WL-04029-OM01
February 25, 1994
Rev. A

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WITH PARTS LIST

GORMAN-RUPP PUMPS

ACCESSORIES

MODEL
EPS 27781-028

THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO
GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA Printed in U.S.A.

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

INTRODUCTION

This Installation, Operation, and Maintenance manual is designed specifically to help you achieve the best performance and longest life from your Gorman-Rupp Model 27781-028 EPS Electronic Pressure Switch.

The EPS is designed as a component part of Gorman-Rupp pump control panels. It is intended for use with a submersible transducer type liquid level sensor for sewage, wastewater, trash, and industrial applications.

Gorman-Rupp shall not be liable for defects in workmanship of any equipment supplied by it in the event such defects may be the result of work, rework, or adjustment on the equipment by any person other than an authorized Gorman-Rupp service representative.

If there are any questions regarding the Model 27781-028 EPS Electronic Pressure Switch which are not covered in this manual or in other literature accompanying this unit, please contact your Gorman-Rupp distributor, or write:

The Gorman-Rupp Company
P.O. Box 1217
Mansfield, Ohio 44901-1217
(419) 755-1011
or
Gorman-Rupp of Canada Limited
70 Burwell Road
St. Thomas, Ontario N5P 3R7
(519) 631-2870

The following are used to alert maintenance personnel to procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel:

DANGER!

Immediate hazards which WILL result in severe personal injury or death. These instructions describe the procedure required and the injury which will result from failure to follow the procedure.

WARNING!

Hazards or unsafe practices which COULD result in severe personal injury or death. These instructions describe the procedure required and the injury which could result from failure to follow the procedure.

CAUTION

Hazards or unsafe practices which COULD result in minor personal injury or product or property damage. These instructions describe the requirements and the possible damage which could result from failure to follow the procedure.

NOTE

Instructions to aid in installation, operation,and maintenance, or which clarify a procedure.

DESCRIPTION

The Model 27781-028 EPS Electronic Pressure Switch is a component part of your Gorman-Rupp pump control panel. It is designed to start and stop pumps, alarms or other devices associated with a Liquid Level Control System.

The EPS provides four outputs. Each output has an adjustable **ON** setpoint and an adjustable **OFF** setpoint. A digital meter is provided to display the **ON-OFF** setpoints of each output and the level in the wet well.

The operating controls and external components of the EPS are shown in Figure I-1. They are described in greater detail in Section C, **OPERATION**.

The major internal components are eight comparators, four latch circuits, four drivers and four output modules. These are also described in Section C, **OPERATION**.

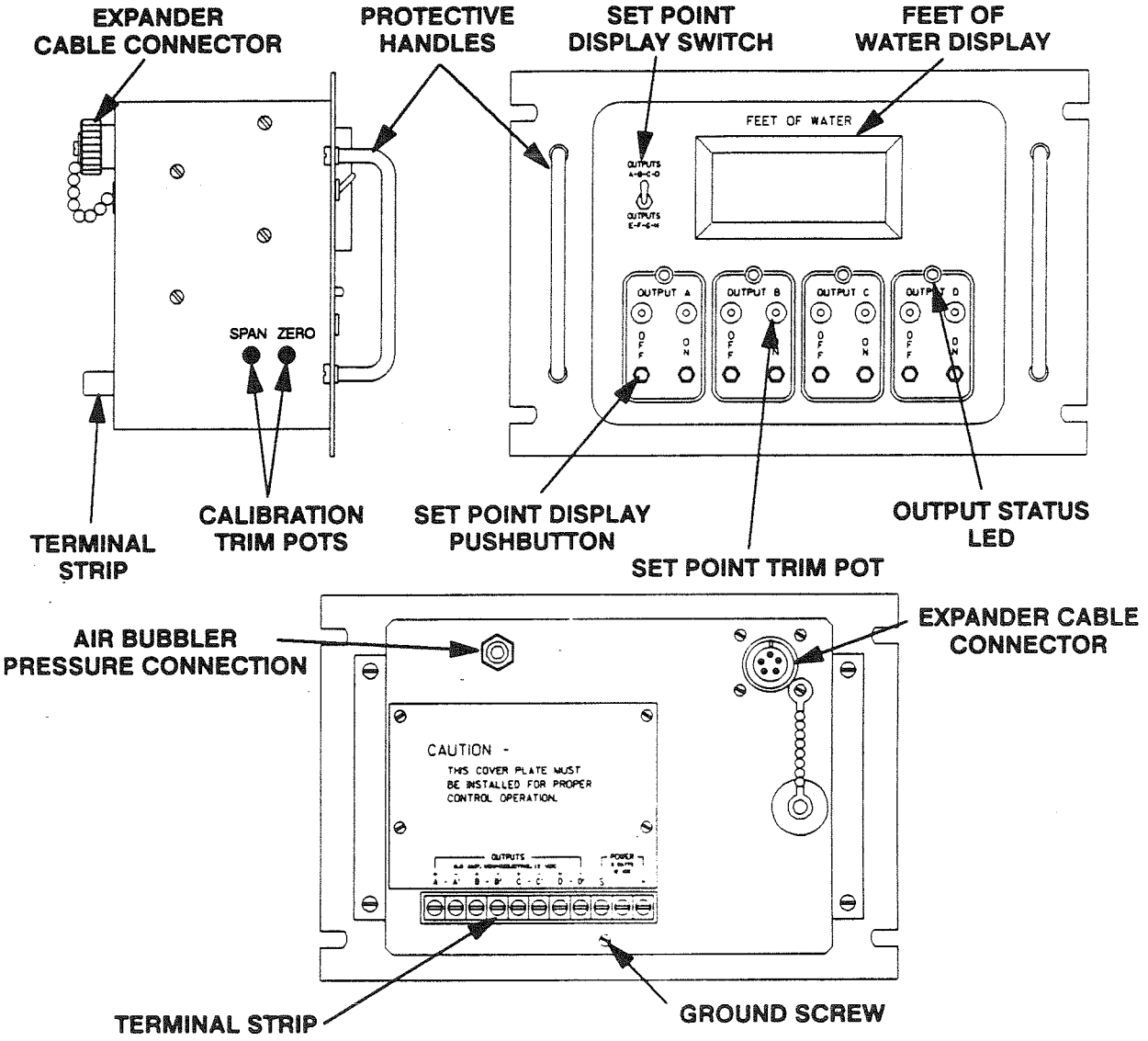


Figure I-1. Model 27781-028 EPS Electronic Pressure Switch

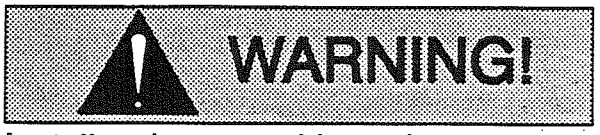
SPECIFICATIONS

Model 27781-028 EPS Electronic Pressure Switch

Control Range:	0 - 23 ft. water column
Leveling Sensing Means:	Low pressure air bubbler
Power Requirements:	12 VDC ± 10%
Pressure Transducer:	Strain gauge, 0 - 15 PSI. 45 PSI overpressure 10 volt DC input 1.5 to 7.0 V output.
Display:	3 1/2 digit, LED, 1/2 inch high
Output:	Solid state relay, optically isolated, zero cross switching, 2 AMP resistive, 135W incandescent, (1) size 4 contactor
O/A Repeat Accuracy:	± 0.1 ft. water column
Temperature Limits:	0°F (-18°C) to 130°F (55°C)
O/A Dimensions:	7.0 inches high X 10.5 inches wide X 6.5 inches deep

SAFETY - SECTION A

The electrical power present in wastewater lift stations is high enough to cause injury or death. If the EPS is installed in a lift station, take care to prevent contact with electrical circuits when performing maintenance, troubleshooting, or repair. Disconnect power before connecting, disconnecting, or servicing electrical components. Check to ensure circuits are dead before making physical contact with current-carrying parts.



Install and operate this equipment in accordance with the National Electric Code and all local codes. If there is a conflict between the instructions provided and N.E.C. Specifications, N.E.C. Specifications shall take precedence. Ground the unit before applying line potential.

INSTALLATION - SECTION B

The Model 27781-028 EPS Electronic Pressure Switch is a component part of your Gorman-Rupp Pump Control Panel, and was installed at the factory. However, if replacement is necessary or spare outputs are to be used, the following installation procedures may be helpful.

MOUNTING

When installing the Model 27781-028 EPS Electronic Pressure Switch in the control panel, a minimum of 5 1/2 inches (139,7 mm) is required behind the mounting surface to provide clearance for the electrical connections. Refer to Figure B-1 for mounting dimensions:

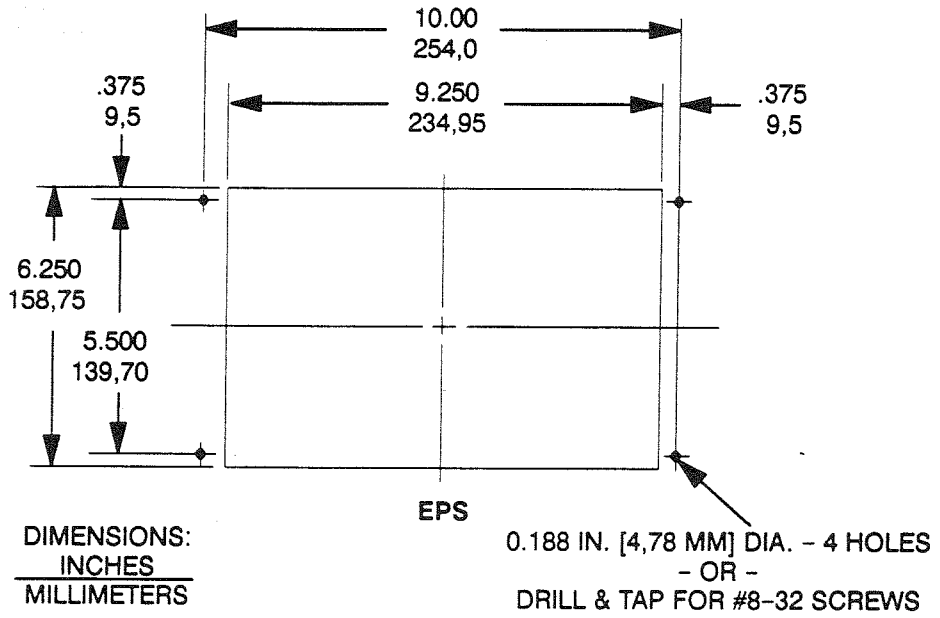


Figure B-1. Model 27781-028 EPS Mounting Dimensions

AIR BUBBLER LINE

The EPS is designed to be connected to an air bubbler level control system. The components of an air bubbler system include a low pressure/low flow air source, air bubbler line or tubing, a clean-out tee, and an air bell. Your Gorman-Rupp pump control panel includes an air source and an air bell. Refer to Figure B-2 for a typical air bubbler line installation.

CAUTION

EPS components are not intended to withstand high pressure. **Do not** exceed 15 PSI.

The air bubbler line must be connected to the 1/8 inch NPT fitting on the back of the EPS. Note that this fitting must be secured with a wrench while tightening mating fittings. Otherwise, the internal tubing will twist or kink.

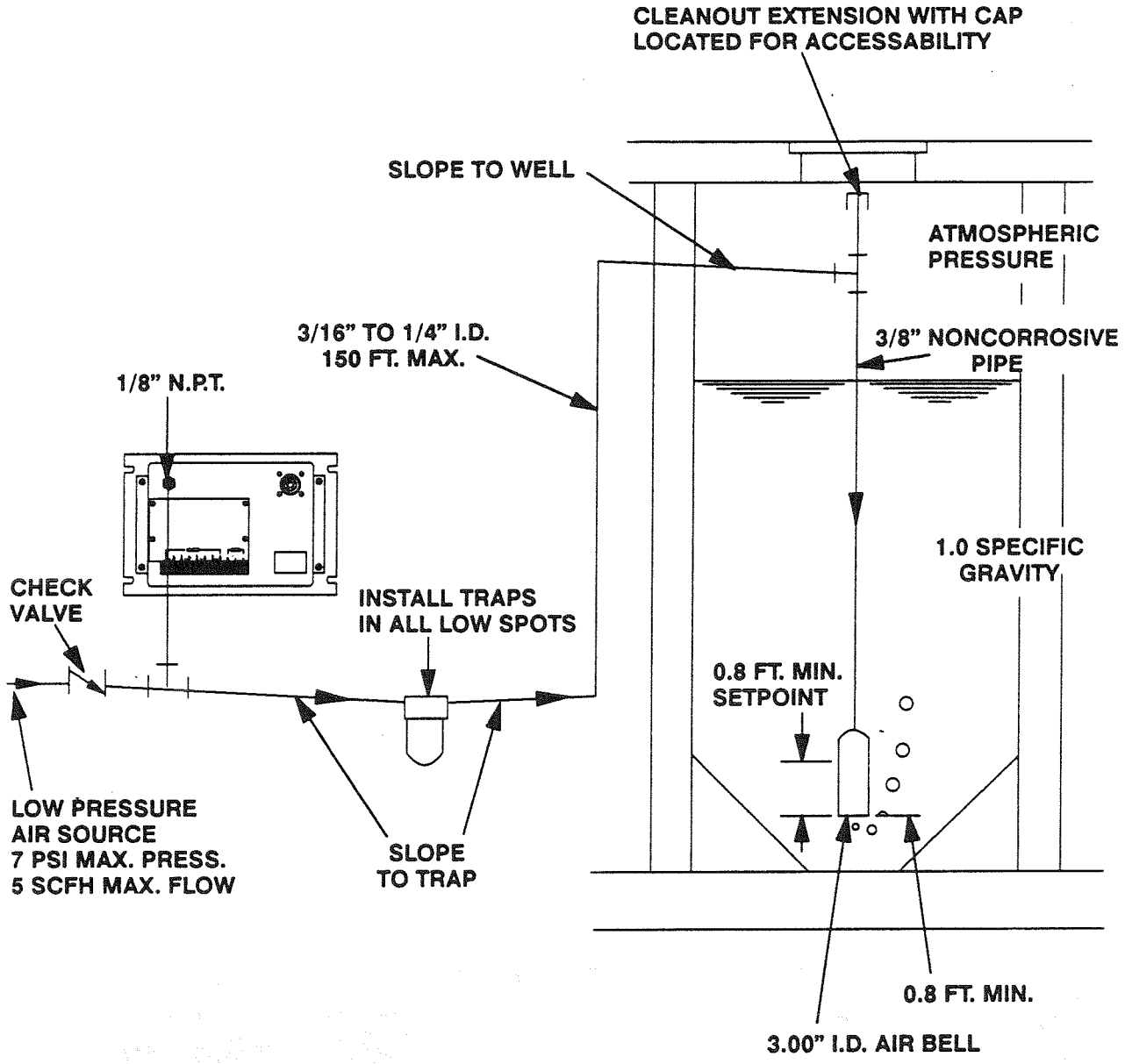


Figure B-2. Typical Air Bubbler Line

When installing an air bubbler line, note the following:

a. The low pressure air source generally should not exceed 7 PSI maximum and 5 SCFH maximum. Higher capacity air sources may cause zero offset of the measured level. A low pressure air source is normally supplied with a Gorman-Rupp pump control panel which will allow a maximum measured level of 12 feet of water column.

