TXAM Advanced Pump Control

Operational Instructions for Version 3 with Modbus

Operates TXAM DC (Solar) Pumps including HBT1, HBT2 and Woodpecker.
Metal enclosure with a five Switch Keypad and a 2x16 Line Display.
Build in Modbus Interface to allow connection (via Pluggable Terminal Block) to a Modbus PLC.
A 4-20ma input for external closed loop control of the pump (via Pluggable Terminal block).
Optional Temperature Probe allows for Temperature controlled operation.
An expansion port allows for field updates of software and for connection to enhanced functions.
Pump Prime Feature and Field replaceable fuse.
Flashing LED to indicate operation, Led Heartbeat at one second.
Incorporates Energy Saving Pump Cutback operation to extend operation of Battery (Patented).
Low Battery shutdown.

The Pump Controller may be configured for any of the following operations:

1. **Cycles per Minute (with Patented life extending battery operation)**
2. **On Time / Off Time Control**
3. **Quarts per Day**
4. **Gallons per Day**
5. **Batch Pump Controller (Quarts)**
6. **Daily Pump Controller**
7. **Variable Speed**
8. **Modbus Controlled (quarts/day, gallons/day, variable speed, On/OFF time, cycles per Minute)**
9. **4-20mA Controlled**
10. **Remote contact control—on/off control (N.O. or N.C. configuration)**

A five switch keypad is used for Pump operational control and a two line display, displays information as well as prompts for pump operation and set up. Additionally, the Pump Controller may be controlled solely by a 4 to 20ma loop, contact closure, or Modbus.

The Keypad Control Switches are as follows

Start/Pause	Test/Prime	Up	Down	Enter

Basic Pump Controller Mode Descriptions

Cycles per minute – Sets how many cycles are run per minute and how long each cycle is on. Ranges are ON time of 1 to 5 seconds and Cycles are 1 to 10 cycles per minute.

ON-OFF Pump Controller - Sets the amount of time that the pump is ON and OFF. Range is 1 to 120 seconds ON and 1 to 120 seconds OFF (in ½ second increments)

Quarts per Day – Sets how many quarts are pumped per day. The calculations decides the ON time and OFF times required each minute in order to pump the selected Quarts per day. Range is 1 to 99 Quarts

Gallons per Day – Sets how many gallons are pumped per day. The calculations decide the ON time and OFF times required each minute in order to pump the selected Gallons per day. Range is 1 to 78 Gallons.

Batch Pump Controller – Sets how many Quarts are pumped during a single time and how many days a month it is done. Range is a batch of 1 to 100 quarts and may operate 1 to 28 times per month (per 4 week period).

Daily Pump Controller - Runs the preset quarts each day at approximately the same time each day.

Variable Speed – Set the speed of the motor. Range is 1 to 10 (with 10 being full speed)

Modbus Control – Allows pump function as well as monitoring to be controlled by SCADA System.

4-20mA Control - Allows an external 4-20mA signal to control the pump operation.

Remote Contact – Allows a contact closure to Start and Stop pump.

The pump will always turn off when the battery voltage gets low. This will be indicated on the display. It will automatically start back running when the battery is charged.

BASIC SPECIFICATIONS

- **Operating Input Voltage: 10.8 to 15 volts**

- **Fuse: Maximum fuse rating 20 amps, ATO type, Blown Fuse Detection**

- **Motor Drive: P-Channel MOSFET**

- **Operating temperature range -30 to +70C (-22 to +158F)**

- **Modbus Connection: RS485 two wire**

- **Battery Voltage Monitor Input: Maximum voltage 15.25 volts, low battery turn off**

- **LED Heartbeat 1 second**

- **Power connection: 0.250 spade Lugs**

- **Motor Connection: 0.250 spade Lugs**

- **4-20ma/Modbus connection: Pluggable Terminal Block 4 position 3.81mm**

- **Voltage Input protected by VARISTOR input clamp and Zener**

- **Temperature Probe failure (short) switches to internal sensor for Control**

- **Field upgradeable by service personnel**

- **Approx Size 5.25 x 5.00 x 1.3 inches Metal Enclosure**

INITIAL SETUP

An initial setup is used to set the type of pump operation (as listed above). This changes the Mode of Operation.

