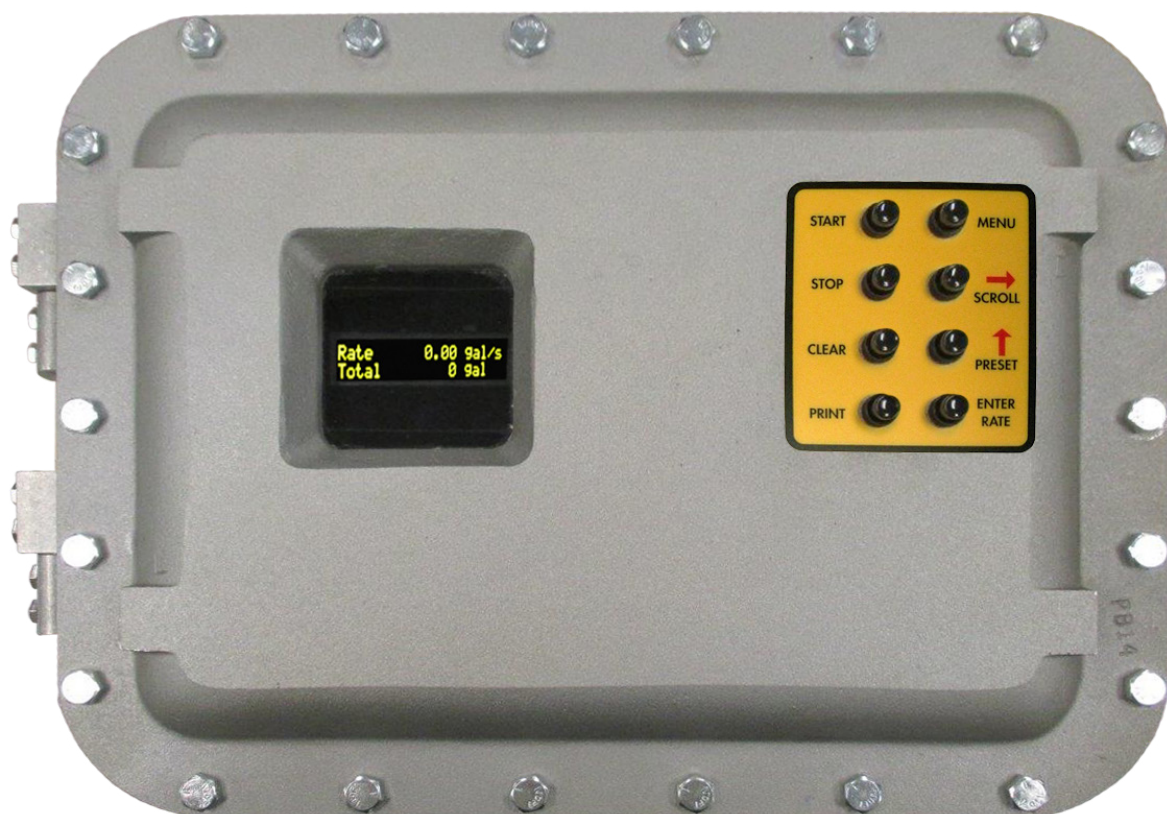


STX-ST1

EXPLOSION PROOF SUPERTROL-I





NOTICE!

The Kessler Ellis equipment is housed in an XCE 101404 N4 Explosion Proof Enclosure which is UL Classified for use in Class I, Division I, Groups B, C & D and Class II, Division I, Groups E, F & G and cUL Classified (Investigated to the CSA standards by UL) for use in Class I, Division I, Groups B, C & D and Class II, Division I, Groups E, F & G hazardous locations and includes miniature operators. Through the cover XMOBS 2 miniature operators are UL Listed and CSA Certified for use in Class I, Division I, Groups B, C & D and Class II, Division I, Groups E, F & G hazardous locations. The enclosure and operators have been investigated to and are approved for Type 4 applications.

Conduit entrances require approved seal fittings rated for the same hazardous locations within 18" of the enclosure.



WARNING!

This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling* procedures must be observed during the removal, installation, or handling of internal circuit boards or devices.

*Handling Procedure

- 1. Power to unit must be removed.
- 2. Personnel must be grounded, via wrist strap or other safe, suitable means, before any printed circuit board or other internal device is installed, removed or adjusted.
- 3. Printed circuit boards must be transported in a conductive bag or other conductive container. Boards must not be removed from protective enclosure until the immediate time of installation. Removed boards must be placed immediately in protective container for transport, storage, or return to factory.

Comments

This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, CMOS, etc.). Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, may exhibit early failure.



SAFETY INSTRUCTIONS

The following instructions must be observed.

- This instrument was designed and is checked in accordance with regulations in force EN 60950 (“Safety of information technology equipment, including electrical business equipment”).
A hazardous situation may occur if this instrument is not used for its intended purpose or is used incorrectly. Please note operating instructions provided in this manual.
- The instrument must be installed, operated and maintained by personnel who have been properly trained. Personnel must read and understand this manual prior to installation and operation of the instrument.
- This instrument is internally fused. Replace the internal fuse with the following specified type and rating only:

<u>Input Power</u>	<u>Recommended Fuse</u>
115 VAC	160 mA slow blow fuse
230 VAC	80 mA slow blow fuse
12-24 VDC	800 mA slow blow fuse

Disconnect power supply before replacing fuse!

- The manufacturer assumes no liability for damage caused by incorrect use of the instrument or for modifications or changes made to the instrument.

Symbols Used On Unit

<u>Number</u>	<u>Symbol</u>	<u>Publication</u>	<u>Description</u>
1		IEC 417, No. 5031	Direct current
2		IEC 417, No. 5172	Equipment protected throughout by DOUBLE INSULATION or REINFORCED INSULATION (equivalent to Class II of IEC 536—see annex H)
3		ISO 3864, No. B.3.1	Caution (refer to accompanying documents)

Technical Improvements

- The manufacturer reserves the right to modify technical data without prior notice.

CONTENTS

1. Description.....	1
1.1 Unit Description:.....	1
1.2 Unit Features:	1
1.3 Specifications:.....	2
2. Installation.....	6
2.1 General Mounting Hints:	6
2.2 Mounting Dimensions:	6
3. Applications	7
3.1 Liquid Volume	7
3.2 Corrected Liquid Volume.....	8
3.3 Liquid Mass	9
3.4 Batching	10
4 WIRING	11
4.1 Terminal Locations	11
4.2 Terminal Designations.....	11
4.3 Typical Batcher Wiring:	12
4.4 Typical Rate/Total Wiring:	12
5. UNIT OPERATION	13
5.2 Front Panel Operation Concept for Rate/Total Mode.....	13
5.1 General Operation	13
5.3 Ratemeter/Totalizer Operation	15
5.3.1 Password Protection for Rate/Total mode.....	15
5.3.2 Relay Operation in Rate/Total mode	15
5.3.3 Pulse Output in Rate/Total mode	15
5.3.4 Analog Output in Rate/Total mode	15
5.3.5 RS-232 Serial Port Operation in Rate/Total mode	16
5.3.6 RS-485 Serial Port (optional).....	16
5.4 Front Panel Operation Concept for Batcher Mode.....	17
5.5 Batcher Operation.....	19
5.5.1 Batcher Configuration.	19
5.5.2 Password Protection for Batcher Mode	20
5.5.3 Relay Operation in Batcher mode.....	20
5.5.4 Pulse Output in Batcher mode	20
5.5.5 Analog Output in Batcher mode	20
5.5.6 RS-232 Serial Port Operation in Batcher mode	21
5.5.7 RS-485 Serial Port (optional).....	21
6. PROGRAMMING	22
6.1 Front Panel Operation Concept for Program Mode	22
6.2.1 TOP LEVEL SETUP MENU	23
6.2.2 EZ Setup Submenu Groups.....	23
6.2 EZ Setup	23
6.3.1 Top Level Setup Menu	24
6.3.2 Submenu Groups.....	24
6.3 Setup Menus.....	24
6.4.1 SELECT EZ SETUP	25
6.4.2 INSTRUMENT TYPE	25
6.4 Setup Sub-Menus	25
6.4.3 SELECT FLOW EQUATION	27
6.4.4 SETUP INDICATORS (Total)	27
6.4.6 SETUP INDICATORS (Rate)	28
6.4.7 SETUP INDICATORS (Temperature).....	28
6.4.8 SETUP FLOW INPUT (Pulse - Ain & PS (A=B)).....	29
6.4.9 SETUP FLOW INPUT (Pulse - Quadrature, Qx1 or Qx2).....	30
6.4.10 SETUP FLOW INPUT (Analog)	32
6.4.11 SETUP AUX INPUT	33
6.4.12 SET FLUID PROPERTIES	34
6.4.13 SETUP PULSE OUTPUT	35
6.4.14 SETUP ANALOG OUTPUT	35
6.4.15 SETUP RELAYS (Relay 1 & Relay 2).....	36
6.4.16 SETUP CONTROL INPUTS (RATE/TOTAL)	38
6.4.17 SETUP CONTROL INPUTS (BATCH)	38
6.4.18 SETUP REALTIME CLOCK (Time).....	39
6.4.19 SETUP REALTIME CLOCK (Date).....	39
6.4.20 SERIAL USAGE.....	40
6.4.21 SETUP DATALOG/PRINT (Configure).....	41
6.4.22 SETUP DATALOG/PRINT (Select_list).....	42
6.4.23 ADMINISTRATIVE SETUP	43
6.4.24 SETUP NETWORK CARD (optional)	44
6.4.25 SETUP DISPLAY LIST (configuration).....	44

CONTENTS

7. Principle Of Operation	45
7.1 General:	45
7.2 Orifice Flowmeter Considerations:	45
7.3 Flow Equations:	45
7.4 Calculating the Expansion Factor	48
7.5 Computation of Viscosity Coef. A and B	49
7.6 Linearization Table	50
7.6.1 Linearization Table General Information	50
7.6.2 Linearization Table for Pulse Inputs	50
7.6.3 Linearization Table for Analog Inputs	50
7.6.4 Linearization Table Interpolation	50
8. Test, Service and Maintenance	51
8.1 Test Menus.....	51
8.2 Test Sub-Menus	52
8.2.1 Audit Trail Submenu Group.....	52
8.2.2 Error History Submenu Group	52
8.2.3 Print System Setup Submenu Group.....	52
8.2.4 Keypad test Submenu Group.....	53
8.2.5 Display test Submenu Group	53
8.2.6 Calibrate CH1 0mA Submenu Group.....	54
8.2.7 Calibrate CH1 20mA Submenu Group.....	54
8.2.8 Calibrate CH2 0mA Submenu Group.....	55
8.2.9 Calibrate CH2 20mA Submenu Group.....	55
8.2.10 Calibrate CH1 0V Submenu Group.....	56
8.2.11 Calibrate CH1 10V Submenu Group.....	56
8.2.12 Calibrate CH2 0V Submenu Group.....	57
8.2.13 Calibrate CH2 10V Submenu Group.....	57
8.2.14 Calibrate 100 ohm RTD Submenu Group.....	57
8.2.15 Calibrate 4mA Out Submenu Group	58
8.2.16 Calibrate 20mA Out Submenu Group	58
8.2.17 Analog In Test Submenu Group	58
8.2.18 Pulse input test Submenu Group	59
8.2.19 Analog out test Submenu Group.....	59
8.2.20 Excitation out test Submenu Group	59
8.2.21 Pulse out test Submenu Group.....	60
8.2.22 Relay test Submenu Group.....	60
8.2.23 Control input test Submenu Group	60
8.2.24 Battery Voltage test Submenu Group	61
8.2.25 Data logger utility Submenu Group.....	61
8.3 Internal Fuse Replacement.....	62
9. RS-232 Serial Port	63
9.1 RS-232 Port Description:	63
9.2 Instrument Setup by PC's over Serial Port	63
9.3 Operation of Serial Communication Port with Printers	63
9.4 RS-232 Terminal Block Pinout	63
10. RS-485 Serial Port (optional)	64
10.1 RS-485 Port Description:	64
10.2 General	64
10.3 Operation of Serial Communication Port with PC	64
10.4 RS-485 Terminal Block Pinout	64
11. Batcher Setup Software	65
11.1 System Requirements:.....	65
11.2 Cable and Wiring Requirements:	65
11.3 Installation	65
11.4 Using the STX-ST1 Setup Software.....	66
11.5 File Tab.....	66
11.6 Setup Tab	66
11.7 View Tab.....	67
11.8 Misc. Tab	67
12. Glossary Of Terms.....	68
13. Diagnosis and Troubleshooting.....	72
13.1 Response of SYX-ST1 on Error or Alarm:	72
13.2 Diagnosis Flow Chart and Troubleshooting	73
13.3 Error & Warning Messages:.....	74
13.3.1 Sensor/Process Alarms.....	74
13.3.2 Self Test Alarms	75
APPENDIX A - Setup Menus	76
APPENDIX B - Batching Diagrams.....	77
WARRANTY	79
Ordering Information.....	79

Unit Description

1. Description

1.1 Unit Description:

The STX-ST1 satisfies the instrument requirements for a variety of flowmeter types in hazardous area rate/total and batching applications. Multiple flow equations and instrument functions are available in a single unit with many advanced features.

The alphanumeric display shows measured and calculated parameters in easy to understand format. User defineable display scrolling is supported.

The versatility of the STX-ST1 permits a wide range of functions within the instrument's explosion proof package. The various hardware inputs and outputs can be "soft" assigned to meet a variety of common application needs. The user "soft selects" the usage of each input/output while configuring the instrument.

The isolated analog output can be chosen to follow volume flow, corrected volume flow, mass flow, temperature, or density by means of a menu selection. Most hardware features are assignable by this method.

The user can assign the standard RS-232 Serial Port for data logging, transaction printing, or for connection to a modem for remote meter reading. Remote metering software available.

A Service or Test mode is provided to assist the user during start-up system check out by monitoring inputs and exercising outputs and printing system setup.

Unit Features

1.2 Unit Features:

The STX-ST1 offers the following features:

- Explosion Proof Enclosure with LCD Display
- Rate/Total and Batching Functions
- Advanced Batching Features: Overrun Compensation, Print End of Batch, Slow Start of Batch Fill, Slow End of Batch Fill, 2 Stage Batching or Digital Control Valve
- Advanced Printing Capabilities
- "EZ Setup" Guided Setup for First Time Users
- Menu Selectable Hardware & Software Features
- Isolated Pulse, Analog and Relay Outputs Standard on AC Powered Models
- RS-232 Port Standard, Modbus RTU RS-485 Optional
- Windows™ Setup Software
- On Board Data Logging
- DDE Server & HMI Software Available
- User Definable Units of Measure
- Enhanced Modem Features for Remote Metering

1.3 Specifications:

Specifications:

Flow Meters and Computations

Meter Types: All liquid linear and square law meters supported including: vortex, turbine, magnetic, PD, target, orifice, venturi, v-cone, coriollis and many others
Linearization: Square root, 16 point table or UVC table
Computations: Volume, Corrected Volume & Mass
Fluid Computations: Temperature, Density, Viscosity and API 2540 for petroleum.

Environmental

Operating Temperature: 0°C to +50°C
Storage Temperature: -40°C to +85 C
Humidity : 0-95% Non-condensing
Extended Temperature: -20°C to +55°C

Display

Type: 2 lines of 20 characters
Types: VFD, Backlit LCD or OLED
Character Size: 0.2" nominal
User programmable label descriptors and units of measure

Keypad

Keypad Type: Mechanical Pushbutton with 8 keys

Enclosure

Size: See Dimensions
Type: Class 1, Div 1, Groups C & D
Materials: Aluminum
Weight: 45 lbs.

Real Time Clock

The STX-ST1 is equipped with a battery backed real time clock with display of time and date.
Format: 12 or 24 hour time display
Day, Month, Year date display

Power Input

The factory equipped power option is internally fused. An internal filter and MOV are provided for added transient suppression.
110 VAC Power: 85 to 127 Vrms, 50/60 Hz
220 VAC Power: 170 to 276 Vrms, 50/60 Hz
DC Power: 12 VDC (10 to 14 VDC)
24 VDC (14 to 28 VDC)
Power Consumption:
AC: 11.0 VA (11W)
DC: 300 mA max.

Flow Inputs:

Analog Input:

Accuracy: 0.02% FS at 20° C
Ranges
Voltage: 0-10 VDC, 0-5 VDC, 1-5 VDC
Current: 4-20 mA, 0-20 mA
Basic Measurement Resolution:
16 bit
Update Rate: 4 updates/sec
Automatic Fault detection: Signal over/under-range, Current Loop Broken
Calibration: Software Calibration (no trimmers) and Auto-zero Continuously
Extended calibration:
Learns Zero and Full Scale of each range using special test mode.
Fault Protection:
Reverse Polarity: No ill effects
Over-Voltage Limit: 50 VDC Over voltage protection
Over-Current Protection: Internally current limited protected to 24VDC

Pulse Inputs:

Number of Flow Inputs: one with or without quadrature or pulse security checking
Input Impedance: 10 KΩ nominal
Pullup Resistance: 10 KΩ to 5 VDC (menu selectable)
Pull Down Resistance: 10 KΩ to common
Trigger Level: (menu selectable)
High Level Input
Logic On: 3 to 30 VDC
Logic Off: 0 to 1 VDC
Low Level Input (mag pickup)
Sensitivity:
10 mV or 100 mV
Minimum Count Speed:
Menu selectable to 1 pulse every 99.9 sec.
Maximum Count Speed:
Menu Selectable: 40Hz, 3000Hz or 20 kHz
Overvoltage Protection: 50 VDC

Auxiliary / Compensation Input

The auxiliary/compensation input is menu selectable for temperature, density or not used. This input is used for the compensated input when performing compensated flow calculations. It can also be used as a general purpose input for display and alarming.

Operation: Ratiometric

Accuracy: 0.02% FS at 20° C

Basic Measurement Resolution:
16 bit

Update Rate: 1 update/sec minimum

Automatic Fault detection:

Signal Over-range/under-range

Current Loop Broken

RTD short

RTD open

Fault mode to user defined default settings

Fault Protection:

Reverse Polarity: No ill effects

Over-Voltage Limit (Voltage Input): 50 VDC

Available Input Ranges

Voltage: 0-10 VDC, 0-5 VDC, 1-5 VDC

Current: 4-20 mA, 0-20 mA

Resistance: 100 Ohms DIN RTD
(DIN 43-760, BS 1904):

Three Wire Lead Compensation

Internal RTD linearization learns ice point resistance

1 mA Excitation current with reverse polarity protection

Temperature Resolution: 0.01°C

Temperature Accuracy: $\pm 0.25^\circ\text{C}$

Control Inputs

Remote Switch Inputs are menu selectable for Start, Stop, Reset, Lock, Inhibit, Alarm Acknowledge, Print or Not Used.

Number of Control Inputs: 3

Control Input Specifications

Input Scan Rate: 10 scans per second

Logic 1: 4 - 30 VDC

Logic 0: 0 - 0.8 VDC

Input Impedance: 100 K Ω

Control Activation:

Positive Edge or Pos. Level based on product definition for switch usage.

Excitation Voltage

Menu Selectable: 5, 12 or 24 VDC @ 100 mA (fault protected)

Relay Outputs

The relay outputs are menu assignable to (Individually for each relay) Low Rate Alarm, Hi Rate Alarm, Prewarn Alarm, Preset Alarm, Digital Control Valve or General purpose warning (security), low temperature/high temperature.

Number of relays: 2 (4 optional)

Contact Style: Form C contacts

Contact Ratings: 5 amp, 240 VAC or 30 VDC

Serial Communication

The serial port can be used for printing, datalogging, modem connection and communication with a computer.

RS-232:

Device ID: 01-99

Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19200

Parity: None, Odd, Even

Handshaking: None, Software, Hardware

Print Setup: Configurable print list and formatting.

Print Out: Custom form length, print headers, print list items.

Print Initialization: Print on end of batch, key depression, interval, time of day, control input or serial request.

RS-485: (optional 2nd COM port)

Device ID: 01-247

Baud Rates: 2400, 4800, 9600, 19200

Parity: None, Odd, Even

Protocol: Modbus RTU (Half Duplex)

Data Logging

The data logger captures print list information to internal storage for approximately 250 transactions. This information can be used for later uploading or printing. Storage format is selectable for Comma-Carriage Return or Printer formats.

Isolated Analog Output

The analog output is menu assignable to correspond to the Uncompensated Volume Rate, Corrected Volume Rate, Mass Rate, Temperature, Density, Volume Total, Corrected Volume Total or Mass Total.

Type: Isolated Current Sourcing

Available Ranges: 4-20 mA, 0-20 mA

Resolution: 12 bit

Accuracy: 0.05% FS at 20° C

Update Rate: 1 update/sec minimum

Temperature Drift: Less than 200 ppm/C

Maximum Load: 1000 ohms (at nominal line voltage)

Compliance Effect: Less than .05% Span

60 Hz rejection: 40 dB minimum

Calibration: Operator assisted Learn Mode

Averaging: User entry of damping constant to cause a smooth control action

Isolated Pulse output

The isolated pulse output is menu assignable to Uncompensated Volume Total, Compensated Volume Total or Mass Total

Pulse Output Form: Photomos Relay

Maximum On Current: 25 mA

Maximum Off Voltage: 30 VDC

Saturation Voltage: 1.0 VDC

Maximum Off Current: 0.1 mA

Pulse Duration: 10 mSec or 100 mSec (user selectable)

Pulse output buffer: 256

Fault Protection

Reverse polarity: Shunt Diode

Operating (Run) Mode

The STX-ST1 can be thought of as making a series of measurements of flow, temperature/density sensors and then performing calculations to arrive at a result(s) which is then updated periodically on the display. The analog output, the pulse output, and the alarm relays are also updated. The cycle then repeats itself.

Step 1: Update the measurements of input signals-
Raw Input Measurements are made at each input using equations based on input signal type selected. The system notes the “out of range” input signal as an alarm condition.

Step 2: Compute the Flowing Fluid Parameters-
The temperature, viscosity, and density equations are computed as needed based on the flow equation and input usage selected by the user.

Step 3 : Compute the Volumetric Flow-
Uncompensated flow is the term given to the flow in volume units. The value is computed based on the flowmeter input type selected and augmented by any performance enhancing linearization that has been specified by the user.

Step 4: Compute the Corrected Volume Flow at Reference Conditions-
In the case of a corrected liquid volume flow calculation, the corrected volume flow is computed as required by the selected compensation equation.

Step 5 : Compute the Mass Flow-
All required information is now available to compute the mass flow rate as volume flow times density.

Step 6: Check Flow Alarms-
The flow alarm functions have been assigned to one of the above flow rates during the setup of the instrument. A comparison is now made by comparing the current flow rates against the specified hi and low limits.

Step 7: Compute the Analog Output-
This designated flow rate value is now used to compute the analog output.

Step 8: Compute the Flow Totals by Summation-
A flow total increment is computed for each flow rate. This increment is computed by multiplying the respective flow rate by a time base scaler and then summing. The totalizer format also includes provisions for total rollover.

Step 9: Total Preset Comparisons-
The total associated with a preset function is then compared against the corresponding preset value and any required control actions taken.

Step 10: Pulse Output Service-
The pulse output is next updated by scaling the total increment which has just been determined by the pulse output scaler and summing it to any residual pulse output amount.

Step 11: Update Display and Printer Output-
The instrument finally runs a task to update the various table entries associated with the front panel display and serial outputs.

Setup Mode

The setup mode is password protected by means of a numeric lock out code established by the user. In addition, a secret, manufacturers numeric unlock entry sequence is available.

The system also provides a minimum implementation of an “audit trail” which tracks significant setup changes to the unit. This feature is increasingly being found of benefit to users or simply required by Weights and Measurement Officials in systems used in commerce, trade, or “custody transfer” applications.

A software program is available which runs on a PC using a RS-232 Serial for connection to the STX-ST1. Illustrative examples may be down loaded in this manner.

The setup mode has numerous subgrouping of parameters needed for flow calculations. There is a well conceived hierarchy to the setup parameter list. Selections made at the beginning of the setup affect offerings further down in the lists.

In the setup mode, the STX-ST1 activates the correct setup variables based on the instrument configuration, the flow equation, and the hardware selections made for the compensation transmitter type, the flow transmitter type, and meter enhancements (linearization) options selected. All required setup parameters are enabled. All setup parameters not required are suppressed.

In the setup mode selections, several parameters are required to be input by the operator since these parameters are blank when the unit is received. The user will be prompted for these necessary values for his application.

Also note that in the setup mode are parameter selections which have preassigned industry standard values. The unit will assume these values unless they are modified by the user.

Most of the process input variables have available a “default” or emergency value which must be entered. These are the values that the unit assumes when a malfunction is determined to have occurred on the corresponding input.

It is possible to enter in a nominal constant value for temperature or density, or analog flow inputs by placing the desired nominal value into both the lo and hi values. This is also a convenience when performing bench top tests without simulators.

Display Mode (Disp)

The user can define a scrolling display list for lines 1 and 2. In batching applications line 2 is reserved for total amount filled in current batch cycle.

