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CHAPTER 1 INTRODUCTION

The Neptune SmartTrol™ is a versatile microprocessor-based controller for use with TRICON/E® electronic registers. The main function of the unit is to display rate and totalization values and control relays for batching or alarming. The SmartTrol allows two meter flows to be measured, separately scaled for both rate and total, then combined into one overall rate and one total. This dual input capability permits the SmartTrol to be used with TRU/FLO® and PROTECTUS® meters having two separate measuring elements to monitor flow.
In the illustration below, the SmartTrol is used to power a single TRICON/E transmitter which, in turn, provides digital pulses to the SmartTrol. The SmartTrol scales the pulse input to determine rate of flow and total quantity through the meter. The SmartTrol then uses the rate of flow or total values to operate two relays which may be used for single or two-stage batching, or under/over alarming. The SmartTrol may be ordered with optional RS-232C serial communications, or 4-20 mA analog output, or both.
CHAPTER 3 OPERATING THE SMARTTROL

When power is initially applied, the SmartTrol is in the normal operating mode in which Total, Grand Total, and Rate are available for view.

To view Total, Grand Total, or Rate, apply power.

<table>
<thead>
<tr>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>VER # . #</td>
<td>(Displayed 1 second)</td>
</tr>
<tr>
<td>########</td>
<td>(Current value of Total)</td>
</tr>
</tbody>
</table>

When power is applied to the SmartTrol, the current value of Total is displayed as indicated. Total remains on the display until another variable is selected. Total represents the volume of liquid through the meter since Total was last reset. The value of Total is preserved when power is removed from the SmartTrol and is restored when power is reapplied. Total is updated only while power is applied.

To display Grand Total,

<table>
<thead>
<tr>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENT</td>
<td>GR TOTAL</td>
</tr>
<tr>
<td>########</td>
<td>(Current value of Grand Total blinks)</td>
</tr>
</tbody>
</table>

Grand Total also represents the volume of liquid through the meter since Grand Total was last reset. Like the value of Total, Grand Total is preserved when power is removed from the SmartTrol, and is restored when power is reapplied. Grand Total is updated only while power is applied.

To return the display to Total,

<table>
<thead>
<tr>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENT</td>
<td>########</td>
</tr>
</tbody>
</table>

To display Rate,

<table>
<thead>
<tr>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>C (Rate Total)</td>
<td>R ########</td>
</tr>
</tbody>
</table>

Notice when Rate is displayed, the first character position on the display is “R”. Rate represents the volume of liquid passing through the meter in some unit of time such as gallons per minute.

To return the display to Total,

<table>
<thead>
<tr>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>C (Rate/Total)</td>
<td>########</td>
</tr>
</tbody>
</table>

Before using the SmartTrol you must program several setup values from the Setup Menu. Fill out the Worksheet (Page 18) using the instructions beginning on Page 19. Instructions for setting up the SmartTrol begin on Page 25. To enter the Menu from the normal operating mode, press the “D” (MENU) key.
4.1 DISPLAY

The SmartTrol shows one of three different variables on its 8-digit, alphanumeric displays: Total, Grand Total, or Rate. Total is typically the volume through the meter in units such as gallons, cubic feet, or cubic meters. Grand Total is similar to Total but continues to count when Total is reset (very useful for many batching operations). Rate is the volume flowing through the meter per unit of time. Since Rate and Total values are scaled independently, different units may be used for each, e.g., Rate displayed in gallons/minute and Total in cubic feet.

4.2 RESETS

Resets return the value of Total or Grand Total to a predetermined point to begin counting up to or counting down from. Resets may be manually entered through the keypad by pressing the “CLR” key, remotely entered by applying 3 to 30 VDC pulse for a minimum of 5 seconds to Pin 5, or by a host computer via RS-232C communications. The SmartTrol may also be programmed to reset automatically when the endpoint is reached.

4.3 PRESETS

Presets are the values of Total or Grand Total the totalizer must reach, or the Rate of flow the ratemeter must register, to trigger relay operation. Total may be configured to count up from zero after a reset, or to count down from the preset value to zero after reset. Grand Total will only count up from zero to the preset value after a reset.

4.4 RELAYS

The SmartTrol may be used for monitoring or for control purposes, such as batching. There are two control relays in the SmartTrol whose operations are based on preset values of Rate, Total, or Grand Total. Each relay may be programmed to its own preset value. The presets can be programmed to allow two-stage stepping of a process providing precise control of a dispensing or blending application. For batching applications, an Auto Reset mode can be selected for continuous blending processes. When Total or Grand Total values are used, relay duration may be set from 1 to 99 seconds or minutes. NOTE: RELAY OPERATION IS DISABLED WHEN THE MENU FUNCTION IS ENTERED.

4.5 K FACTOR

The K Factor is divided into the input pulse to convert them into convenient units of measurement. Separate K Factors are entered into the rate and counter sections of the SmartTrol for each input, and K Factors may be mixed. Thus, you may batch (totalize) in gallons and display Rate in cubic feet per hour.
4.6 RATEMETER

The ratemeter selection of the SmartTrol calculates Rate based on time between pulses from a maximum of two inputs. The resulting value of input pulses per second is then divided by the K Factor to display the Rate in units of volume per time.

4.7 COUNTER

The counter section of the SmartTrol divides pulses from a maximum of two inputs by the Count K Factors to determine Total and Grand Total volumes through the meter in convenient units of volume.

4.8 LOCKOUT

Once the SmartTrol is configured and operating, unauthorized changes can be prevented by use of a lock-out code that must be entered to allow modification of the configuration. The code may be modified periodically to maintain secure operations.

4.9 RS-232C COMMUNICATIONS

The SmartTrol may be ordered with RS-232C computer communications. This option allows the SmartTrol to communicate with virtually any computer that has an RS-232C serial communications port. The data in the SmartTrol may be read or modified by computer to allow customization of the process. In addition, up to 15 SmartTrols may be tied to the same RS-232C port providing a path for future expansion.

4.10 4-20 mA OUTPUT

The 4-20 mA option produces an analog output that is scaled based on Rate as calculated by the SmartTrol. You may select the upper and lower limits of Rate corresponding to the 4-20 mA range appropriate for the application.

4.11 ENTERING DECIMAL POINTS

To include a decimal point as part of the number entered through the keypad, press the “D” button after the digit that you would like to place the decimal point. The decimal point will appear to the right of that digit.
CHAPTER 5 SPECIFICATIONS

- **HOUSING:** High-impact plastic case with NEMA 4X front panel.
- **DIMENSIONS:** Reference 6.2, Page 12.
- **DISPLAY:** 8-character, 0.55” high, 15 segment, red-orange LED.
- **INPUT POWER:** 110 VAC +/- 15% or 12 to 27 VDC.
- **CURRENT:** 5.3 VA at rated AC voltage or maximum 280 mA DC.
- **OUTPUT POWER:** (On AC power units only) +12 VDC at 100 mA
  Separate isolated 12 VDC at 100 mA to allow +/- 12 VDC or +24 VDC, regulated +/- 5% worst case.
- **TEMPERATURE:** Operating: +32° F (0° C) to +130° F (+54° C).
  Storage: -40° F (-40° C) to +200° F (+93° C).
- **MEMORY:** EEPROM stores all programming, display mode, and count data for a minimum of 10 years if power is lost.
- **RESET:** Front panel push button – “CLR” resets displayed number and control output.
  Remote input (Terminal 5) – Open or 0 to 1 VDC (low), 3 to 30 VDC (high), 10K ohm input impedance to ground. Minimum pulse on/off time 5 msec.
- **PULSE INPUT:** High impedance pulse input. Open or 0 to 1 VDC (low), 3 to 30 VDC (high), 10K ohm input impedance.
  1KHz maximum speed (minimum on/off 25 usec).
- **ANALOG OUTPUT:** 4-20 mA sinking output, 3-24 VDC +/- 100 uA worst case.
- **RELAY CONTACTS:** 10 amp, 120/240 VAC or 28 VDC.
CHAPTER 6 MOUNTING AND INSTALLATION

6.1 PANEL MOUNTING

The SmartTrol can be mounted in any panel with a thickness between .047” (1.2 mm) and .187” (4.7mm). It is shipped with two side mounting brackets and screws as well as a panel gasket. The gasket fits between the SmartTrol bezel and the front panel to form a NEMA 4 splash-proof assembly when properly panel-mounted.

To install the SmartTrol into a panel, slip the gasket over the case of the SmartTrol and set the gasket against the SmartTrol bezel. Insert the unit through the front of the panel until it engages the panel. Install the self-tapping screws provided in the mounting brackets and insert the brackets into the side slots of the unit. Tighten the screws firmly to attach the SmartTrol bezel to the panel.

