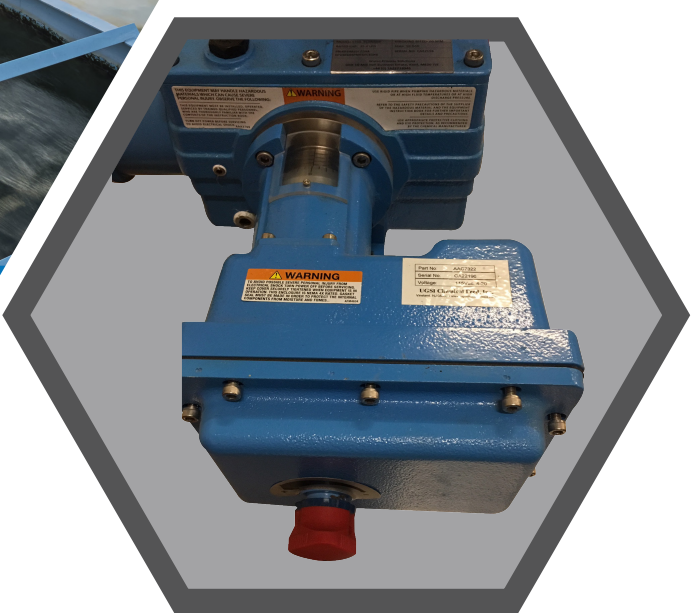


**Operation & Maintenance Manual  
Electric Actuator / Positioner With  
4-20mA Control Board Used with Pumps  
Manual No. CF.040.050.002.IM.0714**



**ELECTRIC ACTUATOR/  
POSITIONER WITH 4-20mA  
CONTROL BOARD USED  
WITH PUMPS**

BOOK NO. CF.040.050.002.IM.0714

EQUIPMENT SERIAL NO. \_\_\_\_\_

DATE OF START-UP \_\_\_\_\_

START-UP BY \_\_\_\_\_

Prompt service available from nationwide authorized service contractors.

#### ORDERING INFORMATION

In order for us to fill your order immediately and correctly, please order material by description and part number, as shown in this book. Also, please specify the serial number of the equipment on which the parts will be installed.

Statements and instructions set forth herein are based upon the best information and practices known to Water Process Solutions LTD., but it should not be assumed that every acceptable safety procedure is contained herein. Water Process Solutions Ltd., does not guarantee that actions in accordance with such statements and instructions included in this manual will result in the complete elimination of hazards and it assumes no liability for accidents that may occur.

## Warranty Statement

(a.) Limited Product Warranty Statements. For each Product purchased from Seller or an authorized reseller, Seller makes the following limited warranties: (i) the Product is free from defects in material and workmanship, (ii) the Product materially conforms to Seller's specifications that are attached to, or expressly incorporated by reference into, these terms, and (iii) at the time of delivery, Seller has title to the Product free and clear of liens and encumbrances (collectively, the "Limited Warranties"). Warranties with respect to software which may be furnished by Seller as part of the Product, if any, are expressly set forth elsewhere in these terms. The Limited Warranties set forth herein do not apply to any software furnished by Seller.

(b.) Conditions to the Limited Warranties. The Limited Warranties are conditioned on (i) the Product being stored, installed, operated and maintained in accordance with Seller's instructions, (ii) no repairs, modifications or alterations being made to the Product other than by Seller or its authorized representatives, (iii) the Product being used in compliance with any conditions or parameters set forth in specifications that are attached to, or expressly incorporated by reference into, these terms, (iv) use of the Product being discontinued after the Buyer or user has, or should have had, knowledge of any defect in the Product, (v) Buyer providing prompt written notice of any warranty claims within the warranty period described below, (vi) at Seller's discretion, Buyer either removing and shipping the Product or non-conforming part thereof to Seller, at Buyer's expense, or Buyer granting Seller access to the Products at all reasonable times and locations to assess the warranty claims, and (vii) Buyer not being in default of any payment obligation to Seller.

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(d.) Limited Warranty Period. Buyer shall have 12 months from initial operation of the Product or 18 months from shipment, whichever occurs first, to provide Seller with prompt, written notice of any claims of breach of the Limited Warranties. Continued use or possession of the Product after expiration of the warranty period shall be conclusive evidence that the Limited Warranties have been fulfilled to the full satisfaction of Buyer and user, unless Buyer has previously provided Seller with notice of a breach of the Limited Warranties.

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(f.) Transferability. The Limited Warranties shall be transferable during the warranty period to the initial end-user of the Product.

THE LIMITED WARRANTIES SET FORTH IN THIS SECTION ARE Seller's SOLE AND EXCLUSIVE WARRANTIES AND ARE SUBJECT TO THE LIMITS OF LIABILITY SET FORTH IN SECTION 8 BELOW. Seller MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OR ANY WARRANTIES THAT MIGHT ARISE FROM COURSE OF DEALING AND USAGE OF TRADE.



## Introduction

This instruction book provides information required for installation, operation, service, and troubleshooting of the Electric Actuator/ Positioner with a 4-20mA Control Board, which is optionally provided with pumps. Additional information concerning the installation and operation of this device is contained in the instruction books provided with the pump. The positioner is actuated/powered by a remote SCADA or DCS system that controls the rotation of the stroke-adjust mechanism of the pump.

The pump positioner is available in two variations: one for a control device supplying 115v 50/60Hz power and one for a control device supplying 230v 50/60Hz.



**WARNING:** TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR DAMAGE TO THE EQUIPMENT, THIS EQUIPMENT SHOULD BE INSTALLED, OPERATED AND SERVICED ONLY BY TRAINED, QUALIFIED PERSONNEL WHO ARE THOROUGHLY FAMILIAR WITH THE ENTIRE CONTENTS OF THIS INSTRUCTION BOOK.

**NOTE:** When ordering material always specify model and serial number of apparatus.

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## Very Important Safety Precautions

This page provides very important safety information related to safety in installation, operation, and maintenance of this equipment.

### **Warning**

TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, OBSERVE THE FOLLOWING: TROUBLESHOOTING OF THE CONTROLLER, SIGNALS AND SOURCE POWER IS PERFORMED WITH AMETER. ONLY PERSONNEL WHO ARE TRAINED WITH THIS EQUIPMENT AND WHO HAVE A COMBINED KNOWLEDGE OF PROPER SAFETY PRECAUTIONS AND W&T EQUIPMENT SHOULD PERFORM ANY TESTING AND/ OR TROUBLESHOOTING. TO AVOID ELECTRICAL SHOCK, TURN POWER OFF AND DISCONNECT SOURCE POWER BEFORE SERVICING. BEFORE SERVICING, SHUT DOWN THE PUMP AND RELIEVE THE BACK PRESSURE IN THE PIPING AS DIRECTED IN THE APPROPRIATE PUMP INSTRUCTION BOOK.

TO ENSURE PROPER AND SAFE OPERATION OF THIS EQUIPMENT, USE ONLY WATER PROCESS SOLUTIONS LTD., LISTED PARTS EXCEPT COMMERCIALY AVAILABLE PARTS AS IDENTIFIED BY COMPLETE DESCRIPTION ON PARTS LIST. THE USE OF UNLISTED PARTS CAN RESULT IN EQUIPMENT MALFUNCTIONS CAUSING POSSIBLE SEVERE PERSONAL INJURY.

DO NOT DISCARD THIS INSTRUCTION BOOK UPON COMPLETION OF INSTALLATION. INFORMATION PROVIDED IS ESSENTIAL FOR PROPER AND SAFE OPERATION AND MAINTENANCE.

ADDITIONAL OR REPLACEMENT COPIES OF THIS INSTRUCTION BOOK ARE AVAILABLE FROM:

#### **Water Process Solutions LTD.**

Unit 10  
Mill Hall, Business Estate  
Aylesford, KENT  
ME20 7JZ

#### **NOTE:**

Minor part number changes may be incorporated into Water Process Solutions Ltd., products from time to time that are not immediately reflected in this instruction book. If such a change apparently has been made in your equipment and does not appear to be reflected in your instruction book, contact Water Process Solutions Ltd. for information.

Please include the equipment serial number in all correspondence. It is essential for effective communication and proper equipment identification.

WATER PROCESS SOLUTIONS LTD. HEADQUARTERS

INSTALLATION, OPERATION, MAINTENANCE, AND SERVICE INFORMATION

Direct any questions concerning this equipment that are not answered in this instruction book to the reseller from whom the equipment was purchased. If the equipment was purchased directly from Water Process Solutions Ltd., Aylesford, Kent, ME20 7JZ, UK contact us at the office on our landline:

**TEL:** (01622) 719 945



## Section 1 - Technical Data

Power Requirements	230V, 50/60Hz 115V, 50/60HZ
Permissible Ambient Temperature Range	32 to 120°F (0 to 49°C)
Weight	10 Lbs
Outputs/Ratings	Three normally open dry contacts, rated at 5A (max.), 250Vac (max.)
Enclosure Rating	NEMA 4X
Speed of Response	Full travel 100 seconds with 60Hz power, 120 seconds with 50Hz power, at maximum pump speed



## Section 2 - Installation

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## 2.1 General

The positioner is generally shipped assembled to the pump. Refer to the instruction book provided with the appropriate pump for location and mounting recommendations.

**NOTE:** Do not discard or remove this instruction book when the installation is completed. The operator will need it.

## 2.2 Wiring

Use flexible, liquid-tight conduit when connections are made to the positioner.



**WARNING:** DISCONNECT ALL SOURCES OF POWER TO DEVICES/ CONDUCTORS TO BE WIRED BEFORE MAKING WIRING CONNECTIONS. FAILURE TO DISCONNECT POWER MAY RESULT IN INJURY OR DEATH BY ELECTROCUTION OR MAY CAUSE DAMAGE TO DEVICES OR CONDUCTORS BY INADVERTENT CONTACT WITH ELECTRICAL POWER.

Refer to the Installation Wiring drawing for specification of connections. Three normally open, unpowered status indicating contacts are provided for connection to the customer's indicators or alarms. These outputs indicate the following status of the positioner when contact is closed:

- Terminals #7 and # 12 – the positioner is at the lower limit/zero position
- Terminals #9 and #10 – the positioner is at the upper limit/maximum position
- Terminals #11 and #12 – the positioner is in manual mode; the automatic positioner is disabled

The maximum limit switch setting is the 100% stroke position of the pump, as read on the knob graduation, and the minimum limit switch setting is the 0% stroke position. These limits establish the span upon which the 4-20mA board is calibrated. Whenever the positioner is disassembled for repair and the setting of the limit switches is disturbed, it must be reset such that the maximum limit is within two graduations over 100%, likewise, the minimum limit must be within two graduations past 0%. Refer to paragraph 4.2.1, Limit Switch Cam Adjustment, for more information.

Four holes are provided in the positioner housing, suitable for termination of conduit using 1/2" conduit fittings. All holes must be plugged with NEMA 4X rated plugs or fittings to protect the positioner components against corrosion. The positioner enclosure comes with all four holes plugged with NEMA 4Xrated plugs.

For access to the positioner wiring terminal strip:

- a. Remove the positioner manual operation knob (red) by loosening the two set screws (2mm Allen head) on the side of the knob. Slide the knob off the shaft.
- b. The cover is attached by ten 6mm socket head screws. Remove the screws.
- c. Lift the cover off carefully, taking care not to tear the rubber gasket.

Reinstall the positioner cover in the reverse order of removal using care not to damage the seal. Tighten the set-screws securely.

