EquipSolutions™

Tempest 2.0

Operation Manual & Programming Guide

Tempest
Liquid Polymer Feed System
2.0

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Introduction

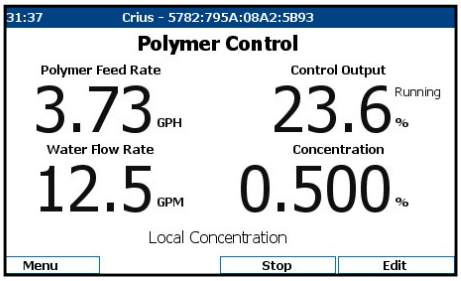
Thank you for your investment in the new Tempest 2.0 Polymer Feed and Control Station.

The Tempest 2.0 Series of liquid polymer feed and control stations are designed to provide maximized polymer performance without the hassles and headaches these applications cause for water treatment professionals.

The system design provides the right type of mixing energy at the critical moment of initial wetting and tapers that energy through a multi-stage regime of hydrating zones.

The net result is a fully hydrated polymer solution with maximum charge site exposure which assures optimized polymer usage and performance. The design eliminates unwanted agglomerations, plugging and the costly mess of dealing with these issues.

The new Tempest 2.0 controller provides a real-time display of your critical application parameters. In addition, the new controller offers a broad range of enhanced capabilities including addition I/O options, and on-board datalogging with graphic display.



Primary dilution water flow is controlled by a solenoid valve which allows water to enter the unit.

Primary dilution water flow rate data is measured continuously to assure that adequate flow is present and fed back to the Tempest 2.0 controller. Using calculations derived from the calibration stage, the unit automatically adjusts the polymer pump output to achieve the desired concentration.

Under conditions of high or low concentration, a loss of water flow or polymer feed (optional) the system automatically shuts down and notifies with an alarm. Each feed cycle is followed by an adjustable, multi-stage flush cycle to eliminate any plugging . The system can be operated remote via a 4-20mA or simple on/off signal.

The Tempest 2.0 is backed by a One Year Warranty. Please call us if we can be of assistance in any way.

Introduction

The Tempest™ 2.0 Polymer Feed System is a self-contained system designed to control feed water and polymer and combine them to produce a high quality solution. The system is designed to receive an Emulsion, Solution or Mannich polymer and mix with feed water to produce and discharge a quality solution from the system.

The Tempest™ 2.0 Polymer Feed System can be enabled in local mode (simple On / Off operation) or remotely via a customer supplied dry contact which will Stop/ Start the Tempest™ Polymer Feed System.

In local mode, the Tempest™ 2.0 Polymer Feed System can be operated based on “override” manual set points or internal flow pacing set points . The manual “override” mode allows the user to manually adjust the rotameter and pump capacities locally. The internal flow pacing mode, allows the Controller to pace the neat polymer metering pump volume output to the flow of water to hold the solution at a set concentration point which is selected in the Tempest 2.0 controller.

In remote mode, the Tempest™ 2.0 Polymer Feed System offers two control options as well. In the Remote Concentration mode, the Controller receives a remote analog signal to adjust the desired concentration set point while the dilution water flow remains constant. Remote Rate mode receives a remote analog signal to adjust to the pump speed. Either remote mode option can be achieved with the remote disable selection on the ON or OFF position.

A complete skid mounted system; the Tempest™ 2.0 Polymer Feed System is equipped with all the necessary components for easy installation, reliable performance and safe operation. The design incorporates an electric solenoid valve (water), the new Endress + Hauser mag flow meter, manually adjustable rotometer, electric solenoid diaphragm pump (Polymer), the new Tempest 2.0 controller, manual ball valves, calibration column, PVC piping and components, all on a SS frame to provide the durability to withstand harsh conditions and minimize maintenance.

This manual is designed to provide simple explanations on how to use the System. The layouts in this manual were done in an effort to “literally” walk you through the system’s operations.

Tempest 2.0 Selection and Pump Guide

The Tempest 2.0 features the Grundfos Smart DDA metering pumps that allows for the consolidation of models and maximum application flexibility. The standard Tempest 2.0 series offers a neat polymer feed range of .02– 15.8 gph. All Tempest 2.0 pumps have spring loaded checks and a PVDF head for maximum compatibility. The standard pumps have a turn-down of 1000:1 and can handle very high viscosities via the slow mode feature.

	Primary Dilution Water Range			Neat Polymer Range	
Model Number	Rated GPH	Min GPH	Max Inlet Pressure	Min GPH	Max GPH
TP2-300-2	300	30	100 PSI	0.02	4.5
TP2-600-4.5	600	60	100 PSI	0.02	4.5
TPS-1200-4.5	1200	120	100 PSI	0.04	4.5
TPSG-1200-15.8	1200	120	100 PSI	0.02	15.8

	Connections			
Model Range	Water Inlet	Polymer Inlet	Solution Outlet	VAC
TP2-300	1" FNPT	1/2" FNPT	1" FNPT	120/1/60
TP2- 600 & 1200	1-1/2" FNPT	1/2" FNPT	1-1/2" FNPT	120/1/60

Tempest 2.0 Specifications

Wetted Materials:

Water: PVC, Brass, Bronze, Buna-N, Acrylic, 316 SS
Neat Polymer: PVC, Acrylic, PTFE, PP, 316 SS

Electrical: 120 VAC / 1 Phase / 60 Hz

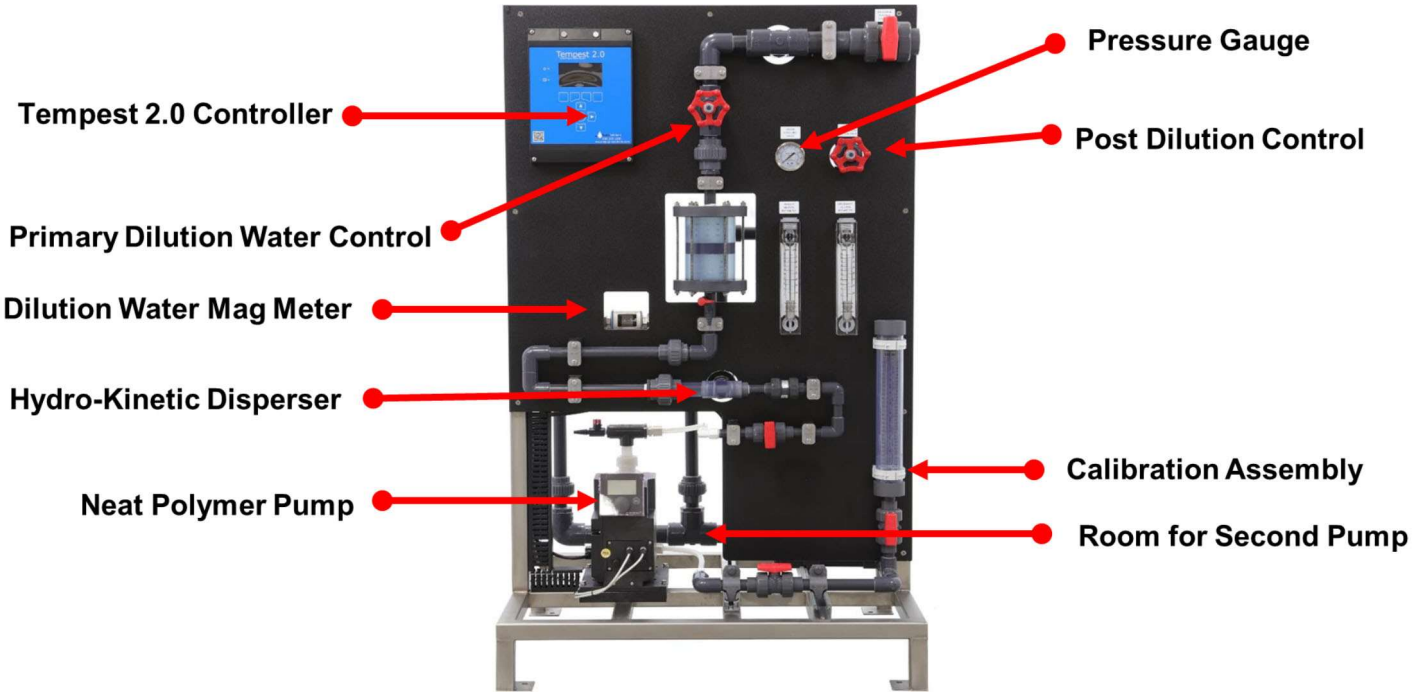
Dimensions: 30”W x 36”D x 60”H

Weight:

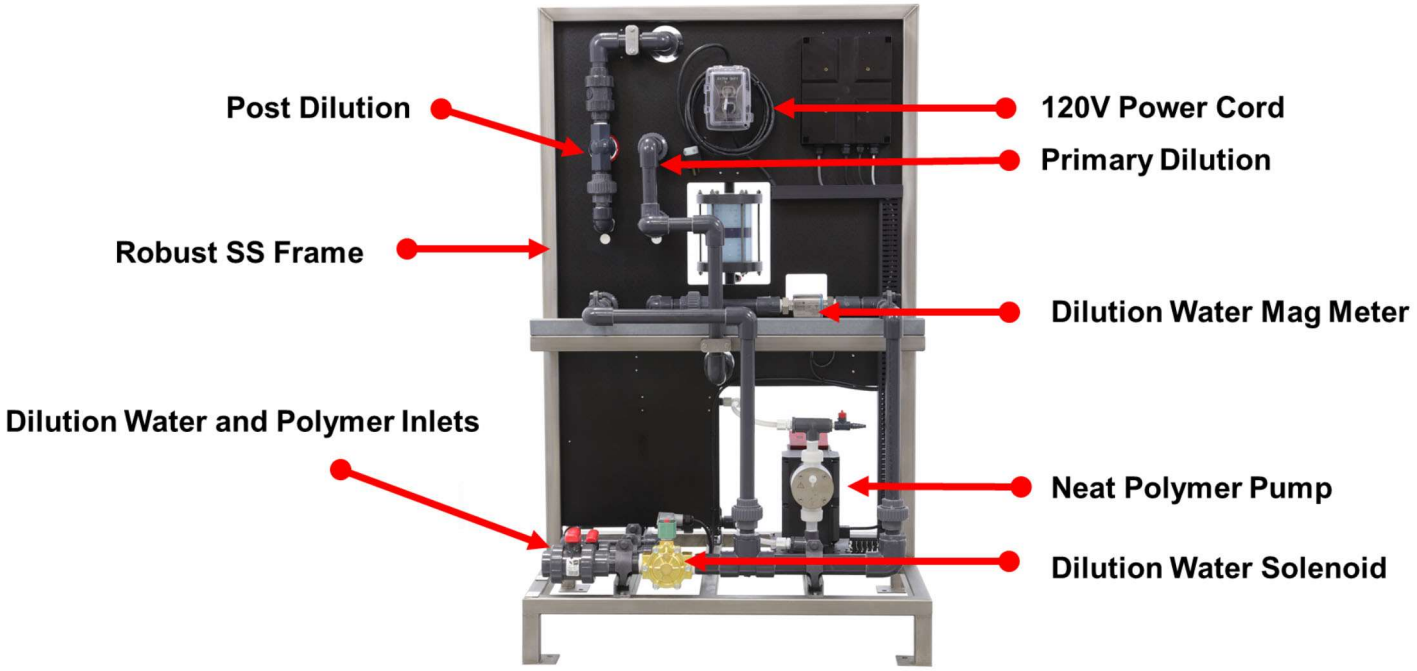
Tempest 2.0 Unit Weight 190 lbs.
Total Packaged Weight: 260 lbs.

Tempest 2.0 Layout

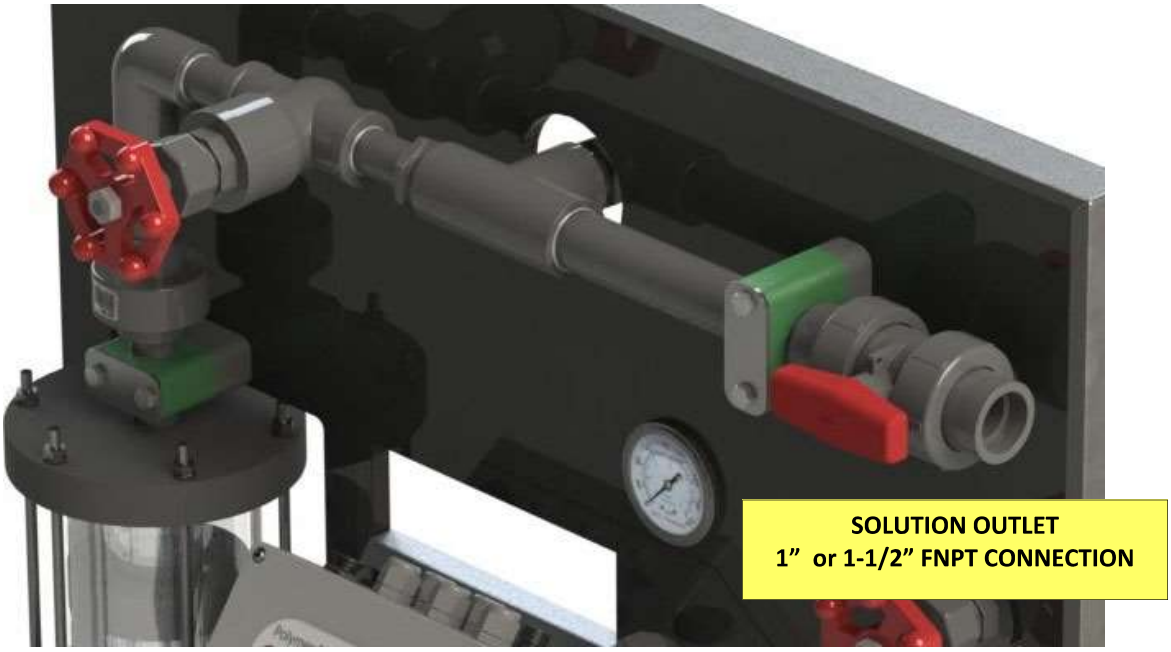
Front View

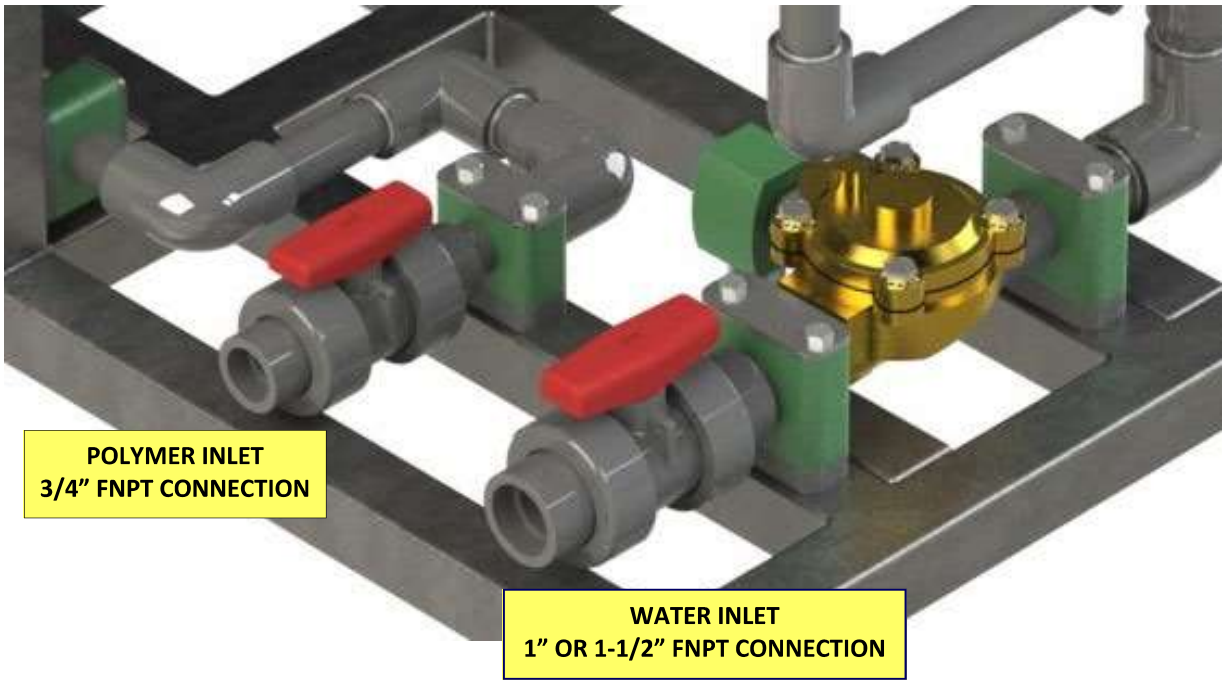


Back View



Tempest 2.0 Water & Neat Polymer Connections





Tempest 2.0 Electrical

The Tempest 2.0 system is supplied with a standard US three prong plug with cord for 120VAC, Single Phase power. Power is pre-wired into the Tempest 2.0 controller and supplies electricity for the Tempest 2.0 Controller and the neat polymer metering pump through a splash-proof GFI receptacle.