6.2 DIMENSIONS
CHAPTER 7 CONNECTIONS TO THE SMARTTROL

7.1 POWER CONNECTION FOR ALTERNATING CURRENT (AC)

(Refer to 7.5.1, Page 12)

Be certain all power is removed from the wire before connecting the power wiring to the SmartTrol. Also be sure that the power is 120 VAC to prevent damage due to application of incorrect voltage. Connect the AC power across terminals 17 and 18 on the large terminal block. Double-check all wiring before applying power to the SmartTrol.

7.2 POWER CONNECTION FOR DIRECT CURRENT (DC)

(Refer to 7.5.5, Page 15)

You may choose to power the SmartTrol with DC. Be certain that all power is removed from the wire before connecting the power wiring to the SmartTrol. Also be sure that the power is 12 to 27 VDC at .5 amp. Connect +DC to terminal 14 and ground to terminal 12 on the large terminal block. Double-check all wiring before applying power to the SmartTrol. If the SmartTrol is powered by DC, it cannot be used to provide DC power for TRICON/E operation. Use the same DC source to power both the SmartTrol and associated TRICON/E transmitters.

7.3 RELAY OUTPUT CONNECTION

(Refer to 7.5.1, Page 12 and 7.5.5, Page 15)

Be certain that all power wiring is de-energized before connecting relay outputs to controlled devices. The relay contacts are located on the six-pin terminal block. The relay associated with Preset A uses terminals 1 (normally open contact), 2 (normally closed contact), and 3 (common contact). The relay associated with Preset B uses terminals 4 (normally open contact), 5 (normally closed contact), and 6 (common contact).

7.4 4-20 mA OPTION

(Refer to 7.5.4, Page 14)

The 4-20 mA output option is connected to terminal 10 of the large terminal block. The output sinks current from a voltage source. The receiving instrument (Ammeter) must NOT be ground-referenced in order to be compatible with this output.

7.5 SCHEMATICS

The following pages illustrate the SmartTrol in various configurations and wiring for each. Your specific application may not be represented, but it may be a composite of several of the illustrations provided.
7.5.1 SmartTrol and Single TRICON/E Transmitter with Pulse Output and Remote Reset

7.5.2 SmartTrol and Two TRICON/E Transmitters with Pulse Output and Remote Reset
7.5.3 SmartTrol and 4-20 mA TRICON/E and SmartChart

4-20 mA TRICON/E must be powered by 24 VDC. The SmartTrol is able to produce 24 VDC by “stacking” two independent 12 VDC power supplies. Configure the SmartTrol to provide +24 VDC by tying the +12 VDC (PIN 15). This jumper causes +24 VDC to appear across PIN 16 referenced to ground (PIN 12).
7.5.4 SmartTrol with 4-20 mA Output Option and SmartChart and Single TRICON/E Transmitter with Pulse Output

![Diagram of SmartTrol connections]

- **Smart Chart 4-20mA**
  - Source +
  - Return -
  - +24 VDC
  - Pulse Output
  - TRICON/E +24V GND
  - AC-1 Neutral Line
  - Fuse
  - AC-2 Neutral Line
  - Fuse
  - AC-3 Neutral Line
  - Fuse
  - User Load
  - Fuse
  - Relay A
  - Relay B

- **SmartTrol**
  - 1. Not Used
  - 2. Scaled Output
  - 3. Input B
  - 4. Input A
  - 5. Reset Input
  - 6. Not Used
  - 7. Not Used
  - 8. Not Used
  - 9. Not Used
  - 10. No Connection (4-20 mA Output)
  - 11. No Connection
  - 12. Ground
  - 13. +12 VDC Out
  - 14. DC Power In
  - 15. Isolated -12 VDC
  - 16. Isolated +12 VDC
  - 17. AC In
  - 18. AC In
  - 19. Preset B Transistor
  - 20. Preset A Transistor

**Connections to the SmartTrol**
7.5.5 SmartTrol Powered by +24 VDC, Relays Controlling +24 VDC, and Single TRICON/E Transmitter with Pulse Output

The SmartTrol may be powered by an external DC power supply. The supply must provide 12-27 VDC and at least 250 mA of current. The positive side (+DC) of the supply should be connected to terminal 14 and the negative (or ground) side to terminal 12. Units Powered by DC voltage do not have an isolated voltage on terminals 15 and 16.
7.5.6 SmartTrol and Single TRICON/S Transmitter with Pulse Output and Remote Reset

NOTE: The SmartTrol must be ordered from the factory configured for use with the TRICON/S.
7.5.7 SmartTrol with 4-20 mA Output Option and Remote Device and Battery-Powered TRU/MAG™

![Diagram of SmartTrol connections]

---

7.5.8 SmartTrol with 4-20 mA Output Option and Remote Device and DC-Powered TRU/MAG

![Diagram of SmartTrol connections]
CHAPTER 8 PROGRAMMING WORKSHEET

CONFIGURED BY: ___________________ DATE: _____/ _____/ ______
MODEL NUMBER:__________________ APPLICATION: __________
CALCULATION AREA________________

COUNTER
K FACTOR A _______________________
K FACTOR B _______________________
RESET TO 0 _____________RESET TO PRESET_______
AUTOMATIC RESET_______MANUAL RESET_______
DECIMAL LOCATION ___# ___# ___# ___# ___# ___# ___# ___#
8 7 6 5 4 3 2 1

RATEMETER
K FACTOR A _______________________
K FACTOR B _______________________
WEIGHT _______________________
WINDOW _______________________
SIG. FIG. _______________________
LOCK OUT CODE ___________________
RS-232C COMMUNICATIONS (SKIP IF UNIT DOES NOT HAVE OPTION)
UNIT NUMBER ______________________

BAUDRATE
300 ____ 600 ____ 1200 ____ 2400 ____ 4800 ____ 9600 ____
PARITY BIT
EVEN ___ ODD ____ SPACE ___ MARK____
4-20 mA OUTPUT (SKIP IF UNIT DOES NOT HAVE OPTION)
LOW LIMIT RATE VALUE _______________________
HIGH LIMIT RATE VALUE _______________
RELAY OPERATION
DURATION IN SEC. _______________ MIN. _______________
RELAY A COMPARISON TO:
RATE _______________ TOTAL _______________ GRAND TOTAL _______________
OUTPUT DURATION _______________
RELAY B COMPARISON TO:
RATE _______________ TOTAL _______________ GRAND TOTAL _______________
OUTPUT DURATION _______________
PRESET A _______________________
PRESET B _______________________

TRICON® SMARTTROL® INSTALLATION AND MAINTENANCE GUIDE
CHAPTER 9 USING THE WORKSHEET

The worksheet is an aid to help in setting the operating configuration of the SmartTrol. By filling out the worksheet first, all the data needed to program the unit is in front of you during programming. This makes programming the unit as simple as selecting items from a menu. The following function definitions will aid in the proper selection of setup values for the application. Refer to the TRICON/E specification sheet (Page 33) as necessary for pulse output constants.

9.1 COUNTER

The counter takes up to two pulse inputs, A and B, scales each using separate K Factors, and sums the resulting scaled counts into a single Total. (If only one input is active, then only the counts from that input are used.) The scaled counts are then used to update the Total and Grand Total values in the SmartTrol. The counter is set up by entering selections for five parameters.

9.1.1 K Factor A and K Factor B (Counter)

These factors are divided into the associated incoming pulses to develop the overall Total in the desired units of volume. The K Factor is the number of TRICON/E output pulses per unit of volume. The SmartTrol uses the K Factor for the following calculation:

\[
\frac{\text{Input pulses}}{\text{K Factor}} = \frac{\text{Input pulses}}{\text{Pulses per unit of volume}} = \text{Total and Grand Total displayed in units of volume}
\]

Using the 4” Trident Turbine as an example, the TRICON/E produces a pulse output for each 1.6 gallons through the meter (reference the TRICON/E specification sheet). Using 1.6 as the K Factor, Total, and Grand Total values would then be displayed as gallons.

\[
\frac{\text{Input pulses}}{1.6 \text{ pulses/gallons}} = \text{Total and Grand Total displayed in gallons}
\]

9.1.1.1 Fractional Units of Volume

You may want to display Total and Grand Total in fractional quantities such as tenths or hundredths of gallons. To change the display, divide the K Factor by 10 or 100 respectively and enter the new value (including the new decimal point). (The physical location of the display decimal point is set in a later step, 9.1.4, Page 21.) In the previous example, suppose you wanted Total Grand Total to be displayed in tenths of gallons.

\[
\frac{\text{K Factor}}{10} = \frac{1.6}{10} = 0.16
\]

Notice the decimal point to the left. Total and Grand Total will be displayed in tenths of gallons.
9.1.1.2 Changing Units of Volume

The K Factor also may be modified so that the displayed values of Total or Grand Total are in units of measurement instead of gallons. To change the display from gallons to cubic feet, multiply the K Factor by 7.4805, which is the number of gallons per cubic foot. To change the display from gallons to cubic meters, multiply the K Factor by 264.172, the number of gallons per cubic meter.