Maintenance Mode (Test):

The Maintenance Mode of the STX-ST1 is the Test and Calibration Mode for the device. This mode provides a number of specialized utilities required for factory calibration, instrument checkout on start-up, and periodic calibration documentation.

A Supervisor password is required to gain access to this specialized mode of operation. Normally quality, calibration, and maintenance personnel will find this mode of operation very useful. It is also useful for factory testing.

Many of these tests may be used during start-up of a new system. Inputs signals may be read, and output signals may be exercised to verify the electrical interconnects before the entire system is put on line.

The following action items may be performed in the Maintenance Mode:

- Error History
- Print Calibration/Maintenance Report
- Examine Audit Trail
- Perform Keypad Checkout
- Perform Display Checkout
- Perform Pulse Input Checkout
- Perform Pulse Output Checkout
- Perform Control Input Checkout
- Perform Relay Output Checkout
- Perform Analog Input Checkout
- Perform Analog Output Checkout
- Calibrate Analog Inputs using the Learn Feature
- Calibrate Analog Output using the Learn Feature
- Battery Check
- Review/Clear/Print Datalogger

Note that a calibration of the analog input/output will advance the audit trail counters since it effects the accuracy of the system.

RS-232 Serial Port

The STX-ST1 has a general purpose RS-232 Port which may be used for any one of the following purposes:

- Transaction Printing
- Data Logging Internal Datalog Dumps
- Remote Metering by Modem (optional)
- Computer Communication Link
- Configuration by Computer
- Print System Setup
- Print Calibration/Malfunction History
- Remote Control

Instrument Setup by PC's over Serial Port

A Diskette program is provided with the STX-ST1 that enables the user to rapidly configure the STX-ST1 using an Personnel Computer. Included on the diskette are common instrument applications which may be used as a starting point for your application. This permits the user to have an excellent starting point and helps speed the user through the instrument setup.

Operation of Serial Communication Port with Printers

STX-ST1's RS-232 channel supports a number of operating modes. One of these modes is intended to support operation with a printer in metering applications requiring transaction printing, data logging and/or printing of calibration and maintenance reports.

For transaction printing, the user defines the items to be included in the printed document. The user can also select what initiates the transaction print generated as part of the setup of the instrument. The transaction document may be initiated via a front panel key depression, a remote contact closure, or upon completion of a batch.

In data logging, the user defines the items to be included in each data log as a print list. The user can also select when or how often he wishes a data log to be made. This is done during the setup of the instrument as either a time of day or as a time interval between logging.

The system setup and maintenance report lists all the instrument setup parameters and usage for the current instrument configuration. In addition, the Audit trail information is presented along with a status report listing any observed malfunctions history which have not been corrected and cleared.

The user initiates the printing of this report at a designated point in the menu by pressing the print key on the front panel.

Operation of Serial Port with Modems (optional)

The STX-ST1 RS-232 channel supports a number of operating modes. One of these modes is intended to support operation with a modem in remote metering applications.

An external modem is intentionally being used with the STX-ST1. This permits use with the variety of modem standards worldwide while avoiding the specialized approvals required for equipment that is deemed to fall under the category of telecommunication equipment.

In the modem mode, the STX-ST1 is assumed to be operating in a remote metering role. The STX-ST1 will support key items in the Hayes Compatible "AT" Command Set. In this role, the STX-ST1 will have the following special abilities:

1. Monitor the modem status as a task of the system
2. Instruct the modem to answer an incoming call ATA
3. Respond to the calling modem at a compatible baud rate and protocol
4. Perform error checking in conjunction with the modem
5. Monitor the status of the carrier
6. Terminate the telephone connection in event the connection is lost.

In addition, the STX-ST1 will be capable of initiating a call to a designed telephone number in the event of a metering malfunction.

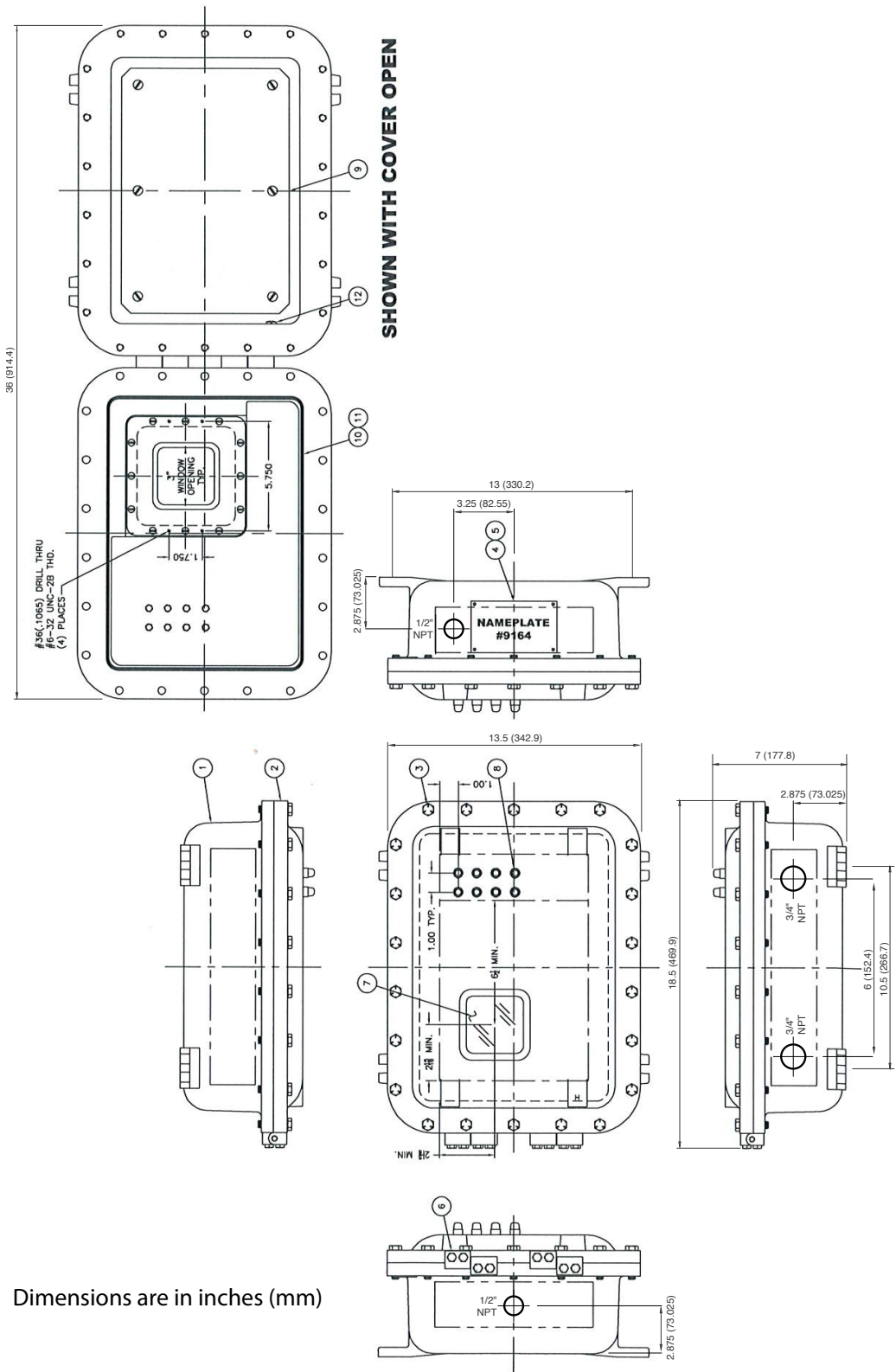
2. Installation

General Mounting Hints

2.1 General Mounting Hints:

The STX-ST1 should be located in an area with a clean, dry atmosphere which is relatively free of shock and vibration.

2.2 Mounting Dimensions:



3. Applications

Liquid Volume

3.1 Liquid Volume

Measurements:

A flowmeter measures the actual volume in a liquid line. A temperature sensor can also be installed to correct for liquid thermal expansion (see 3.2 Corrected Volume).

Calculations:

- For Flowmeters with Pulse Outputs, Volume flow is calculated using the flowmeter frequency output and the user entered K-Factor.
- For Flowmeters with Analog Transmitters, Volume flow is calculated using the measured flowmeter signal and the user entered scale settings.

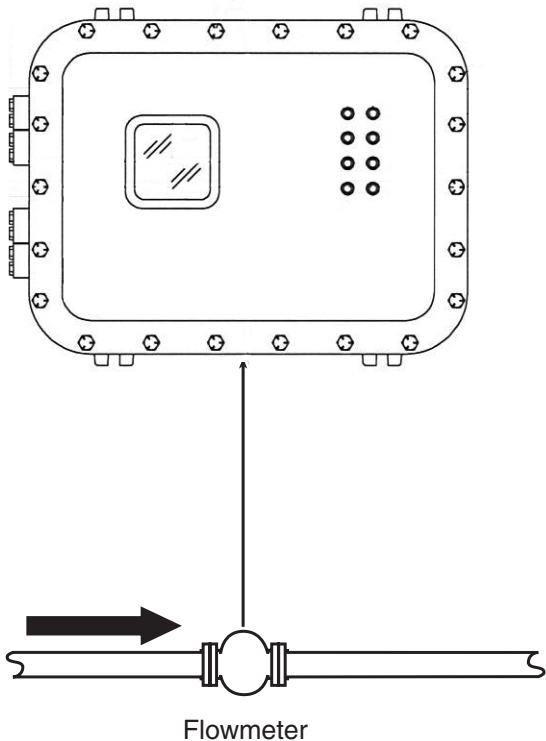
Output Results:

- Display Results
Flow Rate, Resettable Total, Non-Resettable Total
- Analog Output
Rate or Total
- Pulse Output
Total
- Relay Outputs
Rate or Total Alarms

Applications:

The STX-ST1 can monitor actual volume flow and total of any liquid. Flow alarms are provided via relays and datalogging is available via analog (4-20mA) and serial outputs.

Liquid Volume Illustration



Calculations

Pulse Input; Average K-Factor

$$\text{Volume Flow} = \frac{\text{input frequency} * \text{time scale factor}}{\text{K-Factor}}$$

Analog Input; Linear

$$\text{Volume Flow} = \% \text{ input} * \text{Full Scale Flow}$$

Corrected
Liquid Volume

3.2 Corrected Liquid Volume

Measurements:

A flowmeter measures the actual volume in a liquid line. A temperature sensor is installed to correct for liquid thermal expansion.

Calculations:

- Corrected Volume is calculated using the flow and temperature inputs as well as the thermal expansion coefficient stored in the STX-ST1. Use the "SET FLUID PROPERTIES" submenu to define reference temperature and density values for standard conditions.

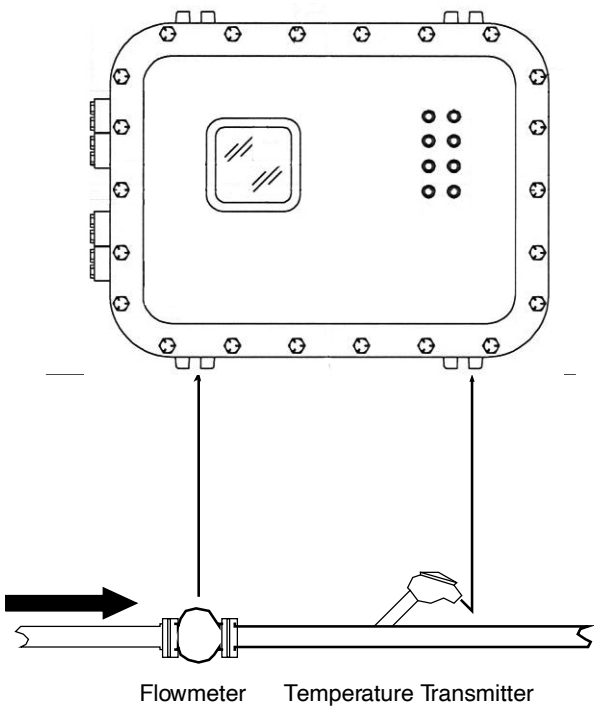
Output Results:

- Display Results
Flow Rate, Resettable Total, Non-Resettable Total, Temperature, Density
- Analog Output
Rate, Total, Temperature or Density
- Pulse Output
Total
- Relay Outputs
Rate , Total or Temperature Alarms

Applications:

Monitoring corrected volume flow and total of any liquid. Flow alarms are provided via relays and datalogging is available via analog (4-20mA) and serial outputs.

Corrected
Liquid Volume
Illustration



Calculations

Volume Flow

As calculated in section 3.1

Corrected Volume Flow (Temp. Transmitter)

$$\text{Corrected Volume Flow} = \text{vol. flow} * (1 - \text{Therm.Exp.Coef.} * (\text{Tf-Tref}))^2$$

or alternately API2540 equation

Liquid Mass

3.3 Liquid Mass

Measurements:

Actual volume is measured by the flow element (DP transmitter or Flowmeter). Temperature is measured by the temperature transmitter. A density transmitter can be used for direct density measurements.

Calculations:

- The density and mass flow are calculated using the reference density and the thermal expansion coefficient of the liquid (see "SET FLUID PROPERTIES" submenu)

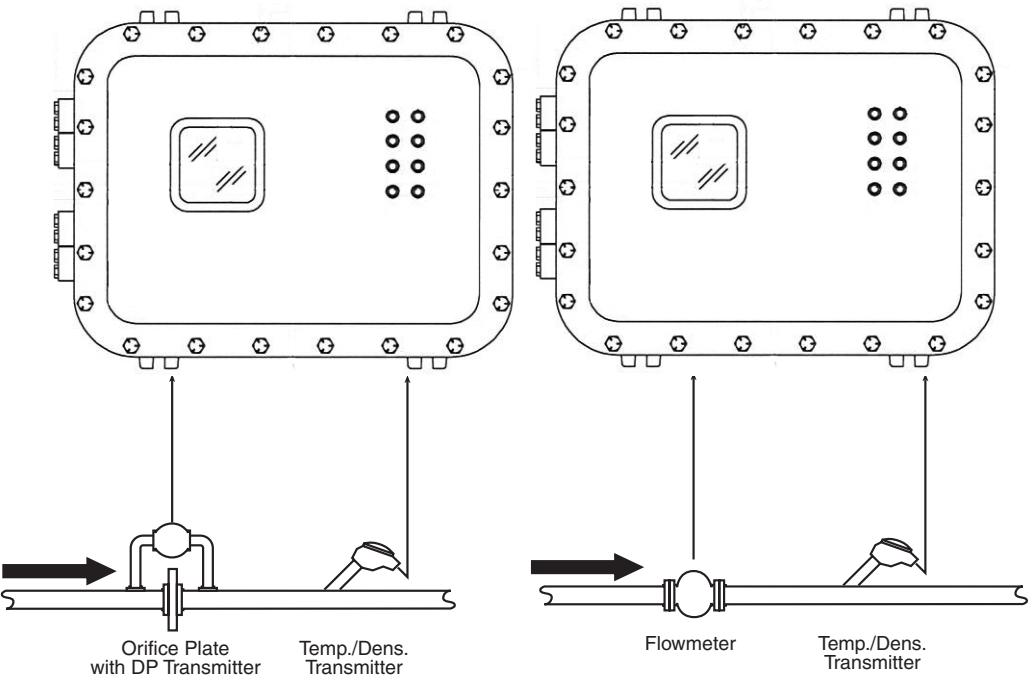
Output Results:

- Display Results
Flow Rate, Resettable Total, Non-Resettable Total, Temperature, Density
- Analog Output
Rate, Total, Temperature or Density
- Pulse Output
Total
- Relay Outputs
Rate, Total or Temperature Alarms

Applications:

Monitoring mass flow and total of any liquid. Flow alarms are provided via relays and datalogging is available via analog (4-20mA) and serial outputs.

Liquid Mass Illustration



Calculations

Volume Flow

As calculated in section 3.1

Mass Flow

Mass Flow = volume flow * density

3.4 Batching

Measurements:

A flowmeter measures the actual volume in a liquid line. A temperature sensor can also be installed to correct for liquid thermal expansion (see 3.2 Corrected Volume or 3.3 Liquid Mass).

Calculations:

- For Flowmeters with Pulse Outputs, Volume flow is calculated using the flowmeter frequency output and the user entered K-Factor.
- For Flowmeters with Analog Transmitters, Volume flow is calculated using the measured flowmeter signal and the user entered scale settings.
- Corrected Volume is calculated using the flow and temperature inputs as well as the thermal expansion coefficient stored in the STX-ST1.

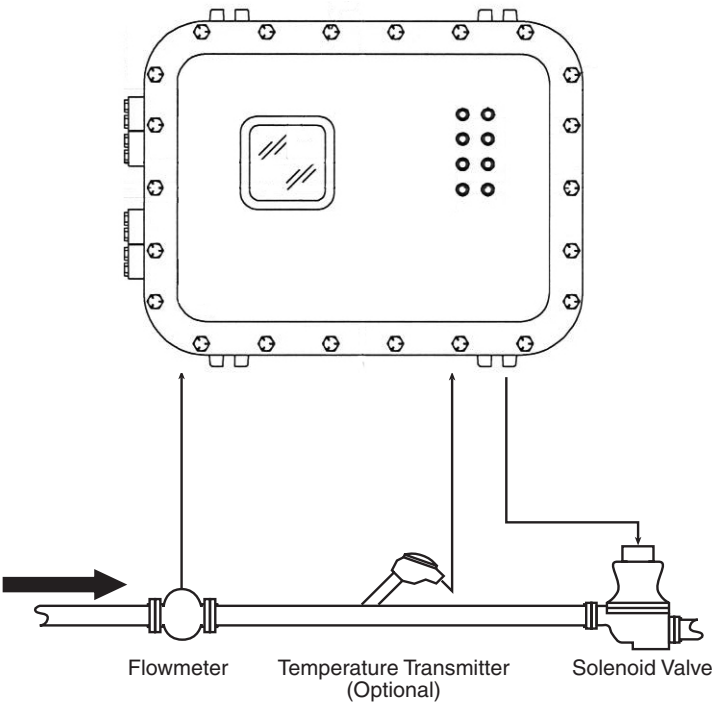
Output Results:

- Display Results
Flow Rate, Batch Total, Non-Resettable Total, Temperature, Density
- Analog Output
Rate, Total, Temperature or Density
- Pulse Output
Total
- Relay Outputs
Batch Total, Rate, or Temperature Alarms

Applications:

Batching and monitoring flow and total of any liquid. Batching is accomplished via relays and datalogging is available via analog (4-20mA) and serial outputs.

Batching Illustration



Calculations

Volume Flow

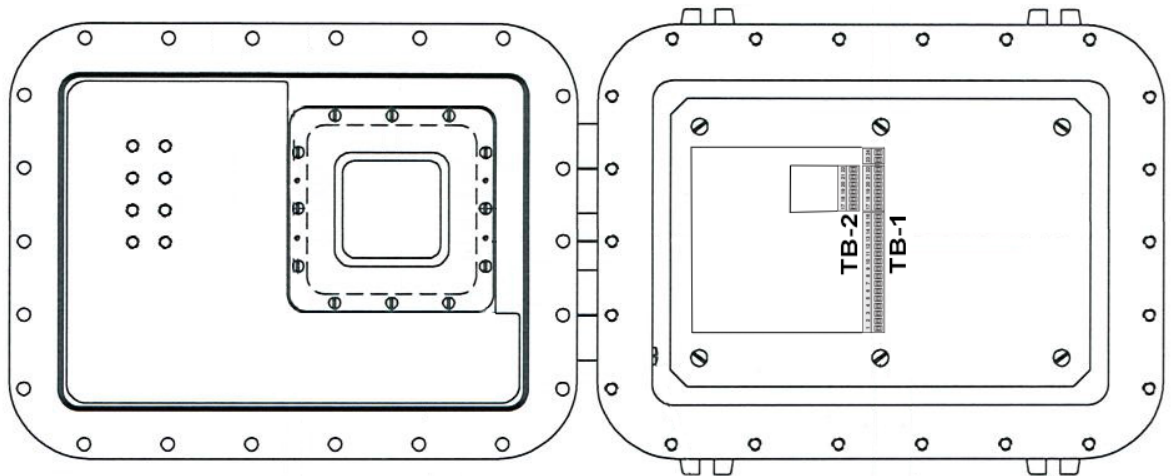
As calculated in section 3.1

Mass or Corrected Volume Flow (Temp. Transmitter) See Sections 3.2, 3.3

Corrected Vol. Flow = volume flow * (1 - Therm.Exp.Coef. *(Tf-Tref))²

4 WIRING

4.1 Terminal Locations



Shown with cover open

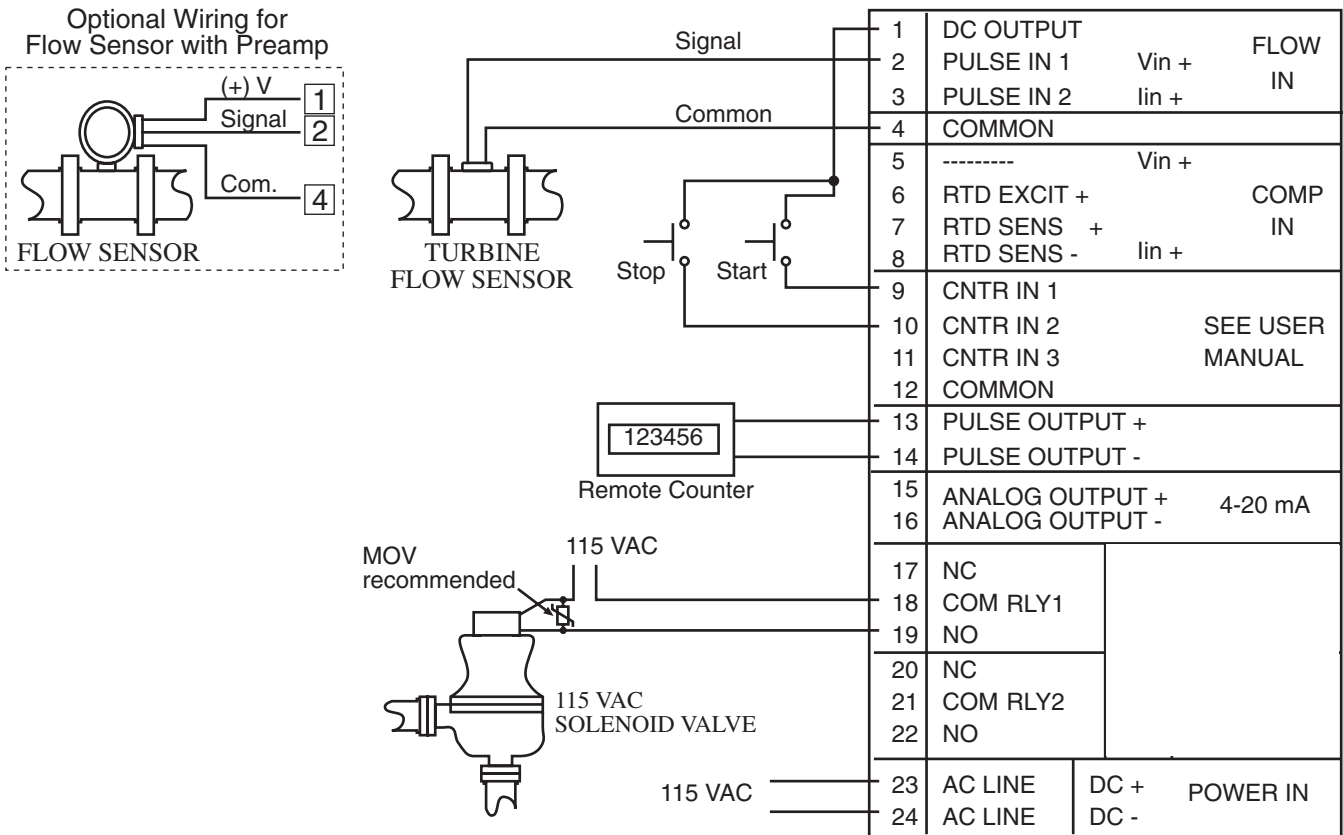
4.2 Terminal Designations

[illegible]

* Power Terminals 23 & 24 used for DC Input only when ordered with DC INPUT option

Batcher
Wiring

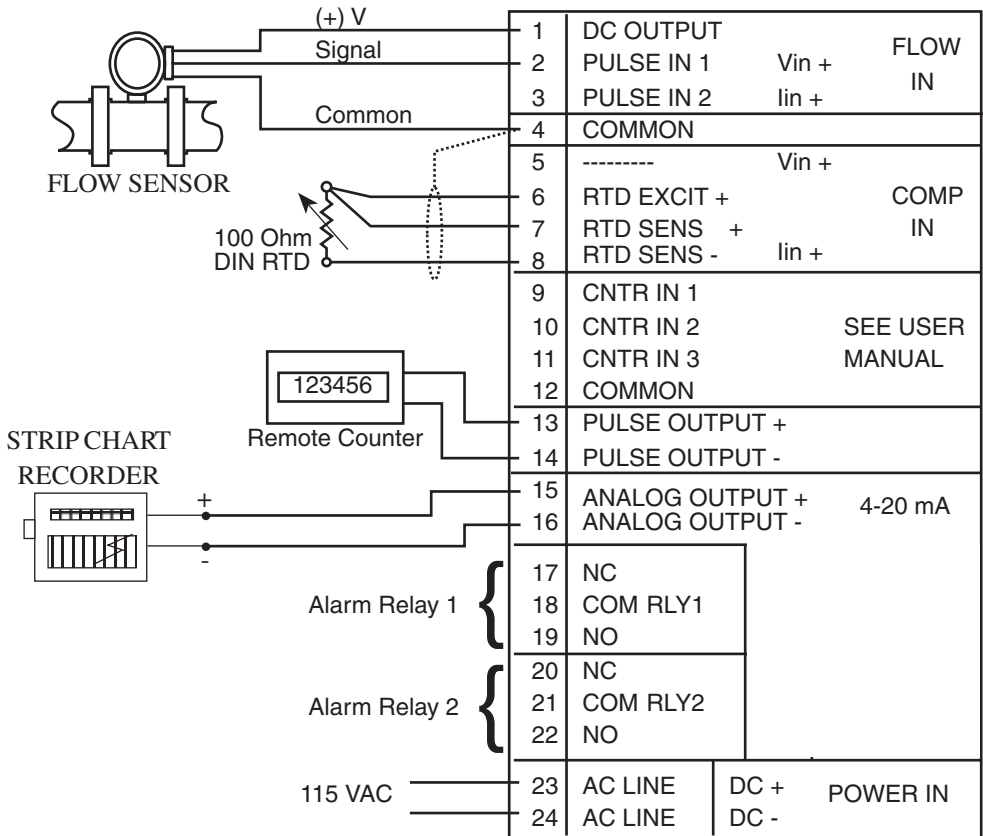
4.3 Typical Batcher Wiring:



NOTE:
Power Terminals 23 & 24 used for DC Input only when ordered with DC INPUT option

Rate / Total
Wiring

4.4 Typical Rate/Total Wiring:



NOTE:
Power Terminals 23 & 24 used for DC Input only when ordered with DC INPUT option

5. UNIT OPERATION

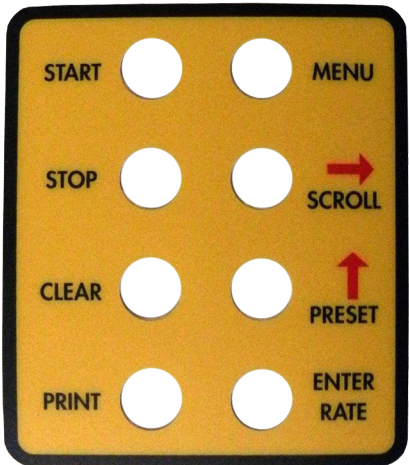
General Operation

5.1 General Operation

The unit can display: Rate, Total, Grand Total, Temperature, Density, Presets and Time of Day on scrolling display. The Temperature and/or Density can be displayed even if you are using the Volumetric Flow Equation (a Temperature or Density sensor must be installed). The unit can perform Mass or Corrected Volume equations using a temperature or density sensor (these equations can be computed without Temp/Dens sensors by using user defined default values). The unit can be programmed to perform Ratemeter/Totalizer or Batching functions.

