

# **CYCLONE 4400**

M e t e r L u b r i c a t i o n S Y S T E M



# THE CYCLONE 4400

## INSTRUCTION & OPERATING MANUAL

Version: 05012002 Rev.1



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# SECTION 1: FIRST THINGS TO KNOW ABOUT THE MLS

## Operation Specifications

### Injection Pump

Operating Pressure:	15 - 1500 psi.(1.03-103.4 Bar (g))
Actuation Pressure:	15 - 55 psi.(1.03-3.79 Bar (g))
Displacement:	.140 cc (fixed)
Operating System Temperature:	*-30 °F — +140 °F(-34 °C — +60 °C)

### Service Connections:

Actuation Gas Inlet:	1/4" NPT Female
Lubricant Discharge:	1/8" S/ST tube, Ferrule

### Oil Reservoir

Material:	Polycarbonate & Anodized Aluminum
Capacity:	6 oz. (175 cc) (1250 injections)
Compatible Lubricants:	Chemlube, Anderol, 5w or equivalent

### Controller

Power Supply:	Lithium battery pack
Battery Reserve:	2 years (1 stroke/hr)
Timer Accuracy:	< + 0.01%, deviation from absolute
Display:	LCD, indicating total injections (re-settable)
Flow input:	
Continuous:	20 Hz
Minimum Pulse Width:	20 ms
Pulse Type:	Electronic, 5 — 24VDC Dry, Contact Closure

### Operating Mode

Timer Mode, Continuous:	.1 to 99 hours (incrementally adjustable) .1 to 9.9 hours in .1 hour (6 minutes) increments
Timer Mode, Intermittent:	Allows control from the YZ DPS-2 to inject proportion to time during periods of flow. .1 to 99 hours (incrementally adjustable)
Proportional-to-Flow Mode: adjustable)	10 to 9900 pulses per injection (incrementally adjustable)

**\*Note:** Operation at extreme temperatures may affect system performance. To enhance the performance of this system, adequate heat should be provided to maintain an operating environment above 30° F (-1° C).



# SECTION 1: FIRST THINGS TO KNOW ABOUT THE MLS

## Theory of Operation

The Cyclone 4400 MLS is a pipeline mounted system which uses the pneumatically operated, positive displacement Cyclone 4400 pump, the Z-65/6.1H timer/controller, the YZ filter/regulator and a low power solenoid valve to deliver injections.

### The 4400 provides three modes of operation:

#### A. Time-based injection:

In this mode of operation, the 4400 injects lubricant into the meter at regular time intervals. The volume of injection is preset at .140 cc/stroke. The Z-65/6.1H controller operates as a recycling timer, periodically energizing a low power solenoid valve. Energizing the solenoid valve allows actuation gas to stroke the C-44 pump. The rate at which this occurs is a function of operator input. Two 10 position switches are used to set the off time interval. The number of times the solenoid output is activated is recorded by the onboard LCD stroke indicator.

#### B. Time-based injection with the YZ differential pressure switch (DPS-2):

This mode of operation is similar to the time-based injection mode, except that the DPS-2 converts a differential pressure signal to an electrical signal that the Z-65/6.1H timer uses to determine if flow is present in the pipeline. In effect, the DPS allows the Z-65/6.1H timer to shut off when flow stops in the pipeline, and when flow starts again, the ability to start-up and resume operation.

#### C. Proportional-to-flow injection:

In this mode of operation, the Z-65/6.1H counter operates as a dividing counter. The Z-65/6.1H counter periodically energizes a low power solenoid valve. As in the other two modes of operation, this allows actuation gas to stroke the C-44 pump. The rate at which this occurs is a function of operator input as well as the host computer or other device that inputs pulses per volume metered. The two 10-position switches on the Z-65/6.1H are used to set the number of

pulses the counter will count before activating the solenoid output. The number of times the solenoid output is activated is recorded by the onboard LCD stroke indicator.

In all three modes of operation, the Z-65/6.1H timer/counter operates using a replaceable internal battery pack. The battery pack condition is monitored by way of two indicator LEDs. When the battery pack needs replacement, the red LED will illuminate when the solenoid output is activated. If the battery pack is good, the green LED will illuminate when the solenoid is activated.

## System Accessories

- The **External Power Option** can be used in lieu of the internal battery pack. The External Power Option (model # EPO-120) consists of an AC to DC converter and intrinsically safe barrier to convert 120 VAC power to 28 VDC to operate the controller without the use of the internal battery pack.
- The **Solar Power Option** can be used in lieu of the internal battery pack. The **Solar Power Option** (model #SPO-12) consists of a 5 watt solar panel with RM-12 charger regulator module and internal 12VDC, 5 Amp hour battery pack.
- 1/8" stainless steel Check Valve. These should be installed in every tubing line that attaches a MLS 4400 to a meter. (P/N A3-0228).

A complete line of accessories is available through YZ. Please contact your local representative or YZ Systems, Inc.



# **SECTION 1: FIRST THINGS TO KNOW ABOUT THE MLS**

## **Application**

One of the difficulties in maintaining turbine meters in the field is that they require lubricant for the unrestricted movement of the turbine, and for measurement accuracy.

Maintaining the lubricant level in meters is a problem that has existed for a very long time. Today, at YZ Systems, we have the solution in the Cyclone — Meter Lubrication System 4400.

Capable of accepting pulses directly from a meter, index pulser, electronic corrector, or flow computer, the Cyclone can operate in Proportional-to-flow or time-based injection modes. Further refinement of the time based mode adds the capability of control from the YZ DPS-2 — Differential Pressure Switch allowing lubricant injection only when flow occurs in the pipeline.

### **Features & Benefits:**

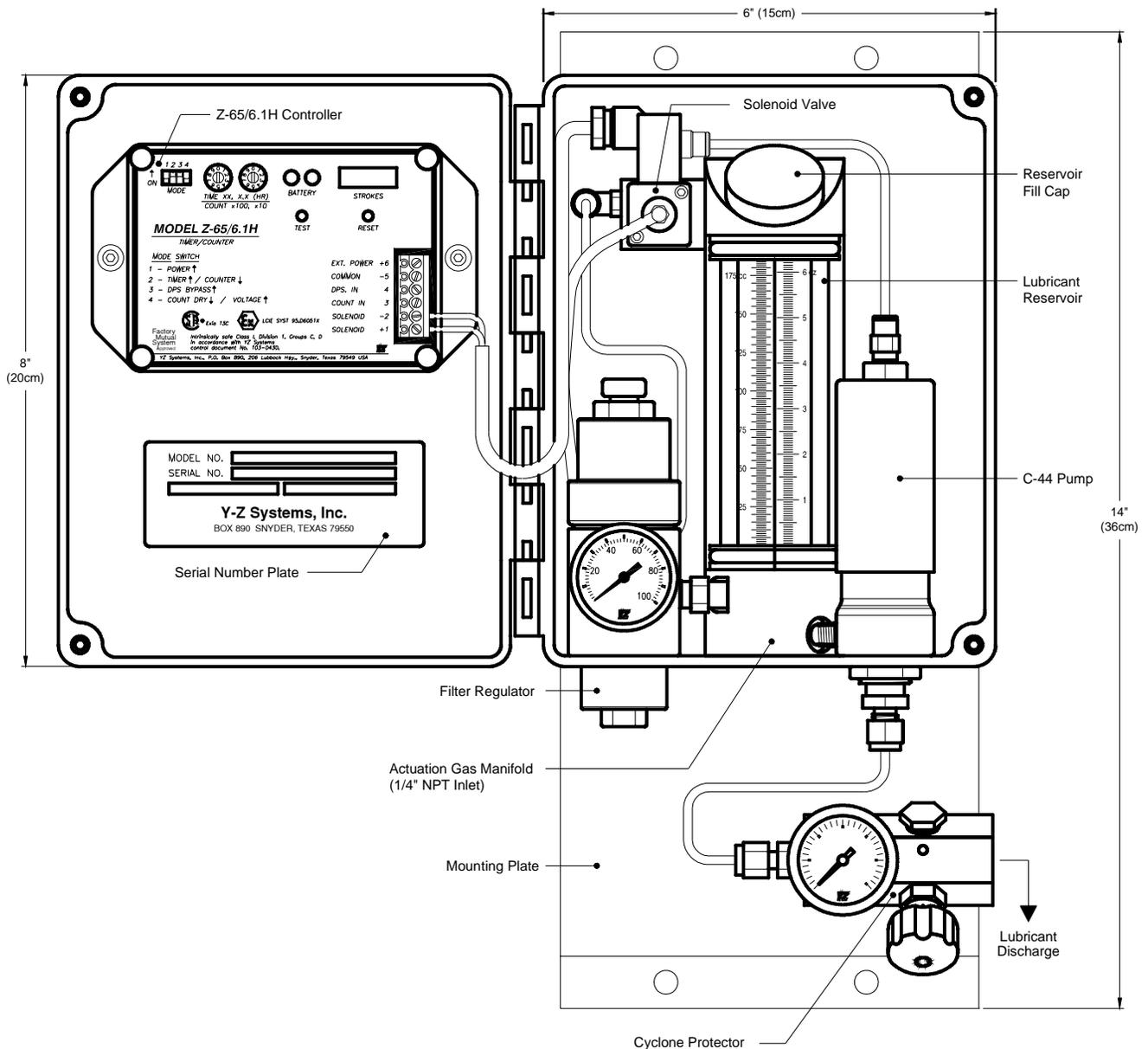
- Provides Systematic Lubrication to the meter for ensured measurement accuracy and durability
- Versatile electronic controller for time-based, time & flow based, and proportional-to-flow operation
- Durable NEMA 4X fiberglass reinforced polyester enclosure to protect from the elements
- Flexible dry contact or voltage pulse flow input
- On-Board LCD stroke & LED battery indicator
- Adjustable Filter/Regulator provides actuation gas
- On-board 6 oz. oil reservoir
- Long life potted electronics
- Intrinsically Safe for Class I, Group C, D; FM approved, and CSA & Cenelec Certified
- Convenient termination block for pulse and differential pressure switch input