b. The air bubbler line in the wet well should be constructed of 3/8 inch non-corrosive pipe. The EPS may be remote mounted up to 150 feet from the well. This line should be 3/16 inch to 1/4 inch I.D. Too large a diameter on long runs will cause measured level to lag changes in the actual level. Too small a diameter will restrict air flow and cause zero offset of the measured level. The entire air bubbler line **must** be air tight and **must** be securely mounted.

c. The air bubbler line should be installed without low spots and sloped toward the wet well to allow condensate to drain.

d. If low spots in the air bubbler line cannot be avoided, traps **must** be installed to allow condensate to accumulate without restricting air flow. A trap is normally supplied with a Gorman-Rupp pump control panel when the design will permit mounting of the control remote from the wet well.

e. The top of the air bubbler line in the wet well should be furnished with a clean-out extension and capped. Locate where accessible for rodding-out the line in event of clogs.

f. The end of the air bubbler line in the wet well should be equipped with a 3 inch I.D. air bell located 0.8 foot minimum from the bottom. If located too close to the bottom, sludge build-up could close off the end of the air bubbler line. The 3 inch I.D. at the end of the air bubbler line minimizes the effects of grease or sludge accumulation inside the line. An air bell is normally supplied with a Gorman-Rupp control panel.

g. The wet well or tank must be vented to atmosphere.

h. The EPS is scaled in feet of water column. If the measured medium is other than 1.0 specific gravity, the reading on the EPS must be divided by the specific gravity of the measured medium to obtain the actual level.

ELECTRICAL CONNECTIONS

The EPS is a component part of your Gorman-Rupp pump control panel and has been pre-wired at the factory. However, use the following procedures if replacement is necessary or spare outputs are to be used.

Ground Connection

The EPS is furnished with a ground screw on the back of the case. The printed circuit card is furnished with a ground guard or shield. Refer to Figure B-3. Connect a ground wire under the ground screw in accordance with the National Electrical Code or local codes. Also provide a jumper from ground screw to terminal "S" or shield on the terminal strip.

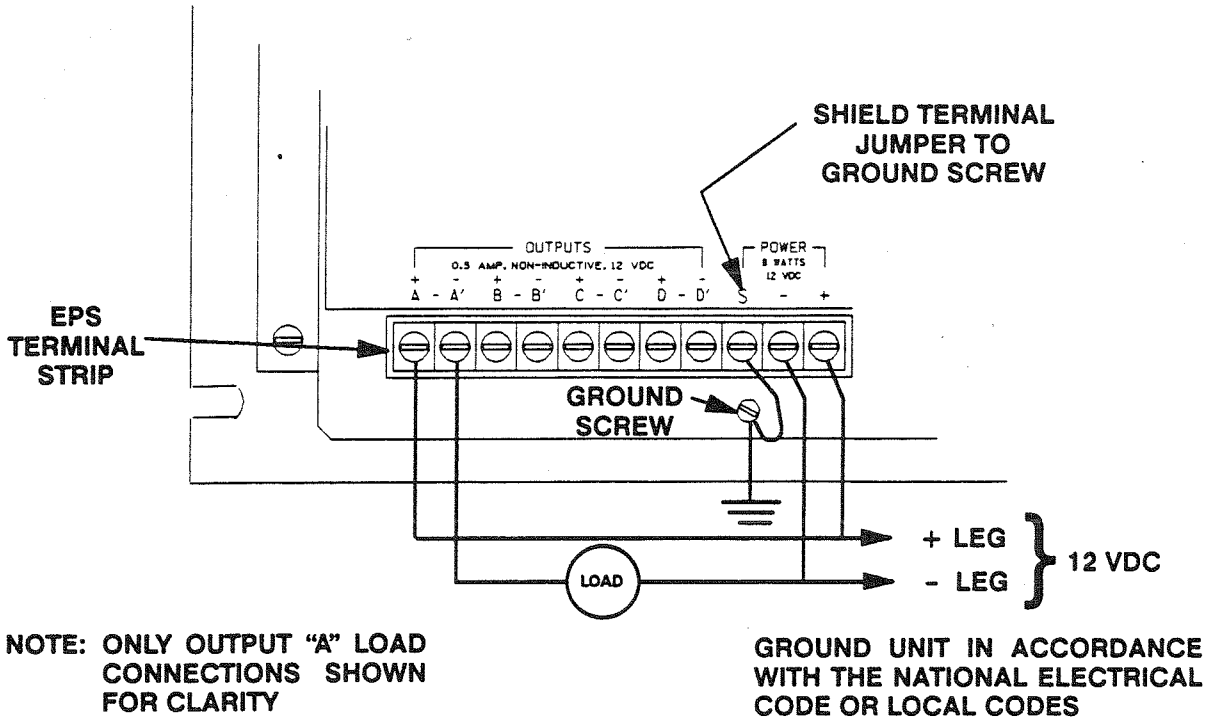


Figure B-3. Ground, Power And Load Connections

DC Power

Turn off DC power at the source before making the power connections to the EPS.

WARNING!

Install and operate this equipment in accordance with the National Electric Code and all local codes. Ground the unit before applying line potential.

Connect the leads supplying 12 VDC to the EPS terminal strip. Refer to Figure B-3. The supply circuit should be protected by a fuse or circuit breaker with the current rating dependent on the loads connected to the EPS.

Load Connections

Turn off DC power at the source before making connections at the EPS.

The EPS is equipped with four normally open solid state outputs. Refer to Figure B-3 and connect the power and load as shown. When connecting loads to the EPS note the following:

a. Loads must be limited to the output rating. See the specifications in Section I.

b. Do not connect outputs to solid state relays, neon lamps, etc. Output leakage current may cause light loads to false turn-on or may not turn off. Loads should be 20 mA or higher for successful operation.

c. Do not connect two outputs in series or parallel. They may not function properly.

d. It is permissible to series or parallel a mechanical contact with an output.

e. The EPS has been designed to minimize the effects of electrical noise. However some loads may exceed the noise immunity limits of the EPS. If this occurs it is more effective to suppress the noise at the source using properly sized capacitors, diodes or other noise suppression techniques.

OPERATION - SECTION C

DESCRIPTION

The Model 27781-028 EPS Electronic Pressure Switch is a component part of your Gorman-Rupp pump control panel. The EPS is used in conjunction with an air bubbler type liquid level sensor and is designed to start and stop pumps, valves, or alarms. The EPS also provides visual indication of wet well level.

The major components of the EPS includes the display, set point trim pots, setpoint display pushbuttons, comparators, latches, drivers and output modules.

The sequence of operation is described below and illustrated in the block diagram. Refer to Figure C-1.

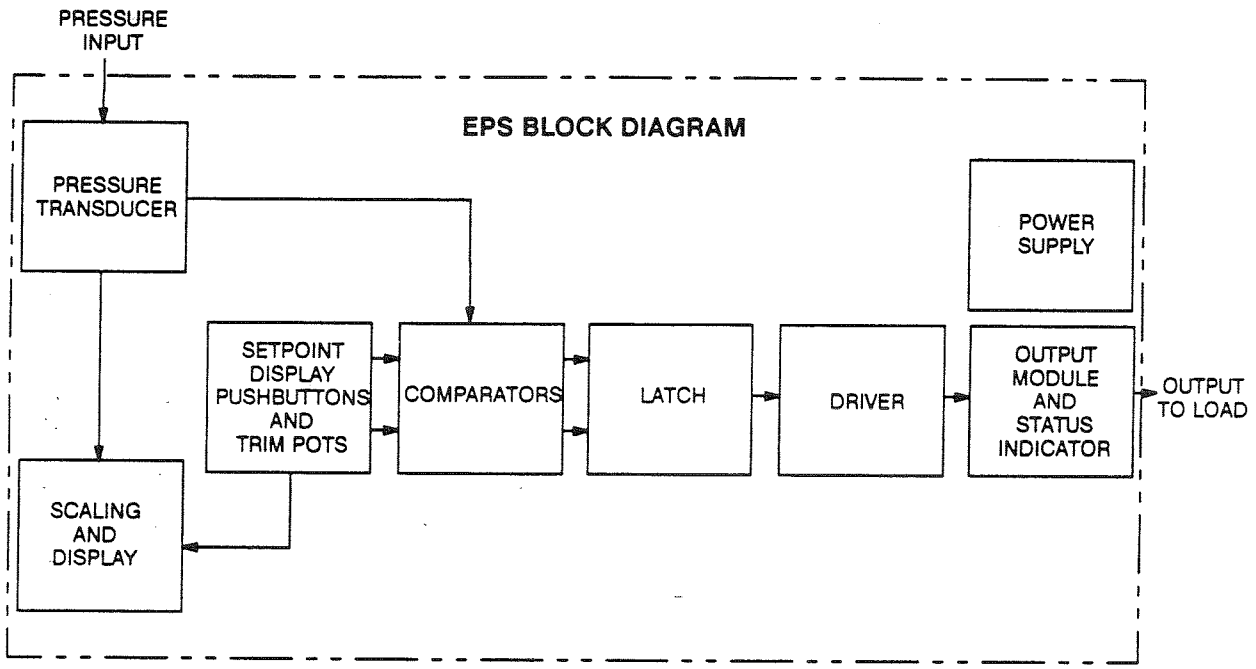


Figure C-1. Sequence Of Operation

The pressure transducer, display and logic circuitry requires low voltage DC power only.

The pressure transducer is connected to the air bubbler line and converts pressure to an electrical signal proportional to liquid level. This electrical signal is distributed to the digital display through a scaling circuit which converts the electrical signal to "feet of water".

Each output circuit is equipped with two trim pots which permit adjustment of the output on and off setpoints. Each trim pot is equipped with a pushbutton which, when depressed, indicates the setpoint on the digital display.

Inputs to the comparators come from the pressure transducer and the setpoint trim pots. When the transducer input equals the setpoint input, the comparator toggles the latch.

The comparator circuits are used in pairs so that one comparator ("ON") sets the latch and the other comparators ("OFF") resets it. As the transducer signal rises to the **"ON"** setpoint, the latch turns **"ON"** and stays **"ON"** until the signal drops below the **"OFF"** setpoint. This creates the "window" between set-

point **ON** and setpoint **OFF** during which time the latch is **ON**.

The driver takes the low power output from the latch and amplifies it to activate the output module and status indicator lights. When activated, the status indicator illuminates and the output module is turned **ON**. The status indicator gives a visual signal that the output module is turned **ON** and the load connected to the output module is energized.

The EPS has eight setpoints and comparators, with four latches, drivers, and output modules. This allows the control of up to four loads from one submersible transducer.

STARTUP

a. Disconnect power to the loads. Apply 12 VDC control power to the EPS.

b. Refer to adjustment and adjust the ON and OFF setpoints for each load.

c. After the setpoint adjustments have been made, apply power to the loads.

d. The operation of the loads is now under control of the EPS.

ADJUSTMENTS

Before adjusting the setpoints, turn off the power to the loads. Otherwise, inadvertent starting and stopping of the loads may occur.

Each output on the EPS has 'ON' and 'OFF' trim pots and pushbuttons mounted on the front panel to facilitate level adjustment.

To adjust the levels refer to the following text and Figure C-2.

a. Apply 12 VDC control power to the EPS.

b. Move the setpoint selector switch on the **EPS** to **output A-B-C-D**.

NOTE

Switch position for output E-F-G-H is used for optional equipment and is not required with your control. If the set point selector switch is inadvertently placed in the output E-F-G-H or DOWN position, the feet of water display will indicate an insignificant value. Turn the switch to the output A-B-C-D or UP position to read wet well level or set points. Switch position does not effect pump operation.

c. Press the 'ON' set point display pushbutton on output A, until it clicks. The output A 'ON' setting will be displayed.

d. Carefully insert the trim pot adjusting tool thru the rubber insulator to engage the slotted trim pot shaft of output A 'ON'.

CAUTION

The set point trim pots are delicate. Do not pry against them with the tool while making adjustments.

e. To increase the setting, turn the tool clockwise; to decrease the setting, turn the tool counterclockwise. Make certain a positive setting is displayed on the FEET OF WATER DISPLAY.

f. Press the 'OFF' set point display pushbutton, output A, until it clicks. The output A 'OFF' setting will be displayed.

g. Engage the trim pot for output A 'OFF' as in step d above.

NOTE

ON levels should be set at least 0.3 feet or more above the OFF levels. Closer settings may cause short cycling of the loads.

h. Adjust the ON and OFF set points for outputs B, C, and D on the EPS repeating adjustments procedures described for output A.

NOTE

The set points are independent and do not interact with other set points. The set point display pushbuttons may be depressed at any time without effecting operation.