In the previous example of the 4” Trident Turbine, to display Total or Grand Total in cubic feet, the K Factor of 1.6 pulses per gallon is multiplied by 7.4805. So:

1.6 pulses/gallon × 7.4805 gallons/cubic foot = 11.9688 pulses/cubic foot

Setting the K Factor to 11.9688 would then display Total and Grand Total in cubic feet for the 4” Trident Turbine.

9.1.1.3 “Datalost”

If the value of the K Factor is less than .0001, or the factored counts exceed 30,000 per second, the counter will be unable to keep up with the counts and “DATALOST” will appear on the display during operation of the SmartTrol. If this message appears, the appropriate K Factor must be increased in value.

9.1.2 Reset to Zero or Set to Preset

The selection of the counter operation depends on the application. For simple monitoring of volume through the meter, the selection would be “Reset to Zero”. This mode is normal for volume measurement where the Total would be reset to zero, then increase, as water passes through the meter.

For some batching applications, it is preferable to inject a fixed amount of water into some process. It may be easier to track the process if, upon reset, the Total is set to the batch volume and decremented as the water is injected. The end point of the batch, zero, would be the same no matter the injected volume. This mode is chosen by selecting “Set to Preset” for the counter operation.

9.1.3 Automatic or Manual Reset

This function determines what happens to the Total upon reaching the end point (preset value for counting up, zero for counting down). If “Manual” mode is selected, the Total will continue to be updated after reaching the end point. The reset, either from panel or external input, would have to be active to reset the counter. In the Automatic mode, the counter is automatically reset upon reaching the endpoint (reset to zero if counting up, reset to the preset value if counting down).
9.1.4 Decimal Location
In a previous example (9.1.1), the K Factor was divided by ten to display Total and Grand Total in tenths of gallons. The decimal point for the display must be set so that the value displayed using the decimal point will be the total in gallons, and the value displayed not using the decimal point will be the total in tenths of gallons. To make this adjustment, the decimal location must be moved between the lowest and second lowest digits of the display. Selecting a decimal location of “2” will properly set the decimal point so that Total and Grand Total in gallons will be the “########.” value and tenths of gallons will be the “#######.” value.

9.2 RATEMETER
The Ratemeter calculates the rate of flow through the meter. It converts the output pulse from up to two TRICON/E registers into convenient units of measurement by using two separate scaling factors. The two input rates are scaled and combined into one rate that is the Total Rate from both inputs. To program the Ratemeter portion of the SmartTrol, there are five parameters that must be entered.

9.2.1 K Factor A and K Factor B (Rate)
These scaling factors are used to convert the input pulses into units of volume per unit of time, such as Gallons per Minute. K Factor A is the scaling factor associated with input A while K Factor B is associated with Input B. The SmartTrol first converts input pulses into pulses per second and then divides the input pulses per second by the K Factor, producing Rate which is displayed. The K Factor for Rate to be displayed in units per minute may be determined by the following formula:

\[
\text{Pulse per unit of volume (seconds/minute)} = \frac{\text{Pulse per unit of volume (per minute)}}{\text{Rate K Factor}}
\]

For example, a TRICON/E for a 4" Trident Turbine outputs 1.6 pulses per gallon (reference the TRICON/E specification sheet).

Thus:

\[
\frac{1.6 \text{ pulses per gallon}}{60 \text{ seconds per minute}} = 0.02667 = \text{K Factor}
\]

Entering a K Factor of 0.02667 will display the Rate in gallons per minute.

9.2.1.1 Changing Units of Time
You may choose to display the Rate of flow in another quantity of time such as hours. To determine the proper K Factor, divide pulses per gallon by the flow rate in gallons per hour, the calculation would be:

\[
\frac{1.6 \text{ pulses per gallon}}{3600 \text{ seconds/hour}} = 0.0004444 = \text{K Factor}
\]

Entering a K Factor of 0.0004444 will display the Rate in gallons per hour.
9.2.1.2 Changing Units of Volume

You may choose to display the Rate of flow in other units of volume such as cubic feet. Just multiply the gallons K Factor by the appropriate value. In the example determining the K Factor for the 4” Trident Turbine Rate in gallons per minute, the K Factor was 0.02667. To display Rate in cubic feet per minute, multiply by 7.4805, the number of gallons per cubic foot. The calculation would be:

\[
\text{Gallons/minute K Factor} \times 7.4805 = 0.02667 \times 7.4805 = 0.1995
\]

With the K Factor set to .1995, Rate will be displayed in cubic feet per minute for the 4” Trident Turbine.

9.2.2 Weight

This value represents how much the value of Rate will change as the SmartTrol re-samples the input pulses to upgrade the Rate being displayed. The value can range from 0.0 to 9.9 as the weighting factor is increased. It is best to adjust this value to suit the application. Initially, set this value to 0.0. If the display rate changes too often (jitters), then the value of Weight can be increased in .1 increments.

9.2.3 Window

This quantity is the number of seconds the ratemeter will sample input pulses before making an update to the value of Rate being displayed. The 2- to 24-second “WINDOW” selected at setup is the maximum time the SmartTrol will wait for sufficient pulses to make an accurate calculation before it displays a Rate of “0”. This function is used in some applications with low flow rates to prevent zero flow from being displayed instead of the low value of the actual flow. For most applications, the Window value should be set to 5.0.

9.2.4 Significant Figures

This function selects the number of significant figures (digits) displayed for the Rate value. This number may be set from one to six. For example, if the number of significant figures is set at three, a rate of 24737.89 will be displayed as 24700, and a rate of 0.739216 will be displayed as 0.739. Note that trailing zeros will be inserted only if necessary. Digits beyond the significant figure value are truncated and zeros are inserted as needed. No rounding is done. Use this function to select the number of digits needed for the application. Usually only four digits are needed to display the Rate properly.
9.3 LOCK OUT
This feature prevents unauthorized access of the SmartTrol. The 4-digit numeric code entered is used to lock out access to the Menu during operation. When the lock out feature is active, no values can be cleared or changed by keyboard entry. Simply entering the code while Total, Grand Total, or Rate is displayed will change the lock condition. Care must be taken in documenting the code to prevent being those authorized from being “locked out”.

The lock-out code is used during normal operating of the SmartTrol. Upon entering the lock-out code, the display should flash “LOCK ON” for one second. To disable the lock-out condition, enter the code one more time. The display will flash “LOCK OFF” for one second, and open access is established.

The SmartTrol is shipped with lock-out disabled and default code of “1000”.

9.4 OUTPUT CARD
For SmartTrols with the RS-232C option, the serial port configuration must be set to allow the SmartTrol to talk the same “language” as the host computer. The SmartTrol uses 7-bit ASCII code with start, stop, and parity bits included. In addition, the following parameters must be set.

9.4.1 Unit Number
The unit number is used to identify which SmartTrol receives the communication. The unit number must be 1 to 15. Up to 15 SmartTrols may be connected to one RS-232C and communicate with the host computer.

9.4.2 Serial or Parallel
This selection is always serial for the RS-232C option.

9.4.3 Baud Rate
The Baud Rate is the communication rate in bits/second. It must be selected to match the host computer Baud Rate. The rate can be set to any of the following values: 300, 600, 1200, 2400, 4800, or 9600 baud.

9.4.4 Parity
Parity is a form of error checking in the data transmission. The parity (even, odd, mark, space) should match the host computer.

9.5 ANALOG OUTPUT
For SmartTrols with the analog output option, this function allows setting of the output scale. The SmartTrol produces the 4-20 mA output based upon the display Rate and uses low and high limits to set the range of the output. For a Trident Turbine, the low limit could be “0” (corresponding to the zero flow) and the high limit could be set to “1000” (corresponding to 1000 GPM flow rate at maximum continuous flow). These values would set the output to 4 mA when zero flow occurred and 20 mA when the flow rate went to 1000 GPM.
The low and high limits may be customized to the application to provide higher resolution of the flow rate if the full range of flow rates is not used. If the flow rate was never less than 20 GPM and never more than 600 GPM, these values could be set to correspond to the 4 and 20 mA output levels respectively. For flow values in between the low and high setpoints, the output current is offset and proportionately scaled.