# SECTION 2: SYSTEM INSTALLATION

## System Components

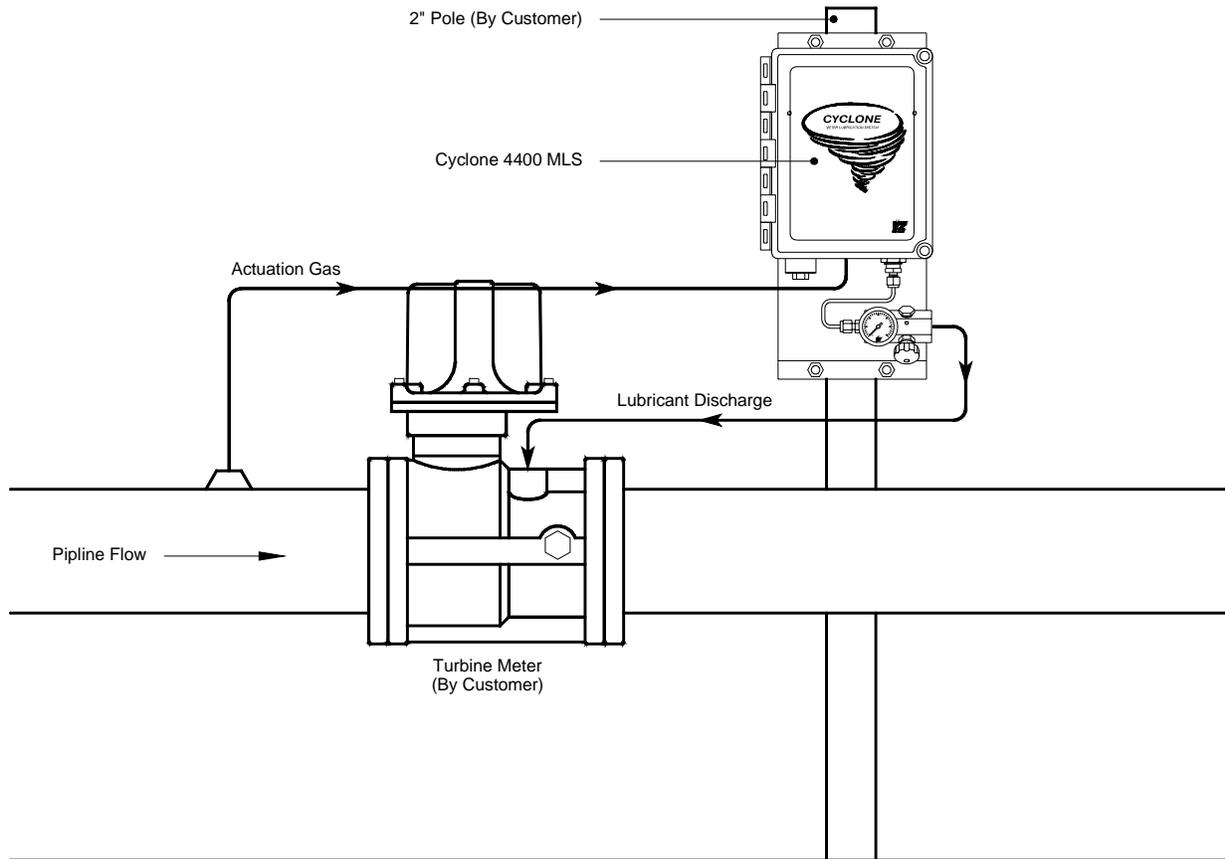
The primary components of the Cyclone 4400 MLS (Meter Lubrication System) are illustrated below.



# SECTION 2: SYSTEM INSTALLATION

## Injector Location

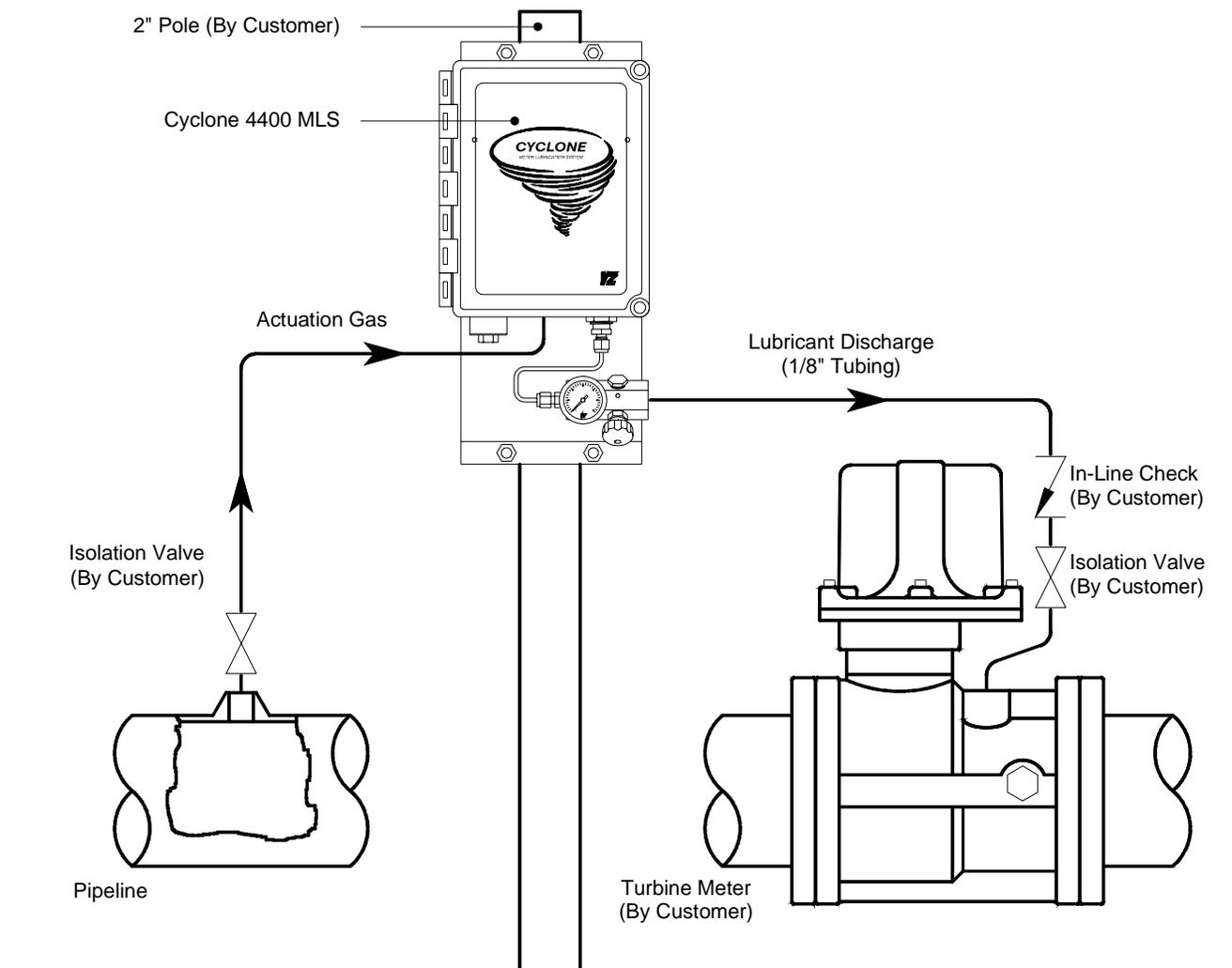
1. The injector unit should be located as close to meter as possible. In addition, discharge tubing should be kept as short as possible.
2. The injector unit is designed to mount to a 2" pole. The recommend mounting configuration is shown below.



# SECTION 2: SYSTEM INSTALLATION

## Injector Installation

1. The Cyclone 4400 should be mounted in a vertical position.
2. The Cyclone 4400 requires a 1/4" NPT pipeline gas connection.
3. The 1/8" discharge tubing should connect to the meter injection port. An in-line check valve should be installed at the injection port.



## SECTION 2: SYSTEM INSTALLATION

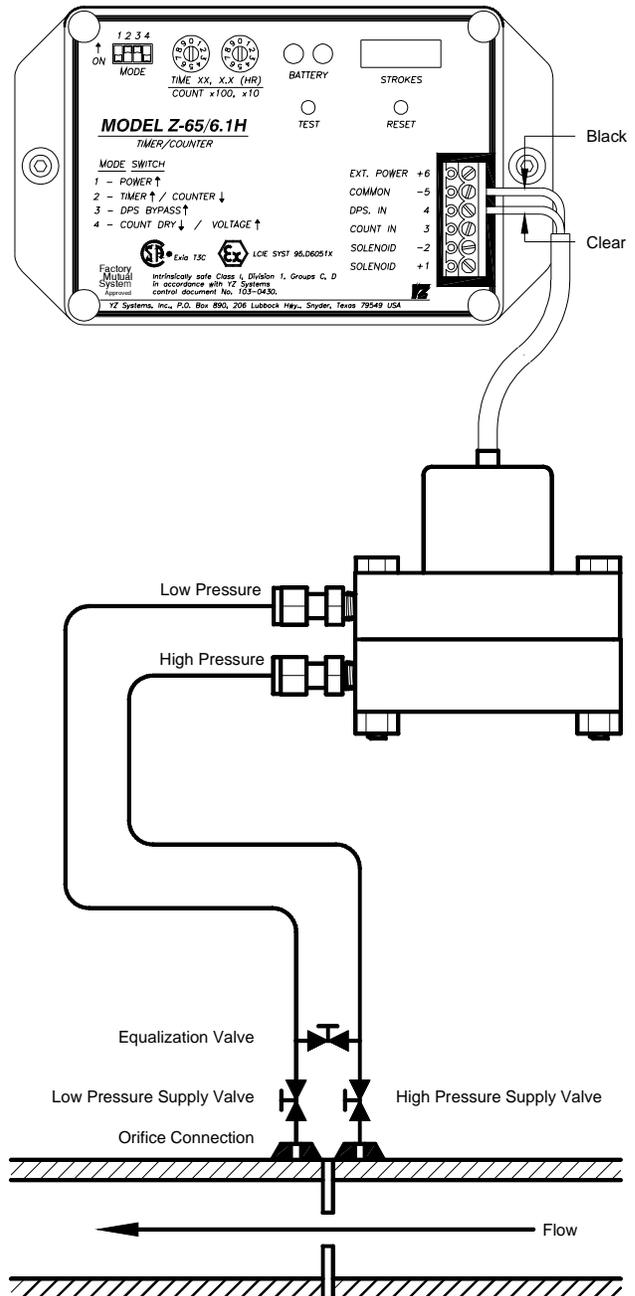
### (Optional) DPS-2 Installation

1. With the low pressure supply valve and the high pressure supply valve closed, connect the DPS-2 to the orifice connection tubing.
2. Open the equalization valve.
3. Open the low pressure supply valve or the high pressure supply valve.