Tempest 2.0 Polymer Dosing Controller - Overview

The new Tempest 2.0 Polymer Dosing Controller offers precise control, easy-to-use operation along with I/O enhancements. The controller now provides our customers with the latest control technologies with the capabilities from expanding sensor/analog inputs and outputs to cloud-based communications.

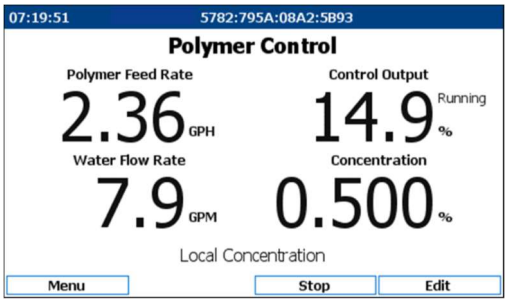
The standard Tempest 2.0 controller comes pre-programmed for plug and play operation. Basic controller I/O includes:

- Two (2) Analog Inputs
  - One (1) for Dilute Water Meter Flow
  - One (1) for Remote % Concentration/Feed Rate Input
- Eight (8) Digital Inputs
  - One (1) for Remote Start/Stop
  - One (1) for Polymer Feed Pump Alarm
  - Two (2) Unused (reserved for Batch Control Capability)
  - Four (4) Unused
- Eight (8) Relay Outputs (Powered or Unpowered)
  - One (1) for Dilute Water Solenoid Valve
  - One (1) for General Alarm Output (120VAC)
  - Two (2) Unused (reserved for Batch Control Capability)
  - Four (4) Unused

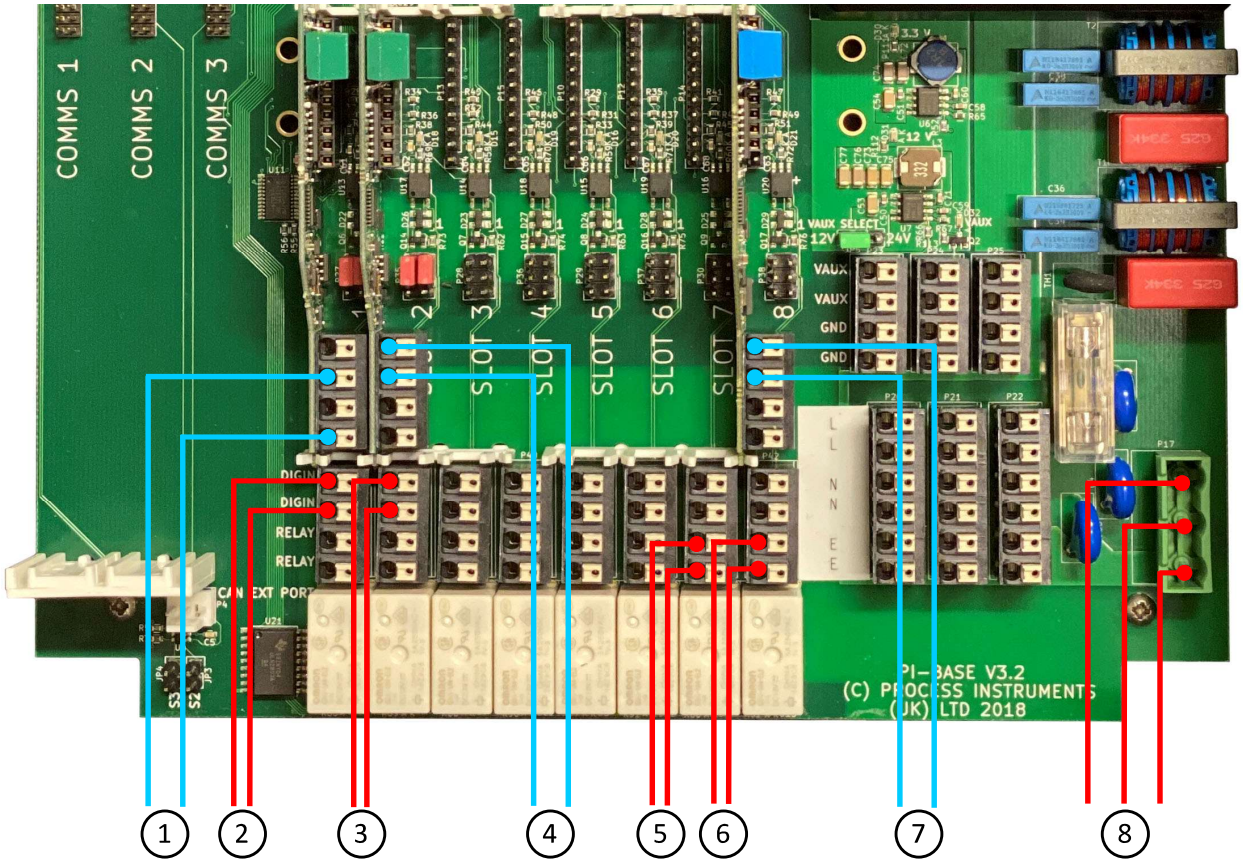
The advances of the Tempest 2.0 controller allows for unparalleled expansion in polymer feed technology when using the Expansion Module including:

- Multiple Analog and Digital I/O
- Specialty Sensor Inputs (i.e. Turbidity, Suspended Solids, pH, Tank Level)
- Common communications protocols including Ethernet and cellular
- Cloud-based data acquisition

For additional information regarding these features contact EquipSolutions at 888-200-1800

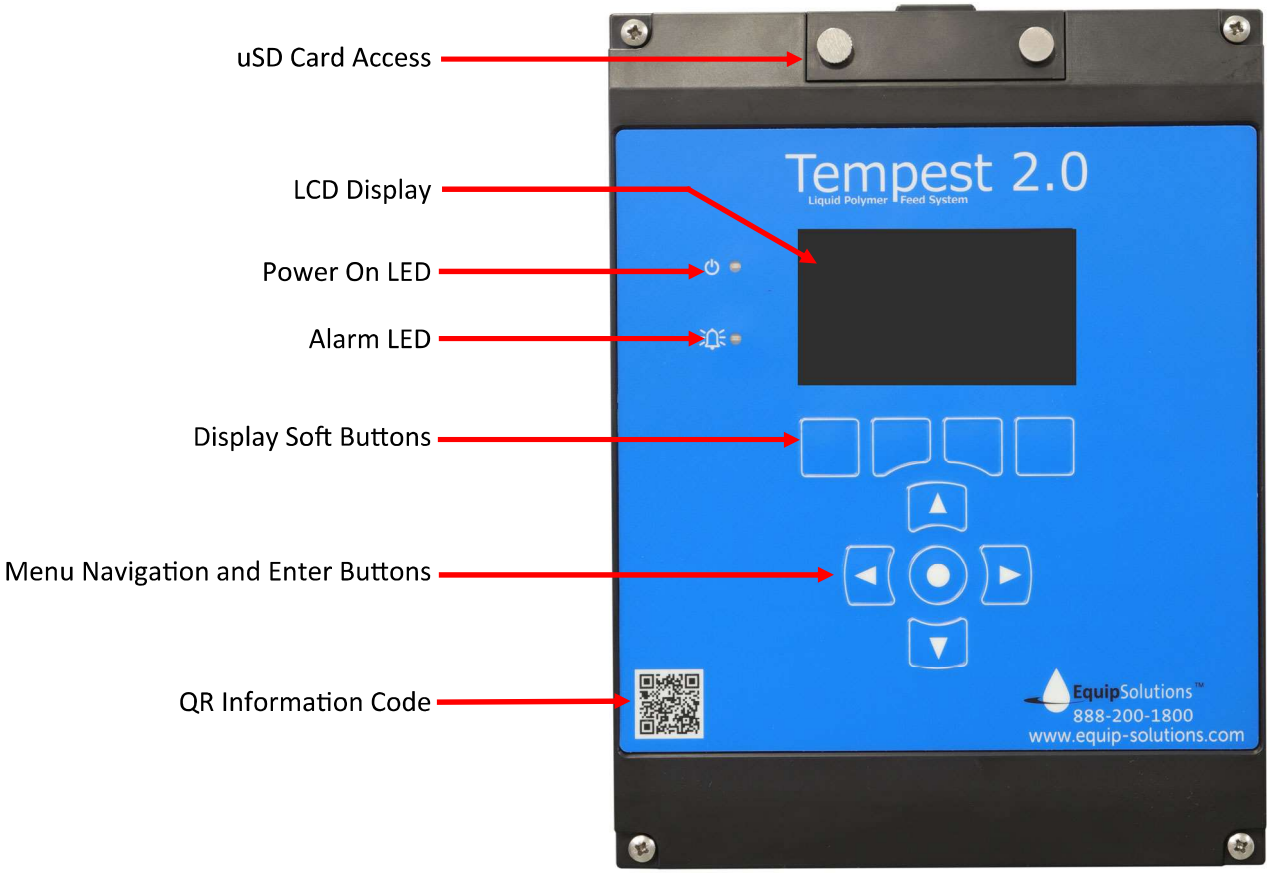


Tempest 2.0 Controller - Electrical Connections



1	4-20mA Input from Water Flow Meter
2	From Customer: Remote Start/Stop (Dry Contact)
3	Polymer Feed Pump Alarm Input (Dry Contact)
4	From Customer: Remote 4-20mA Input for % Concentration or Feed Rate
5	General Alarm Relay Output (120VAC)
6	Water Solenoid Valve Relay Output
7	Polymer Feed Pump 4-20mA Control Output
8	120VAC Power In

Tempest 2.0 Polymer Dosing Controller Main Panel

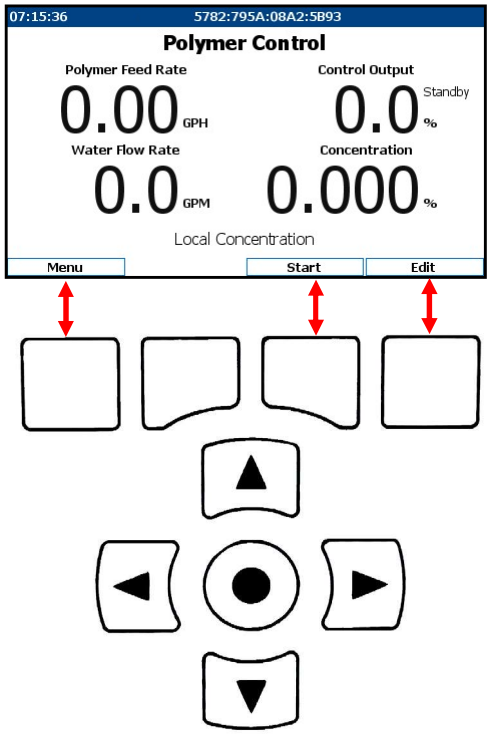


Tempest 2.0 Menu Navigation

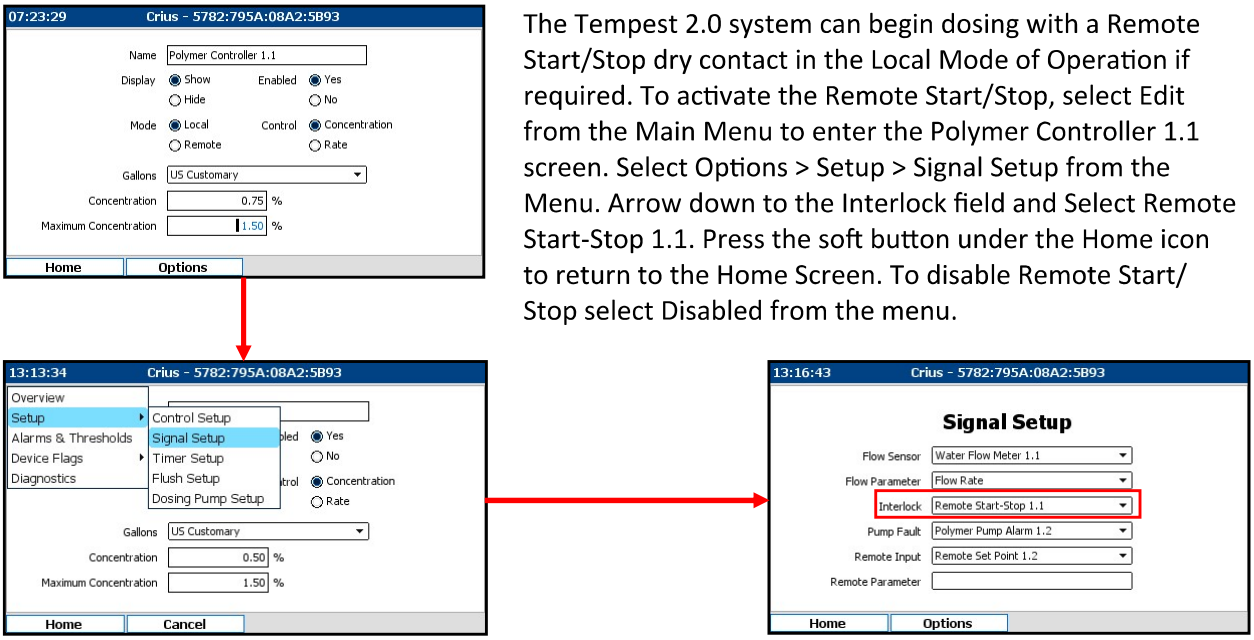
When the Tempest 2.0 is powered on, the Polymer Control Home Screen display is the analyzer default. This screen displays the Polymer Feed Rate of the neat Polymer Pump (in GPH), the Control Output (% mA Output to the Polymer Pump), the Water Flow Rate (in GPM), and the Percent Concentration. Below the parameters indicate whether the Tempest 2.0 is in Local or Remote mode of operation.

