



TSP 600N
Pump Controller
Field Manual

V3.0

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Table of Contents

- Home Screens** 4
- Accessing the Menus** 4
- Figure 1** 4
- Stroke Counting** 5
 - Current Stroke Sensor (CSS) Calibration 5
 - PEPPS Calibration (external stroke counter)..... 5
 - Lost Strokes..... 6
- Stroke Calibration**..... 6
- Modes of Operation** 7
 - QPD Mode..... 7
 - PROFLO Mode 7
 - H2S Mode..... 7
 - Dynamic Temperature Control Mode..... 7
 - Timer Mode..... 7
- Quick Menu** 8
 - Prime Pump..... 8
 - Change QPD 8
 - Change PPM 8
 - Turn on Dynamic Temp Control..... 8
- Setup Menu** 8
 - Select STROKE/TIMER mode 8
 - Select QPD/PRO mode 8
 - Setup Dynamic Temperature Control 8
 - Setup Timer 8
 - Setup SCADA 485 COMMS 9
 - Setup SCADA TCP COMMS..... 9
 - Setup TIME/DATE..... 9
 - Setup Batch Control 9
 - Setup Tank Level 9
 - Setup Change Password..... 9
 - Setup Sensor Configuration 10

Setup Auto or Fixed Group	10
Setup DESTROKE	10
MODBUS INTERFACE	11
Wiring Diagram.....	14
Appendix.....	15
Modbus Information.....	15
Rate Check Procedure.....	15
Lost Stroke Alert (continued).....	15

Press power button  to turn the controller on. To power down, hold the power button for 3 seconds.

Home Screens

Home Screen 1 – This is the default home screen which gives general information such as tank level, temperature, battery level, etc.

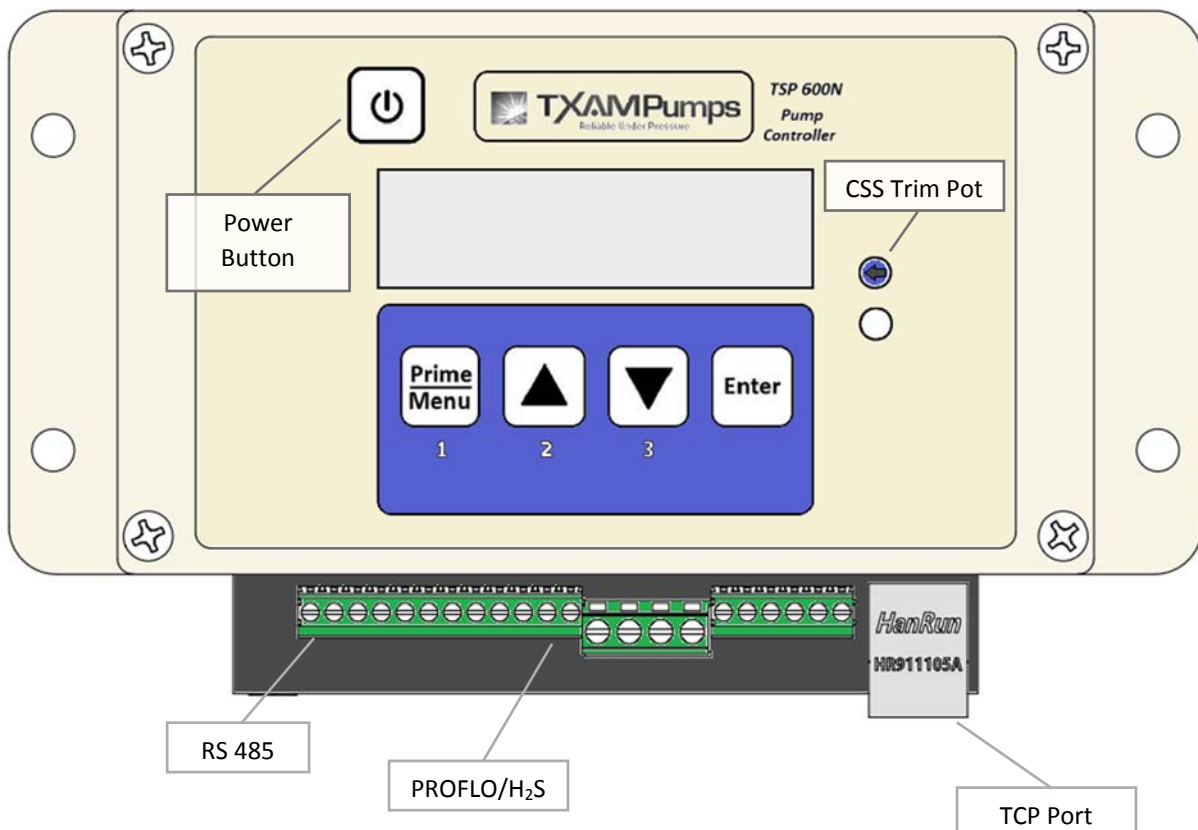
Home Screen 2 – Scroll down once to access this screen. This screen gives time/date and pumping activity including number of strokes per group and number of second per group.