9.6 RELAY OPERATION
This function sets all parameters associated with relay operations with the exception of the actual preset values which will trigger the relays. Relay durations may be set in seconds or minutes. Relay A may be set to use the displayed value of Rate, Total, or Grand Total in comparison to the Preset A value. Relay B is independently set to use the display value of Rate, Total, or Grand Total in comparison to the Preset B value.

For each relay, if the comparison is selected as Total or Grand Total, then a duration value must be set ranging from 0 to 99. If 0 is selected as the duration value, then the relay will be latched on upon reaching the endpoint. For each relay, if the comparison is selected as Rate, then the relay will close whenever the Rate exceeds the preset value and open when the Rate falls below the preset value. Since the normally closed as well as the normally open contacts of the relay are available, this feature can be used for both over and under Rate alarming.

9.7 PRESETS
The value entered for Preset A and Preset B are the values used for comparison with Rate, Total, or Grand Total to actuate the respective relay. (Note: The same decimal location selected in the counter setup is also displayed in Preset A or B if the comparison is made with either Total or Grand Total values.)
CHAPTER 10  SETTING UP THE SMARTTROL

The SmartTrol is configured by using the keyboard on the front panel of the unit. The Set Up Mode is entered by depressing the “D” key. In all cases, when “v” appears in the last position of the display, additional choices can be found by depressing the “D” key. Depressing the “ENT” key will select the choice being displayed. (Refer to the Worksheet.)

10.1 SETTING UP THE COUNTER

<table>
<thead>
<tr>
<th>PRESS</th>
<th>DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>MENU (Displays 1 second)</td>
</tr>
<tr>
<td></td>
<td>DEV TYPv</td>
</tr>
<tr>
<td>ENT</td>
<td>RTv CNTv</td>
</tr>
<tr>
<td>D</td>
<td>K FACT A (Displays 1 second)</td>
</tr>
<tr>
<td></td>
<td>############ (Current value blinks)</td>
</tr>
<tr>
<td>CLR</td>
<td>0 (Blinks)</td>
</tr>
<tr>
<td></td>
<td>Key in new Counter K Factor A from worksheet</td>
</tr>
<tr>
<td>ENT</td>
<td>K FACT B (Displays 1 second)</td>
</tr>
<tr>
<td></td>
<td>############ (Current value blinks)</td>
</tr>
<tr>
<td>CLR</td>
<td>0 (Blinks)</td>
</tr>
<tr>
<td></td>
<td>Key in new Counter K Factor B from worksheet</td>
</tr>
<tr>
<td>ENT</td>
<td>ROv SPv</td>
</tr>
<tr>
<td></td>
<td>Press B for Reset to 0, press D for SET to Preset</td>
</tr>
<tr>
<td>ENT</td>
<td>ATv MANv</td>
</tr>
<tr>
<td></td>
<td>Press B for Automatic Reset, press D for Manual Reset</td>
</tr>
<tr>
<td>ENT</td>
<td>DEC LOC</td>
</tr>
<tr>
<td></td>
<td>Key in number for the appropriate decimal point location; Decimal point will appear at the designated spot on the display</td>
</tr>
<tr>
<td>ENT</td>
<td>SmartTrol returns to normal operating mode</td>
</tr>
</tbody>
</table>
### 10.2 SETTING UP THE RATEMETER

<table>
<thead>
<tr>
<th>PRESS</th>
<th>DISPLAY</th>
</tr>
</thead>
</table>
| D     | MENU (Displays 1 second)  
|       | DEV TYPv |
| ENT   | RTv CNTv |
| B     | K Fact A (Display 1 second)  
|       | ####### (Current value blinks) |
| CLR   | 0 (Blinks)  
|       | Key in new Rate K Factor A from worksheet |
| ENT   | K Fact B (Displays 1 second)  
|       | ####### (Current value blinks) |
| CLR   | 0 (Blinks)  
|       | Key in new Rate K Factor B from worksheet |
| ENT   | WEIGHT#.# (Current value) |
| CLR   | Key in new Weight value from worksheet |
| ENT   | WINDOW## (Current value) |
| CLR   | Key in new Window value from worksheet |
| ENT   | SIGFIG## (Current value) |
| CLR   | Key in new significant value from worksheet |
| ENT   | SmartTrol returns to normal operating mode |

### 10.3 SETTING UP THE LOCK OUT CODE

<table>
<thead>
<tr>
<th>PRESS</th>
<th>DISPLAY</th>
</tr>
</thead>
</table>
| D     | MENU (Displays 1 second)  
|       | DEV TYPv |
| D     | LOCKOUTv |
| ENT   | CODE (Displays 1 second)  
|       | #### (Current value blinks) |
| CLR   | 0 (Blinks)  
|       | Key in new Code value from worksheet |
| ENT   | SmartTrol returns to normal operating mode |
### 10.4 Setting Up the OutCard for RS-232 Communications

<table>
<thead>
<tr>
<th>PRESS</th>
<th>DISPLAY</th>
</tr>
</thead>
</table>
| D     | MENU (Displays 1 second)  
DEV TYPv |
| D     | LOCKOUTv |
| D     | OUTCARDv |
| ENT   | UNIT ## (Current Unit #) |
| CLR   | UNIT 00  
Key in new Unit Number from worksheet |
| ENT   | PLv SERv  
Press D for Serial communications |
| ENT   | BAUDRATE (Displays 1 second)  
####v (Current Baud Rate)  
Press D until Baud Rate value from worksheet is displayed |
| ENT   | PARITY (Displays 1 second)  
#####v (Current Parity)  
Press D until Parity Bit from worksheet is displayed |
| ENT   | SmartTrol returns to normal operating mode |

### 10.5 Setting Up the 4-20 mA Output

<table>
<thead>
<tr>
<th>PRESS</th>
<th>DISPLAY</th>
</tr>
</thead>
</table>
| D     | MENU (Displays 1 second)  
DEV TYPv |
| D     | LOCKOUTv |
| D     | OUTCARDv |
| D     | ALG OUTv |
| ENT   | SET LOW (Displays 1 second)  
######## (Current value blinks) |
| CLR   | Key in new Rate Low Limit from worksheet  
for 4 mA output |
| ENT   | SET HIGH (Displays 1 second)  
######## (Current value blinks) |
| CLR   | Key in new Rate High Limit from worksheet  
for 20 mA output |
| ENT   | SmartTrol returns to normal operating mode |
### 10.6 Setting Up the Relay Operation

<table>
<thead>
<tr>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
</table>
| D     | MENU (Displays 1 second)  
       | DEV TYP v |
| D     | LOCKOUTv |
| D     | OUTCARDv |
| D     | ALG OUTv |
| D     | RELAY v  |
| ENT   | SCV MINV  
       | Press B for Seconds, press D for Minutes |
| ENT   | A ####v (Current Relay A comparison mode)  
       | Press D until Comparison mode from worksheet is displayed |
| ENT   | DUR A ## (Duration of Relay A if Comparison mode is Total or Grand Total) |
| CLR   | Key in new Output Duration from worksheet for Relay A, or if Comparison mode for Relay A is Rate |
| ENT   | B ####v (Current Relay B comparison mode)  
       | Press D until Comparison mode from worksheet is displayed |
| ENT   | DUR B ## (Duration of Relay B if Comparison mode is Total or Grand Total) |
| CLR   | Key in new Output Duration from worksheet for Relay B, or if Comparison mode for Relay B is Rate |
| ENT   | SmartTrol returns to normal operating mode |

### 10.7 Setting Up Preset A

<table>
<thead>
<tr>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
</table>
| A     | PRESET A (Displays 1 second)  
       | ####### (Current value blinks) |
| CLR   | Key in new Preset A value from worksheet |
| ENT   | SmartTrol returns to normal operating mode |

### 10.8 Setting Up Preset B

<table>
<thead>
<tr>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
</table>
| B     | PRESET B (Displays 1 second)  
       | ####### (Current value blinks) |
| CLR   | Key in new Preset B value from worksheet |
| ENT   | SmartTrol returns to normal operating mode |
CHAPTER 11 RS-232C SERIAL COMMUNICATION OPERATIONS

The RS-232C communications port provides the capability of obtaining information from the SmartTrol by a host computer. RS-232 is an EIA (ELECTRICAL INDUSTRY ASSOCIATION) specification for the electrical characteristics and signal assignments for a serial communication format. The SmartTrol expects the connection to the host computer to comply with the electrical characteristics for RS-232C. The SmartTrol is operated as Data Communications Equipment (DCE) and has connection pin assignments as follows:

PIN ASSIGNMENTS

<table>
<thead>
<tr>
<th>CONNECTOR PIN #</th>
<th>SIGNAL NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>RD</td>
<td>RECEIVED DATA (FROM HOST)</td>
</tr>
<tr>
<td>3</td>
<td>TD</td>
<td>TRANSMITTED DATA (TO HOST)</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
<td>REQUEST TO SEND (FROM HOST)</td>
</tr>
<tr>
<td>5</td>
<td>CTS</td>
<td>CLEAR TO SEND (FROM SmartTrol)</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>DATA SET READY (FROM SmartTrol)</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>SIGNAL GROUND</td>
</tr>
<tr>
<td>8</td>
<td>RSLD</td>
<td>RECEIVED SIGNAL DETECT</td>
</tr>
<tr>
<td>20</td>
<td>DTR</td>
<td>DATA TERMINAL READY (FROM HOST)</td>
</tr>
</tbody>
</table>

The SmartTrol only requires the TD, RD, and GND pins for normal operation. No control signals are controlled by the normal operation. No control signals are controlled by the SmartTrol for access control (handshaking). To enable most host devices to operate with the SmartTrol, the RTS and CTS lines are tied together in the SmartTrol. Also, DSR is internally connected to DTR and RSLD to give proper signal levels to the host computer.

Communication between the SmartTrol and the host computer has to be seven-bit ASCII code. The code is embedded in a serial word that has a parity bit, start bit, and stop bit. (Having eight data bits with no parity bit would be the same as seven data bits with parity selected to be a space). The total number of bits then is 10 bits per character.

The SmartTrol only communicates in response to commands from the host. To allow more than one SmartTrol to be connected onto the RS-232C port, each SmartTrol must have a unique number. This number is used to select the SmartTrol to which the command will be issued. To address a SmartTrol unit, the host must transmit a “D” (device) followed by the unit number (1 to 15) and a “Space”. Once the SmartTrol receives the “Space”, the SmartTrol selected becomes active and responds, “DEVICE#: n” (n is the unit number).
Once active, the SmartTrol operates in the full duplex mode and echoes the commands from the host back to the host as they are received by the unit. Up to 80 command characters, including spaces, may be sent to the SmartTrol from the host in one transmission. The commands must be separated by spaces and the last character must be a “Carriage Return”. The carriage return character causes the received command string to be processed. Once the command is received, the data is processed and the response is sent on a low priority basis. If the keyboard is used during the processing of the data, then the communication cycle is halted. If the SmartTrol is not busy, it should take no more than five mSec before the command is processed. The communications response time depends on this delay, the amount of data requested, and the operating baud rate. In practice, if transmission has not started within two seconds after data is requested, it can be assumed that there is a problem. The SmartTrol response contains a “Carriage Return” and “Line Feed” before each data value requested. The data will be returned in the order the command string was received from the host. After the unit has responded to the host command, it becomes inactive and must be activated again before the command can be processed ("D# “Space”).

**Command Code Definitions**

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>COMMAND TO TRANSMIT COUNT (TOTAL)</td>
</tr>
<tr>
<td>DR</td>
<td>COMMAND TO TRANSMIT RATE</td>
</tr>
<tr>
<td>DT</td>
<td>COMMAND TO TRANSMIT GRAND TOTAL</td>
</tr>
<tr>
<td>KA</td>
<td>COMMAND TO TRANSMIT COUNTER K Factor A</td>
</tr>
<tr>
<td>KA (S) XXX</td>
<td>COMMAND TO LOAD COUNTER K Factor A WITH XXX</td>
</tr>
<tr>
<td>KB</td>
<td>COMMAND TO TRANSMIT COUNTER K Factor B</td>
</tr>
<tr>
<td>KB (S) XXX</td>
<td>COMMAND TO LOAD COUNTER K Factor B WITH XXX</td>
</tr>
<tr>
<td>KC</td>
<td>COMMAND TO TRANSMIT RATE K Factor A</td>
</tr>
<tr>
<td>KC (S) XXX</td>
<td>COMMAND TO LOAD RATE K Factor A WITH XXX</td>
</tr>
<tr>
<td>KD</td>
<td>COMMAND TO TRANSMIT RATE K Factor B</td>
</tr>
<tr>
<td>KD (S)</td>
<td>COMMAND TO LOAD RATE K Factor B WITH XXX</td>
</tr>
<tr>
<td>PA</td>
<td>COMMAND TO TRANSMIT PRESET A</td>
</tr>
<tr>
<td>PA (S) XXX</td>
<td>COMMAND TO LOAD PRESET A WITH XXX</td>
</tr>
<tr>
<td>PB</td>
<td>COMMAND TO TRANSMIT PRESET B</td>
</tr>
<tr>
<td>PB (S) XXX</td>
<td>COMMAND TO LOAD PRESET B WITH XXX</td>
</tr>
<tr>
<td>RC</td>
<td>COMMAND TO RESET THE COUNTER (TOTAL) (SET TO PRESET IF IN THE COUNT DOWN MODE)</td>
</tr>
<tr>
<td>RC (S) XXX</td>
<td>COMMAND TO SET COUNTER (TOTAL) TO XXX</td>
</tr>
<tr>
<td>RT</td>
<td>COMMAND TO RESET GRAND TOTAL TO 0</td>
</tr>
<tr>
<td>RT (S) XXX</td>
<td>COMMAND TO SET GRAND TOTAL TO XXX</td>
</tr>
</tbody>
</table>

Note: (S) represents the ASCII “space” character.
Example: Unit Number 1

<table>
<thead>
<tr>
<th>Host Command</th>
<th>SmartTrol Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1 (S)</td>
<td>Device # 1:</td>
</tr>
<tr>
<td>PA (S) 76546 (S) PA (S)</td>
<td>PA 76546 PA (Keystrokes echo)</td>
</tr>
<tr>
<td>KC (S) 1575 (S) KC (S)</td>
<td>KC 1575 KC (Keystrokes echo)</td>
</tr>
<tr>
<td>RC (Enter)</td>
<td>RC (Keystrokes echo, request processed)</td>
</tr>
<tr>
<td></td>
<td>76546 (New Preset A value)</td>
</tr>
<tr>
<td></td>
<td>1575 (New rate K Factor for Input A)</td>
</tr>
</tbody>
</table>

A sample communications program written in BASIC may be found in Appendix B, Page 38. Note the program has been printed using a word processor program, and character posting may not be the same as a printout using BASIC to drive the printer.
CHAPTER 12 WARRANTY

Neptune Technology Group warrants the SmartTrol against defects in materials and workmanship for a period of one (1) year from the date of shipment to the Buyer. The Warranty is limited to repair or replacement of the defective unit at the option of Neptune. 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.
CHAPTER 13 ASSISTANCE

If you should encounter any problems during the installation, operation, or programming of the SmartTrol, please call Neptune Customer Support at (800) 647-4832 or (334) 283-6555.
### APPENDIX A SPECIFICATIONS

#### TRICON/E Performance Data

<table>
<thead>
<tr>
<th>Size</th>
<th>Max Flow (GPM)</th>
<th>Max Continuous Flow (GPM)</th>
<th>Max Flow (GPM)</th>
<th>Pulses/Gallon</th>
<th>Pulse Output @ Max Flow (CPS)</th>
<th>Flow for 20 mA Output (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5⁄8”</td>
<td>20</td>
<td>10</td>
<td>¼</td>
<td>578.1</td>
<td>192.70</td>
<td>20</td>
</tr>
<tr>
<td>¾”</td>
<td>30</td>
<td>15</td>
<td>½</td>
<td>322.6</td>
<td>161.30</td>
<td>30</td>
</tr>
<tr>
<td>1”</td>
<td>50</td>
<td>25</td>
<td>¾</td>
<td>150.8</td>
<td>125.67</td>
<td>50</td>
</tr>
<tr>
<td>1½”</td>
<td>100</td>
<td>50</td>
<td>1½</td>
<td>67.57</td>
<td>112.62</td>
<td>100</td>
</tr>
<tr>
<td>2”</td>
<td>160</td>
<td>80</td>
<td>2</td>
<td>37.50</td>
<td>100.00</td>
<td>160</td>
</tr>
</tbody>
</table>

#### T-B

<table>
<thead>
<tr>
<th>Size</th>
<th>Max Flow (GPM)</th>
<th>Max Continuous Flow (GPM)</th>
<th>Min Flow (GPM)</th>
<th>Pulses/Gallon</th>
<th>Pulse Output @ Max Flow (CPS)</th>
<th>Flow for 20 mA Output (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5⁄8”</td>
<td>20</td>
<td>10</td>
<td>¼</td>
<td>473.60</td>
<td>157.87</td>
<td>24.41</td>
</tr>
<tr>
<td>¾”</td>
<td>30</td>
<td>15</td>
<td>½</td>
<td>329.14</td>
<td>164.57</td>
<td>29.40</td>
</tr>
<tr>
<td>1”</td>
<td>50</td>
<td>25</td>
<td>¾</td>
<td>126.55</td>
<td>105.46</td>
<td>59.58</td>
</tr>
<tr>
<td>1½”</td>
<td>100</td>
<td>50</td>
<td>1½</td>
<td>47.86</td>
<td>79.77</td>
<td>141.18</td>
</tr>
<tr>
<td>2”</td>
<td>160</td>
<td>80</td>
<td>2</td>
<td>25.60</td>
<td>68.27</td>
<td>234.37</td>
</tr>
</tbody>
</table>

NOTE: Because the TRICON/E transmitter is manufactured specifically for the T-10 series of meters, the flow required to produce 20 mA output with the T-B series is greater than the Max Flow listed for each meter size.