To set an Initial Control Type (factory default is Quarts per Day) you press and hold the Start/Pause Switch while TXAM Pumps is being displayed on the screen. (This is when the Pump Controller is first powered up with the power switch.) Continue to hold down the Start/Pause Switch and you will see the Pump Controller cycle through all the various Modes of operation. When you see the Mode of operation you want, release the switch. The Pump Controller is now set for that Mode of operation. Note: Releasing the switch will save the operational Mode and the pump control will always power up to this Mode unless it is changed again using the same procedure. This setting is usually set at the factory or during the initial pump setup.

SERVICE SETUP

This is done during initial pump installation and does not need to be repeated.

After the TXAM Pumps display times out (about 3 seconds) the display will prompt with a question Service Setup?   If you want to do an initial service setup press and release the Up Switch. (You will have about five seconds to press the Up switch.) If you do not press the Up switch the Pump Controller will proceed with its prior settings and begin normal operation. Again this is normally going to be a onetime setup, the exception will be when running the Daily Batch Pump Controller.

If you enter the Service Setup, you will be prompted with questions. You will only be prompted with questions relating to the Type of Operation or Mode that has been set. When doing a Service Setup you will be using the Up and Down Switches to select the correct answer. When you have the correct answer press the Enter switch. If you do not press the Enter switch or the Up or down switch the pump control will wait about 30 seconds and then move to the next question. If you want to use the currently displayed answer just press the Enter switch to move to the next question. After all questions are answered you will see Service Complete displayed and then the Pump Controller goes into the Operational Mode. All these setup answers are saved and do not need to be repeated unless you change the Mode of operation or something about the pump such as the plunger size.

Setup Notes

If you make a mistake during a set up, just turn the power switch off and then back on to start over with the service setup.

If you do not press the enter switch, the old setting will be kept even if you have pressed the Up/Down selection.

If you do not press a switch at anytime during service set up, the display will time out and move on and normal operation will begin based on either the previous settings or any changes you have made.

TEST/PRIME

Pressing the TEST switch will cause the pump to turn on for 30 seconds. After the 30 second time out the Pump Controller resumes operation. (If the Pump Controller was running it will continue to run, if the Pump Controller was in Pause it will return to Pause). During the test Mode the display counts down the time remaining for the test operation. You can press the Pause switch to abort the test Mode. This test Mode is normally used to prime a pump or check for leaks. Testing will always run the pump at maximum speed. Test Mode operates in all Modes even in Modbus or 4-20ma control.

CONTROL OPERATION

Local Keypad Controlled or Remotely Controlled Mode

When the Pump Controller is first powered up, you have the chance to make modifications to the Pump Control Type and Service Setup before operation begins. The Pump Controller will display the Type of Pump Control and what the current settings are for operation. At this point the Pump Controller will begin operation and display *System ON*. Note the Service Set up is not used for the setting of the run parameters, such as quarts per day or cycles per minute (except in the Daily Pump Controller Mode). The Operating values can be changed during the Normal Operation. When the pump is running you will see the display *System ON*, when *System ON* is displayed the pump is being controlled by the Pump Controller locally or remotely. In order to make a change to the operating parameter press the Start/Pause switch. The Pump Controller will now display *Paused*. While in the Pause Mode you are able to change operating parameters. Pressing the Start/Pause switch again will put you back to the *System ON* Mode. If you want to change the operating parameter put the Pump Controller in Pause. Now press the Enter Switch and you will be prompted to Change a parameter. The UP and Down switches are used to change the parameter (i.e. Increase/Decrease quarts per day etc.). When you select the desired operating parameter, press the Enter Switch. The display will display *OK change saved*. The display will now show what the new operating parameters are set to. Press the Start/Pause switch to resume operation and you will see *System ON* displayed. (Be sure you press the Start switch and see *System ON*…if System ON is not displayed the Pump Controller is not running but in a Mode for making changes).