Home Screen 3 – Scroll down twice to access this screen. This screen gives rate information in the various operation modes

Accessing the Menus

There are two menus used in the TSP 600N for setup and adjustments; the “Quick Menu” and the “Setup Menu”. To access the Quick Menu, press the “Prime/Menu” button once. To access the Setup Menu, press and hold the “Prime/Menu” button for 3 seconds. Use the \uparrow and \downarrow buttons to scroll through the menus.

Figure 1



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Stroke Counting

The TSP 600N utilizes stroke counting rather than time based control (i.e. cycles and duration settings) to maintain rates, with a timer mode as an emergency mode of operation. During the initial installation, TSP 600N is calibrated for a “quarts per stroke” (QPS) value and delivers groups of a set number of strokes to achieve the target rate or injection. Utilizing stroke counting, as opposed to time based control, the TSP 600N has a virtual flow meter since the volume of each stroke is known.

The TSP 600N counts stroke using one of two stroke counters; the on board current stroke sensor (CSS) or an inductive sensor installed on the pump housing plate (PEPPS).

Current Stroke Sensor (CSS) Calibration

The current stroke sensor is able to count strokes by sensing current spikes from the pump motor during discharge strokes. Due to differences in the amp ratings of TXAM’s pump motors, small adjustments need to be made to the stroke sensor amplification trim pot in order to distinguish each stroke (see Figure 1 on page 4). This is done with a small “electronics” flathead screwdriver.

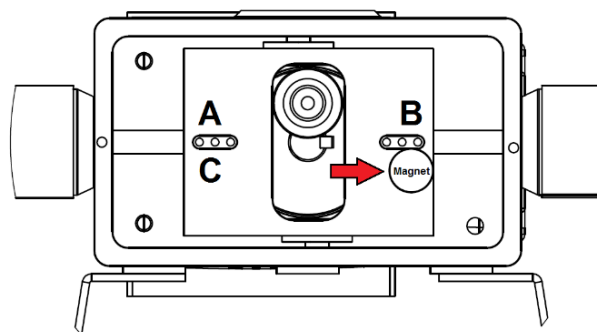
During the motorspeed test¹, start with the stroke sensing amplification trim pot turned all the way counter-clockwise. Next, slowly turn the trim pot clockwise until the TSP 600N begins to register strokes. The goal in the motorspeed portion of the calibration procedure is to achieve 8 strokes per group. If more than 8 strokes are observed, make small clockwise adjustments to the trim pot until 8 strokes are observed. If less than 8 strokes are observed, make small counter-clockwise adjustments to the trim pot until 8 strokes are observed.²

Additional adjustments to the trim pot may be required during the QPS calibration and/or the normal operating mode (i.e. if at 20 QPD the TSP 600N is supposed to give 3 strokes per group, but is giving 2 strokes per group, small counter-clockwise adjustment should correct it.).