5.2 Front Panel Operation Concept for Rate/Total Mode

A two line display and eight labeled push buttons are used as an interface between the operator and the STX-ST1. Some buttons have a single function while others have more than one function depending on whether the user is entering data or processing a batch or requesting a setup change.



START
Not used in Rate/Total Mode

STOP
Not used in Rate/Total Mode

CLEAR
Used to clear or reset a total to 0
Also used to clear a number to 0 during a numeric entry sequence

MENU
Used to request a setup change or to return to a previous setup menu.

➡ / SCROLL
Used to move the current cursor location during a numeric entry sequence / Display Scrolling List

PRESET / ⬆
Used to request a new alarm setpoint
Also used to increment the digit value at the current cursor location during a numeric entry sequence

ENTER / RATE
Used to enter the value currently displayed / View Flow Rate.

PRINT
Used to initiate a request to datalog and print a transaction.

HOW TO CLEAR THE TOTAL IN RATE / TOTAL MODE
Press the ➡ key three times quickly. A message will appear "—ENTER PASSWORD—". Use ➡ and ⬆ to create a valid password, then press "ENTER" A message will appear "Clear Total?". Press ➡ to cause "YES" to flash, then press "ENTER". Total will then clear to a zero value.

HOW TO ENTER ALARM SETPOINT
Press the PRESET key three times quickly. A message will appear "Editing PRE1". Press the CLEAR key to remove the previous value. Next use the ⬆ arrow key to increment the first digit of the preset. Use ➡ arrow key to move to the next digit of the preset, then use ⬆ to change the value in that digit. Repeat the process for each digit until the desired preset is viewed. Press ENTER to save that value. If Supervisor password is entered the Grand Total Reset sequence will also be offered.

HOW TO PRINT A TRANSACTION DOCUMENT:
The setup menus can be configured to automatically log and/or print by several automatic means. Alternately a manually initiated print can be requested by pressing the PRINT button.

5.2 Front Panel Operation Concept for Rate/Total Mode (continued)

HOW TO CONFIGURE YOUR TWO LINE DISPLAY

The two line display may be configured to show various items of information. Refer to the DISP mode for details on configuring your two line display.

HOW TO CONFIGURE A PRINTOUT

Refer to the setup mode for details on configuring your printout

VIEWING ALARM MESSAGES

Alarm messages will appear as alternating messages when a sensor malfunction is detected. Most alarm messages are self clearing once the indicated root-cause has been rectified. Refer to the TEST mode for other messages.

HOW TO ACCESS SETUP, TEST, AND DISPLAY CONFIGURATION MODES

Press MENU to begin accessing the various setup/test modes. You will be prompted for a proper password before any mode can be accessed. Use the CLEAR, “^”, “>” and ENTER keys to enter your password. If no password is entered or if an improper password is entered the unit will return to the run mode after either 1 minute or immediately.

Rate/Total Operation	5.3 Ratemeter/Totalizer Operation The Ratemeter/Totalizer mode is used primarily to monitor flowrate and accumulated total. The relays can be used to trigger flow, total, temperature or density alarms.
Password Protection (Rate/Total mode)	5.3.1 Password Protection for Rate/Total mode After a non-zero Operator and/or Supervisor Password is entered in the setup mode (see section 6.3, SETUP PASSWORD submenu), the unit will be locked. The unit will prompt the user for the password when trying to perform the following functions: - Clear Total - Enter Menu The Supervisor password should be reserved for supervisors. The Supervisor password will allow access to restricted areas of the Setup, Display, and Test menus.
Relay Operation (Rate/Total mode)	5.3.2 Relay Operation in Rate/Total mode Up to four relays are available (two standard) for alarm outputs. The relays can be assigned to trip according to rate, total, temperature, density readings or general system alarms. The relays can be programmed for low or high alarms. Preset 1 (RLY1) is easily accessible by pressing the PRESET key on the front panel. Preset 2, Preset 3 and Preset 4 are accessible only through the setup menu.
Pulse Output (Rate/Total mode)	5.3.3 Pulse Output in Rate/Total mode The isolated pulse output (open collector) is menu assignable to Volume Total, Corrected Volume Total or Mass Total. The pulse output duration can be set for 10mS (50 Hz max) or 100mS (5 Hz max). A pulse output scale factor (pulse value) can be set to scale the pulse output. The pulse output is ideal for connecting to remote totalizers or other devices such as a PLC. See section 1.3 for electrical specifications.
Analog Output (Rate/Total mode)	5.3.4 Analog Output in Rate/Total mode The analog output is menu assignable to correspond to the Volume Rate, Corrected Volume Rate, Mass Rate, Temperature, Density, Volume Total, Corrected Volume Total or Mass Total. The analog output is ideal for "trend" tracking using strip chart recorders or other devices.

RS-232 Serial Port
(Rate/Total mode)

5.3.5 RS-232 Serial Port Operation in Rate/Total mode

The RS-232 serial port can be used for programming (using the Setup Disk) or for communicating to printers and computers in the Operating Mode (Run Mode).

PC Communications:

The Setup Disk also allows the user to query the unit for operating status such as Flow Rate, Flow Total, Temperature, Density, Presets, etc.

Operation of RS-232 Serial Port with Printers:

Transaction Printing

For transaction printing, the user defines the items to be included in the printed document (see section 6.3.20 SET DATA OUTPUT, Select_list). The transaction document can be initiated by pressing the PRINT key or by a remote contact closure.

Data Logging

In data logging, the user defines the items to be included in each data log (see section 6.3.20 SET PRINTER OUTPUT, Select_list). The user can also select when (time of day) or how often (print interval) the data log is to be made (see section 6.3.19 SET PRINTER OUTPUT, Configure).

System Setup and Maintenance Report

The system setup and maintenance report lists all of the instrument setup parameters and usage for the current instrument configuration. The audit trail information and a status report is also printed. This report is initiated in the Test menu (see section 8.2.3 PRINT SYSTEM SETUP).

RS-485 Serial Port
(Rate/Total mode)

5.3.6 RS-485 Serial Port (optional)

RS-485 Port Description:

The optional RS-485 card utilizes Modbus RTU protocol to access a variety of process parameters and totalizers. The Relays can be controlled via Modbus. In addition, action routines can be executed. For further information, contact factory and request RS-485 Protocol manual.

Operation of Serial Communication Port with PC

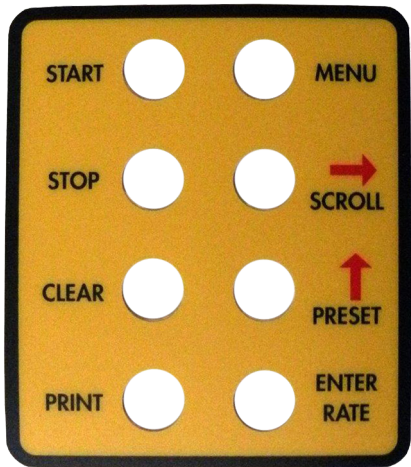
The STX-ST1's RS-485 channel supports a number of Modbus RTU commands. Modbus RTU drivers are available from third party sources for a variety of Man Machine Interface software for IBM compatible PC's.

The user reads and writes information from/to the RS-485 using the Modbus RTU commands. The STX-ST1 then responds to these information and command requests.

Process variables and totalizers are read in register pairs in floating point format. Time and date are read as a series of integer register values. Alarms are individually read as coils. Action routines are initiated by writing to coils.

5.4 Front Panel Operation Concept for Batcher Mode

A two line display and eight labeled push buttons are used as an interface between the operator and the STX-ST1. Some buttons have a single function while others have more than one function depending on whether the user is entering data or processing a batch or requesting a setup change.



START
Used to start a batch.

STOP
Used to pause or stop a batch.

CLEAR
Used to return a batch to an idle or ready condition.
Also used to clear a number to 0 during a numeric entry sequence.

MENU
Used to request a setup change or to return to a previous setup menu.

➡ / SCROLL
Used to move the current cursor location during a numeric entry sequence.

PRESET / ⬆
Used to request a new preset batch size be entered when the batcher is stopped or idle.
Also used to increment the digit value at the current cursor location during a numeric entry sequence.

ENTER / RATE
Used to enter the value currently displayed / View Flow Rate.

PRINT
Used to initiate a request to datalog and print a transaction.

HOW TO ENTER A BATCH QUANTITY IN THE STANDARD PRESET MODE
Press the PRESET key three times quickly. A message will appear “Editing PRE1”. Press the CLEAR key to remove the previous value. Next use the “^” arrow key to increment the first digit of the preset. Use “>” arrow key to move to the next digit of the preset, then use “^” to change the value in that digit. Repeat the process for each digit until the desired preset is viewed. Press ENTER to save that value.

HOW TO START A BATCH
Press the START key to start a batch.

HOW TO PAUSE A BATCH
Press the STOP key to pause a batch.

HOW TO RESUME A BATCH
Pressing START after a pause will cause the batch to resume.

HOW TO PREMATURELY END AND ABORT A BATCH
Press STOP to pause a batch, then press CLEAR to abort the batch.

HOW TO PRINT A TRANSACTION DOCUMENT
The setup menus can be configured to automatically log and print each transaction when it is completed or aborted. Alternately a manually initiated print can be requested by pressing the PRINT button

INFORMATIONAL SEQUENCE MESSAGES
A series of messages will be displayed for a short time as the batch cycle is in progress. The display will then resume showing the PRESET requested and the current TOTAL for the batch. Informative messages will include:
Batch Fill
Slow Start of Fill
Fast Fill
Slow End of Fill
Batch Done
Printing

ADDITIONAL MESSAGES INCLUDE
Batch Stop (after a batch Pause)
Batch Idle (stopped and ready for next batch)

5.4 Front Panel Operation Concept for Batcher Mode (continued)

HOW TO CONFIGURE YOUR TWO LINE DISPLAY

The two line display may be configured to show various items of information. Refer to the DISP mode for details on configuring your two line display.

HOW TO CONFIGURE A PRINTOUT

Refer to the setup mode for details on configuring your printout

HOW TO USE OTHER BATCHING FEATURES

Refer to the setup mode for details on available batching features and their use.

VIEWING ALARM MESSAGES

Alarm messages will appear as alternating messages when a sensor malfunction is detected. Most alarm messages are self clearing once the indicated root-cause has been rectified. Refer to the TEST mode for other messages and for instructions on how to clear the error history.

HOW TO ACCESS SETUP, TEST, AND DISPLAY CONFIGURATION MODES

Press MENU to begin accessing the various setup/test modes. You will be prompted for a proper password before any mode can be accessed. Use the CLEAR, “^”, “>” and ENTER keys to enter your password. If no password is entered or if an improper password is entered the unit will return to the run mode after either 1 minute or immediately.

5.5 Batcher Operation

The STX-ST1 mode is used primarily to control batches. The main difference between the Batch mode and Rate/Total mode is the relay operation. The Batch mode allows the operator to "START" the unit via the front panel or remote input. Once started, the relays (RLY1 & RLY2) will energize and send power to a flow control device (i.e. solenoid valve or pump). The flow sensor will send a signal to the unit and total accumulation will begin. When the Prewarn value (PRE 2) is reached, Relay 2 will drop out (this is ideal for flow slow down). When the Batch amount (PRE 1) is reached, Relay 1 will drop out and the Batch is complete.

Refer to Appendix B for additional diagrams for Batching concepts for conventional two stage batching and/or batching with a Digital Control Valve.

Several messages will be displayed during normal batch operation (i.e. Batch Fill, Batch Stopped). The push-button will be disabled for the duration of these brief timed messages (approx. 2 sec).

Batcher Configuration

5.5.1 Batcher Configuration.

When the unit is programmed for batch mode, several batch operation choices are available. These choices include: Up or Down Counting, Maximum Batch Preset, Batch Overrun Compensation, Flow Signal Timeout, Maximum Drain Time, Slow Start Quantity, Start or Reset/Start, and Stop or Stop/Reset.

Standard Preset or EZ Preset

Use Standard Preset for applications in which the batch amount does not change frequently.

Use EZ Preset in applications in which the batch amounts change frequently. The EZ Preset mode was designed to enter presets with minimum key strokes.

Batch Count Mode

The Batch Count Mode allows the user to choose whether the unit will batch up to a preset value or batch down from a preset value to zero.

Maximum Batch Preset

The Maximum Batch Preset allows the user to program the Maximum Batch value allowed to be entered by the operator. If an operator should try to program a batch higher than this value, the unit will not allow the value to be entered and will prompt the user with an error message saying that the Maximum Batch Preset has been exceeded.

Batch Overrun

The Batch Overrun is used for batch applications that have slow responding valves and a consistent batching flowrate. When the Batch Overrun is set, the unit will compensate for batch overruns by computing an averaged overrun value from the last four batches. This average is used to internally adjust the batch setpoint to minimize overrun.

Flow Signal Timeout

The Flow Signal Timeout allows the user to enter a timeout of 0 to 99 seconds. If a batch is "Filling" and zero flow persists for more than the user entered time then the batch will be aborted. This prevents over flows due to faulty flow sensors and/or wiring.

Maximum Drain Time

The unit declares that a batch is "done" when the flow rate equals "0". A flow rate may be present long after the Preset Relay de-energizes due to slow reacting valves or leaky valves. The Maximum Drain Time allows the user to enter an amount of time (0 to 99 seconds) to wait before declaring "Batch Done". After the Preset Batch quantity is reached, the unit will declare "Batch Done" when the flow rate is "0" or the Maximum Drain Time has expired. The batch data will then be available for printing and datalogging.

Digital Control Valve

Digital Control Valve Functions slow fill rate, fast fill rate, fill rate hysteresis are supported. Refer to Appendix B for concept diagram.

Pump Control

Optional functions for Relay 3 include its use for Pump ON/OFF control in either one stage, two stage or digital control valve applications.

Slow Start Quantity

The Slow Start Quantity is a function that allows an amount to be entered for a Slow Start up. This function requires two stage valve control. RLY 1 (slow flow) will energize for Slow Start and RLY 2 (fast flow) will energize after the Slow Start Quantity has been delivered. This helps reduce turbulence when filling an empty container.

START, RESET/START and STOP, STOP/RESET

When configuring the control inputs, Control Input1 can be set for START or RESET/START. When set for START, the unit will start batching when a signal is applied to Control Input1 or the front panel Start key is pressed. A separate Reset signal must be used to clear the previous batch total. When set for RESET/START, the unit will automatically reset then start when a signal is applied to Control Input1 or the front panel Start key is pressed (provided that the pervious batch was completed). If a previous batch was stopped during a batch cycle, the unit will Start from where it was stopped.

Control Input 2 can be set for STOP or STOP/RESET. When set for STOP, the unit will stop batching when a signal is applied to Control Input 2 or the front panel Stop key is pressed. A separate Reset signal must be used to clear the batch total. When set for STOP/RESET, a running batch will stop when a signal is applied to Control Input 2 or the front panel Stop key is pressed. If the unit is Stopped or after a completed batch, the unit will reset when a signal is applied to Control Input 2 or the front panel Stop key is pressed.

NOTE: Applying a high voltage level to Control Input 2, configured for "STOP" will inhibit all Start inputs in either mode.

Password Protection
(Batch mode)

5.5.2 Password Protection for Batch Mode

After a non-zero Operator and/or Supervisor Password is entered in the setup mode (see section 6.3, SETUP PASSWORD submenu), the unit will be locked. The unit will prompt the user for the password when trying to perform the following functions:

- Clear Grand Total
- Enter Menu

The Supervisor password should be reserved for supervisors. The Supervisor password will allow access to restricted areas of the Setup and Test menus.

The passwords are factory set as follows:
Operator = 0
Supervisor = 2000

Relay Operation
(Batch mode)

5.5.3 Relay Operation in Batch mode

Up to four relays are available (two standard) for alarm outputs. Preset 1 (RLY1) is reserved for batch amount, Preset 2 (RLY2) is reserved for prewarn. (see section 5.4 Batch Operation for Relay 1 & Relay 2 functions)

Preset 1 (RLY1) is easily accessible by pressing the PRE 1 or PRE 2 key on the front panel. Preset 2, Preset 3 and Preset 4 are accessible only through the setup menu.

Relays 3 and 4 can be assigned to trip according to rate, total, temperature, overrun or alarm. When Rate is selected the relays can be programmed for low or high alarms.

Pulse Output
(Batch mode)

5.5.4 Pulse Output in Batch mode

The isolated pulse output (open collector) is menu assignable to Volume Total, Corrected Volume Total or Mass Total. The pulse output duration can be set for 10mS (50 Hz max) or 100mS (5 Hz max). A pulse output scale factor (pulse value) can be set to scale the pulse output. The pulse output is ideal for connecting to remote totalizers or other devices such as a PLC. See section 1.3 for electrical specifications.

Analog Output
(Batch mode)

5.5.5 Analog Output in Batch mode

The analog output is menu assignable to correspond to the Volume Rate, Corrected Volume Rate, Mass Rate, Temperature, Density, Volume Total, Corrected Volume Total or Mass Total. The analog output is ideal for "trend" tracking using strip chart recorders or other devices.

RS-232 Serial Port
(Batch mode)

5.5.6 RS-232 Serial Port Operation in Batch mode

The RS-232 serial port can be used for programming (using the Setup Disk) or for communicating to printers and computers in the Operating Mode (Run Mode).

PC Communications:

The Setup Disk also allows the user to query the unit for operating status such as Flow Rate, Flow Total, Temperature, Density, Presets, etc.

Operation of RS-232 Serial Port with Printers:

Transaction Printing

For transaction printing, the user defines the items to be included in the printed document (see section 6.3.20 SET DATA OUTPUT, Select_list). The transaction document can be initiated by pressing the PRINT key, by a remote contact closure or print at end of batch.

Data Logging

In data logging, the user defines the items to be included in each data log (see section 6.3.20 SET PRINTER OUTPUT, Select_list). The user can also select when (time of day) or how often (print interval) the data log is to be made (see section 6.3.19 SET PRINTER OUTPUT, Configure).

System Setup and Maintenance Report

The system setup and maintenance report lists all of the instrument setup parameters and usage for the current instrument configuration. The audit trail information and a status report is also printed. This report is initiated in the Test menu (see section 8.2.3 PRINT SYSTEM SETUP).

RS-485 Serial Port
(Batch mode)

5.5.7 RS-485 Serial Port (optional)

RS-485 Port Description:

The optional RS-485 card utilizes Modbus RTU protocol to access a variety of process parameters and totalizers. Batches/Relays can be controlled remotely via Modbus. In addition, action routines can be executed. For further information, contact factory and request RS-485 Protocol manual.

Operation of Serial Communication Port with PC

The STX-ST1's RS-485 channel supports a number of Modbus RTU commands. Modbus RTU drivers are available from third party sources for a variety of Man Machine Interface software for IBM compatible PC's.

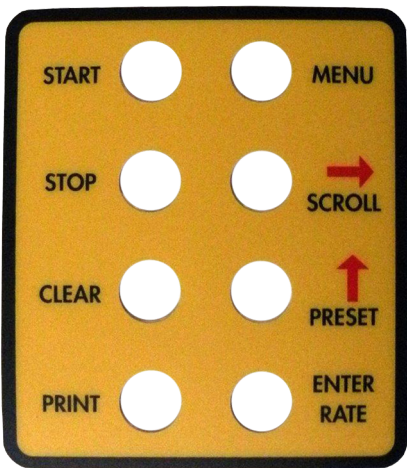
The user reads and writes information from/to the RS-485 using the Modbus RTU commands. The STX-ST1 then responds to these information and command requests.

Process variables and totalizers are read in register pairs in floating point format. Time and date are read as a series of integer register values. Alarms are individually read as coils. Action routines are initiated by writing to coils.

6. PROGRAMMING

6.1 Front Panel Operation Concept for Program Mode

The STX-ST1 is fully programmable through the front panel. Please review the following usage summary before attempting to use the instrument. Refer to Appendix A for a menu overview diagram



Setup Mode:

How To Make Mode Changes

MODE CHANGES
Pressing the MENU key will offer selections of RUN, SETUP, TEST, DISP. RUN is the normal operating mode for the instrument. SETUP offers various sub-menus used for instrument setup. TEST offers various sub-menus for Test, Calibration and System Start-up. DISP offers the setup sequence to configure the top and bottom lines of the display in the run mode.

How To Navigate Through Sub-Menu Groups

Submenu GROUP NAVIGATION
Use the UP arrow key to navigate up through the Sub-Menu groups when in the SETUP or TEST mode. Press the ENTER key to enter a desired setup or test Sub-Menu group.

How To Select Program Choices

SELECTION OF ITEM
During setup, the unit will often offer multiple choices for a given topic. The topic prompt appears on the top line of the display. The choices are shown on the lower line of the display.
To select an item, press the ► key to move the cursor to the desired choice. The selected choice (will blink). Press the ENTER key to accept the selected choice.

How To Enter Numeric Values

NUMERIC ENTRY
The keys labeled "►", "▲", CLEAR and ENTER are used to enter numerical values. A leading 0 will assume that you intend to enter a minus "-" sign. Press the CLEAR key to clear the existing value and to enable editing. Press ENTER to store the value shown.

How To Enter Text Characters

TEXT CHARACTER ENTRY
Some setup items (i.e. Descriptors, Units Label) require the user to enter text characters or strings. Press CLEAR to enable editing. The UP arrow key is used to scroll through the available character sets for each individual character. Press the ENTER key to accept the character and advance to the next character position.

6.2 EZ Setup

The EZ Setup routine is a quick and easy way to configure the unit for the most commonly used instrument functions for basic volume equations.

IMPORTANT! This setup assumes that you are measuring Volumetric Flow using a high level, DC Pulsing flow sensor. Entering the EZ Setup mode automatically sets many features. This may cause any previously programmed information to be lost or reset. For a complete configuration, see sections 6.3 and 6.4.

