[CR]
This places the pump in the remote mode.

Unit 6

R 8E[CR]
The pump acknowledges that it accepted the command.

Network Controller and Master Unit #1

6R00ACONST FLOWF8[CR]
This puts the pump into constant flow rate mode.

Unit 6

R 8E[CR]
The pump verifies that it received the message.

Network Controller and Master Unit #1

6R009FLOW=1.00AB[CR]
This sets the pump's flow rate to 1.00 ml per minute.

Unit 6

R 8E[CR]
The pump verifies that it received the message.

Network Controller and Master Unit #1

6R 58[CR]
Polls the pump.

Unit 1

R 8E[CR]
Pump responds.

Network Controller and Master Unit #1

6R003RUNF0[CR]
The pump is started.

Unit 1

R 8E[CR]
The pump responds.

The system is now running and the network controller continues the polling scheme. If the controller gives an improper command, the units will respond with a problem message indicating the type of error.

The format of the message is given in section 6.5 of this manual and specifies the commands used for this instrument. It is important to follow this format. Spaces are ignored anywhere within the message field. Commands must be in uppercase letters. The network definition allows multiple commands in a message field when delimited by semicolons, but the Demi pump controller is limited to single commands. It will respond with a PROBLEM=INVALID COMMAND message.

Demi Pump

Section 7 Pump Maintenance, Troubleshooting, and Servicing

DANGER

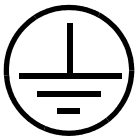
RISK OF ELECTRIC SHOCK - DISCONNECT THE ELECTRIC POWER BEFORE SERVICING. ONLY TRAINED SERVICE PERSONNEL MAY REMOVE THE CASE.

DANGER

RISQUE DE CHOC ÉLECTRIQUE. COUPER L´ALIMENTATION AVANT LA RÉPARATION. L´USAGER NE DOIT PAS DÉMONTER L´INSTRUMENT OU DÉRANGER LE MÉCANISME DEDANS. ADRESSER LA REPARATION SEULEMENT AUX TECHNICIENS COMPÉTENTS.

WARNING

Earth ground bonding conductor. Do not remove or disconnect.



Mise à la terre. Ne pas enlever ni déconnecter.

WARNING

Line voltage is present inside this unit at all times, regardless of switch settings. If internal adjustments or repairs are necessary, the line cords must be disconnected to remove possible shock hazard before opening the case.

7.1 Introduction

The following sections contain maintenance and repair procedures which you can do yourself or have done by a technician at your site.

7.1.1 Service Department

If you have a question about a procedure, need parts information, or need some help, call or email the Teledyne Isco Service department. In your message, be sure to include all the details about your instrument and the nature of the error.

Call the Service Department before returning the unit for factory repair. Often a problem can be solved in the field with just a little extra help.

Contact us at:

Toll free (800) 775-2965
Outside USA, Canada, and Mexico: (402) 464-0231
Email IscoService@teledyne.com

Maintenance Schedule

Recommend Maintenance Schedule	
Strokes	**Maintenance**
Every 5000	Lubricate Ball Screw assembly
Every 10000	Pump seals replacement
Every 15000	Replace valve rotor

To see how many strokes the pump has run press: MENU->RIGHT->RIGHT->DIAGNOSTICS->RIGHT->STROKE COUNT

7.1.2 How to Ship Returns

In the rare event that an instrument must be returned for maintenance the following measures must be taken to ensure a proper return:

- Teledyne Isco Technical Service (800-775-2965) must be contacted prior to shipment.
- Wrap the unit in heavy paper or a plastic bag. If the original box is not available, put the wrapped unit in a strong cardboard box at least six inches longer in each basic dimension than the unit.
- Fill the box equally around the unit with resilient packing material.
- Seal it with strapping tape and ship it to the address on the warranty. The warranty at the end of the manual also describes the conditions under which Teledyne Isco will pay surface shipping costs.

☑ *Note*

It is very important that the shipment be well-packed and fully insured. Damage claims must be settled between you and the carrier. This can delay repair and return of the unit to you.

7.2 Resetting the System

When resetting the system, the control settings return to the factory defaults. The system flow rate will be reset to maximum (5.00 mL/min) and the system units will reset to PSI. Custom pressure limits will be reset to the factory default, and the 'ZERO PRESS' offset will be erased. External control will be set to 'OFF', and the DASNET Serial protocol and MODBUS will be reset to factory defaults (9600 baud). Also, the display contrast will be reset to the default.

To Reset the System

1. Press the STOP key to stop the pump (if running) and return the display to the RUN screen.
2. Press the MENU key. Menu 1 of 4 will display.
3. Press the RIGHT ARROW key three times to display Menu 4 of 4.
4. Use the UP and DOWN arrow keys to set the selection arrow beside the RESET option.
5. Press the 'A' (SELECT) soft key to display the RESET CONTROLLER screen.
6. Press the 'A' (CONTINUE) soft key to execute the reset, or the 'B' (BACK) soft key to exit this option. Once the CONTINUE option is selected, the command executes. Previous settings are lost.

Or a power-up reset can be performed:

1. Shut the pump OFF if it is currently ON.
2. Press and the STOP key while turning the pump ON and hold it until the start up screen is displayed.

7.3 Diagnostic Menu

7.3.1 Analog/Digital Input

The demi pump is capable of receiving signals through the back panel connector labeled INPUT. To get to the INPUT menu press MENU->RIGHT->RIGHT->DIAGNOSTIC->ANLG/DIG IN

A=0.000V	1/2
B=0.000V	TTL0=0
IN0=0.010	TTL1=0
IN1=0.100	BACK

- A and B are the pressure transducers voltage outputs A=Pump A, B=Pump B
- IN0 and IN1 are on the connections to the 6 pin DIN IN0=ANALOG IN 0, IN1=ANALOG IN 1
- TTL0 and TTL1 are on the connections to the 6 pin DIN TTL0=TTL IN 0 (RUN), TTL1= TTL IN 1 (RUN/STOP)

3.3=3.31v	2/2
5V=4.98V	Off0=0
15V=15.0V	Off1=0
ZERO	BACK

This screen shows all the voltages that are present on the pump. OFF0, OFF1 set the voltage offset for the two analog inputs IN0 and IN1.

7.3.2 Analog/Digital Output

The Demi pump is capable of receiving signals though the back panel connector labeled OUTPUT. To get to the OUTPUT menu press MENU->RIGHT->RIGHT->DIAGNOSTIC->ANLG/DIG OUT

OUT0= 799=3.999ma
OUT1= 799=3.999ma
DIG OUT= 0000

- ALOG OUTA and ALOG OUTB are on the connections to the 8 pin DIN (7)OUT0, (8)OUT1.
- DIG OUT are on the connections to the 8 pin DIN (1-4). Press SELECT to toggle the outputs.

7.3.3 Motor Control / Limits

This tests the digital position controls.

The Demi pump uses sensors to detect the end of travel of the piston. When one of these sensors is interrupted, it has a logic 1; when it is not interrupted, it has a logic 0. These sensors are labeled UP and DOWN for each pump ('A' or 'B'). There are a total of 4 position sensors, two for each pump module.

From the DIAGNOSTICS menu, you can observe the state of the position sensors. To do so:

1. Press the MENU key. Menu 1 of 4 should display.
2. Press the RIGHT ARROW key twice. Menu 3 of 4 should display.
3. Press the DOWN ARROW key twice, placing the selection arrow beside DIAGNOSTICS'
4. Press the 'A' (SELECT) key. DIAG screen 1 of 2 should display.
5. Press the RIGHT ARROW key once. DIAG screen 2 of 2 should display.
6. The selection arrow should be beside MOTOR CONTROL. If not, press the UP or DOWN arrow key as necessary until the selection arrow is beside the MOTOR CONTROL option.
7. Press the 'A' (SELECT) key.

When the unit is operating, the sensor indicators have the following meanings:

- UPA (or UPB) = 1, DWNA (or DWNB) = 0 → Cylinder A (or Cylinder B) is empty.
- UPA (or UPB) = 0, DWNA (or DWNB) = 1 → Cylinder A (or Cylinder B) is full.
- UPA (or UPB) = 0, DWNA (or DWNB) = 0 → Cylinder A (or Cylinder B) is partially full.
- UPA (or UPB) = 1, DWNA (or DWNB) = 1 → Cylinder A (or Cylinder B) invalid state.

An invalid state can indicate a failure of one or both sensors. The pump will not run in this state.

These sensors can be tested for operation, if desired. To do so:

1. Turn the pump on, and press the 'MENU' key. Menu screen 1 of 4 should be displayed, and the selection arrow next to RUN SETUP.
2. Press the 'A' (SELECT) soft key. The RUN SETUP screen should display.
3. Press the 'A' (TOGGLE) soft key repeatedly until the display shows EMPTY ONLY.
4. Press the 'B' (BACK) soft key, then the 'B' (EXIT) key to return to the 'RUN' screen. (Alternatively, press the STOP key to exit the menu screens).
5. Press the RUN key.
6. Display the MOTOR CONTROL diagnostic screen as above. This screen can be displayed without stopping the pump.
7. The two fields TACHA and TACHB may increment and decrement in coordination with which pump module is running.
8. As the pump is running, the UPA and UPB will toggle from 0 to 1 when the module is empty, one at a time. The DWNA and DWNB should display a 0.
9. Press the STOP key to exit the menu.
10. Press the 'A' (SELECT) soft key. The RUN SETUP screen should display.
11. Press the 'A' (TOGGLE) soft key repeatedly until the display shows REFILL ONLY.
12. Press the 'B' (BACK) soft key, then the 'B' (EXIT) key to return to the RUN screen. (Alternatively, press the STOP key to exit the menu screens).
13. Press the RUN key.
14. Display the MOTOR CONTROL diagnostic screen as above.
15. The two fields TACHA and TACHB will increment and decrement in coordination with which pump module is running.