PEPPS Calibration (external stroke counter)

When using an external stroke counter (mostly AC and BLDC applications), no calibration of the CSS is required. The provided inductive sensor senses when a magnet (provided with the inductive sensor) on the plunger block passes, representing 1 stroke. **Note – Dual head applications:** Since one cycle of the plunger block gives 2 strokes, the inductive sensor will interpret 2 strokes as one.

To set up an external stroke counter, start by positioning the magnet so that it is flush with the outside edge of the plunger block and the edge of the roll pin hole. Position magnet in the location correlated with the location of the pre drilled hole on the pump housing plate (i.e. location A, B, C, or in fig 2). Next, install the supplied inductive sensor so that there is 2-4 mm of clearance between the inductive sensor and the magnet. The inductive sensor light will illuminate when the magnet passes.



¹ Step 11 of the Stroke Calibration procedures on page 6.

² In low pressure applications utilizing a double head HBT2, the destroke function may need to be enabled.

Lost Strokes

When the TSP 600N fails to register strokes, it gives a “LOST STROKE” alert. During this condition, the TSP 600N will go into simulation mode³ which controls the pump in a time based manner so that pump operation continues. Conditions which cause the TSP 600N to not sense strokes include (but not limited to) motor failure, broken motor wire, pump failure, pump air-lock (see next paragraph), or inductive sensor failure.

The CSS senses spikes in current due to an increased load on the motor during the discharge strokes. An increase in injection pressure will give a greater current spike, thus, less stroke sensor amplification trim pot adjustment is needed. When the pump is air-locked, current spikes are smaller than normal and the TSP 600N does not sense current spikes, thus, it doesn’t sense pump strokes. **Not all pump applications will give a lost stroke alert when the pump is air locked**⁴. In some lower pressure applications, the stroke sensor amplification trim pot must be turned up to a point which the TSP 600N will sense current spikes in an air-lock condition. This is a result of little to no increase in current spikes normally achieved with higher injection pressures.

Stroke Calibration

1. Access the Setup Menu
2. Select “Setup Stroke Calibration” → press ENTER (this is the 1st item in the Setup Menu)
3. Scroll to “Calibrate Y” → press ENTER
4. Set PUMP head “Fullstroke⁵” → press ENTER
5. Select “CSS” (Current Stroke Sensor) or “PEPPS” (External Stroke Counter) → press ENTER
6. If using CSS, proceed to step 9. If using PEPPS, proceed to step 7.
7. Set pulse/stroke to 0001 → press ENTER
8. When a consistent MOTORSPEED is given, press ENTER (Proceed to step 12)
9. Pump type “Y/N” → press ENTER
10. If Y, select pump → press ENTER
11. Adjust CSS so that pump gives 8 strokes in each group.
12. Select # of strokes to calibrate with → press ENTER⁶
13. Setup tank manifold so that the pump will draw down from the sight glass and press ENTER when ready. The pump will draw down from the sight glass.
*Perform this step multiple times to get a consistent measurement. To repeat the draw down, press “Prime/Menu” to go back, and follow the steps on the controller.
14. When a consistent number of graduations is observed, enter the number of graduations observed and press ENTER
15. Record QPS → press ENTER
16. Press ENTER to exit.

³ Use Modbus register 40060 for alarms

⁴ See Appendix for applications which may not give a lost stroke alert when the pump is air locked.

⁵ Fullstroke is used in most applications. Halfstroke is used when there are 2 chemicals, one going to each head.