Menus	Display	Notes
6.2.1 TOP LEVEL SETUP MENU	SELECT OPERATE STATE Run Setup Test Disp ENTER / RATE	Select Setup to enter the instrument setup routine.
6.2.2 EZ Setup Submenu Groups	SELECT EZ SETUP ENTER / RATE	Press ENTER to begin EZ Setup routine.
	ARE YOU SURE? No Yes ENTER / RATE	Confirm that you want to run EZ Setup. Caution: Any previous program settings may be lost or reset.
	INSTRUMENT TYPE Rate/Tot Batch ENTER / RATE	Instrument Function.
	RATE TIME BASE Sec Min Hour Day ENTER / RATE	Select the appropriate rate time base.
	RATE DEC PLACES 0 ENTER / RATE	Enter the desired rate decimal location. 0-3 decimal places allowed.
	TOTAL VOLUME UNITS gal ENTER / RATE	Enter the desired totalizer units label.
	TOTAL DEC PLACES 0 ENTER / RATE	Enter the desired totalizer decimal location. 0-3 decimal places allowed.
	K_FACTOR TYPE Avg LinTbl UVC ENTER / RATE	Enter the desired K-Factor Type.
	AVERAGE KA-FACTOR ##### P/gal	If Average selected, Enter the desired Average K-Factor.
	LINEAR TABLE KA Fre01:##### Hz ENTER / RATE	If LinTbl or UVC selected, Enter the desired frequency/ K-Factor pair for each point in the Linearization Table.
	LINEAR TABLE KA KA--01:##### ENTER / RATE	Enter a frequency of 0 for any point other than Fre01 to exit Linearization Table setup.
	FS ANALOG OUT 20mA #####gal/m ENTER / RATE	Enter the desired full scale setting for the analog output.
	RATE 00.0 gal/m TOTAL 0 gal	Return to Run Mode

6.3 Setup Menus

Menus	Display	Notes
6.3.1 Top Level Setup Menu	SELECT OPERATE STATE Run Setup Test Disp ENTER / RATE	Use ► to select Setup to enter the instrument setup routine.
6.3.2 Submenu Groups	SELECT EZ SETUP PRESET / ▲	Refer to Page 21 for Details.
	INSTRUMENT TYPE PRESET / ▲	Refer to Page 25 for Details.
	SELECT FLOW EQUATION PRESET / ▲	Refer to Pages 27 for Details.
	SETUP INDICATORS PRESET / ▲	Refer to Page 28 & 29 for Details.
	SETUP FLOW INPUT PRESET / ▲	Refer to Page 30, 31 & 32 for Details.
	SETUP AUX INPUT PRESET / ▲	Refer to Pages 33 for Details.
	SET FLUID PROPERTIES PRESET / ▲	Refer to Page 34 for Details.
	SETUP PULSE OUTPUT PRESET / ▲	Refer to Pages 34 for Details.
	SETUP ANALOG OUTPUT PRESET / ▲	Refer to Page 35 for Details.
	SETUP RELAYS PRESET / ▲	Refer to Page 35 & 36 for Details.
	SETUP CONTROL INPUTS PRESET / ▲	Refer to Page 37 for Details.
	SETUP REALTIME CLOCK PRESET / ▲	Refer to Page 38 for Details.
	SERIAL USAGE PRESET / ▲	Refer to Page 39 for Details.
	SETUP DATALOG/PRINT PRESET / ▲	Refer to Pages 40 & 41 for Details.
	ADMINISTRATIVE SETUP PRESET / ▲	Refer to Page 41 for Details.
	SETUP NETWORK CARD	Refer to Page 42 for Details.
MENU		

6.4 Setup Sub-Menus

Sub-menus	Display	Notes
6.4.1 SELECT EZ SETUP	SELECT EZ SETUP PRESET / Advance To INSTRUMENT TYPE	Refer to Section 6.2 for EZ Setup routine. Press the UP (preset) button to advance to Instrument Type submenu group.
6.4.2 INSTRUMENT TYPE	INSTRUMENT TYPE ENTER / RATE	Press ENTER to enter Instrument Type sub-menus.
Rate/Tot	INSTRUMENT TYPE Rate/Tot Batch ENTER / RATE Advance To SELECT FLOW EQUATION	Press ENTER when Rate/Total is flashing to configure the instrument as a Ratemeter/Totalizer. If Rate/Tot selected, advance to Select Flow Equation.
Batch	INSTRUMENT TYPE ENTER / RATE INSTRUMENT TYPE Rate/Tot Batch / SCROLL ENTER / RATE SELECT PRESET TYPE Standard EZ Preset / SCROLL ENTER / RATE SELECT VALVE TYPE Standard Digital / SCROLL ENTER / RATE	Press ENTER to enter Instrument Type sub-menus. Use to select choice Press ENTER when Batch is flashing to configure the instrument as a Batcher. Choose Standard or EZ Preset with button Press ENTER to select choice. Choose Standard or Digital with button Press ENTER to select choice.
	SLOW FILL RATE 10 CLEAR PRESET / / SCROLL ENTER / RATE	Enter the Slow Fill Rate. Use CLEAR, and to create value. Press ENTER to store.
	FULL FILL RATE 1000 CLEAR PRESET / / SCROLL ENTER / RATE	Enter the Full Fill Rate (Fast Fill Rate). Use CLEAR, and to create value. Press ENTER to store.
	BATCH COUNT MODE Up Down / SCROLL ENTER / RATE	Select UP to Reset to 0 and count up to preset. Select DOWN to reset to Preset and count down to 0. The button moved cursor. Press ENTER to select choice.
	MAXIMUM BATCH PRESET 1000.0 gal CLEAR PRESET / / SCROLL ENTER / RATE	Enter the maximum allowable Batch Preset. The operator will not be able to enter a batch preset larger than this value. Use CLEAR, and to create value. Press ENTER to store.
	BATCH OVERRUN COMP Off Auto Manual / SCROLL ENTER / RATE	Select Manual to enter observed overrun. Select Auto to set the unit to operate using a Batch Overrun Compensation routine. Select OFF to inhibit Batch Overrun Compensation routine. (See Section 5.5)
Continue On Next Page		

Sub-menus	Display	Notes
6.4.2 INSTRUMENT TYPE (continued)	AVERAGE OVERRUN COMP 10 CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE ▼	This is the average amount of over-run that the unit has determined. This value will be used if AUTO selected. If MANUAL selected you can change the value. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	FLOW SIGNAL TIMEOUT 10 CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE ▼	Enter a time out of 0 to 99 seconds. If a batch is “Filling” and zero flow persists for more than this time, the batch will be aborted. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	MAXIMUM DRAIN TIME 10 CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE ▼	Enter time (0-99 sec.) for Max. Drain Time. After batch quantity is reached, “Batch Done” is declared when the flow rate is “0” or the Maximum Drain Time has expired. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store. When using automatic over-shoot compensation the value (in seconds) entered into maximum drain time must be greater than the time required for the valve to close.
	SLOW START QUANTITY 10 CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE ▼	Enter a quantity for a Slow Start up. RLY 2 (slow flow) will energize for Slow Start and RLY 1 (fast flow) will energize after the Slow Start Quantity has been delivered. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
Advance To SELECT FLOW EQUATION		

Sub-menus	Display	Notes
6.4.3 SELECT FLOW EQUATION	SELECT FLOW EQUATION ENTER / RATE	Press ENTER to enter Select Flow Equation submenus.
	SELECT FLOW EQUATION Volume Mass Cor/Vol ENTER / RATE	Use ► to select choice. Press ENTER when desired flow equation is flashing.
	Advance To SETUP INDICATORS (Total)	
6.4.4 SETUP INDICATORS (Total)	SETUP INDICATORS ENTER / RATE	Press ENTER to begin setup of the Indicators
	SETUP INDICATORS Total Dens Rate Temp ► / SCROLL ENTER / RATE	Use ► to select choice. Press ENTER when Total is flashing to configure the Totalizer Indicators
	TOTAL DESCRIPTOR TOTAL CLEAR PRESET / ▲ ► / SCROLL ENTER / RATE	Enter the desired Total Descriptor using CLEAR, ► and ENTER to store.
	TOTAL VOLUME UNITS gal CLEAR PRESET / ▲ ► / SCROLL ENTER / RATE	Enter the desired Volume Units Label for the Totalizer using CLEAR, ► and ENTER to store.
	TOTAL DEC PLACES 0 CLEAR PRESET / ▲ ► / SCROLL ENTER / RATE	Select the desired Total Decimal Place. 0-3 decimal places allowed using CLEAR, ▲ and ENTER to store.
	Advance To SETUP INDICATORS (Density)	
6.4.5 SETUP INDICATORS (Density)	SETUP INDICATORS Total Dens Rate Temp ► / SCROLL ENTER / RATE	Use ► to select choice. Press ENTER when Dens is flashing to configure the Density Indicators.
	DENSITY DESCRIPTOR DENS CLEAR PRESET / ▲ ► / SCROLL ENTER / RATE	Enter the desired Density Descriptor using CLEAR, ► and ENTER to store.
	DENSITY MASS UNITS lbs CLEAR PRESET / ▲ ► / SCROLL ENTER / RATE	Enter the desired Mass Units Label for Density using CLEAR, ► and ENTER to store.
	DENSITY DEC PLACES 0 CLEAR PRESET / ▲ ENTER / RATE	Select the desired Density Decimal Place. 0-3 decimal places allowed using CLEAR, ▲ and ENTER to store.
	Advance To SETUP INDICATORS (Rate)	

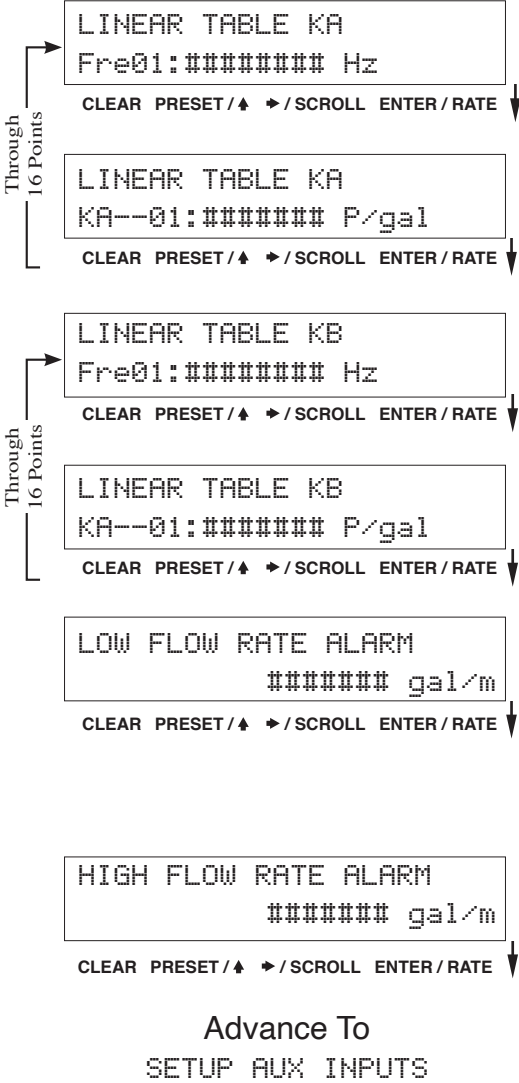
Sub-menus	Display	Notes
6.4.6 SETUP INDICATORS (Rate)	SETUP INDICATORS Total Dens Rate Temp ➡ / SCROLL ENTER / RATE	Use ➡ to select choice. Press ENTER when Rate is flashing to configure the Ratemeter Indicators
	RATE TIME BASE Sec Min Hour Day CLEAR ➡ / SCROLL ENTER / RATE	Select the desired Rate Time Base using CLEAR, ➡ and ENTER to store.
	RATE DESCRIPTOR CLEAR ➡ / SCROLL ENTER / RATE	Enter the desired Descriptor for the Ratemeter using CLEAR, ➡ and ENTER to store.
	RATE DEC PLACES CLEAR PRESET / ⬆ ENTER / RATE	Select the desired Rate Decimal Place using CLEAR, ⬆ and ENTER to store. 0-3 decimal places allowed.
	RATE AVG FILTER CLEAR PRESET / ⬆ ➡ / SCROLL ENTER / RATE	Enter desired Rate Averaging Filter. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	QUICK UPDATE % CLEAR PRESET / ⬆ ➡ / SCROLL ENTER / RATE	Enter desired Percent of Change for Quick Update. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	Advance To SETUP INDICATORS (Temperature)	If the current flowrate deviates by an amount greater than the percentage value entered, the Rate Averaging is inhibited. (See Glossary for more details.)
6.4.7 SETUP INDICATORS (Temperature)	SETUP INDICATORS Total Dens Rate Temp ➡ / SCROLL ENTER / RATE	Use ➡ to select choice. Press ENTER when Temp is flashing to configure the Temperature Indicators.
	TEMP DESCRIPTOR CLEAR ➡ / SCROLL ENTER / RATE	Enter the desired Temperature Descriptor using CLEAR, ➡ and ENTER to store.
	TEMPERATURE SCALE Deg_C Deg_F ➡ / SCROLL ENTER / RATE	Enter the desired Temperature Scale. Use ➡ to select choice and ENTER to store selection.
	TEMP DEC PLACES CLEAR ➡ / SCROLL ENTER / RATE	Select the desired Temperature Decimal Place using CLEAR, ⬆ and ENTER to store. 0-3 decimal places allowed.
	Advance To SETUP FLOW INPUT	

Sub-menus	Display	Notes
6.4.8 SETUP FLOW INPUT (Pulse - Ain & PS (A=B))	SETUP FLOW INPUT ENTER / RATE	Press ENTER to begin setup of Flow Input.
	EXCITATION VOLTAGE 5v 12v 24v ➡ / SCROLL ENTER / RATE	Select the desired Excitation Voltage. Use ➡ to select choice and ENTER to store selection.
	FLOW INPUT TYPE Pulse Analog ➡ / SCROLL ENTER / RATE	Use ➡ to select choice . Press ENTER when Pulse is flashing to configure the flow input for Pulse signals.
NOTE: Ain = Single Pulse PS(A=B) = Pulse Security Qx1 = Quadrature Qx2 = Quadrature x 2	PULSE INPUT TYPE Ain PS(A=B) Qx1 Qx2 ➡ / SCROLL ENTER / RATE	Enter the desired Pulse type. Use ➡ to select choice and ENTER to store selection. See side note.
	PULSE TRIGGER LEVEL 10mV 100mV 2.5V ➡ / SCROLL ENTER / RATE	Select the desired Input Pulse Trigger Level. Use ➡ to select choice and ENTER to store selection.
	LOW PASS FILTER 40Hz 3KHz 20KHz ➡ / SCROLL ENTER / RATE	Select the desired Low Pass Filter. (Max. Count Speed). Use ➡ to select choice and ENTER to store selection.
	INPUT TERMINATION Pullup Pulldown None ➡ / SCROLL ENTER / RATE	Select the proper input termination. Use ➡ to select choice and ENTER to store selection.
	MAX WINDOW (1-99) 1 CLEAR ➡ / SCROLL ENTER / RATE	Enter the desired Maximum Sample Window Time (1-99 sec) using CLEAR, ➡ and ENTER to store.
	K_FACTOR TYPE Avg LinTbl UVC ➡ / SCROLL ENTER / RATE	Enter the desired K-Factor Type. Use ➡ to select choice and ENTER to store selection.
	AVERAGE KA-FACTOR ##### P/gal	If Avg selected, Enter the desired Average K-Factor. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	LINEAR TABLE KA Fre01:##### Hz CLEAR PRESET/⬆ ➡ / SCROLL ENTER / RATE	If LinTbl selected, Enter the desired frequency/ K-Factor pair for each point in the Linearization Table. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
Through 16 Points	LINEAR TABLE KA KA--01:##### P/gal CLEAR PRESET/⬆ ➡ / SCROLL ENTER / RATE	NOTE: Enter 0 for Fre value of any point (other than Fre01) to exit the routine and use the values entered up to that point.
	LOW FLOW RATE ALARM ##### gal/m CLEAR PRESET/⬆ ➡ / SCROLL ENTER / RATE	Enter the desired volumetric Low Rate Alarm. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store. This will trigger an alarm message if alarm conditions occur. The relays are not affected.
	HIGH FLOW RATE ALARM ##### gal/m CLEAR PRESET/⬆ ➡ / SCROLL ENTER / RATE	Enter the desired volumetric High Rate Alarm. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store. This will trigger an alarm message if alarm conditions occur. The relays are not affected.
	Advance To SETUP AUX INPUTS	

Submenus	Display	Notes
6.4.9 SETUP FLOW INPUT (Pulse - Quadrature, Qx1 or Qx2) NOTE: Ain = Single Pulse PS(A=B) = Pulse Security Qx1 = Quadrature Qx2 = Quadrature x 2	SETUP FLOW INPUT ENTER / RATE	Press ENTER to begin setup of Flow Input.
	EXCITATION VOLTAGE 5v 12v 24v ➡ / SCROLL ENTER / RATE	Select the desired Excitation Voltage. Use ➡ to select choice and ENTER to store selection.
	FLOW INPUT TYPE Pulse Analog ➡ / SCROLL ENTER / RATE	Use ➡ to select choice . Press ENTER when Pulse is flashing to configure the flow input for Pulse signals.
	PULSE INPUT TYPE Ain PS(A=B) Qx1 Qx2 ➡ / SCROLL ENTER / RATE	Enter the desired Pulse type. Use ➡ to select choice and ENTER to store selection. See side note.
	PULSE TRIGGER LEVEL 10mV 100mV 2.5V ➡ / SCROLL ENTER / RATE	Select the desired Input Pulse Trigger Level. Use ➡ to select choice and ENTER to store selection.
	LOW PASS FILTER 40Hz 3KHz 20KHz ➡ / SCROLL ENTER / RATE	Select the desired Low Pass Filter. (Max. Count Speed). Use ➡ to select choice and ENTER to store selection
	INPUT TERMINATION Pullup Pulldown None ➡ / SCROLL ENTER / RATE	Select the proper input termination. Use ➡ to select choice and ENTER to store selection
	MAX WINDOW (1-99) 1 CLEAR ➡ / SCROLL ENTER / RATE	Enter the desired Maximum Sample Window Time (1-99 sec). using CLEAR, ➡ and ENTER to store
	K_FACTOR TYPE Avg LinTb1 UVC ➡ / SCROLL ENTER / RATE	Select the desired K-Factor Type. Use ➡ to select choice and ENTER to store selection
	AVERAGE KA-FACTOR ##### P/gal CLEAR PRESET/⬆ ➡ / SCROLL ENTER / RATE	If Avg selected, Enter the desired Average K-Factor (KA for channel A). Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	AVERAGE KB-FACTOR ##### P/gal CLEAR PRESET/⬆ ➡ / SCROLL ENTER / RATE	Enter the desired Average K-Factor (KB for channel B). Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.

Continue on next page

6.4.9 SETUP
FLOW INPUT
(Pulse -
Quadrature,
Qx1 or Qx2)
Continued



If LinTbl selected,
Enter the desired frequency/ K-Factor pair for each point in the Linearization Table. (channel A)
NOTE: Enter 0 for Fre value of any point (other than Fre01) to exit the routine and use the values entered up to that point.
Enter the desired frequency/ K-Factor pair for each point in the Linearization Table. (channel B)
NOTE: Enter 0 for Fre value of any point (other than Fre01) to exit the routine and use the values entered up to that point.
Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.

Enter the desired volumetric Low Rate Alarm.
Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
This will trigger an alarm message if alarm conditions occur. The relays are not affected.

Enter the desired volumetric High Rate Alarm.
Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
This will trigger an alarm message if alarm conditions occur. The relays are not affected.

Sub-menus	Display	Notes
6.4.10 SETUP FLOW INPUT (Analog)	SETUP FLOW INPUTS ENTER / RATE	Press ENTER to begin setup of the Flow Input.
	EXCITATION VOLTAGE 5v 12v 24v ➡ / SCROLL ENTER / RATE	Select the desired Excitation Voltage. Use ➡ to select choice and ENTER to store selection.
	FLOW INPUT TYPE Pulse Analog ➡ / SCROLL ENTER / RATE	Press ENTER when Analog is flashing to configure the flow input for Analog signals. Use ➡ to select choice.
	ANALOG SIGNAL TYPE Voltage Current ➡ / SCROLL ENTER / RATE	Choose Analog Signal Type. Use ➡ to select choice and ENTER to store selection.
	ANALOG VOLTAGE RANGE 0-10V 0-5V 1-5V	If Voltage selected, Choose desired Voltage Range. Use ➡ to select choice and ENTER to store selection.
	ANALOG CURRENT RANGE 4-20mA 0-20mA ➡ / SCROLL ENTER / RATE	If Current selected, Choose desired Current Range. Use ➡ to select choice and ENTER to store selection.
	LINEARIZATION TYPE Linear Sqrt LinTbl ➡ / SCROLL ENTER / RATE	Select the desired Linearization Type. Use ➡ to select choice and ENTER to store selection.
Through 16 Points	LINEAR TABLE KA APR01:##### gal/m CLEAR PRESET/⬆ ➡ / SCROLL ENTER / RATE	If LinTbl selected, Enter the desired Apparent Input Flow (APR) / Correction Factor (CFr) pair for each point in the Linearization Table. NOTE: Enter 0 for APR value of any point (other than APR01) to exit the routine and use the values entered up to that point. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	LINEAR TABLE KA CFr01:##### CLEAR PRESET/⬆ ➡ / SCROLL ENTER / RATE	
	FLOW LOW SCALE ##### gal/m CLEAR PRESET/⬆ ➡ / SCROLL ENTER / RATE	
	FLOW FULL SCALE ##### gal/m CLEAR PRESET/⬆ ➡ / SCROLL ENTER / RATE	Enter the High flowrate corresponding to the High analog signal. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	LOW FLOW CUTOFF ##### gal/m CLEAR PRESET/⬆ ➡ / SCROLL ENTER / RATE	Enter the desired Low Flow Cutoff. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	LOW FLOW RATE ALARM ##### gal/m CLEAR PRESET/⬆ ➡ / SCROLL ENTER / RATE	Enter the desired volumetric Low Rate Alarm. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store. This will trigger an alarm message if alarm conditions occur. The relays are not affected.

Continue on next page

Sub-menus	Display	Notes
6.4.10 SETUP FLOW INPUT (Analog) Continued	HIGH FLOW RATE ALARM ##### gal/m CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE Advance To SETUP AUX INPUT	Enter the desired volumetric High Rate Alarm. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store. This will trigger an alarm message if alarm conditions occur. The relays are not affected.
	SETUP AUX INPUT ENTER / RATE	Press ENTER to begin setup of the Auxiliary Input.
6.4.11 SETUP AUX INPUT	AUX INPUT TYPE None Dens Temp ▶ / SCROLL ENTER / RATE	Select Temperature to set the Auxiliary Input for Temperature inputs. Use ▶ to select choice and ENTER to store selection.
NOTE: When Density (Dens) is selected, The menu prompts will be very similar to the Temperature prompts. The menus will prompt the user for density values and density units.	AUX SIGNAL TYPE Voltage Current RTD ▶ / SCROLL ENTER / RATE	Choose Temperature Signal Type. Advance to "Aux Default", if RTD selected. Use ▶ to select choice and ENTER to store selection.
	INPUT SIGNAL RANGE 0-10V 0-5V 1-5V	If Voltage selected, Choose desired Voltage Range. Skip if RTD. Use ▶ to select choice and ENTER to store selection.
	INPUT SIGNAL RANGE 4-20mA 0-20mA ▶ / SCROLL ENTER / RATE	If Current selected, Choose desired Current Range. Skip if RTD. Use ▶ to select choice and ENTER to store selection.
	AUX LOW SCALE ##### F CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the low temperature scale corresponding to the low temperature signal. Skip if RTD. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	AUX FULL SCALE ##### F CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the high temperature scale corresponding to the high temperature signal. Skip if RTD. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	AUX DEFAULT ##### F CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the Default Temperature. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store. The unit will use this value if the temperature input fails.
	AUX LOW ALARM ##### F CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the Low setpoint for the Temperature Alarm. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	AUX HIGH ALARM ##### F CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the High setpoint for the Temperature Alarm. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	DENS EXTRACT METHOD Therm_Coef API_2540 ▶ / SCROLL ENTER / RATE Advance To SET FLUID PROPERTIES	Choose the Density Extraction method to be used. Use ▶ to select choice and ENTER to store selection.