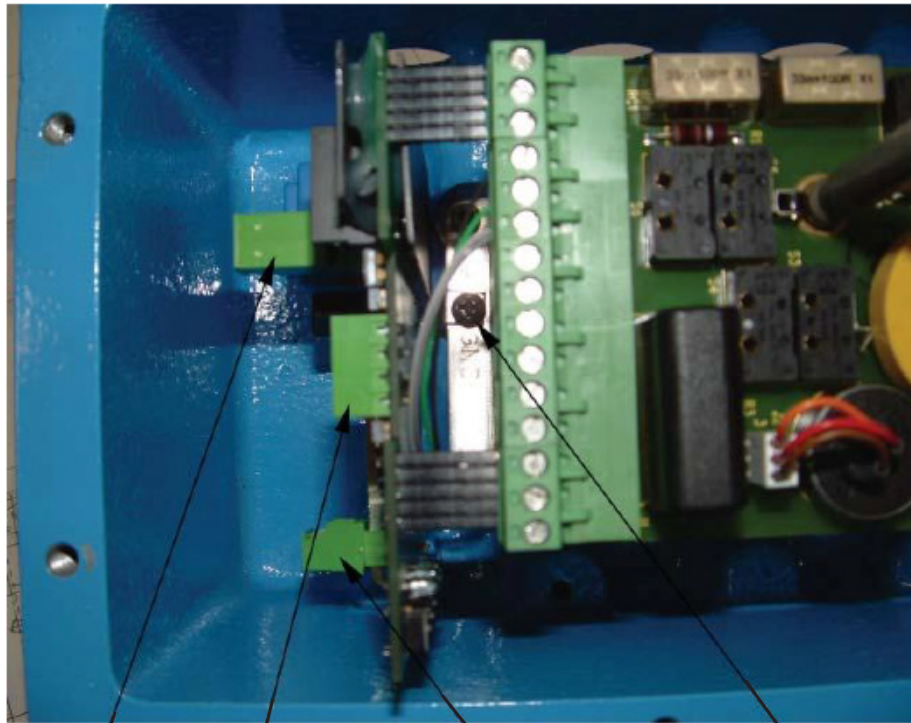
**NOTE:** All wiring must conform to National Electrical Code (NEC) Standards and local electrical codes.

The positioner terminals are designed for bare stranded non-tinned copper wires, from No. 30 AWG to No. 14 AWG, stripped 1/4 inch.

Connect the power wires to the connector of Terminal 1 and 2. Pull out the connector to get access to the locking screw. The ground wire (Color Green) must be connected to the grounding screw of the positioner. See Figure 2.1 and refer to Installation Wiring Dwg. 40.050.130.020.



Figure 2.1



Terminals 1,2  
Connector  
L2/N, L1  
115/2300VAC

Terminals 5, 6  
Connector  
4-20mA Signal

Terminals 13, 14, 15  
Dosing Factor Connector  
1K Ohm Potentiometer

Ground Screw  
(Green Wire)

Remove the connector to Terminals #5 and #6 of the 4-20mA board and connect the signal wire. A shielded wire is recommended. Separate and twist the shield, insert the appropriate length of shrink tubing or wrap it with electrical tape, crimp an eyelet connector at the end, and connect it to one of the 4mm screws that fastens the board bracket.

NOTE: To prevent signal interference, do not run AC power and DC signal wires through the same conduit from distances exceeding three feet.

Ground loops may cause improper equipment operation. Connect only necessary safety grounds to earth ground. Review the complete control system, including accessories, for possible ground loops.

### 2.3 External Dosing Potentiometer (Optional)

If using an external dosing potentiometer (1Kohm Potentiometer), connect the wire to the connector as shown in Figure 2.1. Use a shielded wire. Separate and twist the shield, insert the appropriate length of shrink tubing or wrap it with electrical tape, crimp an eyelet connector at the end, and connect it to the other 4mm screw that fastens the board bracket.

## **2.4 Wiring to the Indicator Outputs**

Refer to Section 1 - Technical Data for output contact ratings. Indicator/ Alarm power is connected to one contact and the Indicator/Alarm device input to the other contact.

## **2.5 Installation of Pump Positioner on Existing Pump (See Dwgs. 40.300.002.010&.020)**

a. With the pump running, check the rotation of the stroke adjust knob for any binding by manually turning it through the whole range. The knob should turn smoothly and there should not be any binding.

b. With the pump still running, manually rotate the knob completely counter clockwise until it stops. Record the stroke length at which it stops and the relative position of knob in and out against scale.

c. Stop the pump, remove power, and relieve all pressure.

d. Loosen the three set screws that secure the stroke adjust knob to the pump and place a rag under the knob to catch any oil that may spill out. Pull the knob off the shaft past the O-ring and remove. Discard the knob. Remove the O-ring and replace with the new sealing ring (quad ring).

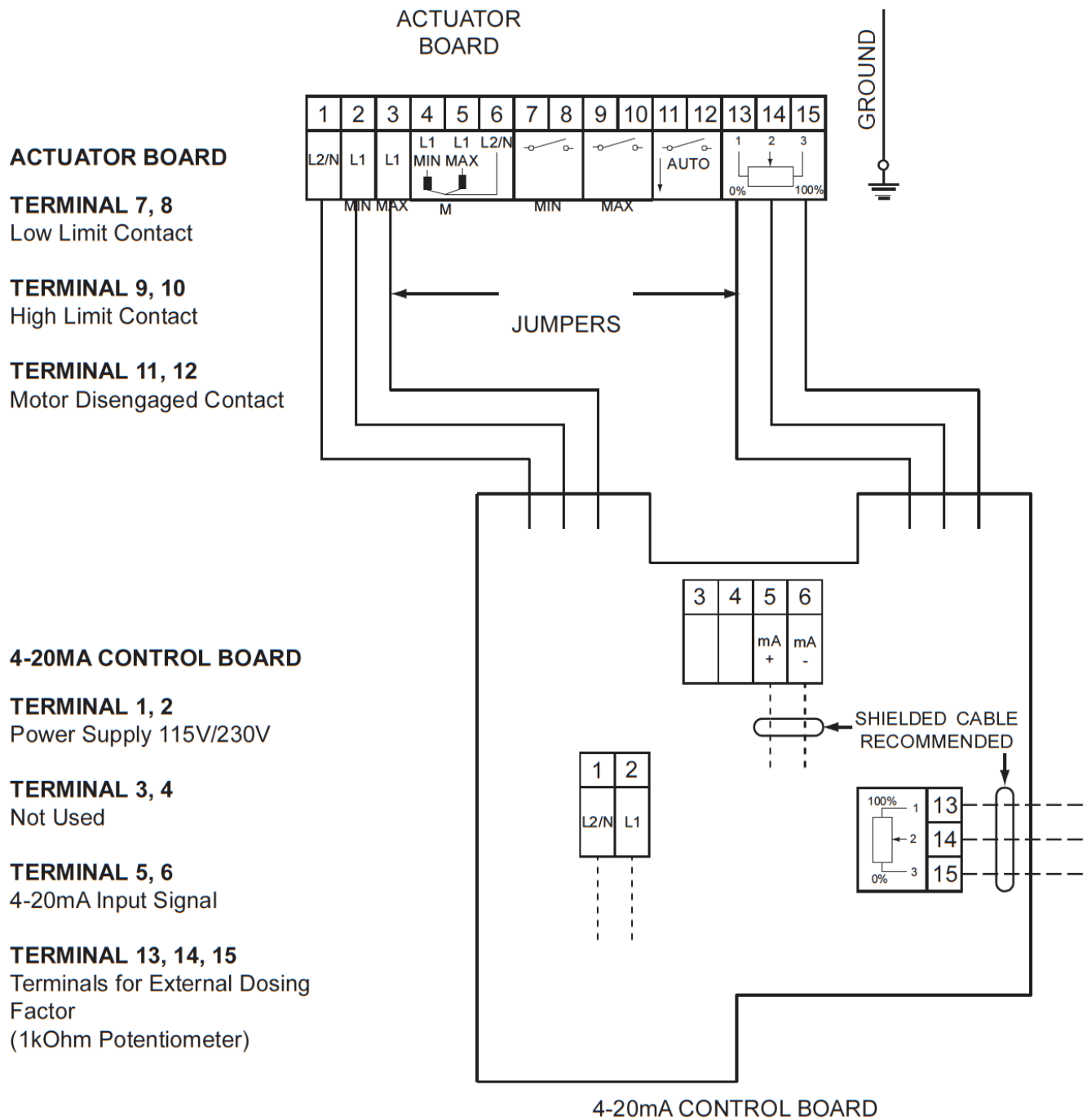
e. Position the new stroke adjust knob over the shaft so that it is approximately at position 0%. Push the knob onto the shaft past the ring seal. Rotate the knob to the same stroke length position noted in step b, above, and also the same relative position of the knob in and out against the scale. Tighten the three set screws to secure the knob to the pump.

f. Remove the four M8 x 20 screws that secure the stroke control housing to the pump gearbox. Discard the screws. Slip the positioner mounting arm over the stroke adjust knob. Assemble it to the pump gearbox using the four M8 x 35 screws supplied, but do not tighten. Adjust the position of the mounting arm so that it is centralized over the knob. There should be equal clearance all the way around the knob. Tighten the four M8 x 35 screws to secure the arm to the gearbox and set the knob at 0.0%.

g. Assemble the drive plate to the stroke adjust knob using the two shoulder screws supplied.

h. Remove the two set screws (2mm Allen wrench) that secure the red knob to its shaft and remove the red knob from the positioner enclosure.

- i. Remove the ten M6 x 20 screws that secure the cover to the positioner enclosure and remove the cover, taking care not to damage the gasket seal.
- j. Remove the four M4 x 10 screws that secure the motor/gearbox assembly to the positioner enclosure and remove the motor/gearbox assembly.
- k. On the bench, install the square drive shaft to the round motor/gearbox shaft using the M3 x 18 spiral pin supplied. Be sure that the pin extends the same amount on either side of the shaft.
- l. Replace the red knob or use a screwdriver to turn the HAND/AUTO shaft. Refer to Figure 4.1 in paragraph 4.2 for MIN limit adjustment and turn HAND/AUTO shaft on the motor/gearbox clockwise until MIN limit is reached.
- m. Install the motor/gearbox assembly to the positioner enclosure using the four M4 x 10 screws. Check that the spiral pin is not rubbing against the side of the enclosure.
- n. Apply a light coat of grease (Molykote is recommended) along the square drive shaft and around the shoulder screws on the drive plate. Slide the square drive shaft into the hole on the drive plate of the pump stroke adjust knob and press the positioner enclosure against the mounting arm.
- o. Orient the positioner enclosure so that two conduit openings are on the right-hand side and the other two conduit openings are on the bottom. Line up the positioner enclosure holes with the corresponding holes on the mounting arm and secure with four M6 x 20 screws supplied.
- p. Refer to paragraph 4.2.1-b., to adjust the MIN limit on the positioner circuit board. Refer to paragraph 4.2.1-c., to adjust the MAX limit on the circuit board. Refer to paragraph 4.2.2 to adjust the feedback potentiometer on the positioner circuit board.
- q. Refer to paragraph 2.2, above, for wiring the positioner with 4-20mA signal board.
- r. Remove the red knob, if present, and replace the enclosure cover using the ten M6 x 20 screws supplied.
- s. Replace the red knob using the two set screws (2mm Allen wrench) supplied.



**NOTE:** ----- FIELD WIRING (NOT BY UGSI CHEMICAL FEED, INC.) MUST CONFORM TO LOCAL ELECTRICAL CODES.

**ELECTRIC POSITIONER - INSTALLATION WIRING**  
With 4-20mA Controller Board

40.050.130.020  
ISSUE 1 7-09





## Section 3 - Operation

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### 3.1 Start-Up

Refer to the instruction books provided with the pump for start-up procedures.

### 3.2 User Interface of the 4-20mA Control Board

#### LED MIN (1) and LED MAX (2)

Lights to display the positioning direction.

**MIN:** Decrease

**MAX:** Increase

#### LED State (3)

Displays the operating mode.