⁶ More strokes will give a more accurate calibration

Modes of Operation

QPD Mode

In this mode, the controller will hold a QPD (quarts per day) set point which the operator selects either locally or via Modbus communications. To set up this mode, follow the instructions below:

1. Perform stroke calibration procedures
2. Select QPD mode (set up menu)
3. Set QPD (quick menu)

PROFLO Mode

In this mode, the controller will have a dynamic QPD injection rate based on the production flow rate via a 4-20 mA signal and a PPM set point set by the operator. The production flow rate and the QPD injection rate can be read locally or via Modbus. The PPM set point can be read and controlled locally and via Modbus. To set up this mode, follow the instructions below:

1. Perform stroke calibration procedures
2. Set up PROFLOW signal in the sensor configuration steps (set up menu)
3. Select PRO mode (set up menu)
4. Set PPM (quick menu)

H2S Mode

In this mode, the controller will have a dynamic QPD injection rate based on the presence of H2S via a 4-20 mA signal, and a max QPD set by the operator. The min PPM will be represented by the 4 mA (0% of max QPD) and the max PPM will be represented by a 20 mA signal (100% of max QPD). The Injection rate will be a linear curve from min to max. The H2S PPM and the QPD injection rate can be read locally or via Modbus. The max QPD set point can be read

and controlled locally and via Modbus. To set up this mode, follow the instructions below:

1. Perform stroke calibration procedures
2. Set up PROFLOW (H2S) signal in the sensor configuration steps (set up menu)
3. Select PRO mode (set up menu)
4. Set QPD (quick menu)

Dynamic Temperature Control Mode

In this mode, the controller will have a dynamic QPD injection rate based on the ambient temperature, and a max QPD set by the operator. The Injection rate will be a linear curve from max temperature to min temperature set points. The temperature and dynamic QPD injection rate can be read locally or via Modbus. The max QPD set point and min and max temp set points can be read and controlled locally and via Modbus. To set up this mode, follow the instructions below:

1. Perform stroke calibration procedures
2. Set up dynamic temp control parameters (set up menu)
3. Select QPD mode (set up menu)
4. Enable Dynamic Temp Control (quick menu)
5. Set QPD (quick menu)

Timer Mode

In this mode, the controller operates as a basic timer. Timer set points can be read and changed locally or via Modbus. To set up this mode, follow the instructions below:

1. Set up timer (set up menu)
2. Select timer mode (set up menu)

Quick Menu

Prime Pump

1. Access the Quick Menu
1. Scroll to Prime Pump → press ENTER
2. Press ENTER to start
3. Press ENTER to Stop
4. Press Prime/Menu to Exit

Change QPD

1. Access the Quick Menu
2. Scroll to QPD Change → press ENTER
3. Select desired QPD → press ENTER

Change PPM

1. Access the Quick Menu
2. Scroll to PPM Change → press ENTER
3. Select desired PPM → press ENTER

Turn on Dynamic Temp Control

1. Access the Quick Menu
2. Scroll to Dynamic Temp ON/OFF Change → press ENTER
3. Select desired QPD → press ENTER
4. Use arrows to select ON or OFF → press ENTER

Setup Menu

Select STROKE/TIMER mode

1. Access the Setup Menu
2. Scroll to “SET STROKE/TIMER”
3. Press ENTER to select between modes (the mode displayed is the current mode of operation)
4. Press PRIME/MENU to exit

Select QPD/PRO mode

1. Access the Setup Menu
2. Scroll to “QPD or PRO MODE”
3. Press ENTER to select between modes (the mode displayed is the current mode of operation)
4. Press PRIME/MENU to exit

*Setup PRO MODE in “Setup Sensor Configuration” menu

Setup Dynamic Temperature Control

1. Access the Setup Menu
2. Scroll to “Setup DYNAMIC Temp Control” → press ENTER
3. Select high end value (“0 above”) → press ENTER
4. Select low end value (“100 below”) → press ENTER
5. Activate dynamic temperature control and set QPD for low end value in the quick menu.⁷

Setup Timer

1. Access the Setup Menu
2. Scroll to “Setup TIMER” → press ENTER
6. Select cycles per minute → press ENTER
3. Select minutes per cycle → press ENTER

⁷ The QPD will scale 100% to 0% with a linear curve from the low end temp value to the high end temp value.

