



TROUBLE SHOOTING GUIDE FOR THE 800F MECHANICAL PUMP CONTROL SYSTEMS

TABLE OF CONTENTS	PAGE
Overview of Console Operation	1
Operational Differences of TMS Consoles	1
Quick Reference to Solving Non-Technical Problems	2
IC-Box Operation Overview	3
Cautions for Wiring TMS Mechanical Controllers	4
Method of Isolating Problems (Non-Specific)	5
Trouble Shooting (Specific)	6

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OVERVIEW OF CONSOLE OPERATION

With the exception of the MPC HYBRID, TMS MECHANICAL PUMP consoles do not require pre-programming to interface with mechanical pumps or dispensers. **MPC HYBRID CONSOLES MUST BE PROGRAMMED WITH A 7 IN MODE 32 FOR EACH MECHANICAL HOSE BEING CONTROLLED.** It is also necessary to connect the correct cable connectors to the TMS-23 pump cards in the IC-Box if the MPC console is controlling a combination of electronic and mechanical hoses. Line voltage must be supplied to the TMS-78 power supply in the 800F IC-Box for proper operation of TMS consoles.

Use one finger from each hand to select modes higher than 8. Hold the **SEL** button down with a finger from your left hand while pressing one number at a time with a finger from your right, until the desired mode number is achieved. When the **SEL BUTTON** is being held down, any number pressed will go to the **MODE** side of the display. Any number pressed without holding the **SEL** button will appear on the **AMOUNT** side of the display.

When a customer removes a nozzle from a hose and lifts the handle, the console **CALL LIGHT** will turn on. If the console is so programmed, an audible beep will sound.

To AUTHORIZE the hose for a fill-up or post paid sale, press and release the **SEL, HOSE#,** and **AUTH** buttons. To authorize a PRE-PAID sale, (a pre-determined amount of fuel), press the **SEL, HOSE#, \$ AMOUNT, PAID,** and **AUTH** buttons. The call light will turn off and the authorize light will turn on. When the customer turns the handle switch off, the **AUTH LIGHT** will turn off and on a post paid sale, the **COLLECT LIGHT** will begin flashing.

The dollar amount that was dispensed can be viewed on the console by pressing the **SEL**, then the desired **HOSE#** buttons. While the display shows the dollar amount for a sale, press the **VOL** button to display the amount of VOLUME pumped. To display the volume on a PRE-PAID sale, press the **VOL** button after pressing **PAID** and **AUTH** BUTTONS.

NOTE: THE PRICE PER UNIT AND THE AMOUNT OF DISCOUNT PER UNIT VOLUME, OR BOTH CASH AND CREDIT PRICE ON MPC CONSOLES HAS TO BE PROGRAMMED INTO THE CONSOLE'S MEMORY FOR THE CONSOLE TO SHOW VOLUME AND DISCOUNTED AMOUNTS.

Discounted sales are displayed by holding the **DISC** button while the hose is selected.

To complete a sale, press the **SEL, PUMP#,** and **PAID** buttons. When a sale is paid-out, it is entered into the console's totals.

OPERATIONAL DIFFERENCES OF TMS CONSOLES

The **TMS-34-16 AND MPC-8/16** consoles have a MANAGER'S KEY SWITCH that must be in the "ON" position to make programming changes, and a PUMP SELECT KEYPAD that allows the operator to select individual hoses using one key-stroke. **800F** and **800F PLUS** consoles do not have these features.

To complete a **DISCOUNTED SALE** on an **800F** console, hold the **DISC** button while pressing **PAID**.

To complete a discounted sale on an **800F PLUS, TMS-34-16,** or **MPC-8/16** console, press the **CASH PAID** button.

To display the **PREVIOUS PAID-OUT SALES** on **800F** and **800F PLUS** consoles, add 10 to the hose number and select the desired mode on the console.

EXAMPLE: TO DISPLAY THE PREVIOUS PAID-OUT SALE ON **HOSE 2** SELECT **MODES 22**.

To display the **PREVIOUS PAID-OUT SALES** on TMS-34-16 AND MPC-8/16 consoles, select **MODE 17** and HOLD the desired **PUMP SELECT** button.