At the bottom of the Home Screen, three (3) choices are available including Menu , Start/Stop (when in Local control mode) and Edit (used to program mode of operation). Selection of any bottom menu button is chosen using the adjacent Display Soft Button directly below the indicator.

NOTE: Please refer to the Programming Guide on Page XX for detailed programming information.

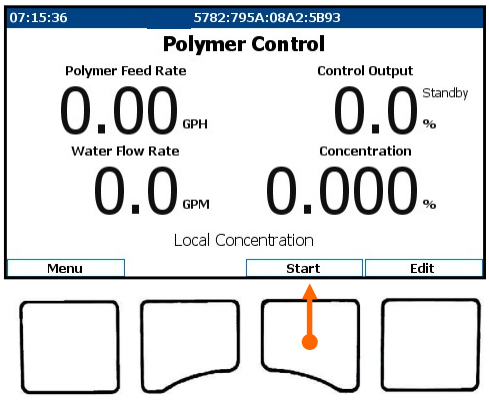


Tempest 2.0 Polymer Dosing Controller—Remote Start/Stop Overview



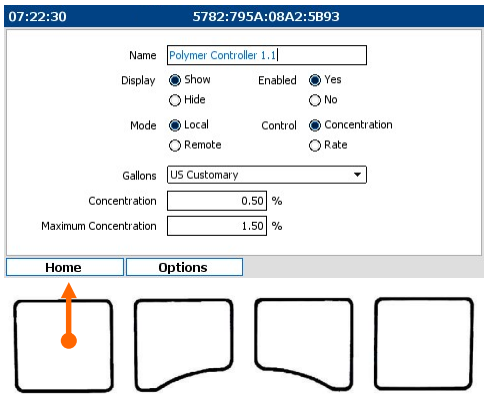
The Tempest 2.0 system can begin dosing with a Remote Start/Stop dry contact in the Local Mode of Operation if required. To activate the Remote Start/Stop, select Edit from the Main Menu to enter the Polymer Controller 1.1 screen. Select Options > Setup > Signal Setup from the Menu. Arrow down to the Interlock field and Select Remote Start-Stop 1.1. Press the soft button under the Home icon to return to the Home Screen. To disable Remote Start/ Stop select Disabled from the menu.

Tempest 2.0 Polymer Dosing Controller—Local Mode Overview



When in Local mode of operation, the user can choose to either feed based on % Concentration or Polymer Feed Rate. The bottom of the display shows which mode of operation the controller is in.

To Start the dosing cycle, press the soft button under the Start icon on the menu. The unit will run continuously until the soft button under Stop is press. The unit will enter the pre-programmed flush cycle and stop until the Start button is pressed again. The Local control cycle works the same whether in % Concentration of Polymer Feed Rate Control.



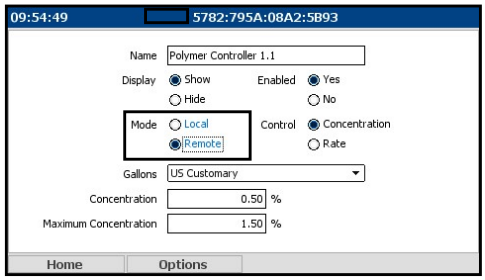
To change from % Concentration control to Polymer Feed Rate Control (or visa-versa), or to make parameter changes, select the soft button under the Edit icon. This directs you to the Polymer Control 1.1 Screen which allows you the enter parameter value changes or to change the mode of operation.

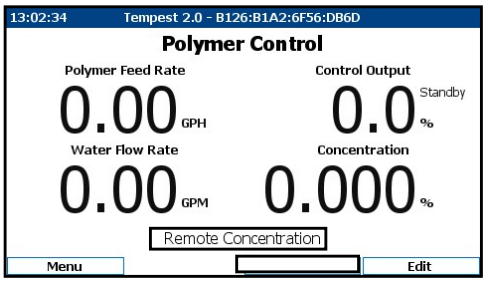
To exit back to the main menu, select the soft button under the Home icon.

NOTE: Please refer to the Programming Guide on Page XX for detailed programming information.

Tempest 2.0 Polymer Dosing Controller—Remote Mode Overview

The Remote Mode of Operation allows the user to use a remote 4-20mA signal to control the Remote % Concentration (up to 1.5%) or the Polymer Feed Rate (from 0-100%). When in the Remote Mode, the Start/Stop icon is no longer available from the Main Menu Screen. Remote Operation can only be run using the remote Start/Stop dry contact input. ***Note: To run in the Remote Mode, the Remote Start/Stop dry contact input must be used to activate and deactivate the feed cycle.***

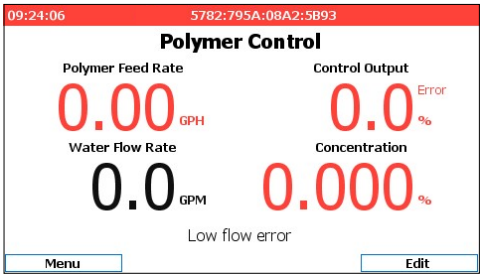




From the Home Screen Select the Edit soft button to access the Polymer Controller 1.1 screen. Arrow down to Mode and press the Enter button. Arrow Up or Down to select Mode of Operation and press Enter and select Home. Note that the bottom of the Home Screen will now display current control mode.

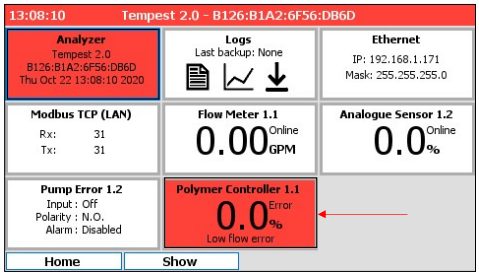
If switching Feed Mode for Remote % Concentration to Remote Feed Rate, a series of programming commands need to be entered into the Tempest 2.0 Controller. These steps include changing the control, rescaling and tagging the new input (% or GPH) and electronically recalibrating the 4-20 mA input for the remote signal. Detailed instructions are provided in the Programming Guide.

Tempest 2.0 Polymer Dosing Controller—Alarm Overview



During either local or remote operation, the Tempest 2.0 system alarm will activate if either the water flow is below the present low level set point, if the % concentration level cannot be satisfied caused by inadequate water volume or inadequate pumping capacity or if the Polymer Feed pump goes into an alarm condition.

When in an alarm condition, the Tempest 2.0 will automatically shut off the Polymer Feed Pump and enter the programmed flush cycle. Immediately following the flush cycle the controller will activate the 120VAC alarm relay. The controller display will turn RED and indicate what parameter activated the alarm. To reset the alarm, the user select the Menu soft button, arrow to highlight the Polymer Controller 1.1 tile and press the soft button under the Reset icon to place the system back into standby mode.



The Low Water Flow Threshold (Alarm) and Flush Cycles are programmable to meet customer requirements. The Polymer Feed Pump alarms are generated from the pump and use a relay contact connected to the controller to activate any pump alarm.

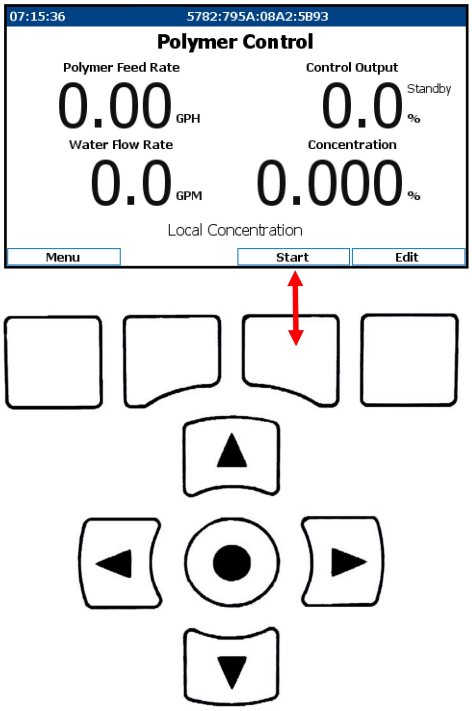
Tempest 2.0 Polymer Dosing Controller—Programming Overview

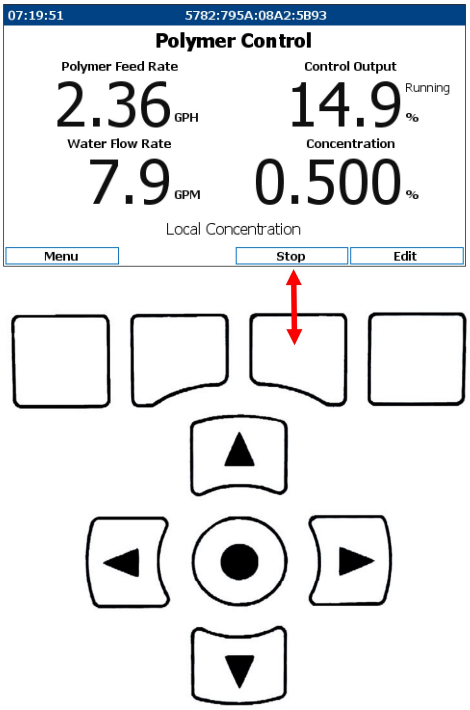
When the Tempest 2.0 is powered on, the Polymer Control Home screen is the analyzer default. This screen displays the Polymer Feed Rate of the neat Polymer Pump (in GPH), the Control Output (% mA Output to the Polymer Pump), the Water Flow Rate (in GPM), and the Percent Concentration. Below the parameters indicate whether the Tempest 2.0 is in Local or Remote mode of operation. At the bottom of the Home Screen, three (3) choices are available including Menu , Start/Stop (when in Local control mode) and Edit (used to program mode of operation). Selection of any bottom menu button is chosen using the adjacent display Soft Button directly below the indicator.

Local Mode Start/Stop:

To initiate Tempest 2.0 Polymer System in Local Mode, press the Start Button adjacent to the Start indicator. This will initiate the Tempest 2.0 to open the water solenoid valve for a pre-programmed time period and then energize the Polymer Feed pump to begin making-down the polymer solution.

To Stop the system press the Stop Button adjacent to the display indicator. The Tempest 2.0 with stop the Polymer Feed pump and continue with the pre-programmed water flush cycle until complete. At that point the system goes into Stand-By mode waiting for the next start

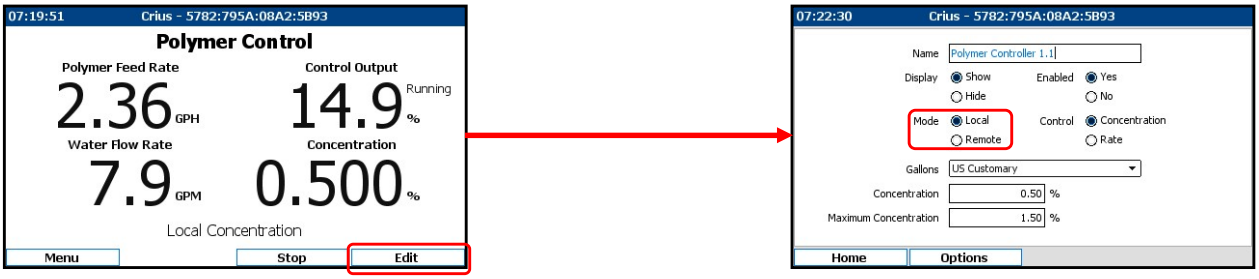




Tempest 2.0 Polymer Dosing Controller—Local/Remote Mode Setting

To Set Tempest 2.0 Feed Mode:

1. From the Home Screen > Select Edit
2. Arrow Down to Mode & Press Enter
3. Arrow Up/Down to Selection and Press Enter > Select Home

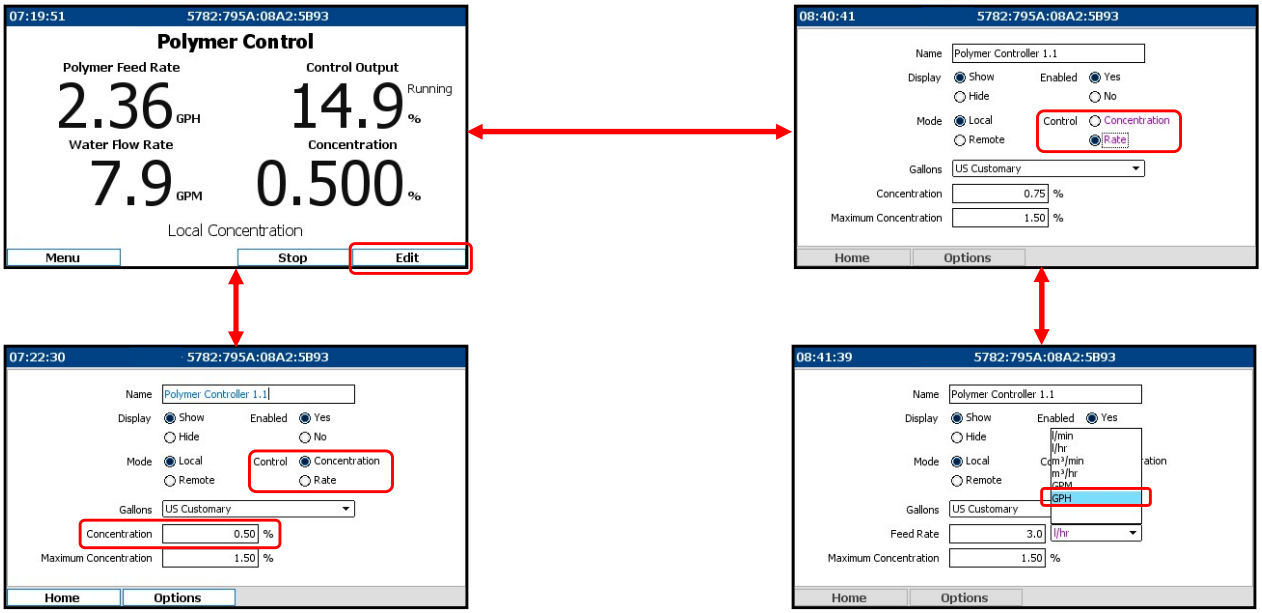


To Set Tempest 2.0 to Local % Concentration

1. From the Home Screen > Select Edit
2. Arrow Down to Control & Press Enter
3. Arrow Up/Down to Concentration Selection and Press Enter
4. Arrow to highlight Concentration & Enter
5. Use the Arrow Keys to change to desired % and Press Enter. Select Home

To Set Tempest 2.0 to Local Feed Rate

1. Select Edit
2. Arrow Down to Control & Press Enter
3. Arrow Up/Down to Rate Selection and Press Enter
4. Arrow to highlight Rate & Enter
5. Use the Arrow Keys to change to Feed Rate and Change units to GPH.
6. Enter your desired Feed Rate. Press Enter. Select Home.

