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7. MICRO SR PUMP MODULE

7.1 DESCRIPTION (FIGURE 7.1)

The Micro SR (Sanitary Rotary) Pump Module, hereafter referred to as the Pump Module, is comprised of the following major components; a ceramic piston fabrication, a ceramic cylinder and a case having intake and discharge ports. The intake and discharge ports accept either 1/4-28 or 5/16-24 male threaded fittings.

7.2 OPERATION

The piston is driven by a spherical bearing mounted within a rotating spindle. This drive arrangement imparts both reciprocating and rotary motion to the piston. The magnitude of the piston's stroke is adjustable by varying the angle of the axis of the pump head relative to the axis of the motor drive shaft. This displacement range is infinitely adjustable within the pump specifications (refer to Table 7.2). Repeatability of 0.1% is obtainable once the stroke length is established.

The end of the piston is never drawn back beyond the intake and discharge ports in normal operation. The piston flat allows only one port to communicate with the interior of the pump cylinder at any time. The effect of this is positive mechanical valving, eliminating the need for check valves under normal operations. The pump, which cannot be driven by liquid pressure, essentially acts as a closed valve when the unit is not in operation.

7.2.1 Piston/Cylinder Set

The piston/cylinder set is constructed from a variety of ceramic materials. The ceramics are compatible with most acids and bases. The piston/cylinder set has a clearance between the piston and cylinder wall of approximately .00005" (.0013mm) which minimizes fluid slip. The ceramic material's mechanical and thermal stability allows the Pump Module to be sealed by virtue of a close-running clearance between the piston and the cylinder bore.

7.3 INSTALLATION

No installation of the Pump Module is required. Refer to section 7.5.5 for assembly and disassembly of the Pump Module to the Motor/Base Module.

7.4 OPTIONS

IVEK Corporation offers a variety of options to best meet the customers needs. Following is a list and description of available options for the Pump Module.

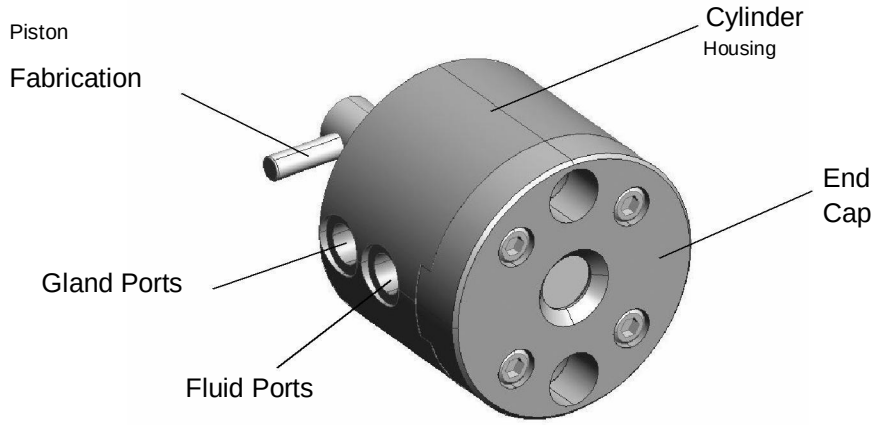


Figure 7.1 Micro SR Pump Module

7.4.1 Ceramic Size and Materials

The Piston/Cylinder set is available in different sizes as shown in table 7.2.

The End Cap, End Cap Retainer, O-ring(s) and Piston/Cylinder set are available in different materials.

7.4.2 Gland

The gland option provides for rinsing the rear portion of the piston with a liquid passing at a low flow rate through the annular gland. This precludes migration of the metered liquid beyond this groove, preventing it from reaching the rear of the pump. A gland also reduces the chance of the piston binding in the cylinder. The gland port accepts 1/4-28 male threaded fittings.

7.4.3 Port Size

The intake and discharge ports accept either 1/4-28 or 5/16-24 male threaded fittings.

7.5 MAINTENANCE (Figure 7.2)

CAUTION

Never forcibly remove or install the piston into the cylinder housed within the Pump Module. Damage to the equipment may result. Ceramic piston/cylinder sets are particularly sensitive to neglect and may seize if allowed to dry out without adequate cleaning.