16. As the pump is running, the DWNA and DWNB will toggle from 0 to 1 when the module is full, one at a time. The UPA and UPB should display a 0.
17. Press the 'STOP' key to exit the menu.

If the UP and DWN indicators did not display as expected on the diagnostic screen, one or more of the sensors is probably not functioning. Replacing these sensors is quite involved, and contacting Teledyne Isco Technical Service should be considered.

7.4 Removing the Case Top

Access to the circuit boards requires removal of some case panels. Troubleshooting using the diagnostic menus should be completed before opening the case.

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⚠ DANGER

RISQUE DE CHOC ÉLECTRIQUE. COUPER L´ALIMENTATION AVANT LA RÉPARATION. L´USAGER NE DOIT PAS DÉMONTER L´INSTRUMENT OU DÉRANGER LE MÉCANISME DEDANS. ADRESSER LA REPARATION SEULEMENT AUX TECHNICIENS COMPÉTENTS.

7.4.1 Removing the Front Panel

Repositioning of the front panel will provide some access to the display board and the controller board.

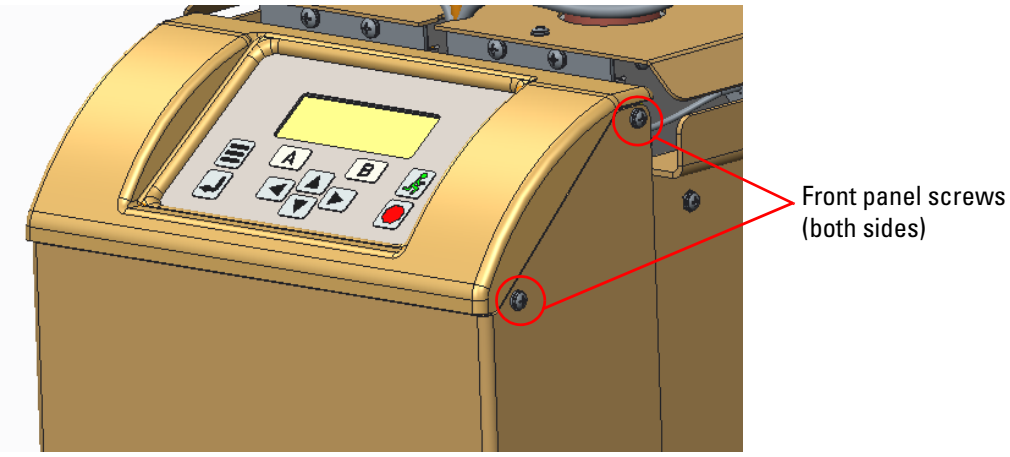


Figure 7-1 Front panel of the Demi

1. Turn off the Mains power switch, and disconnect the unit from all power.
2. Remove the four screws on the top sides of the front portion, immediately below the front panel.
3. Holding the side edges of the front cover, lift the cover about 1/2" (12mm) or so. Tip the front cover assembly down towards the front. Use care, as there are many wires connected to the back of the front panel.

To reinstall the front panel, reverse the above procedure, using care not to pinch any of the wires with the case parts.

7.4.2 Removing the Front Cover

Access to most of the circuit boards requires removal of the front cover (the cover with the Demi logo).

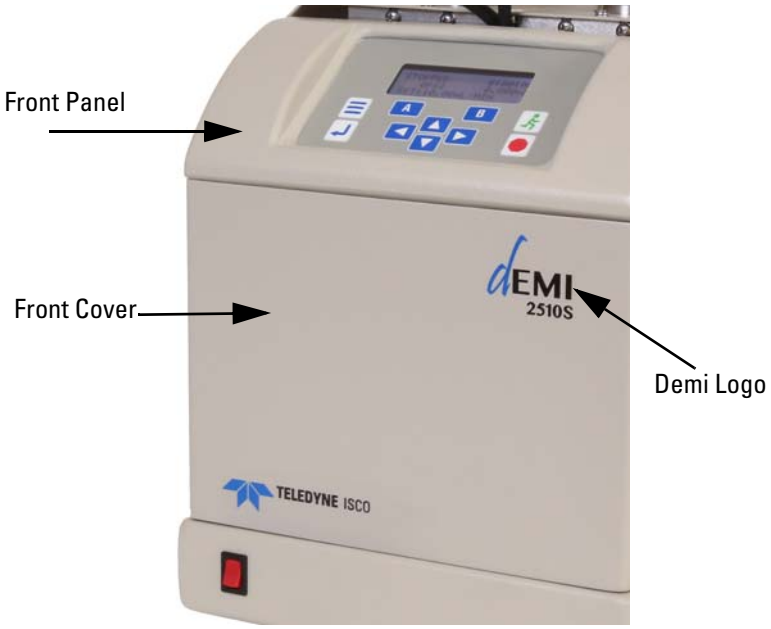


Figure 7-2 Front cover of the Demi

To Remove the Front Cover

1. Remove the front panel as described above.
2. Remove six screws holding the front cover to the unit.
3. Carefully slide the front cover forward and down. There are no wires or attachments to the front cover.
4. Place the cover out of the way.

To Reinstall the Cover

1. Orient the front cover with the Demi logo upright and facing you.
2. Lift the front panel slightly, and slide the front cover into position from below the front panel.
3. Ensure the front cover is outside of the internal mounting points.

4. Carefully push the front cover into position, making sure no wires are pinched or trapped between mating components.
5. Install the middle screw in the front cover first, aligning the hole with the mounting fastener.
6. Push the cover into position, and install the remaining four screws removed in this section.

Reinstall the front panel using the procedure in section 7.4.1 above.

7.5 Lubrication

The Demi pump is a precision engineered instrument that requires lubrication every two years or 10,000 strokes (whichever comes first) to ensure proper service life.

The ball screw is the only component requiring grease. There are two ball screws in each pump, one for each cylinder. For your convenience, a lubrication kit containing Never-Seez® is included in the pump accessory package.

7.5.1 Ball Screw

Each pump module can be serviced separately. It is not necessary to remove valve tubing to access the back covers.

Cover Removal

1. Disconnect the plumbing from the inlet and outlet ports.
2. Position the pump assembly with the back facing toward you.
3. Remove four screws and washers (Item A) from the painted cover (Item B).
4. Pull the cover away at the bottom and remove it downward to clear the valve tubing.
5. Remove six screws and washers (Item C) from the exposed pump cover plate (Item D).
6. Lower the pump cover plate downward and remove it.

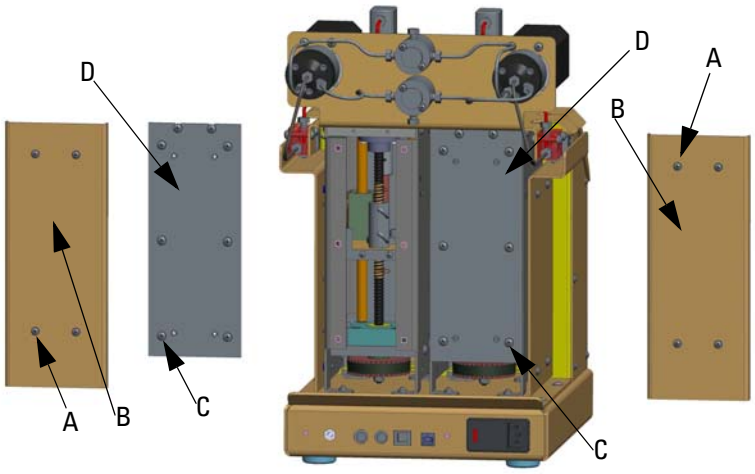


Figure 7-3 Removing the back covers

Cover Installation

1. The cover has holes for the mounting screws closer to one end. The holes closer to the end go toward the top. Be sure the threaded standoffs are facing outward.
2. Insert the cover from below the valve to clear the valve tubing, and position the holes over the threaded holes in the pump assembly.
3. Install the two middle screws first. Do not tighten.
4. Install the remaining four screws and washers, but do not tighten until all six screws are installed.
5. Tighten all six screws.
6. Note that the painted cover has two holes closer to the edge than the other two. These two holes go upward.
7. Position the painted cover over the pump cover plate, aligning the holes with the threaded standoffs.
8. Install the top two screws and washers first, but do not tighten.
9. Install the bottom two screws.
10. Tighten all four screws once all screws are started.
11. Reconnect the plumbing connections and test for proper operation.

7.5.2 Lubricating the Ball Screw

The ball screw, which drives the ball nut, must be kept lubricated with Never-Seez. The only lubrication maintenance required is to reapply ball screw lubricant (60-1244-272) to the ball screw after about 10,000 cycles. The precision thrust bearing at the base of the ball screw is factory lubricated and should not need regreasing.

A service reminder will appear on the display when ball screw maintenance is necessary. No other parts require lubrication.

1. Remove the back covers as described above (See Section 7.5.1).
2. The ball screw is immediately behind this access panel. The ball screw should be straight and rotate without unusual noise.
3. Greasing the ball screw is easiest with the unit operating.

⚠ WARNING

Keep your fingers out of the unit whenever the unit is plugged in to avoid injury.

4. Operate the pump until the ball nut is near the bottom of the ball screw. Alternatively, if the unit is not plugged in, moving the ball nut is possible by rotating the pulley at the bottom of the ball screw.
5. Using a flat applicator, apply Never-Seez grease to the ball screw above the ball nut only. When the unit is operated, this grease will migrate into the ball nut as desired.

6. Applying too much grease is not desirable, but adequate grease is important. Operate the pump with the back cover removed, and observe the flow of the grease. There should be a small pool of grease around the top of the ball nut, but not so much that the grease is dripping down the sides.
7. Allow the pump to cycle a few full strokes and observe the grease flow. Add grease as necessary, or remove excess grease with the flat applicator if too much is applied.
8. Disconnect the power and reinstall the back covers as described in Section 7.5.1.

7.6 Seal Replacement

The seal must be replaced whenever the cylinder is removed to prevent leaks. Cleaning or reusing seals is not recommended.