Setup SCADA 485 COMMS

1. Access the Setup Menu
 2. Scroll to "Setup SCADA 485 COMMS" → press ENTER
 3. Select Modbus address → press ENTER
 4. Select baud rate → press ENTER
 5. Select parity → press ENTER
 6. Select stop bits → press ENTER
- *TSP 600N automatically reboots after SCADA settings are set

Setup SCADA TCP COMMS

1. Access the Setup Menu
2. Scroll to "Setup SCADA TCP COMMS" → press ENTER
3. Select Modbus address → press ENTER
4. Select IP address → press ENTER
5. Select port → press ENTER

Setup TIME/DATE⁸

1. Access the Setup Menu
2. Scroll to "Setup TIME/DATE" → press ENTER
3. Select Date → press ENTER
4. Select Time → press ENTER

Setup Batch Control

1. Access the Setup Menu
2. Scroll to "Setup BATCH Control" → press ENTER
3. Select Start Time → press ENTER
4. Select active period → press ENTER
5. Select inactive period → press ENTER
6. Use arrows to select "Batch Active" or "Batch Inactive" → press ENTER

Setup Tank Level

1. Access the Setup Menu
2. Scroll to "Setup Tank Level" → press ENTER
3. Select Specific Gravity → press ENTER
4. Select Dead Height → press ENTER

Setup Change Password⁹

1. Access the Setup Menu
2. Scroll to "Setup Change Password" → press ENTER
3. Enter password → press ENTER
4. Re-enter password → press ENTER

⁸ Time and Date must be reset after controller has been turned off for extended periods of time.

⁹ If no password is desired, simply enter nothing in steps 3 and 4

Setup Sensor Configuration

1. Access the Setup Menu
2. Scroll to "Setup Sensor Configuration" → press ENTER
3. Scroll to desired sensor to configure → press ENTER

Three types of sensors are able to be configured in this menu (temperature, tank level, and PROFLO/H₂S). If a supplied (std) sensor is selected for the temperature and/or tank sensors, no configuration is required after "standard" is selected.

Temperature Sensor (Other)

1. Select standard/other → press ENTER
2. Select 4 mA temp → press ENTER
3. Select 20 mA temp → press ENTER
4. To calibrate 4-20 mA signal, select YES → press ENTER
5. Inject 4 mA signal → press ENTER
6. Inject 20 mA signal → press ENTER
7. Save calibration values → press ENTER

Tank Level Sensor (Other)

1. Select standard/other → press ENTER
2. Ensure pressure sensor is disconnected from manifold (0 PSI) for "LOW Signal" → press ENTER
3. Enter 0.0 for low inches → press ENTER
4. Connect pressure sensor to manifold for HIGH signal → press ENTER
5. Enter tank level for high inches¹⁰ → press ENTER

¹⁰ Measure from the level of the pressure sensor to the top of the product level.

¹¹ Use "fixed group" feature to assign a fixed number of strokes per group.

PROFLO

1. Select PROFLO (FLOW) → press ENTER
2. Enter minimum bbl → press ENTER
3. Enter maximum bbl → press ENTER
4. Enter update rate → press ENTER
5. To calibrate signal select yes → press ENTER
6. Inject 4 mA signal → press ENTER
7. Inject 20 mA signal → press ENTER
8. Cal signal ok? Yes → press ENTER

H2S

1. Select PROFLO (H₂S) → press ENTER
2. Enter minimum ppm → press ENTER
3. Enter maximum ppm → press ENTER
4. Enter update rate → press ENTER
5. To calibrate signal select yes → press ENTER
6. Inject 4 mA signal → press ENTER
7. Inject 20 mA signal → press ENTER
8. Cal signal ok? Yes → press ENTER

Setup Auto or Fixed Group¹¹

1. Access the Setup Menu
2. Scroll to "Setup AUTO or FIXGRP" → press ENTER
3. Select Y → press ENTER
4. Use arrows to select Auto or fixed group → press ENTER
5. If FIXGRP selected, select number of strokes per group desired → press ENTER

Setup DESTROKE¹²

1. Access the Setup Menu
2. Scroll to "Setup DESTROKE" → ENTER
3. Use arrows to select ON or OFF → ENTER

¹² Used in low pressure applications utilizing a double head HBT2. For more information, contact a TXAM automation representative.