The ceramic components for the Pump Module have been designed to last for millions of repetitions without wear. Preventative maintenance includes careful handling of the piston fabrication and cylinder housing when removed from the Pump Module. Always take great care when removing the piston fabrication from the cylinder and replacing the piston fabrication into the cylinder. If the cleaning procedure includes removing the Pump Module and individually cleaning separate parts, always keep the Pump Module parts together, each piston fabrication with the cylinder housing to which it was originally mated. The number on the piston fabrication should match the number on the cylinder housing. To avoid damage or chipping, never clean in such a way that the ceramics can vibrate against each other.

7.5.1 General Cleaning And Decontamination

Routine cleaning and (or) decontamination is extremely important in order to prolong the life and ensure the proper function of all liquid management system components.

NOTE

Routine flushing with a compatible liquid after shutdown may suffice for most applications.

1. Disconnect intake tubing from process liquid supply container.
2. Cycle pump in continuous mode until remaining process liquid has been purged from the Pump Module liquid path.
3. Connect the intake tubing to the cleaning liquid supply container.
4. Cycle pump in continuous mode at a high prime rate to flush the cleaning liquid through the entire liquid path.

Due to the large variety of process applications utilizing IVEK liquid management systems, this section provides general recommendations regarding cleaning and decontamination practices and procedures. It is ultimately the responsibility of the end user to ensure that a complete evaluation of cleaning and decontamination of this system and its components is performed. It is also imperative that all operating personnel are correctly trained in the proper methods and are diligent in their maintenance of cleaning and decontamination procedures.

If periodic tear-down for cleaning of any system component is required, refer to the appropriate mechanical diagram included in this manual for instructions on disassembly and assembly of that system component. Always use the utmost care when

disassembling and assembling component parts. Take special care when handling the Pump Module piston and cylinder set to avoid damage.

7.5.2 Storage

Storage refers to any extended time that the system remains idle. The main concern is liquid drying in the piston/cylinder area, causing the piston to seize in the cylinder. The duration of idle time that requires storage procedures is based on the liquid, Pump Module configuration, and operating environment. The system can be stored wetted with cleaning liquid, disassembled, or a liquid loop can be made.

7.5.3 O-Rings (Figure 7.2)

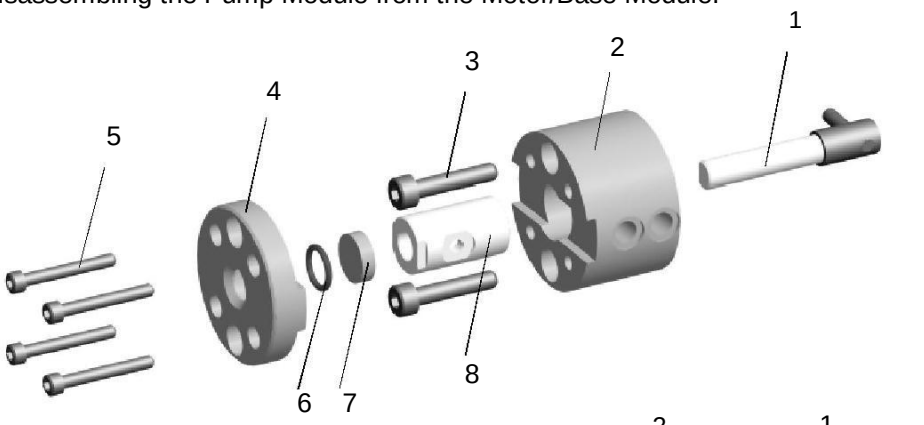
The inner O-ring (6B) serves to seal the head end of the pumping chamber.

Over time, O-rings may loose elasticity and become deformed. Periodic replacement of these O-rings is required. The replacement cycle is dependent on handling during assembly and disassembly in addition to the liquids being pumped.