#### Trident Turbine

<table>
<thead>
<tr>
<th>Size</th>
<th>Max Flow (GPM)</th>
<th>Max Continuous Flow (GPM)</th>
<th>Max Flow (GPM)</th>
<th>Pulses/Gallon</th>
<th>Pulse Output @ Max Flow (CPS)</th>
<th>Flow for 20 mA Output (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2”</td>
<td>250</td>
<td>200</td>
<td>3</td>
<td>4.608</td>
<td>15.36</td>
<td>200</td>
</tr>
<tr>
<td>3”</td>
<td>560</td>
<td>450</td>
<td>5</td>
<td>2.890</td>
<td>21.68</td>
<td>450</td>
</tr>
<tr>
<td>4”</td>
<td>1,250</td>
<td>1,000</td>
<td>10</td>
<td>1.590</td>
<td>26.50</td>
<td>1,000</td>
</tr>
<tr>
<td>6”</td>
<td>2,500</td>
<td>2,000</td>
<td>20</td>
<td>0.464</td>
<td>15.47</td>
<td>2,000</td>
</tr>
</tbody>
</table>

For 8” through S/N 31918014 and For 10” through S/N 31919282

<table>
<thead>
<tr>
<th>Size</th>
<th>Max Flow (GPM)</th>
<th>Max Continuous Flow (GPM)</th>
<th>Max Flow (GPM)</th>
<th>Pulses/Gallon</th>
<th>Pulse Output @ Max Flow (CPS)</th>
<th>Flow for 20 mA Output (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8”</td>
<td>4,500</td>
<td>3,500</td>
<td>35</td>
<td>0.2493</td>
<td>14.54</td>
<td>3,500</td>
</tr>
<tr>
<td>10”</td>
<td>7,000</td>
<td>5,500</td>
<td>50</td>
<td>0.1600</td>
<td>14.67</td>
<td>5,500</td>
</tr>
</tbody>
</table>

For 8” from S/N 31918274 and for 10” from S/N 31919300

<table>
<thead>
<tr>
<th>Size</th>
<th>Max Flow (GPM)</th>
<th>Max Continuous Flow (GPM)</th>
<th>Max Flow (GPM)</th>
<th>Pulses/Gallon</th>
<th>Pulse Output @ Max Flow (CPS)</th>
<th>Flow for 20 mA Output (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8”</td>
<td>4,500</td>
<td>3,500</td>
<td>35</td>
<td>0.2253</td>
<td>13.14</td>
<td>3,873</td>
</tr>
<tr>
<td>10”</td>
<td>7,000</td>
<td>5,500</td>
<td>50</td>
<td>0.1472</td>
<td>13.49</td>
<td>5,981</td>
</tr>
</tbody>
</table>
### HP Turbine

<table>
<thead>
<tr>
<th>Size</th>
<th>Max Flow (GPM)</th>
<th>Max Continuous Flow (GPM)</th>
<th>Min Flow (GPM)</th>
<th>Pulses/Gallon</th>
<th>Pulse Output @ Max Cont. Flow (CPS)</th>
<th>Flow for 20 mA Output (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1½”</td>
<td>200</td>
<td>160</td>
<td>4</td>
<td>6.095</td>
<td>16.25</td>
<td>160</td>
</tr>
<tr>
<td>2”</td>
<td>230</td>
<td>200</td>
<td>4</td>
<td>6.095</td>
<td>20.32</td>
<td>200</td>
</tr>
<tr>
<td>3”</td>
<td>560</td>
<td>450</td>
<td>5</td>
<td>11.20</td>
<td>84.00</td>
<td>450</td>
</tr>
<tr>
<td>4”</td>
<td>1,500</td>
<td>1,200</td>
<td>10</td>
<td>7.556</td>
<td>151.1</td>
<td>1,200</td>
</tr>
<tr>
<td>6”</td>
<td>3,750</td>
<td>3,000</td>
<td>20</td>
<td>.7273</td>
<td>36.36</td>
<td>3,000</td>
</tr>
<tr>
<td>8”</td>
<td>5,000</td>
<td>4,000</td>
<td>35</td>
<td>.7556</td>
<td>50.37</td>
<td>4,000</td>
</tr>
<tr>
<td>10”</td>
<td>8,000</td>
<td>6,500</td>
<td>50</td>
<td>.7556</td>
<td>81.86</td>
<td>6,500</td>
</tr>
</tbody>
</table>

### DISC Elements in Compound Meters

<table>
<thead>
<tr>
<th>Size and Type Compound Meter</th>
<th>Size and Type Disc Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>2” TRU/FLO</td>
<td>½” T-10</td>
</tr>
<tr>
<td>3” TRU/FLO</td>
<td>¾” T-10</td>
</tr>
<tr>
<td>4” TRU/FLO</td>
<td>¾” T-10</td>
</tr>
<tr>
<td>4” PROTECTUS III</td>
<td>1” T-10</td>
</tr>
<tr>
<td>6” TRU/FLO</td>
<td>1” T-10</td>
</tr>
<tr>
<td>6” PROTECTUS III</td>
<td>1½” T-10</td>
</tr>
<tr>
<td>8” PROTECTUS III</td>
<td>2” T-10</td>
</tr>
<tr>
<td>10” PROTECTUS III</td>
<td>2” T-10</td>
</tr>
</tbody>
</table>

Refer to the appropriate chart for TRICON/E performance data.

### TRU/FLO COMPOUND (TURBINE SIDE)

<table>
<thead>
<tr>
<th>Size</th>
<th>Max Flow (GPM)</th>
<th>Max Continuous Flow (GPM)</th>
<th>Min Flow (GPM)</th>
<th>Pulses/Gallon</th>
<th>Pulse Output @ Max Cont. Flow (CPS)</th>
<th>Flow for 20 mA Output (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3”</td>
<td>560</td>
<td>450</td>
<td>5</td>
<td>2.890</td>
<td>21.68</td>
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<tr>
<td>4”</td>
<td>1,250</td>
<td>1,000</td>
<td>10</td>
<td>1.990</td>
<td>26.50</td>
<td>1,000</td>
</tr>
<tr>
<td>6”</td>
<td>2,500</td>
<td>2,000</td>
<td>20</td>
<td>0.464</td>
<td>15.47</td>
<td>2,000</td>
</tr>
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</table>
### Trident® PROTECTUS (Turbine Side)

<table>
<thead>
<tr>
<th>Size</th>
<th>Max Flow (GPM)</th>
<th>Max Continuous Flow (GPM)</th>
<th>Min Flow (GPM)</th>
<th>Pulses/Gallon</th>
<th>Pulse Output @ Max Cont. Flow (CPS)</th>
<th>Flow for 20 mA Output (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4”</td>
<td>1,250</td>
<td>1,000</td>
<td>10</td>
<td>1.590</td>
<td>26.50</td>
<td>1,000</td>
</tr>
<tr>
<td>6”</td>
<td>2,500</td>
<td>2,000</td>
<td>20</td>
<td>.464</td>
<td>15.47</td>
<td>2,000</td>
</tr>
<tr>
<td>8”</td>
<td>4,500</td>
<td>3,500</td>
<td>35</td>
<td>.2493</td>
<td>14.54</td>
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For 10” through S/N 31919282