Sub-menus	Display	Notes
6.4.12 SET FLUID PROPERTIES	SET FLUID PROPERTIES ENTER / RATE	Press ENTER at this prompt to Set Fluid Properties.
	REF. DENSITY ##### lbs/g CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the Reference Density. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store. This is used in the calculation of density when you have a temp transmitter and used for corrected flow calculation if you have a density transmitter.
	REF. TEMPERATURE ##### F CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the Reference Temperature. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	EXPAN. FACTOR [xe-6] ##### CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the proper Expansion Factor. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store. (If Temp Compensated for Mass or Corrected Volume) See Section 7.4, Calculating the Expansion Factor.
	CALIBRATION DENSITY ##### CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the Calibration Density. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store. This is used in calculation of flow for analog inputs using SQRT.
	VISCOSITY COEF. A 0.000 CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the Viscosity A Coefficient. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store. See section 7.5, Computation of Viscosity Coef. A and B.
	VISCOSITY COEF. B 0.000 CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the Viscosity B Coefficient. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store. See section 7.5, Computation of Viscosity Coef. A and B.
	BASE DENSITY H2O@4C ##### lbs/g CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the Base Density H2O@4C. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store. This is used in the centistoke calculation for UVC.
	Advance To SETUP PULSE OUTPUT	

Sub-menus	Display	Notes
6.4.13 SETUP PULSE OUTPUT	SETUP PULSE OUTPUT ENTER / RATE	Press ENTER at this prompt to setup the Pulse Output.
	PULSE OUTPUT USAGE Off Vol CVol/Mass ➡ / SCROLL ENTER / RATE	Select the desired Pulse Output Usage. Use ➡ to select choice and ENTER to store selection.
	PULSE WIDTH 10mS 100mS ➡ / SCROLL ENTER / RATE	Select the desired Pulse Width for the Pulse Output. Use ➡ to select choice and ENTER to store selection.
	PULSE VALUE ##### gal/P CLEAR PRESET / ⬆ ➡ / SCROLL ENTER / RATE	Enter the desired Pulse Value for the Pulse Output (Units per Pulse). Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
Advance To SETUP ANALOG OUTPUT		
6.4.14 SETUP ANALOG OUTPUT	SETUP ANALOG OUTPUT ENTER / RATE	Press ENTER when Analog is flashing to setup the Analog Output.
	ANALOG OUTPUT USAGE Rate Total Temp Dens ➡ / SCROLL ENTER / RATE	Select the desired Analog Output Usage. Use ➡ to select choice and ENTER to store selection.
	ANALOG OUT FLOW TYPE Vol CVol/Mass ➡ / SCROLL ENTER / RATE	Only if Rate selected & Flow EQ. = Mass, Cor/Vol Select the desired Analog Output Flow. Use ➡ to select choice and ENTER to store selection.
	ANALOG OUTPUT RANGE 4-20mA 0-20mA ➡ / SCROLL ENTER / RATE	Select the desired current range for the Analog Output. Use ➡ to select choice and ENTER to store selection.
	LS ANALOG OUTPUT ##### gal/m CLEAR PRESET / ⬆ ➡ / SCROLL ENTER / RATE	Enter desired Analog Output Low Scale Value. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store. NOTE: Units label will correspond with output usage type selected.
	FS ANALOG OUT 20mA ##### gal/m CLEAR PRESET / ⬆ ➡ / SCROLL ENTER / RATE	Enter desired Analog Output Full Scale Value. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	ANALOG OUT DAMPING 0.0 CLEAR PRESET / ⬆ ➡ / SCROLL ENTER / RATE	Enter the desired Analog Output Damping Constant. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
Advance To SETUP RELAYS		

Sub-menus	Display	Notes
6.4.15 (Continued) SETUP RELAYS (Relay 3 & Relay 4)	SETUP RELAYS R1y1 R1y2 R1y3 R1y4 ➡ / SCROLL ENTER / RATE	Select the desired Relay for setup. Use ➡ to select choice and ENTER to store selection. (Relays 3 & 4 Optional)
NOTE: Settings for Relays 3 & 4 may be entered even if relays are not supplied. The settings will still trigger display alarms.	RELAY 3 USAGE Rate Tot Aux Ovr PMP ➡ / SCROLL ENTER / RATE	If Relay 3 Selected, Choose Rate, Total, Aux, Overrun or Pump (on/off). Use ➡ to select choice and ENTER to store selection.
	RELAY 4 USAGE Rate Tot Aux Alrm NA ➡ / SCROLL ENTER / RATE	If Relay 4 Selected, Choose Rate, Total, Aux, Alrm or NA. Use ➡ to select choice and ENTER to store selection.
	RELAY 3 DELAY sec 0 CLEAR PRESET / ⬆ ➡ / SCROLL ENTER / RATE	If Rate / Aux selected, enter desired relay activation delay value. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	RELAY 3 MODE LO_ALARM HI_ALARM ➡ / SCROLL ENTER / RATE	Select the desired Relay Activation for Rate/Aux. Use ➡ to select choice and ENTER to store selection.
	RELAY 3 DURATION ##### CLEAR PRESET / ⬆ ➡ / SCROLL ENTER / RATE	Low: Relay activates when reading is below setpoint. High: Relay activates when reading is above setpoint.
	RELAY 3 SETPOINT ##### gal CLEAR PRESET / ⬆ ➡ / SCROLL ENTER / RATE	If Total Selected, Enter desired Relay Duration. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	RELAY 3 HYSTERESIS ##### gal/m CLEAR PRESET / ⬆ ➡ / SCROLL ENTER / RATE	Enter the desired Setpoint. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	RELAY 3 HYSTERESIS ##### gal/m CLEAR PRESET / ⬆ ➡ / SCROLL ENTER / RATE	If Rate, selected, Enter desired Relay Hysteresis. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	Advance To SETUP CONTROL INPUTS	

RELAY NOTES & CONSIDERATIONS

- Relay activation is based on the computed readings not the displayed value. Therefore the display damping factor will not affect the relay response time. The RELAY DELAY feature allows the user to enter a time delay for relay activation. This feature is very useful in applications where short over/under range conditions are not considered alarm conditions.
- When INSTRUMENT TYPE is set to batcher, Relay 1 is reserved for PRESET and Relay 2 is reserved for PREWARN.
- Setting the relays to NA (Not Assigned), will allow the relay activation to be controlled via the RS-232 Serial and/or RS-485 Modbus ports.
- Relay 3 and Relay 4 settings may be used to trigger display alarm conditions even if the relays are not supplied.

Sub-menus	Display	Notes
6.4.16 SETUP CONTROL INPUTS (RATE/ TOTAL)	SETUP CONTROL INPUTS ENTER / RATE	Press Enter to begin setup of the Control Inputs.
	SETUP CONTROL INPUTS Input1 Input2 Input3 ► / SCROLL ENTER / RATE	Select the desired Control Input for setup. Use ► to select choice and ENTER to store selection.
	CONTROL INPUT1 USAGE INHIBIT_TOTAL NA	If Control Input 1 Selected, Select Inhibit Total or NA (Not Assigned). Use ► to select choice and ENTER to store selection.
	CONTROL INPUT2 USAGE RESET_TOTAL NA	If Control Input 2 Selected, Select Reset Total or NA (Not Assigned). Use ► to select choice and ENTER to store selection.
	CONTROL INPUT3 USAGE Prn Ack KeyLk NA ► / SCROLL ENTER / RATE Advance To SETUP REALTIME CLOCK	If Control Input 3 Selected, Select Prn (Print), Ack (acknowledge), KeyLk (Keylock) or NA (Not Assigned). Use ► to select choice and ENTER to store selection. ACK will acknowledge and clear alarms and warning messages. Note: Alarms may reassert themselves if alarm conditions are still present.
6.4.17 SETUP CONTROL INPUTS (BATCH)	SETUP CONTROL INPUTS Input1 Input2 Input3 ► / SCROLL ENTER / RATE	Select the desired Control Input for setup. Use ► to select choice and ENTER to store selection.
	CONTROL INPUT1 USAGE Start Rst/Start NA	If Control Input 1 Selected, Select Start ,Reset/ Start, NA (Not Assigned). Use ► to select choice and ENTER to store selection.
	CONTROL INPUT2 USAGE Stop Stop/Rst NA	If Control Input 2 Selected, Select Stop, Stop/ Reset, NA (Not Assigned). Use ► to select choice and ENTER to store selection.
	CONTROL INPUT3 USAGE Rst Prn KeyLk Ack NA ► / SCROLL ENTER / RATE Advance To SETUP REALTIME CLOCK	If Control Input 3 Selected, Select Prn (Print), Ack (acknowledge), KeyLk (Keylock) or NA (Not Assigned). Use ► to select choice and ENTER to store selection. ACK will acknowledge and clear alarms and warning messages. Note: Alarms may reassert themselves if alarm conditions are still present.

Sub-menus	Display	Notes
6.4.18 SETUP REALTIME CLOCK (Time)	SETUP REALTIME CLOCK ENTER / RATE	Press Enter to begin setup of the Realtime Clock.
	SETUP REALTIME CLOCK Time Date ➡ / SCROLL ENTER / RATE	Select Time to set the time. Use ➡ to select choice and ENTER to store selection.
	CLOCK TYPE 24HR 12HR ➡ / SCROLL ENTER / RATE	Select 24Hr or 12Hr clock. Use ➡ to select choice and ENTER to store selection.
	SELECT CLOCK AM/PM AM PM ➡ / SCROLL ENTER / RATE	If 12Hr Clock, Enter AM or PM. Use ➡ to select choice and ENTER to store selection.
	TIME OF DAY HH:MM:SS ##:##:## CLEAR PRESET/⬆ ➡ / SCROLL ENTER / RATE	Enter time of day. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store selection.
	Advance To SETUP REALTIME CLOCK (Date)	
6.4.19 SETUP REALTIME CLOCK (Date)	SETUP REALTIME CLOCK Time Date ➡ / SCROLL ENTER / RATE	Select Date to enter the date. Use ➡ to select choice and ENTER to store selection.
	DATE: MONTH, DAY, YEAR ##/##/#### CLEAR PRESET/⬆ ➡ / SCROLL ENTER / RATE	Enter the date. (Month, Day, Last two digits of Year). Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	Advance To SERIAL USAGE	

Sub-menus	Display	Notes
6.4.20 SERIAL USAGE	SERIAL USAGE ENTER / RATE	Press Enter to begin setup of the Serial Port.
	SERIAL HARDWARE RS232 RS485 ➡ / SCROLL ENTER / RATE	Select Serial Hardware type for standard port. Use ➡ to select choice and ENTER to store selection. (See SETUP NETWORK CARD for RS485 Modbus option)
	DEVICE ID ## CLEAR PRESET / ⬆ ➡ / SCROLL ENTER / RATE	Select the Device ID. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	BAUD RATE 300 600 1200 <more>	Select the desired Baud Rate. Use ➡ to select choice and ENTER to store selection.
	BAUD RATE 2400 4800 9600 19200 ➡ / SCROLL ENTER / RATE	(If <more> selected)
	PARITY None Odd Even ➡ / SCROLL ENTER / RATE	Select the desired Parity. Use ➡ to select choice and ENTER to store selection.
	HANDSHAKING None Software Hardware ➡ / SCROLL ENTER / RATE	Set the Handshake. Use ➡ to select choice and ENTER to store selection.
	DEVICE LINE FEED <CR> <CR+LF> ➡ / SCROLL ENTER / RATE	Choose end of line termination. Only choose <CR> if your external device automatically assigns a line feed for every <CR> carriage return. Use ➡ to select choice and ENTER to store selection.
	MODEM OPTIONS No Yes ➡ / SCROLL ENTER / RATE	Select "Yes" if the serial port will be used to control a modem. Use ➡ to select choice and ENTER to store selection.
	MODEM INIT MASTER No Yes ➡ / SCROLL ENTER / RATE	Select "Yes" to have the unit send a configuration conversation to the modem on power up . Use ➡ to select choice and ENTER to store selection.
	MODEM AUTO ANSWER No Yes ➡ / SCROLL ENTER / RATE	Select the desired Modem Auto Answer mode. Use ➡ to select choice and ENTER to store selection.
NOTE: 1 = Sunday 2 = Monday 3 = Tuesday 4 = Wednesday 5 = Thursday 6 = Friday 7 = Saturday	CALL OUT DAY OF WEEK 1 ➡ / SCROLL ENTER / RATE	Enter the day of week to perform Call Out transmission. Use ➡ to select choice and ENTER to store selection.
	CALL OUT TIME ##:##:## CLEAR PRESET / ⬆ ➡ / SCROLL ENTER / RATE	Enter the time of day to perform Call Out transmission. Use CLEAR, ➡ and ⬆ to create value. Press ENTER to store.
	CALL ON ERROR/ALARM No Yes ➡ / SCROLL ENTER / RATE	Select "Yes" to have the unit perform a Call Out transmission upon error/alarm condition. Use ➡ to select choice and ENTER to store selection.

Continued on Next Page

<u>Sub-menus</u>	<u>Display</u>	<u>Notes</u>
6.4.20 SERIAL USAGE (continued)	CALL OUT PHONE # 0 CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the Call Out Phone Number to be dialed for "Call Out Time" or "Print On Error/Alarm". Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	NUMBER OF REDIALS 0 CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the number of redials to be performed on call out time if busy or no answer. (error/alarm tries until connected) Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	HANGUP IF 2MIN INACT No Yes ▶/SCROLL ENTER/RATE	Select "Yes" to perform hangup if there is inactivity for more than 2 minutes. Use ▶ to select choice and ENTER to store selection.
Advance To SETUP DATALOG/PRINT		
6.4.21 SETUP DATALOG/PRINT (Configure)	SETUP DATALOG/PRINT ENTER / RATE	Press Enter to setup the Datalog/Print information.
	SETUP DATALOG/PRINT Config Select_list ▶/SCROLL ENTER/RATE	Select Config to configure the Datalog/Print information. Use ▶ to select choice and ENTER to store selection.
	OUTPUT FORMAT Printer Term Dbase ▶/SCROLL ENTER/RATE	Select the type of Output Format. Use ▶ to select choice and ENTER to store selection.
	PAGE LENGTH [66 max] 66 CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the desired Page Length. If Printer selected above. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	TOP MARGIN [60 max] 3 CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter the desired Top Margin. If Printer selected above. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	DATALOG ONLY No Yes ▶/SCROLL ENTER/RATE	Select Yes to record events to the datalogger only. Events will not be sent to the serial port. Use ▶ to select choice and ENTER to store selection.
	PRINT TIME HH:MM:SS 00:00:00 CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter Print Time, printer will print at this time every day. Enter 00:00:00 to inhibit print time. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	PRINT INTERVAL 00:00:00 CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter Print Interval, Enter 00:00:00 to inhibit print interval. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
Advance To SETUP DATALOG/PRINT (Select_list)		

Sub-menus	Display	Notes
6.4.21 SETUP DATALOG/PRINT (Configure) Continued	ENABLE PRINT KEY NO YES ➡ / SCROLL ENTER / RATE	Select YES to enable Print Key. Select NO to disable Print Key. Use ➡ to select choice and ENTER to store selection.
	PRINT END OF BATCH NO YES ➡ / SCROLL ENTER / RATE	Batch mode only. Select Yes to print at end of batch. Use ➡ to select choice and ENTER to store selection.
	Advance To SETUP DATALOG/PRINT (Select_list)	
6.4.22 SETUP DATALOG/PRINT (Select_list)	SET DATALOG/PRINT ENTER / RATE	Press enter to begin Setup Datalog/Print routine.
	SET DATALOG/PRINT Config Select_list ➡ / SCROLL ENTER / RATE	Press enter when Select_list is selected to setup print list. Use ➡ to select choice and ENTER to store selection.
	PRINT LIST ITEMS TOTAL YES	Use ⬆ to view list status.
	PRINT LIST ITEMS RATE YES	Press PRINT to select YES or NO for the items that you wish to add or remove from the list. Items marked with Yes will be added to the list, items marked with No will be removed from the list. Press ⬆ to advance to next item. Press ENTER to store Print List.
	PRINT LIST ITEMS PRE 1 YES PRESET / ⬆ ➡ / SCROLL ENTER / RATE	
	PRINT LIST ITEMS DataLog size = 215 ENTER / RATE	The Select Print List Information display shows the current possible Datalog size.
Advance To ADMINISTRATIVE SETUP		



- List Items:
- TOTAL
 - RATE
 - PRE1
 - TEMP
 - GRAND
 - PRE2
 - DENS
 - TIME

Sub-menus	Display	Notes
6.4.23 ADMINISTRATIVE SETUP	ADMINISTRATIVE SETUP ENTER / RATE	Press Enter to begin Administrative Setup.
	TAG NUMBER FT#### CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter Tag Number. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	OPERATOR PASSWORD ***** CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter Operator Password. (Factory Set to 0) Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	SUPERVISOR PASSWORD ***** CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	Enter Supervisor Password. (Factory Set to 2000) Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	SOFTWARE VERSION VXX.XX ENTER / RATE	This display is used to show the software version of the installed software.
	PRODUCT ORDER CODE XXXXXXXXXXXX	This display is used to show the product order code (model number).
	UNIT SERIAL NUMBER 00000 ENTER / RATE	This display is used to show the unit's serial number.
	SENSOR SERIAL NUMBER 00000 CLEAR PRESET/▲ ▶/SCROLL ENTER/RATE	This display is used to show the sensor's serial number. Use CLEAR, ▶ and ▲ to create value. Press ENTER to store.
	Advance To SETUP NETWORK CARD	

Sub-menus	Display	Notes
6.4.24 SETUP NETWORK CARD (optional)	SETUP NETWORK CARD ENTER / RATE	Press Enter to setup Network Card
	SELECT NTW PROTOCOL ModbusRTU ENTER / RATE	Select desired Network Protocol.
	NETWORK DEVICE ID 1 CLEAR PRESET / / SCROLL ENTER / RATE	Enter the device address on network (00-255). Use CLEAR, and to create value. Press ENTER to store.
	BAUD RATE 2400 4800 9600 19200 / SCROLL ENTER / RATE	Select the desired Baud Rate. Use to select choice and ENTER to store selection.
	PARITY None Odd Even / SCROLL ENTER / RATE	Select the desired Parity. Use to select choice and ENTER to store selection.
	Advance To SELECT EZ SETUP?	
6.4.25 SETUP DISPLAY LIST (configuration)	SELECT OPERATE STATE Run Setup Test Disp / SCROLL ENTER / RATE	Use to move cursor to DISP then press ENTER to select.
	SELECT DISPLAY ITEM Total Line Two PRESET / ENTER / RATE	Use to select line assignment. Choose between Removed, Line One, and Line Two. Press ENTER to save that items assignment and move to next item.
	 SELECT DISPLAY ITEM Rate Line One PRESET / ENTER / RATE	Repeat the steps above for all the available items: TOTAL, RATE, PRE 1, TEMP, GRAND, PRE 2, DENS, TIME. Press ENTER on last item to save selections and return to SELECT OPERATE STATE
	Return To SELECT OPERATE STATE	

7. Principle Of Operation

General Operation

7.1 General:

The STX-ST1 uses several internal calculations to compute the compensated flow based on specific data input. Several computations are performed to arrive at the uncompensated flow, temperature, density and viscosity. This information is then used to compute the Corrected Volume Flow or Mass Flow.

Orifice Flowmeter Considerations

7.2 Orifice Flowmeter Considerations:

Head class flowmeters are supplied by the manufacturers with a 4-20 mA output span which is already in flow units. The STX-ST1 permits the user to enter this flowmeter information directly. However, closely associated with this information is the density that was assumed during flowmeter calibration. This information must also be input if the user is to obtain maximum accuracy.

It is assumed that the user has the printout from a standardized orifice sizing program for the particular device he will be using. Such standardized printouts list all the necessary information which the user will then be prompted for.

Several specialized flow equations are listed that are not intended for the standard unit but to be offered to appropriate OEMs or as special order items. These are designated by a “†”.

Note concerning Fluid Information

The user will be prompted for Fluid Information during the setup of the instrument. The Factory will assist you in preparing application information for your fluid type.

Flow Equations

7.3 Flow Equations:

Input Flow Computation:

Linear or External SQRT

$$\text{Input Flow} = [\% \text{ input span} * (\text{flow FS} - \text{flow low scale})] + \text{flow low scale}$$

Orifice

$$\text{Input Flow} = [(\sqrt{\% \text{ input span}}) * (\text{flow FS} - \text{flow low scale})] + \text{flow low scale}$$

Input Flow Computation:

General Case

$$Tf = [\% \text{ input span} * (\text{temp FS} - \text{Temp low scale})] + \text{temp low scale}$$

RTD Case

$$Tf = f(\text{measured input resistance})$$

Input Density Computation:

Temperature Transmitter

$$\text{density} = \text{reference density} * (1 - \text{Therm.Exp.Coef.} * (Tf - Tref))^2$$

Density Transmitter

$$\text{density} = [\% \text{ input span} * (\text{density FS} - \text{density low scale})] + \text{density low scale}$$

7.3 Flow Equations: (Continued)

Flow Equations

Input Viscosity Computation:

$$\text{centistokes} = \frac{\left(A \exp \frac{B}{(\text{Deg F} + 459.67)} \right)}{\text{Absolute Density}}$$

Where: centistokes = cP/(kg/l)

Uncompensated Flow Computation:

Pulse Input; Average K-Factor

$$\text{Volume Flow} = \frac{\text{input frequency} * \text{time scale factor}}{\text{K-Factor}}$$

Pulse Input; Linear Table

$$\text{Volume Flow} = \frac{\text{input frequency} * \text{time scale factor}}{\text{K-Factor (Hz)}}$$

Pulse Input; UVC

$$\text{Volume Flow} = \frac{\text{input frequency} * \text{time scale factor}}{\text{K-Factor (Hz/cstk)}}$$

Analog Input; Linear

$$\text{Volume Flow} = \text{input flow}$$

Analog Input; Linear Table

$$\text{Volume Flow} = \text{input flow} * \text{correction factor (input flow)}$$

Analog Input; Orifice or External SQRT

$$\text{Volume Flow} = \text{input flow} * \frac{\sqrt{(\text{calibrated density})}}{\sqrt{(\text{density})}}$$

Analog Input; Orifice Linear Table or External SQRT Linear Table

$$\text{Volume Flow} = \text{CF(rn)} * \text{input flow} * \frac{\sqrt{(\text{calibrated density})}}{\sqrt{(\text{density})}}$$

Corrected Volume Flow Computation:

Temperature Transmitter

$$\text{Standard Volume Flow} = \text{volume flow} * (1 - \text{Therm.Exp.Coef.} * (\text{Tf} - \text{Tref}))^2$$

Density Transmitter

$$\text{Standard Volume Flow} = \text{volume flow} * \frac{\text{density}}{\text{reference density}}$$

Mass Flow Computation:

$$\text{Mass Flow} = \text{volume flow} * \text{density}$$

7.3 Flow Equations: (Continued)

Flow Equations

API 2540 Equation. The American Petroleum Institute, in a joint program with the National Bureau of Standards (NIST), developed a density equation based on 463 samples of five different oil products. The results of this work are incorporated into Chap. 11.1, “Volume Correction Factors,” of API Standard 2540 (1987).
The density equation is based on the thermal-expansion coefficient of the product at 60°F (15.6°C) base temperature, which is calculated from the base density as

$$\alpha_b = \frac{K_0}{\rho_b^{*2}} + \frac{K_1}{\rho_b^*} \tag{2.188}$$

where the base density ρ_b^* is in kilograms per cubic meter. The empirically derived constants K_0 and K_1 for the five product groups are given in Table 2.23. The density of the product at flowing temperature is then calculated as

$$\rho_F^* = \rho_b^* \exp [-\alpha_b \Delta T_F (1 + 0.8 \alpha_b \Delta T_F)] \tag{2.189}$$

where $\Delta T_F = T_F - 60$. The specific gravity at flowing or measured temperature is then

TABLE 2.23 Constants K_0 and K_1 for Five Product Groups

Product group	K_0	K_1
Crude oils and JP4†	341.0957	0.0
Jet fuels, kerosenes, solvents	330.3010	0.0
Gasolines and naphthenes	192.4571	0.2438
Lubricating oils	144.0427	0.1895
Diesel oil, heating oils, fuel oils	103.8720	0.2701

Note: Pentanes and hydrocarbons lower in the hydrocarbon chain are *not* covered by this data.
†API News Release 1987 added JP4.

The above information was obtained from "Flow Measurement Engineering Handbook, 3rd Edition" by Richard W Miller.

7.4 Calculating the Expansion Factor

Calculating Expansion Factor

The liquid density is a function of the flowing temperature for many fluids. This unit solves an equation which represents this physical property of the fluid.

The information which the unit uses to describe the fluid is entered by the user in the following variables: Reference Temperature, Reference Density, Expansion Factor. This information is available for many fluids in one or more of the following forms:

Fluid Specific Gravity vs. Temp. Table

Specific Gravity vs. Temp. Graph

Fluid Density vs. Temp. Table

Fluid Density vs. Temp. Graph

Begin by obtaining one of the fluid properties for the fluid you are using from available manufacturers information or Engineering Handbooks. In some cases this information is listed on the Material Safety Data Sheet for the fluid.

Two temperature-specific gravity pairs will be required to compute the temperature coefficient.

The reference temperature is simply chosen by the user. Common reference temperatures are 60° F or 15° C.

However, for cryogenic fluids, the normal boiling point may also be used. In some cases the fluid data may list properties at 100° F, this temperature may also be used as the reference temperature.

The reference temperature should be chosen so that it is in the application temperature range. i.e. application temperature range -10 to 120° F, reference temperature of 60° F chosen.

Enter the reference temperature you have chosen at this point.

The reference specific gravity corresponds to the fluid SPECIFIC GRAVITY at the reference temperature chosen.

You may convert the fluid density information to specific gravity if it is in units other than specific gravity. Use EQ1.