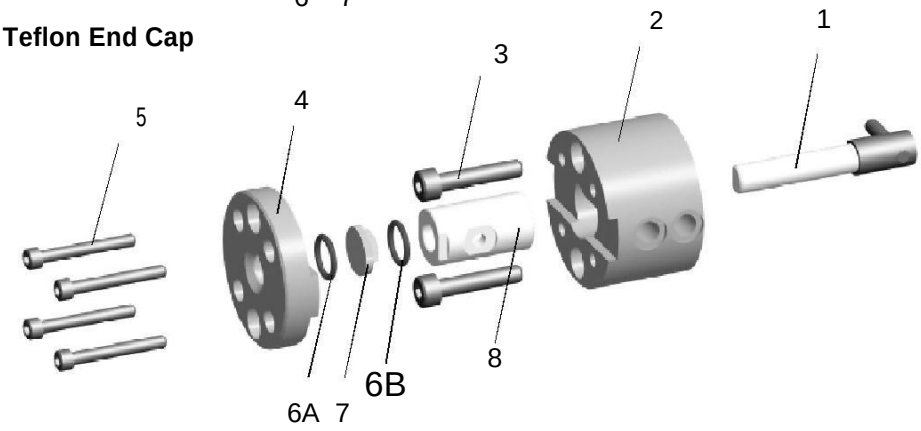
Please contact technical support at IVEK Corporation with any questions or concerns you may have regarding the operation or maintenance of this module.

7.5.4 Assembly/Disassembly Procedures (Figure 7.2)

The Pump Module contains the following replaceable parts. Also contained in this section are the procedures for assembling and disassembling the Pump Module from the Motor/Base Module.



Teflon End Cap



Sight Glass End Cap

Figure 7.2 Micro SR Pump Module Components Assembly/Disassembly

- End Cap Retainer (4)
- Sight Glass End Cap (7) or *optional Teflon End Cap/Seal (7)*
- O-Rings (6, 6A and 6B)
- Piston Fabrication and Cylinder (1 and 8)
- Case (2)

WARNING

Make sure the power is OFF and all hazardous liquids have been flushed from the system prior to performing any disassembly or assembly procedures.

7.5.5 Pump Module (Figure 7.2)

IVEK systems are shipped with the Pump Module assembled onto the Motor/Base Module. The following procedures are only necessary if you received a new Pump Module or for assembly after removing the Pump Module for cleaning, maintenance or repair.

Disassembly:

1. Loosen two M4 socket head cap screws (3) securing the Pump Module to the Motor/Base Module.
2. Pull the Pump Module away from the Motor/Base Module until piston fabrication (1) is approximately 2/3 of the way out of cylinder (8).
3. Determine the location of the spherical bearing and move the Pump Module laterally away from it until the pin in piston fabrication (1) slides out.

Assembly:

CAUTION

Lubricate the drive pin with IVEK Spindle Grease (Part # 052065) prior to assembly. Failure to lubricate the drive pin may result in damage to the Pump Module and Motor/Base Module.

1. Rotate the spindle on the Motor/Base Module so the spherical bearing is at the 3 O'clock position.
2. Extend piston fabrication (1), which is housed in the Pump Module, approximately 2/3 of the way out of cylinder (8).
3. Slide the drive pin, which is pressed into the piston end cap, into the center bore of the spherical bearing.
4. Position the Pump Module on the Motor/Base Module aligning over the mounting key.
5. Secure the Pump Module to the Motor/Base Module by installing and tightening two M4 socket head cap screws (3), torque to 5 in. lbs..

7.5.6 End Cap Retainer, End Cap and O-rings (Figure 7.2 items 4,7,6)

Disassembly

1. Remove four #4-40 socket head cap screws (5) securing end cap retainer (4) to cylinder housing (2).
2. Remove end cap retainer (4).
3. Remove inner O-ring (6B), sight glass end cap (7) and outer O-ring (6A).

OR if optional Teflon end cap/seal purchased.

3. Remove Teflon end cap/seal (7) and O-ring (6).

NOTE

Clean and inspect seals (6 or 7) prior to assembly. (Replace if necessary)

Assembly

1. Position outer O-ring (6A), sight glass end cap (7) and inner O-ring (6B) into the recessed diameter of end cap retainer (4).

OR if optional Teflon end cap/seal purchased.

1. Position O-ring (6) and Teflon end cap/seal (7) into the recessed diameter of end cap retainer (4).

NOTE

Install sight glass end cap with the reduced diameter facing towards the cylinder housing.

2. Position end cap retainer (4) with installed components into the recessed diameter of cylinder housing (2).
3. Secure with four #4-40 socket head cap screws (5), torque to 5 in. lbs..

7.5.7 Case, Piston Fabrication and Cylinder (Figure 7.2 Items 2, 1 and 8)

NOTE

The piston fabrication and cylinder are a matched set. If either the piston fabrication or cylinder needs replacing, both parts must be replaced.