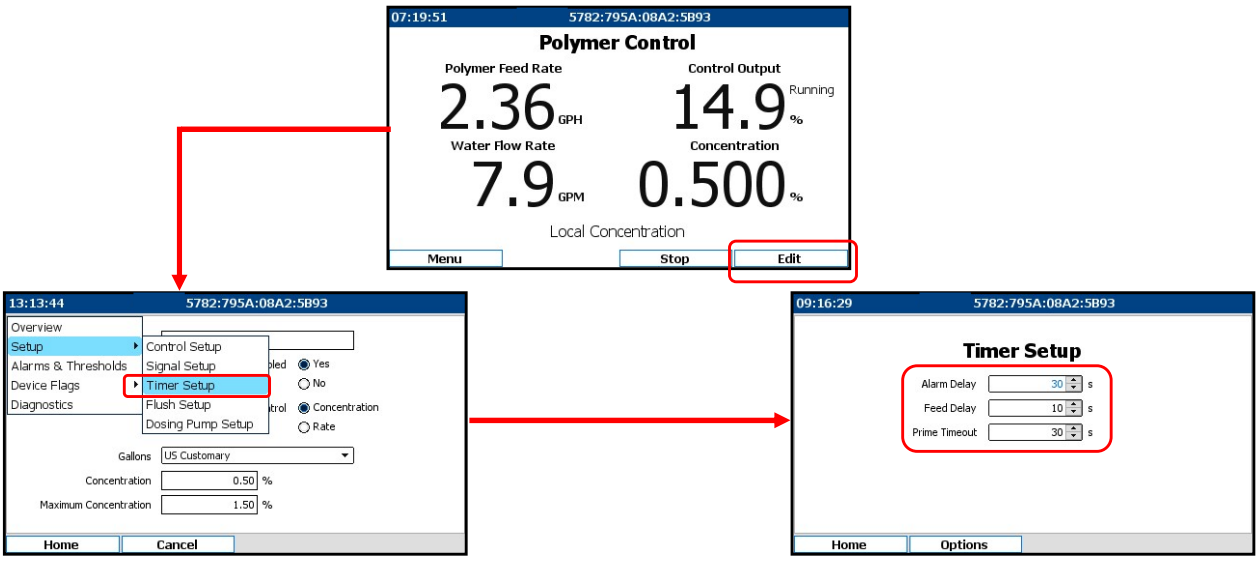


Tempest 2.0 Polymer Dosing Controller—Timer & Low Water Alarm Setting

To Set Tempest 2.0 Timers:

The Timer sections allows to program general alarm delay time, start-up feed time delay and auto-prime time-out

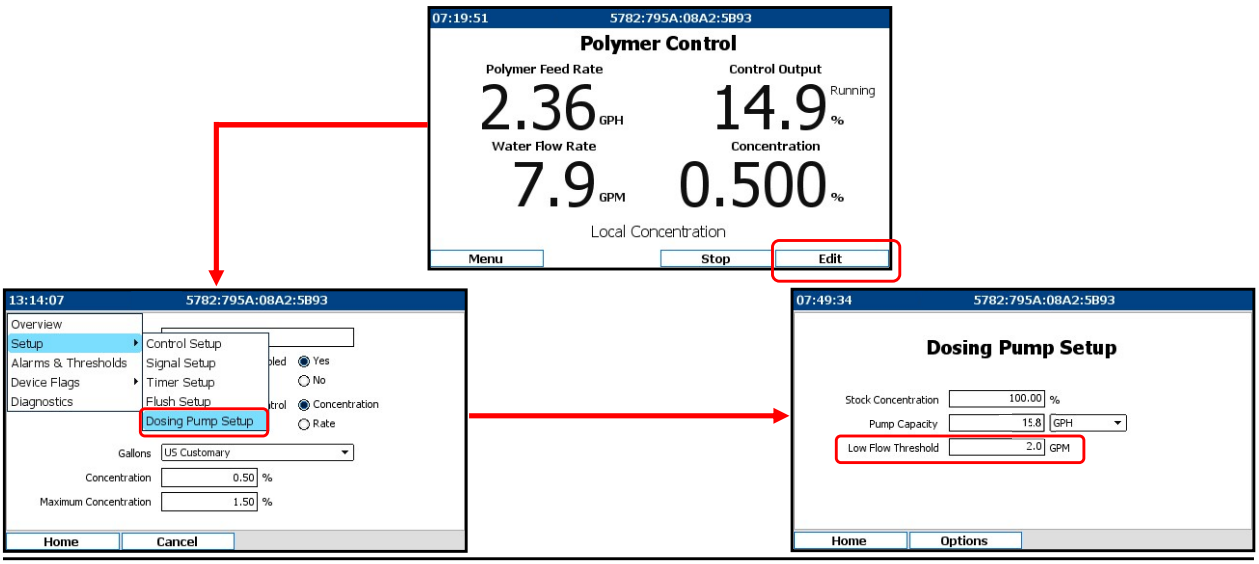
1. Home Screen > Select Edit
2. Select Options > Setup > Timer Setup
3. Arrow Up/Down to Timer Selection and Press Enter
4. Use Arrow Keys to adjust desired time and Press Enter. Select Home



To Set Tempest 2.0 Low Water Flow Alarm:

The default Low Water Flow Threshold (Alarm) is set for 10% of full capacity. Follow the instructions to change the Low Water Flow setpoint. Home Screen > Select Edit

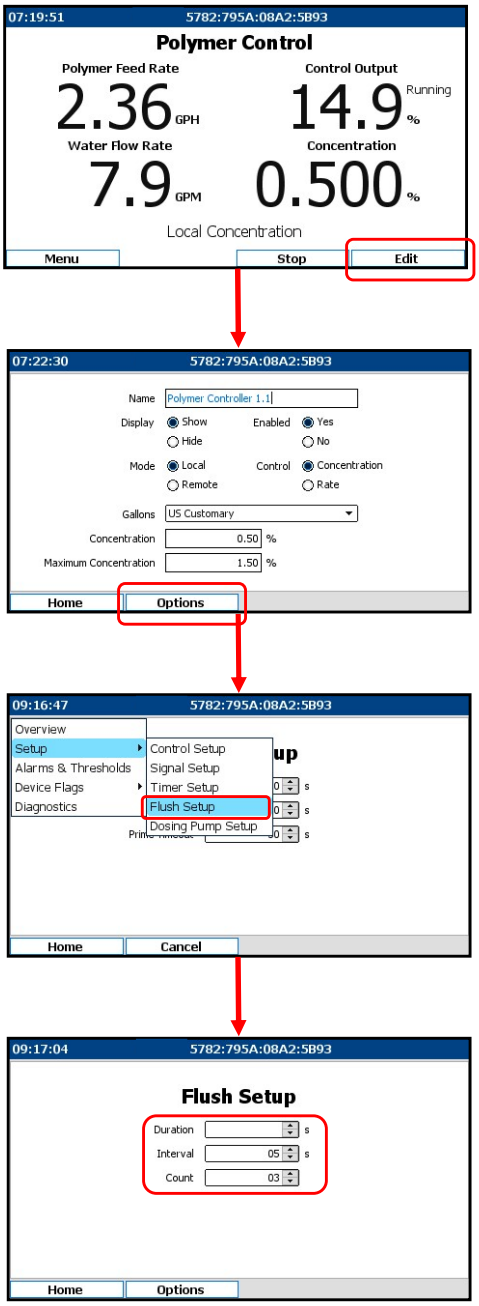
1. Select Options > Setup > Dosing Pump Setup
2. Arrow Up/Down to make Timer Selection and Press Enter
3. Use Arrow Keys to adjust desired time and Press Enter. Select Home.



Tempest 2.0 Polymer Dosing Controller—Flush Cycle Setting

To Set Tempest 2.0 Flush Cycles:

1. Select Edit > Options
2. Select Setup > Flush Setup
3. Arrow and Select Flush Duration (how long to flush mix chamber). Press Enter
4. Arrow and Select Flush Interval (time between flush duration). Press Enter
5. Arrow and Select Count (number of flush cycles). Press Enter & Select Home

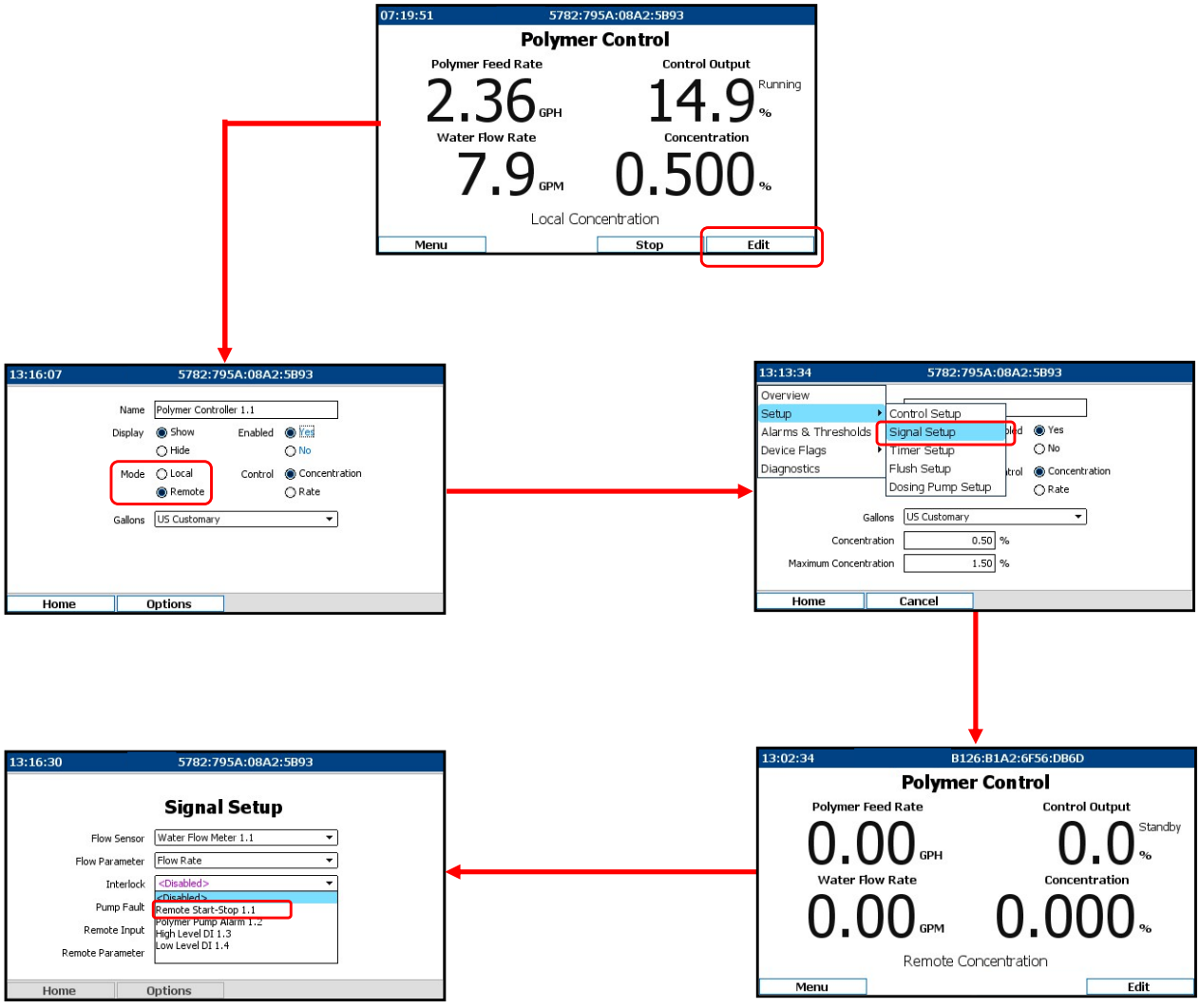


Tempest 2.0 Polymer Dosing Controller—Remote Start/Stop Settings

To Set Tempest 2.0 to Remote Start/Stop

1. Home Screen > Select Edit
2. Arrow Up/Down to Mode and Press Enter. Select the Remote Button and Press Enter.
3. Select Options > Setup > Signal Setup
4. Arrow Down to the Interlock Field
5. Arrow Down to Select Remote Start Stop 1.1 and Press Enter & Select Home

NOTE: The Home Screen will display the system is in Remote (% Concentration or Rate) Mode and the Local Start/Stop buttons are no longer visible. The Tempest 2.0 will only run in Remote % Concentration or Remote Feed Rate with a customer supplied Remote Start/Stop Dry Contact closure.



Tempest 2.0 Polymer Dosing Controller—Remote % Concentration or Remote Polymer Feed Rate Feed Settings

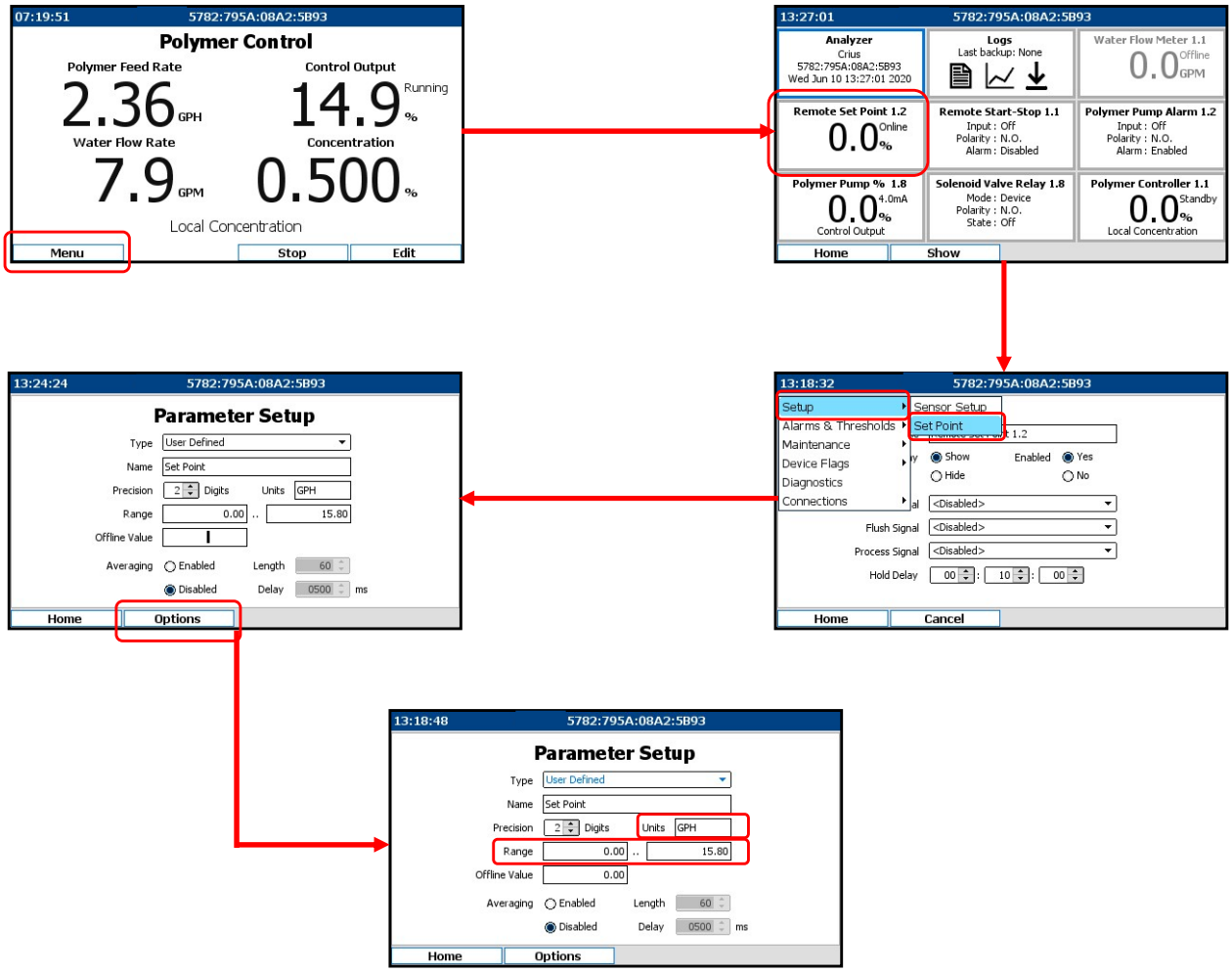
To Set Remote Rate or % Concentration Input

Note: To switch from Remote % Concentration to Remote Rate, the Remote Input 1.2 requires rescaling, changing engineering units, and a calibration reset. The following steps outline this procedure

1. Home Screen > Select Menu
2. Arrow Down to Highlight Remote Set Point 1.2 Tile and Press Enter
3. Select Options > Setup > Set Point. Press Enter
4. Select Options > Setup > Signal Setup
5. Arrow Down to the Range Field.