#### **IMPORTANT NOTE:**

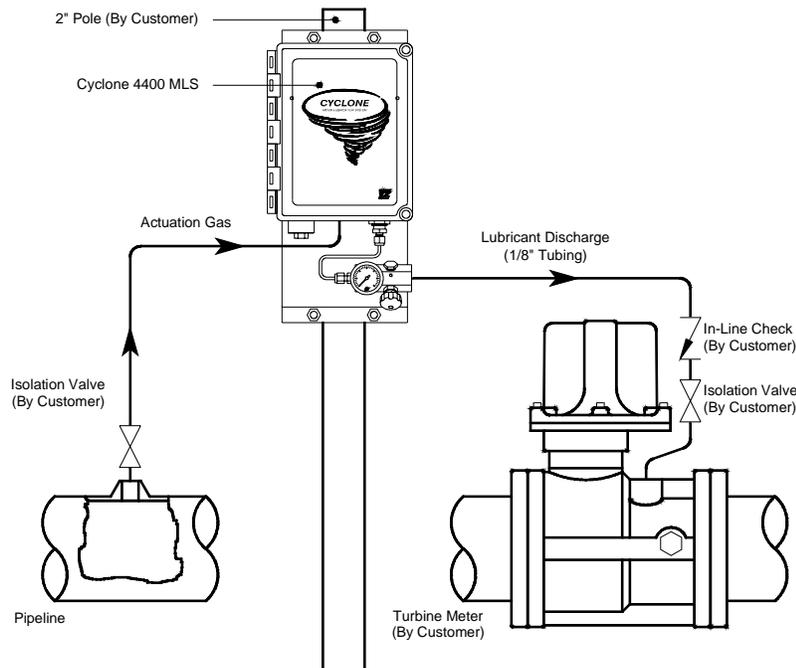
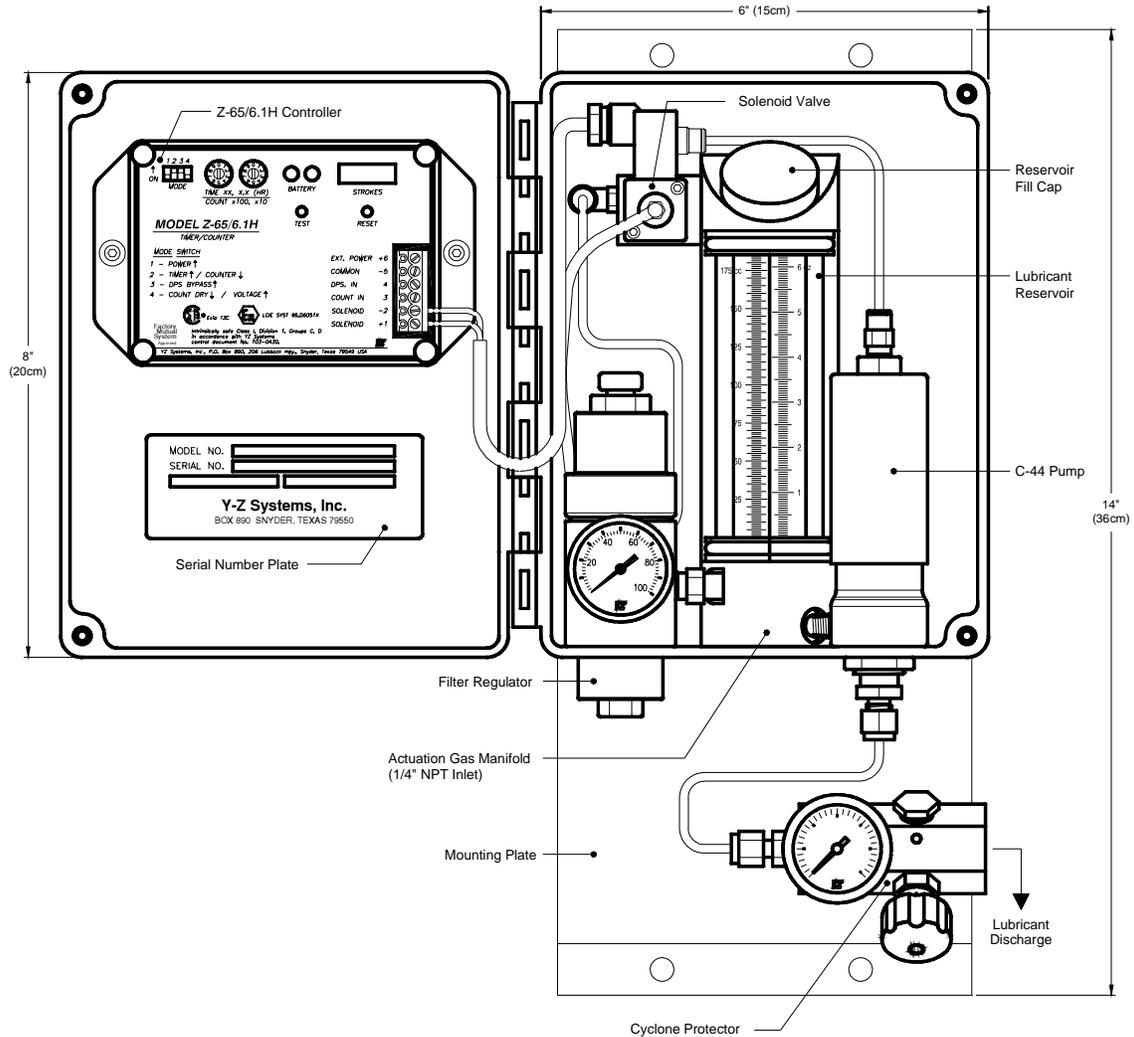
*Do not open either the low pressure supply valve or the high pressure supply valve without ensuring that the equalization valve is open. Failure to do so may damage the DPS-2's internal components.*

4. Open the other supply valve.
5. Close the equalization valve.
6. Run the free end of the DPS-2 cable through the cable entry connector located on the upper left side on the Cyclone 4400 enclosure.
7. Connect the DPS-2 cable as shown in the diagram.
8. Tighten the cable entry connector, allowing for enough cable length to open the enclosure.



# SECTION 3: SYSTEM CONTROL AND ELECTRONICS

## Overview



# SECTION 3: SYSTEM CONTROL AND ELECTRONICS

## Setting Input Parameters Z-65 Set-Up Proportional-To-Flow

In this mode of operation, the Z-65 controller is used as a dividing counter to control the rate at which the pump is actuated. The desired time between pump strokes is controlled by the host computer or output device that will give an input pulse to the Z-65 controller.

1. Determine if the incoming input is either a dry contact or voltage pulse.

**2. If the input is a dry contact:**

a. Terminate the incoming connections to the Z-65/6.1H terminal strip (see illustration).

b. Turn mode switch 1 to on.

c. Turn mode switch 2 to off.

d. Turn mode switch 3 to on.

e. Turn mode switch 4 to off.

**OR**

**3. If the input is a voltage pulse:**

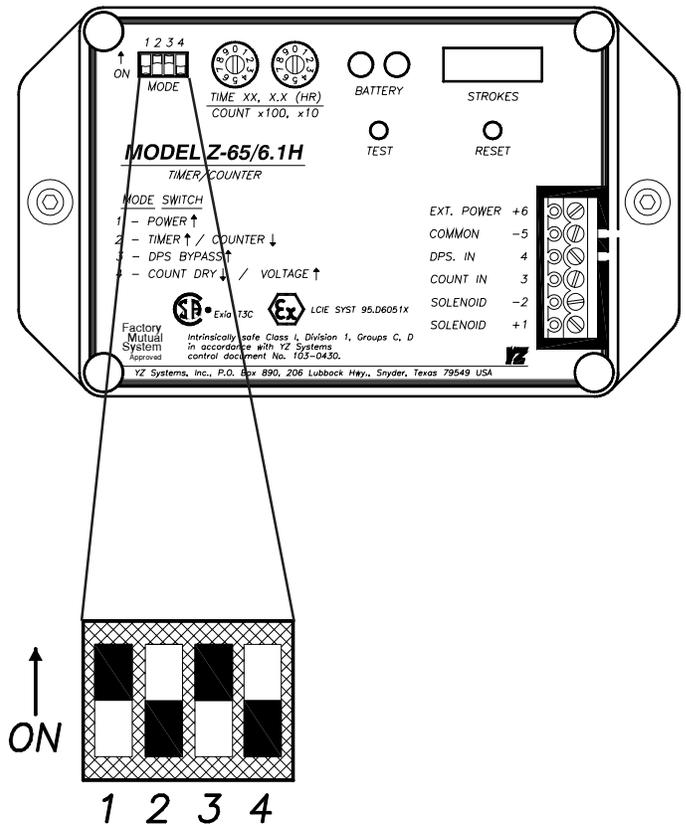
a. Terminate the incoming connections to the Z-65/6.1H terminal strip (see illustration).

b. Turn mode switch 1 to on.

c. Turn mode switch 2 to off.

d. Turn mode switch 3 to on.

e. Turn mode switch 4 to on.



# SECTION 3: SYSTEM CONTROL AND ELECTRONICS

Calculate the counter setting using the following chart:

1. C-44 pump displacement (.140cc)	=	a. _____
2. Desired injections lubricant per volume of flow (cc/MMCF or cc/MCM)	=	b. _____
3. pulses/volume metered (pulses/MMCF or pulses/MCM)	=	c. _____
4. Counter setting	=	$\frac{a \times c}{b}$

	Example #1:	Example #2:
	English Gas	Metric Gas
	Flow Units	Flow Units
pump displacement (a.)	= .140cc	.140cc
injection rate (b.)	= .05cc/MMCF	.05cc/MCM
pulses per volume metered (c.)	= 100 pulses/MMCF	100 pulses/MCM

**Example #1**  
**counter setting** =  $\frac{.140\text{cc} \times 100 \text{ pulses per MMCF}}{.05\text{cc/MMCF}}$  = **280 pulses**

**Example #2**  
**counter setting** =  $\frac{.140\text{cc} \times 100 \text{ pulses per MCM}}{.05\text{cc/MCM}}$  = **280 pulses**

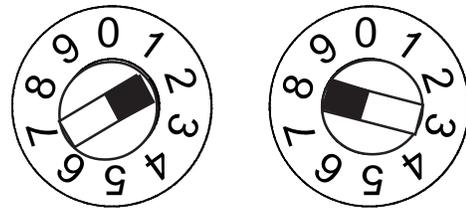
## IMPORTANT NOTE:

If the calculated counter setting is less than 10 or greater than 9900, the pulses per volume metered will need to be adjusted. This can be programmed in most flow meters to the desired rate. If the calculated counter setting is less than 10, increase the pulses per volume metered. If the calculated counter setting is greater than 9900, decrease the pulses per volume metered.

Turn the counter dials to the appropriate number of pulses you want to count before the sample pump strokes.

Example: 280 pulses; turn dials to 28.

Press the test button once to load the value into the memory.



(COUNT x10)

## IMPORTANT NOTE:

Counter above corresponds to dial setting for Z-65 with counter range setting in X10 position (center two pins). See page 21 Counter range setting.



# SECTION 3: SYSTEM CONTROL AND ELECTRONICS

## Setting Input Parameters Z-65 Set-Up Proportional-To-Time

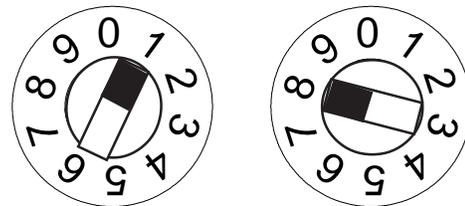
1. Calculate the injection rate using the following 30 day chart:

Counter Range Settings

Low Rate (xx hour range)		High Rate (x.x hour range)	
cc/month	dial setting	cc/month	dial setting
1	99	10	99
2	50	15	67
3	34	20	50
4	25	25	40
5	20	30	34
6	17	40	25
7	14	50	20
8	13	60	17
9	11	75	13
10	10	100	10

2. Set the timer dials on the Z-65/6.1H to the injection rate from step 8.1.

Example



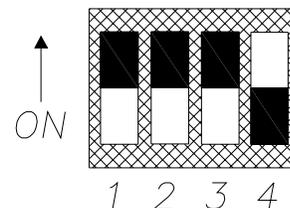
$$\frac{\text{TIME XX, X.X (HR.)}}{\text{COUNT x100, x10}}$$

18 hours

### IMPORTANT NOTE:

The time (18 hours) above corresponds to the dial setting shown for the Z-65/6.1H model with the timer range setting in the factory position (jumper on the two left pins). See page 21 [Timer Range Setting](#).

3. Turn mode switch 1 to on.
4. Turn mode switch 2 to on.
5. Turn mode switch 3 to on.
6. Turn mode switch 4 to off.
7. Press the test button once to initiate the timer sequence.



# SECTION 3: SYSTEM CONTROL AND ELECTRONICS

## Setting Input Parameters

### Z-65 Set-Up Proportional-To-Time w/DPS-2 Option

1. Calculate the injection rate using the following 30 day chart:

Low Rate (xx hour range)		High Rate (x.x hour range)	
cc/month	dial setting	cc/month	dial setting
1	99	10	99
2	50	15	67
3	34	20	50
4	25	25	40
5	20	30	34
6	17	40	25
7	14	50	20
8	13	60	17
9	11	75	13
10	10	100	10

2. Set the timer dials on the Z-65 to the determined time from step 1 above.

3. Turn mode switch 1 to on.

4. Turn mode switch 2 to on.

5. Turn mode switch 3 to off.

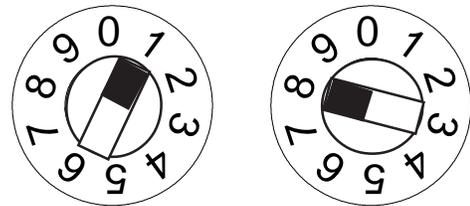
6. Turn mode switch 4 to off.