QUICK REFERENCE TO SOLVING NON-TECHNICAL PROBLEMS

NO POWER SYMPTOMS AT CONSOLE - If " P P P P P P P P " is displayed or flashes on any TMS console after the key switch is turned on, confirm the cable is plugged securely into the back of the console, and that the breaker to the TMS system is turned on. **IF CONSOLE CONTINUES TO SHOW NO POWER SYMPTOMS - TURN THE KEY SWITCH OFF AND SEEK HELP FROM A TRAINED PUMP TECHNICIAN.**

NO AUDIBLE BEEP FOR CALL OR COLLECT LIGHTS - The console's programming has been changed. See specific operator's guide to reset beeper setting.

REMEMBER:

HOLD **SEL** BUTTON DOWN WHILE PRESSING MODE NUMBERS. WHEN CORRECT MODE IS ACHIEVED, RELEASE **SEL** AND PRESS DESIRED CODE.

DOLLAR AMOUNT SHOWS BUT NO VOLUME IS DISPLAYED ON INDIVIDUAL SALES OR TOTALS - Confirm the price per unit volume has been programmed into the console's memory. See specific operator's guide for programming instructions.

DOLLAR AMOUNT SHOWS BUT A DISCOUNTED AMOUNT CANNOT BE DISPLAYED -

Confirm a discount per unit, along with the price per unit volume or both the cash and a credit price has been programmed into the console's memory. See specific operator's guide for programming instructions.

HOSE DELIVERS MORE FUEL THAN CONSOLE WAS SET FOR ON PRESET/PREPAID SALES ON ALL HOSES -

Increase the VALVE SLOWDOWN POINT amount programmed in the console's memory. See specific operator's guide for programming instructions.

ELECTRICAL NOISE AND WHAT TO DO - Voltage spikes, electrical storms and power blinks can cause electrical noise.

NOTE:

IF TURNING THE CONSOLE KEY OFF, WAITING FOR A FEW MINUTES, AND TURNING IT BACK ON SEEMS TO HAVE SOLVED THE PROBLEM, ELECTRICAL NOISE HAS AFFECTED THE CONSOLE AND A HARD CLEAR IS NECESSARY.

NO PRINT - Confirm all cable connections are tight. Confirm both green lights on the printer are turned on. Press the **SEL** button on the printer to turn the **SEL/ALARM** light on. If the SEL/ALARM light is flashing, the printer's "low paper sensor" may be activated. After confirming the paper roll is 3 inches wide and that it is properly positioned, press the SEL button on the printer repeatedly until the SEL/ALARM light stays on. If the printer still will not print, replace the paper with a full roll, or seek help from a trained technician.

NO HEADER PRINTS - The 800F and TMS-16 consoles read the header chip ONLY during power-up. Using the A126 key, turn the console off, plug the memory chip WITH THE PAPER LABEL FACING UP into the back of the console above where the IC cable plugs in. Turn the console on, select a hose number and press the print button. **IF THE HEADER STILL DOES NOT PRINT, ORDER ANOTHER TMS-11 HEADER CHIP.**

NOTE: THE HEADER CHIP WILL BE DAMAGED IF PLUGGED IN UPSIDE DOWN.

TMS 800F IC BOX OPERATION OVERVIEW

The 800F IC box contains a TMS-78 power supply and one TMS-23D pump card for each mechanical hose being controlled by the TMS console. The IC box is connected to the console by a TMS-47 cable. The cables are available in stock lengths of 25, 50, 75, 100 AND 150 feet. Longer length cables are special ordered in advance by the distributor.

The DC OUTPUT terminal on the TMS-78 supplies **+9 VDC** to the **RED** wire, **+12VDC** to the **WHITE** wire and **+12 VDC** to the **BLACK** wire (voltages can vary 20%). The **BLUE, YELLOW** and **EARTH GROUND SCREW** are common. The RED wire supplies the console its operating voltage. The white, wire splits into eight smaller ones supplying the operating voltage for the ILD chip and the valve and authorize relays. The black wire goes directly to the console and drops to **+6VDC** across two resistor packs before being routed by individual wires in the TMS-47 cable to the TMS-23D pump cards. The +6VDC voltage is then routed to the #2 terminal of the TMS-23D FIELD WIRE TERMINAL (FWT). The YELLOW wire splits into eight smaller ones connected to position #1 of the FWT (called pulser common) through the TMS-47 cable and provides a return for the #2 pulser signal.