Disassembly

1. Remove the Pump Module from the Motor/Base Module as described in section 4.5.5.
2. Remove piston fabrication (1).
3. Remove four screws (5) securing end cap retainer (4) to cylinder housing (2).

CAUTION

Be careful cylinder (8) does not fall out of cylinder housing (2).

4. Remove end cap retainer (4).
5. Remove inner O-ring (6B), sight glass end cap (7) and outer O-ring (6A).

OR if optional Teflon end cap/seal purchased.

5. Remove Teflon end cap/seal (7) and O-ring (6).

6. Push or slide cylinder (8) out of pump case (2).

NOTE

Clean and inspect seals (6 and 7) prior to assembly. (Replace if necessary)

Assembly

1. Push cylinder (8) into pump case (2).

NOTE

Install cylinder (8) so flats on the end of cylinder (8) line up with groove in pump case (2).

CAUTION

Thread fittings into cylinder housing (2) ports to prevent cylinder (8) from falling out of cylinder housing (2).

2. Position outer O-ring (6A), sight glass end cap (7) and inner O-ring (6B) into the recessed diameter of end cap retainer (4).

OR if optional Teflon end cap/seal purchased.

2. Position O-ring (6) and Teflon end cap/seal (7) into the recessed diameter of end cap retainer (4).

NOTE

Install sight glass end cap with the reduced diameter facing towards the cylinder housing.

3. Position pump case (2) with fittings installed onto end cap retainer (4), with installed components.
4. Secure with four #4-40 socket head cap screws (5), torque to 5 in. lbs.
5. Assemble the Pump Module onto the Motor/Base Module as described in section 4.5.5.

7.6 PROBLEM GUIDE

7.6.1 Piston Seized In The Cylinder (Figure 7.2)

The following tools are required to free a seized piston.

Pump Extractor Tool Kit IVEK Part Number 250052
9/64" Allen Wrench
3/32" Allen Wrench

The following steps should free a seized piston (refer to Figure 7.2):

CAUTION

DO NOT TRY TO FORCE THE PISTON FREE! Damage to the piston/cylinder set or Motor/Base Module may occur.

1. Remove four #4-40 socket head cap screws (5).
2. Remove end cap retainer (4), sight glass/teflon seal (7) and O-ring(s) (6).
3. Remove two M4 socket head cap screws (3).
4. Install end cap extractor with countersink out using the four #4-40 socket head cap screws (5).
5. Insert correct size extractor tip (based on the piston/cylinder set size) into the thumb screw knob.
6. Turn (by hand) the thumb screw knob (clockwise) into the end cap extractor until cylinder (8) becomes loose from piston fabrication (1).
7. Remove cylinder (8).

If step 7 can not be performed, move cylinder (8) laterally until the pin in piston fabrication (1) slides out of the spherical bearing then perform steps 8 and 9.

8. Soak the whole assembly in a liquid compatible with the materials and process liquids.
9. After soaking, try removing piston fabrication (1) from the cylinder (8) by applying a light torque to piston fabrication (1) using only your fingers (no tools).

If the aforementioned procedures fail, contact IVEK Technical Support Department. It may be necessary to ship the Pump Module and Motor/Base Modules back to the factory. Provide a note describing, in detail, what conditions caused the seizure.

7.6.2 Additional Problems

Table 7.1 contains a list of possible problems, causes and solutions for the Pump Module.

7.7 SPECIFICATIONS

Table 7.2 lists the volumetric output of the different size Pump Modules. Refer to the Title Page section of this manual for the Pump Module size provided with your system.

Table 7.2. Maximum Volumetric Output Per Rotation of the Pump Modules

Size	Maximum Displacement Per Stroke (ul)	Recommended Minimum Displacement Per Stroke (ul)
3A	25	1
2A	50	5
1A	100	10

7.8 MODEL NUMBER

The model number provides important information about the specifics of your Pump Module. Refer to this number when calling IVEK Technical support. The model number for your Pump Module is located in the Title Page section of this manual.