7. Press the test button once to initiate the timer sequence.

#### **IMPORTANT NOTE:**

For the Z-65 to operate the Cyclone 4400, a pressure differential of 3" of water column (w.c.) must exist between the high pressure and low pressure ports of the DPS-2.

Example

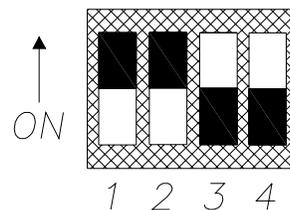


TIME XX, X.X (HR.)  
COUNT x100, x10

18 hours

#### **IMPORTANT NOTE:**

The time (18 hours) above corresponds to the dial setting shown for the Z-65/6.1H model with the timer range setting in the factory position (jumper on the two left pins). See page 21 Timer Range Setting.



# SECTION 3: SYSTEM CONTROL AND ELECTRONICS

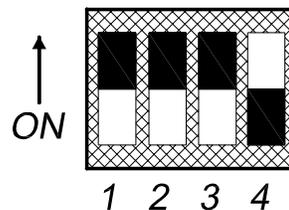
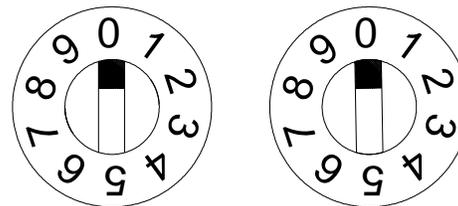
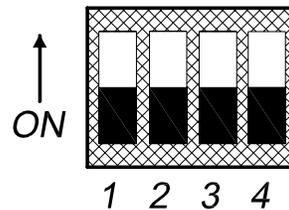
## Operational Check and Leak Testing

- When all of the tubing connections have been completed, open the gas supply valve to allow pipeline pressure into the injector. Check all connections using a liquid leak detector.
- Adjust the filter/regulator from the following ranges:

Pipeline psi	Actuation psi
15-50	(no regulator required)
50-200	35
200-500	40
500-800	45
800-1200	50
1200-1500	55

**NOTE: Black indicates the switch position.**

- Fill oil reservoir with desired quantity of lubricant (Anderol, Chemlube or 5W equivalent). The reservoir has a 6 oz. capacity.
- Verify isolation valve on protector is closed
- Open purge nut on protector approximately 1 turn.
- Move all of the mode switches on the Z-65/6.1H to their off positions.
- Move both timer/counter dials to the 0 position (00 minutes).
- Move mode switches 1, 2 and 3 to the on position. The pump will begin stroking once every 2 seconds in a diagnostic test/prime mode.
- Allow the injector to operate until oil is present at the purge orifice on the protector, then close purge nut
- Allow the injector to operate until pressure begins to build on the protector gauge.  
**STOP Unit-Promptly.**  
Do not allow pressure to exceed 1000 psi.



## **SECTION 3: SYSTEM CONTROL AND ELECTRONICS**

### **Operational Check and Leak Testing**

11. Open the Cyclone protector isolation valve.
12. Open the meter isolation valve.
13. Allow the injector to operate until pipeline pressure is achieved at the injector discharge.
13. Return mode switches to their OFF positions.
14. Check all connections from the injector discharge to the connection on the meter for oil leaks.
15. If no leaks are found, the pump and tubing should be considered tested and functional.



## **SECTION 4: INJECTOR MAINTENANCE**

### **Recommended preventative maintenance schedule**

Every injection situation is unique. Below are our recommendations for average conditions. High injection rates will necessitate more frequent pump/filter maintenance.

1. Clean and inspect injector pump biannually.
2. Check the filter element every six months, replacing as necessary.
3. Test the battery every month.
4. Test the system for leaks each time a fitting or connection has been made.

### **Recommended spare parts for the Cyclone 4400 MLS.**

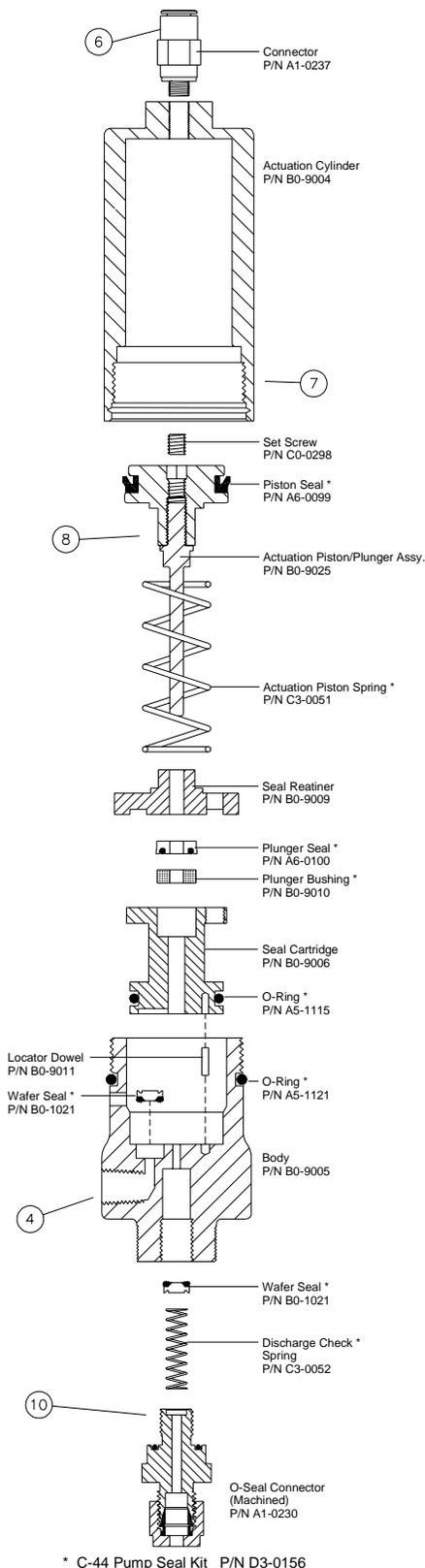
<b><u>Part Number</u></b>	<b><u>Description</u></b>	<b><u>Qty.</u></b>	<b><u>Location</u></b>
C4-0004	Filter element	1	see diagrams #3 and #4
D3-0156	C-44 pump seal kit	1	see diagrams #1 and #2
D3-0003	YZ filter regulator repair kit	1	see diagrams #3 and #4
D3-0142	Z-65/200 fuse replacement kit	1	see diagram #5
E3-2001	Battery pack	1	see diagram #5



# SECTION 4: INJECTOR MAINTENANCE

## Pump Rebuild-Disassembly

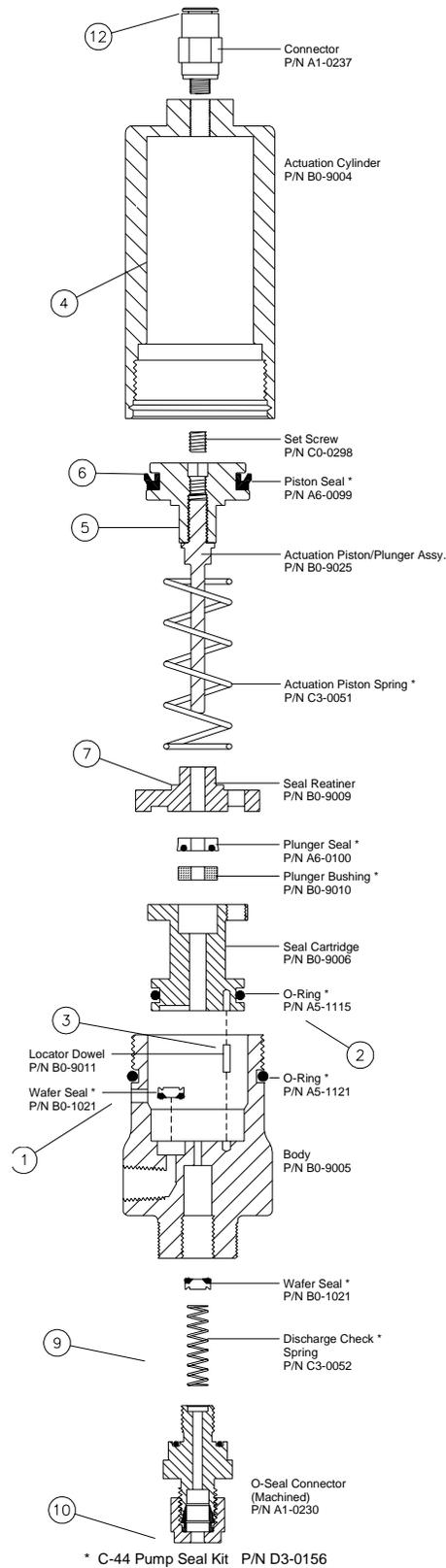
1. Move all Mode switches to their OFF position.
2. Close isolation valves from pipeline and to meter.
3. Open the Purge Nut on the protector to relieve pressure
4. Remove discharge tubing.
5. Remove reservoir drain plug, and drain the oil.
6. Disconnect the actuation line from the actuation cylinder.
7. Unscrew the actuation cylinder from the pump body.
8. Remove plunger and piston from the actuation cylinder.
9. Insert a 8-32 bolt into the threaded hole in the seal cartridge; pull up to remove cartridge. Inlet check valve wafer can now be removed from pump body.
10. Remove discharge tubing fitting from pump body. Discharge wafer/spring can now be removed from pump body.
11. Clean and inspect all components and replace if necessary.



# SECTION 4: INJECTOR MAINTENANCE

## Pump Rebuild-Assembly

1. Install ICV wafer into seat pocket in the pump body.
2. Install new seal, bushing and 015 o-ring in seal cartridge.
3. Apply light grease to 015 o-ring on seal cartridge. Orient alignment pin on cartridge with alignment hole in pump body. Install cartridge body.
4. Apply light grease to inside of actuation cylinder.
5. Install piston/plunger into actuation cylinder with spring attached.
6. Apply light coat of grease to top of plunger seal.
7. Place seal retainer on top of seal cartridge.
8. Install actuation cylinder/plunger assembly.
9. Install DCV wafer, spring and fitting.
10. Reconnect discharge tubing.
11. Refill reservoir to proper level with lubricant.
12. Reconnect actuation cylinder tubing line.
13. Prime system.



# SECTION 4: INJECTOR MAINTENANCE

## Battery Test

1. Set the mode switches as follows:  
Mode Switch 1, 2 and 3 **On**  
Mode Switch 4 **Off**
2. Set the time switches to the 01 position.

---

### **IMPORTANT NOTE:**

Time switches must **not** be in 00 position to test the battery.

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This will set the solenoid output rate to one actuation every one hour (based on the factory set time range for the Z-65/6.1H).

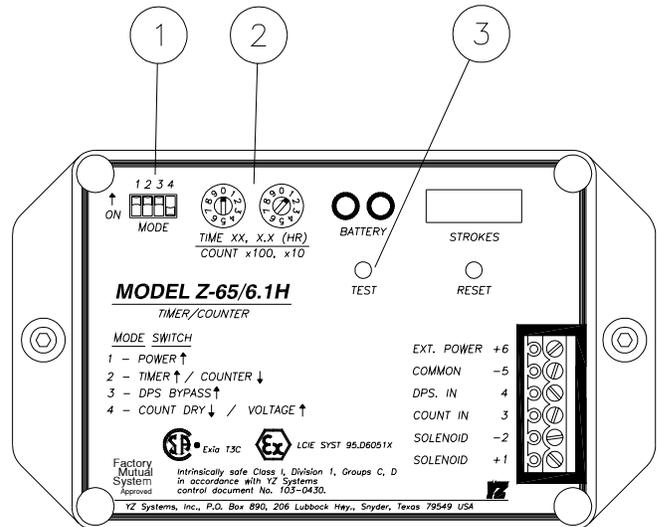
3. Depress the test switch to test the battery. A green LED will illuminate if the battery is good and a red LED will illuminate if the battery is low.