Line voltage supplied across L1-IN hot and neutral terminals is routed through a series of resistors, diodes, capacitors and an ILD chip, and is turned into a high negative DC voltage. This voltage out put is at the **#5 AUTH** wire of the FWT and is used to detect a call signal. In a NON-CALL state and the hose not authorized, (-) 180VDC is read from #5 of TMS-23 FWT to neutral. When the handle is turned on, the high -DC current flowing through the reset motor windings to NEUTRAL activates the ILD circuitry. The ILD chip is used like a switch. +12vdc supplied by the white wire of the power supply is switched through the ILD chip, and activates the call circuit in the console.

When the console, or the BYPASS switch on the TMS-23 authorizes a hose, L1-IN voltage is shorted to the **#5 AUTH** wire of the FWT. The reset motor is energized and resets the mechanical computer to zero. Under normal operating conditions, the console will not count the pulses made during reset. When reset is complete, the authorize voltage is mechanically switched to the **MR WIRE** in the reset housing.

Line voltage on the **MR WIRE** supplies a hot to both valves at the pump, and returns to #4 MR of the TMS-23 FWT. When #4 MR is hot, it energizes the coil of the L-1 OUT RELAY that supplies voltage to turn on the pump motor, and activates the ILD circuitry again. This time, the +12vdc supplied by the white wire of the power supply is switched through the ILD chip, and activates the MR circuit in the console. The MR circuit signals the console that reset is complete and to start counting the money pulses. The console counts the contact closures of the pulser by reading the +6vdc cycle to ground across #2 PULSER and #1 PULSER COMMON WIRES of the TMS-23 FWT.

SOME APPLICATIONS USE AN AUXILIARY RELAY TO POWER THE PUMPING UNIT. IN THIS CASE, L1-OUT WILL ENERGIZE THE COIL OF THE RELAY BEING USED.

When valves are present, the full flow or fast valve neutral of is connected to the #3 of the TMS-23 FWT and the neutral to the cut-off or slow valve is connected DIRECTLY to neutral. IF A SLOW VALVE IS NOT AVAILABLE, THE NEUTRAL SIDE OF THE FAST VALVE IS CONNECTED TO NEUTRAL.

The neutral on #3 wire of the TMS-23D FWT is always present until the hose reaches the valve slow-down point during a preset or prepaid sale. When the slow-down point is reached, the console takes the fast valve neutral away using a small relay. The console will supply the neutral to the #3 wire after the preset sale is paid out.

When the customer turns the handle switch off, the TOP/BIG switch in the reset housing opens and breaks the connection between the AUTH and MR wires taking away the line voltage on the MR wire. The lack of voltage on the MR wire de-activates the L1-OUT relay coil, switching the pump motor off, and the MR signal sent by the ILD chip turns off. The console IMMEDIATELY de-authorizes a hose when it detects MR voltage going low. This causes a collect signal at the console.

THE CONSOLE DELAYS DE-AUTHORIZING A HOSE BEFORE 10 PULSES HAVE BEEN COUNTED AND WILL NOT DE-AUTHORIZE A HOSE UNTIL IT HAS READ PULSES, EVEN IF MR HAS GONE LOW. This makes the hose act as if it was in BYPASS on manual.

CAUTIONS FOR WIRING TMS MECHANICAL CONTROLLERS

TO AVOID BURNING THE TMS-23 RELAY BOARD, temporarily connect the **#5 AUTH WIRE** directly to L1-IN HOT of the TMS-23 LINE VOLTAGE TERMINAL to test the operation of hoses being connected to TMS systems. If AC HOT wires are connected to NEUTRAL in the conduit or pump junction box, the circuit breaker to the TMS-23 will trip thus AVOIDING BURNING THE TMS-23. To determine where the mis-connection is, **NOTICE WHEN THE BREAKER TRIPS**. If it trips immediately, the AUTH wire is mis-connected. A mis-connection on the MR OR L1 OUT wire will trip the breaker after reset is complete.

When replacing VEEDER-ROOT controllers, USE **CAUTION** because they typically have AC line voltage across the pulser leads. TMS diagrams have NO LINE VOLTAGE SHOWN ACROSS PULSER LEADS.

If line voltage is connected to the #2 position of TMS-23 field wiring terminal (FWT), money amounts will not register on the console on a limited number, or all hoses. The resistors that drop +12 VDC down to +6 VDC (supplied to TMS-23) will likely be burned. If line voltage "hot" is connected to the #1 position of the TMS-23 FWT, the TMS-23 board will be damaged, again preventing money amounts to read for that hose number at the console.

TMS stocks replacement barrier pipes (TMS-13) that replace the ones used on VEEDER-ROOT pulser totalizers. VEEDER-ROOT pulse totalizers typically have line voltage on their out-puts. Using the TMS-13 saves the cost of replacing the pulser if the pulser totalizer part number is 773384-001 for 2002E and 773380-601 for VR-10 computers.