250021 - # # # # # ##

End Cap Material
- **1** - Sight Glass
- **2** - Teflon

O-Ring Material
- **1** - Buna-N
- **2** - Ethylene Propylene
- **3** - Kalrez
- **4** - Polyurethane
- **5** - Silicone
- **6** - Teflon Encapsulated Silicone
- **7** - Viton
- **8** - Teflon Encapsulated Viton

O-Ring Quantity
- **1** - 1
- **2** - 2

End Cap Retainer
- **1** - Delrin
- **2** - Stainless Steel

Port Size / Case Material
- **1** - 1/4-28 / Delrin
- **2** - 5/16-24 / Delrin
- **3** - 1/4-28 / Stainless Steel
- **4** - 5/16-24 / Stainless Steel

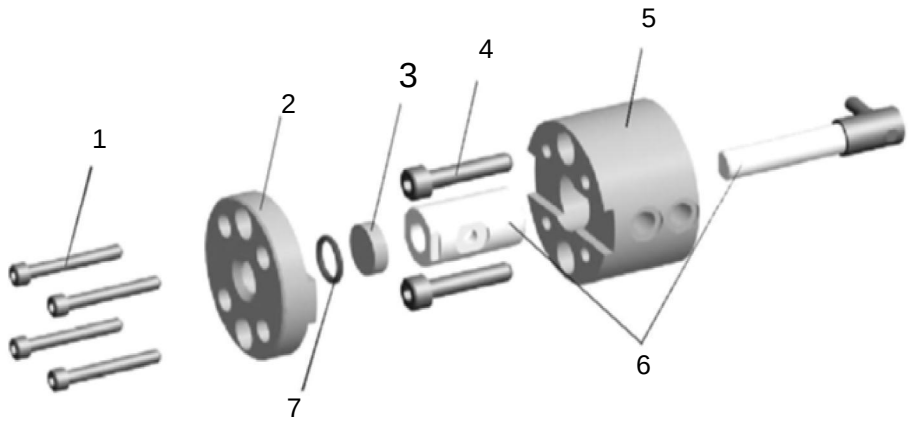
Ceramic Size and Material
- **01** - 3A Hip/YTZP
- **02** - 3A Hip/YTZP W/Gland
- **03** - 3A Mag Zirc
- **04** - 3A Mag Zirc W/Gland
- **05** - 2A Mag Zirc
- **06** - 2A Mag Zirc W/Gland
- **07** - 2A Alumina
- **08** - 2A Alumina W/Gland
- **09** - 1A Mag Zirc
- **10** - 1A Mag Zirc W/Gland
- **11** - 1A Alumina
- **12** - 1A Alumina W/Gland
- **13** - 1A Hex SA SIC
- **14** - 1A Hex SA SIC W/Gland

7.9 ILLUSTRATED PARTS BREAKDOWN

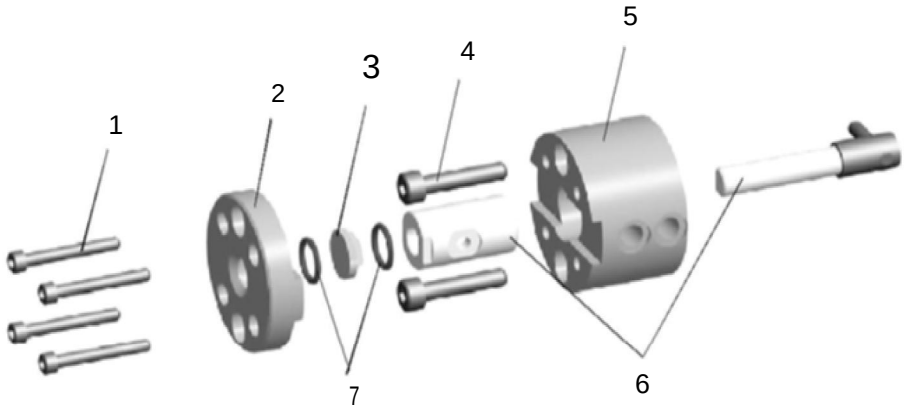
The illustrated parts breakdown (Figure 7.3) contains replacement parts for the Micro SR Pump Module.