Expansion Factor Equations

EQ1.

$$\text{Spec.Grav.} = \text{Density of Fluid} / \text{Density of Water}$$

Given the reference temperature, reference specific gravity, a second temp. and a second Spec.Grav., the Expansion Factor (C Factor) can be computed as follows:

EQ2. Used for Liquid Mass and Corrected Volume Equations

$$C = \left[\frac{1 - \sqrt{\text{Spec.Grav.2} / \text{Ref.Spec.Grav.}}}{\text{Temp.2} - \text{Ref.Temp}} \right] \times 1,000,000$$

Given the reference temperature, reference density, a second temp. and a second density, the Expansion Factor (C Factor) can be computed as follows:

EQ3. Used for Liquid Mass and Corrected Volume Equations

$$C = \left[\frac{1 - \sqrt{\text{Dens.2} / \text{Ref.Dens.}}}{\text{Temp.2} - \text{Ref.Temp}} \right] \times 1,000,000$$

7.5 Computation of Viscosity Coef. A and B

Computation of Viscosity Coef. A & B

The STX-ST1 solves an equation which computes the viscosity as a function of temperature. Two parameters must be entered for this calculation to be performed. These are the setup parameters Viscosity Coef. A and Viscosity Coef. B. A table listing these values for common fluids is available from THE FACTORY.

Alternately, if your intended fluid is not listed, the Viscosity Coef. A and B can be derived from two known temperature/viscosity pairs. Begin by obtaining this information for your intended fluid. Convert these known points to units of Degrees F and centipoise (cP)

The information is now in a suitable form to compute the Viscosity Coef. A and Viscosity Coef. B using the following equation based on the fluid state.

For a liquid, A and B are computed as follows:

$$B = \frac{(T1 + 459.67) \cdot (T2 + 459.67) \cdot \ln [cP1/cP2]}{(T2 + 459.67) - (T1 + 459.67)}$$

$$A = \frac{cP1}{\exp [B / (T1 + 459.67)]}$$

NOTE: $cS = \frac{cP \cdot \text{Density of Water at } 4^{\circ}\text{C}}{\text{Density of Liquid}}$

7.6 Linearization Table

Linearization Table
General Information

7.6.1 Linearization Table General Information
The Linearization Table is used when the flow input device gives a nonlinear input signal. The unit uses up to 16 different point pairs, as entered by the operator, to form a curve for linearizing the input signal.

- Notes:
- 1) A minimum of three points must be set up.
 - 2) If "0" is entered for the frequency of any point other than point 1, the STX-ST1 assumes there are no more points above the points that preceded them. The display will advance to the next setup prompt. Extrapolation is taken from the last two nonzero points.
 - 3) If the input frequency is above the highest or below the lowest frequency programmed, the unit will use the last known point for the K factor in computing the resulting actual flow.
 - 4) Frequencies or apparent flows should be entered in ascending order.

Linearization Table
(Pulse Inputs)

7.6.2 Linearization Table for Pulse Inputs
The linearization table for pulse inputs programming is quite simple when values of frequency and flow are known. The STX-ST1 asks for 16 different frequencies (Freq) and 16 corresponding K factors (K). It then uses this data to determine what the actual flow is for any given input frequency. Usually the necessary data is provided with the flowmeter.

Linearization Table
(Analog Inputs)

7.6.3 Linearization Table for Analog Inputs
The Linearization Table for Analog inputs programming is similar to the Pulse input setup. The STX-ST1 asks for 16 different flow rates (apparent flow) and 16 corresponding Correction Factors. It then uses this data to determine what the Actual flow is for any given apparent input signal. Again, a minimum of three points must be set up.

Correction factor = $\frac{\text{Actual Flow}}{\text{Apparent Input Flow}}$

The same rules that applied for the Digital setup apply for the Analog setup as well.
The STX-ST1 prompts you for the Apparent input signal (APR) and a correction factor CFr) to multiply it by to yield true actual flow.

Linearization Table
Interpolation

7.6.4 Linearization Table Interpolation
The Linearization Table routine uses the entered data to determine the K factor for any given input frequency or input flow signal. This is done by taking the closest data points above and below the input signal, then using those points to interpolate the K factor (correction factor), then calculating the uncompensated flow from the data. Below are the formulas.

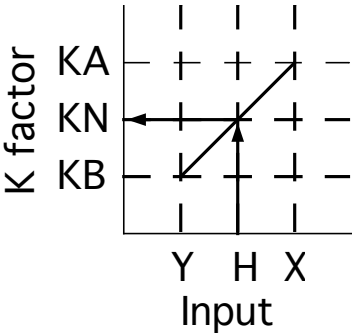
Parameters:
Determine closest point above input signal
signal = X, K factor (correction factor) = KA

Determine closest point below input signal
signal = Y, K factor (correction factor) = KB

Let input signal = H,
unknown K factor (correction factor) = KN

To find KN use this formula:

$\frac{H - Y}{X - Y} \times (KA - KB) + KB = KN$



8. Test, Service and Maintenance

8.1 Test Menus

Menus	Display	Notes
8.1.1 TOP LEVEL TEST MENUS	SELECT OPERATE STATE Run Setup Test Disp ENTER / RATE	Use ➡ to select Test to enter the instrument test & calibration routine. NOTE: Supervisor (Service) password required to gain access to this mode.
	Audit Trail PRESET / ⬆	Refer to Page 52 for Details.
	Error history PRESET / ⬆	Refer to Page 52 for Details.
	Print System Setup PRESET / ⬆	Refer to Page 52 for Details.
	Keypad Test PRESET / ⬆	Refer to Page 53 Details.
	Display test PRESET / ⬆	Refer to Page 53 for Details.
	Calibrate PRESET / ⬆	Refer to Pages 54 - 57 for Details.
	Analog In Test PRESET / ⬆	Refer to Page 58 Details.
	Pulse input test PRESET / ⬆	Refer to Page 59 for Details.
	Analog out test PRESET / ⬆	Refer to Page 59 for Details.
	Excitation out test PRESET / ⬆	Refer to Page 59 for Details.
	Pulse out test PRESET / ⬆	Refer to Page 60 for Details.
	Relay Test PRESET / ⬆	Refer to Page 60 for Details.
	Control inputs test PRESET / ⬆	Refer to Page 60 for Details.
	Battery Voltage Test PRESET / ⬆	Refer to Page 61 for Details.
	Data logger utility PRESET / ⬆	Refer to Page 61 for Details.

8.2 Test Sub-Menus

Sub-menus	Display	Notes
8.2.1 Audit Trail Submenu Group	Audit Trail	Press Enter to view the audit trail information.
	ENTER / RATE	
	Audit Trail nnnnn hh:mm:ss mm/dd/yy	The audit trail is viewed in this format: nnnnn= number of critical menu changes, hh:mm:ss; mm/dd/yy = time and date of last change.
8.2.2 Error History Submenu Group	MENU	
	Audit Trail	Press Menu to get back to audit trail top-level menu.
8.2.2 Error History Submenu Group	Error history	Press Enter to view error history.
	ENTER / RATE	NOTE: Press Print Key to print Error History. Printout will include time/date of each errors first occurrence.
	Error history Flow rate alarm low	Use ▲ to scroll through error message history. Press CLEAR to clear entire error log.
8.2.3 Print System Setup Submenu Group	MENU	
	Error history	Press Menu to get back to error history top-level menu.
8.2.3 Print System Setup Submenu Group	Print System Setup	Press enter key to enter print system setup submenu
	ENTER / RATE	
	Print System Setup Press ENTER to print	Press enter to begin printing the system setup.
8.2.3 Print System Setup Submenu Group	ENTER / RATE	
	Print System Setup -- Printing --	This message will display as the data transmission takes place.
	MENU	
8.2.3 Print System Setup Submenu Group	Print System Setup	Press Menu to get back to print system setup top-level menu.

<u>Sub-menus</u>	<u>Display</u>	<u>Notes</u>
8.2.4 Keypad test Submenu Group	Keypad test	Press Enter to enter keypad test
	ENTER / RATE	
	Keypad test Key_pressed-> ENTER	Press the various keys and the display will show the key that was pressed. Press Menu to exit the test
	MENU	
	Keypad test	Press Menu to get back to Keypad test top-level menu.
8.2.5 Display test Submenu Group	Display test	Press Enter to enter display test.
	ENTER / RATE	
	000000000000000000000000 000000000000000000000000	Upon pressing enter the each digit on the display will scroll 0-9 then A-Z. Press menu to exit the test.
	MENU	
	Display test	Press Menu to get back to Display test top-level menu.

ALL UNITS ARE CALIBRATED AT THE FACTORY PRIOR TO SHIPMENT

CAUTION:

This unit must be calibrated using precision and calibrated equipment.

Equipment needed is as follows: Frequency Generator, Digital Multimeter, Precision Current/Voltage Source, Oscilloscope, Frequency Counter.

Sub-menus	Display	Notes
Calibration Submenu Group	Calibrate ENTER / RATE	Press Enter to begin the calibration routine. (Please note the caution above)
8.2.6 Calibrate CH1 0mA Submenu Group	Calibrate ch1 0mA Iin=TB1-3 GND=TB1-4 ENTER / RATE	Connect Current Source (+) TB1-3, (-) TB1-4. Input 0mA and press Enter.
	Calibrate ch1 0mA CALIBRATING --	This message is displayed during calibration.
	Calibrate ch1 0mA *** DONE ***	This message is displayed when the 0mA calibration is finished.
	Calibrate ch1 0mA Iin=TB1-3 GND=TB1-4	The display will automatically return to the Calibrate CH1 0mA submenu. Press the ▲ arrow button to advance to the CH1 20mA calibration.
8.2.7 Calibrate CH1 20mA Submenu Group	Calibrate ch1 20mA Iin=TB1-3 GND=TB1-4 PRESET / ▲	Connect Current Source (+) TB1-3, (-) TB1-4. Input 20mA and press Enter.
	Calibrate ch1 20mA 0 CALIBRATING --	This message is displayed during calibration.
	Calibrate ch1 20mA *** DONE ***	This message is displayed when the 20mA calibration is finished.
	Calibrate ch1 20mA Iin=TB1-3 GND=TB1-4 PRESET / ▲	The display will automatically return to the Calibrate CH1 20mA submenu. Press the ▲ arrow button to advance to the CH2 0mA calibration.
	Advance to Calibrate ch2 0mA	

Sub-menus	Display	Notes
8.2.8 Calibrate CH2 0mA Submenu Group	Calibrate ch2 0mA Iin=TB1-8 GND=TB1-4 ENTER / RATE	To Calibrate: Connect Current Source (+) TB1-8, (-) TB1-4. Input 0mA and press Enter.
	Calibrate ch2 0mA 0 CALIBRATING --	This message is displayed during calibration.
	Calibrate ch2 0mA *** DONE ***	This message is displayed when the 0mA calibration is finished.
	Calibrate ch2 0mA Iin=TB1-8 GND=TB1-4 PRESET / ▲	The display will automatically return to the Calibrate CH2 0mA submenu. Press the ▲ arrow button to advance to the CH2 20mA calibration.
8.2.9 Calibrate CH2 20mA Submenu Group	Calibrate ch2 20mA Iin=TB1-8 GND=TB1-4 ENTER / RATE	To Calibrate: Connect Current Source (+) TB1-8, (-) TB1-4. Input 20mA and press Enter.
	Calibrate ch2 20mA 0 CALIBRATING --	This message is displayed during calibration.
	Calibrate ch2 20mA *** DONE ***	This message is displayed when the 20mA calibration is finished.
	Calibrate ch2 20mA Iin=TB1-8 GND=TB1-4 PRESET / ▲	The display will automatically return to the Calibrate CH2 20mA submenu. Press the ▲ arrow button to advance to the CH1 0V calibration.
Advance to Calibrate ch1 0V		

Sub-menus	Display	Notes
8.2.10 Calibrate CH1 0V Submenu Group	Calibrate ch1 0V Uin=TB1-2 GND=TB1-4 ENTER / RATE	To Calibrate: Connect Voltage Source (+) TB1-2, (-) TB1-4. Input 0V and press Enter.
	Calibrate ch1 0V 0 CALIBRATING --	This message is displayed during calibration.
	Calibrate ch1 0V *** DONE ***	This message is displayed when the 0V calibration is finished.
	Calibrate ch1 0V Iin=TB1-2 GND=TB1-4 PRESET / ▲	The display will automatically return to the Calibrate CH1 0V submenu. Press the ▲ arrow button to advance to the CH1 10V calibration.
8.2.11 Calibrate CH1 10V Submenu Group	Calibrate ch1 10V Iin=TB1-2 GND=TB1-4 ENTER / RATE	To Calibrate: Connect Voltage Source (+) TB1-2, (-) TB1-4. Input 10V and press Enter.
	Calibrate ch1 10V 0 CALIBRATING --	This message is displayed during calibration.
	Calibrate ch1 10V *** DONE ***	This message is displayed when the 10V calibration is finished.
	Calibrate ch1 10V Iin=TB1-2 GND=TB1-4 PRESET / ▲	The display will automatically return to the Calibrate CH1 10V submenu. Press the ▲ arrow button to advance to the CH2 0V calibration.
Advance to Calibrate ch2 0V		

Sub-menus	Display	Notes
8.2.12 Calibrate CH2 0V Submenu Group	Calibrate ch2 0V Vin=TB1-5 GND=TB1-4 ENTER / RATE	To Calibrate: Connect Voltage Source (+) TB1-5, (-) TB1-4. Input 0V and press Enter.
	Calibrate ch2 0V 0 CALIBRATING --	This message is displayed during calibration.
	Calibrate ch2 0V *** DONE ***	This message is displayed when the 0V calibration is finished.
	Calibrate ch2 0V Iin=TB1-5 GND=TB1-4 PRESET / ▲	The display will automatically return to the Calibrate CH2 0V top-level menu. Press the ▲ arrow button to advance to the CH2 10V calibration.
8.2.13 Calibrate CH2 10V Submenu Group	Calibrate ch2 10V Iin=TB1-5 GND=TB1-4 ENTER / RATE	To Calibrate: Connect Voltage Source (+) TB1-5, (-) TB1-4. Input 10V and press Enter.
	Calibrate ch2 10V 0 CALIBRATING --	This message is displayed during calibration.
	Calibrate ch2 10V *** DONE ***	This message is displayed when the 10V calibration is finished.
	Calibrate ch2 10V Iin=TB1-5 GND=TB1-4 PRESET / ▲	The display will automatically return to the Calibrate CH2 10V top-level menu. Press the ▲ arrow button to advance to the 100 ohm RTD calibration.
Advance to Calibrate 100ohm RTD		
8.2.14 Calibrate 100 ohm RTD Submenu Group	Calibrate 100ohm RTD JMP TB1-6,7 100R=7,8 ENTER / RATE	To Calibrate: Connect a jumper wire between TB1-6 and TB1-7, Place a 100 ohm 0.1% resistor between TB1-7 and TB1-8. Press enter to calibrate.
	Calibrate 100ohm RTD 0 CALIBRATING --	This message is displayed during calibration.
	Calibrate 100ohm RTD *** DONE ***	This message is displayed when the RTD calibration is finished.
	Calibrate 100ohm RTD JMP TB1-6,7 100R=7,8 PRESET / ▲	The display will automatically return to the Calibrate 100 ohm RTD top-level menu. Press the ▲ arrow button to advance to the 4mA out calibration.
Advance to Calibrate 4mA out		

Sub-menus	Display	Notes
8.2.15 Calibrate 4mA Out Submenu Group	Calibrate 0mA out + TB1-15 - TB1-16 ENTER / RATE	Connect ammeter to (+) TB1-15, (-) TB1-16. Press enter.
	Calibrate 0mA out Enter mA: 0.00000 ENTER / RATE	To trim 0mA output: Press CLEAR, ➡ and ⬆ to begin editing and enter a small negative number (i.e. -0.100) to force a display reading, then clear and enter small quantity measured on your meter.
	Calibrate 0mA out + TB1-15 - TB1-16 PRESET / ⬆	The display will return to Calibrate 0mA out. Press the ⬆ arrow button to advance to Cal. 20mA out or repeat above if necessary.
8.2.16 Calibrate 20mA Out Submenu Group	Calibrate 20mA out + TB1-15 - TB1-16 ENTER / RATE	Connect ammeter to (+) TB1-15, (-) TB1-16. Press enter.
	Calibrate 20mA out Enter mA: 20.00000 ENTER / RATE	To trim 20mA output: Press CLEAR, ➡ and ⬆ to begin editing and enter the current reading that is on the ammeter display. Press enter.
	Calibrate 20mA out + TB1-15 - TB1-16 MENU	The display will automatically return to the Calibrate 20mA out submenu. Calibration is complete.
	Calibrate	Press the Menu key to go back to Calibrate top-level menu.
8.2.17 Analog In Test Submenu Group	Analog In Test ENTER / RATE	Press enter to test the analog inputs.
	Analog In Test Volts T2:00.000 T5:00.000 PRESET / ⬆	To check voltage input accuracy: Use TB1-4 as Reference Ground, input 0-10 Volts to TB1-2 and/or TB1-5. Display should show voltage being input. Use voltage meter to verify input.
	Analog In Test mA T3:00.000 T8:00.000 PRESET / ⬆	To check current input accuracy: Use TB1-4 as Reference Ground, input 0-20mA to TB1-3 and/or TB1-8. Display should show current being input. Use ammeter to verify input.
	Analog In Test OHMS RTD 00.000 MENU	To check RTD input accuracy: Connect a jumper wire between TB1-6 and TB1-7, Place a 100 ohm 0.1% resistor between TB1-7 and TB1-8. Display should show 100 ohms ±0.1%.
	Analog In Test	Press Menu key to return to Analog In Test top-level menu.

Sub-menus	Display	Notes
8.2.18 Pulse input test Submenu Group	Pulse input test ENTER / RATE	Press Enter key to test the pulse input.
	2.5V 10mV 100mV Pulse input test Trigger level 2.5V ENTER / RATE	Use the ▲ arrow button to select the appropriate trigger level. Press ENTER.
	40Hz 3kHz 20kHz Pulse input test count speed 3kHz ENTER / RATE	Use the ▲ arrow button to select the appropriate frequency range. Press ENTER.
	Pulse input test F1: 0 F2: 0 MENU	To check Pulse input accuracy: Use TB1-4 as reference ground, input a frequency on TB1-2. The display should show frequency being input. Use a frequency counter to verify input.
	Pulse input test	Press Menu key to return to Pulse input test top-level menu.
8.2.19 Analog out test Submenu Group	Analog out test ENTER / RATE	Press Enter to test the analog output.
	Analog out test *0 4 10 15 20 mA MENU	To simulate analog output: Connect an ammeter to (+) TB1-15, (-) TB1-16. Use the ► arrow button to move the asterisk (*). The unit should output the selected current.
	Analog out test	Press Menu key to return to Analog out test top-level menu.
8.2.20 Excitation out test Submenu Group	Excitation out test ENTER / RATE	Press Enter to test the excitation output.
	Excitation out test *5v 12v 24v MENU	To test the excitation output: Connect a voltmeter to (+) TB1-1, (-) TB1-4. Use the ► arrow button to move the asterisk (*). The unit should output the selected voltage.
	Excitation out test	Press Menu key to return to Excitation out test top-level menu.

<u>Sub-menus</u>	<u>Display</u>	<u>Notes</u>
8.2.21 Pulse out test Submenu Group	Pulse out test ENTER / RATE	Press Enter key to test the pulse output.
	Pulse out test *0Hz 1Hz 10Hz 20Hz MENU	To simulate a frequency on the pulse output: Connect a frequency counter to (+)TB1-13, (-)TB1-14. Use the ► arrow button to move the asterisk (*). The unit should output the selected frequency.
	Pulse out test ENTER / RATE	Press Menu key to return to Pulse out test top-level menu.
8.2.22 Relay test Submenu Group	Relay Test	Press Enter to test the relays.
	R1y1 R1y2 R1y3 R1y4 Off Off Off Off MENU	To manually control the relay outputs: Press the ► key to select the desired relay. Use the ▲ to toggle the relays On/Off. Use an ohmmeter to check the relay contacts.
	Relay Test	Press Menu key to return to Relay Test top-level menu.
8.2.23 Control input test Submenu Group	Control inputs test ENTER / RATE	Press Enter to test the control inputs.
	TB1-9 TB1-10 TB1-11 Off Off Off MENU	To check the control inputs: Use TB1-12 as reference, input a DC signal to TB1-9, TB1-10 and/or TB1-11, The Display will show ON when input is active, OFF when inactive.
	Control inputs test	Press Menu key to return to control input test top-level menu.

<u>Sub-menus</u>	<u>Display</u>	<u>Notes</u>
8.2.24 Battery Voltage test Submenu Group	Battery Voltage Test ENTER / RATE	Press Enter key to view the battery voltage.
	Battery Voltage Test 3.312 Volts MENU	The display will show the battery voltage. Replace battery at 2.5 VDC or below.
	Battery Voltage Test	Press Menu key to return to battery voltage test top-level menu.
8.2.25 Data logger utility Submenu Group	Data logger utility ENTER / RATE	Press Enter to use data logger utility.
	Data logger utility Log 10 958 Max PRESET / ▲	The displays shows the number of Data Logs. Press the ▲ arrow button to advance to PRT (print) or CLR (clear).
	Data logger utility Log 00001 PRT CLR MENU	Press PRINT key to output data logger logs to printer, Press CLEAR key to clear the data logger contents.
	Data logger utility	Press Menu key to return to Data logger utility top-level menu.

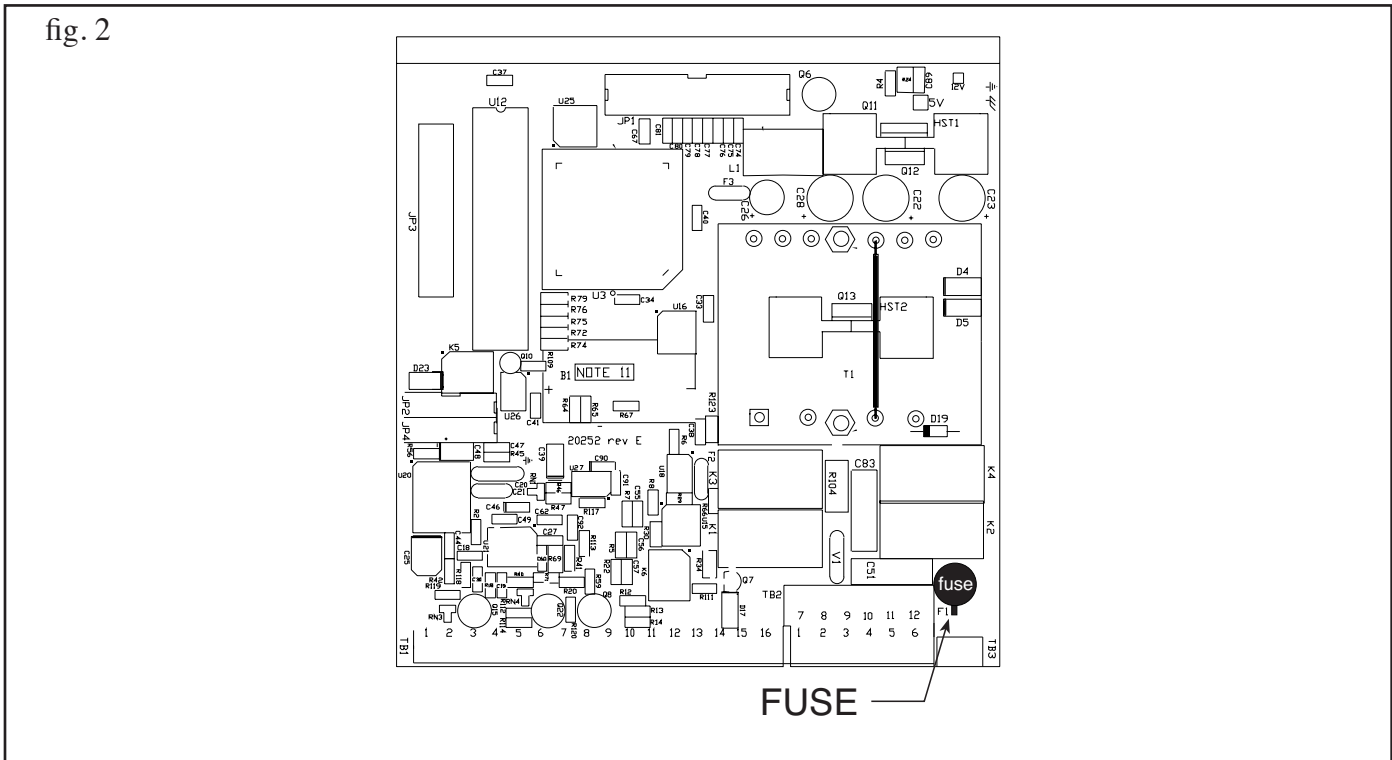
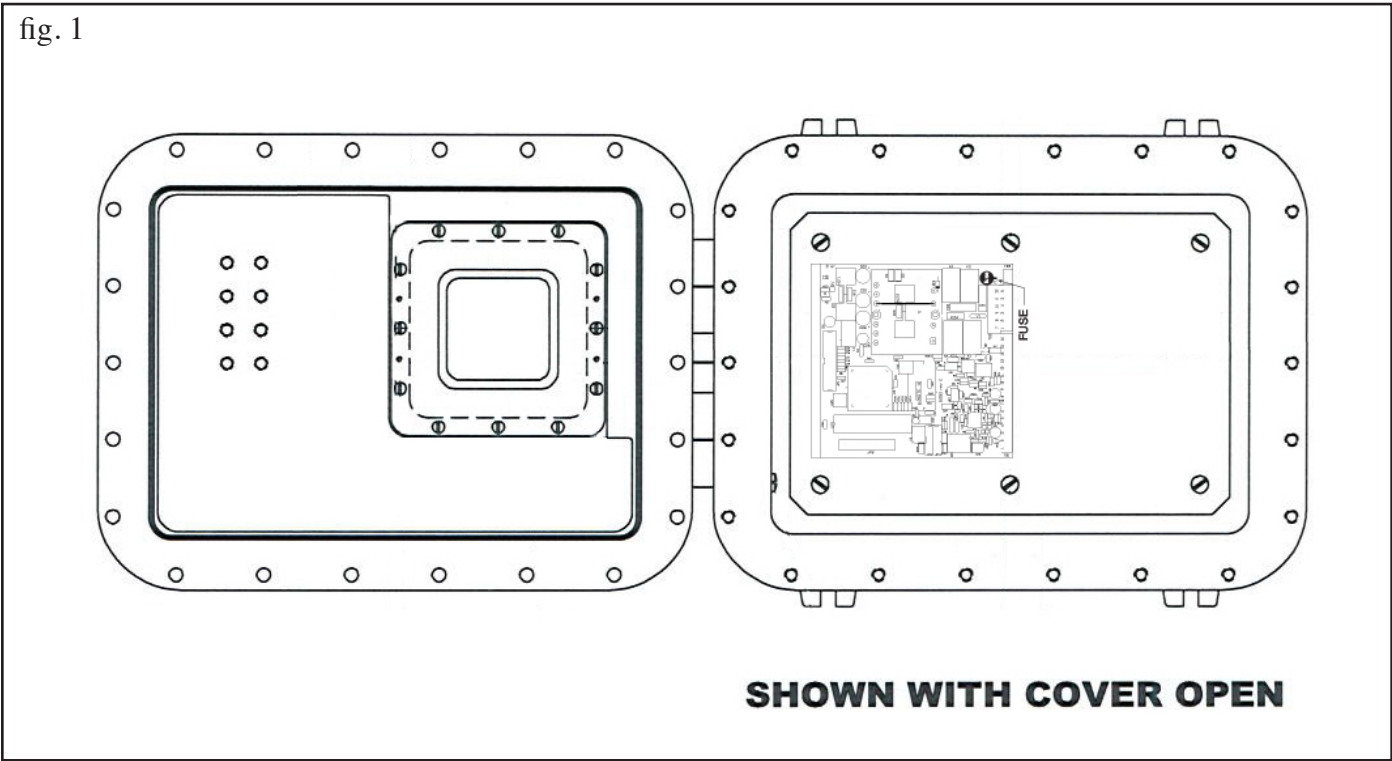
8.3 Internal Fuse Replacement

Instructions:

- 1. Make sure you follow proper E.S.D. and hazardous area Precautions. All persons performing this replacement must follow proper grounding procedures.
- 2. Turn the power to the unit off.
- 3. Remove the machine screws which hold the cover to rear case
- 4. The front panel should swing away from the rest of the case. (see fig. 1) With the cover open the fuse will be located at the lower right of PC board.
- 5. Locate the Fuse F1 (see fig. 2) and unplug the fuse from its socket.
- 6. Insert the new fuse into the socket. Insure that the pins are fully inserted and straight.
- 7. Reassemble the case and install the cover screws
- 8. Turn the unit back on.