**On:** Automatic

**Off:** Manual

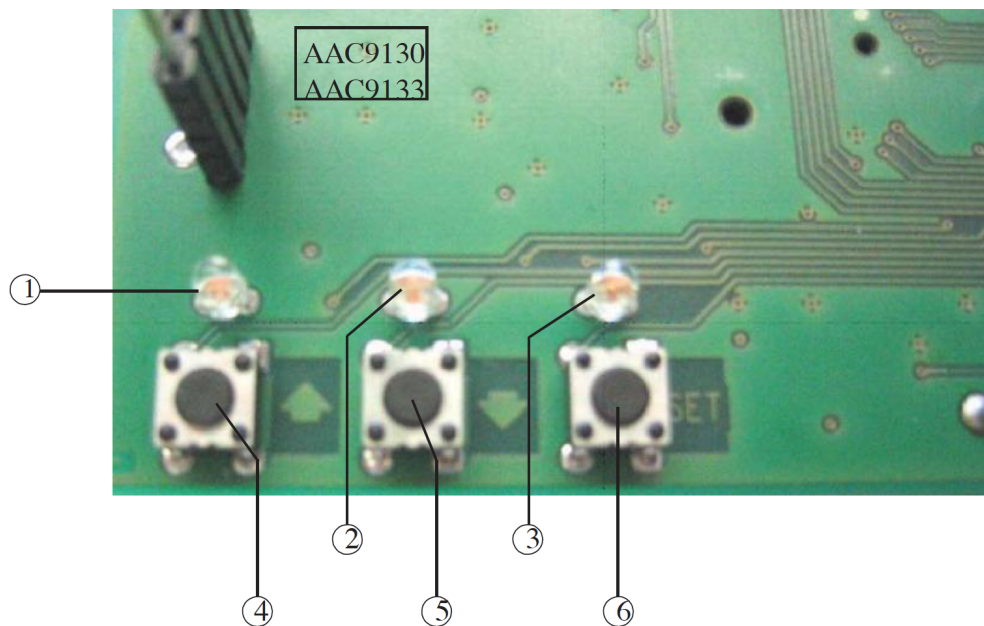
#### Flash

**fast** (2 per sec): Device error

**middle** (1 per sec): Actuator disengaged

**slow** (every 2 sec): Calibration

Figure 3.1



**MIN Button (4)**

**MAX Button (5)**

Buttons for manual actuator positioning.

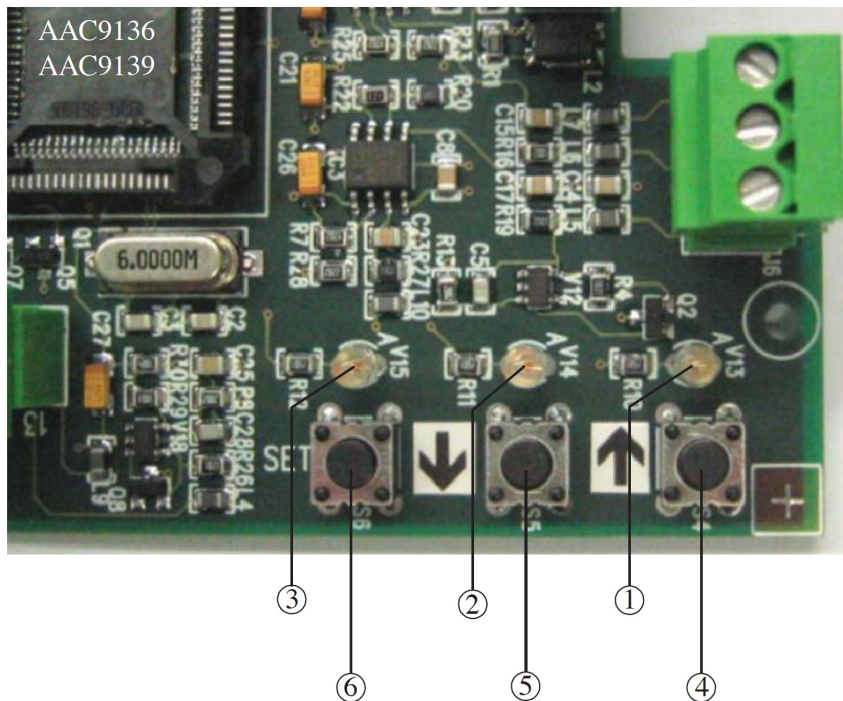
**Push both buttons simultaneously:** Push for about 6 seconds for actuator calibration

**SET Button (6)**

**Manual mode:** Push for about 3 seconds to set the internal dosing factor

**In Error mode:** Press and hold for error diagnosis

**Figure 3.2**



**3.3 Calibration of the 4-20mA Card**

Pressing the buttons “MIN” and “MAX” simultaneously for approximately six seconds will begin the calibration process. This is performed after the actuator calibration as described in Section 4.

The calibration process is displayed by slow flashing of the State LED. The MIN and MAX LED shows the direction of positioning.

### 3.4 Dosing Factor

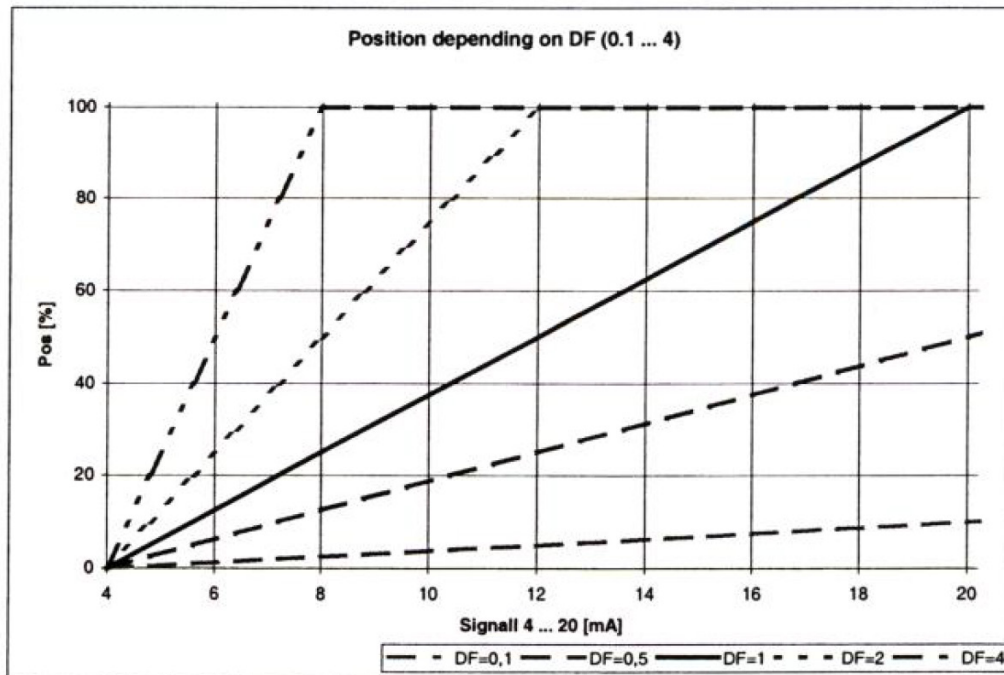
The actuator control has an adjustable dosing factor (DF). The dosing factor can be set to values between 0.1 to 4.0.

The output value POS (position of the actuator) is calculated as follows:

$$\text{POS} = \text{DF} \times \text{FLW}$$

FLW = Command signal mA input signal in %

DF = Dosing factor; range between [0.1...4.0]



The dosing factor can be adjusted either of two ways: by way of the buttons on the 4-20mA control board (refer to Internal Dosing Factor, Section 3.4.1) or through an external 1K potentiometer (refer to External Dosing Rate with 1K Potentiometer, Section 3.4.2).

#### 3.4.1 Internal Dosing Rate

The internal dosing factor can be adjusted by the buttons. In this way the dosing factor will be set by the current position and the current mA input signal. It can only be set to values between 0.1 and 4.0. If you try to set out of this range, the dosing factor will be set at the corresponding limit.

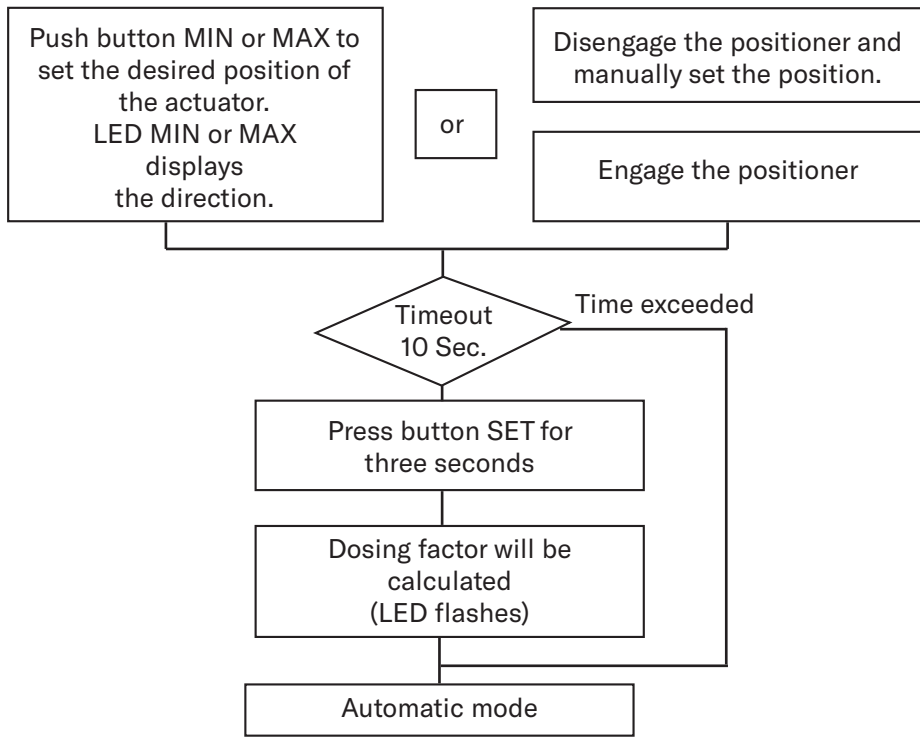
For Example:

- mA input signal = 6mA (12.5%)
- current Position = 80%
- calculated dosing factor = 6.4 (outside limit)
- set dosing factor = 4.0

The dosing factor is stored in an EEPROM. The value is maintained after interruption of the power supply. The default value of the dosing factor is 1.0.

**NOTE:** For resetting the dosing factor to the default value, the actuator calibration must be started.

To adjust the internal dosing factor, use the following schematic.



### 3.4.2 External Dosing Rate with 1K Potentiometer

To use the external dosing factor, plug a linear 1K potentiometer at terminals 13...15. As soon as the control detects a potentiometer, the control will use the adjusted dosing factor at the potentiometer. Dosing factor values between 0.1 and 4.0 are possible. The following scale displays the graduation of the dosing factor.

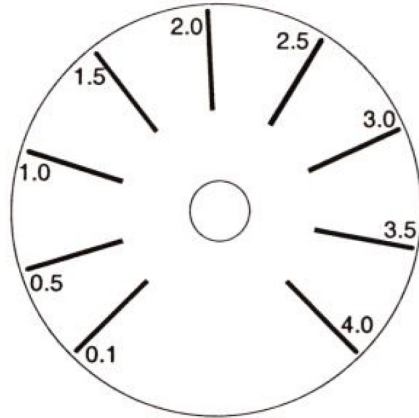


Figure 3.3

### 3.5 Local Manual Override



**CAUTION:** Do not attempt to turn the positioner knob with the knob in the automatic (pushed-in) position. Doing so may damage the positioner shaft or gear train. Disengage the knob by pulling out to the manual position (blue band on knob is visible) before attempting to manually rotate the knob.

The positioner can be manually operated and the signal disabled. This may be necessary if the positioner is being serviced, if it malfunctions, or if it is necessary to stabilize or observe the process.

Before manually operating the positioner, pull out the manual (red) knob on the positioner to disengage the actuator shaft from the motor. The knob and shaft slide out about 1/4 inch (blue band on knob is visible) and strike an internal stop. The #3 LED will flash one flash per second to indicate that the positioner is in "manual" mode. Once the shaft is disengaged from the motor, the stroke length is determined by manual operation only. With the pump running, rotate the knob to manually position the stroke length.