Note: This Field will show the Min and Max Setting for the Pump (Remote Rate) or the Min and Max Setting for % Concentration (0-1.5%). If changing from Rate to % Concentration or % Concentration to Rate, the Units will need to be changed and the Calibrations Curve will need to be Reset.

1. Select Units to open Units of Measure Menus
2. To change to %, Arrow Right to the 1st Type button and Press Enter.
3. Arrow Down to open the folder labeled Miscellaneous. Arrow Down to Select percent.
4. Enter Done.



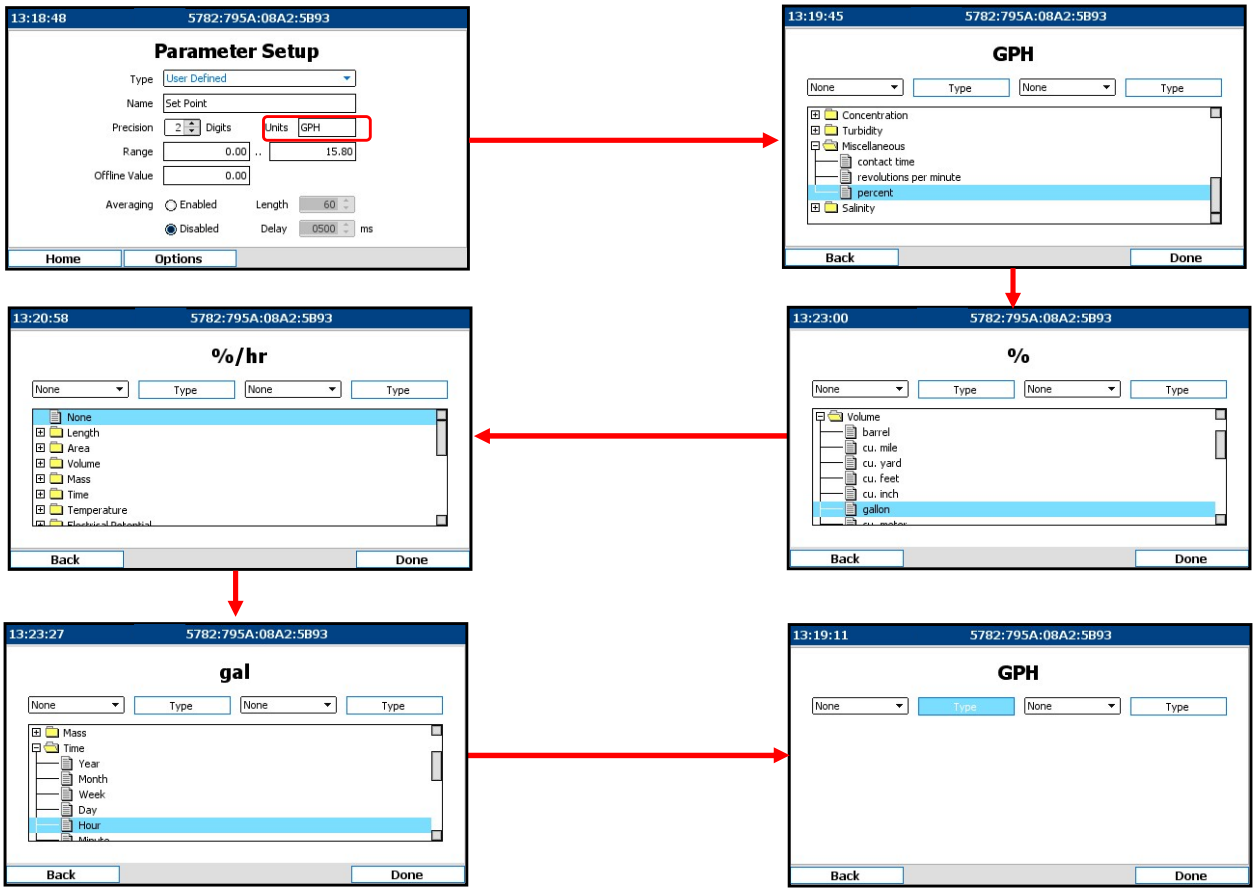
Tempest 2.0 Polymer Dosing Controller—Programming Remote Polymer Feed Rate or Remote % Concentration Input Units of Measure

To Set Engineering Units for Remote % Concentration or Remote Rate and Rescaling Input

Note: This Field will show the Min and Max Setting for the Pump (Remote Rate) or the Min and Max Setting for % Concentration (0-1.5%). If changing from Rate to % Concentration or % Concentration to Rate, the Units will need to be changed and the Calibrations Curve will need to be Reset.

1. From the Parameter Setup Screen, Select Units to open Units of Measure Menus
2. To change to %, Arrow Right to the 1st Type button and Press Enter.
3. Arrow Down to open the folder labeled Miscellaneous.
4. Arrow Down to select percent. Press Enter
5. Arrow Right to 2nd Type button and Press Enter
6. Arrow to top of menu and select None. Press Enter. Enter Done.

1. To Change from % to GPH, Arrow Right to 1st Type button and Press Enter.
2. Arrow to Volume folder and select gallon and Press Enter.
3. Arrow Right to 2nd Type button and Press Enter
4. Arrow to Time folder and select Hour. Press Enter.



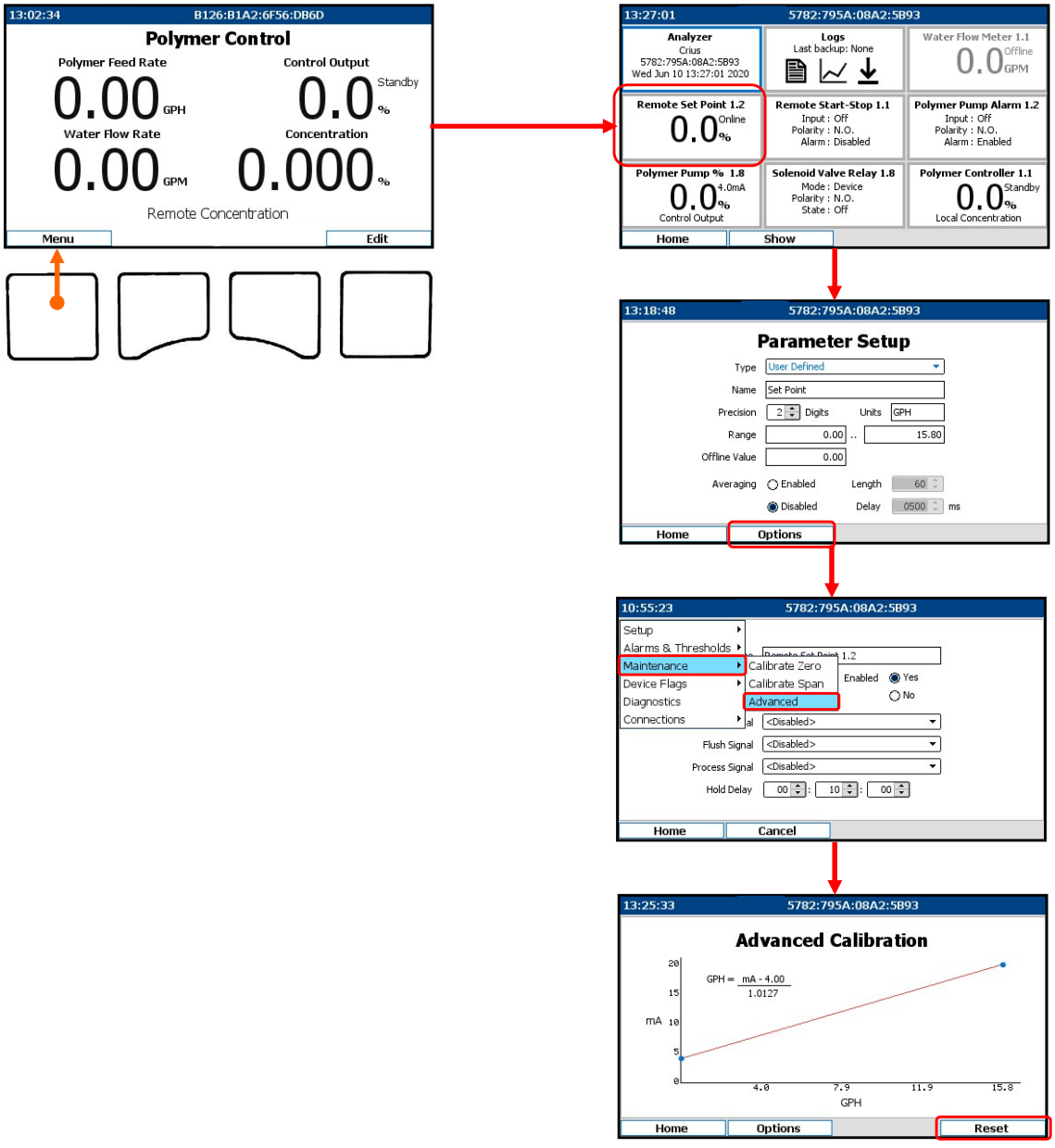
Tempest 2.0 Polymer Dosing Controller—Resetting the Calibration Curve

Note: The Tempest 2.0 controller requires the Calibration Curve to be reset when changing from Remote % Concentration input to Remote Polymer Feed Rate input, or visa-versa. The proper Calibration Curve is required to properly scale the 4-20mA remote input.

To Reset Calibration Curve:

1. From the Home Screen select the button adjacent to the Menu icon.
2. Use the Arrow Keys to highlight the Remote Set Point 1.2 tile and press Enter
3. Select Options > Maintenance > Advanced
4. Press Reset > Yes

This set recalculates the input curve of the signal and calibrates the 4-20mA input to the Min/Max range of the units.

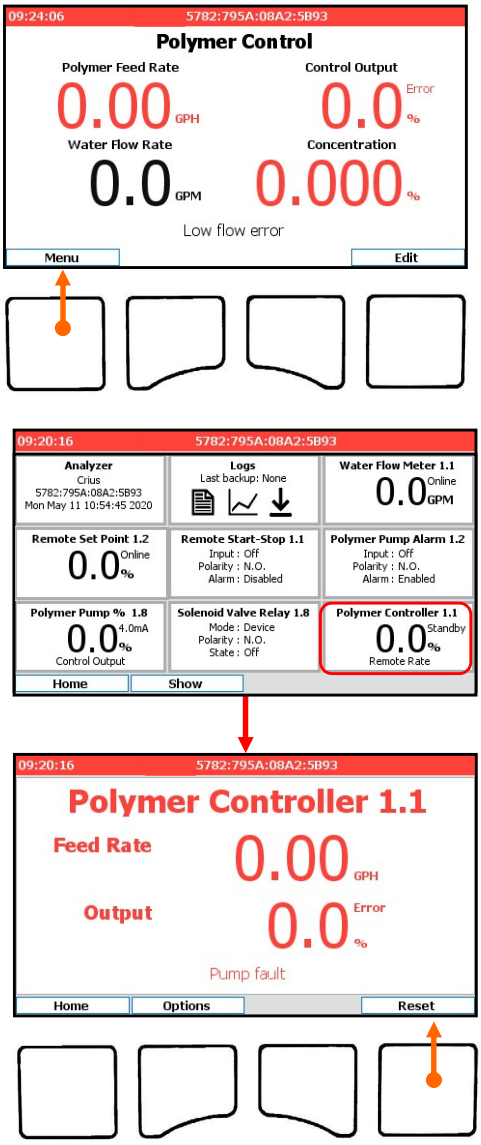


Tempest 2.0 Polymer Dosing Controller—Resetting an Alarm Condition

The Tempest 2.0 Controller is designed to Alarm in several conditions including low water flow, % Concentration can not be reached based on input parameters or a pump fault error. When an alarm is active after the pre-programmed delay time, the Home Screen (Polymer Control Screen) will indicate no polymer feed and the system will automatically go into a flush cycle. At the end of the flush cycle the display bar turn red and indicate the alarm. At this time the system will shut down until the alarm is reset.

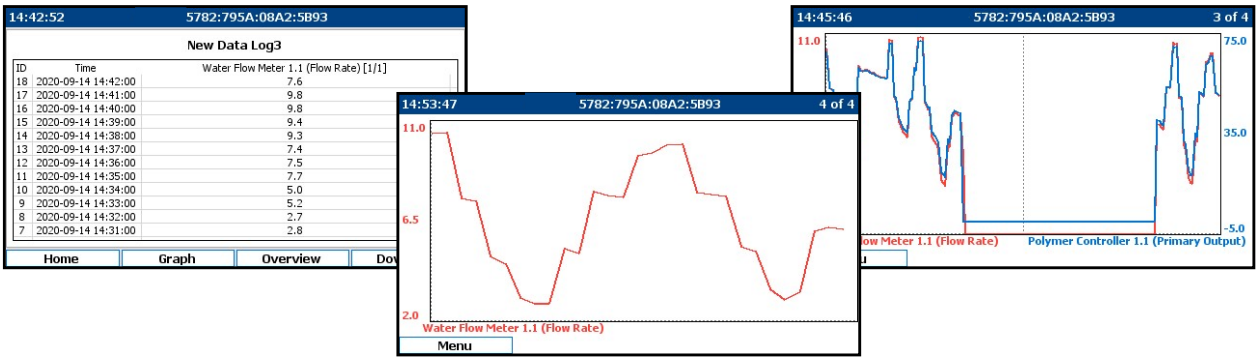
To Reset the Polymer control after an alarm:

1. From the Polymer Control (Home) Screen Press the soft button adjacent to the Menu icon
2. Arrow to highlight the Polymer Controller 1.1 Tile and Press Enter
3. Press the soft button adjacent to the Reset icon. This resets the alarm.
4. Press the soft button adjacent to the Home icon to return to the Home Screen.