---

### **IMPORTANT NOTE:**

The solenoid must be connected to test the battery condition. **Battery condition cannot be tested with a volt meter.**

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# SECTION 4: INJECTOR MAINTENANCE

## Replacing a Depleted Battery

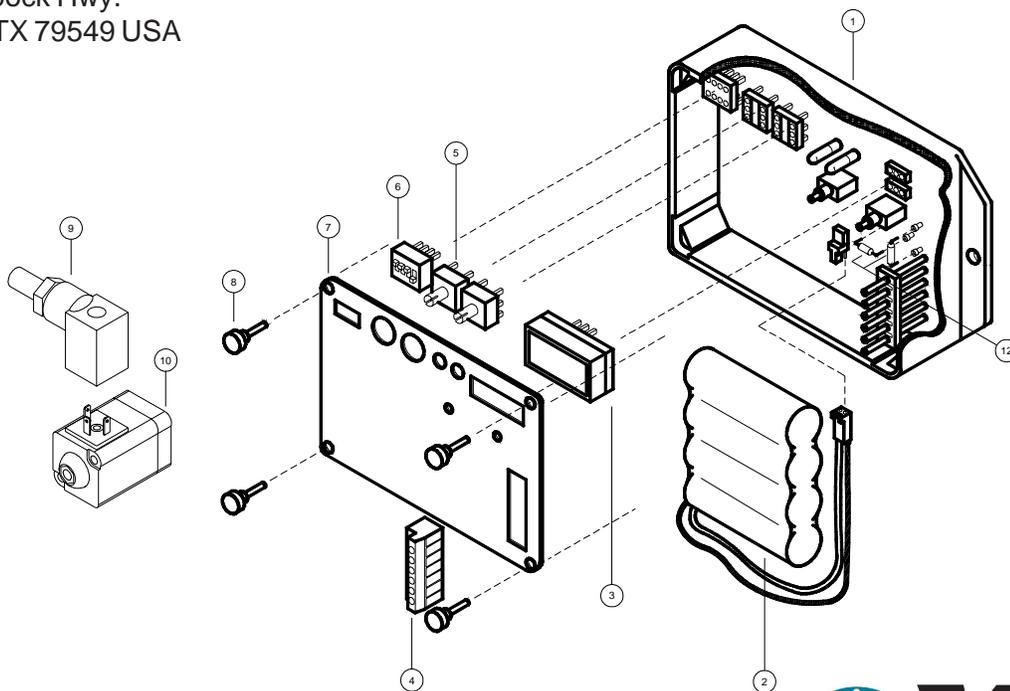
1. Remove the four thumb screws, cover plate and orange terminal connector.
2. The battery is located in the lower left hand corner of the Z-65 controller assembly.
3. Un-clip the battery plug from the battery receptacle.
4. Replace the depleted battery with a fresh battery pack (part No. E3-2001).

### **IMPORTANT NOTE:**

*Follow the illustration to assure proper battery wire placement in the Z-65 enclosure.*

5. Return the mode switches to their original positions.
6. Send your depleted battery to:  
YZ Systems Inc.  
206 Lubbock Hwy.  
Snyder, TX 79549 USA

Ref. No.	Description	Part No.	Qty.
1	Z-65/6.1H Controller Assembly	F2-0063	1
2	Battery Pack	E3-2001	1
3*	Stroke Counter Assembly	G1-0001	1
4*	Terminal Strip, 6 Position	H1-0001	1
5*	BCD Switch	E1-0001	2
6*	Mode Switch	E1-0002	1
7	Face Plate (Model Z-65/6.1H)	A9-3046	1
8	Thumb Screw	A9-1001	4
9	Cable Assembly	G2-0001	1
10	Solenoid Valve	A4-0010	1
11	Repair Kit*	D3-0005	1
12	Z-65/200 Fuse Replacement Kit (2 Fuses Per Kit)	D3-0142	1



# SECTION 5: TROUBLESHOOTING

## Troubleshooting: Timer Mode

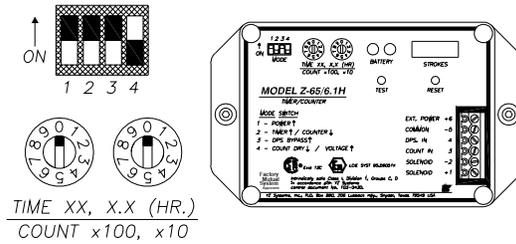
### Mechanical Operation Test:

1. Set the mode switches as follows:

Mode Switch Positions:

- 1, 2 and 3 **ON**
- 4 **OFF**

2. Set the time switches to 00 to enter the diagnostic mode. This mode enables the user to increase the solenoid output rate to one pulse every two seconds.



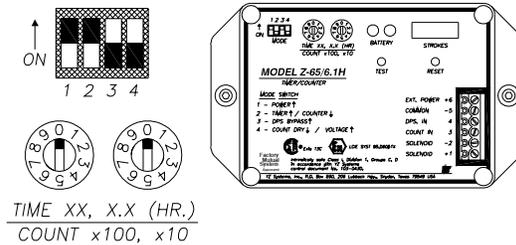
### DPS-2 Test

1. Set the mode switches as follows:

Mode Switch Position

- 1 and 2 **ON**
- 3 and 4 **OFF**

2. Set the time switches to 00 to enter the diagnostic mode.



3. This mode enables the operator to determine if the DPS is operating properly. This is accomplished by depressing and holding the test switch. If the DPS is sensing flow in the pipeline, the green LED should illuminate. If flow is not present, the red LED should illuminate.

### LCD Stroke Indicator Test Mode:

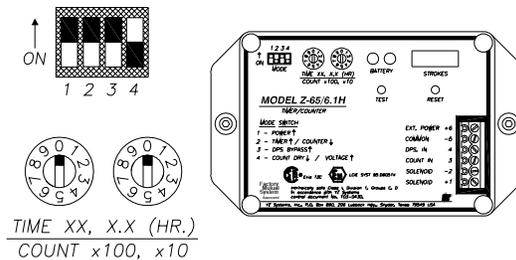
1. To test the stroke counter, set the mode switches as follows:

Mode Switch Positions:

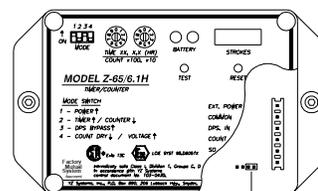
- 1, 2 and 3 **ON**
- 4 **OFF**

2. Set the time switches to 00.

3. Unscrew the thumbscrews and remove the six position terminal strip and cover. This will expose the battery pack and the three position configuration jumper (located in the lower right corner of the Z-65 controller assembly).



4. Set the configuration jumper to the far right position marked stroke indicator test.



Jumper switch location



# SECTION 5: TROUBLESHOOTING

5. This will cause all six digits to become active on the stroke counter. Depress the reset. The stroke counter should increment 000000, 111111, etc., up to 999999 each time the solenoid fires. When the counter display reads 999999, the test is complete.

## IMPORTANT NOTE:

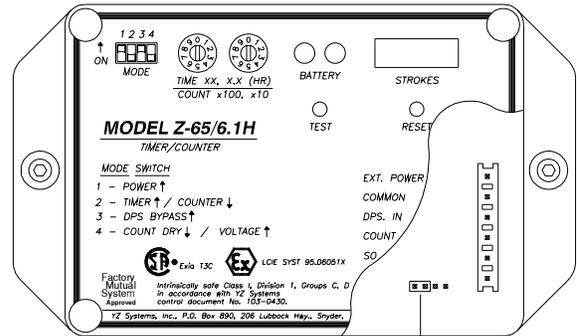
When the test is complete, move the jumper back to the factory position (far left position).

### Range Setting

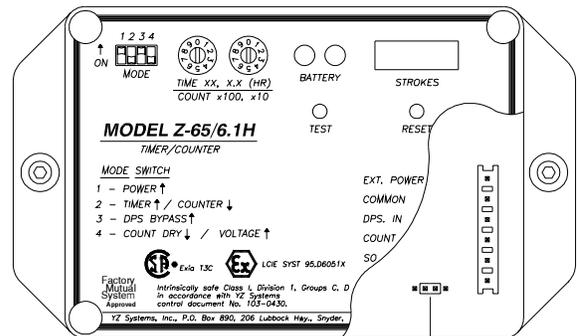
The Z-65/6.1H timer/counter has two ranges for the setting dials.

Z-65/6.1H Range Setting:

- xx hours: set the configuration jumper to the far left position (factory setting).
- x.x hours: set the configuration jumper to the center position.



Jumper switch location for 1 - 99 counts (XX) factory setting



Jumper switch location for .1 - 9.9 counts (X.X)

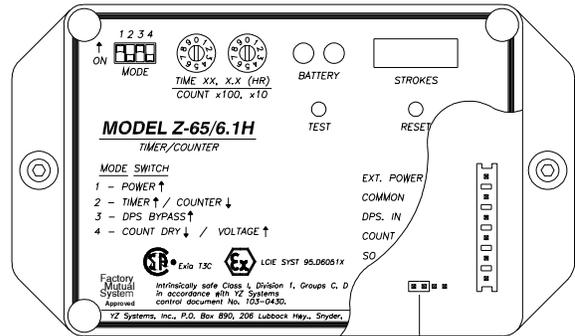


# SECTION 5: TROUBLESHOOTING

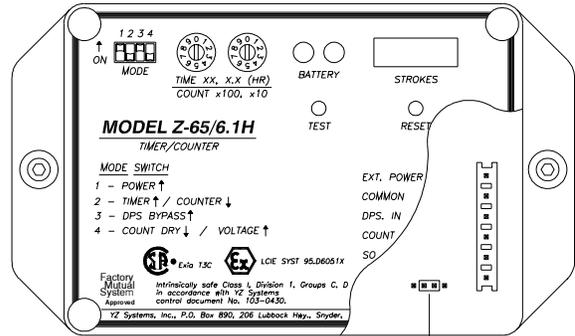
## Counter Range Setting

Z-65/6.1H Counter Range Setting:

- x100 counts: set the configuration jumper to the far left position (factory setting).
- x10 counts: set the configuration jumper to the center position.



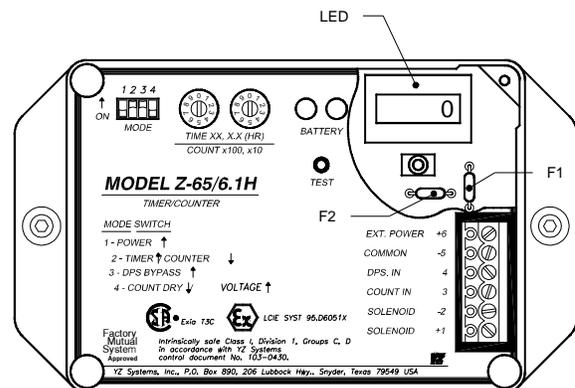
Jumper switch location for 100 - 9900 counts (x100) factory setting



Jumper switch location for 10 - 990 counts (x10)

## Fuse Replacement

- If the Z-65 will not power-up, from battery or external power supply, replace F1.
- If the Z-65 operates and the stroke light illuminates, but the solenoid does not activate, replace F2.