MODBUS INTERFACE¹³

Register	Data Type	Access	Description	Units	Range
40001	Bit	Read	Bad Write Value	N/A	N/A
40001.1	Bit	Read	Reserved	N/A	N/A
40001.2	Bit	Read	Simulation ON (Lost Strokes) ¹⁴	N/A	0=OFF 1=ON
40001.3	Bit	Read	Pump ON	N/A	0=OFF 1=ON
40001.4	Bit	Read	Stroke Counter (PEPPS uses external sensor)		0=CSS 1=PEPPS
40001.5	Bit	Read	BATCH		0=BATCH INACTIVE 1=ACTIVE
40001.6	Bit	Read	PROTEMP Mode	N/A	0=OFF 1=ON
40001.7	Bit	Read	Fullstroke/Halfstroke	N/A	0=Fullstroke 1=Halfstroke
40001.8	Bit	Read	Temperature Sensor Bad	N/A	0=Good 1=Bad
40001.9	Bit	Read	(Not used)	N/A	(Normal value "1")
40001.10	Bit	Read	(Not used)	N/A	(Normal value "1")
...
40002	Bit	Read	PROTEMP Active and Pumping	N/A	0=Inactive 1=Active
40002.1	Bit	Read	reserved	N/A	N/A
40002.2	Bit	Read	Low Voltage Alarm (See register 40084)	N/A	0=Inactive 1=Active
...
40003	Signed Int	Read	System Time, Year	Year	0001-4000
40004	Signed Int	Read	System Time, Month	Month	1-12
40005	Signed Int	Read	System Time, Day	Day	1-31
40006	Signed Int	Read	System Time, Hour	Hour	0-23
40007	Signed Int	Read	System Time, Minute	Minute	0-59
40008	Signed Int	Read	System Time, Second	Second	0-59
...
40017	Signed Int	Read	PROFLO Signal Status ("Low Signal" represents no production flow)	N/A	0=OK (4-20ma) 1=High Signal (>20mA) 2=Low Signal (3-4mA) 3=Sig lost (<3mA)

¹³ See Appendix for detailed Modbus information

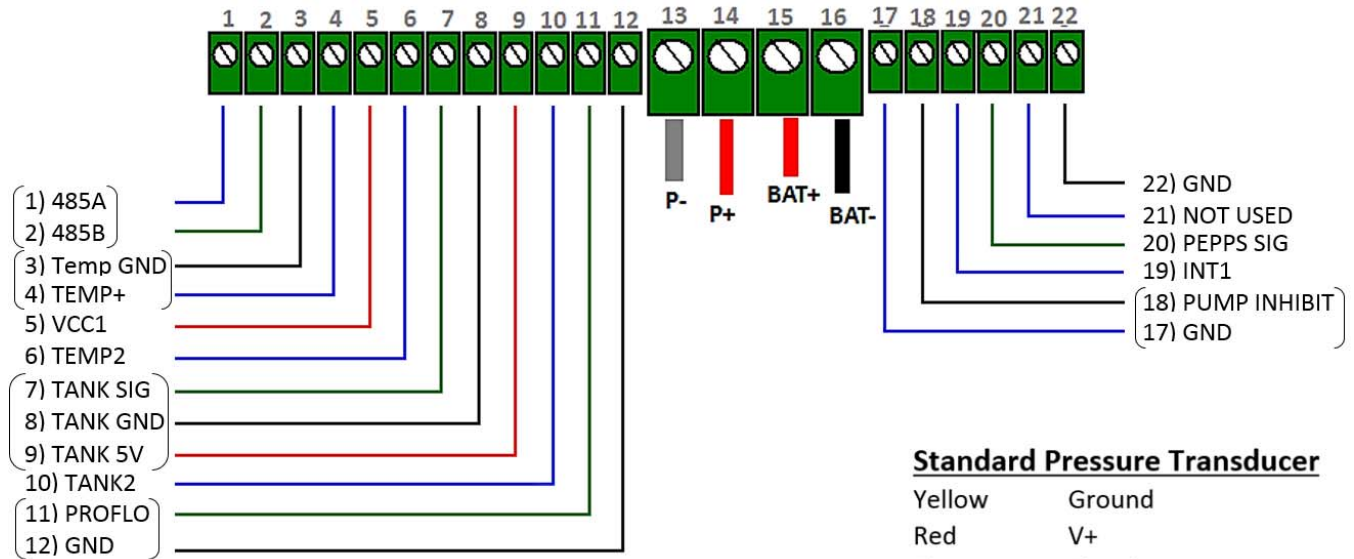
¹⁴ This bit comes on intermittently when the pump is stroking