The replacement seal is available in two different packages. Normally, the replacement seal is in a package (601249137) including a new wear ring and backup ring, with two retaining rings. The seal is also available separately with only two retaining rings (601249134), should the seal be damaged during installation.

Generally, the wear rings should be replaced at the same time as the seal.

☑ *Note*

Seal replacement needs to be performed soon after the seal replacement warning message appears on the display. Failure to replace the seal when necessary risks damaging the cylinder and potentially reducing the ball screw life.

⚠ CAUTION

Handle the seal with care. Never let the surface of the seal piston or cylinder contact abrasives or fingernail.

Tools required:

- 3/8" open end wrench
- 9/64" Hex wrench
- 9 mm open end wrench

1. Run the pump until empty.
2. Remove the fitting from both cylinder caps. Loosen or remove the tube from the transducer mounts to make positioning the tubing easier.
3. With the fitting removed from the cylinder cap, refill the cylinder. This fills the cylinder with air.
4. Locate the four cap screws near the base of the cylinder. Using a 9/64” Allen wrench, remove these four screws.
5. Pull the cylinder straight upward. It is not necessary to disconnect the cylinder cap from the pump cylinder.
6. Run the pump until the piston is fully up.

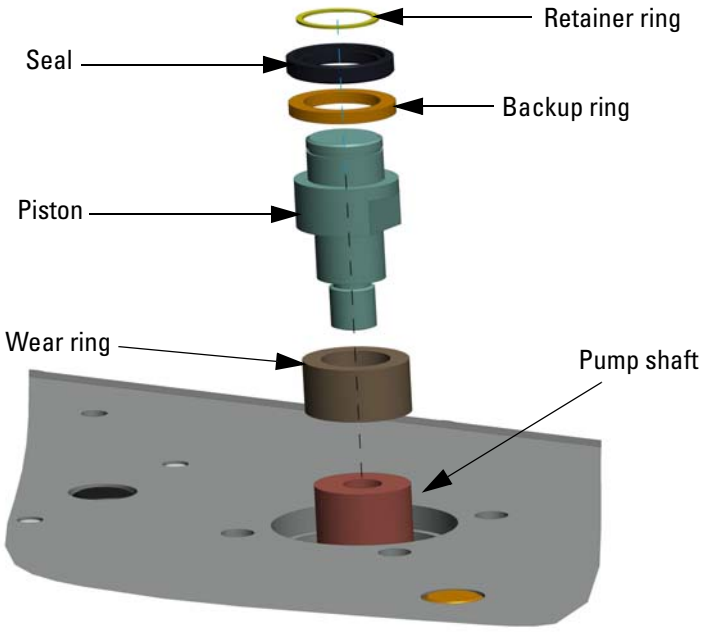


Figure 7-4 Piston Assembly

7. Using a suitable tool (such as a wooden toothpick), remove the retaining ring from the piston above the seal. Bending, distorting, or damaging this ring is acceptable since it will not be reused. Avoid scratching the piston.
8. Pull the seal straight upward. Usually the seal backup ring comes off with the seal. If it does not, remove the backup ring by pulling straight upward.
9. Using a 9 mm open end wrench, unscrew the piston. The wear ring should slide off of the piston easily.
10. Only the piston is reused. Clean the piston using a suitable solvent and a clean cloth. DO NOT USE ABRASIVES such as a scrub pad. Fully dry the piston before continuing.
11. Clean the end of the push rod with a cloth and suitable solvent. DO NOT USE ABRASIVES. Fully dry the push rod end before continuing.
12. Apply a small amount of removable thread locker (like blue Loctite or Permatex) designed for small screws to the threads on the piston.
13. Insert the new wear ring (the larger of the two plastic parts in the seal package) onto the threaded end of the piston. It fits somewhat loosely, so hold it in position while installing. Either end of the wear ring can face up.
14. Thread the piston into the push rod, capturing the wear ring. Tighten the piston to about 50 in-lbs. (5.5 N*m) with a 9 mm wrench.

15. Install the seal backup ring (the smaller of the two plastic parts in the seal package) onto the end of the piston. It should fit against the flange on the piston.
16. Position the new seal with the SPRING SIDE UP on the end of the piston. The seal is a tight fit.
17. Using your thumb, press the seal down against the backup ring. You may feel the seal catch on the retaining ring groove. Push the seal fully against the backup ring.
18. Two retaining rings are provided because these parts are small and easily lost. Only one is used, the other is discarded upon completion.
19. Lay the retaining ring on the top of the piston with the opening toward you. Hold it in position with your thumb while completing the next step.
20. Push one free end of the retaining ring into the groove in the piston. Run your finger around the edge of the retaining ring to seat it into the groove. The retaining ring will snap into place when properly positioned.
21. Inspect that the retaining ring is fully seated and properly positioned.
22. Apply a couple of drops of a suitable lubricant (water, IPS, etc.) to the seal to ease installing the cylinder.
23. Run the piston to the fully down (cylinder full) position.
24. Position the cylinder above the piston, and while keeping the cylinder aligned with the piston, slide the cylinder fully into place.
25. Rotate the cylinder clockwise until the fluid port is directed to the rear of the pump and the flats on the cap are approximately parallel to the sides of the unit. DO NOT ROTATE THE CYLINDER COUNTERCLOCKWISE, as this could cause the piston to loosen.
26. Align the holes in the cylinder clamp with the threaded holes in the top of the unit. Start the four cap screws. Thread locker is not required. Loosely tighten the screws against the clamp.
27. Reattach the fittings to the cap (and transducer, if necessary).
28. Tighten the cap screws 1/8 of a turn at a time in a cross pattern using a 9/64" Allen wrench. Torque the screws to 50 in-lbs. (5.5 N*m).
29. Run the pump and inspect for leaks.

7.7 Flushing the Cylinder

After cylinder / seal maintenance or when the working fluid is changed, the Demi pump should be flushed to remove possible residue.

7.7.1 Liquid Solvent Changeover and Flushing

This procedure is typically used when the Demi pump is moved from one application to another or the working fluid is different than previously used.

☑ Note

If high ionic strength aqueous reagent solutions are allowed to remain in the pump, solid residues may form which will scratch the seals and the polished inner surface of the cylinder. These scratches can lead to leakage and poor performance.

To Empty the Cylinder

1. Connect the outlet port to a suitable waste container.
2. Turn the pump ON
3. Press the MENU key.
4. Using the UP/DOWN keys, highlight the RUN SETUP item (if not already).
5. Press the A [SELECT] soft key or the Enter [↵] key.
6. Press the A [TOGGLE] soft key to cycle through the options. Stop cycling when the display shows EMPTY ONLY.
7. Press the B [BACK] soft key, then the B [EXIT] soft key.
8. Press the RUN [Running Man] key.

The pump will run both pistons to the top of the cylinder at half speed, and stop when the cylinders are empty. This may take a couple of minutes to complete.

To Clean the Cylinder

1. Connect the outlet port to a suitable waste container.
2. Place clean suitable solvent into a clean reservoir, such as a beaker. Choose a solvent that is compatible with the fluid currently in the pump.
3. Connect the inlet port to the clean solvent reservoir.
4. Turn the pump ON.
5. Press the MENU key.
6. Using the UP/DOWN keys, highlight the RUN SETUP item (if not already).
7. Press the A [SELECT] soft key or the Enter [↵] key.
8. Press the A [TOGGLE] soft key to cycle through the options. Stop cycling when the display shows EMPTY ONLY.
9. Press the B [BACK] soft key, then the B [EXIT] soft key.
10. Press the RUN [Running Man] key.
11. When both cylinders are empty [the unit stops], press the STOP key.
12. Press the MENU key.
13. Using the UP/DOWN keys, highlight the RUN SETUP item (if not already).
14. Press the A [SELECT] soft key or the Enter [↵] key.
15. Press the A [TOGGLE] soft key to cycle through the options. Stop cycling when the display shows REFILL> DELIVER.

16. Press the B [BACK] soft key, then the B [EXIT] soft key.
17. Press the RUN [Running Man] key.
18. The unit will draw in slightly more than 20 mL for each cycle. Allow the pump to auto-cycle until adequate solvent has flushed the cylinders (usually five cycles, about 100 mL or more).
19. Press the STOP key.
20. Press the MENU key.
21. Using the UP/DOWN keys, highlight the RUN SETUP item (if not already).
22. Press the A [SELECT] soft key or the Enter [↵] key.
23. Press the A [TOGGLE] soft key to cycle through the options. Stop cycling when the display shows EMPTY ONLY.
24. Press the B [BACK] soft key, then the B [EXIT] soft key.
25. Press the RUN [Running Man] key.
26. Allow the pump to complete its cycle to empty the cylinders.

The pump will run both pistons to the top of the cylinder at half speed, and stop when the cylinders are empty. This may take a couple of minutes to complete.

☑ Note

Never store the pump with buffer solutions containing dissolved salts or corrosive fluids overnight or for long periods. The pump should be stored with methanol or isopropanol (using the flushing procedure above) when it is not being used.

7.8 Overpressure Conditions

This pump is designed to operate in constant flow mode only at delivery pressures between 10psi and 2500psi [0.7bar to 180 bar].

In the event of an unexpected change in the operation, the system pressure may rise excessively (such as with a plugged restriction) or drop (such as a fitting fail or a tube rupture). Upper and lower pressure limits can be set to help detect such unexpected changes. When the pump pressure exceeds the pressure limits you set, the pump will stop.

By default, the lower pressure limit is set to 0 psi (disabled), and the upper limit is set to 2750 psi.

☑ Note

When setting the upper limit, always set the value to at least 250psi (17bar) above the normal operation pressure. This is a constant flow pump, and the pressure is not regulated. There may be situations (such as during changeover) when the pressure on one pump may be temporarily higher than the normal operation set point. Failing to set the upper limit sufficiently

high may result in an unexpected overpressure warning and stoppage of the unit.