<table>
<thead>
<tr>
<th>Size</th>
<th>Max Flow (GPM)</th>
<th>Max Continuous Flow (GPM)</th>
<th>Min Flow (GPM)</th>
<th>Pulses/Gallon</th>
<th>Pulse Output @ Max Cont. Flow (CPS)</th>
<th>Flow for 20 mA Output (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10”</td>
<td>7,000</td>
<td>5,500</td>
<td>50</td>
<td>.1600</td>
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For 10” from S/N 31919300

<table>
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<th>Size</th>
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<th>Max Continuous Flow (GPM)</th>
<th>Min Flow (GPM)</th>
<th>Pulses/Gallon</th>
<th>Pulse Output @ Max Cont. Flow (CPS)</th>
<th>Flow for 20 mA Output (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10”</td>
<td>7,000</td>
<td>5,500</td>
<td>50</td>
<td>.1472</td>
<td>13.49</td>
<td>5,981</td>
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</table>

### HP TRU/FLO Compound (Turbine Side)

<table>
<thead>
<tr>
<th>Size</th>
<th>Max Flow (GPM)</th>
<th>Max Contributions Flow (GPM)</th>
<th>Min Flow (GPM)</th>
<th>Pulses/Gallon</th>
<th>Pulse Output @ Max Cont. Flow (CPS)</th>
<th>Flow for 20 mA Output (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2”</td>
<td>250</td>
<td>220</td>
<td>4</td>
<td>6.095</td>
<td>20.32</td>
<td>200</td>
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</table>

### HP PROTECTUS III (TURBINE SIDE)

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<th>Size</th>
<th>Max Flow (GPM)</th>
<th>Max Continuous Flow (GPM)</th>
<th>Min Flow (GPM)</th>
<th>Pulses/Gallon</th>
<th>Pulse Output @ Max Cont. Flow (CPS)</th>
<th>Flow for 20 mA Output (GPM)</th>
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</thead>
<tbody>
<tr>
<td>4”</td>
<td>1,500</td>
<td>1,200</td>
<td>10</td>
<td>7.556</td>
<td>151.1</td>
<td>1,200</td>
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<tr>
<td>6”</td>
<td>3,750</td>
<td>3,000</td>
<td>20</td>
<td>.7556</td>
<td>37.78</td>
<td>2,888</td>
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<tr>
<td>8”</td>
<td>5,000</td>
<td>4,000</td>
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<td>.6095</td>
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<tr>
<td>10”</td>
<td>8,000</td>
<td>6,500</td>
<td>50</td>
<td>.5333</td>
<td>57.78</td>
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</table>
### TRU/MAG HIGH FREQUENCY OUTPUT/K FACTOR

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>Pulses per Gallon</th>
<th>Pulses per Liter</th>
<th>Qmax* Gallons per Minute</th>
<th>Qmax* Liters per Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot;</td>
<td>25.228</td>
<td>6.665</td>
<td>600</td>
<td>2,271</td>
</tr>
<tr>
<td>4&quot;</td>
<td>16.362</td>
<td>4.323</td>
<td>1000</td>
<td>3,780</td>
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<tr>
<td>6&quot;</td>
<td>6.307</td>
<td>1.666</td>
<td>2,400</td>
<td>9,462</td>
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<tr>
<td>8&quot;</td>
<td>3.344</td>
<td>0.883</td>
<td>4,400</td>
<td>16,656</td>
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<tr>
<td>10&quot;</td>
<td>2.150</td>
<td>0.568</td>
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</table>

* Flow rate at 150 Hz max pulse rate.

### TRU/MAG PULSE RATES

<table>
<thead>
<tr>
<th>Signal</th>
<th>TRU/MAG: Current sinking pulse, opto-isolated, co Vdc at 10 mA max</th>
<th>TRU/MAG: Pulse output available only with the addition of post-factory output cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse Rates</td>
<td>10 units/pulse (default): 100 units/pulse: 1000 units/pulse: High Frequency</td>
<td></td>
</tr>
<tr>
<td>High Frequency (pulse/gal)</td>
<td>3&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>25.228</td>
<td>16.362</td>
<td>6.307</td>
</tr>
</tbody>
</table>
APPENDIX B COMMUNICATIONS PROGRAM

10 ‘---------------------------------------------------------------------------------------------------------------------------------
20 ‘ INITIALIZE PROGRAM
30 ‘---------------------------------------------------------------------------------------------------------------------------------
40 KEY OFF: CLS: CLOSE
50 PRINT, "SAMPLE PROGRAM IN BASIC FOR COMMUNICATING”
60 PRINT
70 PRINT, "WITH NEPTUNE TECHNOLOGY GROUP SmartTrol”
80 LOCATE 10,
90 PRINT, ‘WRITTEN BY JOHN SMITH
100 PRINT
110 PRINT, “DECEMBER 31, 2002
120 LOCATE 20,
130 PRINT,” *** PROGRAM WILL CONTINUE MOMENTARILY ***
140 ‘---------------------------------------------------------------------------------------------------------------------------------
150 ‘FIRST SCREEN HELD FOR 8 SECONDS, THEN PROGRAM PROCEEDS.
160 ‘---------------------------------------------------------------------------------------------------------------------------------
170 OLDSEC = VAL(MID$(TIME$, 7,2))
180 SEC = VAL(MID$(TIME$, 7, 2))
190 IF OLDSEC>51 THEN IF SEC< THEN SEC=SEC+60
200 IF SEC-OLDSEC<8 THEN 180
210 CLS
220 PRINT” THIS PROGRAM IS INTENDED FOR DEMONSTRATION PURPOSES ONLY. NEPTUNE
230 PRINT
240 PRINT” TECHNOLOGY GROUP IS NOT LIABLE FOR ERRORS OF OMISSION OR COMMISSION SHOULD
250 PRINT
260 PRINT” THE PROGRAM BE USED FOR OTHER THAN INTENDED PURPOSES. QUESTION MAY BE
270 PRINT
280 PRINT” FORWARDED TO : NEPTUNE TECHNOLOGY GROUP INC
290 PRINT
300 PRINT” REPAIR DEPARTMENT
310 PRINT
320 PRINT” ROUTE 229 SOUTH
330 PRINT
340 PRINT” TALLASSEE, AL 36078
350 PRINT
360 PRINT” PHONE 1-800-645-1892 OR 334-283-6555
370 LOCATE 20
380 PRINT,” “ PRESS ENTER WHEN READY TO PROCEED
390 IF INKEY$ <> CHR$ (13) THEN 390
400 ‘---------------------------------------------------------------------------------------------------------------------------------
410 ‘ SELECT OPERATING PARAMETERS.
CLS
PRINT "SmartTrol BASIC COMMUNICATIONS PROGRAM"
LOCATE 7,
PRINT "THIS PROGRAM IS USED TO COMMUNICATE WITH THE SmartTrol USING A SERIAL"
PRINT
PRINT "COMMUNICATIONS PORT. PLEASE INPUT THE INFORMATION REQUESTED IN THE "
PRINT
PRINT "FORMANT INDICATOR AS YOU ARE PROMPTED. THE VALUES YOU WILL PROVIDE"
PRINT
PRINT "CONTROL THE PROGRAM SETUP AND OUTPUT."
LOCATE 17,
PRINT "PRESS ENTER WHEN READY TO PROCEED"

PROGRAM WILL NOT CONTINUE UNTIL ENTER IS Pressed.

IF INKEY$<> CHR$ (13) THEN 580

"CONFIGURE COMMUNICATIONS PORT"
CLS
PRINT "ENTER SmartTrol UNIT NUMBER"
LOCATE 4,
INPUT "(NUMBER MUST RANGE BETWEEN 1 AND 15) ",(UN$)

‘ FORCE CHOICE TO BE ONLY WHAT IS OFFERED.

