

# Universal Pump Control

## Operational Instructions - version 1.00--UPC

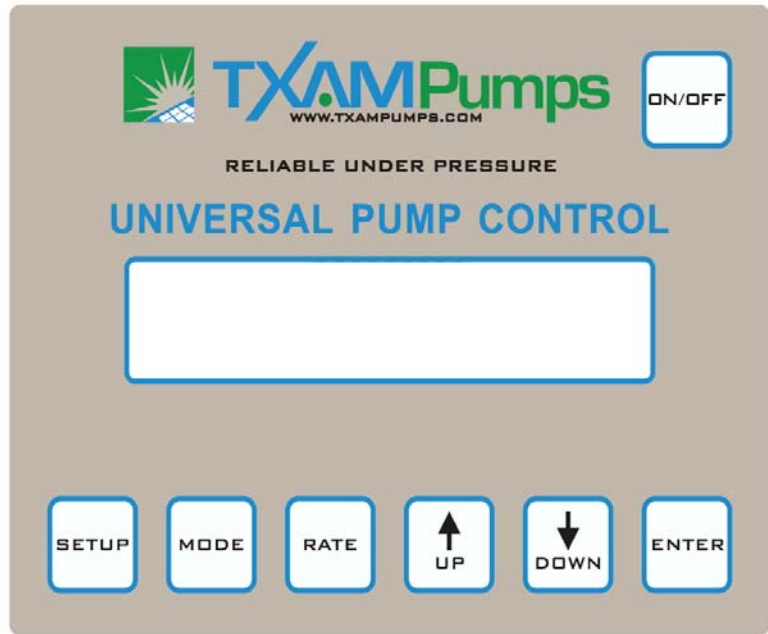
### Operational Features

- The TXAM Pumps Universal Pump Control is available in AC, DC or Brushless Motor configurations.
- Can be configured to operate ALL TXAM Pumps.
- Common Setup and Operations, Independent of the Pump Type.
- Watertight Enclosure with a Seven Switch Keypad and 2 x 20 Line Display.
- Built-in Modbus Interface to Allow Connection to a Modbus Master.
- A 4-20mA Input for External Closed Loop Control of the pump.
- Optional Temperature Probe allows for Multipoint Temperature Controlled Operation.
- Pump Prime Feature and Manifold Valve Control.
- Flashing LED to Indicate Operation, LED Heartbeat at One Second.
- Incorporates Energy Saving Pump Cutback operation to extend operation of a Battery (Patented).
- Low Battery Shutdown.
- Inhibit Contact Input.

## Controller

A seven switch keypad is used for pump operational control with a two line display that displays information & prompts for:

- **Setup**
- **Mode**
- **Rate Setting**
- **Pump Operation**



Additionally, the timer may be controlled solely by a 4 to 20mA Loop, Modbus or a Contact Inhibit.

## Settings

### The UPC 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 in Seconds
3. On Time / Off Time Control in Minutes
4. Quarts per Day
5. Liters per Day
6. Gallons per Day
7. Batch Operation (Quarts)
8. Modbus Controlled
9. Manifold Control (Quarts)
10. Manifold Control (Time Based)
11. Remote 4-20mA Loop Controlled
12. Contact Closure Inhibit Operation
13. Single or Multiple Temperature Set Point Operation

### Set Point Range by Mode of Operation

#### **CpM (Cycles per Minute)**

1 to 10 cycles per minute, duration 1 to five seconds (On Time)

#### **On/Off Time Seconds**

0.5 to 90 seconds in half second increments On Time

1 to 240 seconds in one second increments Off Time

#### **On/Off Time Minutes**

10 to 240 Minutes (4 hours) in ten minute increments On Time

10 to 1440 Minutes (24 hours) in ten minute increments Off Time

#### **Quarts per Day, Liters per Day and Gallons per Day**

1 to 99 (may be limited by pump selection)