A contact is provided on the actuator, which closes when the red knob is pulled out.

**NOTE:** Be sure to reactivate the positioner by sliding the knob back to the engaged position when automatic positioning is to be resumed. A slight rotation may be necessary to align the gear teeth.

### 3.6 Positioner Adjustment

Adjustment of the positioner involves adjusting the feed-back potentiometer and limit switch cams so that they are within acceptable tolerances. The positioner is adjusted at the factory and should not require calibration on start-up or in normal use. Refer to Section 4 - Service for instructions on Testing and Calibration of the Positioner.

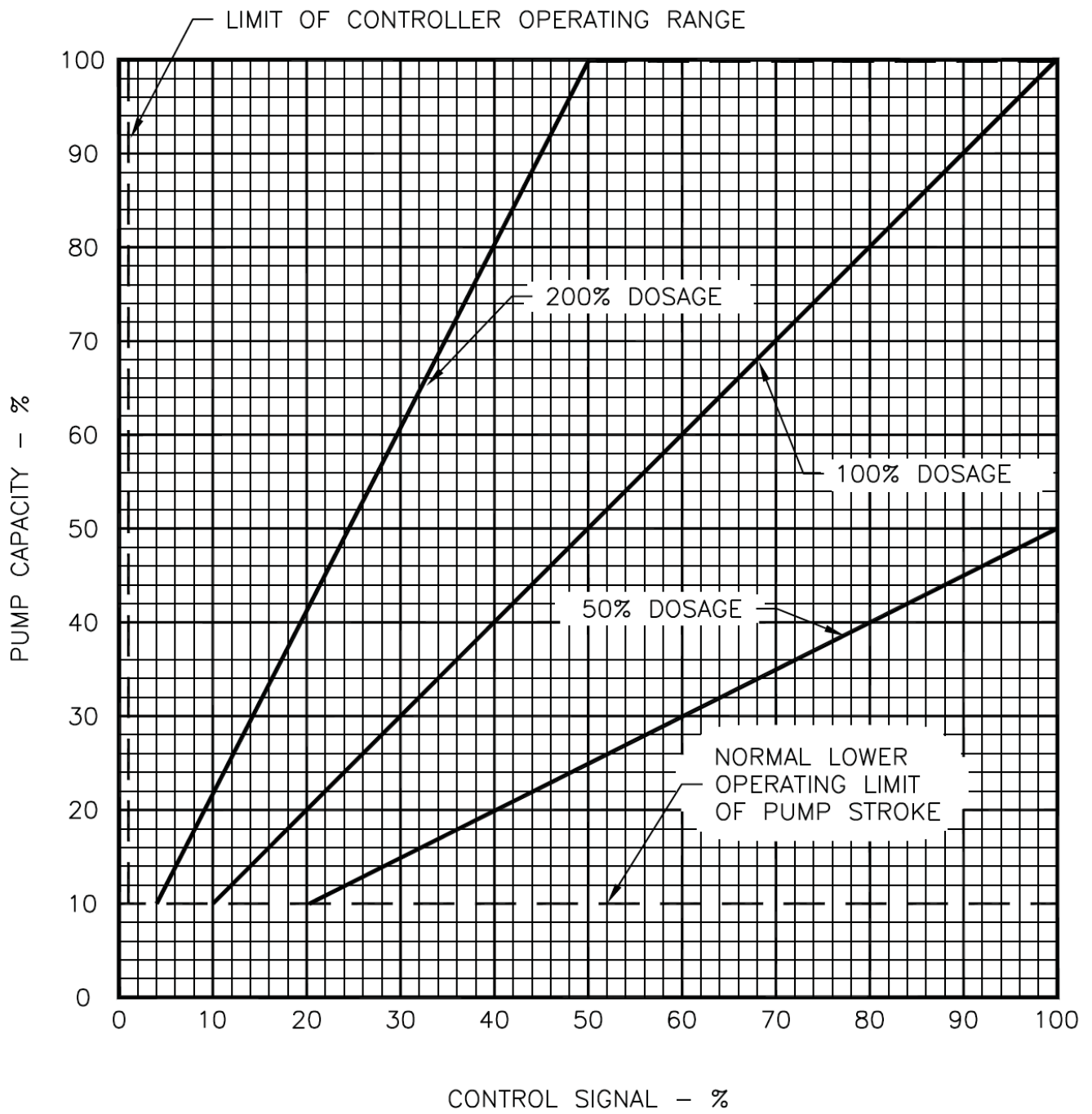
### 3.7 Method of Operation

The positioner consists of a signal input/output board, 4-20mA signal board, a small reversible motor, a gearbox, a metal enclosure with four holes for conduit termination, and an external knob that can be used to manually control the positioner. A drive shaft, which engages the knob of the stroke adjustment mechanism of the pump, is pinned to the output shaft of the reversible motor.

The main power input and the 4-20mA signal are directly wired to the 4-20mA signal board in the enclosure housing, eliminating the process controller. A feedback potentiometer in the input/output board returns a position feedback signal through the "wiper." The position of the wiper follows the number of rotations of the driving shaft, so that the potential on this line is proportional to the stroke length. These lines also provide feedback on the "Manual/Automatic" state of the positioner. When the manual actuation knob is pulled out, disengaging the motor to the driving shaft, the Auto/Manual position switch contacts are opened, effectively placing a resistor in series with the feedback potentiometer.

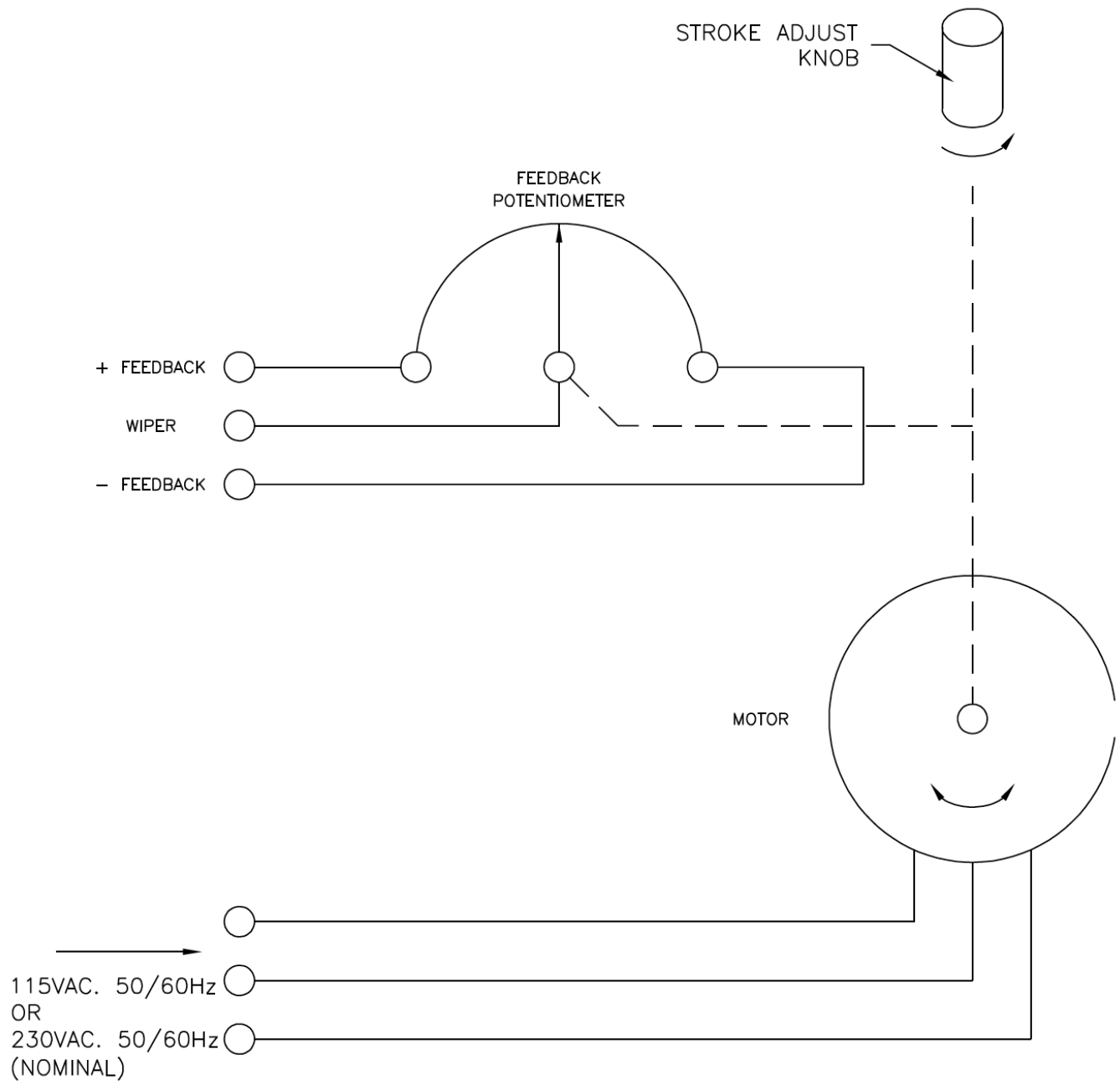
The positioner also incorporates two pairs of maximum and minimum limit switches. One pair disconnects the power line to the motor when the positioner reaches its limit of operation—maximum or minimum extension—so that the actuating mechanism is not physically driven against a stop. The maximum limit is the 100% position of the pump and the minimum limit is the 0% position of the pump. The second pair of limit switches is available as output contacts, to indicate remotely that the positioner is at its limit of travel. These switches are activated by two cams on the positioner gear train shaft. The position of the cams on the shaft can be adjusted to limit the range of the positioner and establish the span at which the 4-20mA board is calibrated. Refer to the Schematic drawing for additional detail.





FLOW PROPORTIONAL PUMP - PERFORMANCE  
DOSAGE CONTROL

40.300.191.010  
ISSUE 0 4-98



**ELECTRIC POSITIONER - BLOCK DIAGRAM**

40.300.181.020  
ISSUE 0 3-98

## Section 4 - Service

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## 4.1 Testing the Positioner

The positioner can be tested by local/mechanical operation of the manual knob. When operating the positioner manually, the stroke length is changed, allowing the operator to observe that the stroke length changes smoothly over the entire operating range of the positioner. If desired, the chemical supply may be turned off first.

### Manual Test

Pull the knob out (about 1/4") to the manual position. Verify that the positioner is in manual mode (LED #3 is flashing at one flash per second [see Figure 3.1]). If not, refer to the Schematic drawing and locate the problem by testing/verifying first the wiring, then the positioner circuit board. The AUTO/MAN detect switch is open when the knob is in the MAN position (out).

With the pump running and the knob in the manual position, rotate it from stop to stop (gently) and observe the pump knob and chemical feed rate. The positioner should operate smoothly and the feed rate should change steadily as the positioner is moved. Do not turn past the 100% or 0% positions of the knob. If the movement is not easy and smooth, refer to the Troubleshooting section of the pump manual. If the chemical feed rate does not change steadily over the full range of the stroke length of the pump, refer to the Operating and Service sections of the instruction book provided with the pump.

### Electrical Test (See Figure 3.1 for location of Push Buttons and LEDs)

With the pump running, push the red knob in to engage the positioner. Disconnect the signal wire and turn the power on to the positioner. LED #3 will flash fast (two flashes per second) indicating an error due to the lost of signal. The positioner will automatically drive the pump stroke toward 0% and stop.