NOTE

The EPS has been factory calibrated to close tolerances. Do not tamper with the zero and span trim pots. If calibration becomes necessary refer to Section D, ***TROUBLESHOOTING AND TESTING****.*

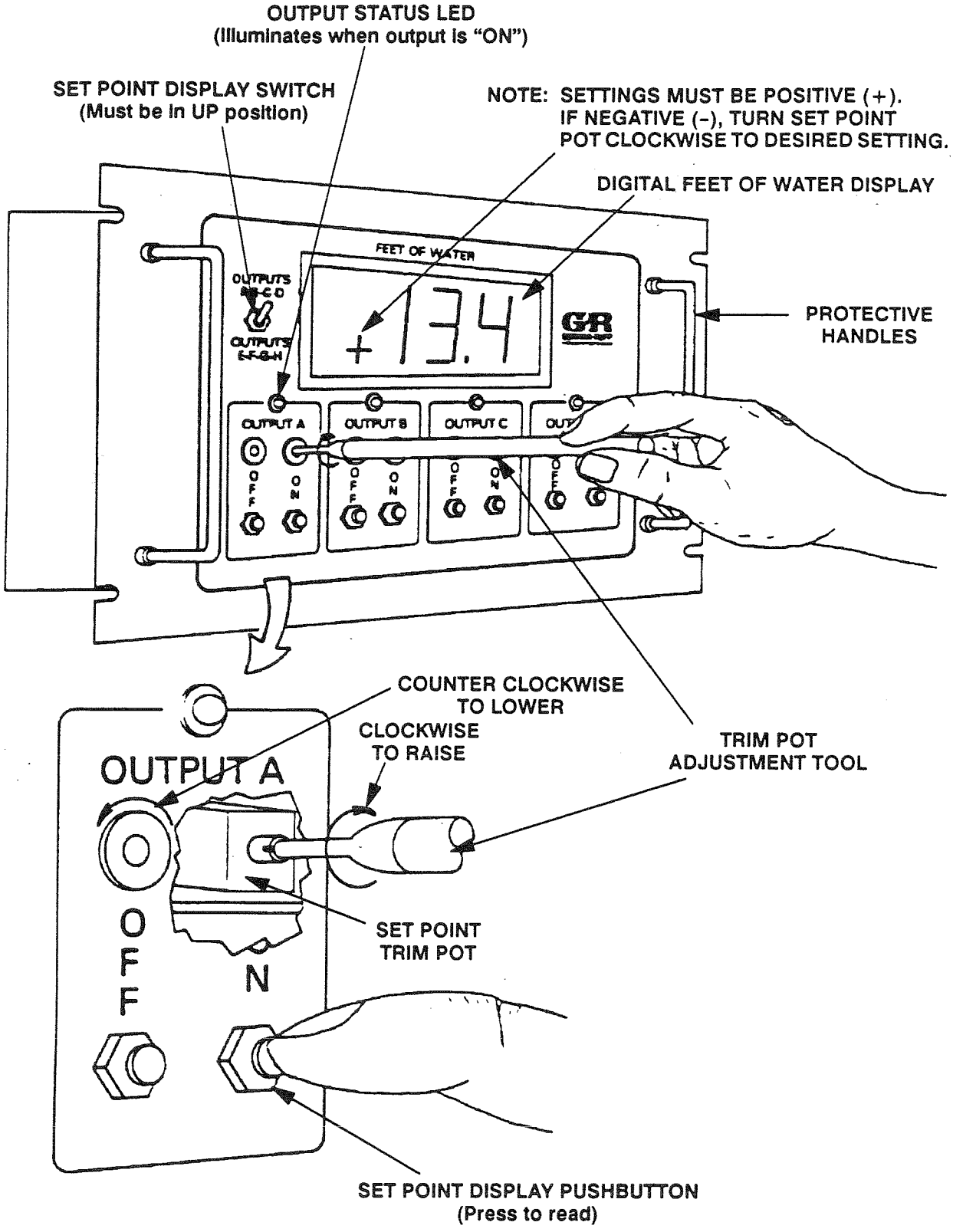


Figure C-2. Model 27781-028 EPS Electronic Pressure Switch Set Point Adjustment

TROUBLESHOOTING AND TESTING - SECTION D

This section is divided into three areas: Preliminary Examination, Calibration Procedures, and Circuit Analysis. Preceeding these three areas is a Troubleshooting Chart which lists Symptoms, Possible Causes, Probable Remedies and directs you to the proper section of this manual.

The troubleshooting and testing procedures should be attempted only by qualified persons familiar with instrumentation, electricity, and the hazards involved. In addition, the procedures included in circuit analysis should be attempted only by qualified persons familiar with linear/digital techniques.

If there are any questions regarding the Model 27781-028 EPS Electronic Pressure Switch which are not covered in this manual or in other literature accompanying this unit, please contact your Gorman-Rupp distributor, or write:

The Gorman-Rupp Company
P.O. Box 1217
Mansfield, Ohio 44901-1217
(419) 755-1011
or
Gorman-Rupp of Canada Limited
70 Burwell Road
St. Thomas, Ontario N5P 3R7
(519) 631-2870

Gorman-Rupp shall not be liable for defects in workmanship of any equipment supplied by it in the event such defects may be the result of work, rework, or adjustment on the equipment by any person other than an authorized Gorman-Rupp service representative.

TROUBLESHOOTING CHART

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
FEET OF WATER DISPLAY RESPONDS TO LEVEL CHANGES, BUT INDICATES WRONG LEVELS	Air source capacity excessive.	See Section B, Installation.
	Air line too small or too long.	See Section B, Installation.
	Air line too large.	See Section B, Installation.
	Obstruction in air line.	Rod out air line. See Preliminary Examination, Section D.
	Condensation accumulation in air line low spot.	Install traps in all air line low spots. See Section B, Installation.
	EPS out of calibration.	See Calibration, Section D.
FEET OF WATER DISPLAY INDICATES SET POINTS BUT INDICATES SAME LEVEL CONTINUOUSLY	Air line connection on back of EPS loose or disconnected.	Tighten connection. See Section B, Installation.
	Leak or loose connection in air bubbler line.	Repair leak or tighten connection.
	Obstructed air bubbler line.	Rod out air line. See Preliminary Examination, Section D.
	Level transducer failure.	See Circuit Analysis, Section D

TROUBLESHOOTING CHART (cont'd)

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
FEET OF WATER DISPLAY INDICATES SAME VALUE CONTINUOUSLY (NEITHER LEVEL OR SET POINTS DISPLAY PROPERLY)	Set point display switch in wrong position.	Turn switch to output A-B-C-D.
	Connector J4 in EPS loose or disconnected.	Reconnect J4. See Preliminary Examination, Section D.
	Set point display switch failure.	See Circuit Analysis, Section D.
	Set point display pushbutton(s) failure.	See Circuit Analysis, Section D.
	Calibration trim pot failure.	See Circuit Analysis, Section D.
	Feet of water display failure.	See Circuit Analysis, Section D.
FEET OF WATER DISPLAY WILL NOT TURN ON THOUGH OUTPUT AND OUTPUT STATUS LED'S FUNCTION PROPERLY	Display connector J3 disconnected.	Reconnect J3. See Preliminary Examination, Section D.
	Feet of water display failure.	See Circuit Analysis, Section D.
FEET OF WATER DISPLAY, OUTPUT, AND OUTPUT STATUS LED'S WILL NOT TURN ON (EPS APPEARS DEAD)	Loss of supply voltage.	Apply 12 VDC power. See Section B, Installation.
	Loose power connection(s) at terminal strip.	Tighten connection(s). See Section B, Installation.
	Power supply connector J2 disconnected.	Reconnect J2. See Preliminary Examination, Section D.
ALL OUTPUTS FAIL TO TURN ON THOUGH OUTPUT STATUS LED'S ILLUMINATE	Loss of supply voltage to output terminals.	Apply power to output terminals. See Section B, Installation.
	Loose connections at output terminals.	Tighten connection.
ONE OUTPUT FAILS TO TURN ON THOUGH OUTPUT STATUS LED ILLUMINATES	Loss of supply voltage to output terminals.	Apply power to output terminals. See Section B, Installation.
	Loose connections at output terminals.	Tighten connection.
	Failure of load device.	Repair or replace load device.
	Output fuse blown.	See Preliminary Examination, Section D.
	Output module failure.	See Circuit Analysis, Section D.
OUTPUT(S) AND OUTPUT STATUS LED(S) FAIL TO TURN ON THOUGH FEET OF WATER DISPLAY INDICATES HIGH LEVEL	Setpoint(s) adjusted too high.	Readjust setpoint(s). See Section C, OPERATION.
	EPS out of calibration.	See Calibration, Section D.

TROUBLESHOOTING CHART (cont'd)

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
OUTPUT(S) AND OUTPUT STATUS LED(S) FAIL TO TURN ON THOUGH FEET OF WATER DISPLAY INDICATES HIGH LEVEL (cont'd)	Connector J5 in EPS loose or disconnected.	Reconnect J5. See Preliminary Examination, Section D.
	Setpoint trim pot failure.	See Circuit Analysis, Section D.
	Comparator failure.	See Circuit Analysis, Section D.
	Latch failure.	See Circuit Analysis, Section D.
	Driver failure.	See Circuit Analysis, Section D.
	Output status LED failure.	See Circuit Analysis, Section D.
	Output module failure.	See Circuit Analysis, Section D.
OUTPUT(S) STAYS ON CONTINUOUSLY THOUGH OUTPUT STATUS LED(S) IS (ARE) OFF	Leakage current through output module.	Approximately 5mA leakage current is normal.
	Load connected to output is too small.	Revise wiring to drive load through electromechanical relay.
	Output module failure.	See Circuit Analysis, Section D.
OUTPUT(S) AND OUTPUT STATUS LED(S) STAY ON THOUGH FEET OF WATER DISPLAY INDICATES LOW LEVEL	Setpoint(s) adjusted too low or to a negative level.	Readjust setpoint(s). See Section C, OPERATION.
	EPS out of calibration.	See Calibration, Section D.
	Setpoint trim pot failure.	See Circuit Analysis, Section D.
	Comparator failure.	See Circuit Analysis, Section D.
	Latch failure.	See Circuit Analysis, Section D.
	Driver failure.	See Circuit Analysis, Section D.
SET POINT(S) WILL NOT DISPLAY	Set point display switch in wrong position.	Turn switch to output A-B-C-D.
	Connector J4 in EPS loose or disconnected.	Reconnect J4. See Preliminary Examination, Section D.
	Set point trim pot failure.	See Circuit Analysis, Section D.
	Set point display pushbutton(s) failure.	See Circuit Analysis, Section D.
SETPOINT(S) WILL NOT ADJUST THOUGH SET POINT INDICATED ON FEET OF WATER DISPLAY	Setpoint trim pot failure.	See Circuit Analysis, Section D.
EPS WILL NOT CALIBRATE	Calibration test set-up incorrect.	Check set-up. See Calibration, Section D.
	Voltage reference diode failure.	See Circuit Analysis, Section D.
	Calibration trim pot failure.	See Circuit Analysis, Section D.

PRELIMINARY EXAMINATION

WARNING!

These procedures should be attempted only by qualified persons familiar with instrumentation, electricity, and the hazards involved.

Test equipment and tools required.

- VOM meter
- Test lamp, 7 to 15 W, 12 V incandescent
- Trim pot adjusting tool
- Straight blade screwdriver - 3/16 X 4 inches long

Set Point Adjustment Check

Many times, errors in EPS operation can be attributed to incorrect adjustment of set points. Refer to **Adjustments,** Section C. Make certain **OFF** settings are lower than **ON** settings and that they are positive. Negative settings will cause the outputs to remain on continuously. When attempting to display and adjust outputs, make certain the output display switch is in the up position (up to display A-B-C-D).

Air Line Check

a. Air line leaks:

Visually inspect and tighten all suspected connections. Soapy water may be brushed on connections outside the control panel. However, it is not recommended to use soapy water inside electrical enclosure. Dangerous electric shock or damage to electrical components may occur.

The air bubbler line in the wet well should be constructed of non-corrosive material. However, check to make certain the line has not corroded through. See **Internal Inspection**, Section D, for checking the air line inside the EPS.

b. Air line obstruction:

CAUTION

Components in the level control system are not designed to withstand high air pressures. **Do not** exceed 15 psi air pressure to clear a clogged air bubbler pipe.

Condensation build-up inside the air line will obstruct air flow. Lines should be installed sloping toward the wet well allowing condensate drainage. Condensate traps should be installed in any low spots. See Section B, **INSTALLATION.**

NOTE

Condensation cannot be blown out of low spots in the line with an air compressor. As soon as the air is removed, the condensation will again "pool" at the low spot.

Grease or sludge may build up in the end of the air line at the bottom of the wet well. Remove the clean-out plug and "rod-out" the air line. Never use an air compressor to blow out the line.

Electrical Connections

a. Input power check

Take care not to come in contact with live terminals and check the input power across terminal number 1 and 2. See Section I, Figure I-1. Voltmeter reading should be 12 VDC ± 10%. If no voltage is present, check the supply for open switches, fuses, or circuit breakers. Check for disconnected leads. If the voltage is low, check for loose or corroded connections. Check the voltage at the source. If no voltage is present or voltage is high or low, contact the electric utility.

b. Power to outputs check

Take care not to come in contact with live terminals and check the power to the output terminal(s). See Section I, Figure I-1 and I-2. Using a voltmeter, check across terminal A and 2, B and 2, C and 2, and so on until all outputs used have been checked. Voltmeter readings should be 12 VDC ± 10%. If no voltage is present, check the supply for open switches, fuses, or

circuit breakers. Check for disconnected leads. If the voltage is low, check for loose or corroded connections. Check the voltage at the source. If no voltage is present or voltage is high or low, contact the electric utility.

c. Power from outputs check

Take care not to come in contact with live terminals and check the power from the output terminal(s). A 7 to 15 watt, 12 V incandescent test lamp can be used. **Do not** use a voltmeter or neon test lamp. Leakage current through the solid state outputs will cause voltage to be present even when the output is off if the test device is a small load. Using the test lamp, check across terminal A' and 2. See Section I, Figure I-1. Adjust the output A "ON" trim pot until the output status LED illuminates. The test lamp should also illuminate. Adjust the output "A" trim pots until the output status LED turns off. The test lamp should also turn off. Continue checking across terminals B' and 2, C' and 2, etc., until all outputs have been checked. If the test lamp functions as described above, yet the connected load does not turn on and off as required, check the wiring to the load. Also check to make certain the connected load is not malfunctioning.

If the test lamp does not illuminate with the output **ON**, see **Internal Inspection**, Section D, to check the output fuses.

If the test lamp remains on continuously even though the output status LED is off, the output module may be shorted. See **Circuit Analysis**, Section D.

Internal Inspection

a. Turn off all power to the EPS. Remove the EPS housing. See Figure D-1.

- Tag and disconnect the leads connected to the terminal strip.
- Remove the four protective handle mounting screws. These screws also secure the housing to the stainless steel front panel.
- Gently pull the housing away from the front panel. Check that wiring does not hang up on internal components.
- Wires are long enough to permit approximately 3 inches (76,2 mm) of separation between the housing and circuit board.