Table 7.1 Common Operational Problems And Solutions

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
Air evident in discharge line.	Loose/Damaged Ferrules.	Tighten/replace ferrules.
	Loose or damaged intake tubing.	Tighten/replace intake tubing.
	Loose/Damaged End Cap Seals.	Clean, inspect and replace if necessary.
	Cavitation	Increase feed pressure, inlet tubing size or reduce Pump Module speed.
Piston seizing	Particulate materials entrapped between piston and cylinder or liquid has polymerized.	Disassemble Pump Module and clean all wetted surfaces.
Fluid leaks	Improperly seated or worn end cap retainer, sight glass, end cap or O-ring.	Disassemble Pump Module and clean all wetted surfaces, inspect components and replace if necessary.
	Loose/damaged ferrule or tubing.	Inspect and replace ferrule or tubing if necessary.



Teflon End Cap



Sight Glass End Cap

Figure 7.3 Micro SR Pump Module (Sheet 1 of 3)

	PART NUMBER	DESCRIPTION	UNITS PER ASSY
	250021-#######	Micro SR Pump Module	1

Model # Tab	Dwg Index #	Part #	Description	Qty
	4	182009-0420	Scr, Soc Hd Cap, 18-8; Metric	2
	1	182011-C04088	Scr, Soc Hd Cap, 18-8; Inch	4
250021-(#)## # # # ## END CAP MATERIAL				
1	3	022044	End Cap, Cyl, Sight Glass	1
2	3	102104	End Cap, Cyl, Teflon	1
250021 - #(##) # # ## O-RING MATERIAL				
11	7	142294-01101	O-Ring ; -011 Buna-N	1
12	7	142294-01101	" ; -011 Buna-N	2
21	7	142294-01102	" ; -011 Ethylene Propylene	1
22	7	142294-01102	" ; -011 Ethylene Propylene	2
31	7	142294-01103	" ; -011 Kalrez	1
32	7	142294-01103	" ; -011 Kalrez	2
41	7	142294-01104	" ; -011 Polyurethane	1
42	7	142294-01104	" ; -011 Polyurethane	2
51	7	142294-01105	" ; -011 Silicone	1
52	7	142294-01105	" ; -011 Silicone	2
61	7	142294-01107	" ; -011 Teflon Encapsulated Silicone	1
62	7	142294-01107	" ; -011 Teflon Encapsulated Silicone	2
71	7	142294-01108	" ; -011 Viton	1
72	7	142294-01108	" ; -011 Viton	2
81	7	142294-01109	" ; -011 Teflon Encapsulated Viton	1
82	7	142294-01109	" ; -011 Teflon Encapsulated Viton	2
250021- # ##(#) END CAP RETAINER				
1	2	250012-001	Retainer, End Cap, Micro SR; Delrin	1
2	2	250012-002	Retainer, End Cap, Micro SR; SST	1
250021 - # ## #(#) ## PUMP CASE SIZE / MATERIAL				
1	5	250020-001	Pump Case Fab; 1/4-28 / Delrin	1
2	5	250020-002	Pump Case Fab; 5/16-24 / Delrin	1
3	5	250030-001	Pump Case Fab; 1/4-28 / Stainless Steel	1
4	5	250030-002	Pump Case Fab; 5/16-24 / Stainless Steel	1

Figure 7.3 Micro SR Pump Module (Sheet 2 of 3)

	PART NUMBER	DESCRIPTION	UNITS PER ASSY
	250021-#######	Micro SR Pump Module	1

Model # Tab	Dwg Index #	Part #	Description	Qty
250021 - # ## # # ##			**CERAMIC SIZE/MATERIAL**	
01	6	022286-13322	Piston/Cyl Set; 3A, Hip/YTZP	1
02	6	022286-13321	" ; 3A, Hip/YTZP w/gland	1
03	6	022286-23322	" ; 3A, Mag Zirc	1
04	6	022286-23321	" ; 3A, Mag Zirc w/gland	1
05	6	022286-22222	" ; 2A, Mag Zirc	1
06	6	022286-22221	" ; 2A, Mag Zirc w/gland	1
07	6	022286-32232	" ; 2A, Alum	1
08	6	022286-32231	" ; 2A, Alum w/gland	1
09	6	022286-21122	" ; 1A, Mag Zirc	1
10	6	022286-21122	" ; 1A, Mag Zirc w/gland	1
11	6	022286-31132	" ; 1A, Alum	1
12	6	022286-31131	" ; 1A, Alum w/ gland	1
13	6	022286-41142	" ; 1A, Hex SA SIC	1
14	6	022286-41141	" ; 1A, Hex SA SIC w/gland	1

Figure 7.3 Micro SR Pump Module (Sheet 3 of 3)