To Set the Pressure Limits

1. It is not necessary to stop the pump to set the pressure limits.
2. Press the MENU key. Menu screen 1 of 4 should display.
3. Using the UP and DOWN keys, place the selection arrow beside PRESSURE LIMITS.
4. Press the 'A' (SELECT) key.
5. A PRESSURE LIMITS menu appears.
6. Using the UP and DOWN keys, place the selection arrow beside the limit you wish to change (MIN PRESS or MAX PRESS).
7. Press the 'A' (SELECT) key. The screen will change, prompting you to enter the limit.
8. Using the UP and DOWN arrow keys, set the pressure limit to the desired value.
9. Press the 'A' (ACCEPT) key within four seconds.

☑ Note

If the ACCEPT key is not pressed within four seconds, the limit you entered will be discarded, the setting will revert to what it was previously, and the screen will return to the PRESSURE LIMITS menu.

10. Repeat this for the other limit, if desired.

☑ Note

When the lower pressure limit is set, it does not become active until after the first time the pump exceeds the lower pressure limit threshold. Until the system pressure exceeds the lower pressure you set, the pump will operate as if the lower pressure limit were disabled.

7.9 Electric Valve Rotor Replacement

As the electric valves become older, they may wear enough to cause a leak. When this happens, working fluid may be noticed coming from the small weep hole on the side of the valve head or the delivered flow rate may be less than expected. Replacing the rotor is fairly simple to do, and does not require much time to complete.

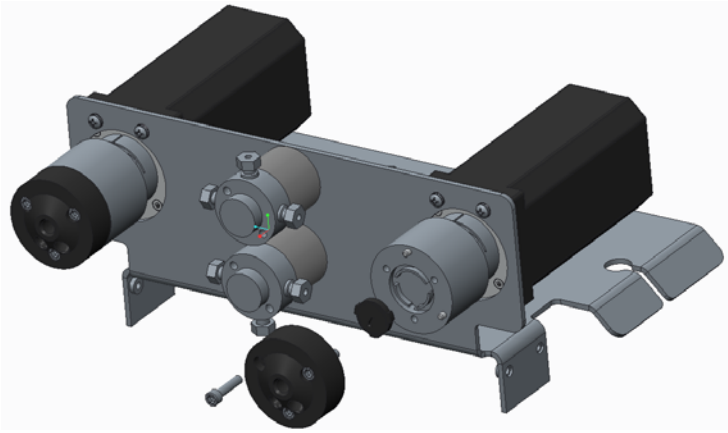


Figure 7-5 Electric Valve Rotor

☑ Note

Some features are not shown in the above figure for clarity.

To Replace the Rotor:

1. Turn the Mains power switch off.
2. Disconnect the Mains power cord.
3. Remove the fluid connections from the valve to be repaired with a 3/8” open end wrench.
4. Using a 9/64” Allen wrench, remove the three cap screws holding the valve head to the valve body.
5. Holding the valve head, pull the head away from the unit toward the rear. Do not twist or rotate the head while removing it. The head should come off easily.
6. The small rotor should now be visible in the valve body, although it may have adhered to the valve head and come off already.
7. Remove the rotor from the unit, and set it aside.
8. Note that the new rotor has the three tabs spaced unequally, and that there is a single groove in one face of the rotor.
9. Identify the edge with the longest gap between the tabs. Similarly, identify the edge in the valve body where the mating slots are furthest apart.
10. Orient the new rotor with the groove facing away from the motor.
11. Align the longest gap between the rotor tabs with the edge in the valve body with the mating slots furthest apart.

12. Gently push the new rotor into the valve body, using care to orient it squarely with the valve body. When properly positioned, the rotor should be nearly even with the metal surfaces in the valve body with the groove in the rotor facing out.
13. Align the holes in the valve head with the two dowel pins in the valve body, and push the valve head into position. When assembled correctly, the valve head should fit squarely and there should be a very small clearance between the valve head and the valve body. If not, remove the head and repeat the steps above.
14. Insert the three cap screws into the holes in the valve head, and thread them in finger tight. Do not completely tighten these screws until all three have been inserted.
15. One at a time, tighten each screw 1/8 of a turn. Repeat this until all three screws are tight to about 20 in-lbs. (2.3 N-m).
16. Reattach the fluid connections to the valve head, using care not to cross thread the nuts.
17. Connect the Mains power cord, and turn the unit on.

Operate the unit, and inspect for leaks.

7.10 Calibration

Like all electronic pressure transducers, the pressure transducers in the Demi pump may drift slightly over time. Since the Demi pump is a constant flow pump, the pressure transducers are only significant when pressure limits are set, and when the two internal cylinders hand off delivery between them. If the two internal pressure transducers differ significantly, there may be a small, brief dip or spike in the flow when the delivery is switched between the two internal cylinders.

It is not normally required to calibrate the pressure transducer unless the transducer has been replaced. Should it become necessary to replace the transducer, the full calibration (offset and gain) can be completed to renew the system to factory performance or the "offset only" calibration can be completed if high pressure accuracy (better than +/- 2%) is not required.

> ☑ ***Note***
>
> This is a constant flow pump, not a constant pressure pump. The pump does not have a mode to operate in constant pressure. Therefore, precise calibration of the transducers is not usually required. However, the two internal transducers should agree with each other within about 10psi (0.7bar) to prevent pulses during the cycle when one pump is nearly empty and the other is taking over flow (called ‘changeover’). In the majority of applications, the following steps are not usually required.

Transducer Offset Calibration

1. Turn the pump ON while holding down the A key until the startup screen is displayed. After the startup screen, the display will show CAL TRANSDUCER SETUP on the first row.
2. Press the right/left arrow keys to select OFFSET ONLY. Press the A (Continue) key to start the calibration sequence.
3. Confirm that the outlet port is open to atmosphere and press the A (Yes) key.
4. After the offset has been measured, the display will show the offset value for each transducer. The offset value should be between 70 and 160 mV for each transducer if they are functioning correctly.
5. Press the B (Exit) key to end the calibration sequence and go back to the home screen.

Full Transducer Calibration

The semi-automated pressure calibration function can be completed with the following items:

- Reference pressure gauge rated for at least 2500 PSI
- Tubing connections to connect the pump and gauge
- Inlet refill line
- Container filled with at least 20 mL of water or other non-compressible, pump-compatible fluid
- Container for pump waste
- Valve and tee rated for at least 2500 PSI (optional)

1. If an external valve and tee is available for diverting pump waste, connect the valve, pump outlet, and pressure gauge to the tee. If not, plumb the pumps outlet to a waste container.
2. Connect the pumps inlet port to the inlet line and place the inlet line inside the intake container.
3. Turn the pump ON while holding down the A key until the startup screen is displayed. After the startup screen, the display will show CAL TRANSDUCER SETUP on the first row.
4. Press the right arrow key to select OFFSET+SW GAIN. Press the A (Continue) key to start the calibration sequence.
5. Open the outlet waste valve if applicable.
6. Press the A (Next) key. The pumps will begin emptying.
7. Press the A (Next) key when prompted that the pumps are empty.
8. Confirm that the outlet/waste valve is still open to atmosphere and press the A (Yes) key.

9. The display will show the calibration offset values as CAL A and CAL B. Verify that these values are between 700 and 1700, then press the A (Next) key.
10. Ensure the inlet line is connected and press the A (Yes) key. The pumps will begin refilling.
11. When prompted that the pumps are full press the A (Next) key.
12. If applicable, confirm that the outlet/waste valve is closed. With no outlet valve or tee, plumb the pumps outlet directly to the pressure gauge. Press the A (Yes) key. The pumps will begin pressurizing.
13. When prompted enter the pressure reading from the pressure gauge into the pump by pressing the up/down keys.
14. Press the A (Next) key when the correct pressure is entered. The calculated gain settings for each transducer will be displayed.
15. Press the A (Finish) key to depressurize the pumps.

7.10.1 Limit Sensor

Limit sensors are used at both ends of the piston excursion to prevent the piston from contacting the mechanical hard stops. Should a limit sensor fail, the first indication may be that the pump will not run when commanded to do so, or a loud, hard, growling noise will be heard when the piston contacts the hard stops at either end.

Generally, these limit sensors do not require adjustment. Repair of these sensors normally only involves replacing the sensor harness (60-1264-121).

In the rare event that the screws holding the sensor are observed to be loose, approximately center the mounting screws in the middle of the slots in the sensors, and tighten the screws to 3.4-4.9 in-lbs. (0.38-0.55 N-m) using a 3/32” hex wrench.

⚠ CAUTION

Do NOT use thread locker on these screws, as thread locker will attack and damage the sensor.

7.10.2 Removing the Pump Module from the Pump

Some repair procedures require access to the bottom or internal wall of the pump module. This procedure is rather involved, so consider contacting Teledyne Isco Technical Service for assistance.

Pump Module Removal

1. Turn the Mains power switch off.
2. Disconnect the Mains power cord.
3. Disconnect the fluid ports from the supply reservoir and your system at the Tees on the back of the unit.
4. Loosen the fittings on the tubes between the cylinder heads and the transducers. Remove these tubes, and set them aside. Keep track of which tube goes to which cylinder.

5. Remove the screws holding the valve support plate on the top of the unit.
6. Disconnect electrical connector from the bottom of both valve motors, and pull the wires out of the grooves in the valve support plate.
7. Lift the valve support plate slightly, and disconnect the electrical connection on the back of the transducers (one on each side).
8. Lift the valve support plate straight up and off. Set this aside.
9. Detach the Front Panel as described in Section 7.4.1. It is not necessary to disconnect the wires.
10. Remove the Front Cover as described in Section 7.4.2.
11. Locate the two cable ties on each side of the internal support plate. Remove the cable ties on the side that the pump module is to be removed from.

⚠ CAUTION

Mark the connectors before removing them. The four connectors for the limit sensors are identical, and if reinstalled in the wrong position, the unit will not function.