 While *System ON* is displayed, press the Pause switch to make changes. You can also press the Down switch without pausing you will see Battery Voltage, then Temperature displayed. The Enter switch has no function when *System On* is displayed. NOTE: If in a remote Mode such as Modbus you cannot make changes to the setting but you are able to Pause and Test/Prime the Pump.

Connections:

The four spade lugs above the display are required connections for Power and the Pump. The lugs on the left are for Power (Battery) connections. The lugs are labeled Positive and Negative. The Spade lugs on the right are for connection of the motor. (All Connection Lugs are marked on the Laminate).

The Modbus and 4-20mA Control use a 4 Position 3.81mm Pluggable Terminal Block on the side of the Advanced Pump control and is labeled REMOTE. The Modbus operation is RTU slave Mode.

TB Connections - Right Side -- Labeled REMOTE (opposite of the power switch)

Top pin -------------- 4-20mA input
2nd pin ------------- RS485 D+
3rd pin -------------- Ground
Bottom pin -------- RS485 D-

The Contact Closure connection requires a special plug-in cable. This connection is located along the top next to the temperature sensor connection and is the same connection as used for software updates.

Advanced Controller Specific Mode Instructions

CYCLES PER MINUTE Mode **(Runs a set number of cycles per minute with a set ON time)**

1. Power on the unit and hold the Start/Pause Button until *Cycles/Minute* appears on the screen then release the Start/Pause Button.

2. The controller will display *Service Setup? Up=Yes*; Push the Up button and the screen will scroll and ask you some questions that relate to the Cycles/Minute Mode. Just answer the questions and press Enter to save. Then the Screen will display *System On*.

3. Press the Pause button then press Enter to change the operating settings.

4. The screen will display *Set Pump "On Time"* and you enter the number of seconds you want the pump to run using up/down keys and then press Enter.

5. The screen will then display *Set Cycles per Minute*. Enter the number of Cycles per minute you want the pump to run using up/down keys then press Enter. The screen will now display your settings for ON Time and Cycles.

6. Press the Start button and the pump will operate as per your settings.

ON-OFF Pump Controller Mode **(Runs based on a set ON time and a set OFF time)**

1. Power on the unit and hold the Start/Pause Button until *On Time/Off Time* appears on the screen then release the Start/Pause Button.

2. The controller will display *Service Setup? Up=Yes*; Push the Up button and the screen will scroll and ask you some questions that relate to the On Time/Off Time Mode. Just answer the questions and press Enter to save. Then the Screen will display *System On*.

3. Press the Pause button then press Enter to change the operating settings.

4. The Screen will display *Set "On Time"* (Between .5 Seconds and 120 Seconds) use the up/down keys to change and then press Enter.

5. The Screen will display *Set "Off Time"* (Between .5 Seconds and 120 Seconds) use the up/down keys to change and then press Enter.

6. Then the Screen will now display your settings for ON and OFF times.

7. Press the Start button and the pump will operate as per your settings.

QUARTS PER DAY Mode – Sets how many quarts are pumped per day. The internal calculations will decide the ON time and OFF times required each minute in order to pump the selected Quarts per day. Range is 1 to 100 Quarts.

1. Power on the unit and hold the Start/Pause Button until *Quarts per Day* appears on the screen then release the Start/Pause Button.

2. The controller will display *Service Setup? Up=Yes*; Push the Up button and the screen will scroll and ask you some questions that relate to the Quarts per Day Mode. Just answer the questions and press Enter to save. Then the Screen will display *System On*.

3. Press the Pause button then press Enter to change the operating settings.

4. The Screen will display *Set Quarts/Day*

5. Press the Up or Down Arrow to set the desired quarts per day then Press Enter

6. The Screen will display your settings.

7. Press the Start button and the pump will operate as per your settings.

US GALLONS PER DAY Mode – Sets how many gallons are pumped per day. The calculations decide the ON time and OFF times required each minute in order to pump the selected Gallons per day. Range is 1 up to 78 Gallons based on the pump, stroke and plunger settings.

1. Power on the unit and hold the Start/Pause Button until *Gallons per Day* appears on the screen then release the Start/Pause Button.