Tempest 2.0 Polymer Dosing Controller—Datalogging & Graphing

Datalogging and graphing capabilities are a new feature offered with the Tempest 2.0 controller. The data collection can be set to as low as 1 minute (90 days) for any valid parameter. The Tempest 2.0 controller also provides a real-time visual graph of those parameter. In addition, the data log can be downloaded (*.csv format) onto the provided uSD Card and imported into common spreadsheet programs.



Tempest 2.0 Polymer Dosing System—Grundfos Polymer Feed Pump

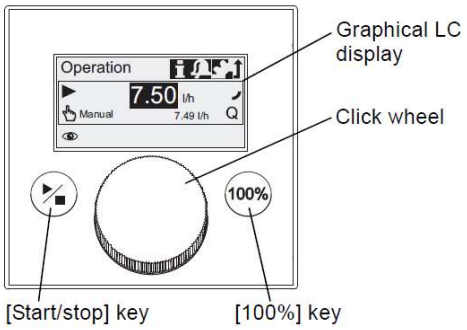
The Tempest 2.0 Polymer Feed System comes standard with the Grundfos SMART Digital DDA Series pump(s) for neat polymer feed. The DDA pump comes pre-programmed and calibrated with the Tempest 2.0 controller for ease of commissioning and start-up. The variable speed stepper-motor and enhanced electronic controls allow for consistent repeatability and a high turndown ratio.

The Grundfos DDA Polymer Feed pump is controlled via 4-20mA signal from the Tempest 2.0 controller. Depending in your feed mode (% Concentration or Feed Rate), the controller maintains the desired % Concentration of pre-determined Feed Rate regardless of process conditions. In addition, the DDA pump provides its own alarm contact signal if any pump issues are activated including internal pump error or loss of 4-20mA input signal.

Grundfos DDA Pump Control Elements

The Grundfos DDA pump includes a LCD display with easy to use functions. The pump is pre-programmed with the Tempest 2.0 controller and is setup to accommodate the system specifications. The easy to use face includes:

1. Graphical LCD display
2. Start/Stop key
3. 100% key (for quick priming)
4. Click wheel (used to navigate through the menus)

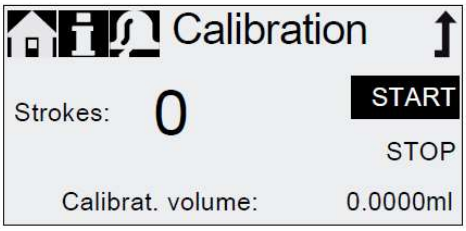


Please refer to the Grundfos DDA pump manual for detailed operations.

Grundfos DDA Pump Calibration

To calibrate the Polymer Feed Pump:

1. Place the Tempest 2.0 Polymer Feed System into Standby mode.
2. Open the ball valve to fill the Calibration Column to the 500ml mark and close the neat polymer inlet valve.
3. On the DDA Pump select Setup > Calibration
4. Press Start. The pump will start to count down from 200 strokes.
5. At the end of the sequence the pump will stop. Note the volume of product drawn down from the calibration column. Enter that volume into the DDA display.
6. Close the Calibration Column ball valve and open the neat polymer inlet valve.



Tempest 2.0 Polymer Dosing System—Maintenance & Troubleshooting Guide

The Tempest 2.0 Polymer Feed system is designed for reliable and accurate polymer make-down feed with minimum maintenance required. However, as with any electro-mechanical system, periodic checks are required to provide years of optimal service. Below is a suggested maintenance planner along with a troubleshooting guide to maximize performance and in the event of a problem.

Maintenance Planner

Maintenance Item	Weekly	Every 6 Months	Annually	Next Planned Date
Check Pump Calibration	X			
Check Water Flow	X			
Inspect & Clean All Check Valves		X		
Inspect and Clean Mixing Tee		X		
Complete Pump Maintenance			X	

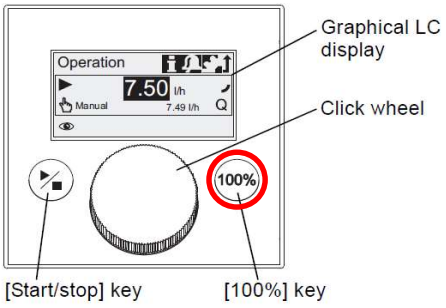
Troubleshooting Guide

Problem	Possible Cause	Remedy
No water flow	Water supply failed	Check water pressure
	No electrical power	Check power supply
	Dirt in solenoid valve	Clean valve
No solution, only water	Polymer isolating valve closed	Open valve
	Air in polymer pump	Re-prime pump
	Polymer pump defective	Overhaul pump
	Polymer check valve clogged	Clean
Solution strength varying	Pump head/valve fault	Clean pump head and valves. Replace pump
	Partial blockage in: Polymer check valve, Mixing tee, Water flow meter	Clean
	Varying water supply pressure	Check water pressure at period of peak demand. Check if other water users restrict supply to feeder. Consider installing a booster pump.

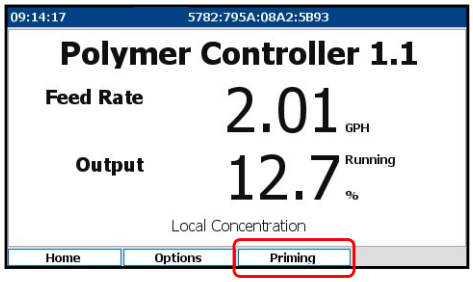
Tempest 2.0 Polymer Feed System—Installation & Start-Up

Polymer Supply Installation
Flooded suction of the neat polymer product is recommended for the Tempest 2.0 system. If suction lift is required, no more than four (4) feet is recommended and requires a suction lance. In addition, it may be helpful to fill the calibration column with polymer and pump from the column to get the pump primed and exert maximum suction lift.

Priming the Polymer Pump
The Tempest 2.0 provides two ways to quickly prime the polymer pump. With the polymer line connected from either the source or a full calibration column, simply pressing the 100% key on the face of the Grundfos DDA pump will run the pump at 100% output until released.



You can also prime and run the polymer pump from the Tempest 2.0 controller by selecting the Edit soft button from the Home Screen and select the Priming soft button from the Polymer Controller 1.1 Screen. The polymer pump will run at 100% for the pre-programmed time period.

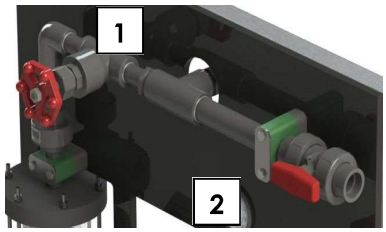


Tempest 2.0 Polymer Dosing System—Dilution Water

The Tempest 2.0 system directs and manipulates hydraulic force to invert and homogenize the polymer solution.

<u>The system requires a pressure range 26 psi above the injection point and no higher than 90 psi.</u>

The dilution water isolation ball valve needs to be opened (1). The solution outlet isolation valve also needs to be opened(2).

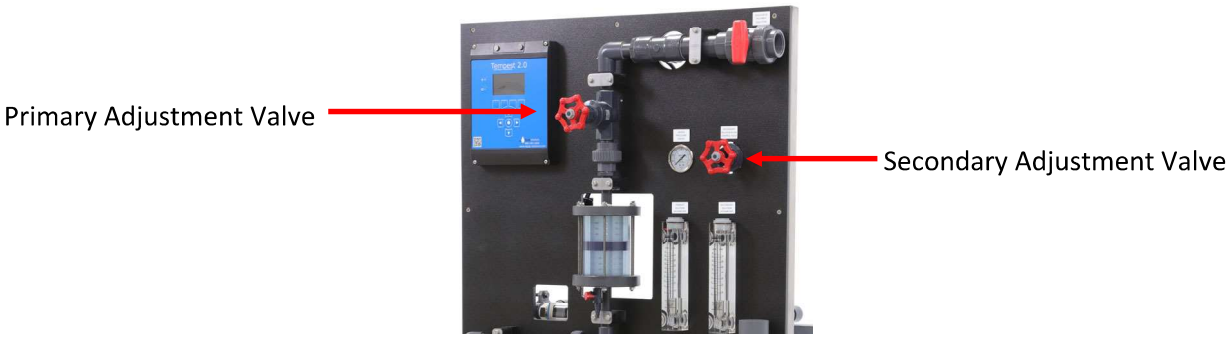


If required before start up, the solenoid can be opened by manually by going to the Tempest 2.0 Menu, select Water Solenoid Relays and momentarily change the relay state form Normally Open to Normally Closed. This will activate the output to the water solenoid valve and stay open until the state is changed back to Normally Open.

Tempest 2.0 Polymer Feed System—Setting the Dilution Water Flow

The Tempest 2.0 uses the Endress & Hauser Mag Flow Meter to ratio the polymer addition to the primary water dilution. Primary and Secondary dilution water rate is manually adjusted. A rotometer is supplied to assist the operator in making adjustments and is for visual indication only. The flow meter is factory preset and calibrated with the Tempest 2.0 Controller. The E+H flow meter reads out current water flow in GPM and can be programmed to display current water temperature or water totalizer. In addition to the E+H Mag Flow Meter, the Tempest 2.0 controller is calibrated to and provides a repeatable display output of current water flow. The controller uses this reading to also sense and take action in the event of a low water flow alarm.

The Primary dilution flow adjustment is adjusted through the gate valve at the top of the feeder. The secondary dilution is adjusted through the valve on the right side located above the primary and secondary rotometers. The rotometers provide a quick mechanical visual of your desired flow rate. You will notice that as the flow increases or decreases the polymer pump will speed up or slow down (in % Concentration mode).



Post Dilution

The Tempest 2.0 system includes a Post Dilution Circuit as a standard feature. The secondary rate control valve allows a flow rate equal to the primary flow rate to be added to the solution after it exits the mixing chamber. By opening the post dilution gate valve, the polymer solution make-up concentration can varied to achieve a final feed concentrationThe rate is displayed on a rotometer directly adjacent to the control valve.

Example:

1gph neat polymer / 100gph primary dilution = 1% make-up concentration

100 gallons of 1% make-up solution / 100gph post dilution = 0.005% final feed concentration

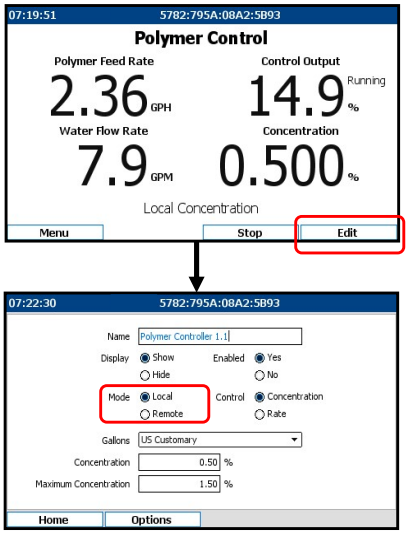
Tempest 2.0 Polymer Controller—Specifications

Power: 100-240VAC/0.25 A or 12VDC/0.8 A
Fuse: 2A (100-240VAC)
Working Temperature Range: -10°C..60°C
Display: 4.3" 480x272 24-bit color
Inputs: One (1) 4-20mA Input Signal for E+H Water Flow Meter
One (1) 4-20mA Input Signal for Remote % Concentration or Remote Feed Rate
One (1) Digital Input for Remote Start/Stop
One (1) Digital Input for Polymer Feed Pump Alarm
Two (2) Digital Inputs (Reserved for Batch Control)
Four (4) Digital Inputs Unused
Outputs: One (1) 4-20mA Output for Polymer Feed Pump Control
One (1) Relay Output for General Alarm (Unpowered)
One (1) Relay Output for Water Solenoid Valve
Two (2) Relay Outputs for Batch Control (Reserved)
Four (4) Relay Outputs Unused
Communication (Optional): Modbus ASCII/RTU (RS485), Profibus DP, Modbus TCP (Ethernet), 2G/3G Modem
Status Log: Over 1 million records
Data Log: Internal - Single parameter data log or status message log over 1 million records
Weight: 2kg
IP Rating: IP65, NEMA 4X
Enclosure Material: ABS flame retardant
Seals: EPDM

Tempest 2.0 Polymer Controller—Appendix

- **Programming Guide**
- **General Arrangement Drawings**
- **Notes**

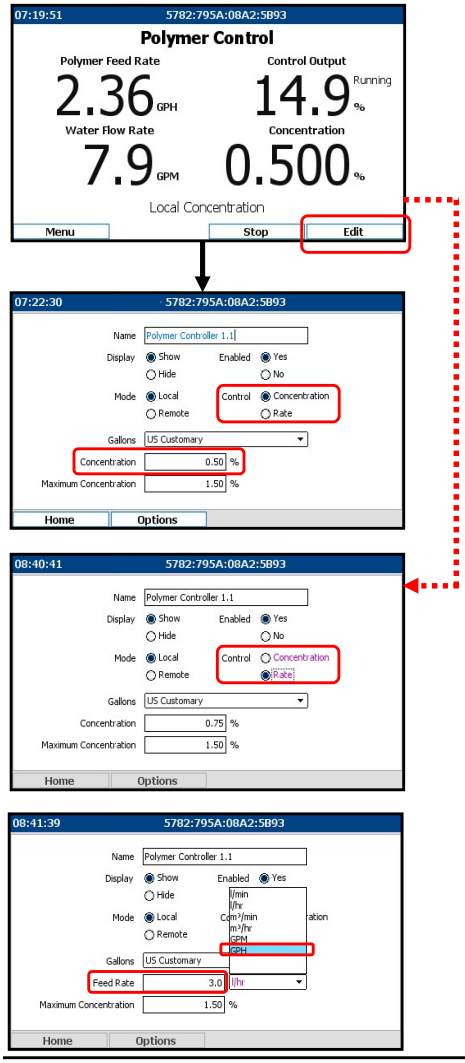
Local / Remote Mode Settings



To Set Tempest 2.0 Feed Mode:

1. Select Edit
2. Arrow Down to Mode & Press Enter
3. Arrow Up/Down to Selection and Press Enter
4. Select Home

Local % Concentration / Rate Control Settings



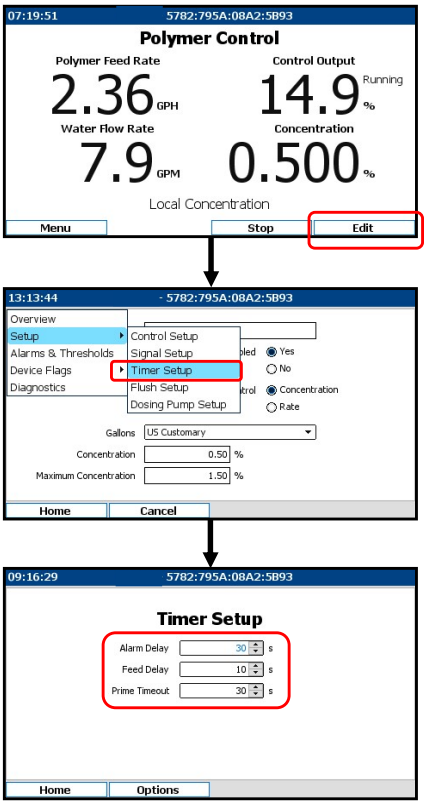
To Set Tempest 2.0 to Local % Concentration

1. Select Edit
2. Arrow Down to Control & Press Enter
3. Arrow Up/Down to Concentration Selection and Press Enter
4. Arrow to highlight Concentration & Enter
5. Use the Arrow Keys to change to desired % and Press Enter
6. Select Home

To Set Tempest 2.0 to Local Rate

1. Select Edit
2. Arrow Down to Control & Press Enter
3. Arrow Up/Down to Rate Selection and Press Enter
4. Arrow to highlight Rate & Enter
5. Use the Arrow Keys to change to Feed Rate and Change units to GPH
6. Press Enter
7. Select Home

Timer Setup

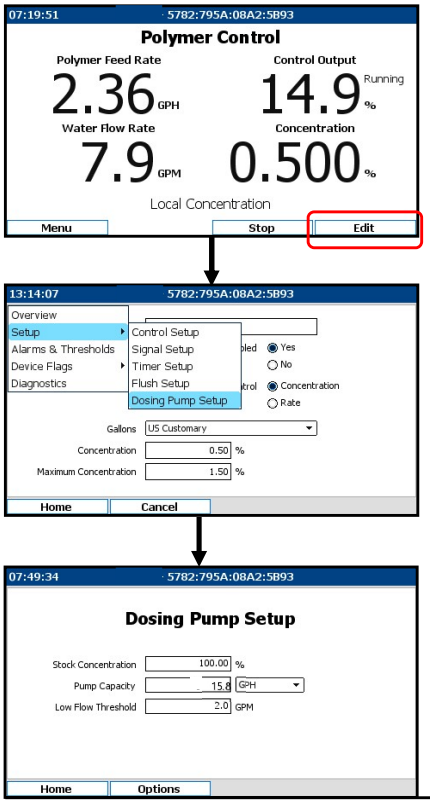


To Set Tempest 2.0 Timers:

The Timer sections allows to program general alarm delay time, start-up feed time delay and auto-prime time-out

1. Home Screen > Select Edit
2. Select Options > Setup > Timer Setup
3. Arrow Up/Down to Timer Selection and Press Enter
4. Use Arrow Keys to adjust desired time and Press Enter.
5. Select Home

Setting Dosing Pump & Low Water Flow Alarm

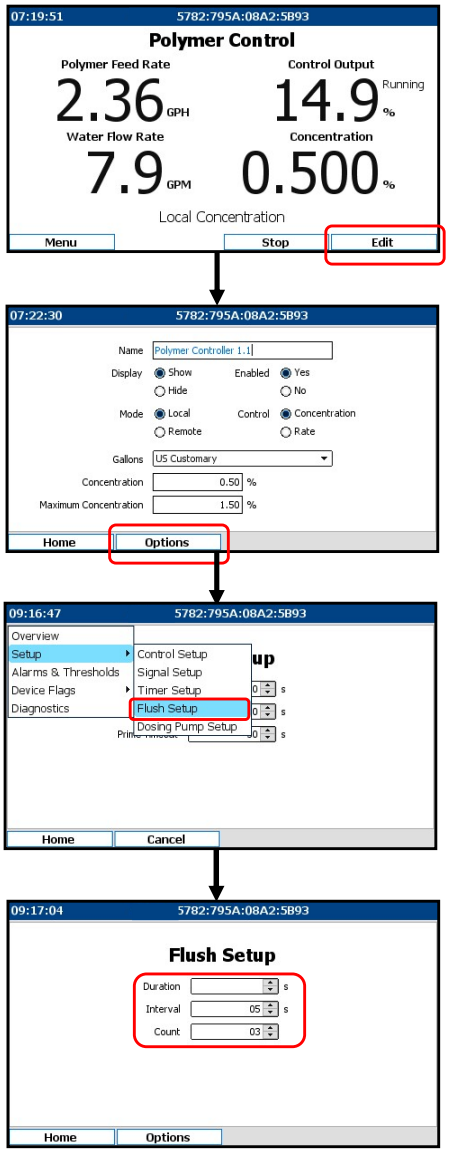


To Set Tempest 2.0 Dosing Pump & Low Water Flow Alarm:

The Dosing Pump Setup is programmed for the minimum and maximum neat polymer pump output in GPH. The Low Flow Threshold is the low water flow alarm setting.

1. Home Screen > Select Edit
2. Select Options > Setup > Dosing Pump Setup
3. Arrow Up/Down to Timer Selection and Press Enter
4. Use Arrow Keys to adjust desired time and Press Enter.
5. Select Home

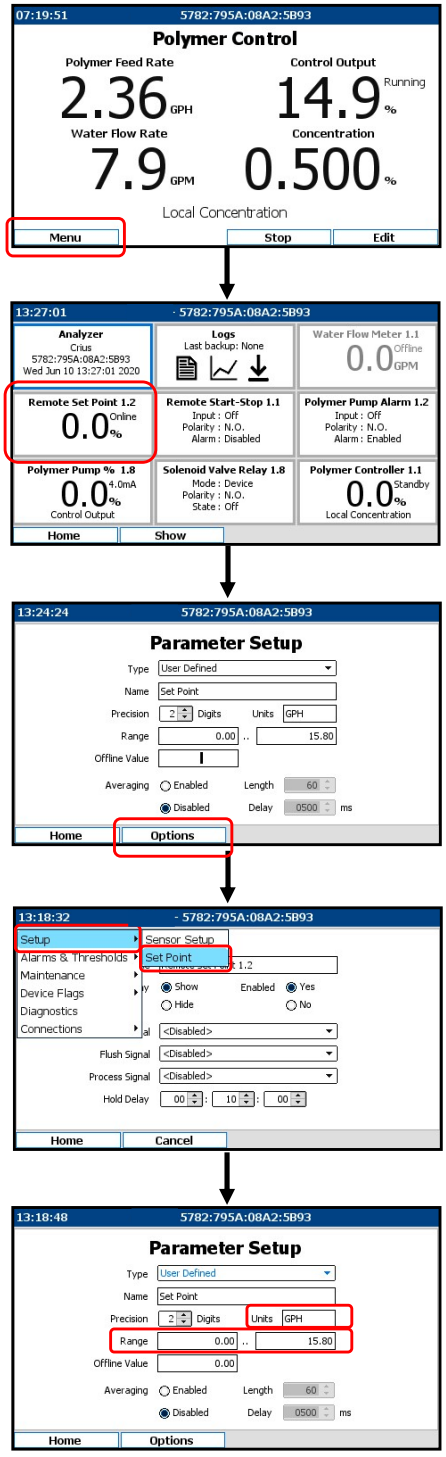
Setting Flush Cycles



To Set Tempest 2.0 Flush Cycles:

1. Select Edit
2. Select Options
3. Select Setup
4. Select Flush Setup
5. Arrow and Select Flush Duration (how long to flush mix chamber). Press Enter
6. Arrow and Select Flush Interval (time between flush duration). Press Enter
7. Arrow and Select Count (number of flush cycles). Press Enter
8. Select Home

Setup Remote Rate or % Concentration Input



To Set Remote Rate or % Concentration Input
Note: To switch from Remote % Concentration to Remote Rate, the Remote Input 1.2 requires rescaling, changing engineering units, and a calibration reset. The following steps outline this procedure

1. Home Screen > Select Menu
2. Arrow Down to Highlight Remote Set Point 1.2 Tile and Press Enter
3. Select Options > Setup > Set Point. Press Enter
4. Select Options > Setup > Signal Setup
5. Arrow Down to the Range Field.

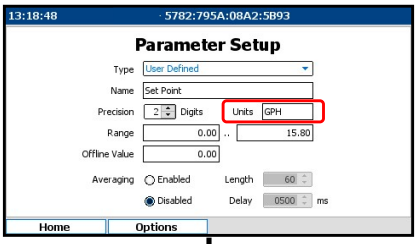
Note: This Field will show the Min and Max Setting for the Pump (Remote Rate) or the Min and Max Setting for % Concentration (0-1.5%).

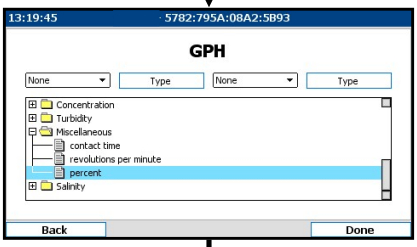
If changing from Rate to % Concentration or % Concentration to Rate, the Units will need to be changed and the Calibrations Curve will need to be Reset.

1. Select Units to open Units of Measure Menus
2. To change to %, Arrow Right to the 1st Type button and Press Enter.
3. Arrow Down to open the folder labeled Miscellaneous.
4. Arrow Down to Select percent.
5. Enter Done.

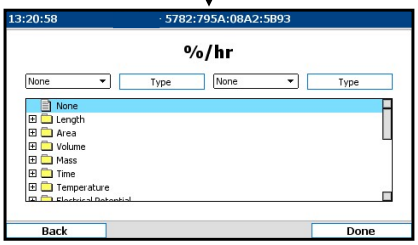
1. To Change from % to GPH, Arrow Right to 1st Type button and Press Enter.
2. Arrow to Volume folder and select gallon and Press Enter.
3. Arrow Right to 2nd Type button and Press Enter
4. Arrow to Time folder and select Hour. Press Enter.

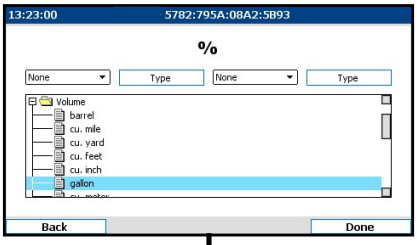
Setup Remote Engineering Units

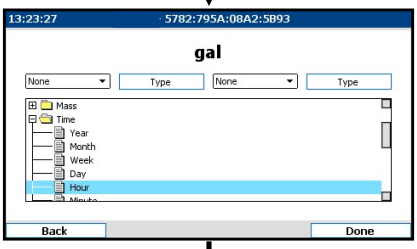




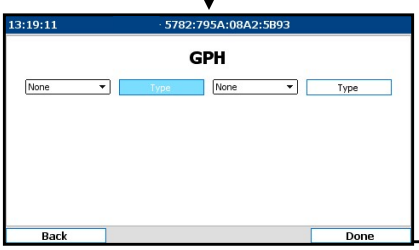
GPH to %







% to GPH



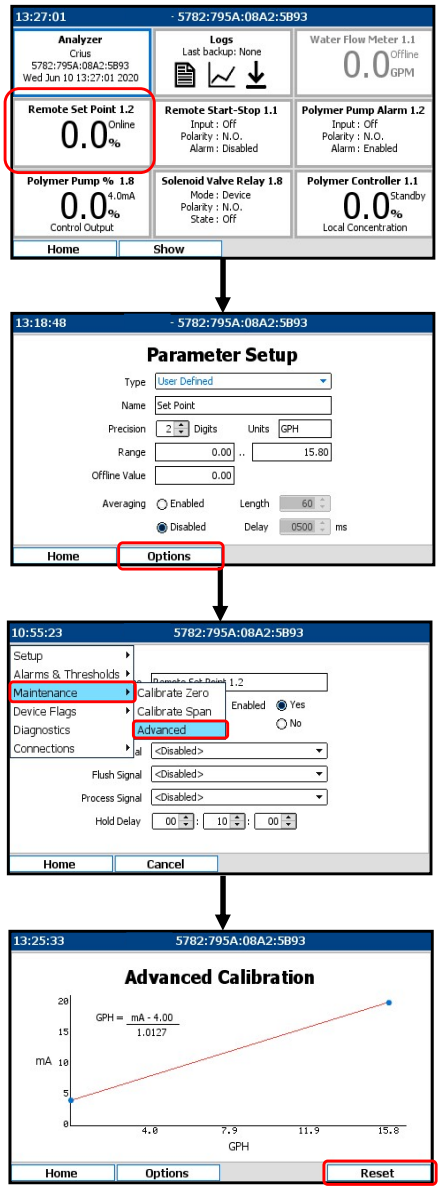
To Set Engineering Units for Remote % Concentration or Remote Rate and Rescaling Input

Note: This Field will show the Min and Max Setting for the Pump (Remote Rate) or the Min and Max Setting for % Concentration (0-1.5%). If changing from Rate to % Concentration or % Concentration to Rate, the Units will need to be changed and the Calibrations Curve will need to be Reset.

1. From the Parameter Setup Screen, Select Units to open Units of Measure Menus
2. To change to %, Arrow Right to the 1st Type button and Press Enter.
3. Arrow Down to open the folder labeled Miscellaneous.
4. Arrow Down to select percent. Press Enter
5. Arrow Right to 2nd Type button and Press Enter
6. Arrow to top of menu and select None. Press Enter.
7. Enter Done.

1. To Change from % to GPH, Arrow Right to 1st Type button and Press Enter.
2. Arrow to Volume folder and select gallon and Press Enter.
3. Arrow Right to 2nd Type button and Press Enter
4. Arrow to Time folder and select Hour. Press Enter.