#### **Max Head Capacity**

Set Range is 12 to 99 Gallons

## Operation

- When the UPC powers on a quick self test is performed and pump motor type detection is performed and then it displays information about the operational settings.
- Pressing the ON/OFF key powers the UPC (Universal Pump Control) on and off.
- Pressing the SETUP key the UPC will prompt you with questions. You then use the up/down keys to select the answer and then press the enter key for selection. You can just press ENTER to select the currently displayed answer. One of the important questions which is critical is the Max Head Capacity. This is the amount of chemical that the pump is capable of pumping per day. This capacity is used for all rate calculations. Setting this parameter correctly will improve pump accuracy and adjustments to this allow you to hone in to an accurate rate. Watching the tank sight glass during a prime cycle allows you to determine the Max Head Capacity.
- Pressing and holding down the SETUP key for about 5 seconds will initiate a pump prime cycle, this is a 30 second continuous run of the pump. Pressing it again allows you to abort the prime cycle. If you are controlling a manifold, the prime cycle is run for each valve. The display will count down the time left until it resumes normal operation.
- Pressing the MODE key will allow you to cycle through different modes of operation. The display will display the operational mode and by then using the up/down keys allow selections of the other modes which are Cycles per Minute, On time/Off time in seconds, On time/Off time in Minutes, Quarts per day, Liters per Day, Gallons per day, Batch Control mode, Modbus operation, Manifold Control Quarts, Manifold control Time based, or 4-20mA loop controlled.
- If you press the RATE key it allows you to change the rate of the pump. For example, the number of Quarts or Gallons being pumped, or the On/Off Time. Always press the Enter key after your selection for the rate to take effect. Some rate changes will not take effect until the next cycle. The display indicates the system is operating.
- Anytime you select SETUP or MODE keys and entering information with the Enter key you will be prompted to enter a new rate. Also if you select the SETUP or MODE keys the pump will stop, and wait for you to enter information.
- Pressing the UP key while in normal operation causes the display to display the battery voltage (or if it is an AC pump it displays the internal power supply voltage).
- Pressing the DOWN key while in normal operation will display several types of information.
- The display always blanks out after a few minutes when no keys have been pressed. The first key press while there is a blanked display will bring the display back on. Note the green LED in the upper left corners flashes each second to let you know the UPC has power on. If you see the LED flash at a slower rate (2 SEC's) that indicates the pumping has stopped due to Temperature settings.

## Definitions of Terms in the Setup Menu

- Remote Contact-this indicates how the Status Input will be used
  1. Inhibit mode indicates that the input will stop pump operation if a contact closes.
  2. Status mode indicates this input is only for information for Modbus.
  3. Flow Switch Input indicates a flow switch is connected and passes Flow/No Flow information to Modbus.
- Max Head Capacity *is the amount of chemical that the pump set is capable of pumping per day.* This capacity is used for all rate calculations, but does not affect CpM or On/OFF modes. This number is based on the motor, plunger, stroke, head, etc. This can be determined by asking TXAM Pumps Personal or by running a prime cycle.
- Motor Speed, the DC motors speed may be adjusted to other than 100% to allow fine tuning of the chemical injection rate.
- Temperature control can be enabled or disabled (if it is enabled and the probe is unplugged the temperature control will be active until a temperature probe is detected).
- Multi Temperature enable allows for four different temperature set points with independent rates.
- On Temperature is the temperature that the pump will start operation.
- Off Temperature is the temperature that the pump will stop operation.
- Pre batch wetting time is a delay that allows a valve to open before starting a batch.
- Post batch flush time is a delay that allows a valve to open or close after a batch.
- Batch Delay to Start is the time delay before a batch treatment actually starts after power up.
- Battery Saver mode is a incremental rate cut back based on low battery voltage, to allow the pump to run for a longer amount of time as opposed to just stopping all operation. This feature is typically sought after as an addition and is a standard feature built-in.

**Note:** Setting motor speed is normally used to lower rates while running CpM or On/Off Time modes. When running in Quarts, Liters or Gallons, the motor should be set to 100%, unless you are fine tuning the pump rate. Anything other than 100% will cause the rate calculation mode to be off. Variable Speed settings are only available when using a DC motor. For AC applications you will need to source a VFD (Variable Frequency Drive) or use our DC motor with AC inverter.

The Display will ask prompting questions or provide information when keys are pressed and will guide you through operation.