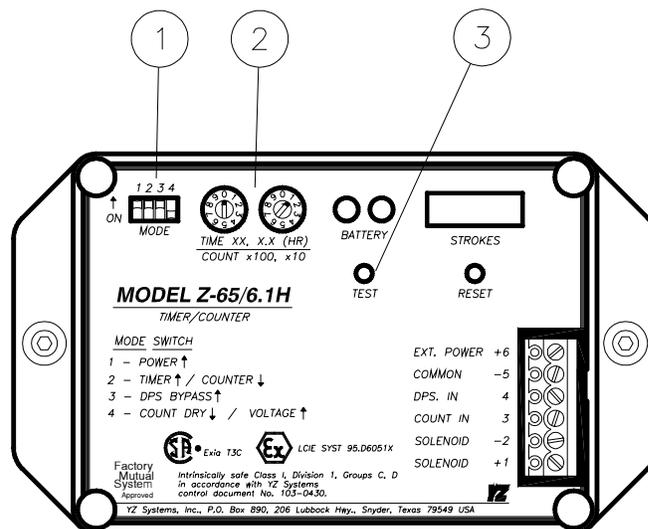


# SECTION 5: TROUBLESHOOTING

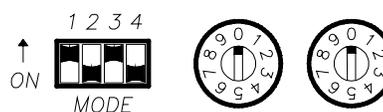
## Trouble Shooting: Counter Mode

### Input Pulse Test

- Set the mode switches as follows:  
Mode Switch Positions:  
Position 1 and 3 on, 2 and 4 OFF
- Set the count switches to 00 to enter the diagnostic mode. This mode enables the user to determine if the proper input pulses are being received at the count input (ter. #3).



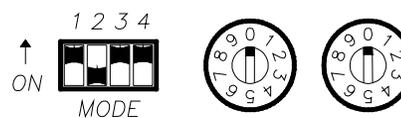
**Dry Contact Input:** mode switch 4 should be in the off position. Depress the test switch and hold. A red LED should illuminate. When the dry contact input is received at the counter input (ter. #3) the green LED will turn on and off and the red LED will illuminate again. This will normally occur very quickly and give the appearance that the green LED blinks on when the pulse input is received and removed.



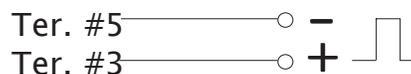
dry contact  
open collector  
(20 mSec duration min.)



**Voltage Pulse Input:** move mode switch 4 to the on position. Depress the test switch and hold. A green LED should illuminate. When the voltage pulse input is received at the count input (ter. #3) the red LED will turn on and off and the green LED will illuminate again. This will normally occur very quickly and give the appearance that the red LED blinks on when the pulse input is received and removed.



voltage pulse  
5-24 VDC  
(20 mSec duration min.)



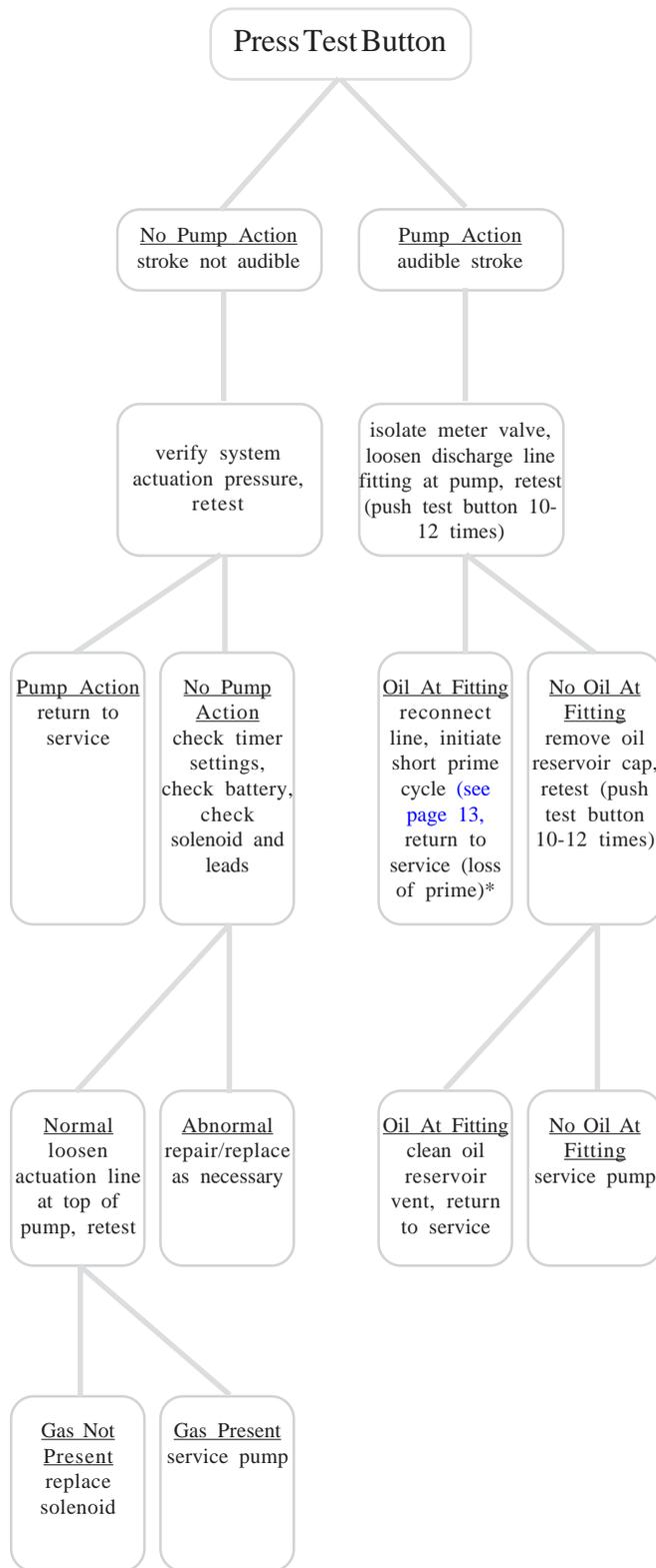
# SECTION 5: TROUBLESHOOTING

## Mechanical Assembly

- The basic mechanical components of the Cyclone 4400 MLS are:
  - C-44 Pump
  - Calibration Oil Reservoir/Actuation Manifold
  - Filter Regulator
  - Solenoid and Manifold

2. Should malfunction of the mechanical system be suspected, follow the following procedure:

- System actuation pressure: absolute minimum requirement is 15 psi. Refer to chart located on page 13 for actuation requirements.
- Oil level: must be visible in reservoir.
- Pump action: pump stroke and actuation gas vent should be audible when actuated with test button on Z-65/6.1H controller. Follow diagram to test system.



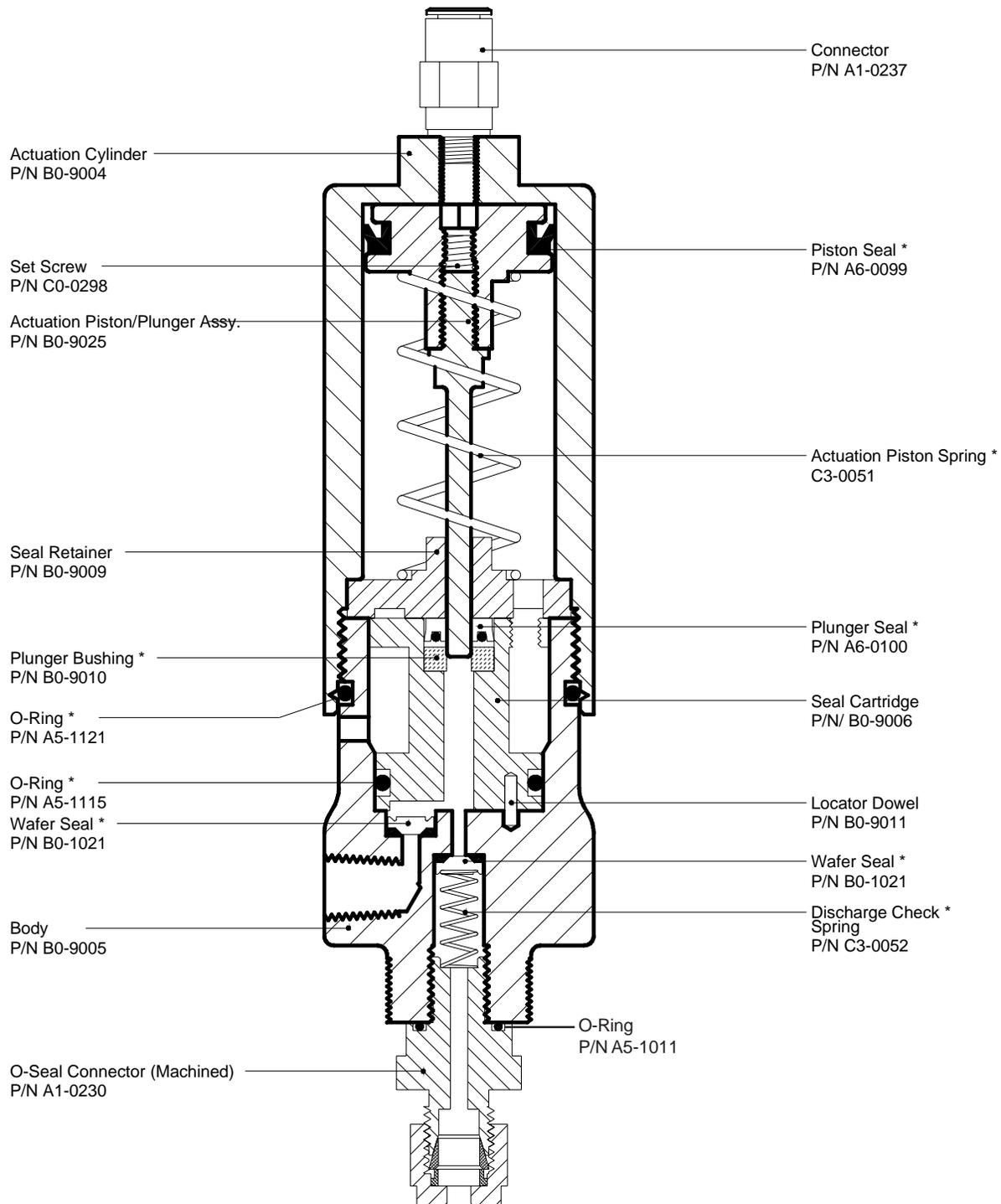
### **IMPORTANT NOTE:**

*\* a loss of prime would be expected should reservoir supply be depleted while in service.*