METHOD OF ISOLATING NON-SPECIFIC PROBLEMS

NO POWER SYMPTOMS - No DC voltage on the RED (console), WHITE (TMS-23D) or BLACK (pulser) wires on DC VOLTAGE OUTPUT terminal of TMS-78.

1. Confirm 120vac with an earth ground is present at TMS-78 AC input terminal. The TMS-78 should have no other connections being made to or from the TMS-78 AC INPUT terminal.
2. Disconnect console from cable. Check for voltage at DC VOLTAGE OUTPUT terminal of TMS-78 power supply (or TMS-46 on earlier versions of 800F IC boxes).
 - A) If voltage is present - Replace console.
 - B) If voltage is not present - See step 3.
3. Disconnect cable from DC VOLTAGE OUTPUT terminal of TMS-78 and check for voltage on DC OUTPUT terminal.
 - A) If voltage is present - Replace cable.
 - B) If voltage is not present - Replace power supply.

ONE OR MORE HOSES ARE MALFUNCTIONING - Use the following procedure to determine if the problem is from the cable pigtail to the console, or from the TMS-23 to the field wiring, or the reset/pump.

1. Confirm the cable is plugged securely into back of console.
2. Run a test on ONE HOSE AT A TIME to determine SPECIFIC PROBLEM(S).
3. Put suspect cable PIGTAIL on KNOWN GOOD TMS-23 and pump.

NOTE: Do not use known good cable connector during this test!! **Further damage or confusion may result.**

4. Authorize ONLY the suspect hose at the console.
5. Pump a small amount from KNOWN GOOD pump that suspect cable is now connected to.
 - A) If problem goes away - Suspect original TMS-23, wiring, or pump. See **specific section**.
 - B) If problem persists - Suspect console or cable. See step 6.
6. Re-connect suspected cable pigtail connector to original relay position.
7. Replace console with a known good one and retest for problem.
 - A) If problem goes away - Original console was defective.
 - B) If problem persists - Replace defective cable.

NOTE: If a problem goes away **only temporarily, see appropriate section of TROUBLE SHOOTING SPECIFIC PROBLEMS** found on the following pages.

TROUBLE SHOOTING SPECIFIC PROBLEMS

NO CALL LIGHT

- 1 Confirm all hoses are not authorized or in by-pass.
- 2 Confirm +12VDC is present across the +12VDC white and blue (common) wires of the TMS-78.
 - A) If no voltage is present - See step 3 under NO POWER SYMPTOMS.
 - B) If voltage is present - See step 3.
- 3 Confirm line voltage is present across L1-IN and NEUTRAL of all TMS-23'S.
 - A) If no line voltage is present - Check breaker and all connections.
 - B) If voltage is present - See step 4.
- 4 With an INSULATED wire, short across #5 AND #4 of FWT of suspect TMS-23.
 - A) If call light turns on - TMS system is working correctly. Consult TMS wire diagrams to confirm proper connection of #5 AUTH wire at pump junction box and to the call handle switch of reset.
 - B) If call light does not turn on - Replace TMS-23.

FALSE CALL LIGHT - The call light is caused by a current leak from the #5 authorizes wire to neutral. A defective TMS-23, the console cable connectors being mis-pinned or plugged in upside down, a shorted wire in the TMS-47 cable, console damaged by lightning, bad wires in the conduit, or a call handle switch can cause a continuous false call on the console.

NOTE: If a false call happens ONLY AFTER PRESET OR PREPAID SALES on VEEDER-ROOT resets that are about 15 years old, update them with a **FINGER PAWL KIT**. Contact a VEEDER-ROOT dealer for part numbers and availability.

- 1 Unplug the TMS-23 FWT of the hose with the false call.
 - A) If call light turns off - System is mis-wired or the #5 AUTH wire has a current leak. Consult TMS wiring diagrams, then see step 2.
 - B) If call light(s) do not turn off - Problem is in the TMS system. See step 4.
- 2 Re-connect the TMS-23 FWT of the hose with the false call.
- 3 Disconnect #5 AUTH wire at pump junction box.
 - A) If call light stays on - Problem is the insulation of #5 AUTH wire. Exchange AUTH wire **AT BOTH ENDS** with an unused wire, the #4 MR, #3 VALVE or #1 PULSER COMMON wire. Check for proper operation of call signal. Small current leaks on MR, VALVE and PULSER COMMON wires are acceptable.
 - B) If call light turns off - Problem is from pump wiring terminal to call switch. Carbon dust from reset on the handle switch can cause a false call. Repair as needed.
- 4 Unplug the console cable pigtail connector of the hose with the false call.
 - A) If call light stays on - See step 5.
 - B) If call light turns off - Problem was the TMS-23.
- 5 Reconnect console cable to original position and replace console with a known good one.
 - A) If call light stays on - Replace TMS-47 cable.
 - B) If call light turns off - Original console was defective.