***Always power off timer prior to any work on pump***

# UNIVERSAL PUMP CONTROL MAX HEAD CAPACITY CHART

## DC PUMP SELECTION

### HWP100- DC

HWP100- DC 1/4" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>7.7</b>

HWP100 3/8" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>17.2</b>

HBT1 3/16" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>8</b>
HBT1 1/4" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>15</b>
HBT1 3/8" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>32</b>
HBT1 1/2" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>53</b>

HBT2 3/16" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>13</b>
HBT2 1/4" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>23</b>
HBT2 3/8" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>50</b>
HBT2 1/2" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>90</b>
HBT2 1" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>320</b>

HBT3 3/16" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>11</b>
HBT3 1/4" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>17</b>
HBT3 3/8" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>36</b>
HBT3 1/2" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>63</b>
HBT3 1" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>248</b>

HBTEXP-DC 3/16" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>12</b>
HBTEXP-DC 1/4" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>21</b>
HBTEXP-DC 3/8" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>48</b>
HBTEXP-DC 1/2" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>86</b>
HBTEXP-DC 1" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>305</b>

HBTEXP-BLDC 3/16" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>13</b>
HBTEXP-BLDC 1/4" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>25</b>
HBTEXP-BLDC 3/8" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>52</b>
HBTEXP-BLDC 1/2" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>93</b>
HBTEXP-BLDC 1" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>325</b>

## AC PUMP SELECTION

### HWP100- AC

HWP100- AC 1/4" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>11.5</b>

HWP100 3/8" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>25.9</b>

HBT2-AC 3/16" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>12</b>
HBT2-AC 1/4" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>21</b>
HBT2-AC 3/8" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>47</b>
HBT2-AC 1/2" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>85</b>

HBT2-AC Inverted 3/16" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>13</b>
HBT2-AC Inverted 1/4" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>25</b>
HBT2-AC Inverted 3/8" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>53</b>
HBT2-AC Inverted 1/2" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>92</b>
HBT2-AC Inverted 1" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>325</b>

HBT3-AC Inverted 3/16" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>12</b>
HBT3-AC Inverted 1/4" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>19</b>
HBT3-AC Inverted 3/8" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>41</b>
HBT3-AC Inverted 1/2" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>74</b>
HBT3-AC Inverted 1" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>251</b>

HBTEXP-AC 3/16" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>13</b>
HBTEXP-AC 1/4" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>22</b>
HBTEXP-AC 3/8" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>48</b>
HBTEXP-AC 1/2" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>87</b>
HBTEXP-AC 1" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>305</b>

HBTEXP-AC-IGB 3/16" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>13</b>
HBTEXP-AC-IGB 1/4" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>22</b>
HBTEXP-AC-IGB 3/8" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>47</b>
HBTEXP-AC-IGB 1/2" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>86</b>
HBTEXP-AC-IGB 1" MAX GPD		PSI
Control Setting		0
<b>MAX</b>		<b>300</b>