2. The controller will display *Service Setup? Up=Yes*; Push the Up button and the screen will scroll and ask you some questions that relate to the Gallons per Day Mode. Just answer the questions and press Enter to save. Then the Screen will display *System On*.

3. Press the Pause button then press Enter to change the operating settings

4. The Screen will display *Set Gallons/Day* (Range based on pump setup)

5. Press the Up or Down Arrow to set the desired Gallons per Day then Press Enter

6. The Screen will display your settings

7. Press the Start button and the pump will operate as per your settings.

BATCH Mode – Set how many Quarts are pumped during a single time and how many days a month it is done. Range is a batch of 1 to 100 quarts and pumped 1 to 28 times per month (per 4 week period)

1. Power on the unit and hold the Start/Pause Button until *Batch Pump Controller* appears on the screen then release the Start/Pause Button.

2. The controller will display *Service Setup? Up=Yes*; Push the Up button and the screen will scroll and ask you some questions that relate to the Batch Pump Controller Mode. Just answer the questions and press Enter to save. Then the Screen will display *System On*.

3. Press the Pause button then press Enter to change the operating settings.

4. The Screen will display *Set "On Days"* (1-28 Days). Set the number of days in a month you want the pump to run using the up/down buttons and then Press Enter.

5. The Screen will display *Set Rate/Quarts* (1-100 Quarts) Set the quarts per batch using the up/down buttons and then press Enter.

6. The Screen will display your settings.

7. Press the Start button and the pump will operate as per your settings.

DAILY Control Mode – Runs the preset quarts each day at approximately the same time each day

In the set up Menu you will set the number of quarts to pump as a batch and the time delay until the first batch starts. The batch runs each 24 hours and the display will indicate the time until the next batch is run.

1. Power on the unit and hold the Start/Pause Button until *Daily Pump Controller* appears on the screen then release the Start/Pause Button.

2. The controller will display *Service Setup? Up=Yes*; Push the Up button and the screen will scroll and ask you some questions that relate to the *Daily Pump Controller* Mode. Just answer the questions and press Enter to save. Then the Screen will display *System On*.

3. The operating parameters are set using the Service Setup and cannot be changed while they system is operation. The Pause button stops the batch, but does not affect the time until the next batch starts.

VARIABLE SPEED Mode – Set the speed of the motor. Range is 2 to 100 (with 100 being full speed)

1. Power on the unit and hold the Start/Pause Button until *Variable Speed* appears on the screen then release the Start/Pause Button.

2. The controller will display *Service Setup? Up=Yes*; Push the Up button and the screen will scroll and ask you some questions that relate to the Variable Speed Mode. Just answer the questions and press Enter to save. Then the Screen will display *System On*.

3. Press the Pause button then press Enter

4. The Screen will display Set Pump Speed (Range 2-100)

5. Press the Up or Down Arrow to set the desired Pump Speed then Press Enter

6. The Screen will display your setting

7. Press the Start button and the pump will operate as per your settings.

MODBUS Controlled Mode – (acts in a RTU slave Mode)

1. Power on the unit and hold the Start/Pause Button until *Modbus* appears on the screen then release the Start/Pause Button.

2. The controller will display *Service Setup? Up=Yes*; Push the Up button and the screen will scroll and ask you some questions that relate to the Modbus setup. Just answer the questions and press Enter to save. Then the Screen will display *System On.*

3. See additional Manual for operating instructions and Register Map, since the Advanced Pump Control is now under remote control, no changes are allowed other than monitoring, "Pause" and "Prime".

4-20mA Controlled Mode – Closed Loop Control

This Mode allows an external 4-20mA signal to control the pump operation. The pump will operate in the variable speed Mode, at 4mA the motor is off and 20mA the motor is running full speed.

1. Power on the unit and hold the Start/Pause Button until *4-20mA* appears on the screen then release the Start/Pause Button.