12. Disconnect the limit sensor connectors for the pump being serviced on the left side of the controller board. Connectors P6 and P8 go to the right pump module; connectors P9 and P10 go to the left pump module.
13. Follow the wires coming from the top of the motors to the circuit board on the back of the display, and disconnect them from the display circuit board. Observe which connector goes to which motor AND MARK WHICH IS WHICH. The Left connector goes to plug P7, and the right connector goes to P9.
14. Track the motor lead wires from the motor to the controller circuit board, and disconnect them from the controller board. Observe which connector goes to which motor AND MARK WHICH IS WHICH. The connector from the left motor goes to plug P5, and the right connector goes to P11.
15. Reinsert two screws into the Front Panel through the internal support plate to hold the Front Panel.
16. Locate the two grommets on the front edge of the circuit board support that the motor wires go through, and pull them away from the support.
17. Gather the wires from each motor together separately (e.g. coil them up to keep them out of the way).
18. Locate the four nuts at the bottom of the internal support plate holding this support plate to the case bottom. Using a 5/16” socket wrench, remove these nuts and washers.
19. Thread one nut back onto the unit in the front left corner finger tight to hold the assembly for later manipulation.

⚠ WARNING

Make sure the Mains power cord is disconnected before proceeding.

20. Locate the eight button head cap screws holding the drip tray to the case bottom. Using a 1/8" Allen wrench, loosen the two button head cap screws on the left side of the unit, but do not remove them. Remove the six remaining button head screws.
21. Lay the unit on its right side, using care not to pinch or break the wires.
22. Remove the two remaining button head cap screws.
23. Rotate the case bottom to expose the screws holding the pump module to the drip tray. There are eight screws, four holding each module.
24. Remove the screws from the module to be detached, using a #2 Phillips screwdriver.
25. Remove the single nut on the front left corner of the support plate that you reattached to hold the plate while manipulating.
26. Slide the support plate and circuit board assembly away from the drip tray to allow the motor to clear the support plate.
27. Slide the grommet out of the internal support plate holding the wires to the limit sensors to the pump you are removing.
28. Remove the pump module by sliding it rearward and out of the unit. Set the module in a convenient area to complete the repair.

Pump Module Installation

Reinstallation of the pump module is basically the reverse of the removal described above.

1. Lay the partially disassembled pump unit on its side, if not already.
2. Slide the internal support plate away from the drip tray to allow the motor to pass under it.
3. Insert the pump assembly from the rear of the unit motor side first, using care not to snag any wires in the process.
4. Thread the home sensor wires along the motor. Align the home sensor grommet with the slot in the internal support plate, and push it into position. Route the wires close to the mount where the cable ties were.
5. Align one pump module mounting foot over the corresponding hole in the drip tray, and insert one mounting screw loosely. Do not tighten.
6. While holding the module, position another mounting foot over its corresponding hole in the drip tray, and insert another mounting screw loosely. Do not tighten.

7. Install the remaining two mounting screws into the two remaining mounting feet.
8. Once all four screws have been inserted, tighten the four screws with a #2 Phillips Screwdriver.
9. Rotate the case bottom so that one of the fasteners aligns with the holes in the drip tray, and install a button head cap screw loosely. Do not tighten.
10. Position the case bottom to align another fastener, and install the button head cap screw loosely. Do not tighten.
11. Tip the unit back upright. Check that no wires are pinched or damaged.
12. Make sure the wires coming from the motors are routed forward, and not pinched.
13. Position the internal support plate over the fasteners in the drip tray, using care not to pinch any wires.
14. Install the washers and nuts holding the internal support plate to the drip tray loosely.
15. Inspect that no wires are pinched, that all are free to move in their panel openings, and that no wires have been cut or damaged.
16. Replace the remaining six button head cap screws, and tighten all eight with a 1/8” Allen wrench.
17. Observe that no wires are pinched or trapped by the internal support plate, and that it sets fully against the drip tray. Tighten the internal support plate with a 5/16” socket wrench.
18. Remove the screws temporarily holding the front panel to the internal support plate.
19. Using the markings on the home sensor wires you made during removal, reconnect the home sensor wires.
20. Reconnect the connectors from the motors to the display board and the controller board. The Left connector from the top of the motor goes to plug P9 on the display board, and the right connector goes to P10. The connector from the left motor goes to plug P5 on the controller board, and the right connector goes to P11.
21. Using new cable ties collect the wires along each side of the unit, and cable tie the bundle to the mounting points on the internal support plate.
22. Inspect that no connector has become disconnected. Pay particular attention that the ribbon cable connecting the display board to the controller has not become loose.
23. Position the display panel in its approximate location, and install the Front Cover from below. More detail is provided in Section 7.4.2. It is usually easiest to install the middle screws on the side of the front cover first. Do not tighten any of these six screws yet.

24. Refit the Front Panel, aligning the holes in the Front Cover with the holes in the Front Panel. Install four screws and washers loosely.
25. While holding the Front Cover in its proper position, tighten the six screws holding the Front Cover.
26. Pushing down and rearward to close the gaps in the cabinet; tighten the four screws holding the Front Panel to the Front Cover.
27. Reconnect the Mains power cord, and observe for unexpected behavior.
28. Turn on the Mains power switch, and observe that the display functions as expected.
29. Run the unit briefly to test for proper operation.
30. Return the unit to service, and reconnect the fluid connections.

7.10.3 Replacing the Home Sensors

Replacement of the home sensors requires significant disassembly of the pump to remove the pump module. Consider working with Teledyne Isco Technical Service when this replacement is required. It is necessary to remove the pump module (described elsewhere) to perform this replacement.

Removing the Home Sensors

1. Remove the pump module using the procedure in 7.10.2 *Removing the Pump Module from the Pump*.
2. Remove six screws and washers from back cover, and four nuts and washers from front cover. Remove the pump front and back covers.

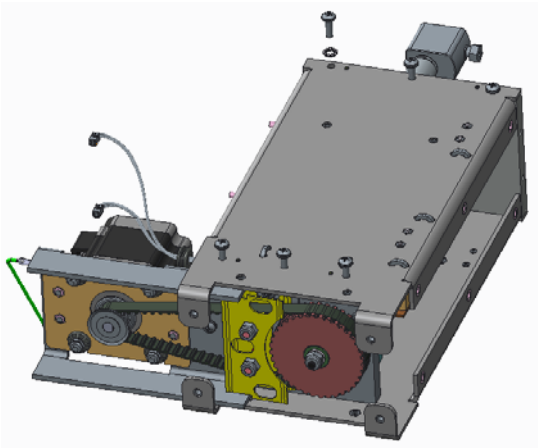


Figure 7-6 Module on its side

3. Lay the pump module on its side with the motor to the left and the cylinder oriented away from you.
4. Rotate the large timing pulley in Figure 7-6 until the sensor flag is approximately midway between the two home sensors.
5. Remove six screws and washers holding the side plate to the pump module.

6. Lift the side plate away from the pump module, observing that the wires are not caught on the pump module (Figure 7-7).

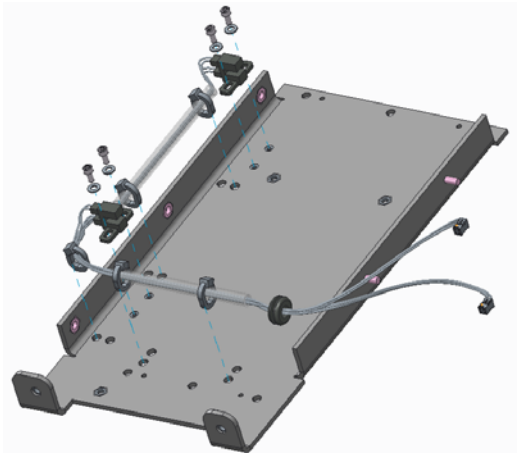


Figure 7-7 Have the home sensor facing upward on the workspace

7. Lay the side plate with the home sensors facing upward on a workspace.
8. Observe and note the location of the five cable ties holding the wires to the side plate. Note the location of the grommet and the wire connectors.
9. Snip five cable ties holding the wires to the side plate.
10. Using a 3/32" hex wrench, remove four cap screws and washers holding the home sensors to the side plate.
11. Remove the home sensors.

Installing the Home Sensors

1. Orient the side plate as shown in the figure 7-7.
2. Note that there are two home sensors on the sensor harness, one at the end, and the other near the middle. Orient the end home sensor over the threaded holes closest to the top edge shown in the figure 7-7, with the wires oriented toward the bent edge of the side plate.

☑ Note

The sensor wires must be oriented toward the bent flange on the side plate or damage to the Home Sensor will result during assembly later.

3. Install two screws and washers to hold this sensor in place. Position the sensor so that the screws are approximately centered on the slots. Tighten the screws to about 4.5 in-lbs. (0.5 N-m).

☑ Note

Do not use thread locker on these cap screws.

4. Orient the remaining sensor over the lower threaded holes in the side plate with the wires toward the bent flange on the side plate.

☑ Note

The sensor wires must be oriented toward the bent flange on the side plate or damage to the Home Sensor will result during assembly later.

5. Install two screws and washers to hold this sensor in place. Position the sensor so that the screws are approximately centered on the slots. Tighten the screws to about 4.5 in-lbs. (0.5 N-m).

☑ Note

Do not use thread locker on these cap screws.