## TXAM Pumps Universal Pump Control Modbus Registers - ver1.00

Register		Example	Data Information	Comments
				0xnn indicates hex number, nn indicate decimal number(unsigned)
<b>Control Coils - Function code 05</b>				
00000	Pump On/Off	0xff00	Turn Pump ON = 0xff00 and OFF=0000 (hex)standard modbus	Coil 1 controls the pump ON and OFF (note: before 1st control works must write pump type and value)
<b>Discrete Inputs - Function code 02</b>				
10000	Temperature Status-COLD	1	Temp sensor status for below 32 degrees	0 = Above 32 degrees, 1 = Below 32 Degrees
10001	System is turned on --Running	0	System run status--requested to be on/off	0 = System halted, 1 = System Running
10002	Initialization complete	1	System up and running- has completed initialization	0 = Not Initialized, 1 = OK
10003	Battery Voltage OK	1	Battery above is 10.8 volts	0 = Low Battery, 1 = Battery OK
10004	Temperature inhibit	0	Temperature not stopping operation- system within limits	0 = Temperature in Operating Range, 1 = Outside Temperature SetPoints
10005	Voltage Cutback	1	Voltage getting low	0 = Voltage OK, 1 = Battery Low Running in Cutback Operation
10006	Temperature Probe Fault	1	Temperature Probe status	0 = Probe working, 1 = Probe fault-not connected
10007	Invalid modbus mode	1	Modbus has sent an invalid operational mode	0 = Modbus Data Valid, 1 = modbus set invalid operational mode
<b>Holding Registers - function code 06 (03 for read)</b>				
				<b>Readback is in upper byte after set</b>
40000	Timer Mode--Type of operation	0x0000	Strokes per 2 minute operation = 00	Operational mode 00 = CpM 1 = on/off secs, 2 = on/off minutes, see below
40001	Run setpoint value	0x0205	2 cycles per minute and each cycle is 5 seconds	1-10 cycles, 1 to 5 seconds on time, see below for other ranges
40002	Not Used	0		
40003	Temperature Set Point	60	Set Temperature set point Hi=60°F (OFF temperature)	Range 30 to 90 F (if you read this register bytes are swapped)
40004	Temperature Set Point	30	Set Temperature set point Low=30°F (ON Temperature)	Range 30 to 90 F (recommend read setpoints using Reg 30010 and 30011)
40005	Temperature Enable / Disable	1	Temperature Control Enable or Disable	0 = Disable, 1 = Enable Temperature Control (any non zero = enable)
40006	Alternate to 40001 lower byte	05	Cycle <b>On-Time</b> 5 seconds	
40007	Alternate to 40001 upper byte	02	2 Cycles per Minute	
			NOTE: for proper operation the high (OFF) temperature Should be 4 degrees higher than the Low temperature	
<b>Input Registers - function code 04</b>				
30000	External Input-Status	0x0001	External Contact - Status Input	current Status input state 0 = open, 1 = closed
30001	External Input-Flow Switch	0x0001	External Contact - Flow input (flow fault status)	0 = flow OK, 1 = no flow for 10 minutes
30002	Heat Sink Over Temperature	0x0001	BLDC heat sink too hot	0 = temperature OK, 1 = too hot
30003	Spare	0x0003	Unused	Always set to 3
30004	Software Version_Base	0x0010	ver 1.0 (version number in low byte)	Used for Internal Houskeeping functions
30005	Analog Input	164	Analog Input on Terminal Block 164 = 4ma, 819 = 20ma	Raw A/D reading
30006	Motor Amps	121	Motor Current--DC Motor ONLY 12.1 amps	Value x 0.1 this reading is only available on DC motor
30007	Software Version_Control	100	ver 1.00 (version number in low byte)	Used for Internal Houskeeping functions
30008	Battery Voltage	126	Battery Voltage = 12.6 i.e. incoming value x 0.1	Range 8 to 20 volt
30009	Temperature Sensor	0077	Temperature Value is 77 degrees F	Range 32 to +158 F
30010	Temperature High set point	0060	Temperature OFF Set Point Hi=60°F	Range 20 to 70 F
30011	Temperature Low set point	0020	Temperature ON Set Point Lo=20°F	Range 20 to 70 F
30012	Head Capacity	0050	Setting for Maximum Pump Rate	Range 15 to 100 gallons per day
30013	UPM Pump Type	0001	Board ID	0= DC, 1 = AC, 2 = Brushless
30014	Speed Setting	0050	Motor Speed speed = 50%	Range 2 to 100
30015	Spare	0015	Unused	Always set to 15 (0x000F)
			<b>Modes of Operation</b>	<b>Settable Range</b>
			0 = Cycles per Minute	1 to 10 Cycles, 1 to 5 Second On Timer Each Cycle
			1 = On time Off time in Seconds	On Time 1 to 180, Off Time 1 to 240 (each count is 1/2 second)
			2 = On time Off time in Minutes	On Time 1 to 240 minutes, off time 1 to 1440 minutes
			3 = Quarts per Day	1 to 99 Quarts
			4 = Liters per Day	1 to 99 Liters
			5 = Gallons per Day	1 to 90 Gallons
			6 = Batch Mode	1 to 100 Quarts, 1 to 30 days delay until next batch operation

## Valve Control Board (VCBg)

The Valve Control Board controls eight Solenoids for valve/manifold control. It may be controlled either by the Universal Pump Control or by a Modbus master. It controls up to eight valves.

When all valves are closed the LED flashes fast, if any valve is open the LED flashes each second.

When power is applied to the VCB (12V) all valves are closed, if you install a jumper from IN1 to Gnd on terminal block TB2 the VCB will power up and open valve 1. Terminal block TB1 is the connections for the control commands that come from either the Universal Pump Control or Modbus.