NO AUTHORIZE LIGHT - The console will not re-authorize a hose if it did not see the line voltage on the #4 wire of the TMS-23 FWT go low after a preset or prepaid sale.

1. Slide the MANUAL/BY-PASS switch towards the L1-OUT relay, and then back into the console position. This connects AC HOT to #5 AUTH of TMS-23 FWT and allows the reset to cycle if it is not in the normal position after a sale. If this operation solves the problem, see section 4.0, false calls.
2. Confirm console re-authorizes the hose after a post pay sale.
 - A) If console does not re-authorize the hose - Replace defective console.
 - B) If console re-authorizes the hose - Consult TMS wire diagrams and confirm proper operation of reset. Make repairs as needed.

PUMP DOES NOT RESET

1. Confirm hose position is authorized at console.
2. Confirm line voltage is present at TMS-23 AC input terminals L1-IN and NEUT.
 - A) If no line voltage is present - Check breaker and all connections.
 - B) If voltage is present - See step 3.
3. Confirm line voltage is present at TMS-23 AC output terminal #5 AUTH and NEUT.

Note: Putting the pump into manual mode by sliding the MANUAL/BY-PASS switch towards the L1-OUT relay should always connect AC HOT to #5 AUTH of TMS-23 FWT.

- A) If no line voltage is present - TMS-23 may be burned as the resulting from the mis-connection of AC NEUTRAL to #5 AUTH wire. Correct mis-connection and replace burned TMS-23.
 - B) If voltage is present - Suspect wiring or pump/reset operation. See step 4.
4. At pump junction box, confirm line voltage is present across #5 AUTH wire and AC NEUTRAL.
 - A) If no line voltage is present - Suspect wire in the conduit is bad.
 - B) If voltage is present - Suspect pump/reset operation. Repair or replace as needed.

THE CONSOLE COUNTS LOWER than at the pump are usually caused by the pulser or an intermittent connection between the pulser and the TMS system. Follow steps shown in sections 5.0 and 6.0, then see 7.0.1.

1. Confirm the pulser wires are run directly from the pulser output to the TMS-23 without passing through any switches.
2. Confirm all connections between pulser output and the TMS-23 FWT is tight.
3. Replace pulser with a known good one.
 - A) If console reads correctly - Original pulser is defective.
 - B) If console reads incorrectly - Replace TMS-23.

FUEL DOES NOT DISPENSE - If fuel does not dispense, the tank may be empty, or the reset, wiring, TMS-23, or pump motor relay may be defective.

1. Determine if fuel is in the main storage tank.
 - A) If fuel is not present - Call supplier for a delivery.
 - B) If fuel is present - See step 2.

2. Confirm Pump motor turns on.
 - A) If pump motor does not turn on - Suspect TMS-23 or pump motor relay. See step 3.
 - B) If pump motor does turn on - Suspect blockage in line or mis-connected/defective valves.

3. With hose authorized and reset complete, measure line voltage across **NEUTRAL** and **MR** terminals of TMS-23 FWT.
 - A) If voltage is present - See step 4.
 - B) If voltage is not present - Check wiring and reset for proper operation, then make repairs as needed.

4. Confirm line voltage is across **NEUTRAL** and **L1 OUT** of TMS-23.
 - A) If line voltage is present - See step 5.
 - B) If line voltage is not present - Replace TMS-23 and repeat steps 3 and 4, then see step 5.

5. Confirm line voltage is present at pump motor relay coil.
 - A) If voltage is present - See step 6.
 - B) If voltage is not present - Confirm wiring from TMS-23 L1-OUT terminal to the relay coil is correct and all connections are tight.

6. Determine if line voltage is across input terminals of pump motor relay.
 - A) If voltage is not present - Confirm breaker is turned on and all connections from panel to relay inputs are tight.
 - B) If voltage is present - Suspect pump motor relay.