6. Position the clear plastic sleeve between the home sensor and the grommet over the holes in the side plate, as shown in the figure 7-7.
7. Insert two cable ties through the paired holes in the side plate, orienting the tie heads as noted during disassembly. Position the clear tube so that the cable ties will hold the tube, not the wires.
8. Pull the cable ties snug, and snip the excess tie length.
9. Inspect that the wires from the home sensors are located correctly, then install the fifth cable tie through the paired holes just below the lower home sensor. Pull the cable tie snug, holding the wires to the side plate; then snip the excess tie length.
10. Position the side plate over the pump module, aligning the locating pins in the pump module with the mating holes in the side plate.
11. Examine that no wires have been pinched between the metal parts, and that the grommet and connectors are oriented toward the motor. Push the side plate fully onto the locating pins.
12. Install six screws and washers removed earlier to hold the side plate to the pump module.
13. Apply a small amount of thread locker to the threads mounting the front and back covers, then attach the front and back pump covers removed above using the screws, nuts and washers removed earlier.
14. Reinstall the pump module in the unit following the steps in the *Pump Module Installation* section 7.10.2

7.10.4 Timing Belt Replacement

The timing belts used to drive the pumps should never need adjustment or replacement in normal use. These belts are designed to function without attention for the life of the unit. Some chemicals or foreign objects may cause damage to them however. Replacing a timing belt is somewhat involved; consider getting assistance from Teledyne Isco Technical Service.

To Replace a Belt

1. Remove the pump module to be repaired using the steps in Section 7.12.4 above.
2. Lay the module on its side on a clean workbench, with the bottom oriented toward you (Figure 7-8).

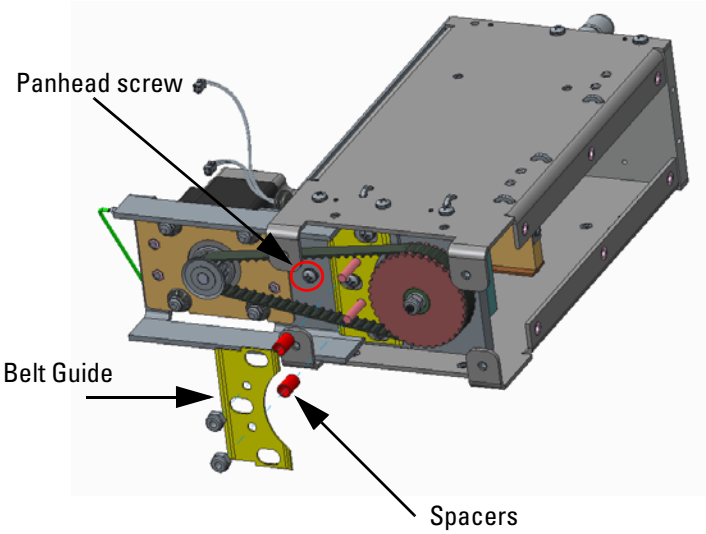


Figure 7-8 Pump module

3. Using a 3/8” socket wrench, remove the two nuts holding the belt guide in place.
4. Remove the belt guide and two spacers (Figure 7-8)
5. Locate the four pan head screws between the two pulleys. Using a #2 Phillips screwdriver, loosen all four screws about 1-2 revolutions. DO NOT REMOVE THE SCREWS.
6. Push on the motor to make the belt looser.
7. Remove the belt from the larger pulley first. It should slide off easily. (If the belt has broken, it may already be off). Clean up any debris from the pulleys and guides.
8. Do not remove the upper belt guide. If the upper belt guide should come free of the unit, observe there are two shims under the guide, one on each mounting screw. Also, observe the edges of the guide are bent slightly. These edges must be oriented closer to the main pump mounting plate.
9. Place the new belt over the smaller pulley first, and then thread it over the larger timing pulley. Observe that the two guide plate mounting screws are inside the belt. The drive is designed not to assemble if the belt is on the wrong side of these screws.

10. Slide the two spacers over the threaded screws, and then install the guide plate. Notice that there are bent edges on the guide plate; these edges must be oriented away from the belt.
11. Reinstall the two nuts that hold the guide plate in position, and tighten to about 20 in-lbs. (2.3 N-m).
12. Pull the motor to tighten the belt and rotate the pulleys to ensure the belt teeth are properly engaged.
13. Lift the entire assembly off of the workbench by holding the motor. While supporting the weight of the module by holding its motor, tighten the four Phillips head screws to 20 in-lbs. (2.3 N-m).
14. When properly installed, the belt will be fully engaged in the pulley grooves, and may seem a little loose when the belt is deflected. This is normal.

⚠ CAUTION

Avoid getting the timing belt too tight. Doing so will shorten the motor life.

15. Reinstall the pump module as described in Section 7.12.4.

7.10.5 Replacing a Transducer

The transducers used in the Demi pump are high quality, and should not need to be replaced in the life of the unit unless they are subjected to pressures beyond their rated capacity (and beyond the capability of the pump). Should the transducer need replacing because of overpressure, other components (such as the piston seals, the cylinder, and the valve rotor) should be inspected for damage too.

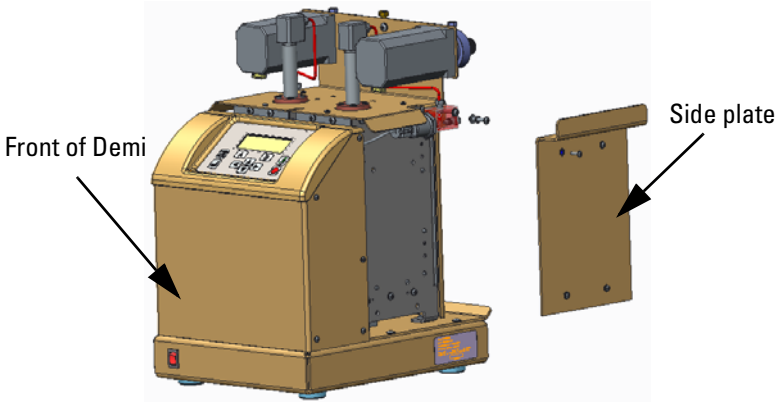


Figure 7-9 Demi with panel removed

The transducers are located on each side, just below the valve motors. They can be replaced without removing the main case. Both transducers are replaced using similar procedures so only the right transducer is described here. The left transducer is replaced following the same procedure on the other side of the instrument.

The pressure transducers must be able to track the system pressure within 25-50 psi (1.7-3.4 bar) in order to effectively transfer delivery from one pump cylinder to the other during operation. However, the transducer may not need replaced if the offset can be adequately adjusted.

To Replace a Transducer

1. Determine which transducer is in need of replacement before proceeding. A damaged transducer will usually display an unexpected pressure that cannot be adjusted properly. Damaged transducers may show a pressure of several hundred psi (greater than 7 bar) when the pressure in the cylinder is known to be released, or the transducer will fail to increase the displayed pressure when the cylinder pressure is known to be increasing.
2. Refer to the figure above. Remove four screws and washers from the side plate covering the transducer to be replaced.
3. Remove the two fluid connection fittings from the transducer mounting block.
4. Remove the two screws and related washers holding the transducer mounting block.
5. Remove the transducer and block assembly.
6. Disconnect the electrical connector on the back side of the transducer. It has a snap-lock feature; use care not to break it.
7. Unscrew the transducer from the mounting block.
8. Record the offset number from the label on the side of the transducer.
9. Apply pipe tape to the threads of the new transducer, and screw the new transducer into the mounting block.
10. Reattach the electrical connector to the transducer. The connector installs only one way, and should click when the lock engages.
11. Hold the transducer and mount against the mounting flange on the side of the unit.
12. Reinstall the two screws and related washers holding the transducer mounting block to the unit.
13. Connect the fluid fittings to the transducer mounting block.
14. Turn the unit on and check for fluid leaks, particularly noting around the transducer threads. Tighten the transducer fittings slightly if leaks are detected.
15. Turn the pump off.
16. Reinstall the side cover using the four screws and washers removed earlier.
17. Turn the pump back on, and calibrate the transducers. At a minimum, the offset should be calibrated. The gain can also be calibrated for better accuracy at high pressures. Refer to Section 7.10 for transducer calibration information.

7.10.6 Replacing the Internal Fan

A small internal fan is used to cool the motors when they are operated continuously. This is a very quiet fan that runs constantly whenever the power is on and may be difficult to hear it running. Removing the front cover allows you to see if it is working.

> **Note**
>
> Replacing the fan is a rather involved process. You may want to consider working with Teledyne Isco Technical Service to perform this procedure.

If Fan Needs to be Replaced:

1. Turn the Mains power switch OFF.
2. Disconnect the Mains power cord.
3. Remove both side covers from pump modules to gain access to the transducers.

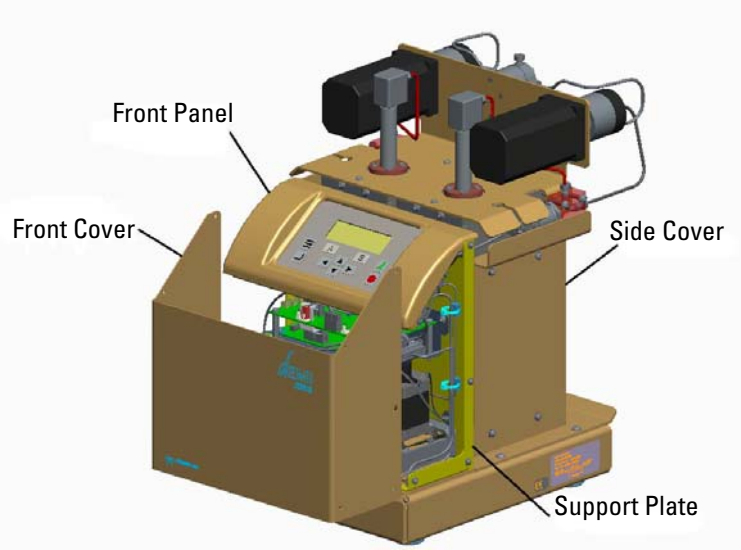


Figure 7-10 Remove the cover of the Demi

4. Unplug cables from both transducers.
5. Identify the valve motor cables by marking them Left and Right then unplug the cables from both valve motors.
6. Detach the Front Panel as described in Section 7.4.1. It is not necessary to disconnect the wires.
7. Remove the Front Cover as described in Section 7.4.2.
8. Reattach Front Panel to the support plate using only two screws. This will help keep the wires from the display from being damaged and coming unplugged.
9. Cut all three wire ties that retain the bundle of wires to the back surface of the support plate.
10. Locate the four nuts at the bottom of the support plate holding it to the drip tray. Using a 5/16” socket wrench, remove these nuts and washers.