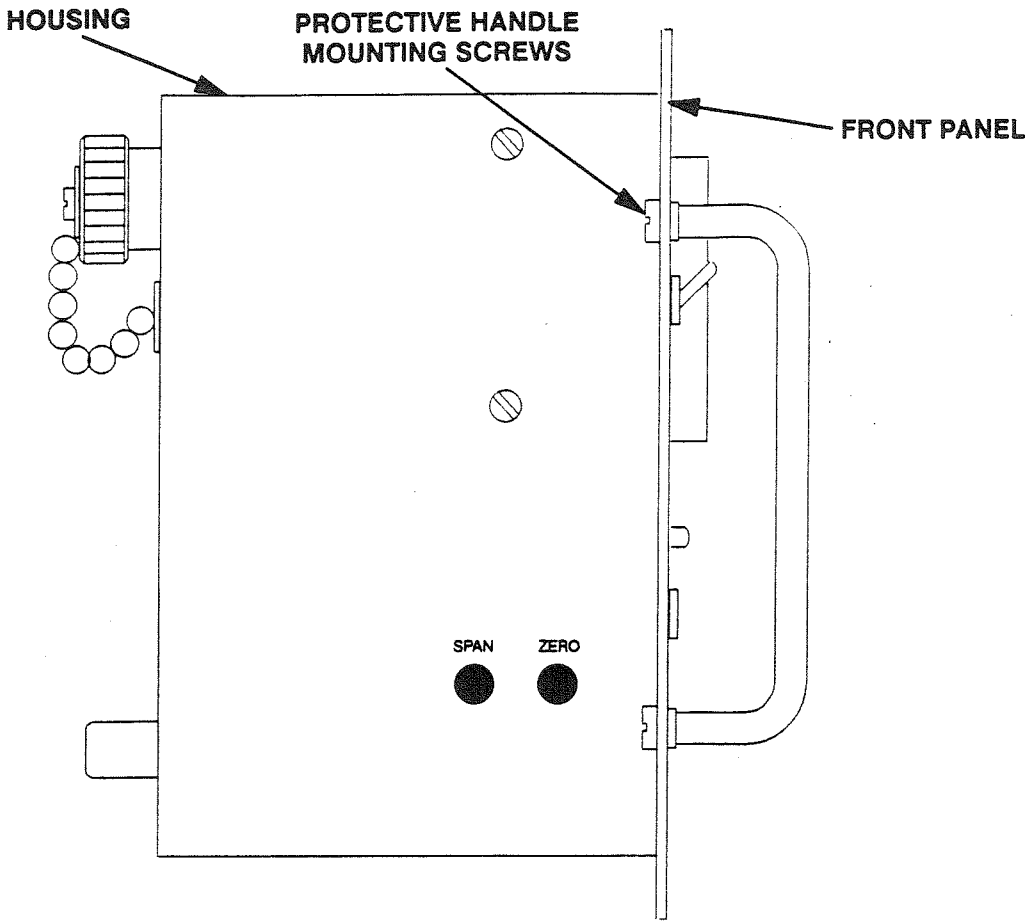


Figure D-1. Housing Removal

b. Check EPS output fuses FA, FB, FC, and FD. See Figure D-2. Use an ohmeter and check continuity across each fuse. Correct the cause and replace any blown fuses. See Section E, **REPAIR**.

c. Check the EPS connectors J2, J3, J4 and J5 making certain they are properly seated. See Figure D-2. Do not wiggle connectors J3, J4, or J5 as the mating pins are easily bent.

Reassemble the EPS in reverse order and return to service. If the problem can not be isolated, contact the factory or proceed with circuit analysis.

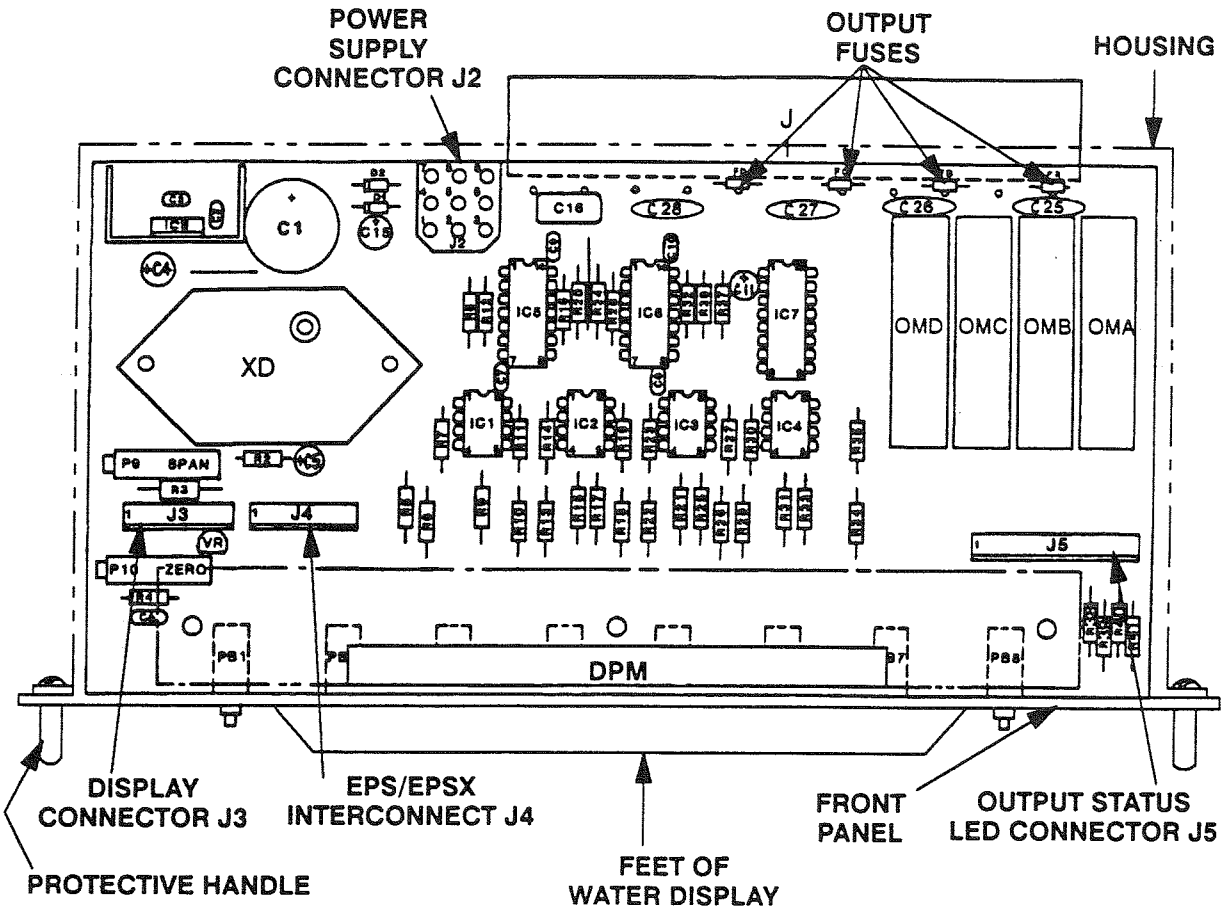


Figure D-2. Internal Inspection

CALIBRATION

The EPS and submersible transducer have been factory calibrated before shipment and are accurate to within ± 0.1 foot water. Field calibration is not normally required unless components have been replaced as noted in Section D, **Circuit Analysis** and Section E, **Repair**.

Test equipment and tools required:

a. Make certain the EPS is grounded and the control power leads are connected. See Figure D-3.

b. Using the necessary tubing and fittings, connect the air source, needle valve, EPS and mercury manometer together. See Figure D-3. A gauge may be substituted for the mercury manometer. However, the EPS is only as accurate as the instrument used for comparison.

CAUTION

Components in the EPS are not designed to withstand high pressure. The low pressure air source must not exceed 15 psi.

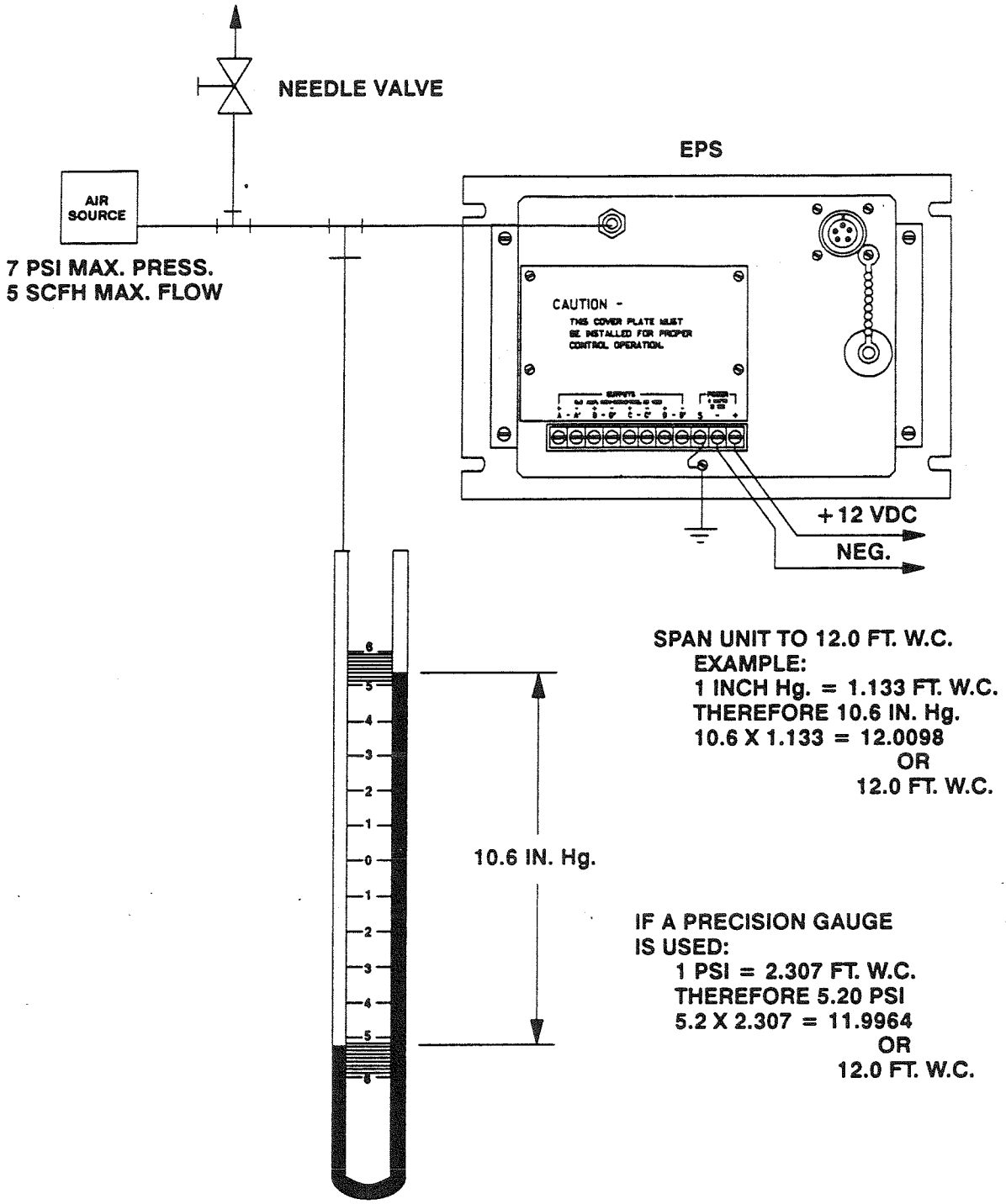


Figure D-3. Span Adjustment

Calibration

a. Remove the plugs concealing the zero and span trim pots. See Section I, Figure I-1.

b. Turn off the air supply and open the bleed valve to release all pressure in the pneumatic line. Make certain the manometer reads zero. Turn on 12 VDC control power to the EPS.

c. Observe the feet of water display on the EPS. Use the trim pot adjusting tool and turn the zero pot until the display reads + 00.0. Clockwise increases the reading, counterclockwise will decrease the reading.

d. Turn on the air supply and slowly adjust the bleed valve until the mercury manometer reads 8 to 12 inches difference between column heights. Multiply the manometer reading by 1.133 and adjust the span pot until the product is indicated on the feet of water display. See Figure D-3. Clockwise will increase the reading, counterclockwise will decrease the reading.

e. The span and zero pots are interactive. Repeat steps c and d at least three times or until both the zero and span settings are achieved.

f. Linearity is not adjustable but may be checked at one or two intermediate points. Again, multiply the manometer reading by 1.133. The product should display within ± 0.1 foot.

When calibration is completed, replace the calibration plugs. Place the submersible transducer back in service. See Section B, **INSTALLATION**. Check the output **ON** and **OFF** settings and readjust if necessary. See Section C, **OPERATION**.

If the EPS will not zero and span properly or is not linear within tolerance, proceed to **Circuit Analysis** or contact the factory.

CIRCUIT ANALYSIS

These procedures should be attempted only by qualified persons familiar with linear/digital techniques, instrumentation, electricity, and the hazards involved.

Test equipment and tools required:

- Digital voltmeter with spring hook test leads (Keithley #130 or equivalent, 10 megohms input impedance on DC scales)
- Logic probe (OK #PRB-1 or equivalent, above DVM may be substituted)
- 12" jumper with spring hook probes
- IC test clips (AP #TC-8 and TC-16 or equivalent)
- Straight blade screwdriver - 1/8 X 3 inches long and 3/16 X 4 inches long
- Test lamp, 7 to 15 W, 12 V incandescent
- Test equipment and tools listed under calibration

The procedures described in **Circuit Analysis** should not be conducted under field conditions. Circuit analysis should be performed in a relatively clean area on a bench or table with a non-conductive surface. Some components are static sensitive and will be damaged if handled without first discharging your body to a metal object. Do not perform these procedures in a carpeted room.

Each step should be performed in the order listed. When a problem is found and corrected, repeat the **Operational Check**. If the EPS still does not operate correctly, continue circuit analysis where you left off.