HE CONSOLE COUNTS HIGHER than at the hose can be caused by the console counting pulses during reset (defective TMS-23 or console), AC voltage inductance across the pulser wires (bad insulation on the #2 wire), or a defective computer (loose or slipping clutches).

1. Replace TMS-23 with a known good one and re-check console for a correct count.
 - A) If console miscounts - Suspect wires, pulser, or computer. If both sides of the computer do not read the same at the beginning and end of a sale, it may cause an **intermittent 1 to 4-pulse miscount** on the console. Check operation of computer, then See step 2.
 - B) If console counts correctly - Original TMS-23 is defective.

2. Replace suspect pulser with a known good one and re-check console for correct count.
 - A) If console miscounts - suspect wires. If pulses read **EXTREMELY HIGH** on the console, it is reading **AC VOLTAGE INDUCTANCE** across the pulser leads through a bad spot in the insulation of the #2 wire on the TMS-23 FWT. See step 3.
 - B) If console counts correctly - Original pulser is defective.

3. Switch the positions of the #1 and #2 wires of the TMS-23 **ONLY AT THE TMS-23 FIELD WIRING TERMINAL** and run a sale on suspect hose.
 - A) If console continues to count incorrectly - Replace the #2 wires AT BOTH ENDS with either the #3 VALVE, the #4 MR wire, or any other unused that has good insulation. **DO NOT USE THE #5 WIRE OR A FALSE CALL WILL RESULT.**
 - B) If console counts correctly - Problem is solved.

NO MONEY REGISTERS AT THE CONSOLE - The console is designed to register money and calculate volume.

NOTE: If the solder side of a defective TMS-23 is burned, find any source of AC voltage being connected across the pulser inputs, or mis-connected AC hot and neutrals, and repair it. If AC voltage is connected to its pulser inputs, or a hot is connected where a neutral should be, the TMS system will be damaged.

1. On suspect TMS-23, disconnect #2 pulser lead from FWT and **ISOLATE IT FROM CIRCUIT** with a wire nut on the conductor portion of the wire in case line voltage is present.
 2. Determine if +6VDC voltage can be read ON THE TERMINAL across #1 and #2 of the TMS-23 FWT.
 - A) If voltage can be read - the system's pulse output is good. See step 5.
 - B) If +6vdc cannot be read - the system's pulse output is bad. See step 3.
 3. Determine if +12vdc can be read across #1 of FWT (common) to BLACK wire of TMS-78 power supply.
 - A) If voltage can be read - pulser common circuit is complete. See step 4.
 - B) If +12vdc cannot be read - the TMS-23 has likely burned as the result of having line voltage connected to the #1 terminal position. Correct wiring problem and replace damaged TMS-23.
 4. Determine if +6vdc can be read across #2 of FWT (pulse) to YELLOW wire of TMS-78 power supply.
 - A) If voltage can be read - console pulse circuit is intact. See step 5.
 - B) If +6vdc cannot be read - the resistors in the pulse circuit are likely burned as a result of having line voltage connected to the #2 terminal position. Correct wiring problem and replace damaged console.
 5. Authorize suspect hose on console and let hose reset and lay the nozzle down on the island **DO NOT DISPENSE FUEL**.
- Note: If hose does not reset - Consult TMS wire diagrams and confirm proper operation of reset. See section 9.0
6. Confirm line voltage is across #4 of TMS-23 FWT to neutral and that the pump motor is running.
 - A) If line voltage is not present - Consult TMS and pump manufacturer wire diagrams and confirm proper operation of reset.
 - B) If line voltage is present - See step 7
 7. **WITH A SCRAP PIECE OF WIRE**, make and break contact closures like a pulser, across #1 and #2 of TMS-23 FWT. **DO NOT USE THE #2 WIRE THAT WAS PREVIOUSLY DISCONNECTED!**
 - A) If pulses read on suspect hose on console - Suspect pulser or wires in the conduit. See step 8.
 - B) If no pulses read on console - Replace TMS-23.
 8. Reconnect #2 pulser wire to FWT.
 9. Disconnect #2 pulser wire at the pump junction box.
 10. Make and break connections, like a pulser, by connecting, then disconnecting the two pulser wires as they go into the conduit.
 - A) If pulses read on console - wires are good because pulses were read through them. Replace suspect pulser.
 - B) If no pulses read on console - Suspect wires. Use another set of existing wires, or run temporary wires over the ground to confirm that the wires in the conduit are bad.