## 4.2 Calibration of Positioner

### 4.2.1 Limit Switch Cam Adjustment

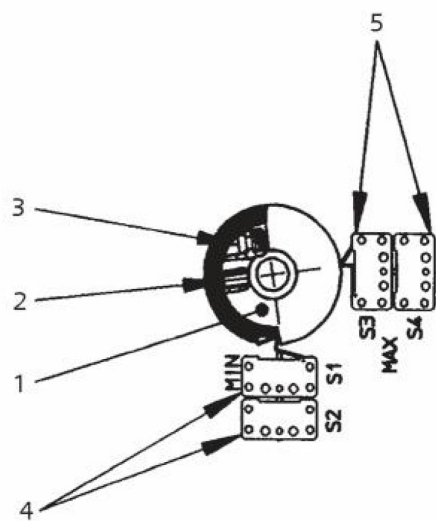
The positioner is supplied pre-adjusted and assembled to the pump. Adjustment should be necessary only after servicing. The pump must be running while the HAND/AUTO shaft is being turned.

a. Preparation:

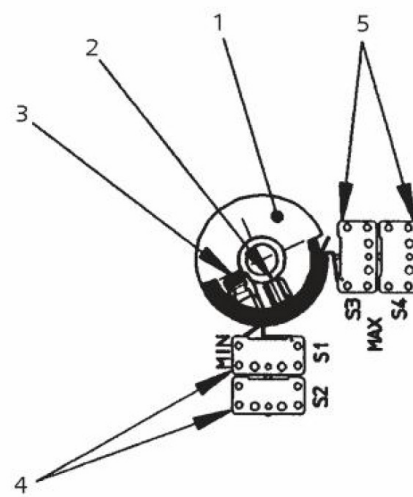
- (1) Switch off the power to the positioner and to the limit switches and ensure that the wires are free of voltage.
- (2) Disengage the motor by pulling the knob out.
- (3) Remove the knob by loosening the two set screws (Allen key 2 mm), unscrew the ten cover attaching screws and remove the cover. Replace the knob or turn the knob shaft with a screw- driver.

b. Adjust the MIN Limit (see Figure 4.1):

- (1) Rotate the HAND/AUTO shaft clockwise, until the pump knob is at 0%.
- (2) Loosen the set screw (pos. 2) of the cam wheel (pos. 1).
- (3) Turn the fixed cam wheel until both MIN-limit switches (pos. 4) have just switched open. (Switch arm at the slot.)
- (4) Fasten the set screw without turning the cam wheel.
- (5) Check by moving the HAND/AUTO shaft.



**Figure 4.1**



**Figure 4.2**

c. Adjust the MAX Limit (see Figure 4.2)

- (1) Rotate the HAND/AUTO shaft counter clockwise, until the pump knob is at 100.5%.
- (2) Turn the movable cam wheel by turning the set screw (pos. 3) so far that both MAX switches (pos. 5) have just switched open. (Switch arm at the slot.) Do not loosen or turn the whole cam wheel.
- (3) Repeat procedures b. and c., to confirm that the settings are correct.

## 4.2.2 Positioner Feedback Potentiometer Adjustment

### a. Adjust the feedback potentiometer

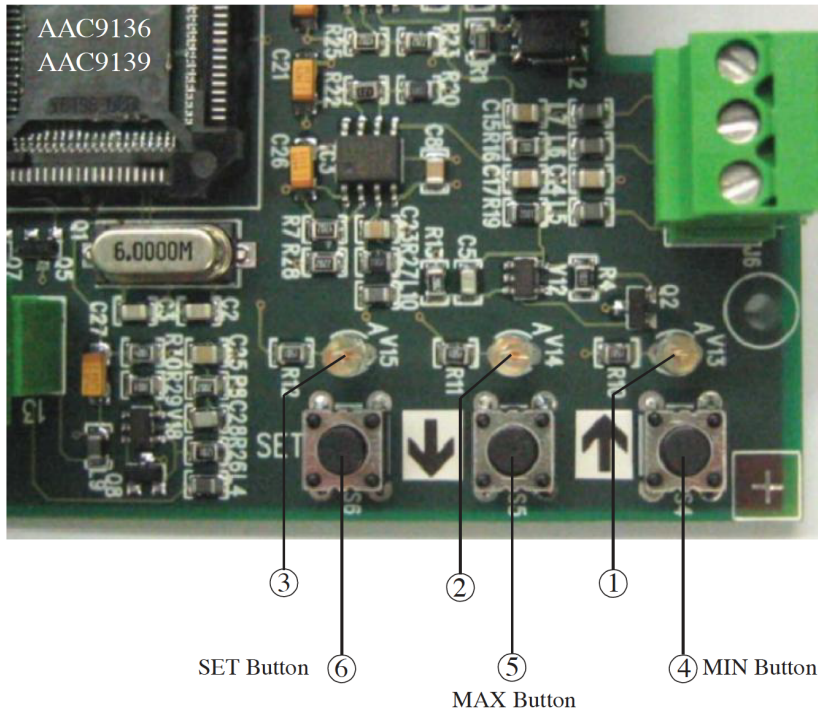
Adjustment is necessary when a new board or potentiometer is mounted in the positioner or the motor-gear-unit has been removed or changed.

- (1) Open the cover (see Limit Switch Cam Adjustment, Preparation).
  - (2) With pump running, rotate the HAND/AUTO shaft clockwise until the pump knob is at 0%.
  - (3) Connect an ohmmeter to terminals 13 and 14 on the board.
  - (4) Loosen the gear on the shaft of the feedback potentiometer. Set screw may not be immediately accessible. If so, turn gear to access set screw. Loosen set screw and disengage gear from actuator gear. With the feedback potentiometer gear disengaged, return pump knob to 0%.
  - (5) Rotate the potentiometer by engaging the notch on shaft with a small flat head screwdriver until the ohmmeter displays between 30 and 60 ohms. 45 ohms is ideal.
- NOTE:** The resistance must change smoothly without any “opens” or short circuits.
- (7) Re-tighten the output gear, without turning it.
  - (8) With the pump running, rotate the HAND/AUTO shaft counter clockwise until the pump knob is at 100%.
  - (9) Ohmmeter must display resistance of about 45 ohms less than the full potentiometer resistance.
  - (10) Check both adjustments by rotating the HAND/AUTO knob.
  - (11) Remove the ohmmeter and reconnect terminals 13/14/15.

### 4.2.3 4-20mA Control Board Calibration

The feedback potentiometer of the positioner has to be calibrated with the 4-20mA board.

- (1) Apply power to the positioner and simultaneously push the buttons “MIN” and “MAX” for approximately six seconds



- (2) The calibration process is displayed by slow flashing of the LED below the "SET" button. The LED below the "MIN" and "MAX" buttons shows the direction of positioning.

- (3) The calibration runs automatically. Do not interrupt this process by switching off the power supply. The positioner will stop automatically when the calibration is finished.

- (4) Turn off the power to the positioner and connect 4-20mA signal either from a milliamp generator or from the system.

- (5) Turn the power on and apply 4mA signal. The positioner will go to “0” limit switch setting.

- (6) Apply 20mA signal. The positioner will go to “100%” limit switch setting.

- (7) Push either “MAX” or “MIN” button to position the knob at exactly “100%” stroke.

- (8) Then push the “SET” button until the LED lights up.

- (9) The positioner is now ready to run in automatic mode.

#### **4.2.4 Install Positioner Cover**

- (1) Remove the HAND/AUTO knob, if mounted. Replace the cover without damaging the shaft seal.
- (2) Place the knob on the shaft, positioned so that the set screws are aligned with the flats on the shaft and tighten the set screws.
- (3) Switch to automatic operation (press in the knob).
- (4) Switch on power and check operation.

### **4.3 Parts Removal/Replacement**

#### **4.3.1 Cover Removal/Replacement**

To remove the cover from the positioner, first remove the manual knob from the shaft. To remove the knob, loosen the set screws in the side of the knob using a 2mm Allen wrench. Remove the ten 6mm cover screws. Slide the cover off the knob shaft taking care not to damage the gasket or shaft seals. Inspect the shaft seal to be sure that it is not damaged before replacing the cover.

Replacement is the reverse of removal. It is preferred that the knob be reinstalled so that the arrow points to the minimum of the graphic band when the positioner is at approximately 0% of stroke. Be sure to tighten the set screws securely so that the knob will not slip and mar the shaft.



#### **4.3.2 Circuit Board Removal/Replacement (See Dwg. 40.300.001.020)**

- a. Disconnect power from the positioner.
- b. Remove the knob and the cover.
- c. Pull out the connector of the power and signal wires from the 4-20mA board.
- d. Loosen the six jumper wire connections from the terminal strip of the input/output board.
- e. Remove the two 4mm screws that hold the 4-20mA board and pull out the board.
- f. Remove the cam wheel.
- g. Remove the gear from the potentiometer shaft.
- h. Replace the transparent cover on the new board.
- i. Place the gear on the potentiometer shaft, push to the stop, and tighten the set screws.
- j. Attach the new board with the gears meshed.
- k. Replace the cam wheel.
- l. Replace the connectors, adjust the limit switches and the potentiometer, close the cover, and replace the knob.
- m. Check for operation.
- n. Install the 4-20mA board to the input/output board (reverse of steps c and d).
- o. Replace the connectors, adjust the limit switches and the potentiometer
- p. Check the setting of the limit switches.
- q. Calibrate the 4-20mA board.
- r. Close the cover and replace the knob.
- s. Check the operation with a signal generator, if available.

### 4.3.3 Motor/Gear Assembly Removal/Replacement

- a. Disconnect power from the positioner
- b. Pull out the manual knob and turn the pump stroke to 0%. Do not disturb this stroke setting.
- c. Remove the knob and cover
- d. Pull out the connector of the power and signal wires from the 4-20mA board.
- e. Loosen the six jumper wire connections from the terminal strip of the input/output board.
- f. Remove the two 4mm screws that hold the 4-20mA board and pull out the board.
- g. Remove the conduit from the positioner housing.
- h. Remove the four 6mm screws that hold the housing to the arm and pull out the positioner assembly.
- i. Work on a bench, remove the four 4mmscrews that hold motor/gear assembly to the housing.
- j. Pull out the motor/gear assembly.
- k. Remove the board and place on the new motor/gear assembly. See paragraph 4.3.2, Circuit Board Removal/Replacement.
- l. Assemble the appropriate drive shaft to the motor/gear output shaft using new spring pin. See the following drawings:  

Encore®700:	Dwg. 40.300.001.010A
Chemtube®200:	Dwg. 40.300.002.010A
Chemtube®2000:	Dwg. 40.300.002.020A
- m. Install the motor/gear assembly to the housing with four 4mmscrews (reverse of step i).
- n. Install the 4-20mA board to the input/output board (reverse of steps e and f).
- o. Set the positioner such that the lower limit switch is just activated. On the terminal strip of the input/output board, Terminal #7 and #8 just made contact.
- p. Apply Molykote grease to the drive shaft and engage to the stroke adjust knob drive plate.
- q. Secure the housing to the arm with four 6mmscrews (reverse of step h).
- r. Replace the connectors, adjust the limit switches and the potentiometer
- s. Check the setting of the limit switches.
- t. Calibrate the 4-20mA board.
- u. Close the cover and replace the knob.
- v. Check the operation with a signal generator, if available

#### 4.4 Troubleshooting the Positioner

Perform troubleshooting systematically and in a step-by-step order to determine the probable cause of malfunction. Do not indiscriminately exchange parts or vary adjustments.

All service information contained herein assumes that the installation has been wired in accordance with the appropriate installation wiring diagram, and that any components removed or disconnected for any reason have been reconnected as originally installed.



**CAUTION:** Ensure that the covers are replaced tightly to avoid damage to the mechanical and electronic components from chemicals, gases, or water.