11. Gently pull the support plate up so all the wires are free enough to allow the fan to be accessed above the pump module motors.
12. Lay the pump on its left side. This will help keep the support plate from dropping behind the motors and hindering access to the fan.
13. Track the fan wires from the fan to the controller circuit board, and disconnect it from the 2-pin header at P13.
14. Using a #2 Phillips screwdriver remove the four screws and washers disconnecting the fan from the support plate.
15. Gently remove the fan.

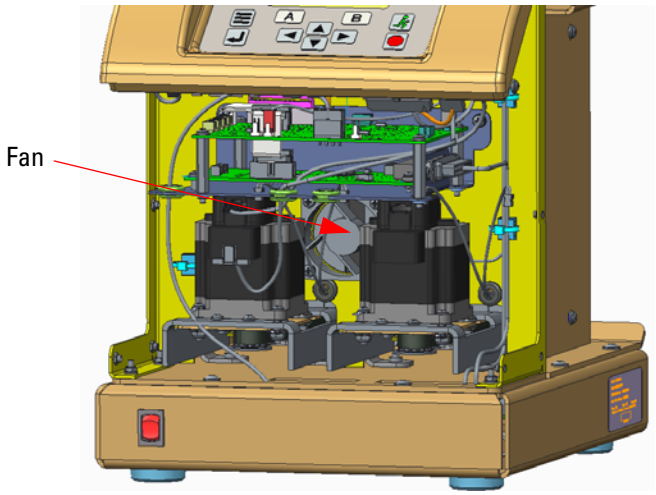


Figure 7-11 Location of the fan

Reassembly

Note

There is an arrow located on the fan that indicates the direction of airflow. In this application the fan blows air out of the cabinet so the arrow should be pointing towards the Support Plate.

1. Insert one screw and lock washer into the fan nearest the fan wires.
2. Attach the fan to the support plate so this one screw is located on the Right side of the pump. Do not tighten screw at this time.
3. Loosely install remaining three screws and lock washers and when they are all started then tighten all four screws securely.
4. Route fan wires along support plate and connect plug to 2-pin connector at P13 on controller circuit board.
5. Place pump back upright.
6. Reroute wires for valve motors through proper slots and connect to motors.

7. Locate support plate over four studs so it sits flush with base plate.
8. Observe that no wires are pinched or trapped by the internal support plate, and that it sets fully against the drip tray. Tighten the internal support plate with a 5/16” socket wrench.
9. Remove the screws temporarily holding the front panel to the internal support plate.
10. Using new cable ties collect the wires along each side of the unit, and cable tie the bundle to the mounting points on the internal support plate.
11. Connect both cables back onto the transducers.
12. Install both side covers making sure that the wires for the transducers do not get pinched.
13. Inspect that no connector has become disconnected. Pay particular attention that the ribbon cable connecting the display board to the controller has not become loose.
14. Position the display panel in its approximate location, and install the Front Cover from below. More detail is provided in Section 7.4.2. It is usually easiest to install the middle screws on the side of the front cover first. Do not tighten any of these six screws yet.
15. Refit the Front Panel, aligning the holes in the Front Cover with the holes in the Front Panel. Install four screws and washers loosely.
16. While holding the Front Cover in its proper position, tighten the six screws holding the Front Cover.
17. Pushing down and rearward to close the gaps in the cabinet; tighten the four screws holding the Front Panel to the Front Cover.
18. Reconnect the Mains power cord, and observe for unexpected behavior.
19. Turn on the Mains power switch, and observe that the display functions as expected.
20. Run the unit briefly to test for proper operation.
21. Return the unit to service.

Demi Pump

Appendix A Replacement Parts

A.1 Replacement Parts

Replacement parts are called out in the following illustrations. Refer to the call-out in the adjacent table to determine the part number for the item.

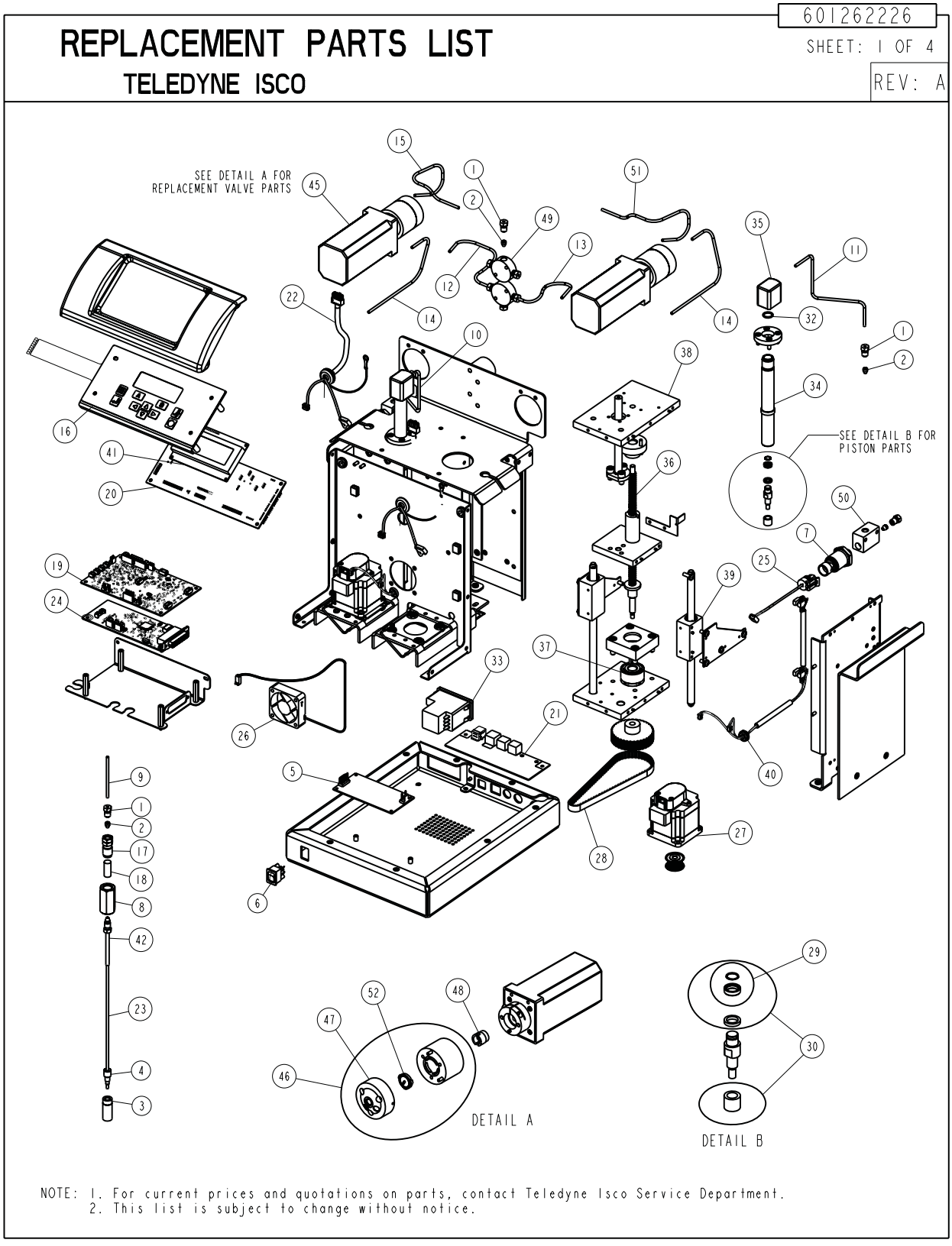
Replacement parts can be purchased by contacting Teledyne Isco's Customer Service Department.

Teledyne Isco
Customer Service Department
P.O. Box 82531
Lincoln, NE 68501 USA

Phone: (800) 228-4373
(402) 464-0231
FAX: (402) 465-3022

E-mail: IscoInfo@teledyne.com

A.1.1 Demi Pump



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REPLACEMENT PARTS LIST

SHEET: 2 OF 4

TELEDYNE ISCO

REV: A

ITEM NO.	PART NUMBER	DESCRIPTION
1	209016927	NUT 1/8" ZERO VOL
2	209016941	FER 1/8" ZERO VOL
3	209016980	FILTER, 10 MICRON
4	209016981	NUT MALE 1/8 TBG
5	341000003	POWER SUPPLY BOARD, 24VDC
6	410730401	DPDT ROCKER SWITCH
7	601264129	REPL XDCR,CAL2500PSI
8	601243516	LOWER HOUSING,CHECK VALVE
9	601243570	TUBING, SS, 2.5" LONG
10	601263227	TUBE,1/8",CYL CAP/TEE,LEFT
11	601263228	TUBE,1/8",CYL CAP/TEE,RIGHT
12	601263239	VALVE A INLET TUBING
13	601263240	VALVE B INLET TUBING
14	601263238	XDCR TO VALVE TUBING
15	601263241	VALVE A OUTLET TUBING
16	601264126	REPLACEMENT KEYPAD LABEL
17	602253240	HOUSING, CHECK VALVE
18	603864010	CHECK VALVE CARTRIDGE
19	691264211	CBA POWER
20	601249136	CBA CONTROLLER,PROGRAMMED
21	691264225	CBA CONN FOR E-NET USB (SELECT MODELS ONLY)
21	691264234	CBA CONN FOR RS232/RS485 (SELECT MODELS ONLY)
22	691264230	CABLE ASSY, VALVE
23	023050302	TBG FEP TEF .085ID CLEAR
24	691264074	CBA, FOR USB ETHERNET (SELECT MODELS ONLY)
25	691264231	CABLE ASSY, TRANSDUCER

NOTE: 1. For current prices and quotations on parts, contact Teledyne Isco Service Department.
2. This list is subject to change without notice.