Operational Check

a. Construct operational check set up Figure D-4, and calibrate the EPS as described previously in **CALIBRATION**.

b. Adjust the ON setpoints to 4.0 feet and the OFF setpoints to 2.0 feet. Each setpoint potentiometer should be linear as it is adjusted with no discontinuities. The setpoints must be displayed on the digital FEET OF WATER display, when each setpoint pushbutton is pressed. Setpoint adjustment procedures are presented in Section C, **OPERATION**.

c. Slowly close the needle valve. The valve on the FEET OF WATER display should rise as the pressure in the pneumatic l ine increases, and

should correspond to the value on the mercury manometer. As the pressure increases to the ON setpoints, the output test lights should illuminate.

d. Slowly open the needle valve. The valve on the FEET OF WATER display should drop as the pressure in the pneumatic line decreases, and should correspond to the value on the mercury manometer. As the pressure decreases to the OFF setpoints, the output test lights should turn off.

e. The output status LED's must also turn on and off with the output test lights.

If the EPS fails to perform as described in the **Operational Check**, disassemble the housing and proceed with **Circuit Analysis**. See Section D, **Internal Inspection**, for disassembly procedures.

After housing removal, attach a temporary ground jumper from the housing to the stainless steel front panel.

Refer to Figure E-2 and E-3 for component and test point locations.

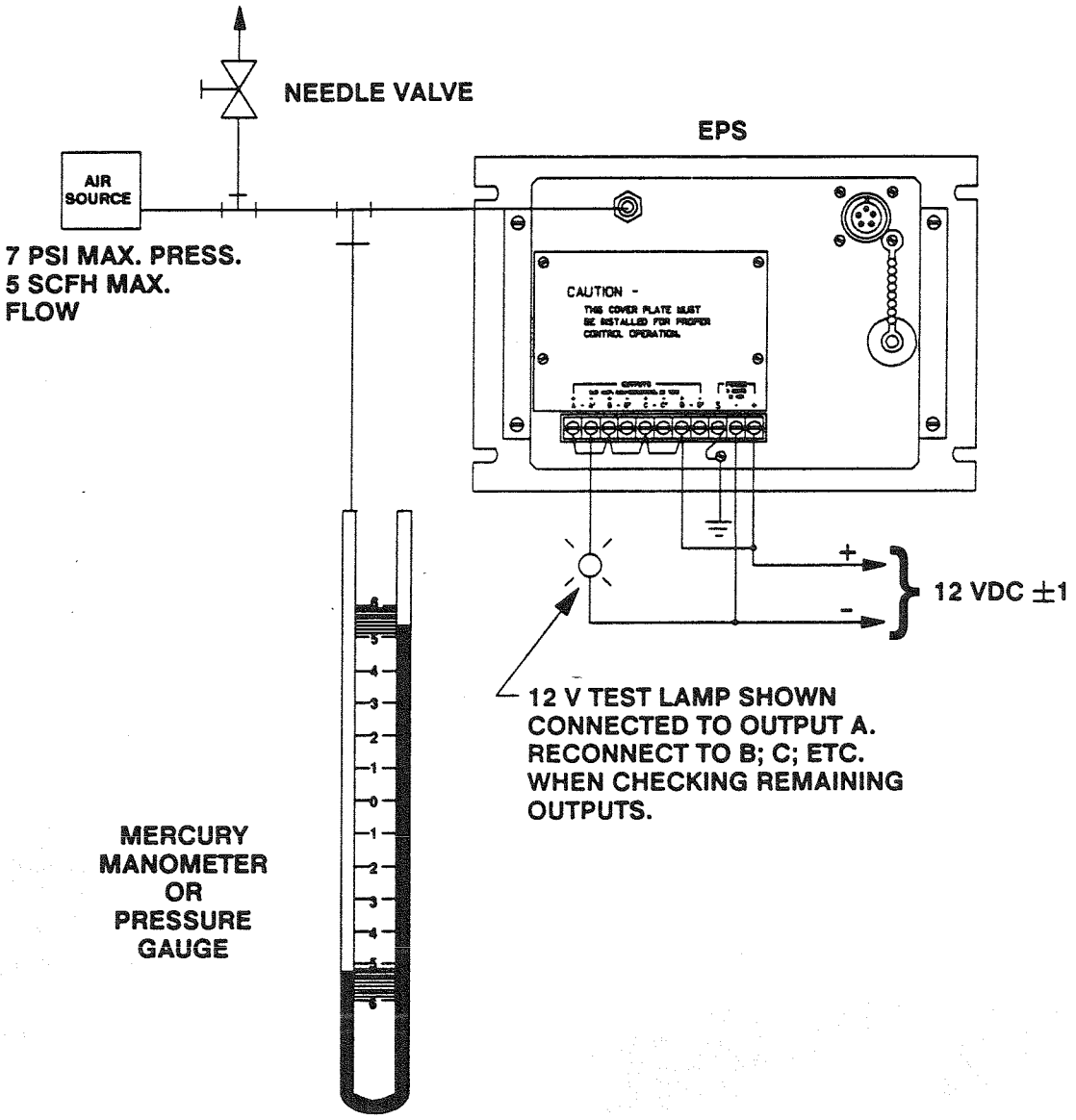


Figure D-4. Operation Check

5 Volt Power Supply

Refer to the flow chart, Figure D-5, when checking the 5 volt power supply.

a. Check the regulated side of the 5 volt power supply. Turn control power OFF and disconnect connector J3A. Do not wiggle the connector as the mating pins are easily bent. Connect the positive lead of a digital voltmeter (DVM) to Pin 1 of J3. Connect the DVM negative lead to TP1. See Figure E-2. Reconnect J3A to J3 taking care not to disturb the positive DVM lead. Turn control power on. Correct voltage is 5.0 VDC ± .25V. Turn control power off and disconnect test leads. Make certain J3A is properly seated to J3.

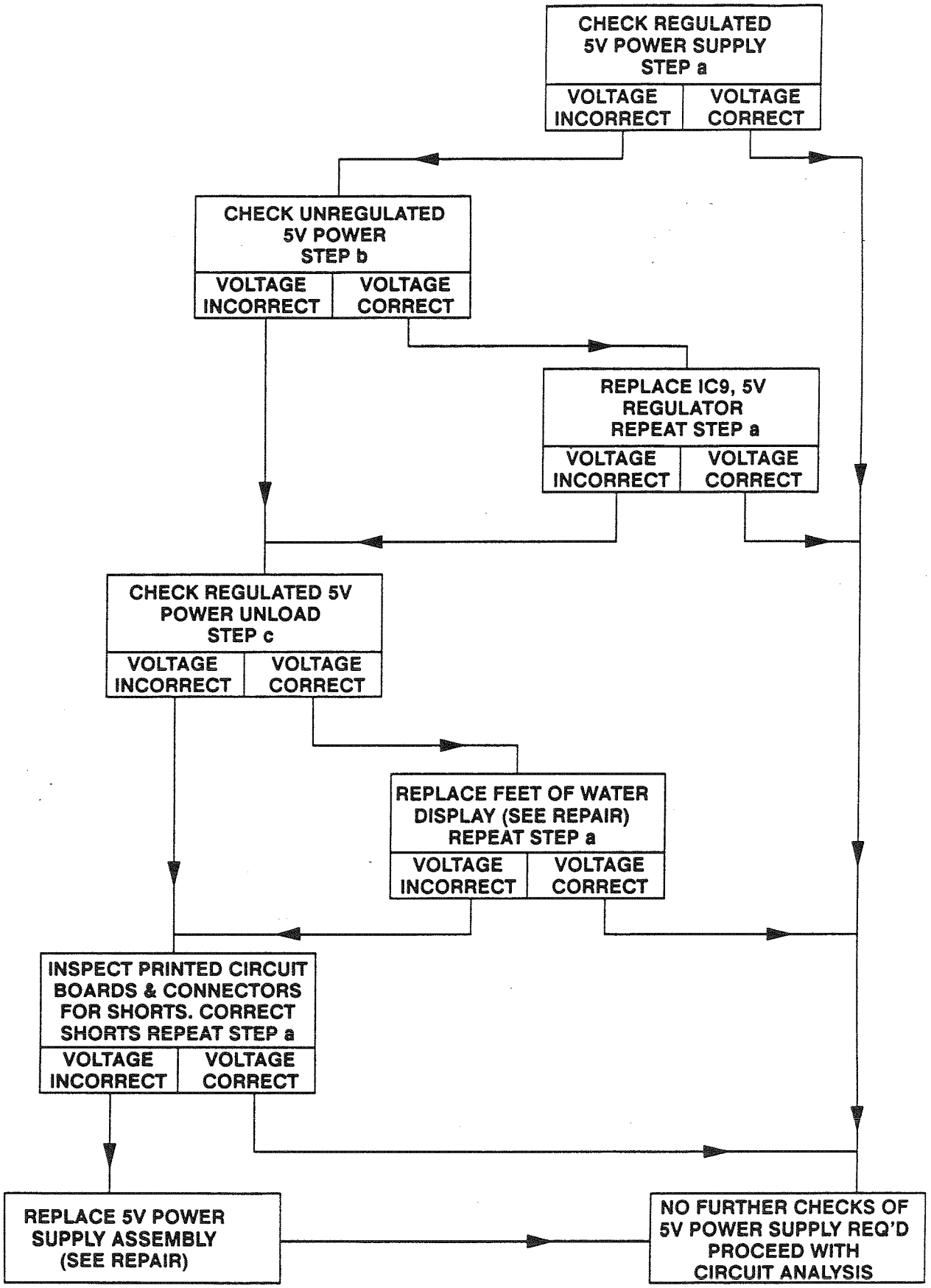


Figure D-5. 5 Volt Power Supply Check

b. Check the unregulated side of the 5 volt power supply. Turn control power OFF. Connect the DVM positive lead to TP2, Figure E-3 and the negative lead to TP1, Figure E-2. Turn control power on. Correct voltage is 9.3 VDC ± 1.0 V. Turn control power OFF and disconnect test leads.

c. Check the regulated side of the 5 volt power supply unloaded. Turn control power OFF and disconnect connector J3A. Do not wiggle the connector as the mating pins are easily bent. Connect the DVM positive lead to Pin 1 of J3. Connect the DVM negative lead to TP1. See Figure E-2. Do not reconnect J3A to J3. Turn control power ON. Correct voltage is 5.0 VDC ± .25V. Turn control power OFF and disconnect test leads. Reconnect J3A to J3.

10 Volt Power Supply

Refer to the flow chart, Figure D-6 when checking the 10 volt power supply.

a. Check the regulated side of the 10 volt power supply. Turn control power OFF. Connect the DVM positive lead to TP3 and the negative lead to TP1, Figure E-2. Turn control power ON. Correct voltage is 10.0 VDC ± .6V. Turn control power OFF and disconnect test leads.

b. Check the unregulated side of the power supply. Turn control power OFF. Connect the DVM positive lead to TP4 and the negative lead to TP1, Figure E-2. Turn control power ON. Correct voltage is 12 VDC ± 3 V.

c. Check the regulated side of the 10 volt power supply unloaded. Turn control power OFF. Connect the DVM positive lead to TP3 and the negative lead to TP1, Figure E-2. Remove IC1 from its socket by gently prying with a small screwdriver, Figure E-2. Turn control power ON. Correct voltage is 10.0 VDC ± .6 V. Turn control power OFF. Continue checking the voltage in this manner, removing IC2 through IC7 one at a time until the defective IC is found.

CAUTION

IC5 and IC6 are static sensitive. Take precautions when handling to prevent component damage.

Replace any defective IC's and return good IC's to their sockets. Take care to align the IC notch or marking with the notch in the socket.

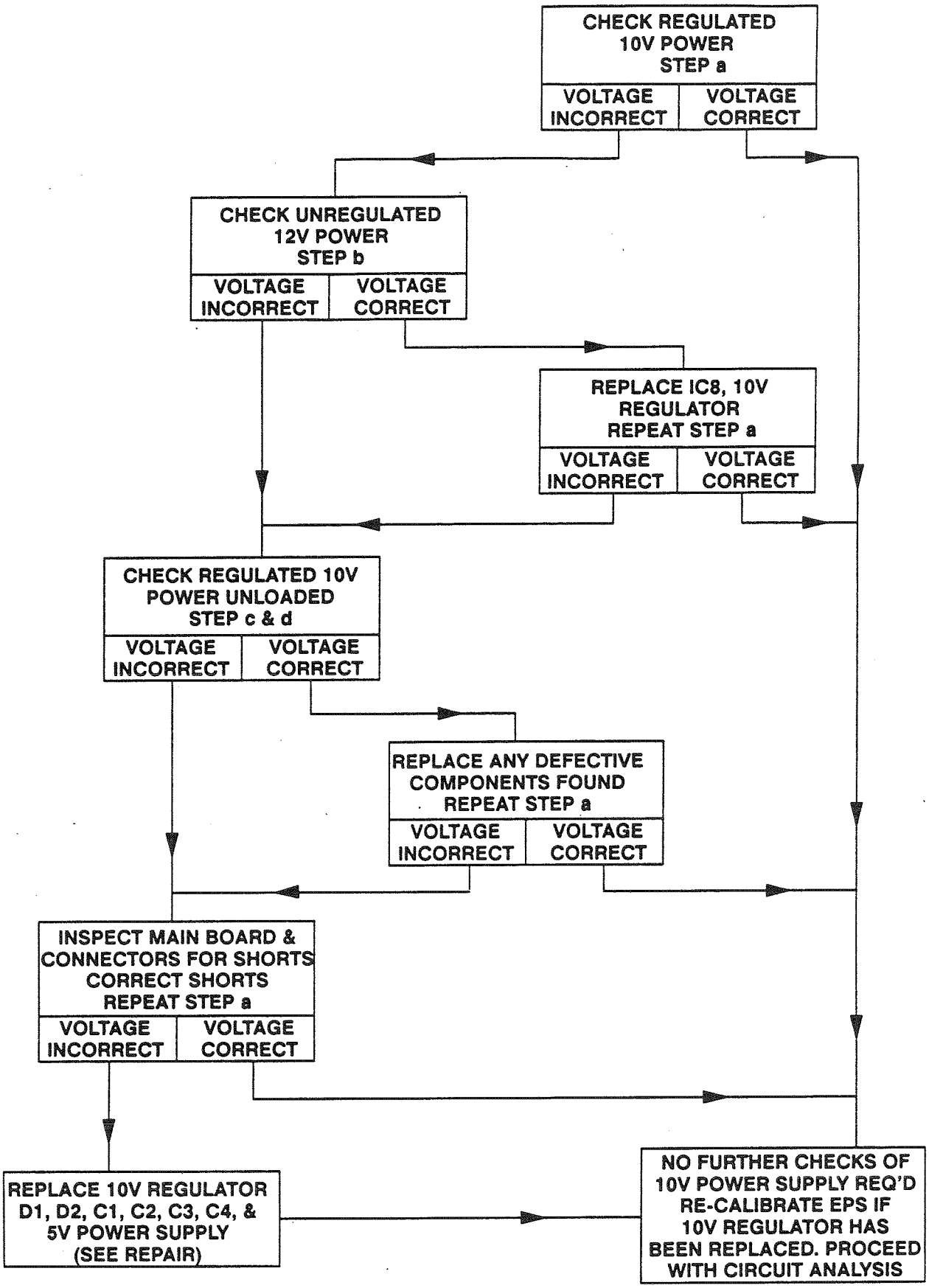


Figure D-6. 10 Volt Power Supply Check

Feet Of Water Display

a. Turn control power OFF and disconnect connector J3A. Do not wiggle the connector as the mating pins are easily bent. Connect the DVM positive lead to Pin 4 of J3 and the negative lead to Pin 3 of J3, see Figure E-2. Reconnect J3A to J3 taking care not to disturb the DVM leads.

b. Set the DVM scale to 200mVDC and turn control power ON. Note that 1mV = 0.1 foot of water. Compare the reading on the DVM with the feet of water display. Slowly increase and decrease pressure on the transducer. See Figure D-4. The DVM and feet of water display should read relatively close but not necessarily the same value. However, the two readings should track together as the pressure increases or decreases. Turn control power OFF and replace the feet of water display if it fails to follow the DVM by excessive amounts. See Section E, **REPAIR**.