40018	Signed Int	Read	Dynamic Temp % QPD	Percent	0-100
40019	Signed Int	Read	Pump Delivery mode (Use this register as a mode status)		1=QPD 2=PROFLO 3=H2S 4=TIMER
40020	Signed Int	Read	PROH2S Signal Status ("Low Signal" represents no H2S presence)	N/A	0=OK (4-20ma) 1=High Signal (>20mA) 2=Low Signal (3-4mA) 3=Sig lost (<3mA)
40021	Signed Int	Read	PROTEMP Signal Status ("OTHER" sensor)	N/A	0=OK (4-20ma) 1=High Signal (>20mA) 2=Low Signal (3-4mA) 3=Sig lost (<3mA)
40022	Signed Int	Read	Tank level Signal Status ("OTHER" sensor)	N/A	0=OK (4-20ma) 1=High Signal (>20mA) 2=Low Signal (3-4mA) 3=Sig lost (<3mA)
...
40030	Float	Read	Temperature	Fahrenheit	0-100
40032	Float	Read	Actual Input Voltage	VDC	0-100
40034	Float	Read	Minimum Input Voltage (since midnight)	VDC	0-100
40036	Float	Read	Quarts Stroked Previous Day	Quarts	32768
40038	Float	Read	Quarts Stroked Today	Quarts	32768
40040	Float	Read	Total Pump Strokes	Whole number	...
40042	Float	Read	MOTORSPEED	Seconds/stroke	0-100
40044	Float	Read	Pump Stroke Volume	Quarts/ Stroke	0-1
...
40048	Float	Read	Production flow rate (PROFLO)	bbl/day	n/a
40050	Float	Read	QPD	Quarts Per Day	0-32768
40052	Float	Read	Tank level (standard sensor)	Inches	0-200
40054	Float	R/W	Tank Specific Gravity (std. sensor)	constant	0-2.0
40056	Float	R/W	Tank Dead Height (std. sensor)	Inches	-6 to +6
40058	Float	Read	Tank level ("other" sensor)	Inches	0-200
40060	Signed Int	R/W	Pump Operation Mode (Use this register to change modes)	Mode	1=QPD 2=Timer 3=PROFLO/H2S 9=Simulation ¹⁵
40061	Signed Int	R/W	Timer Mode (seconds)	Seconds/cycle	0-60
40062	Signed Int	R/W	Timer Mode (cycles)	Cycles/minute	1-10
40063	Signed Int	R/W	Reserved	N/A	N/A