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REPLACEMENT PARTS LIST

SHEET: 3 OF 4

TELEDYNE ISCO

REV: A

ITEM NO.	PART NUMBER	DESCRIPTION
26	601244500	REPL FAN,MED PRES PMP
27	304000110	MOT STPR W ENCD
28	209018301	TIMING BELT
29	601249134	KIT, PISTON SEAL REPLACEMENT
30	601249137	KIT, PISTON REBUILD
31	REMOVED	
32	202500426	O-RING
33	120001007	AC POWER ENTRY,3A,SINGLE FUSE,SNAP IN
34	601263233	CYLINDER
35	601263209	CYLINDER CAP
36	601249135	KIT, BALL NUT/SCREW REPLACEMENT
37	201023901	DOUBLE ROW, ANGULAR BALL BEARING
38	601263186	MEDIUM PRESSURE CYLINDER MOUNT
39	601264128	REPL GUIDE BLOCK
40	601264121	CABLE ASSY,HOME SENSOR
41	691264232	CABLE ASSY,LCD/CONT BRD
42	602258019	SPRING NUT ASSY
43	411031151	FU 1.0A 250 SB 3AG (110/117V ONLY) (NOT SHOWN)
44	411031130	FUSE 0.5A 250 SB 3AG (234V ONLY) (NOT SHOWN)
45	209009818	VLV,3 PORT,1/8X.08 PORT,2500PSI
46	209009819	REPL VALVE,3 PORT,1/8X.080 PORT
47	209009820	REPL VALVE STATOR,3-PORT
48	209009817	REPL DRIVE COUPLING,VALVE
49	209016136	TEE FITTING, 1/8", 2MM BORE
50	601263223	XDCR TEE
51	601263242	VALVE B OUTLET TUBING

NOTE: 1. For current prices and quotations on parts, contact Teledyne Isco Service Department.
2. This list is subject to change without notice.

601262226

REPLACEMENT PARTS LIST

SHEET: 4 OF 4

TELEDYNE ISCO

REV: A

ITEM NO.	PART NUMBER	DESCRIPTION
52	209009821	REPL VALVE ROTOR, 3-PORT

NOTE: 1. For current prices and quotations on parts, contact Teledyne Isco Service Department.
2. This list is subject to change without notice.

Demi Pumps

Index

NOTICE

Disregard the following “Declaration of Conformity” and Radio Interference Statement” if your instrument does not have a CE label on its rear panel

Radio Interference Statement

FCC

This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which the user will be required to correct the interference at his own expense.

Canada

This ISM apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Ce générateur de fréquence radio ISM respecte toutes les exigences du Règlement sur le materiel brouilleur du Canada.

DECLARATION OF CONFORMITY

ISM1-A

Application of Council Directive:	2014/30/EC -The EMC Directive 2014/35/EC – The Low Voltage Directive
Manufacturer's Name:	Teledyne Isco
Manufacturer's Address:	4700 Superior, Lincoln, Nebraska 68504 USA Mailing Address: P.O. Box 82531, Lincoln, NE 68501 Phone: +1 (402) 464-0231 FAX: +1 (402) 465-3799
Equipment Type/Environment:	Laboratory Equipment for Light Industrial/Commercial Environments
Trade Name/Model No:	Model 2510S dEMI Medium Pressure Pump
Year of Issue:	2016
Standards to which Conformity is Declared:	EN 55011:2009:A1:2010 EMC Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use EN 61326-1:2013 EMC Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use -- Part 1: General requirements EN 61000-3-2:2014 Limits for harmonic current emissions (equipment input current ≤ 16 A per phase) EN 61000-3-3:2013 Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A

Standard	Description	Severity Applied	Performance Criteria
IEC61000-4-2	Electrostatic Discharge	Level 2 - 4kV contact discharge Level 3 - 8kV air discharge	A
IEC61000-4-3	Radiated RF Immunity	80 MHz to 1GHz, 3V/m 1.4 to 2.0GHz, 3V/m, 2.0 to 2.7GHz 1 V/m, 80% AM at 1 kHz Level 2	A
IEC61000-4-4	Electrical Fast Transient (EFT) on Mains and I/O	Level 2 - 1kV on AC lines	A
IEC61000-4-5	Surge on AC Lines	Level 2 - 1kV Line Common Mode Level 2 - 0.5kV Differential Mode	A
IEC61000-4-6	Conducted RF Immunity on Mains and I/O	150 kHz to 80 mHz Level 2 – 3V rms, 80% Modulated at 1 kHz	A
IEC61000-4-11	Voltage Dips	0% during1 cycle and full cycle 70% at 25 cycles	A
IEC61000-4-11	Voltage Dips	0% for 5 seconds	C
CISPR11/ EN 55011:2009 /A1:2010	RF Emissions Radiated, below 1GHz and Conducted, AC Mains	Group 1, Class A Industrial, Scientific, and Medical Equipment	PASS

The undersigned, hereby declare that the design of the equipment specified above conforms to the above Directive(s) and Standards as of Jun e 28, 2016.

USA Representative

Edward J. Carter
Director of Engineering

TELEDYNE ISCO
Everywhereyoulook™

60-1262-132
Rev. 0

产品中有毒有害物质或元素的名称及含量

Name and amount of Hazardous Substances or Elements in the product

部件名称 Component Name	有毒有害物质或元素 Hazardous Substances or Elements					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二联苯 (PBDE)
线路板 Circuit Boards	X	O	O	O	O	O
液晶显示 LCD Display	X	O	O	O	O	O
电解电容 Capacitor	O	O	O	O	X	O
接线 Wiring	O	O	O	O	X	O
内部电缆 Internal Cables	O	O	O	O	X	O
外部电缆 External Cables	O	O	O	O	X	O
主电源线 Line Cord	O	O	O	O	X	O
变压器 Transformer	X	O	O	O	X	O
前面板标志 Front Panel Label	O	O	O	O	X	O
小键盘 Keypad	O	O	O	O	X	O
直流电机 DC Motor	X	O	O	O	X	O

产品中有毒有害物质或元素的名称及含量：Name and amount of Hazardous Substances or Elements in the product

O: 表示该有毒有害物质在该部件所有均质材料中的含量均在ST/ 标准规定的限量要求以下。

O: Represent the concentration of the hazardous substance in this component's any homogeneous pieces is lower than the ST/ standard limitation.

X：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出ST/ 标准规定的限量要求。

(企业可在此处，根据实际情况对上表中打"X" 的技术原因进行进一步说明。)

X: Represent the concentration of the hazardous substance in this component's at least one homogeneous piece is higher than the ST/ standard limitation.

(Manufacturer may give technical reasons to the "X"marks)

环保使用期由经验确定。

The Environmentally Friendly Use Period (EFUP) was determined through experience.

生产日期被编码在系列号码中。前三位数字为生产年(207 代表2007年) 。随后的一个字母代表月份：A为一月，B为二月，等等。

The date of Manufacture is in code within the serial number. The first three numbers are the year of manufacture (207 is year 2007) followed by a letter for the month. "A" is January, "B" is February and so on.

Teledyne Isco One Year Limited Factory Service Warranty*

This warranty exclusively covers Teledyne Isco instruments, providing a one-year limited warranty covering parts and labor.

Any instrument that fails during the warranty period due to faulty parts or workmanship will be repaired at the factory at no charge to the customer. Teledyne Isco's exclusive liability is limited to repair or replacement of defective instruments. Teledyne Isco is not liable for consequential damages.

Teledyne Isco will pay surface transportation charges both ways within the 48 contiguous United States if the instrument proves to be defective within 30 days of shipment. Throughout the remainder of the warranty period, the customer will pay to return the instrument to Teledyne Isco and Teledyne Isco will pay surface transportation to return the repaired instrument to the customer. Teledyne Isco will not pay air freight or customer's packing and crating charges. This warranty does not cover loss, damage, or defects resulting from transportation between the customer's facility and the repair facility.

The warranty for any instrument is the one in effect on date of shipment. The warranty period begins on the shipping date, unless Teledyne Isco agrees in writing to a different date.

Excluded from this warranty are normal wear; expendable items such as desiccant, pH sensors, charts, ribbon, lamps, tubing, and glassware; fittings and wetted parts of valves; check valves, pistons, piston seals, wash seals, cylinders, pulse damper diaphragms, inlet lines and filter elements; and damage due to corrosion, misuse, accident, or lack of proper installation or maintenance. This warranty does not cover products not sold under the Teledyne Isco trademark or for which any other warranty is specifically stated.

No item may be returned for warranty service without a return authorization number (RMA) issued by Teledyne Isco.

This warranty is expressly in lieu of all other warranties and obligations and Teledyne Isco specifically disclaims any warranty of merchantability or fitness for a particular purpose.

The warrantor is Teledyne Isco, 4700 Superior, Lincoln, NE 68504, U.S.A.

***This warranty applies to the USA and countries where Teledyne Isco does not have an authorized dealer. Customers in countries outside the USA, where Teledyne Isco has an authorized dealer, should contact their Teledyne Isco dealer for warranty service.**

Problems can often be diagnosed and corrected without returning the instrument to the factory. Before returning any instrument for repair, please contact the Teledyne Isco Service Department for instructions and to obtain a return material authorization number (RMA).

Instruments needing factory repair should be packed carefully and shipped to the attention of the service department. Small, non-fragile items can be sent by insured parcel post. **PLEASE WRITE THE RMA NUMBER ON THE OUTSIDE OF THE SHIPPING CONTAINER** and enclose a note explaining the problem.

Shipping Address: Teledyne Isco - Attention Repair Service
4700 Superior Street
Lincoln, NE 68504 USA

Mailing Address: Teledyne Isco
PO Box 82531
Lincoln, NE 68501 USA

Phone: Repair service: (800) 775-2965 (lab instruments)
(866) 298-6174 (samplers & flow meters)
Sales & General Information: (800) 228-4373 (USA & Canada)

Fax: (402) 465-3001

Email: IscoService@teledyne.com

March 2, 2016 P/N 60-1002-040 Rev J

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