NOTE

The DVM and FEET OF WATER display values may differ an amount equal to their tolerances.

Zero Calibration Trim Pot (P10)

a. Remove all pressure from the transducer by removing it from the wet well. Turn control power ON.

b. Observe the Feet of Water display. Turn the Zero trim pot clockwise 2 to 3 turns, then counterclockwise until the Feet of Water display returns to 00.0. The reading should increase, then decrease slowly. If large increases or discontinuities occur, turn control power OFF and replace the Zero calibration trim pot. Recalibration is necessary if the trim pot is replaced.

Span Calibration Trim Pot (P9)

a. Turn control power ON.

b. Refer to calibration and Figure D-3. Select a span value similar to the example and apply the equivalent pressure to the transducer.

c. Observe the FEET OF WATER display. Turn the span pot clockwise 2 to 3 turns, then counterclockwise until the feet of water display returns to the original value. If large increases or discontinuities occur, turn control power OFF and replace the span pot. Recalibration is necessary if the span pot is replaced.

Set-point Display Pushbuttons (PB1, 2, 3, 4, 5, 6, 7, 8)

a. Turn control power OFF. Position the EPS upside down with circuit side of main board up.

b. Check the resistance through the EPS setpoint display pushbuttons. Set the DVM to the lowest resistance scale and connect one lead to setpoint display pushbutton for A OFF normally closed. Connect the other probe to setpoint display pushbutton for D ON common. See Figure E-2.

NOTE

The printed circuit assembly is coated with a moisture sealer. Scratch through this coating on the pushbutton terminals to ensure good contact.

c. Observe the DVM reading. The correct resistance is 20 OHMS or less. If it exceeds 20 OHMS, test each pushbutton individually from common to normally closed until the defective pushbutton is found. The maximum allowable resistance for one pushbutton is 2.5 OHMS. See Section E, **REPAIR**.

d. Connect the DVM leads to common and normally open for each pushbutton. Depress the pushbutton and observe the DVM reading. The maximum allowable resistance with the button depressed is 2.5 OHMS. See Section E, **REPAIR**.

EPS Interconnect Assembly

a. Turn control power OFF. Position the EPS upside down with circuit side of main board up.

b. Check the resistance of the interconnect assembly in the EPS. Set the DVM to the lowest resistance scale. All readings should be below 1.0 OHM.

c. Locate the soldered connections of J4. See Figure E-2.

NOTE

The printed circuit assembly is coated with a moisture sealer. Scratch through this coating to ensure good contact.

d. Position the set point display switch to A-B-C-D and check the following:

J4, Pin 1 to J4, Pin 2.

e. If any reading exceeds 1.0 OHM, replace the interconnect assembly. See Section E, **REPAIR**.

Voltage Reference Diode (VR)

a. Turn control power OFF and disconnect connector J3A. Do not wiggle the connector as the mating pins are easily bent. Connect the DVM positive lead to Pin 6 of J3 and the negative lead to Pin 7 of J3, Figure E-2. Turn control power ON. Correct voltage is 1.25 VDC ± .08 V.

b. If the reading is not acceptable, turn control power OFF and replace the voltage reference diode, VR. See Section E, **REPAIR**. Reconnect connector J3A. Recalibration is necessary if the voltage reference diode is replaced.

Transducer

a. Turn control power OFF. Connect the DVM positive lead to the setpoint display pushbutton for A OFF normally closed. Connect the negative lead to TPI, Figure E-2.

b. Turn control power ON, apply pressure to the transducer, Figure D-4, and compare applied pressure to the transducer voltage output in Table D-7.

IN. HG	PSI	FT. W. C.	TRANSDUCER VOLTS
0	0	0	1.5 VDC ± .3V
4.41	2.17	5	Voltage @ Zero + 1.1 VDC ± .2V
8.82	4.33	10	Voltage @ Zero + 2.2 VDC ± .3V

Table D-7

c. Turn control power OFF and disconnect test leads.

d. Replace the transducer if the results obtained do not agree with the tabulation. See Section E, **REPAIR**. Recalibration is necessary if the transducer is replaced.

Setpoint Trim Pots (P1, 2, 3, 4, 5 ,6, 7, 8)

a. Turn control power ON and turn the setpoint display switch to A-B-C-D. Depress the set point display pushbutton for A OFF and slowly adjust the set point trim pot from minimum to maximum.

b. Observe the Feet Of Water display. The reading should increase slowly. If large increases or discontinuities occur, turn control power OFF and replace the set point trim pot. See Section E, **REPAIR**.

c. Continue checking the remaining trim pots in this manner.

Comparators (IC1, 2, 3, and 4)

When checking the comparator chips, use the 8-pin IC test clip to extend the pins to an accessible position. Make all checks using a logic probe or the recommended DVM. Connect the negative lead to TP1 and the positive lead to the pin being checked.

a. Connect to the air bubbler pressure connection, Figure D-4. Turn the control power ON. Adjust all **ON** setpoints to 3.0 feet and all **OFF** setpoints to 1.0 feet.

b. Adjust the pressure to the EPS to some value greater than 3.0 feet and check the comparator pins to Table D-8. Refer to Figure E-2 for comparator and pin locations.

EPS OUTPUT	COMPARATOR	PIN NO.	LOGIC LEVEL	VOLTS, DC
A	IC1	7	"1"	> 9V
B	IC2	1	"1"	> 9V
C	IC3	7	"1"	> 9V
D	IC4	1	"1"	> 9V

Table D-8

c. Replace defective comparators. See Section E, **REPAIR**.

d. Adjust the pressure to the EPS to some value less than 1.0 foot and check the comparator pins to Table D-9. See Figure E-2.

EPS OUTPUT	COMPARATOR	PIN NO.	LOGIC LEVEL	VOLTS, DC
A	IC1	1	"1"	>9V
B	IC2	1	"0"	<0.7V
C	IC3	1	"1"	>9V
D	IC4	1	"0"	<0.7V
A	IC1	7	"0"	<0.7V
B	IC2	7	"1"	>9V
C	IC3	7	"0"	<0.7V
D	IC4	7	"1"	>9V

Table D-9

e. Replace defective comparators. See Section E, **REPAIR**.

Latches

When checking the latch chips, use the 16-pin IC test clip to extend the pins to an accessible position. Make all checks using a logic probe or the recommended DVM. Connect the negative lead to TP1 and the positive lead to the pin being checked.

a. Connect to the air bubbler pressure connection, Figure D-4. Turn control power ON. Adjust all **ON** setpoints to 3.0 feet and all **OFF** setpoints to 1.0 feet.

b. Adjust the pressure to the EPS to some value greater than 3.0 feet and check the latch pins to Table D-10. Refer to Figure E-2 for latch and pin locations.

EPS OUTPUT	LATCH	PIN NO.	LOGIC LEVEL	VOLTS, DC
A	IC5	6	"1"	>9V
B	IC5	8	"1"	>9V
C	IC6	6	"1"	>9V
D	IC6	8	"1"	>9V
A	IC5	1	"1"	>9V
B	IC5	13	"1"	>9V
C	IC6	1	"1"	>9V
D	IC6	13	"1"	>9V

Table D-10

c. Replace defective latches. See Section E, **REPAIR**.

d. Adjust the pressure to the EPS to some value less than 1.0 feet and check the latch pins to Table D-11. See Figure E-2.

EPS OUTPUT	LATCH	PIN NO.	LOGIC LEVEL	VOLTS, DC
A	IC5	4	"1"	>9V
B	IC5	10	"1"	>9V
C	IC6	4	"1"	>9V
D	IC6	10	"1"	>9V
A	IC5	1	"0"	<0.7V
B	IC5	13	"0"	<0.7V
C	IC6	1	"0"	<0.7V
D	IC6	13	"0"	<0.7V

Table D-11

e. Replace defective latches. See Section E, **REPAIR**.

Driver (IC7) And Output Modules

When checking the driver chip, use the 16-pin IC test clip to extend the pins to an accessible position. Make all checks using a logic probe or the recommended DVM. Connect the negative lead to TP1 and the positive lead to the pin being checked.

a. Connect to the air bubbler pressure connection, Figure D-4. Turn control power on. Adjust all **ON** setpoints to 3.0 feet and all **OFF** setpoints to 1.0 feet.

b. Adjust the pressure to the EPS to some value greater than 3.0 feet and check the driver pins to Table D-12. Refer to Figure E-2 for driver and pin locations.

EPS OUT-PUT	IC7 INPUT PIN NO.	LOGIC LEVEL	APPROX VOLTS, DC	IC7 OUTPUT PIN NO.	LOGIC LEVEL	VOLTS DC
A	7	"1"	9V	10	"0"	<1.5V
B	6	"1"	9V	11	"0"	<1.5V
C	2	"1"	9V	15	"0"	<1.5V
D	4	"1"	9V	14	"0"	<1.5V

Table D-12

c. If the results of the driver check do not agree with the table, turn control power OFF and ground the IC7 output pin in question. I.E., place a jumper from TP1 to IC7 pin 10, 11, 15, or 14, Figure E-2.

d. Observe the 12 VDC test lamp, Figure D-4, and turn control power on. If the output module turns on as evidenced by the test lamp, turn control power off and replace the defective driver IC7. See Section E, **REPAIR**.

e. If the output module does not turn on, turn control power off and remove the TP1 to IC7 jumper

from step c above. Disconnect connector J5A, Figure E-2 and jumper J5 pins of the output in question. See Table D-13. Do not wiggle the connector as the mating pins are easily bent.

EPS OUTPUT	JUMPER J5 PIN NO.
A	8 to 7
B	9 to 6
C	10 to 5
D	11 to 4

Table D-13

f. Observe the 12 V test lamp, Figure D-4, and turn control power on. If the output module turns on as evidenced by the test lamp, turn control power off and replace the defective status LED. See Section E, **REPAIR**.

g. If the output module does not turn on, turn control power OFF and replace the defective output module. See Section E, **REPAIR**.

h. Disconnect the jumper(s) from J5 pins and reconnect J5A.

REPAIR - SECTION E

WARNING!

Install and operate this equipment in accordance with the National Electric Code and all local codes. Ground the units before applying line potential.

If there are any questions regarding the Model 27781-028 EPS Electronic Pressure Switch which are not covered in this manual or in other literature accompanying this unit, please contact your Gorman-Rupp distributor, or write:

The Gorman-Rupp Company
P.O. Box 1217
Mansfield, Ohio 44901-1217
(419) 755-1011
or
Gorman-Rupp of Canada Limited
70 Burwell Road
St. Thomas, Ontario N5P 3R7
(519) 631-2870

Gorman-Rupp shall not be liable for defects in workmanship of any equipment supplied by it in the event such defects may be the result of work, rework, or adjustment on the equipment by any person other than authorized Gorman-Rupp service representative.

EPS repair instructions are keyed to the parts list, schematic drawing, and Figure E-1 through E-6.

All repair procedures are performed with power **OFF**. Most repair work will require disassembly. Refer to Section D, **Internal Inspection** for housing disassembly procedures.

The procedures described in **Repair** should not be conducted under field conditions. Repair should be performed in a relatively clean area on a bench or table with a non-conductive surface. Some components are static sensitive and will be damaged if handled without first discharging your body to a metal object. Do not perform these procedures in a carpeted room.