**Table 4.1 - Troubleshooting the Positioner**

<b>SYMPTOMS</b>	<b>PROBABLE CAUSE</b>	<b>REMEDY</b>
<b>PUMP KNOB DOES NOT MOVE WITH THE SIGNAL FROM THE 4-20mA BOARD.</b>	Positioner is in manual operation (knob is pulled).	Switch to automatic operation (push the knob in).
	Mechanical binding in pump.	Check torque required to turn stroke adjust knob (max. 18 in.- lbs. or 2.0 Nt-m torque).
	Limit switch in the positioner has switched.	Check the limits, adjust if necessary.
	Motor defective.	Check the wire resistance.
	Gear defective (chattering noise).	Replace motor and gear.
	Board defective (switches or capacitor).	Replace board.
<b>PUMP KNOB DOES NOT MOVE, ALTHOUGH HAND/AUTO KNOB TURNS.</b>	Pump knob is defective (wear).	Replace pump knob.
	Gear defective	Check teeth and clamping of the gear, replace motor-gear if necessary.
<b>PUMP KNOB MOVES IN THE WRONG DIRECTION.</b>	Incorrect wiring.	Check the terminal connections (change terminal 2 and 3).
<b>PUMP KNOB MOVES TO THE STOP.</b>	Limit switch misadjusted or defective.	Adjust limit switch.
<b>FEEDBACK SIGNAL CANNOT BE ALIGNED.</b>	Potentiometer misadjusted.	Check potentiometer adjustment.
	Potentiometer defect (it should be 1kOhm + 10%).	Replace potentiometer. <b>NOTE: Special potentiometer, may not be replaced by a standard potentiometer.</b>
	Wiring and terminals defective.	Check wiring and terminals to the board.
	Gears or potentiometer shaft loose.	Adjust potentiometer and tighten gears.
<b>POSITIONER MOVES TO AN INCORRECT POSITION.</b>	Potentiometer defective or loose.	Check potentiometer resistance while moving the HAND/AUTO knob by hand, if necessary replace circuit board.
	Cable to the control unit loose.	Check the cable.
	Capacitor defective.	Replace board.
<b>POSITIONER OSCILLATES.</b>	Positioner not correctly attached to the mounting plate or potentiometer loose.	Check mounting of the motor/gear assembly and potentiometer.
	Controller sensitivity is set too high.	Controller sensitivity is set too high.
<b>MOVEMENT SLOW.</b>	Load too great. Poor alignment.	Check load. Check positioner without load. Check alignment.

#### 4.5 Troubleshooting 4-20mA Control Board

In case of an error, the positioner will steer the position to 0%. Manual positioning is only possible by disengaging the actuator.

Errors are displayed by a fast flashing (two per second) of the SET LED. To get a better diagnosis of the error, push the button SET. The LEDs will show the error code.

Error code LED			Description	Suggestion
MIN	MAX	SET		
X	-	-	No command signal, mA input signal < 4mA	Plug 4-20mA input signal at the terminals 5(+) and 6(-) on the 4-20mA control board; Test the signalling transmitter.
-	X	-	Error in feedback signal; calibration error.	Adjust the potentiometer of the positioner; adjust the cam switch correctly.
-	-	X	No feedback potentiometer available.	Connect terminals 13/14/15 on the actuator board to terminals 10/11/12 on the 4-20mA control board.

#### 4.6 Checking the Motor

- a. Make sure the positioner is free from the voltage.
- b. Remove knob and screws; lift the cover.
- c. Pull off terminals 4/5/6.
- d. Measure winding resistance with an ohmmeter. If the tolerance is exceeded, replace the motor.

Terminals	4-6	5-6	4-5
230v - Motor	8500 ohm	8500 ohm	17000 ohm
115v - Motor	1960 ohm	1960 ohm	3920 ohm
	Tolerance $\pm$ 10%		

#### WARNING LABEL

The following warning label has been attached to the equipment:

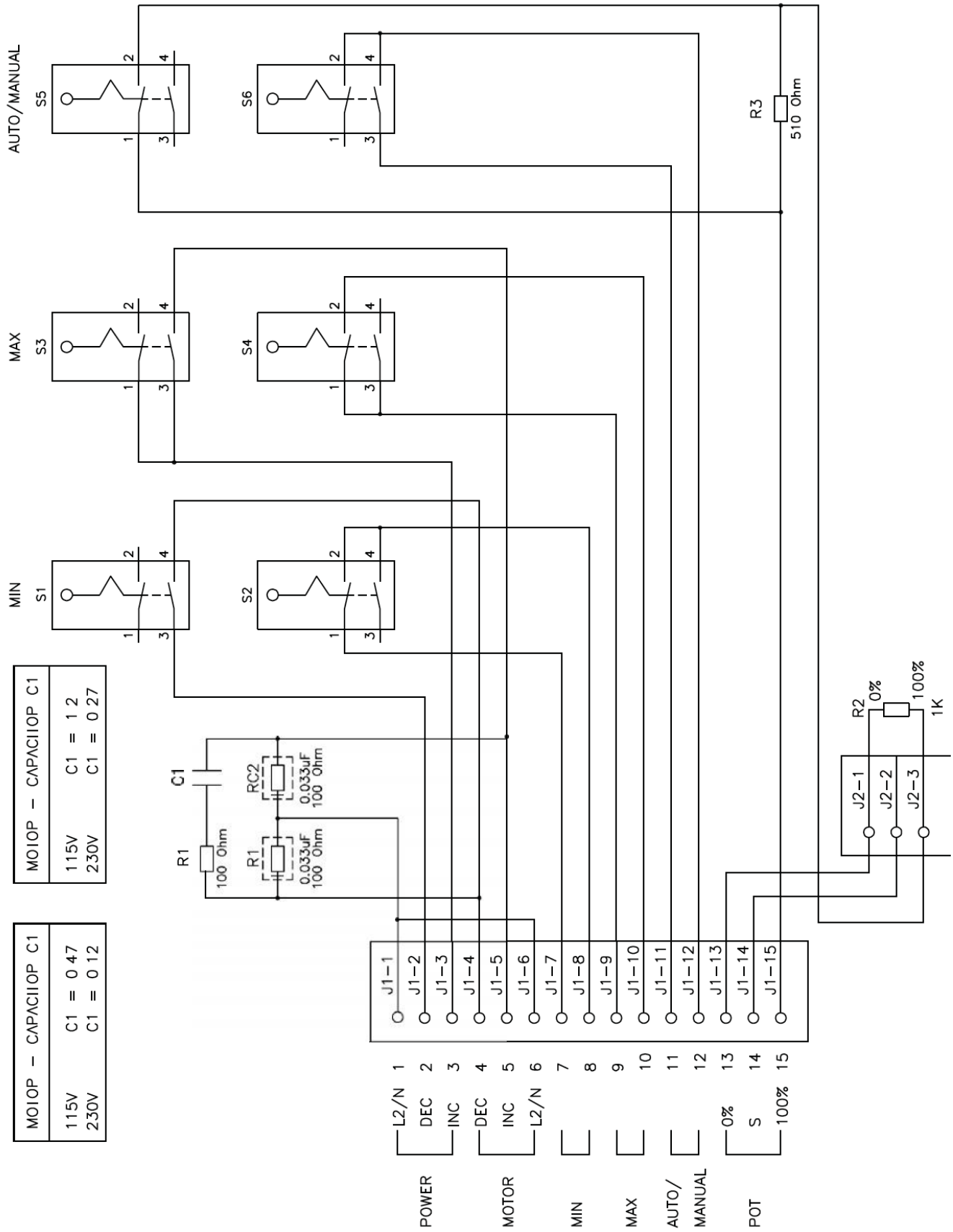
AFM4634: TO AVOID POSSIBLE SEVERE PERSONAL INJURY FROM ELECTRICAL SHOCK, TURN POWER OFF BEFORE SERVICING. KEEP COVER SECURELY TIGHTENED WHEN EQUIPMENT IS IN OPERATION. THIS ENCLOSURE IS NEMA 4X RATED. GASKET SEAL MUST BE MADE IN ORDER TO PROTECT THE INTERNAL COMPONENTS FROM MOISTURE AND FUMES.

FOR GAS FEEDER

MOIOP - CAPACIOP C1	
115V	C1 = 0.47
230V	C1 = 0.12

FOR PUMPS

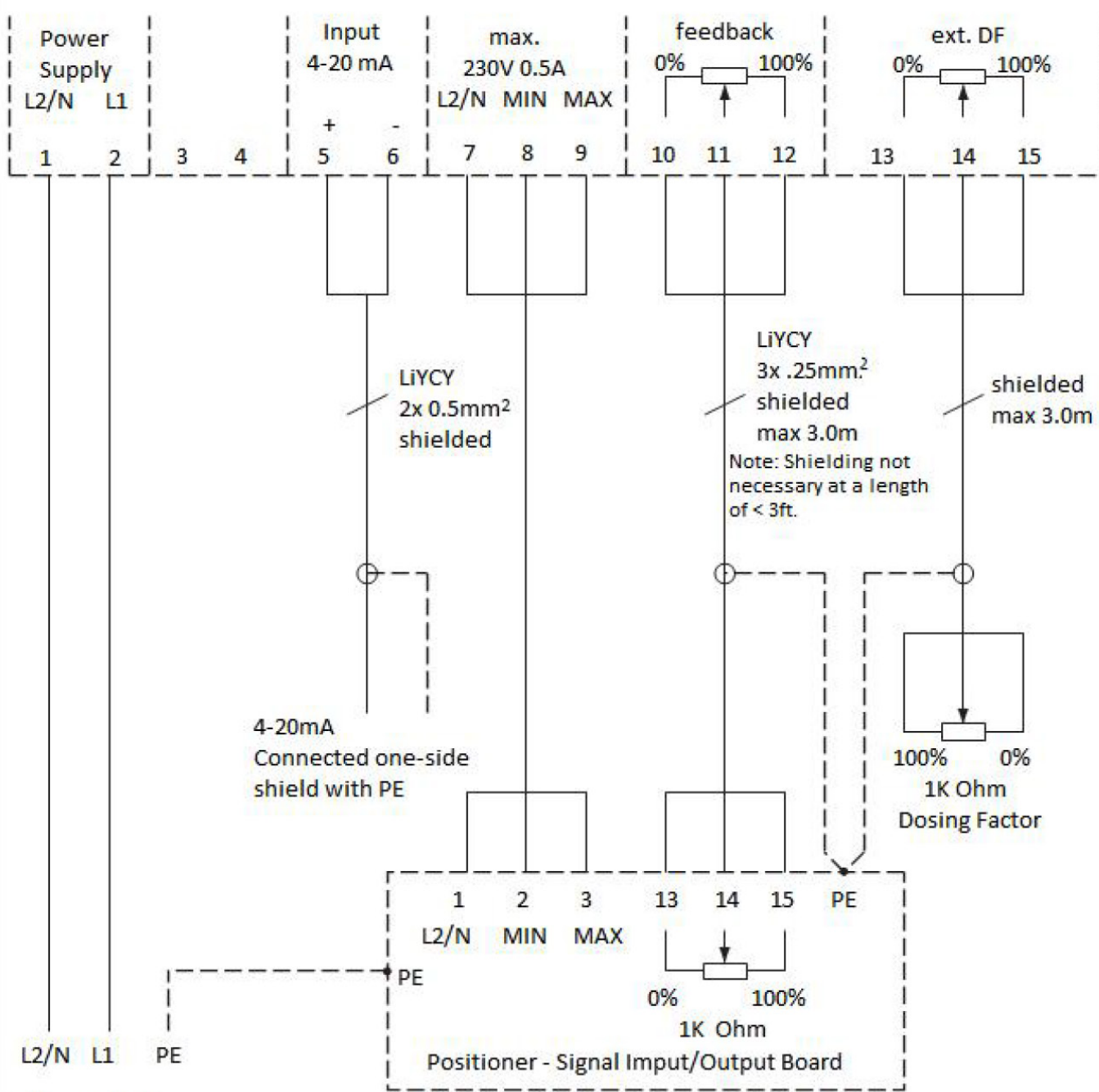
MOIOP - CAPACIOP C1	
115V	C1 = 1.2
230V	C1 = 0.27