¹⁵ See Page 6 for explanation of Simulation Mode

40064	Signed Int	R/W	Special Register (DO NOT USE)	Boolean	N/A
40065	Signed Int	R/W	Temperature Control Enabled	N/A	0=Disabled 1=ARMED
...
40067	Signed Int	R/W	Batch Active Minutes	Minutes	
40068	Signed Int	R/W	Batch Inactive Minutes	Minutes	
...
40070	Signed Int	R/W	Dynamic Temp LOW Temp set point 100%	Fahrenheit	-100 to +100
40071	Signed Int	R/W	Dynamic Temp HIGH Temp set point 0%	Fahrenheit	-100 to +100
...
40073	Signed Int	R/W	System Time, Year	Year	0001-9999
40074	Signed Int	R/W	System Time, Month	Month	1-12
40075	Signed Int	R/W	System Time, Day	Day	1-31
40076	Signed Int	R/W	System Time, Hour	Hour	0-23
40077	Signed Int	R/W	System Time, Minute	Minute	0-59
40078	Signed Int	R/W	System Time, Second	Second	0-59
40079	Signed Int	R/W	Enable Set Time	N/A	0=Disabled 1=Enabled
40080	Float	R/W	Quarts/Day Set point	Quarts/Day	0-32768
40082	Float	R/W	Pump Stroke Volume	Quarts/ Stroke	0-1
40084	Float	R/W	Low Voltage set point to turn off pump	VDC	0-100
40086	Float	R/W	PROFLO PPM	PPM	N/A
40088	Float	R/W	PROFLO - bbl at 4 mA	bbl	0-999999
40090	Float	R/W	PROFLO - bbl at 20 mA	bbl	0-999999
40092	...	R/W	Reserved
40094	Float	Read	PROH2S - Current H2S PPM	H2S PPM	0-999999
40096	Float	Read	PROH2S - Min PPM (4mA)	PPM	0-999999
40098	Float	Read	PROH2S - Max PPM (20 mA)	PPM	0-999999

Wiring Diagram



- Temp 2 (4-20mA): 12V+ / TEMP2 (6)
- Tank 2 (4-20mA): 12V+ / TANK2 (10)
- PEPPS Sensor: GND (22) / PEPPS SIG (20) / 12V+

Appendix

Modbus Information

The TSP 600N operates utilizing either RS485 or TCP/IP (RTU) protocol. The slave ID, baud rate, parity, and stop bits are user selectable during installation. When using TCP/IP (RTU), the user will enter the IP address for the unit. This unit also follows PLC addressing, requiring an offset by one¹⁶.

To set the time and date via Modbus, first send a "1" to register 40079 to enable set time. Then proceed to setting the date and time in each respective register (073-078). Finish by sending a "0" to 40079 to disable set time.

Rate Check Procedure

Since the TSP 600N operates based on stroke counting, the stroke groups are not delivered in a 60 second intervals. Therefore, a standard 60 second rate check is not accurate. For example, the pump may give 3 strokes every 23 seconds. This would either give 2 groups in 46 seconds (23x2=46) or 3 groups in 69 seconds (23x3=69). The seconds per group can be found on home screen 2. You will see a countdown timer on home screen 2, on the second row, on the right side of the row. In order to get an accurate rate check, the total time tested needs to be factored in. To do so, multiply 60 by the number of graduations the chemical was drawn down in the sight glass, then divide by the total time tested (number of groups times the number of seconds per group).

Example using the numbers from above:

(60 x total graduations) / (number of stroke groups x seconds per group) = QPD rate

$$(60 \times 9) / (3 \times 23) = \text{QPD RATE}$$

$$(540) / (69) = \text{QPD RATE}$$

$$7.83 = \text{QPD RATE}$$

Lost Stroke Alert (continued)

Applications which may not give a lost stroke alert when the pump is air locked include (but are not limited to):

- HBT1 - ¼" double head (<500 PSI)
- HBT1 - ⅜" double head (<250 PSI)
- HBT2 - ¼" single head (<500 PSI)
- HBT2 - ⅜" single head (<250 PSI)
- HBT2 - ½" single head (<150 PSI)
- HBT2 - ¼" double head (<500 PSI)
- HBT2 - ⅜" double head (<500 PSI)
- HBT2 - ½" double head (<250 PSI)
- HBT3 - ¼" single head (<1000 PSI)
- HBT3 - ⅜" single head (<1000 PSI)
- HBT3 - ½" single head (<500 PSI)
- HBT3 - ¼" double head (<1000 PSI)
- HBT3 - ⅜" double head (<500 PSI)
- HBT3 - ½" double head (<250 PSI)

¹⁶ Some PLC software automatically offsets registers



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