Fuse Specifications:

- 110 VAC Power: 160mA/250V, TD Wickman 19372-030-k or equivalent
- 220 VAC Power: 80mA/250V, TD Wickman 19372-026-k or equivalent
- 12/24 VDC Power: 800mA/250V, TD Wickman 19374-046-k or equivalent



9. RS-232 Serial Port

9.1 RS-232 Port Description:

The STX-ST1 has a general purpose RS-232 Port which may be used for any one of the following purposes:

- Transaction Printing
- Data Logging
- Remote Metering by Modem (optional)
- Computer Communication Link
- Configuration by Computer
- Print System Setup
- Print Calibration/Malfunction History

9.2 Instrument Setup by PC’s over Serial Port

A setup program is provided with the STX-ST1 that enables the user to rapidly configure the STX-ST1 using a Personal Computer. Included on the disk are common instrument applications which may be used as a starting point for your application. This permits the user to have an excellent starting point and helps speed the user through the instrument setup. Any cabling or accessories must be purchased separately.

9.3 Operation of Serial Communication Port with Printers

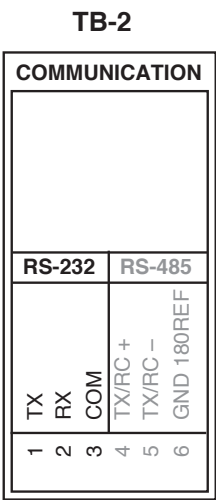
Batcher’s RS-232 channel supports a number of operating modes. One of these modes is intended to support operation with a printer in metering applications requiring transaction printing, data logging and/ or printing of calibration and maintenance reports.

For transaction printing, the user defines the items to be included in the printed document. The user can also select what initiates the transaction print generated as part of the setup of the instrument. The transaction document may be initiated via a front panel key depression, a remote contact closure, or upon completion of a batch.

In data logging, the user defines the items to be included in each data log as a print list. The user can also select when or how often he wishes a data log to be made. This is done during the setup of the instrument as either a time of day or as a time interval between logging.

The system setup and maintenance report list all the instrument setup parameters and usage for the current instrument configuration. In addition, the Audit trail information is presented as well as a status report listing any observed malfunctions which have not been corrected. The user initiates the printing of this report at a designated point in the menu by pressing the print key on the front panel in the TEST mode.

9.4 RS-232 Terminal Block Pinout



10. RS-485 Serial Port (optional)

10.1 RS-485 Port Description:

The STX-ST1 has a an optional general purpose RS-485 Port which may be used for any one of the following purposes:

- Accessing Process Parameters
 - Rate, Temperatures, Density, Setpoints, Month, Day, Year, Hour, Minutes, Seconds, etc.
- Accessing System Alarms
 - System, Process, Self Test, Service Test Errors
- Accessing Totalizers
 - Totalizer and Grand Totalizer
- Executing Various Action Routines
 - Reset Alarms, Reset Totalizers, Print Transaction, Reset Error History, Start, Stop, Clear

10.2 General

The optional RS-485 card utilizes Modbus RTU protocol to access a variety of process parameters and totalizers. In addition, action routines can be executed. For further information, contact factory and request RS-485 Protocol manual for Batcher.

10.3 Operation of Serial Communication Port with PC

The STX-ST1's RS-485 channel supports a number of Modbus RTU commands. Refer to port pinout (below) for wiring details. Modbus RTU drivers are available from third party sources for a variety of Man Machine Interface software for IBM compatible PC's.

The user reads and writes information from/to the RS-485 using the Modbus RTU commands. The STX-ST1 then responds to these information and command requests.

Process variables and totalizers are read in register pairs in floating point format. Time and date are read as a series of integer register values. Alarms are individually read as coils. Action routines are initiated by writing to coils.

10.4 RS-485 Terminal Block Pinout

TB-2

COMMUNICATION					
RS-232			RS-485		
TX	RX	COM	TX/RC +	TX/RC -	GND 180REF
1	2	3	4	5	6

11. Batcher Setup Software

The STX-ST1 setup program provides for configuring, monitoring and controlling a Batch unit.

Sample applications are stored in disk files. The setup program calls these *Templates*. You can store the setup from the program's memory to either the STX-ST1 (*Downloading* the file) or to a disk file (*Saving* the file) for later usage. Similarly you can load the setup in program memory from either a disk file (*Opening* a file) or from the STX-ST1 unit (*Uploading* a file).

The program can monitor outputs from the unit while it is running.

The program can reset alarms and totalizers.

For assistance there are mini-helps at the bottom of each screen in the program. There is also context sensitive help available for each screen accessible by pressing the F1 key.

11.1 System Requirements:

Windows® XP/Vista/7/8/10

4 MB RAM

3 MB free disk space

Communication Port - RS-232 (A USB to RS232 converter is required for PCs without RS-232 port)

RS-232 Cable as needed

11.2 Cable and Wiring Requirements:

The serial communication port on your PC is either a 25 pin or 9 pin connector. No cabling is supplied with the setup software. A cable must be purchased separately or made by the user. It is recommended to purchase a modem cable which matches the available communication port on your PC and 3 wire lead connection for the STX-ST1 serial port.

11.3 Installation

CD Installation

The Setup Software Disk includes an installation program which copies the software to your hard drive.

Insert Setup Disk; if install doesn't automatically begin then browse the disk and double-click the file named Setup_STX-ST1

Follow the instructions on your screen. If you're prompted for an administrator password or confirmation, type the password or provide confirmation.

Download and Installation

The Setup Software can also be downloaded from the KEP website (www.kep.com).

Download the file from www.kep.com (downloads section) and note the location where the file is being saved.

When download is complete. Browse to the downloaded file location and double-click on the file named Setup_STX-ST1.

Follow the instructions on your screen. If you're prompted for an administrator password or confirmation, type the password or provide confirmation.

11.4 Using the STX-ST1 Setup Software

The setup software window consists of several menu “Tabs”. Each tab is organized into groups containing various configuration and/or monitoring functions. To view the tab windows, simply click on the tab. The previous tab window will be hidden as the new tab window is brought to the foreground.

11.5 File Tab

The File Tab has three sections. Any of the options on this tab can also be accessed from the File submenu.

The **Template Section** provides for opening and saving templates. The *Save* and *Save As* buttons provide the standard Windows functionality for dealing with files. The *Load* button is used to open existing templates.

There are two additional menu items available *only* from the File menu: Create new file and Templates.

The *Create new file*, option allows for creating custom templates using the existing template in memory as the starting point. Assign a new name for this template. The template will be saved under this new name.

The *Template* option will bring up a list of predefined templates that can be loaded into the program. These predefined templates are useful as a starting point when defining custom templates.

A typical scenario using the setup program would be the following:

- Open up a predefined template from the supplied list
- Choose ‘Save As’ to save this to a new file name
- Proceed to customize the template by making any changes that are needed
- Save the template to disk (if you want to reuse this template)
- Download the template to an attached unit.

The **Communications with Batcher Section** allows the user to upload a template file from the unit, download the program’s current template to the unit.

The **Print (report) Section** allows the user to:

1. Configure the current Windows printer through the Select Printer option.
2. Print a Maintenance Report through the PC's printer using the Print Maintenance option.
3. Print the current template through the PC's printer using Print Setup option.

11.6 Setup Tab

The Setup tab is where majority of the STX-ST1 instrument setup modifications are done. The Setup tab is divided into five sections.

- System Section:** Parameters, Display, Indicators
- Input Section:** Flow, Fluid, Compensations, Control Inputs
- Output Section:** Pulse, Currents
- Relay Section:** Relays
- Other Settings Section:** Administration, Communication, Printing

NOTE: Many setup items are enabled or disabled depending on previous setup selections, It is important to work your way through the above list in the order shown. Be sure to verify your selections when you are through programming to insure that no settings were changed automatically.

11.7 View Tab

The View Tab screen allows for viewing selected group items on the PC in a similar format as shown on the unit display. Data from the following groups can be viewed in the List of Values section:

Process Parameters (i.e. rate, temperature)

Totalizers (i.e. total, grand total)

The setup software assumes the current setup has been uploaded from the STX-ST1 into the PC. It is important that the setup program and the STX-ST1 unit are using the same setup information at all times or the data will be inconsistent. It is best to upload or download the setup before using this feature.

To start the viewer, first check the boxes of items to view and then click the start button. The data will appear in the appropriate sections and will be continuously updated. The refresh rate is dependent on the number of items that are being viewed and the baud rate of the connection. Data in the List of Values section can be collapsed by clicking on the 'minus' sign in front of the group title. The data can be expanded by clicking on the 'plus' sign in front of the group title. If a group is collapsed and data in the group changes on refresh, the group will automatically expand. Changing the view items requires stopping the current viewing, checking the new selections and then restarting the viewer.

If communication errors occur while reading data from the STX-ST1 device, the word 'Error' will appear in place of the actual value. If the connection to the STX-ST1 is lost, the viewer will time out with a message saying the device is not responding.

The viewer will attempt to communicate with the STX-ST1 device matching the device ID set in the communications screen. If you are having trouble establishing communication, compare settings for the PC and the STX-ST1. Also verify the connections between the PC and STX-ST1.

11.8 Misc. Tab

This tab has three sections: Tools, Actions and Options.

The tools section contains various system administration activities such as creating/modifying the initial sign-on screen or calibration, service test etc.

Create Sign-on, Create Print Header

The Actions section is used to send commands to the unit.

Reset Totalizers, Reset Alarms

The Options section has the following selections:

Additional capabilities may be provided in the future.

NOTE: Future options appear as disabled buttons on the screen.

12. Glossary Of Terms

Acknowledge & Clear Alarms

Acknowledge is used to clear alarm relays and remove any visual alarm messages from the display. In the run mode, press the ENTER key or activate CONTROL INPUT 3 (if set for *ACK*) to momentarily clear alarms and alarm messages. Alarms will reassert themselves if alarm conditions are still present.

Analog Output

The analog signal (4-20mA) that is generated by the STX-ST1. It can correspond to the Rate, Total, Temperature or Density. This output is used primarily for transmission of process information to remote systems.

Audit Trail

The audit trail is used to track the number of changes made to the units setup program.

Batch Count Mode

Batch Count Mode specifies the user preference for count direction. The "*Up*" selection begins with a value of "0" and counts up until the batch size is reached. The "*Down*" selection begins with a value equal to the desired batch size and counts down to "0".

Batch Overrun

The STX-ST1 offers a batch overrun compensation routine. If batch overrun occurs due to slow valve response time, the unit will compensate for the overrun amount on the next batch. This feature can be disabled if desired.

Batcher

An instrument which controls the dispensing of desired batch amounts. Liquid batching systems are usually comprised of a batch controller (STX-ST1), flowmeter and control valve. The STX-ST1 opens and closes the valve through the use of relays and measures the amounts of liquid being dispensed via the flowmeter.

Baud Rate

The speed of serial communication transmissions, expressed in bits per second.

C-Factor (Fluid Expansion Factor)

A parameter in a flow equation which is used to describe the relationship between density or volume and temperature changes.

Corrected Volume Flow

The equivalently volume at a reference temperature condition which involves the measurement of liquid volume flow using a flow sensor and temperature sensor to compensate for thermal expansion.

Custody Transfer

Weights and Measure metering codes often specify several requirements for instruments and mechanisms to prevent and track changes in the setup of an instrument which may be used in the commercial sale of goods. The STX-ST1 tracks changes via the Audit Trail.

Data Logger

The capturing of information for later use and the mechanism for specifying the conditions where a capture should be made.

DC Output / Excitation Voltage

An on-board DC power supply used to power peripheral sensors. The STX-ST1 offers excitation voltages of 5VDC, 12VDC or 24VDC when powered by AC voltage.

Default Value

The value to be used by the instrument if a sensor failure or out of range signal is detected.

Expansion Factor

See C-Factor

EZ Preset

The EZ Preset mode was designed for users who frequently change the batch amount.

Fast Fill Rate

The user specified flow rate for the fast fill portion of a batch cycle when used in batching application with a digital control valve.

Flow Alarm

A visual indication that the volumetric flowrate is above or below the flow alarm setpoint specified by the user.

Flow Signal Timeout

The Flow Signal Timeout allows the user to enter a timeout of 0 to 99 seconds. If a batch is "Filling" and zero flow persists for more than the user entered time then the batch will be aborted. This prevents over flows due to faulty flow sensors and/or wiring.

12. Glossary Of Terms (Continued)

Flow Equation

A flow control expression or algorithm describing a mathematical equation to be solved by the STX-ST1 in the desired application.

Follow, Alarm

Alarm relays which are non latching and whose output state is based solely on the comparison of the current process value and the alarm setpoint (trip point).

Function Key

A key on a push-button panel or keyboard (whose function is described by the key label) used to perform an instrument function or special routine.

Handshake

A means of controlling the information flow between two pieces of equipment to prevent the sending device from transmitting information at a rate faster than what can be accepted by the receiver.

Hysteresis

The relay hysteresis is a "dead band" setting which allows the relay to remain energized for a given amount below the setpoint. This is used to prevent relay chatter when the process value is near the setpoint value.

Example: If the Preset is set at 100, and the hysteresis is set at 10, the relay will energize when the rate, temp or dens. reaches 100, the relay will remain energized until the reading falls below 90.

Input Termination

Input signal lines on digital inputs often require pullup or pulldown resistor configurations to operate properly with different sensor configurations. The STX-ST1 contains such resistors and may be enabled via the setup menu.

Inhibit Totalizer

"*Inhibit Total*" is a Control Input 1 setting that is used to stop the totalization. If enabled, a voltage level on control input 1 will inhibit the total as long as the voltage is present. This feature is useful during meter proving and in applications that provide a sensor to signal the STX-ST1 when fluid is present.

K-Factor

A scaling factor derived from the pulses produced by a flowmeter output, expressed in pulses per unit (i.e. pulses/gallon)

LCD

Abbreviation for: Liquid Crystal Display

Limit Setpoint

An alarm trip point setting which specifies the value or magnitude of a process parameter necessary to activate an alarm indicator or control relay.

Linear Flowmeter

A flow measurement device whose output is proportional to flow.

Linearization

The mathematical correction of a nonlinear device. The STX-ST1 uses a linearization Table which is made up of input/output values and makes interpolations of the table to arrive at a "linearized" measurement.

LinTbl

Abbreviation for Linearization Table.

Low Flow Cutoff

A value set at which any flow measurements read below this value will be ignored.

Low Pass Filter

A low pass filter passes low input frequencies while blocking high frequencies. In the STX-ST1, this is the maximum input count speed to be encountered in an application. It is expressed in counts per second (Hz).

Mass Flow

Mass Flow is inferred by the volumetric flow and density (or implied density) of a fluid.

Maximum Batch Preset

The Maximum Batch Preset allows the user to program the Maximum Batch value allowed to be entered by the operator. If an operator should try to program a batch higher than this value, the unit will not allow the value to be entered and will prompt the user with an error message saying that the Maximum Batch Preset has been exceeded.

12. Glossary Of Terms (Continued)

Maximum Drain Time

The unit declares that a batch is “done” when the flow rate equals “0”. A flow rate may be present long after the Preset Relay de-energizes due to slow reacting valves or leaky valves. The Maximum Drain Time allows the user to enter an amount of time (0 to 99 seconds) to wait before declaring “Batch Done”. After the Preset Batch quantity is reached, the unit will declare “Batch Done” when the flow rate is “0” or the Maximum Drain Time has expired. The batch data will then be available for printing and datalogging.

NOTE: When using automatic over-shoot compensation the value (in seconds) entered into maximum drain time must be greater than the time required for the valve to close.

Max Window

The max. window time sets the maximum sample time (1 to 99 sec) for the ratemeter.

Modem Init Master

The "Modem Init Master" menu allows the user to select whether the unit will engage in a configuration conversation with the modem on power up or impart no setup information to the modem and use it "as is". For most users it is recommended to choose "yes" for "Modem Init Master".

Orifice Plate Flowmeter

A class of flow measurement devices where the measured signal (differential pressure) has a square law relationship to flow.

Parity

A method for detecting errors in transmissions of serial communications data.

Preset

A set point used to trigger the relay outputs of the STX-ST1.

Print Interval

The print interval allows the STX-ST1 to transmit information to the serial port at selectable time intervals.

Private Code

An operator password code which authorizes changes to the setup of the instrument but blocks access to the Service/Calibration/Test mode. The private code also blocks the clearing of the Grand Total.

Process Parameters

Any sensor information which has been scaled to engineering units including Flow, Temperature and Density.

Pulldown (Input Termination)

The termination of an input at which the input is pulled down to ground through a resistor. Inputs that are terminated by this method need to be driven high with a positive voltage pulse.

Pullup (Input Termination)

The termination of an input at which the input is pulled up to a positive voltage through a resistor. Inputs that are terminated by this method need to be pulled low with a sinking current or contact to ground .

Pulse Output

The pulse output of the STX-ST1 is available for remote accumulation of the total or sent to peripheral devices, such as a PLC. The output can be scaled using the Pulse Output Scaling Constant.

Quad

Abbreviation for Quadrature. Quadrature signals are used for direction control. Two flowmeter signals are output with a 90° phase shift. The counter counts UP when channel A precedes channel B, and counts DOWN when Channel A lags Channel B.

Quick Setup

A utility that provides for rapid configuration of an instrument. The STX-ST1 quick setup provides the following:

- 1) Prompts the user for only critical information.
- 2) Automatically sets specifications to common uses.

After following the Quick Setup procedure, the unit will be operational to perform the basic measurement. The setup can be further customized using the setup menus.

Quick Update %

This feature is used to disable the rate averaging filter when a significant change in the flow rate occurs. The user can enter the percent of change needed to be detected to disable the averaging feature. This is especially useful during start-up and shutdown of flow.

Rate Averaging Filter

The rate averaging filter is used to stabilize fluctuating rate displays. Higher settings provide more averaging for a more stable display. Derived from the equation:

$$\frac{(\text{OLD DATA} \times \text{"Avg. Filter"} + \text{NEW DATA})}{(\text{"Avg. Filter"} + 1)}$$

12. Glossary Of Terms (Continued)

Ratemeter

Any device used to display the speed of a process. The ratemeter in the STX-ST1 displays flow rate.

Ref. Dens.

Abbreviation for Reference Density. This is the fluid density at reference temperature.

Ref. Temp.

Abbreviation for Reference Temperature. This represents the base or reference condition to which corrected flow will be computed.

Reset/Start Control Input

In a batching system, a single operator activation of the START key or Control Input 1 will reset the total then start the batch process.

Single_Pulse

The Single_Pulse setting is used for flowmeters with single pulse outputs.

Slow Fill Rate

The user specified flow rate for the slow start of fill and slow end of fill portion of the batching cycle in a batching application with a digital control valve.

Slow Start Quantity

The Slow Start Quantity is a function that allows an amount to be entered for a Slow Start up. This function requires two stage valve control. RLY 1 (slow flow) will energize for Slow Start and RLY 2 (fast flow) will energize after the Slow Start Quantity has been delivered. This helps reduce turbulence when filling an empty container.

Sqrt

Abbreviation for Square Root Extraction. Used for flow elements using differential pressure measurements.

Standard Preset

The Standard Preset mode should be used in applications where the batch amount does not change often.

Stop/Reset Control Input

In a batching system, a single operator activation of the STOP key or Control Input 2 will stop the batch process then reset the total.

Time Constant

A damping factor for an averaging filter for the analog output. (see also Rate Averaging Filter)

Totalizer

Any device which accumulates and displays a total count.

UVC

Abbreviation for Universal Viscosity Curve. A presentation of the combined flowrate/viscosity calibration for a turbine flowmeter.

VFD

Abbreviation for Vacuum Fluorescent Display

Visc Coef

Abbreviation for Viscosity Coefficient. One or more coefficients in an equation used to describe the viscosity as a function of temperature for a fluid.

Volume Flow

The measurement of volumetric flow.

13. Diagnosis and Troubleshooting

13.1 Response of SYX-ST1 on Error or Alarm:

Error and warning indications which occur during operation are indicated in the RUN mode alternately with the measured values. The STX-ST1 has three types of error:

TYPE OF ERROR	DESCRIPTION
Sensor/Process Alarms	Errors detected due to sensor failure or process alarm conditions
Self Test Errors	Errors detected during self test.
System Alarms	Errors detected due to system failure

Some alarms are self clearing. Other alarms require the user to acknowledge and clear the alarm. Press the ENTER button to acknowledged and clear alarms. Alarms may reassert themselves if the alarm condition is still present.