2. The controller will display *Service Setup? Up=Yes*; Push the Up button and the screen will scroll and ask you some questions that relate to the 4-20mA setup. Just answer the questions and press Enter to save. Then the Screen will display *System On.*

3. Since the Advanced Pump Control is now under remote control, no changes are allowed other than monitoring, Pause and Prime.

REMOTE CONTACT Controlled Mode – on/off controlled

This Mode is simple pump ON or pump OFF control. The motor is either off or full speed on. The contact may either be normally open or normally closed.

1. Power on the unit and hold the Start/Pause Button until *Remote Contact* appears on the screen then release the Start/Pause Button.

2. The controller will display *Service Setup? Up=Yes*; Push the Up button and the screen will scroll and ask you some questions that relate to the Remote Contact setup. Just answer the questions and press Enter to save. Then the Screen will display *System On.*

3. Since the Advanced Pump Control is now under remote control, no changes are allowed other than monitoring, Pause and Prime.

<div align="center">Additional Notes</div>

The pump will always turn off when the battery voltage gets low. This will be indicated on the display along with the current battery voltage. When the battery recharges it will automatically start back running.

In BATCH MODE if you pause or test the system, when you turn the system back on it will resume with the off time. This is to prevent the pump from running another batch cycle. If you need it to run another batch just cycle the power OFF then ON.

In DAILY PUMP CONTROL Mode if you pause the system pumping will stop while in pause and resume when taken out of Pause. The Pump Controller for the next 24 hour cycle is not affected while in pause (it will continue timing).

In VARIABLE SPEED Mode anytime the motor is stopped it will always start at full speed for two seconds to overcome the torque of the system and then change to the variable speed setting. All settings are saved once they are set and the Enter key pressed.

<div align="center">*** *Defaults Set For Each Operational Mode* ***</div>

Questions asked during Service Setup are based on the operation and may ask such things as motor type, stroke length, plunger size, dual or single head pump and pressure range. These parameters are used to calculate gallons and quarts.

The Pump Controller may ask to Enable/Disable Temperature control in which case you will be prompted for the *ON and OFF* temperatures. You may also be asked for Battery Saver Mode Enable/Disable. This is used to slow down pump operation as the battery discharges to allow for longer pump operation (Patented). Temperature Set points are when Temperature Control is enabled and you have a probe connected.

The temperature setting range is 20 to 70 degrees Fahrenheit. To set the temperature control, two set points are required, high set point and low set point. The low set point is where the Pump begins operation and the high set point is where operation stops. In order to set the temperature low and high set points you must enable Temperature control. If temperature probe is disconnected temperature control is disabled. Connection of the temperature probe is always monitored so you may plug or unplug the probe during operation.

Quarts and gallons per day Modes configure the pump to run X number of seconds per minute in order to pump the rate set. It is possible to set the rate too low for the pump to run, since the minimum run time is one second per minute.

If no switch is pressed for 4 minutes, the display will blank to save energy, but normal operation continues. Momentarily pressing a push button turns the display back on.

You may select the PATENTED Energy Saver Mode either as Enabled or Disabled. (Default is enabled) This means that while running cycles per minute operation as the battery voltage get lower the

WARNING: DO NOT REVERSE THE POWER CONNECTIONS OR DAMAGE MAY OCCUR!

Software Version 3.XX (Changes Noted)

Version 3.00
Initial release with internal Modbus (previous versions 1.xx and 2.xx used external Modbus module)
Same register applies

Version 3.10
Add Daily Pump Controller Mode and fix a temperature operation bug.

Version 3.11
Add display of internal temperature sensor and external 4-20mA loop input reading that is displayed after battery voltage when the Down key is pressed.

Version 3.20
Increase the maximum gallons in Gallons per Day that can be set on Pump Controller locally (old limit was 24, now up to 78 for HBT2 full stroke, half inch plunger).
Allow Modbus baud rate to be changed 9600 or 19,200.
Change Variable Speed setting of motor from 1 to 10 to 2 to 100 for finer speed control.
Make LED flash slower while in voltage cut back operation.

Version 3.21
Increase the maximum gallons in Gallons per Day that can be set via Modbus (old limit was 24, now up to 78 for HBT2 full stroke, half inch plunger).