# APPENDIX A: DIAGRAMS

## Diagram #1: C-44 pump (assembled)

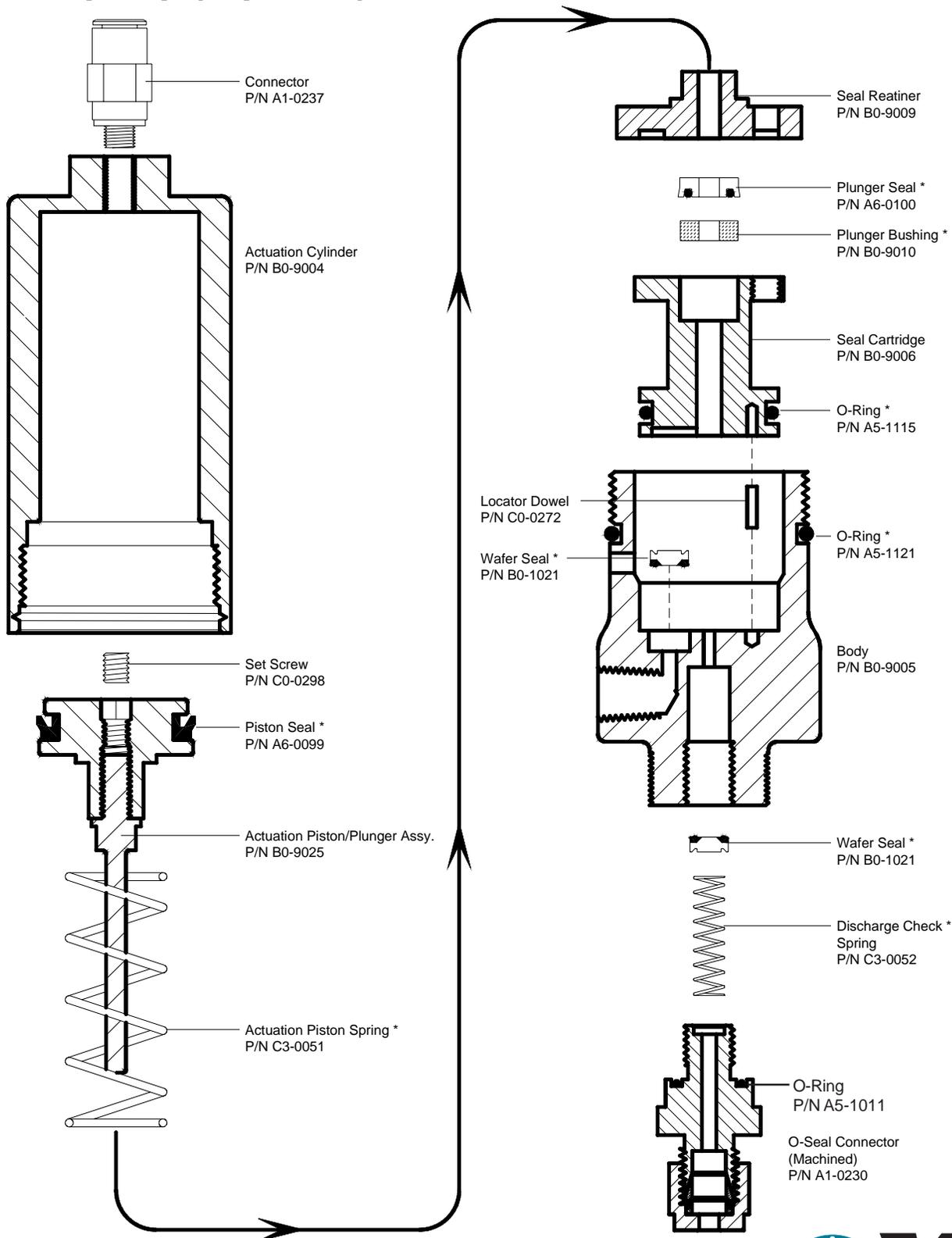


\* C-44 Pump Seal Kit P/N D3-0156



# APPENDIX A: DIAGRAMS

## Diagram #2: C-44 pump (exploded)

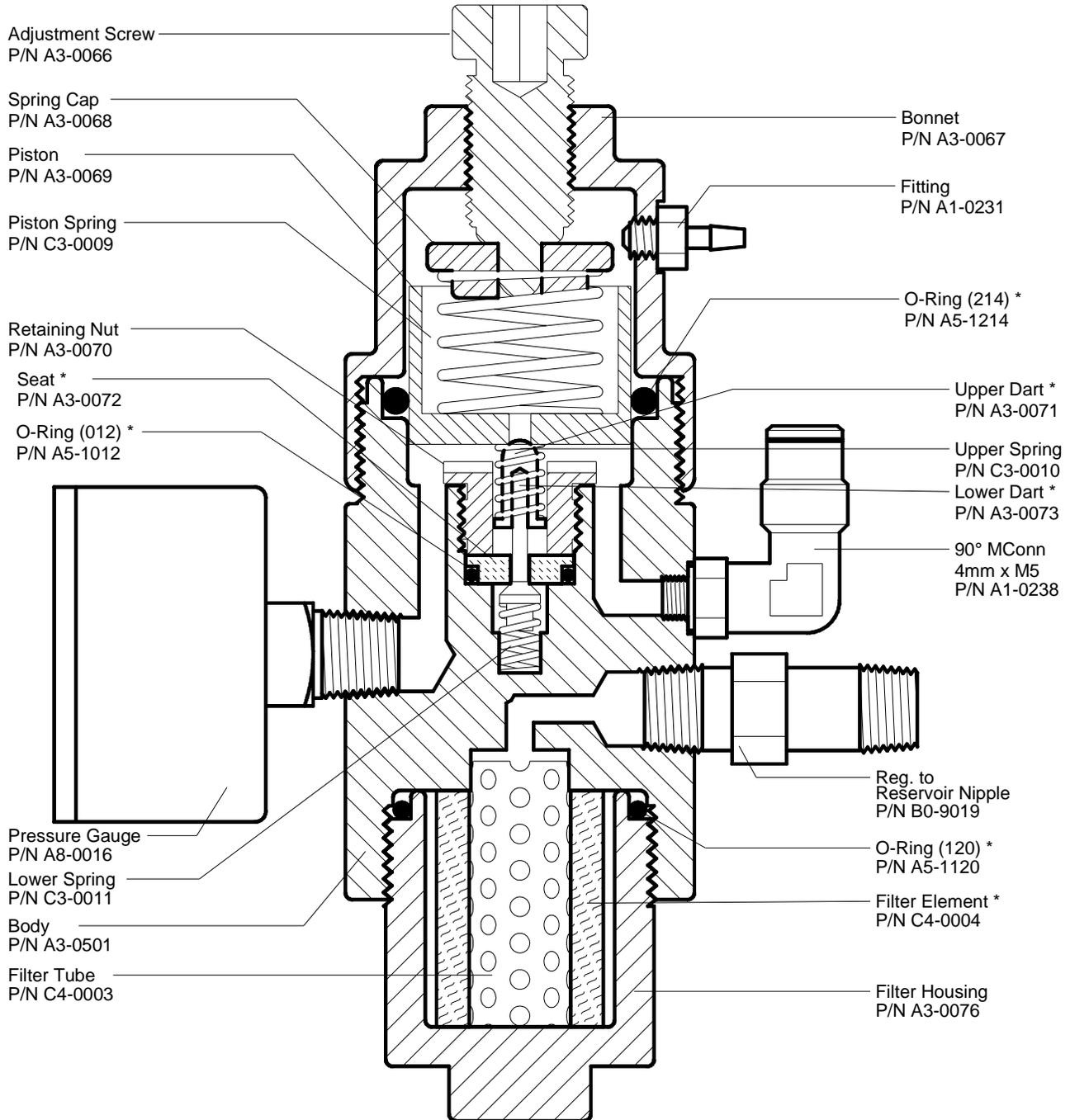


\* C-44 Pump Seal Kit P/N D3-0156



# APPENDIX A: DIAGRAMS

## Diagram #3: YZ filter/regulator (assembled)

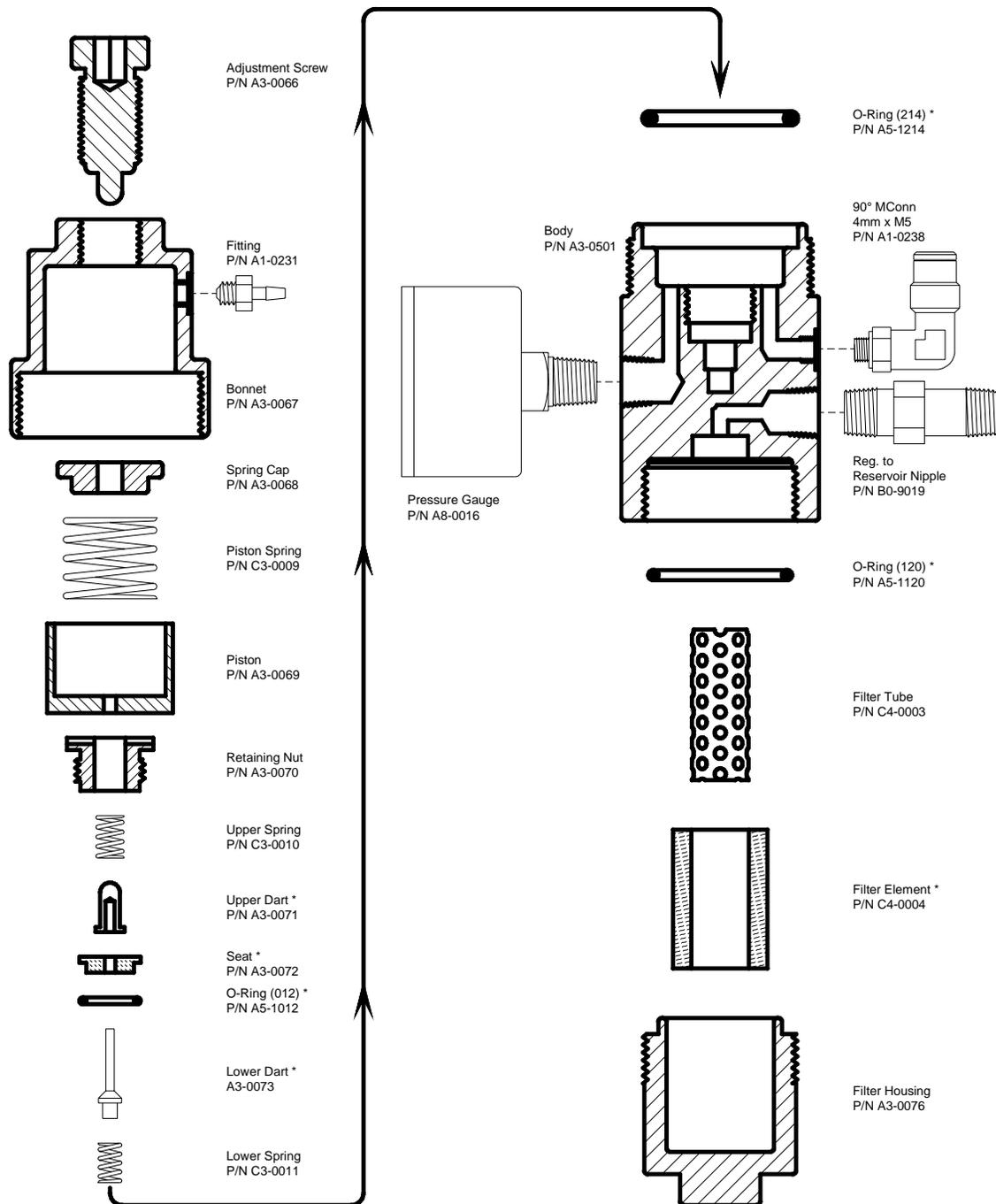


\* Filter/Regulator Repair Kit P/N D3-0003



# APPENDIX A: DIAGRAMS

## Diagram #4: YZ filter/regulator (exploded)

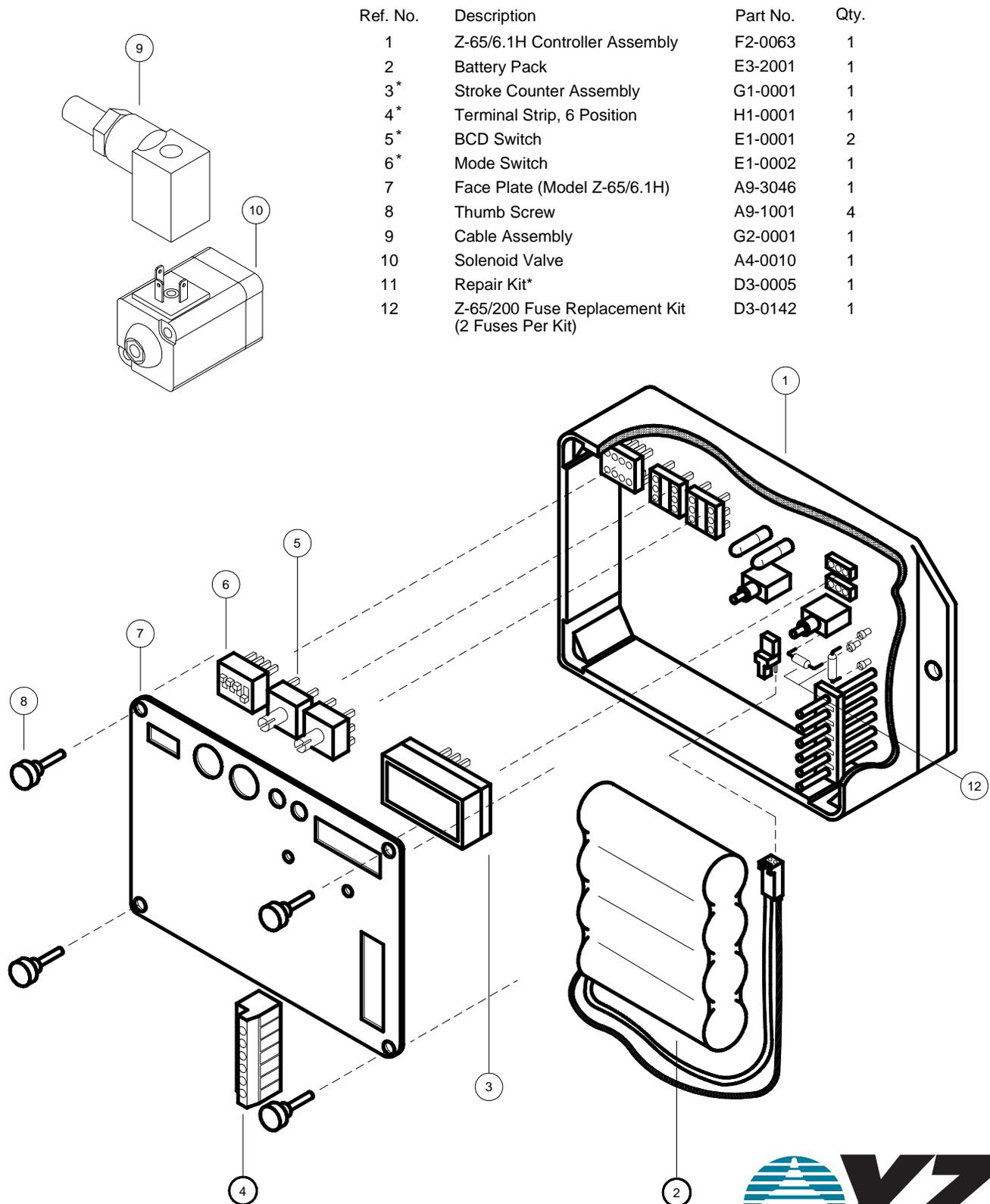


\* Filter/Regulator Repair Kit P/N D3-0003



# APPENDIX A: DIAGRAMS

## Diagram #5: Z-65 Controller



Ref. No.	Description	Part No.	Qty.
1	Z-65/6.1H Controller Assembly	F2-0063	1
2	Battery Pack	E3-2001	1
3*	Stroke Counter Assembly	G1-0001	1
4*	Terminal Strip, 6 Position	H1-0001	1
5*	BCD Switch	E1-0001	2
6*	Mode Switch	E1-0002	1
7	Face Plate (Model Z-65/6.1H)	A9-3046	1
8	Thumb Screw	A9-1001	4