Test equipment and tools required:

- Fine tip soldering iron (Ungar #6903 with 18 watt #6918 heat capsule or equivalent)
- Solder sucker
- Heat sink
- Solder aid tools - reamer, scraper, wire brush
- Small diagonal cutters
- Nut driver - 1/4 inch and 5/16 inch
- Straight blade screwdriver - 1/8 X 3 inches long and 3/16 X 4 inches long

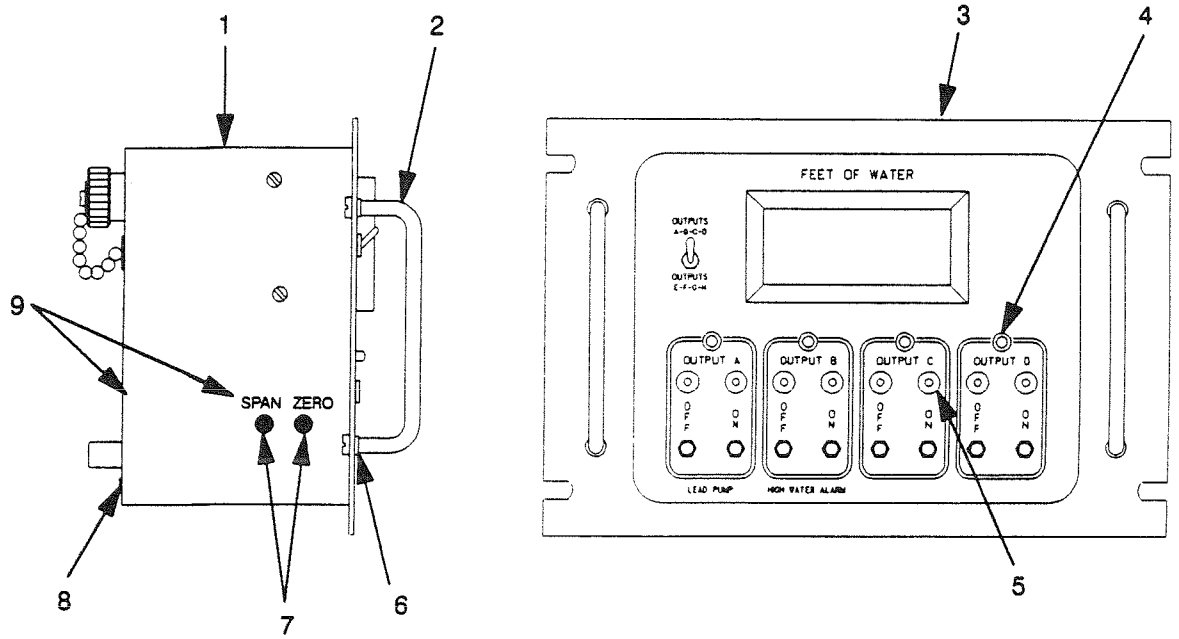


Figure E-1. Model 27781-028 EPS Electronic Pressure Switch

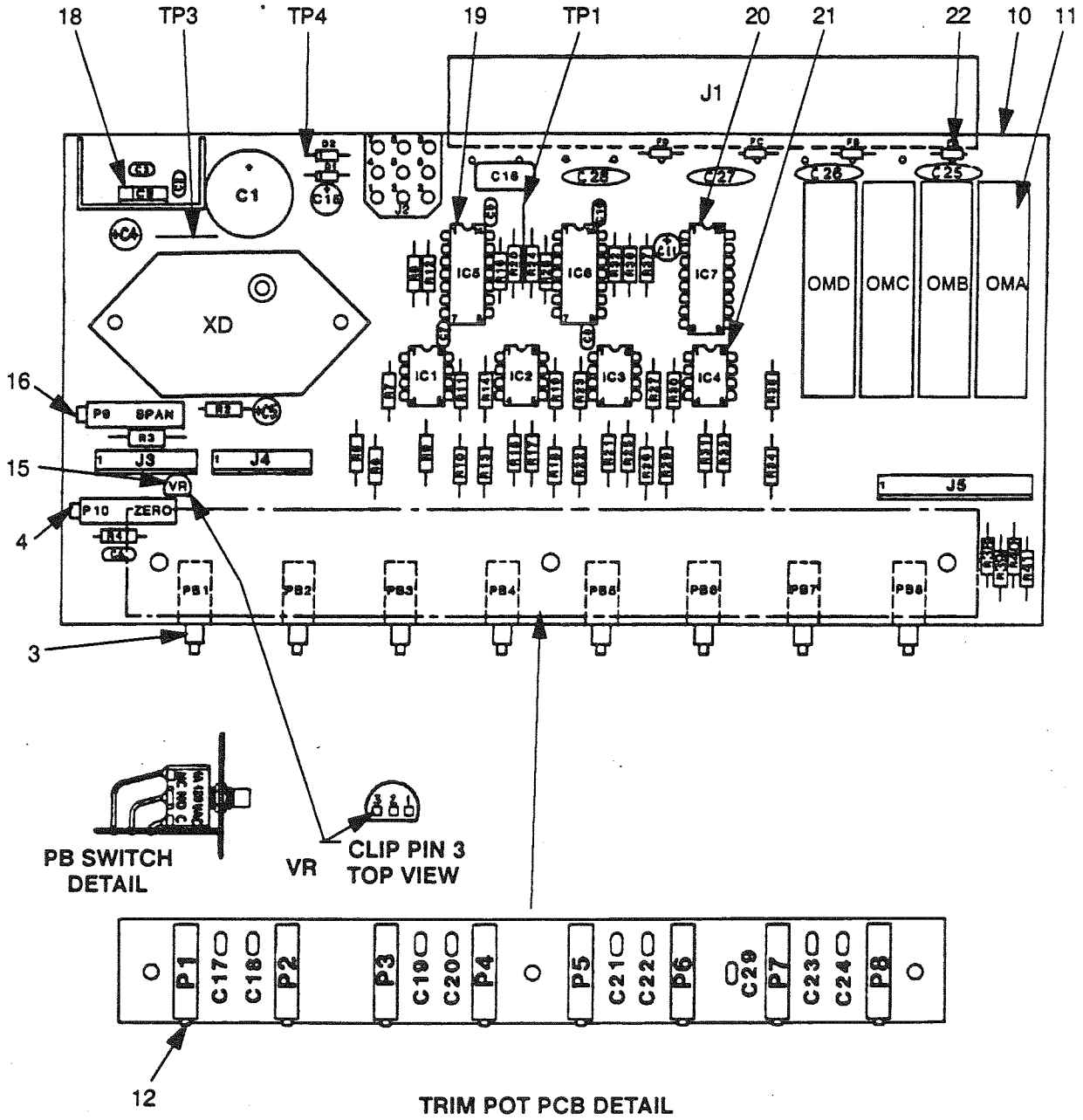


Figure E-2. Main Board Assembly Part No.

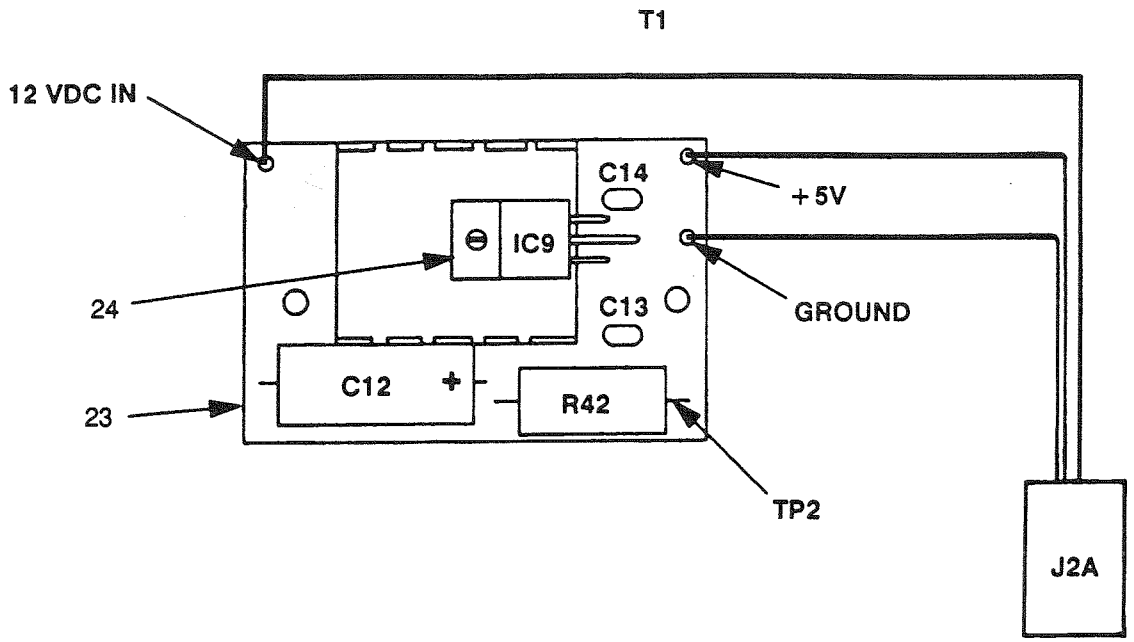


Figure E-3. EPS 5 Volt Power Supply Assembly Part No. 27788-342

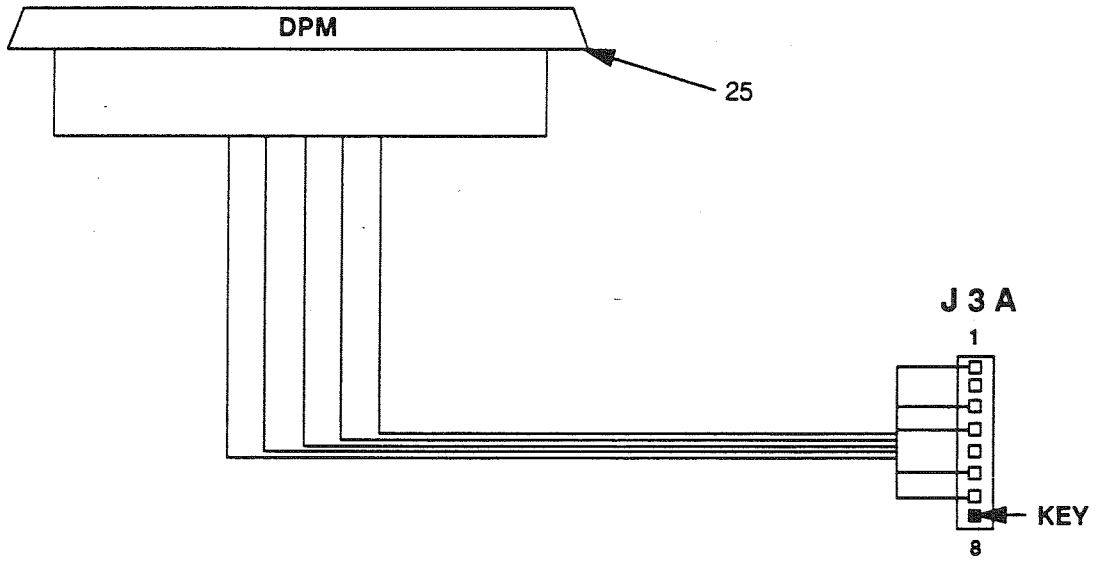


Figure E-4. Feet Of Water Display Assembly Part No. 27788-303

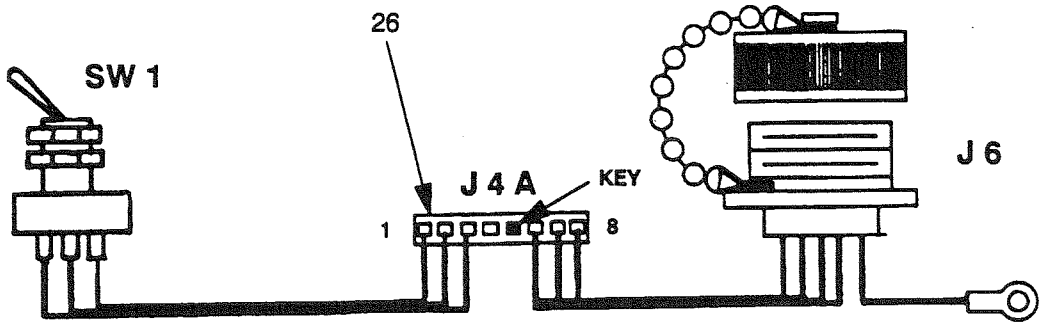


Figure E-5. EPS Interconnect Assembly Part No. 27788-304

PARTS LIST
Model 27781-028 EPS Electronic Pressure Switch

ITEM NO.		PART NAME	PART NUMBER	MAT'L CODE	QTY
1		HOUSING (WITH ACCESS COVER)	27788-338	-----	1
2		PROTECTIVE HANDLE	27788-305	-----	2
3		EPS FRONT PANEL	27788-325	-----	1
4		STATUS LED (LA, B, C, D)	27788-327	-----	4
5		GROMMETT	27788-328	-----	8
6		FERRULE	27788-306	-----	4
7		CALIBRATION PLUG	27788-329	-----	2
8		GROUND SCREW	27281-301	-----	1
9		EPS LABEL KIT - AIR BUBBLER	27788-350	-----	1
10	*	12VDC MAIN BOARD ASSY - AIR BUBBLER	27788-348	-----	1
11		200 VDC OUTPUT MODULE (1A OPTO 22 #DC200MP)	27788-344	-----	4
12		SET POINT TRIM POT (P1, 2, 3, 4, 5, 6, 7, 8)	27788-347	-----	8
13		SET POINT DISPLAY PUSHBUTTON (PB1, 2, 3, 4, 5, 6, 7, 8)	27788-314	-----	8
14		ZERO CALIBRATION TRIM POT (P10)	27788-312	-----	1
15		VOLTAGE REFERENCE (VR)	27788-309	-----	1
16		SPAN CALIBRATION TRIM POT (P9)	27788-311	-----	1
17		PRESSURE TRANSDUCER (XD)	27788-313	-----	1
18		10 VOLT REGULATOR (IC8) (NATIONAL SEMI #LM2940-10)	27788-343	-----	1
19	**	LATCH (IC5, 6)	27788-332	-----	2
20	**	DRIVER (IC7)	27788-333	-----	1
21	**	COMPARATOR (IC1, 2, 3, 4)	27788-334	-----	4
22	**	OUTPUT FUSE (FA, B, C, D)	27788-345	-----	4
23	***	5 VOLT POWER SUPPLY ASSY	27788-342	-----	1
24		5 VOLT REGULATOR (IC9)	27788-316	-----	1
25		FEET OF WATER DISPLAY ASSY (DPM, J3A)	27788-303	-----	1
26		EPS INTERCONNECT ASSEMBLY (SW1, J4A, J6)	27788-304	-----	1

* Includes all components assembled as shown in Figure E-2.

** Not packaged individually. Order spare parts kit No. 27788-346. Includes one (1) item 19, 20, and 21 and two (2) item 22.

*** Includes all components assembled as shown in Figure E-3.

NOTE: Refer to schematic for component values not listed above.