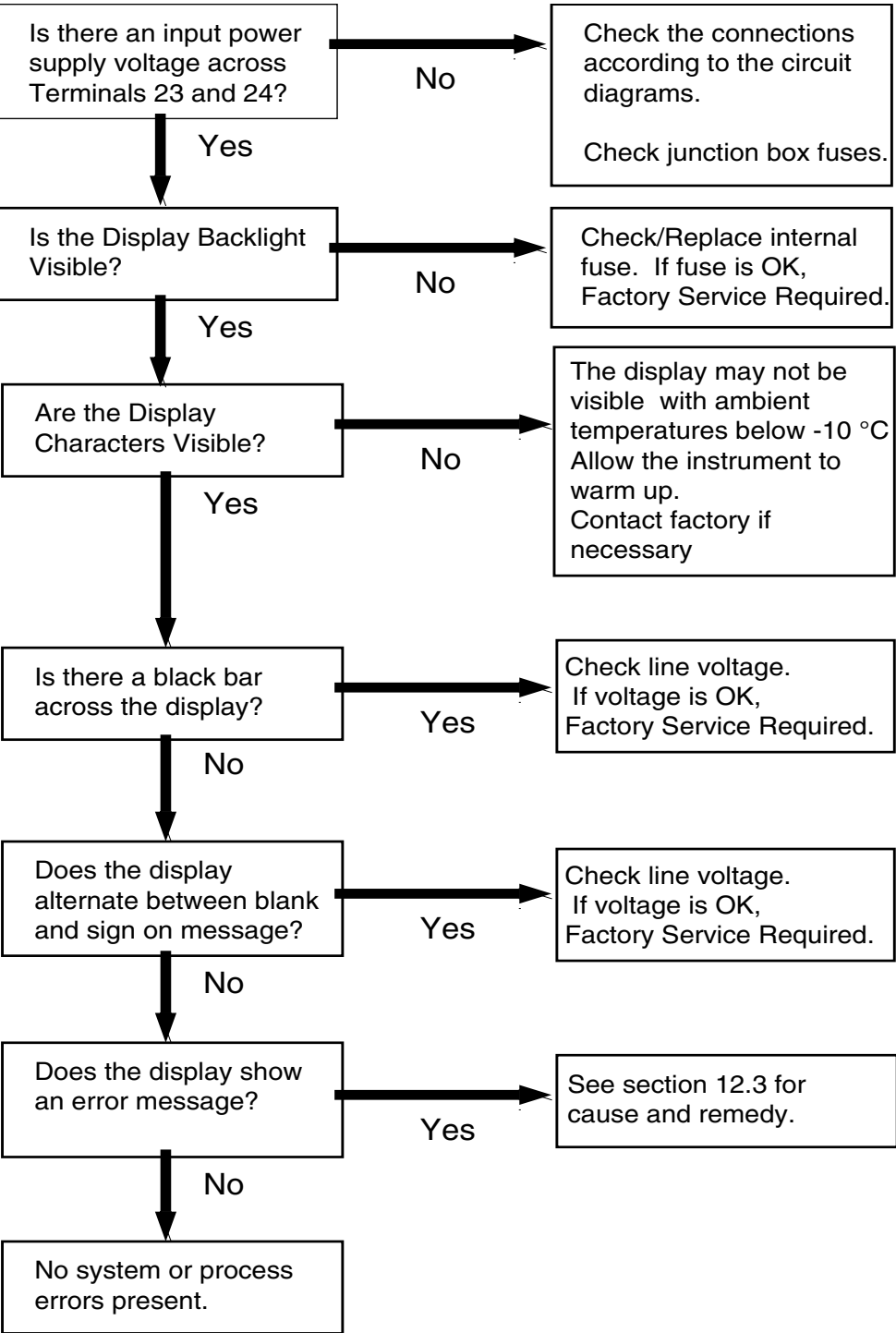
NOTE: A historical error alarm log is available in the "Test Mode".

The following descriptions suggest possible causes and corrective actions for each alarm message.

13.2 Diagnosis Flow Chart and Troubleshooting

All instruments undergo various stages of quality control during production. The last of these stages is a complete calibration carried out on state-of-the-art calibration rigs.

A summary of possible causes is given below to help you identify faults.



13.3 Error & Warning Messages:

13.3.1 Sensor/Process Alarms

Error/Warning Message	Cause	Remedy
TOTALIZER ROLLOVER	Displayed when totalizer rolls over beyond the maximum limit	Acknowledge Rollover, Remedy not required
AUX INPUT TOO LOW	4-20 mA Input current at aux input smaller than 3.5 mA: - Faulty Wiring - Transmitter not set to "4-20 mA" - Transmitter defective	- Check wiring - Check function of sensor
RTD OUT OF RANGE	Input current at RTD input too low: - Faulty wiring - RTD defective	- Check wiring - Check function of RTD sensor
RATE OVERFLOW ERROR	Pulse counter overflowed. The remote totalizer may have lost counts.	- Report error to factory - Check application conditions - Check wiring
PULSE OUT OVERFLOW	Calculated pulse frequency too large: - Pulse width setting too long - Larger pulse scaler needed	- Adjust pulse value - Adjust pulse width - Check process conditions
FLOW RATE ALARM LOW FLOW RATE ALARM HIGH TEMP ALARM LOW TEMP ALARM HIGH DENSITY ALARM LOW DENSITY ALARM HIGH	Limit value exceeded.	- Check application if necessary - Check limit value - Adjust the limit value if required
BATCH OVERRUN ALARM	Batch size exceeded by more than set limit.	- Check valves in system for proper operation and/or leaks - Check limit value - Adjust the limit value if required
MODEM NOT PRESENT	The setup expects modem usage and a modem is not responding.	- Check setup for proper baud rate, parity, etc. - Check modem connection and cycle power to Batcher - Replace modem
SOFTWARE ERROR RESET	Watchdog Error. Transient likely	Cycle power to Batcher
EXTENDED PFI LOCKUP	Unit was operated with an input power level lower than safe operating range for an extended period of time.	- Check data in unit. Totalizer may have inaccuracies - Investigate brownout cause.

13.3 Error & Warning Messages: (Continued)

13.3.2 Self Test Alarms

Error/Warning Message	Cause	Remedy
FLOW INPUT TOO HIGH	Analog input signal of the flow input exceeded by more than 3%: • Sensor overranged • Incorrect full scale setting of flowmeter • Function error in transmitter or faulty wiring	• Check analog signal range • Check the application conditions • Check wiring
AUX INPUT TOO HIGH	Analog input signal of the auxiliary input exceeded by more than 3%: • Sensor overranged • Incorrect full scale setting of transmitter • Function error in transmitter or faulty wiring	• Check analog signal range • Check the application conditions • Check wiring
FLOW INPUT TOO LOW	Analog input signal of the flow input fell below the low scale range by more than 3% of full scale value: • Flowmeter not set to 4-20 mA • Function error in transmitter or faulty wiring	• Check wiring • Check calibration of flowmeter • Check function of flowmeter
BATTERY LOW WARNING	Battery voltage too low	• Replace Battery • Consult Factory for service information
A to D NOT CONVERTING	Fault in analog/digital converter	• Unit may self correct, Press ENTER to acknowledge & clear alarm • If error reasserts, factory service is required
TIME CLOCK ERROR	The correct time/date is no longer shown	• Re-enter time and date. • If error occurs again contact factory
CAL CHECKSUM ERROR	Calibration constants have been corrupted	• Report error to factory
SETUP CHECKSUM ERROR	The units setup has been corrupted	• Report error to factory

APPENDIX A - Setup Menus

SETUP MENUS

START HERE

SELECT EZ SETUP

INSTRUMENT
TYPE

SELECT FLOW EQUATION

SETUP INDICATORS

SETUP FLOW INPUT

SETUP AUX INPUT

SET FLUID PROPERTIES

**SETUP PULSE
OUTPUT**

SETUP ANALOG OUTPUT

SETUP RELAYS

SETUP CONTROL INPUTS

SETUP REAL TIME CLOCK

SERIAL USAGE

**SETUP
DATA LOG/PRINT**

ADMINISTRATIVE SETUP

SETUP NETWORK CARD

INSTRUMENT TYPE	SELECT PRESET TYPE	SELECT VALVE TYPE	SLOW FILL RATE	FAST FILL RATE	BATCH COUNT MODE	BATCH OVERRUN COMP.	AVERAGE OVERRUN VALUE	FLOW SIGNAL TIMEOUT	MAX DRAIN TIME	SLOW START QUANTITY
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SELECT FLOW EQUATION

SETUP INDICATORS	TOTAL DESCRIPTOR	VOLUME UNITS	TOTAL DECIMAL PLACES	DENSITY DESCRIPTOR	MASS UNITS	DENSITY DECIMAL PLACES	RATE TIME BASE	RATE DESCRIPTOR	RATE DECIMAL PLACES	RATE AVERAGE FILTER	QUICK UPDATE %	TEMP DESCRIPTOR	TEMPERATURE SCALE	TEMPERATURE DECIMAL PLACES
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EXCITATION VOLTAGE	FLOW INPUT TYPE	PULSE INPUT TYPE	PULSE TRIGGER TYPE	LOW PASS FILTER	INPUT TERMINATION	MAX WINDOW	K-FACTOR TYPE	AVERAGE K-A-FACTOR	AVERAGE KB-FACTOR	CHANGE TABLE A	CHANGE TABLE B	LOW FLOW RATE ALARM	HIGH FLOW RATE ALARM
		ANALOG INPUT TYPE	VOLTAGE/CURRENT RANGE	LINEARIZATION TYPE	FLOW/LOW SCALE	FLOW/HIGH SCALE	CHANGE TABLE A	LOW FLOW CUTOFF	LOW FLOW RATE ALARM	HIGH FLOW RATE ALARM			

AUX INPUT TYPE	AUX SIGNAL TYPE	VOLTAGE/CURRENT RANGE	AUX LOW SCALE	AUX FULL SCALE	AUX. DEFAULT	AUX LOW ALARM	AUX HIGH ALARM	DENS. EXTRACT METHOD
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REF. DENSITY	REF. TEMPERATURE	EXPANSION FACTOR	CALIBRATION DENSITY	VISCOSITY COEF. A	VISCOSITY COEF. B	H2O DENSITY AT 4DEGC
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PULSE OUTPUT USAGE	PULSE WIDTH	PULSE VALUE
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ANALOG OUTPUT USAGE	ANALOG OUTPUT FLOW TYPE	ANALOG OUTPUT RANGE	ANALOG OUTPUT LOW SCALE	ANALOG OUTPUT FULL SCALE	ANALOG OUTPUT DAMPING
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SETUP RELAYS 1, 2, 3, 4	RELAY USAGE	RELAY DELAY	RELAY DURATION	RELAY MODE	RELAY SETPOINT	RELAY HYSTERESIS
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SETUP CONTROL INPUTS 1, 2, 3	CONTROL INPUT 1 USAGE	CONTROL INPUT 2 USAGE	CONTROL INPUT 3 USAGE
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SETUP REAL TIME CLOCK	CLOCK TYPE	SELECT CLOCK AM/PM	TIME OF DAY	ENTER DATE
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SERIAL HARDWARE	DEVICE ID	BAUD RATE	PARITY	HANDSHAKE	DEVICE LINE FEED	MODEM CONTROL	MODEM AUTO ANSWER	CALL OUT DAY OF WEEK	CALL OUT TIME	CALL ON ERROR ALARM	CALL OUT PHONE NUMBER	NUMBER OF REDIALS	HANGUP PHONE IF INACTIVE
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SETUP DATALOG/PRINT	OUTPUT FORMAT	PAGE LENGTH	TOP MARGIN	DATALOG ONLY	PRINT TIME	PRINT INTERVAL	ENABLE PRINT KEY	PRINT END OF BATCH	CLEAR TOTAL IF PRINT	PRINT LIST ITEMS
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OPERATOR PASSWORD	TAG NUMBER	SUPERVISOR PASSWORD	SOFTWARE VERSION	PRODUCT ORDER CODE	UNIT SERIAL NUMBER	SENSOR SERIAL NUMBER
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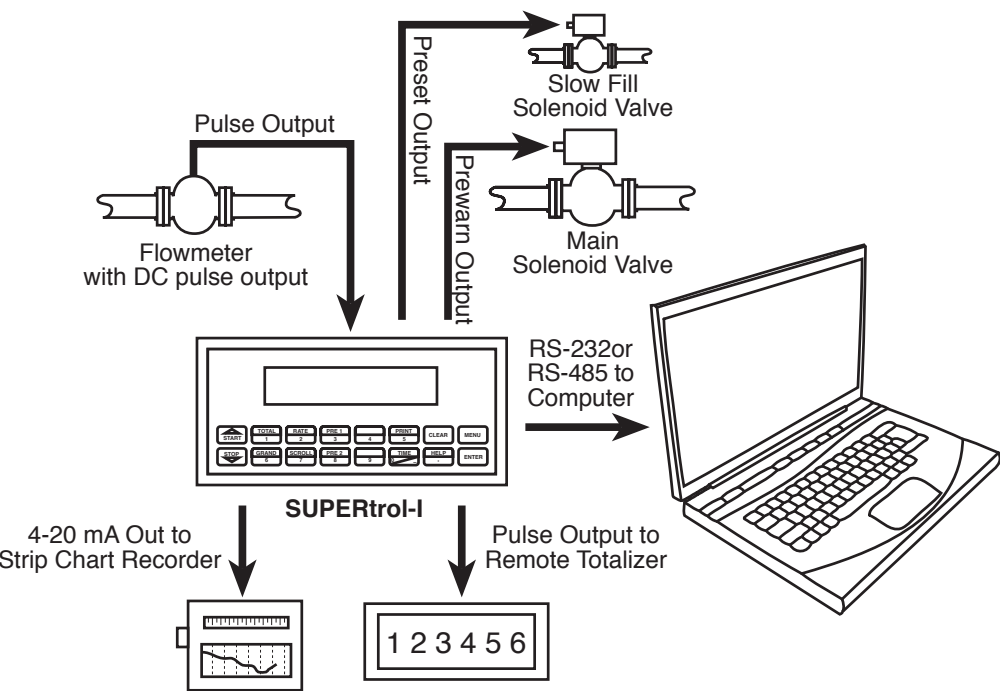
SELECT NETWORK PROTOCOL	NETWORK DEVICE ID	BAUD RATE	PARITY
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These functions will only appear with appropriate settings in other functions.

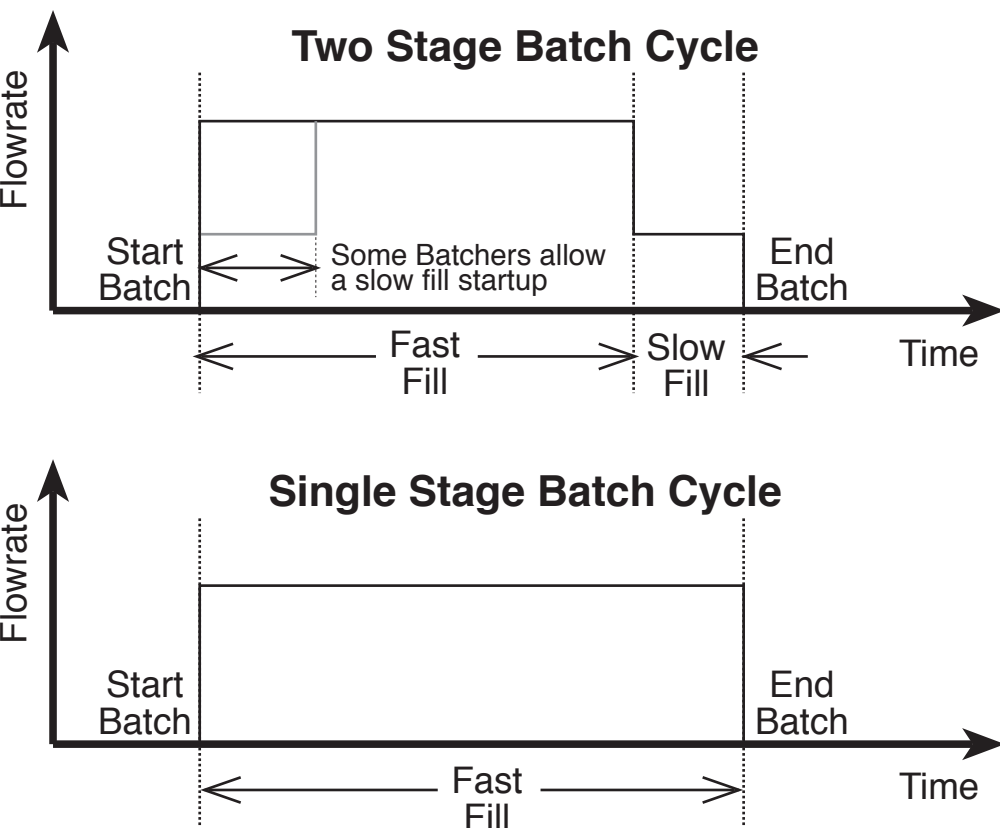
These functions will only appear with appropriate settings in other functions.

APPENDIX B - Batching Diagrams

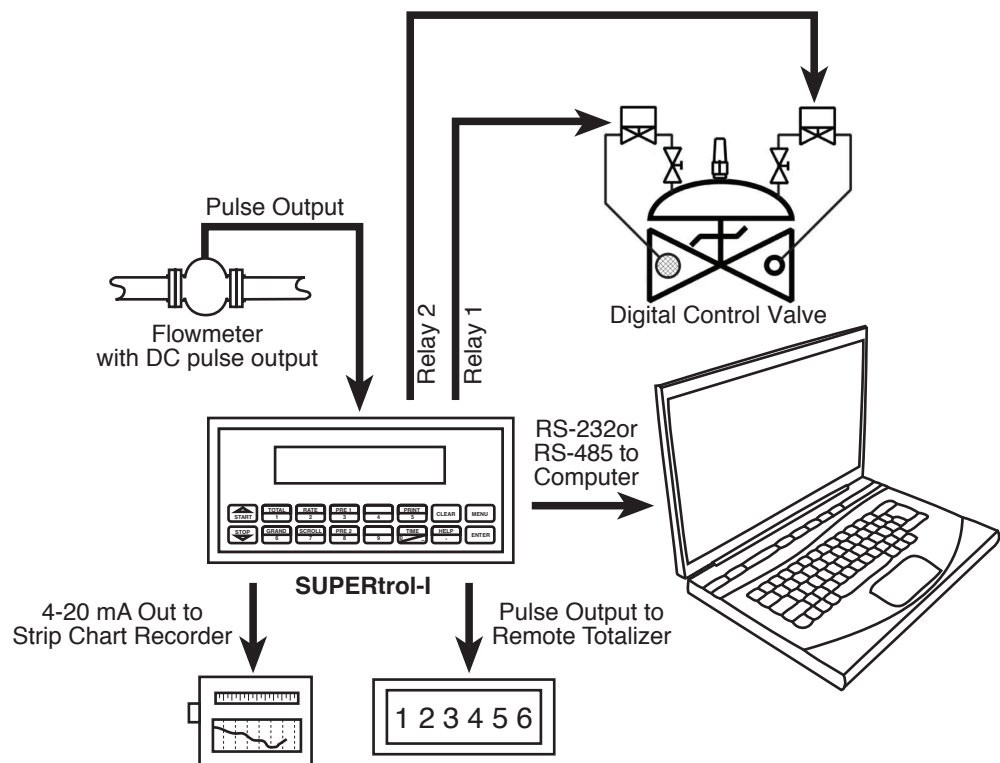
Typical Batcher Application with STANDARD Valve(s)



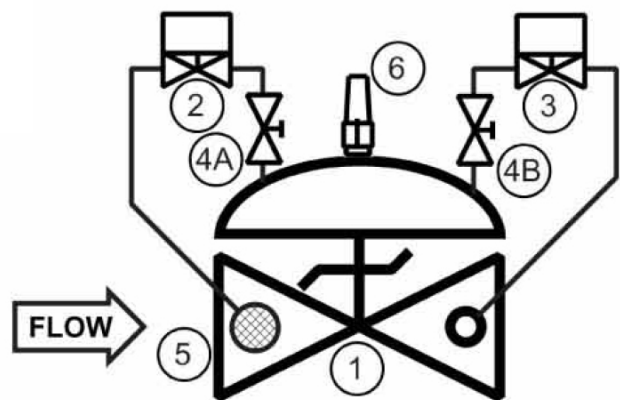
Two Stage vs. Single Stage Batching Illustration with STANDARD Valve(s)



Typical Batcher Application with DIGITAL CONTROL VALVE



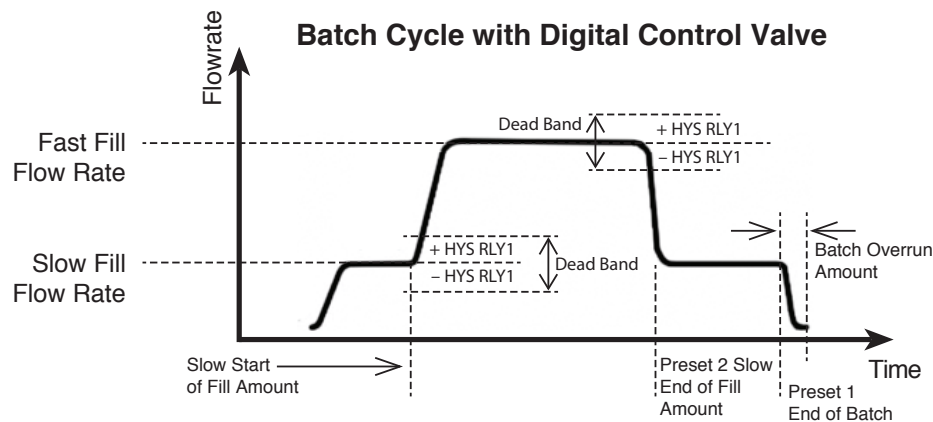
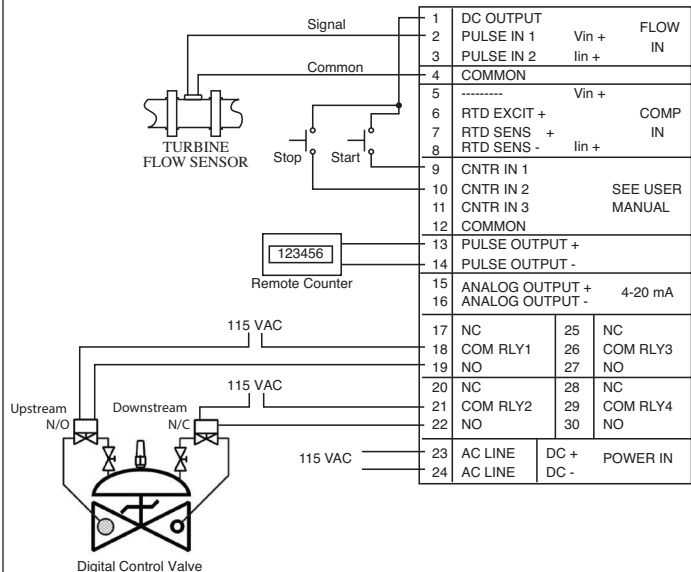
DIGITAL CONTROL VALVE Diagram



- 1. Basic Control Valve (Fail Closed)
- 2. Two-Way Solenoid Pilot (upstream N/O)
- 3. Two-Way Solenoid Pilot (downstream N/C)
- 4. Needle Valve
- 5. Inline Strainer
- 6. Visual Indicator

STX Relay 1	STX Relay 2	Function
ON	ON	Opening Valve (increase flow rate)
ON	OFF	Hold Position (maintain flow rate)
OFF	OFF	Closing Valve (reduce flow rate)

DIGITAL CONTROL VALVE Wiring



This product is warranted against defects in materials and workmanship for a period of two (2) years from the date of shipment to Buyer.

The Warranty is limited to repair or replacement of the defective unit at the option of the manufacturer. This warranty is void if the product has been altered, misused, dismantled, or otherwise abused.

ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, ARE EXCLUDED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Ordering Example

Series: _____

STX-ST1= Supertrol-1 Explosion Proof		
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Display Type:

O= OLED (STD)					
LED					

L= LCD					
V= VED					

V= VFD				
Input Type:				

Input type: _____ 1= 110 VAC				
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1= 110 VAC				
3= 330 VAC				

2= 220 VAC				
3= 12 VDC (10 to 14 VDC)				

3= 12 VDC (10 to 14 VDC)			
4= 24 VDC (14 to 28 VDC)			

Relays: _____

Relays:

A= 2 SPDT Relays

A = 2 or 3 Relays		
B = 4 Relays (consult factory)		

Network Card: _____

0= None (STD)	
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2= RS485/Modbus (optional 2nd COM port)

Mounting: _____

X= Explosion Proof

A. Expression 1: 100.

Options: _____

ET= Extended Temperature LCD Display

ET- Extended Temperature LCD Display
-4°F to 131°F (-20°C to 55°C)

IM = Internal Modem

M = Modem Power Option

Accessories:

OPC/DDE Server for RS232 Port

OPC/DDE Server for Modbus Suite

Modem Available, see MPP-2400N (requires M option)

Serial printer available, see P1000, P295

Ethernet Port Server available, see IEPS for RS232 port
Ethernet Port Server Modbus TCP available, see ADAM1532

Ethernet Port Server Modbus TCP available, see ADAM4572
RS-422/485 to RS-232 Communication Adaptor available, see

Remote metering and data collection software available, see T

Quencharc 32145 - Relay Contact Protection

02/18/14 - Original Release

03/11/14 - PMP (Pump) selection added to Relay 3 on page 37

06/25/14 - Updated Cover Photo, updated dimension drawing on page 6, updated ordering code page 79

07/30/14 - Updated Keypad Labels throughout the manual to reflect new product labeling

04/13/15 - Updated Keypad Labels throughout the manual to reflect new button assignment on keypad labeling

05/26/16 - Optimized graphic files to reduce PDF file size

10/04/16 - Added conduit entry specifications to dimension drawing on page 6

10/04/16 - Updated Setup Software Installation on page 65

04/23/25 - Updated contact information for Industrial Flow System.