9	Cable Assembly	G2-0001	1
10	Solenoid Valve	A4-0010	1
11	Repair Kit*	D3-0005	1
12	Z-65/200 Fuse Replacement Kit (2 Fuses Per Kit)	D3-0142	1



# APPENDIX A: DIAGRAMS

## Diagram #6: DPS-2

Cable Assembly (30 ft.)  
P/N G2-0002

Shrink Wrap  
P/N H2-0002 (Qty. 2)

SS Bolt  
P/N C0-0047 (Qty. 8)

Set Screw  
P/N C0-0005

Magnet  
P/N E0-5001

Diaphragm  
P/N A6-0013

SS Hex Nut  
P/N C0-0048 (Qty. 8)

Strain Relief  
P/N H2-1001

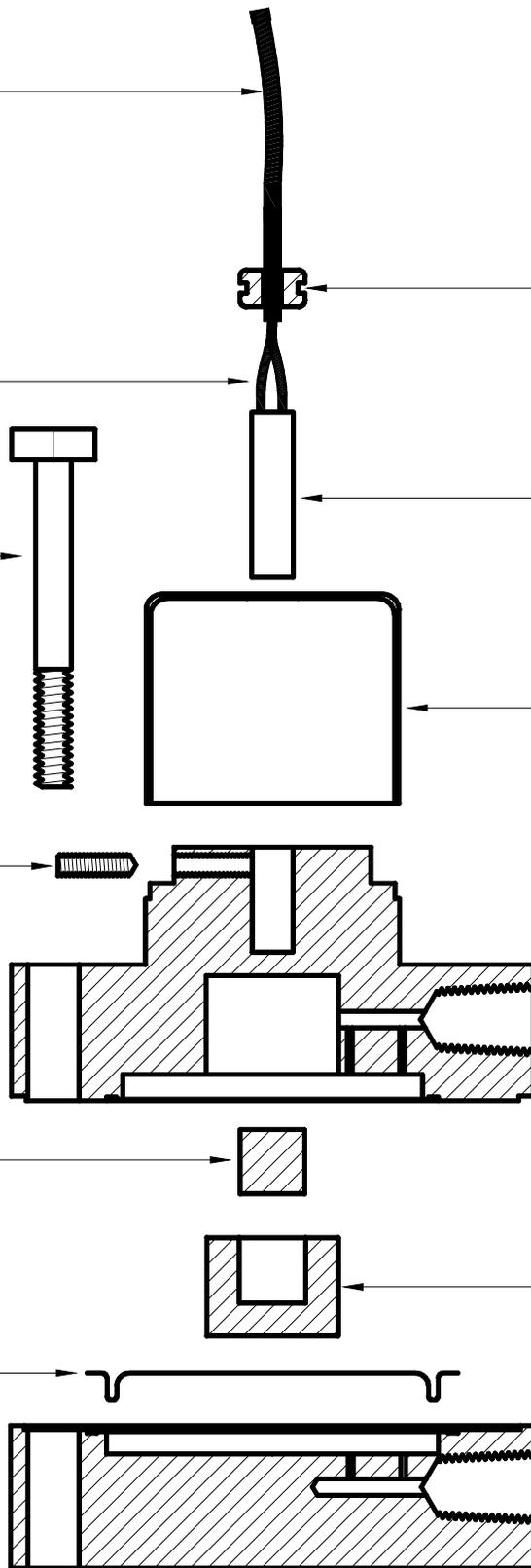
Reed Switch  
P/N E1-0003

Cap  
P/N A9-5001

Diaphragm Body  
Low Pressure  
P/N A9-5002

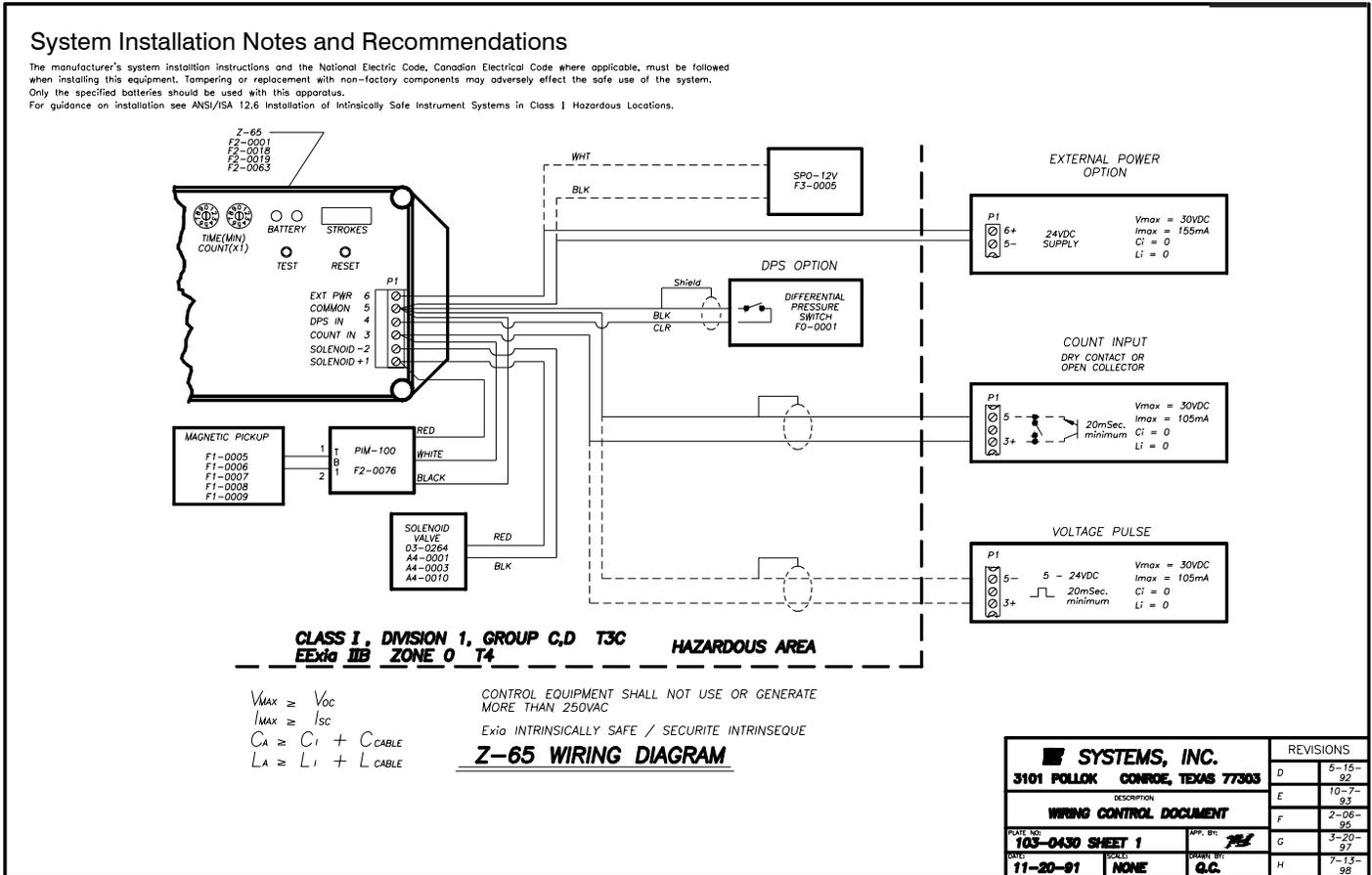
Magnet Support Body  
P/N A9-5004

Diaphragm Body  
High Pressure  
P/N A9-5003



# APPENDIX A: DIAGRAMS

## Diagram #7: Z-65 Installation Notes/Wiring Control Documentation







3101 Pollok Drive

Conroe, Texas 77303

800.653.9435

P: 936.788.5593

F: 936.788.5698

Em: Service@yzhq.com

Web: www.yzsystems.com

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