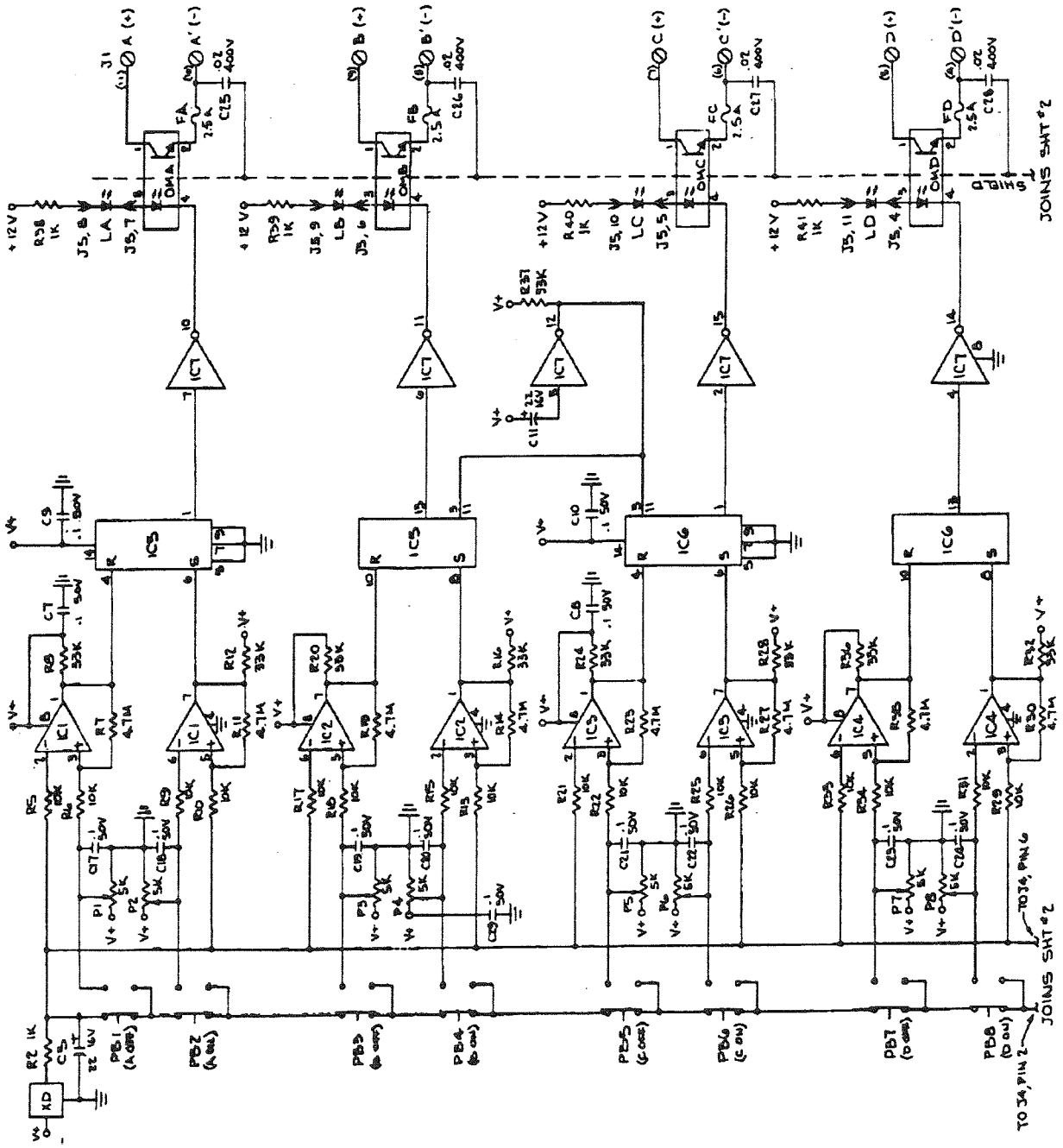


Figure E-6. Model 27781-028 EPS Schematic

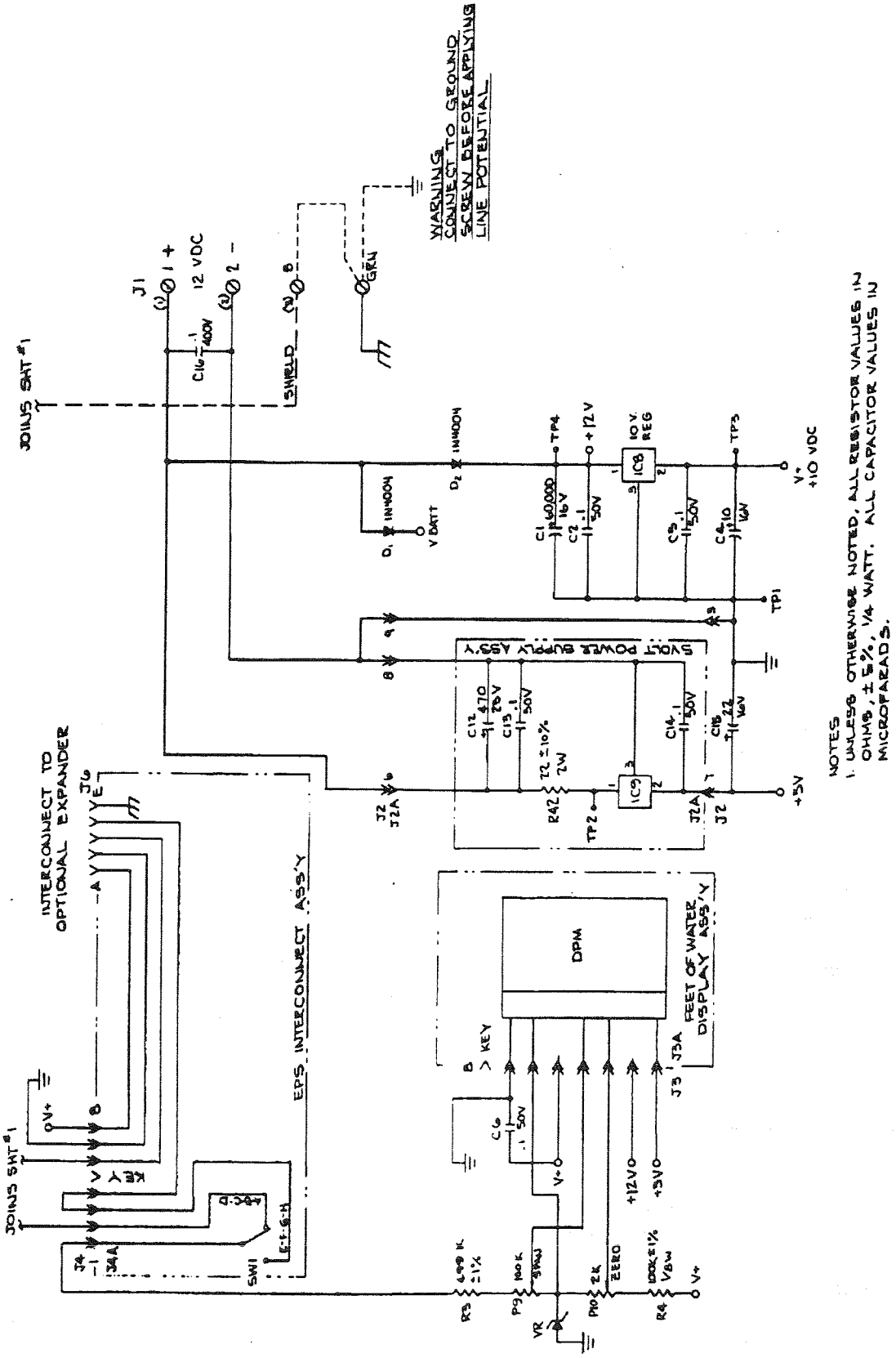


Figure E-6A. Model 27781-028 EPS Schematic

PLUG-IN COMPONENT REPLACEMENT

5 Volt Power Supply Replacement

a. Grasp the main board assembly near connector J2 and disconnect J2A. Slight wiggling may aid in removal of this connector.

b. Remove the two screws which secure the power supply board to the housing.

c. Remove the transformer screws and nuts in a like manner.

d. Install the new 5 V power supply in reverse order. Observe the proper positioning of J2A and reconnect to J2. Be sure to support the main board directly beneath the connector.

Feet Of Water Display Replacement

a. Gently pry the bottom of the bezel and remove the bezel and filter.

b. Grasp connector J3A and firmly pull straight up. **Do not** wiggle the connector as the mating pins are easily bent.

c. Remove the four mounting screws and nuts which secure the display. Remove the Feet Of Water Display with cable assembly through the front panel opening.

d. Install the new Feet Of Water Display in reverse order. J3A connector is keyed. Be sure to install the connector with the key in the proper position.

EPS Interconnect Assembly Replacement

a. Remove the panel nut which secures the set point display switch, S1 and remove the switch through the back of the front panel.

b. Grasp connector J4A and firmly pull straight up. **Do not** wiggle the connector as the mating pins are easily bent.

c. Remove the four mounting screws and nuts which secure the expander cable connector, J6, to the back of the housing. Remove J6 through the opening in the housing.

d. Install the new EPS interconnect assembly in reverse order. Be sure to attach the ground lead under one of the J6 mounting screw nuts. Install the new set point display switch, S1, with the lead attached to J4A, pin 3 in the up position. Install J4A connector with the key in the proper position.

Comparator Latch And Driver Replacement

a. Remove a comparator latch or driver, IC1 thru 7, from its socket by gently prying with a small screwdriver.

CAUTION

IC5 and IC6 are static sensitive. Take precautions when handling to prevent component damage.

b. Install new IC's in their sockets. Be sure to align the notch or marking on the IC with the notch in the socket.

NOTE

The comparators have 8-pins, latches 14 and the driver 16.

Output Module Replacement

NOTE

Output modules may be replaced through the small access cover on back of the housing or by completely removing the housing.

a. Grasp the output module with thumb and forefinger. Pull up using a slight rocking motion lengthwise to the module.

b. Install new output module while carefully aligning the pins with sockets. Gently press the output module until seated.

Output Fuse Replacement

a. Form the leads of the new fuse to match the fuse socket spacing. Trim the leads to approximately 3/8 inch long.

b. Install new fuses in their sockets. Use thumbnails of each hand and press on the fuse leads to engage in sockets. Pressing on the fuse body may damage the fuse.

SOLDERED COMPONENT REPLACEMENT

When replacing soldered components, use only the soldering and desoldering tools specified at the beginning of this section. Too much heat will damage the components or printed circuit board.

The printed circuit boards have been treated with a moisture seal coating at the factory. Remove the board coating from applicable areas with Kester AP-20 solvent/cleaner before soldering or desoldering. Use the solvent carefully as the coating/solvent mixture may contaminate pushbuttons and switches.

When repair and check-out has been completed, clean then recoat the applicable areas of the board by brushing on Hysol PC-20, PC-16 or Humiseal IB15.

Most components may be replaced using standard soldering/desoldering techniques and require no specific instructions. Use the illustrations and schematic as a guide.

The following components may also be replaced using standard techniques but require recalibration of the EPS: span calibration pot, P9; Zero calibration pot P10; voltage reference, VR; and precision resistors R3 and R4. Refer to Section D, **Calibration**.

The following components include more detailed repair instructions:

5 Volt Regulator Replacement

a. Remove the 5 volt power supply as described under **Plug-in Component Replacement** to gain access to the 5 volt regulator, IC9.

b. Remove the screw and nut which secures the 5 volt regulator to the board.

c. Desolder the three pins and remove the 5 volt regulator.

d. Form the leads of the new 5 volt regulator to match the hole spacing.

e. Apply thermal joint compound to the heat sink surface of the regulator and remount with the screw and nut. Solder the three pins and trim after cooling.

f. Remount the 5 volt power supply to the housing.

10 Volt Regulator Replacement

Follow the procedures for the 5 volt regulator in b, c, and e, above. Recalibration is necessary if the 10 volt regulator is replaced.

Set Point Display Pushbutton Replacement

a. Remove a defective set point display pushbutton, PB1 thru PB8. Cut the pushbutton pins flush at the board with small diagonal cutters.

b. Remove the panel nut securing the pushbutton to the front panel and desolder the remaining pushbutton pins.

c. Install the new pushbutton through the front panel and insert pins in the printed circuit board.

NOTE

It may be necessary to loosen all other pushbutton panel nuts to permit installation.

d. Tighten pushbutton panel nut(s) and solder the three pins.

Set Point Trim Pot Replacement

a. Disconnect connector J2A, J3A, J4A, and J5A. Do not wiggle these connectors as the mating pins are easily bent.

b. Remove the main board assembly from the front panel by removing all eight panel nuts from the set point display pushbuttons.

c. Remove a defective set point trim pot, P1 thru P8, by breaking the pins off and desoldering the pins remaining in the board.

d. Install the new set point trim pot, form the pins in the direction of the circuit track and solder.

e. Reinstall the main board assembly in reverse order.

Status LED Replacement

a. Remove a defective status LED, LA thru LD, by cutting the leads 1 inch to 2 inches from the LED. Press the LED through the opening in the front panel.

b. Install a replacement LED through the front and press until flush.

c. Slide 1/16 inch I.D. shrink tubing over each lead of the LED. Solder splice the red lead from connector J5A to the red lead from the LED and insulate with the shrink tubing. Splice the black leads together in a similar manner.

July 18, 1979

WARRANTY

Pumping units manufactured by The Gorman-Rupp Company, Mansfield, Ohio are guaranteed to be free from defects in material and workmanship for one year from date of shipment from factory in Mansfield, Ohio. The obligation under this Warranty, statutory or otherwise, is limited to replacement or repair at Mansfield, Ohio factory or at a point designated by Gorman-Rupp, of such part as shall appear to us upon inspection at such point, to have been defective in material or workmanship.

This Warranty does not obligate The Gorman-Rupp Company to bear the cost of labor or transportation charges in connection with replacement or repair of defective parts; nor shall it apply to a pump upon which repairs or alterations have been made unless authorized by Gorman-Rupp.

No warranty is made in respect to engines, motors, or trade accessories, such being subject to warranties of their respective manufacturers.

In Submersible Pumps, pump and motor are integral and Submersibles are warranted as a unit. Since motor is subject to an important degree upon quality and performance of electrical controls, unit warranty is valid only when controls have been specified and provided by Gorman-Rupp.

No express implied or statutory warranty, other than herein set forth is made or authorized to be made by Gorman-Rupp.

In no event shall The Gorman-Rupp Company be liable for consequential damages or contingent liabilities arising out of the failure of any Gorman-Rupp pump or parts thereof to operate properly.

THE GORMAN-RUPP COMPANY
Mansfield, Ohio

NOTE: In Canada, all above references to "The Gorman-Rupp Company, Mansfield, Ohio" is understood to mean "Gorman-Rupp of Canada Limited, St. Thomas, Ontario."

THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA Printed In U.S.A.