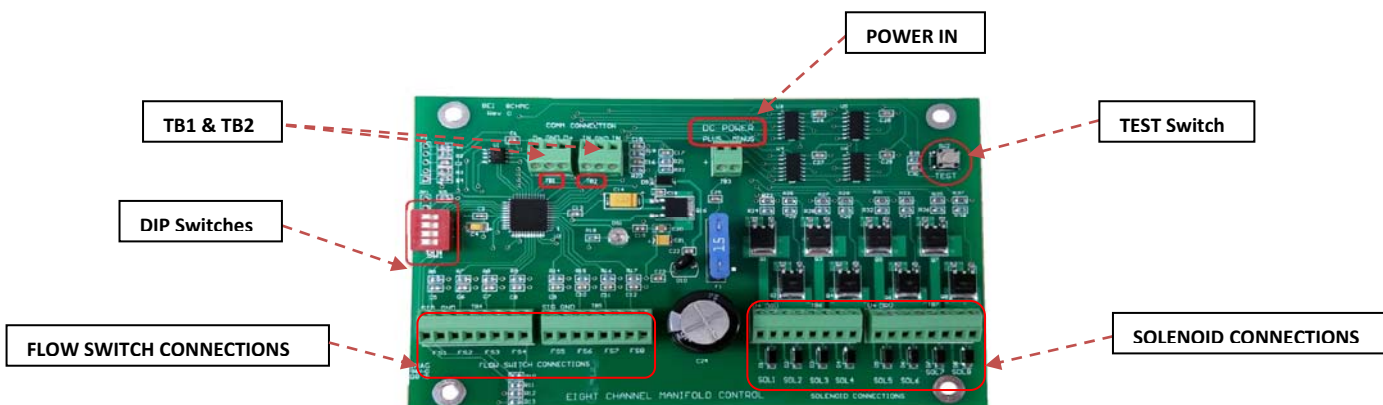
***To operate with Universal Pump Control, all the DIP Switches on the board must be OFF.***

### Modbus Control Mode

- Close Switch # 4 for use with Modbus.
- Switches 1, 2, 3 will set the Modbus Slave Address from 40 to 47.
- Modbus Controls Valves 1 to 8, Modbus will Write Coils 1 to 8.
  - Coil ON = Valve Open
  - Coil OFF = Valve Closed.

### Valve Control Board Test Switch

Pressing the test button in the upper right-hand corner of the VCB will allow each valve to open for two *seconds*, starting with valve 1, then valve 2, and so on in sequence. Once the manifold has cycled through all eight valves the test is over. If necessary, you may repeat this test as desired.





## Universal Pump Control (UPC)

The display will automatically blank out after a few minutes without any keys being pressed. If the display blanks out, momentarily press the Setup key to light the display.

## Operational Mode Selection

There are two modes of operation that will control a manifold. To select an operation to control the manifold press the mode key and then use the up/down keys to select either Manifold Quarts/Day or Manifold Timed Based (and then press the enter key).

When using the Valve Control Board, be sure that you select the Setup key and answer the prompted questions. **A very important question is the Max Head Capacity;** this is the total volume the pump head is capable of pumping each day if it were to run continuously (*see max head capacity chart and choose your pump model & head size*). Answering the question properly based on the Max Head Capacity chart provided will determine the accuracy of the Quarts/Day. This calculation is always used when you are in the **Manifold Quarts/Day Mode**.

The pump will only run only when a valve is open, the pump momentarily turns off as one valve closes and restarts when the next valve opens. This is typically about half a second.

## Manifold Time Based Mode

Manifold Time Based allows you to enter the amount of time each solenoid (valve) will be opened. The valves are numbered 1 to 8, you will be prompted to select an ON Time (valve open and pump run time) for each valve. This time has a range from 0 to 60 *seconds*. (*Zero (0) means skip the valve*). You will be prompted for an off time with a range of 0 to 120 *seconds*. This is the delay time after valves #8 closes and before reopening valve number 1. This is the time when no valve is open and before the cycle starts over.

## Manifold Quarts/Day Mode

Manifold Quarts/Day allows you to set the amount of quarts you want to pump from each line (valve) each day. The range is 0 to 24 quarts. If zero is set it means this valve will not be used. If the total quarts (combination of all eight settings) is more than the pump is capable of pumping, a message will appear on the screen requesting you re-enter new rates.

**NOTE:** To run a Prime Cycle, hold down the Setup key for 4 or more *seconds* and then release it. The way a prime cycle works with manifold control is that each valve will open in sequence (1 to 8) and the pump will run for 30 *seconds* with each valve, it then repeats for each valve. If you press the Setup key while in a prime cycle, it will end the time period for the open valve and cycle to the next valve.