ELECTRIC POSITIONER - SCHEMATIC WIRING

40.300.156.010  
ISSUE 0 4-98

### 4-20mA Control Board



Power Supply  
 230V 50Hz AAC9130  
 115V 60Hz AAC9133

### ELECTRIC POSITIONER WITH 4-20mA BOARD - SCHEMATIC WIRING

40.050.155.020  
 ISSUE 0 1-05



## Section 5 - Illustration

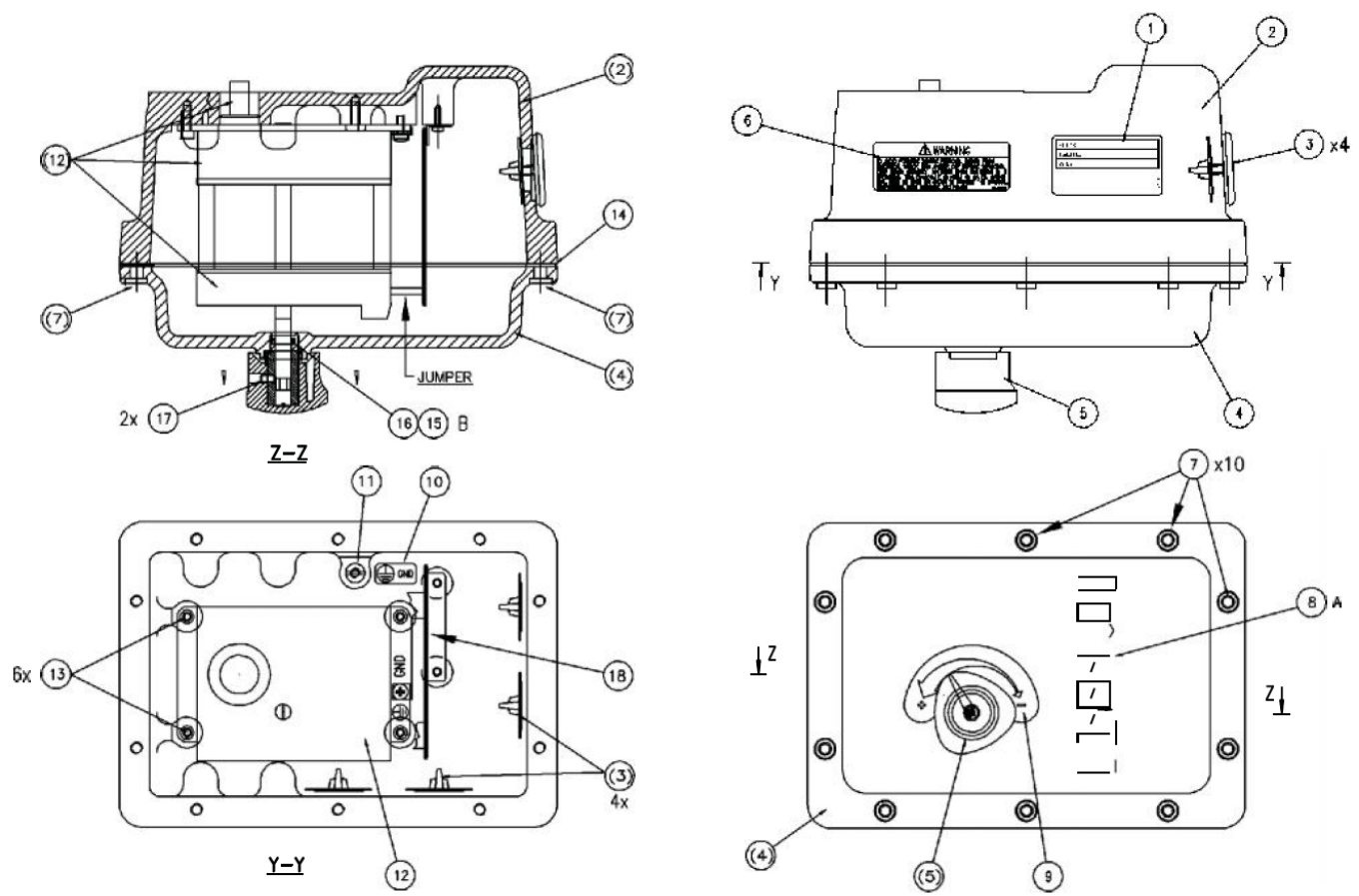
### List of Contents

#### Parts

Electric Positioner Assembly  
Stroke Positioner Mounting Hardware  
Encore<sup>®</sup>700  
Chemtube<sup>®</sup>200  
Chemtube<sup>®</sup>2000

### DRAWING NO.

40.050.000.020A&B  
40.300.001.010A&B  
40.300.002.010A&B  
40.300.002.020A&B



**NOTE:** FOR PARTS LIST, SEE DWG. 40.050.000.020B.

**STROKE POSITIONER ASSEMBLY - PARTS  
AAC7322 - 115VAC; AAC7325 - 230VAC**

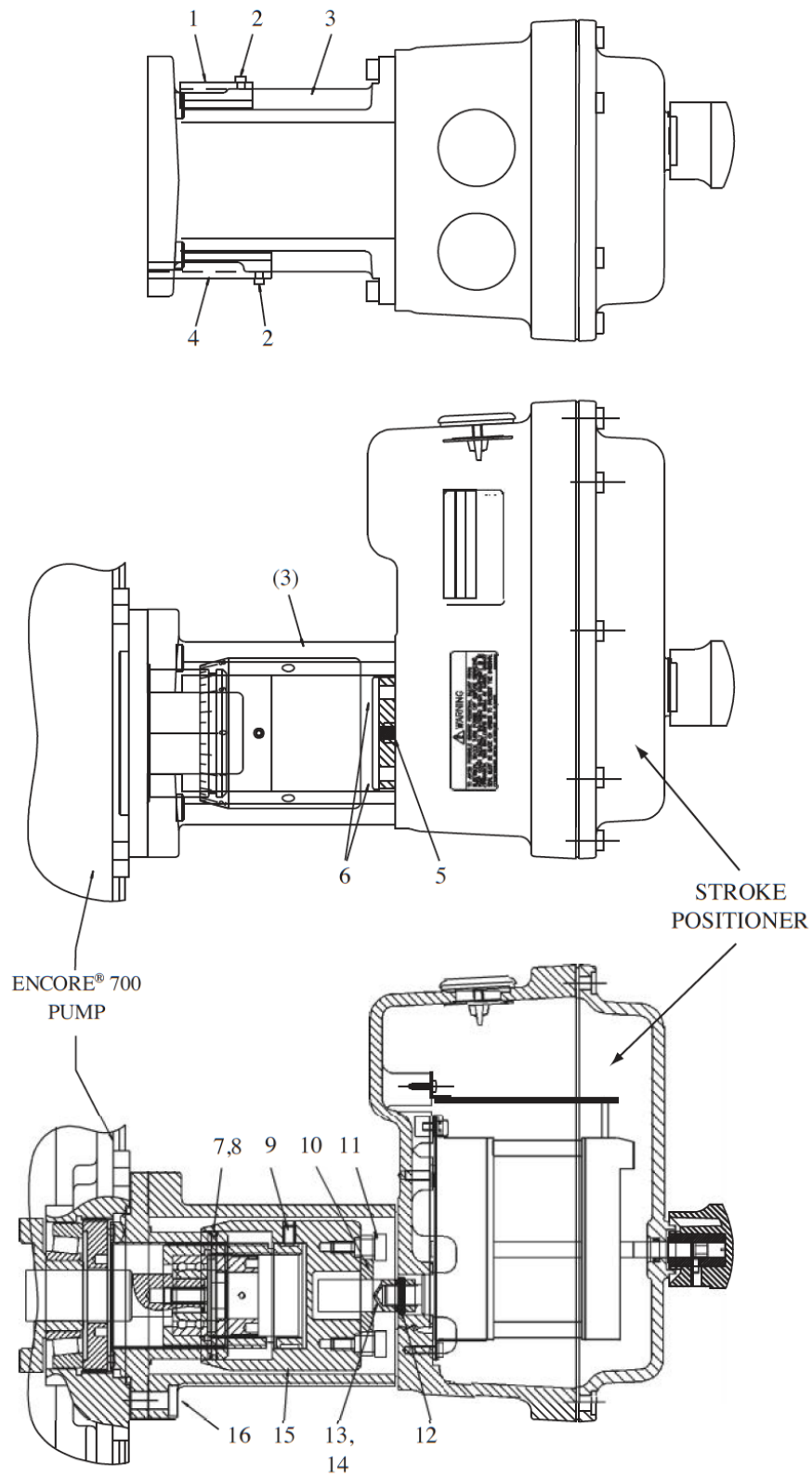
KEY NO.	PART NO.	QTY.	DESCRIPTIONS
1	AAC2034	1	LABEL, DATA PLATE, STROKE POSITIONER
2	AAC7064	1	HOUSING, STROKE POSITIONER (MACH)
3	P52085	4	SEAL, HOLE, 3/4" CONDUIT
4	AAC7058	1	COVER, STROKE POSITIONER (MACH)
5	P97070	1	KNOB, RED, TRIANGULAR
6	AFM4634	1	LABEL, WARNING, (ELECTRIC SHOCK)
7	AUK3561	10	SCR. CAP, SOCK HD, M6 x 20, 316SS
8	P97075	1	LABEL, CONNECTOR
9	AAA2031	1	LABEL, INCREASE CCW, STROKE POSITIONER
10	AAA2478	1	LABEL, EARTH GROUND
11	AAA1335	1	SCR, M5 x 12, PAN HD, SLOT, 316SS
12	APP3449	1	DRIVE UNIT, 115VAC, STROKE POSITIONER
	OR		
	AAA1379	1	DRIVE UNIT, 230VAC, STROKE POSITIONER
13	AAA2115	6	SCR, CAP, SOCK HD, M4 x 10, 316SS GASKET,
14	AAC7073	1	HOUSING, STROKE POSITIONER GREASE,
15	AAA3797	0	SILICONE, LIGHT
16	P97073	1	SEAL, SHAFT, G8 x 12 x 3, NBR
17	AAA2712	2	SCR, SET, M4 x 8, SOCK HD, CUP, 316SS
18	AAC9133	1	4 -20mA BOARD, 115VAC
	OR		
	AAC9130	1	4 - 20mA BOARD, 230VAC