Setup Remote Rate or % Concentration Input Units Reset Calibration Curve

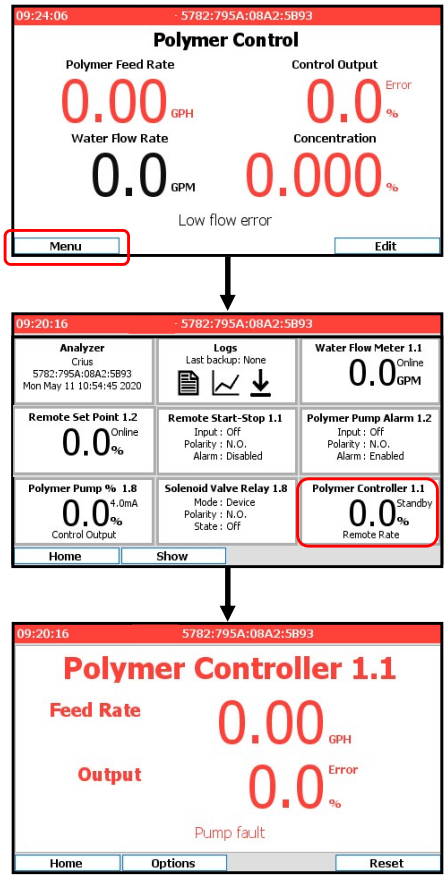


Reset Calibration Curve

1. From the Menu Screen Select Remote Set Pint 1.2
2. Select Options > Maintenance > Advanced
3. Press Reset > Yes

This set recalculates the input curve of the signal and calibrates the unit to the Min/Max range of the units

Reset Tempest 2.0 Alarm



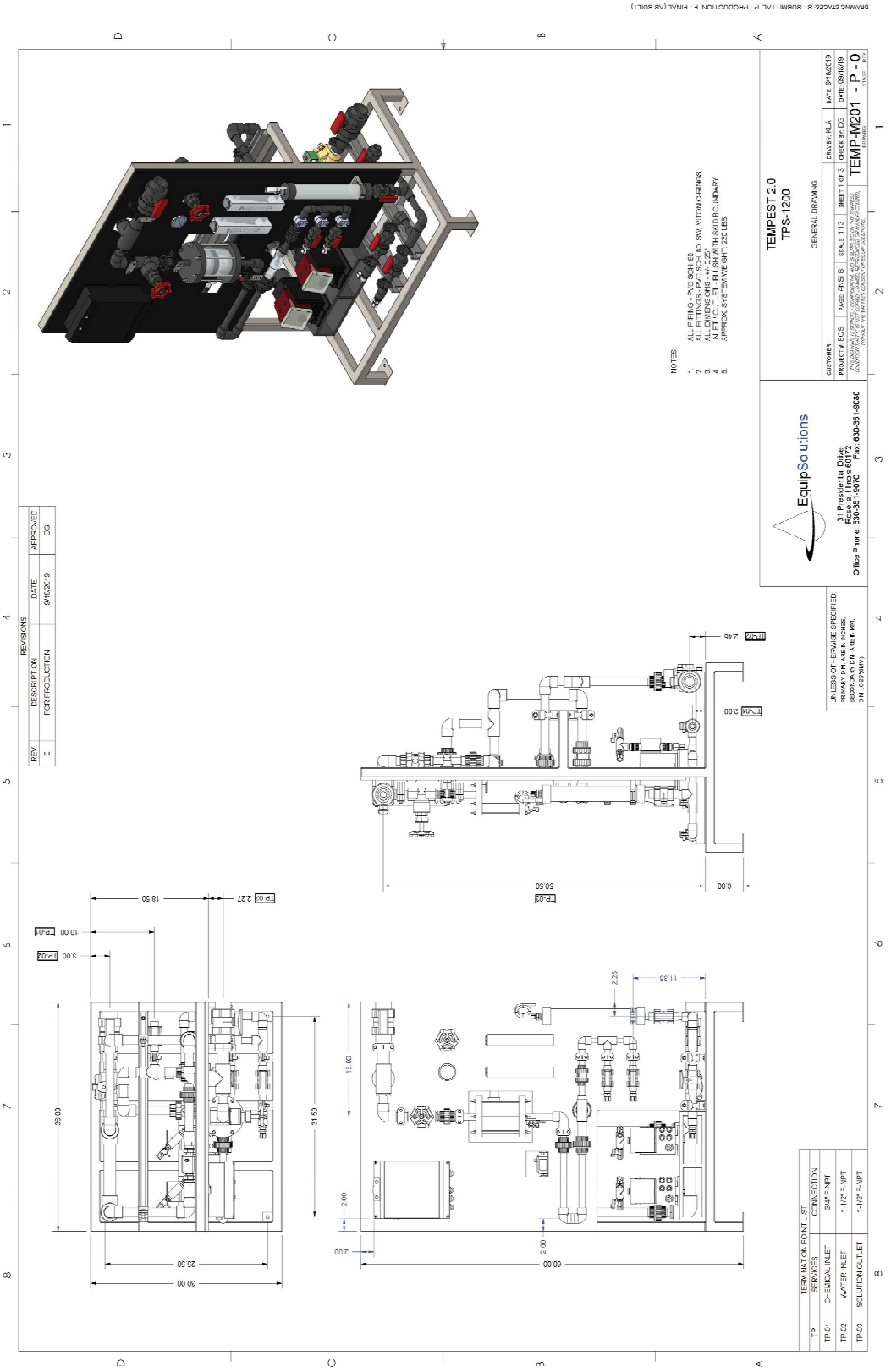
Procedure to Reset Alarm

The Tempest 2.0 Controller is designed to Alarm in several conditions including low water flow, % Concentration can not be reached based on input parameters or a pump fault error. When an alarm is active after the pre-programmed delay time, the Home Screen (Polymer Control Screen) will indicate no polymer feed and the system will automatically go into a flush cycle. At the end of the flush cycle the display bar turn red and indicate the alarm. At this time the system will shut down until the alarm is reset.

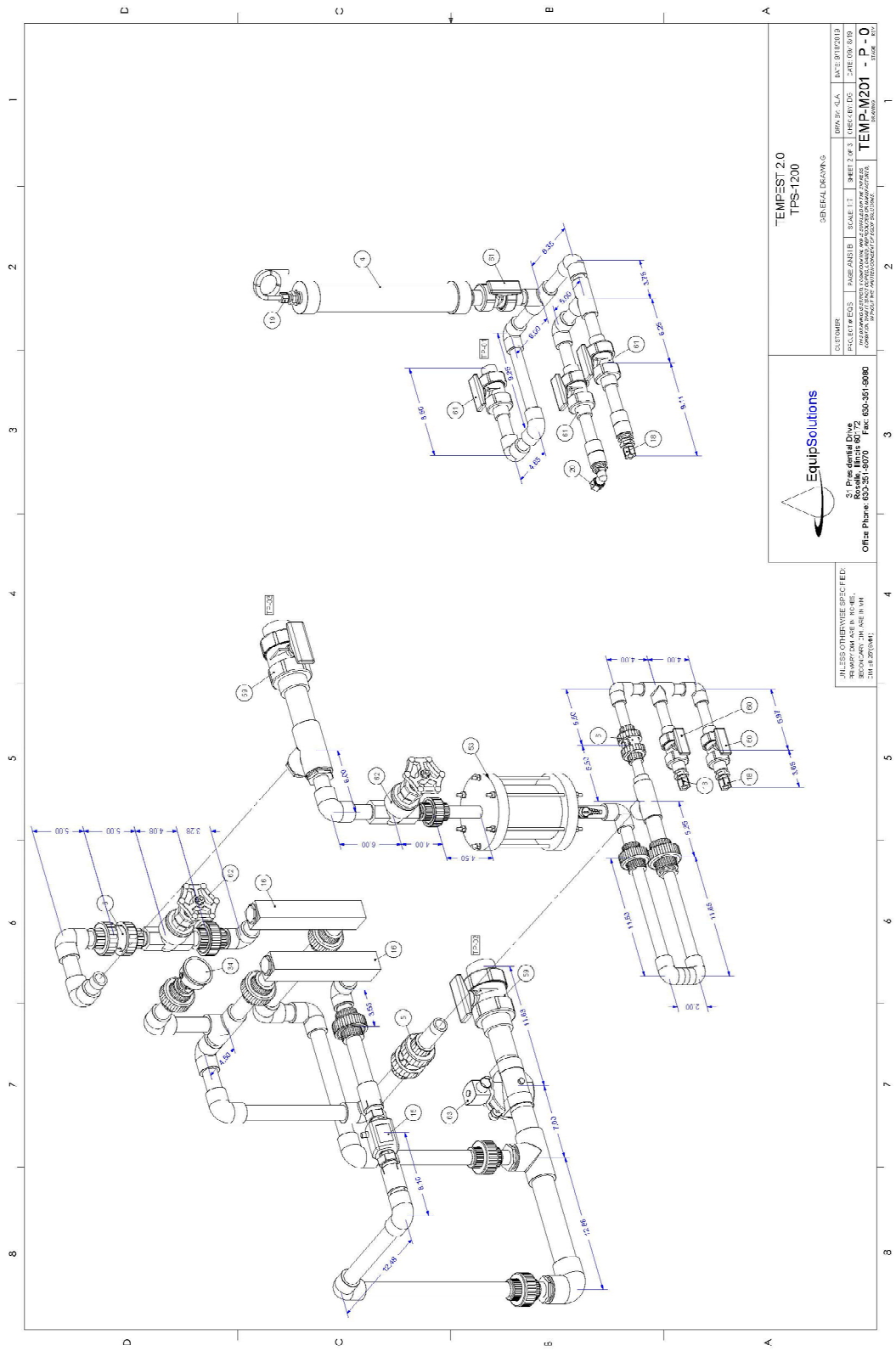
To Reset the Polymer control after an alarm:

1. From the Polymer Control (Home) Screen Press the Menu button
2. Arrow to the Polymer Controller 1.1 Tile and Press Enter
3. Press the Reset button and then press the Home button to return to the Home Screen

Tempest 2.0 Polymer Dosing System—General Arrangement



Tempest 2.0 Polymer Dosing System—General Arrangement (cont.)



ITEM NO.	DESCRIPTION	QTY.	PART #
2	ADAPTER, 1/2" NPT, PVC, GRUNDFOS	4	97702494
3	BACK PANEL, PP BLACK, 1/2" THICK	1	PPB-0500
4	CALIBRATION COLUMN, 500 ML (0 - 8.0 GPH), 3/4" F-NPT, FIXED CAP, PVC, KOFLO	1	500 ML
5	CHECK VALVE - SPRING LOADED, 1" SW, DOUBLE UNION, PVC, SCH. 80, VITON O-RINGS, CEPEX	2	22017VIT
6	CHECK VALVE - SPRING LOADED. 1/2" SW. DOUBLE UNION. PVC. SCH. 80. VITON O-RINGS. CEPEX	1	22015VIT
7	COUPLING, 3/4" SW, PVC, SCH80	2	829-007
8	ELBOW 90D, 1" SW, PVC, SCH.80	12	806-010
9	ELBOW 90D, 1" THD, PVC, SCH.80	2	808-010
10	ELBOW 90D, 1-1/2" SW, PVC, SCH.80	1	806-015
11	ELBOW 90D, 1/2" SW, PVC, SCH.80	2	806-005
12	ELBOW 90D, 3/4" SW, PVC, SCH.80	8	806-007
13	FEMALE ADAPTER, 1" SW/THD, PVC, SCH80	2	835-010
14	FEMALE CONNECTOR, 1/2" TUBE X 1/2" F-NPT, PVDF, JACO	2	25-8-8-K-PG
15	FLOW METER	1	??
16	FLOWMETER, 2 - 20 GPM, 1" M-NPT, ACRYLIC BODY, 316SS FLOAT MATERIAL, PANEL MOUNT, F-550 SERIES, BLUE / WHITE	2	F-55200L
17	FRAME, 30" X 36" X 60", 1-1/2" SQ. TUBE, 304 SS. WIH MOUNTING PADS (4)	1	TPS-M501-0
18	MALE CONNECTOR, 1/2" TUBE X 1/2" NPT, PVDF, JACO	5	10-8-8-K-PG
19	MALE CONNECTOR, 3/8" TUBE X 1/2" NPT, PVDF, JACO	1	10-6-8-K-PG
20	MALE ELBOW, 1/2" TUBE X 1/2" F-NPT, PVDF, JACO	1	40-8-8-K-PG
34	PRESSURE GAUGE S.S., 0-160 PSI, 1/4" M-NPT PROCESS CONNECTION, GLYCERIN FILLED, BACK MOUNT, 300 SERIES KODIAK	1	KC302L25160
35	PUMP, GRUNDFOS DDA 17-7 AR-PVC/T/C-F-311004BG, 1/2" M-NPT, 4.49 GPH @ 102 PSI, PVC HEAD/TEFLON GASKET, VALVE BALL CERAMIC, WITH ALARM RELAY	2	97722579
36	REDUCER BUSHING, 1" M-NPT X 3/4" F-NPT, PVC, SCH.80	1	839-131
37	REDUCER BUSHING, 1" SPG X 3/4" SW, PVC, SCH.80	2	837-131
38	REDUCER BUSHING, 1-1/2" SPG X 1" SW, PVC, SCH.80	4	837-211
39	REDUCER BUSHING, 1/2" M-NPT X 1/4" F-NPT, PVC, SCH.80	2	839-072
40	REDUCER BUSHING, 3/4" M-NPT X 1/2" F-NPT, PVC, SCH.80	1	839-101
41	REDUCER BUSHING, 3/4" SPG X 1/2" F-NPT, PVC, SCH.80	2	838-101
42	REDUCER BUSHING, 3/4" SPG X 1/4" F-NPT, PVC, SCH.80	1	838-098
43	SINGLE STRUT, MEDIUM DUTY 1-1/2", POLYESTER FRP, GRAY, 27" LONG, AICKINSTRUT	2	20P-1500
44	SINGLE STRUT, MEDIUM DUTY 1-1/2", POLYESTER FRP, GRAY, 33" LONG, AICKINSTRUT	2	20P-1500
45	TEE, 1" SW, PVC, SCH.80	1	801-010
46	TEE, 1" SW, PVC, SCH. 80, CLEAR, SPEARS	1	401-010L
47	TEE, 1-1/2" SW, PVC, SCH.80	2	801-015
48	TEE, 1/2" SW, PVC, SCH.80	1	801-005
49	TEE, 1/2" THD, PVC, SCH.80	2	805-005
50	TEE, 3/4" SW, PVC, SCH.80	2	801-007
51	TEMPEST CONTROLLER	1	??
52	TEMPEST HYDRO KINETIC MIXING TEE INSERT, PVC	1	TPS-010-PVC
53	TEMPEST MIXING CHAMBER, 3/4" FNPT	1	TPS-202-0
55	UNION, 1" SW, PVC, SCH.80, VITON O-RING	4	857-010
56	UNION, 1" SW, PVC, SCH. 80, VITON O-RING, SPEARS	2	857-010
57	UNION, 1" THD, PVC, SCH.80, VITON O-RING	2	858-010
58	UNION, 3/4" SW, PVC, SCH.80, VITON O-RING	2	857-007
59	VALVE BALL, 1-1/2" SW, PVC, SCH. 80, TRUE UNION 2000 STANDARD, VITON O-RINGS, SPEARS	2	3639-015
60	VALVE BALL, 1/2" SW, PVC, SCH. 80, TRUE UNION 2000 STANDARD, VITON O-RINGS, SPEARS	2	3639-005
61	VALVE BALL, 3/4" SW, PVC, SCH. 80, TRUE UNION 2000 STANDARD, VITON O-RINGS, SPEARS	4	3639-007
62	VALVE GLOBE, 1" F-NPT, PVC, EPDM O-RINGS, ASAHI	2	1261010
63	VALVE SOLENOID 1-1/2" F-NPT, BRASS NC, 120/60, NEMA 4, ASCO	1	8210G22 120/60
64	VALVE, LABCOCK 1/4" M-NPT X F-NPT, PVC, ASAHI	2	1080002

Remote operation of the Tempest can be configured in two different control modes. When configured for REMOTE CONCENTRATION operation, a 4-20 mA DC signal input will allow changing the pumping rate over the complete 0.01 to 1.5% concentration range within the limits of water flow and pump capacity. The pump rate will follow the instantaneous water flow to maintain the desired concentration as set by the remote 4-20 mA DC control signal.
When configured for REMOTE RATE operation, a 4-20mA DC signal input will allow changing the pump output (capacity) rate over the complete range of the metering pump.

Notes

Tempest 2.0

Operation & Programming Manual

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