WHEN ORDERING MATERIAL ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

STROKE POSITIONER ASSEMBLY - PARTS LIST  
AAC7322 - 115VAC; AAC7325 - 230VAC

40.050.000.020B

ISSUE 1 7-09



**NOTE:** FOR PARTS LIST, SEE DWG. 40.300.001.010B.

**AAA1283 ENCORE® 700 - PARTS  
Stroke Positioner Mounting Hardware**

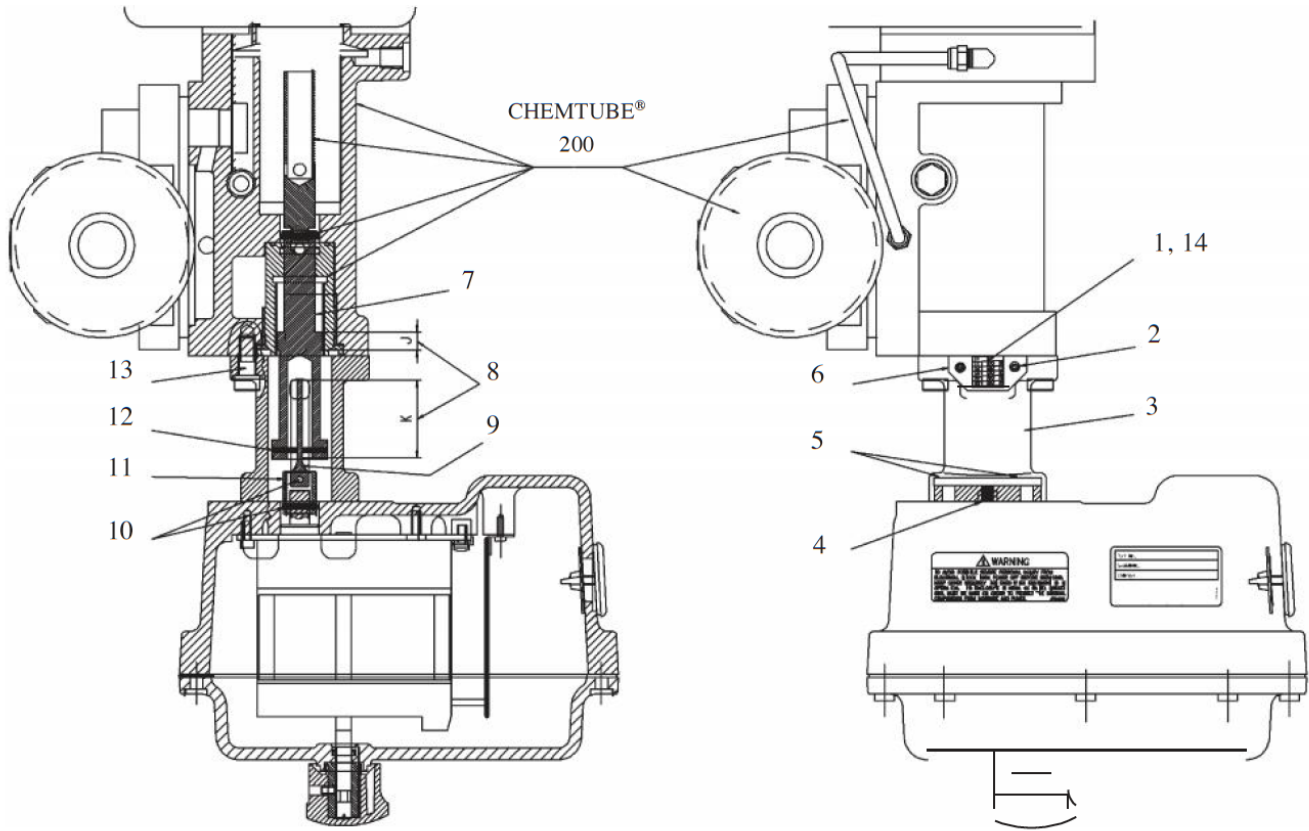
**40.300.001.010A**  
ISSUE 3 5-08

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAA4556	1	COVER, TOP
2	AAA3057	2	CAP SCREW, M3 x 8, SOCK. HD., 316SS
3	ALJ3066	1	ARM (MACH) (ENCORE 700)
4	AAA4565	1	COVER, BOTTOM
5	AAA5577	2	PIN DOWEL, 6x10, M6 HARDENED
6	AUK3561	4	CAP SCREW, M6 x 20, SOCK.HD., 316SS
7	AAA3797	0	GREASE, SILICONE, LIGHT
8	AAA3920	1	QUAD-RING #4141, HNBR, 56.82 x 2.6
9	AAA2382	3	SET SCREW, M6 x 8, SOCK. HD., FLAT PT.
10	ALJ3477	1	PLATE DRIVE, STROKE POSITIONER
11	AVM3985	2	SHOULDER SCREW, 8/M6 x 10, SOCK. HD., STL.
12	AAA2139	1	PIN, SPIRAL, 3x18, STL. HEAVY DUTY
13	APP3463	1	SHAFT, DRIVE (ENCORE 700)
14	E1209	0	GREASE, MOLYKOTE
15	AJA3455	1	STROKE POSITIONER KNOB (ENCORE 700)
16	AAA5425	4	CAP SCREW, M8 x 35, SOCK.HD., 316SS

WHEN ORDERING MATERIAL ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

AAA1283 ENCORE® 700 - PARTS LIST  
Stroke Positioner Mounting Hardware

40.300.001.010B  
ISSUE 2 5-08



**NOTE:** FOR PARTS LIST, SEE DWG. 40.300.002.010B.

**AAA1526 CHEMTUBE® 200 - PARTS  
Stroke Positioner Mounting Hardware**

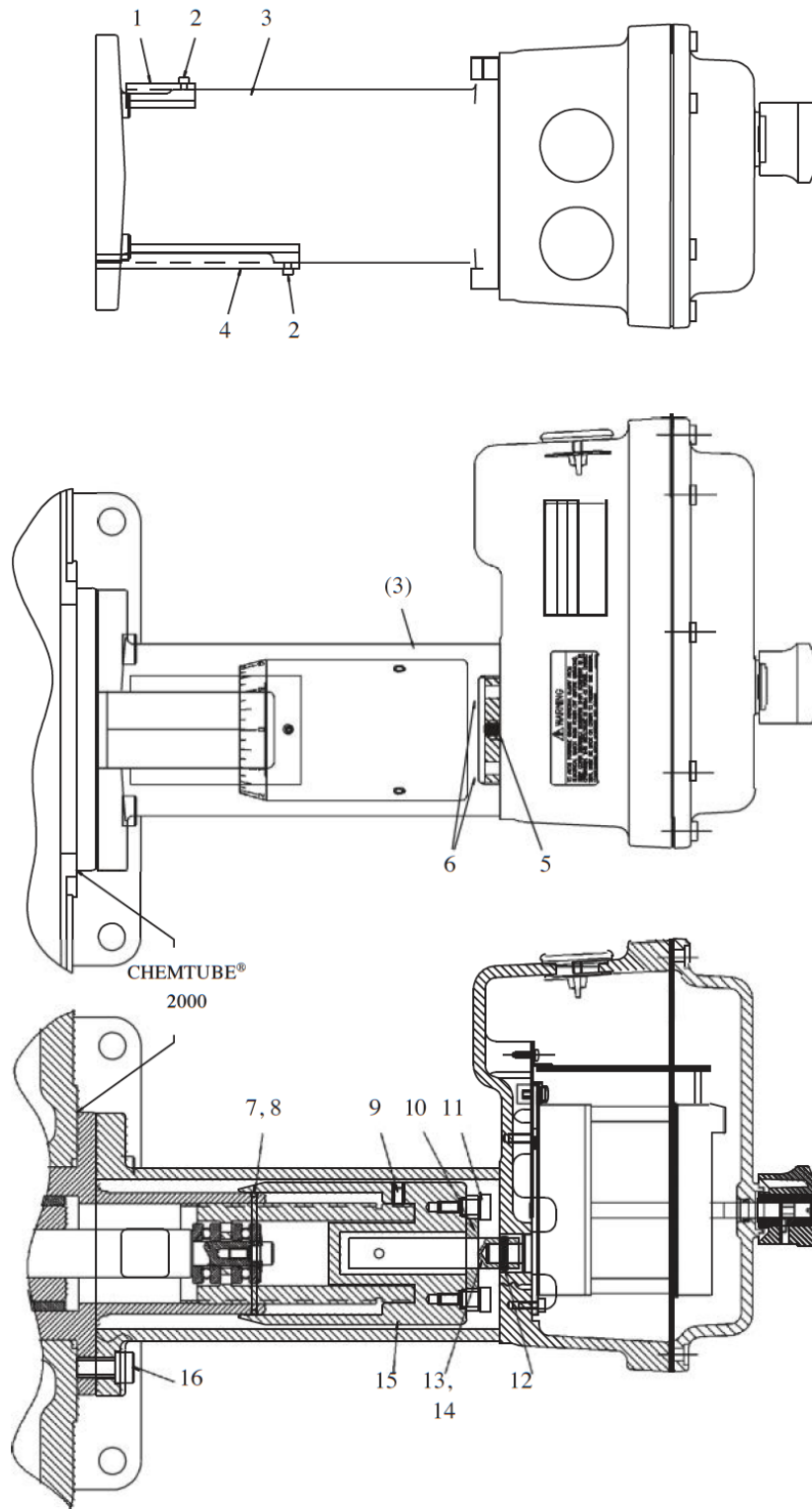
**40.300.002.010A**  
ISSUE 2 5-08

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAA2385	1	LABEL, STROKE, SHAD
2	AAA3057	2	SCR, CAP, M3x8, SOCK HD, 316SS
3	AAA1514	1	ARM, SHAD (MACH) STRK.POS.
4	ABE5449	2	PIN, DOWEL, 6x10, h6 HARDENED
5	AUK3561	4	SCR, CAP, M6x20 SOCK. HD, 316SS
6	AAA4562	1	COVER, TOP, SHAD, STRK.POSITI.ARM
7	AAA6332	1	ADJUSTER, AUTO
8	E1209	0	GREASE, MOLYKOTE
9	AAA1520	1	SHAFT, COUPLER, SHAD, STRK.POS.
10	AAA2139	2	PIN, SPIRAL, 3x18, STL HEAVY DUTY
11	AAA1517	1	COUPLER, SHAD, STRK.POS.
12	P30341	2	GROOV-PIN, .094"x.500",SS
13	AXS3656	4	SCR, CAP, M8x20, SOCK.HD, 316SS
14	AAA5310	1	MYLAR, OVERLAY

WHEN ORDERING MATERIAL ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

AAA1526 CHEMTUBE® 200 - PARTS LIST  
Stroke Positioner Mounting Hardware

40.300.002.010B  
ISSUE 1 1-05



**NOTE:** FOR PARTS LIST, SEE DWG. 40.300.002.020B.

**CHEMTUBE® 2000 - PARTS**  
**Stroke Positioner Mounting Hardware**

**40.300.002.020A**  
 ISSUE 2 5-08



KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAA4559	1	COVER, TOP, LHAD STRK POSITI.ARM
2	AAA3057	2	CAP SCREW, M3 x 8, SOCK. HD., 316SS
3	ANM4864	1	ARM, LHAD (MACH), STRK.POS.
4	AAA4565	1	COVER, BOTTOM STRK.POSITI.ARM
5	AAA5577	2	PIN DOWEL, 6x10, M6 HARDENED
6	AUK3561	4	CAP SCREW, M6 x 20, SOCK.HD., 316SS
7	AAA3797	0	GREASE, SILICONE, LIGHT
8	AAA3920	1	QUAD-RING #4141, HNBR, 56.82 x 2.6
9	AAA2382	3	SET SCREW, M6 x 8, SOCK. HD., FLAT PT.
10	ALJ3477	1	PLATE, DRIVE, STROKE POS. (COM)
11	AVM3985	2	SHIELD SCREW, 8/M6 x 10, SOCK. HD., STL.
12	AAA2139	1	PIN, SPIRAL, 3x18, STL. HEAVY DUTY
13	APS3468	1	SHAFT, DRIVE, LHAD, STRK.POS.
14	E1209	0	GREASE, MOLYKOTE
15	APP3459	1	STROKE POSITIONER KNOB, LHAD
16	AWO3362	4	CAP SCREW, M8 x 35, SOCK.HD., 316SS

WHEN ORDERING MATERIAL ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

CHEMTUBE® 2000 - PARTS LIST  
Stroke Positioner Mounting Hardware

40.300.002.020B  
ISSUE 1 1-05



## Section 6 - Conversion Kit

PUMP	EXISTING STROKE ADJUSTMENT	CONVERSION KIT WITH 4-20mA BOARD	
		115VAC	230VAC
ENCORE® 700	MANUAL STROKE ADJUSTER	AAC7595	AAC7604
CHEMTUBE® 200	MANUAL STROKE ADJUSTER	AAC7601	AAC7610
CHEMTUBE® 2000	MANUAL STROKE ADJUSTER	AAC7598	AAC7607
COMMON TO ALL 3 PUMPS	AUTOMATIC STROKE POSITIONER WITH SCU/PCU CONTROLLER	AAC7616	AAC7613


One conversion kit is required per stroke adjuster.



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[www.waterprocesssolutions.com](http://www.waterprocesssolutions.com)  
[enquiries@waterprocesssolutions.com](mailto:enquiries@waterprocesssolutions.com)

 Water-Process-Solutions

 @waterwps

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Kent, ME20 7JZ

**WATER PROCESS**  
 **SOLUTIONS**

Literature No. WPS Gen Flyer UK 001.V1