IF VAL (UN$) = 1 OR VAL (UN$) = 2 OR VAL (UN$) = 3 OR VAL (UN$) = 4 OR VAL (UN$) = 5 OR
VAL (UN$) = 4 OR VAL (UN$) = 7 OR VAL (UN$) = 8 OR VAL (UN$) = 9 OR VAL (UN$) = 10
OR VAL (UN$) = 11 OR VAL (UN$) = 12 OR VAL (UN$) = 13 OR VAL (UN$) = 14 OR VAL (UN$) = 15 THEN 730
ELSE 700
LOCATE 4,
PRINT STRINGS (79,32)
GOTO 640
LOCATE 7
PRINT "ENTER COMMUNICATIONS PORT NUMBER"
LOCATE 10
INPUT "(1 OR 2) ",PORT$”
IF VAL (PORT$) = 1 OR VAL (PORT$) = 2 THEN 810 ELSE 780
LOCATE 10,
PRINT STRING$ (79,32)
GOTO 750
LOCATE 13,
PRINT “ENTER COMMUNICATIONS BAUD RATE”
LOCATE 16,
INPUT “([300, 600, 1200, 2100, 4800, OR 9600])”, BAUDRATE$
IF VAL (BAUDRATE$) = 300 OR VAL (BAUDRATE$) = 600 OR VAL (BAUDRATE$) = 1200 OR VAL (BAUDRATE$) = 2400 OR VAL (BAUDRATE$) OR VAL (BAUDRATE$) = 4800 OR VAL (BAUDRATE$) = 9600 THEN 890 ELSE 860
LOCATE 16,
PRINT STRING$ (79,32)
GOTO 830
LOCATE 19,
PRINT “ENTER PARITY”
LOCATE 22,
INPUT “E(ven), O(dd), S(pace), M(ark)”, PARITY$
IF PARITY$ = “E” OR PARITY$ = “O” OR PARITY$ = “S” OR PARITY$ = “M” THEN 970 ELSE 940
LOCATE 22
PRINT STRING$ (79, 32)
GOTO 910
COMFIL$ = “CPM” + PORT$ + “:” + BAUDRATE$ + “,” + PARITY$ + “,” + 7
OPEN COMMUNICATIONS FILE WITH SELECTED VALUES
OPEN COMFIL$ AS #1
CLS
PRINT, “REMEMBER TO PROGRAM SmartTrol TO THESE SETTINGS”
LOCATE 4,
PRINT “UNIT NUMBER = ” UN$
LOCATE 7,
PRINT “BAUD RATE = ” BAUDRATE$
LOCATE 10,
PRINT “PARITY = ” PARITY$
LOCATE 13,
PRINT, “PRESS ENTER WHEN READY TO PROCEED”
IF INKEY$ <> CHR$ (13) THEN 1120
CLS
PRINT, “YOU MUST NOW SELECT WHAT THE SmartTrol WILL DO. A MENU WILL BE”
PRINT
PRINT “PRESENTED AND YOU MAY MAKE YOUR CHOICES. NOTE SOME CHOICES WILL”
PRINT
PRINT “REQUIRE YOU TO ENTER SOME NUMERIC VALUE.”
LOCATE 9,
PRINT, "PRESS ENTER WHEN READY TO PROCEED"
IF INKEY$ <> CHR$ (13) THEN 1210
DC = 0: DR = 0: DT = 0: PA = 0: PB = 0: PAS = 0: PANS$ = "0": PBS = 0: PBSN$ = "0"
CLS
'_____________________________________
"PRESET MENU OF SOME SmartTrol COMMANDS. CHOICES WHICH REQUIRE ADDITIONAL 
INPUTS ONLY REQUEST INPUT WHEN THOSE CHOICES ARE SELECTED 
'_____________________________________
PRINT "STATUS | NUMBER | COMMAND"
PRINT "————-|————————-|———————————————————
IF DC= 0 THEN PRINT " 1 1 1 TRANSMIT COUNT (TOTAL)" ELSE PRINT " * 1 1
1 TRANSMIT COUNT (TOTAL)"
IF DR= 0 THEN PRINT " 1 2 1 TRANSMIT RATE" ELSE PRINT " * 1 2 1
TRANSMIT RATE"
IF DT=0 THEN PRINT " 1 3 1 TRANSMIT GRAND TOTAL" ELSE PRINT " * 1
3 1 TRANSMIT GRAND TOTAL"
IF PA= 0 THEN PRINT " 1 4 1 TRANSMIT PRESET A" ELSE PRINT " * 1 4 1
TRANSMIT PRESET A"
IF PAS =0 THEN PRINT " 1 5 1 LOAD PRESET A WITH " PASN$ ELSE PRINT 
* 1 5 1 LOAD PRESET A WITH "PASN$
IF PB= 0 THEN PRINT " 1 6 1 TRANSMIT PRESET B " ELSE PRINT " * 1 6
1 TRANSMIT PRESET B"
IF PBS =0 THEN PRINT " 1 7 1 LOAD PRESET B WITH " PBSN$ ELSE PRINT 
* 1 7 1 LOAD PRESET B WITH "PBSN$
PRINT "————-| ————————————————————
PRINT "NOTE : * = SELECTED, BLANK = NOT SELECTED"
LOCATE 23,
INPUT "DO YOU WISH TO MAKE CHANGES TO ANY STATUS (Y= YES, N= NO)" ; Y$
IF Y$= "n" OR Y$="NO" OR Y$= "no" OR Y$ = "N" THEN 1800
IF Y$ = "y" OR Y$= "yes" OR Y$= "Y" OR Y$ = "YES" THEN 1450 ELSE 1420
LOCATE 23,
PRINT STRINGS$ (79, 32)
GOTO 1380
LOCATE 23,
PRINT STRINGS$ (79, 32)
LOCATE 23,
LOCATE 23,
INPUT "WHICH ITEM DO YOU WISH TO CHANGE"; ITEM %
IF ITEM% <> 1 THEN 1520
IF ITEM% = 1 THEN IF DC=0 THEN DC=1 ELSE DC=0
1510 IF ITEM% = 1 THEN 1230
1520 IF ITEM% <> 2 THEN 1550
1530 IF ITEM% = 2 THEN DR=0 ELSE DR=1
1540 IF ITEM% = 2 THEN 1230
1550 IF ITEM% <> 3 THEN 1580
1560 IF ITEM% = 3 THEN DT=0 ELSE DT=1
1570 IF ITEM% = 3 THEN 1230
1580 IF ITEM% <> 4 THEN 1610
1590 IF ITEM% = 4 THEN PA=0 ELSE PA=1
1600 IF ITEM% = 4 THEN 1230
1610 IF ITEM% <> 5 THEN 1690
1620 IF ITEM% = 5 THEN PAS=0 ELSE PAS=1
1630 IF ITEM% = 5 THEN 1640
1640 LOCATE 23,
1650 PRINT STRING$(79, 32)
1660 LOCATE 23,
1670 INPUT "LOAD WITH WHAT VALUE (PRESS ENTER IF DESELECTING 5) ", PAS$
1680 GOTO 1230
1690 IF ITEM% <> 6 THEN 1720
1700 IF ITEM% = 6 THEN PB=0 ELSE PB=1
1710 IF ITEM% = 6 THEN 1230
1720 IF ITEM% > 7 THEN 1230
1730 IF ITEM% = 7 THEN PBS=0 ELSE PBS=1
1740 IF ITEM% = 7 THEN 1750
1750 LOCATE 23,
1760 PRINT STRING$(79, 32)
1770 LOCATE 23,
1780 INPUT "LOAD WITH WHAT VALUE (PRESS ENTER IF DESELECTING 7) ", PBS$
1790 GOTO 1230
1800 CLS
1810 PRINT "COMMUNICATIONS ARE BEING OPENED WITH THESE PARAMETERS:"
1820 LOCATE 4,
1830 PRINT "", COMFIL$ 
1840 '..............................................................................
1850 "SEND A CARRIAGE RETURN TO CLEAR THE SmartTrol (ASCII 13). POLL SmartTrol TO
1860 "ACTIVATE COMMUNICATIONS."
1870 '..............................................................................
1880 PRINT #1, CHR$(13);
1890 PRINT #1, "D" = UNS + CHR$(32); 
1900 '..............................................................................

TRICON® SMARTTROL® INSTALLATION AND MAINTENANCE GUIDE
ENTER ROUTINE THAT DETERMINES THE CURRENT SECOND OF TIME AND HOLDS THE PROGRAM UNTIL SECONDS CHANGE TWICE. THE HOLD OF 1 TO 2 SECONDS ALLOWS SmartTrol TO RECEIVE AND ECHO BACK COMPUTER COMMAND.

SEC=VAL(MIND$(TIME$, 7, 2))

IF SEC = VAL(MIDS(TIME$, 7, 2)) THEN 1940
SEC=VAL(MIDS(TIME$, 7, 2))

IF SEC=VAL(MIDS(TIME$, 7, 2)) THEN 1960

IF THE COMMUNICATIONS BUFFER IS NOT EMPTY, PUT ALL THE CHARACTERS RECEIVED INTO A VARIABLE STRING AND PRINT THE STRING TO SCREEN. IF BUFFER IS EMPTY PROGRAM ASSUMES COMMUNICATIONS FAILURE AND PROCEEDS ACCORDINGLY.

IF LOC(1) > 0 THEN 2170
IF LOC (1) = 0 THEN 2020
CLS
PRINT "COMMUNICATIONS FAILURE. RECHECK PROGRAMMING VALUES. ENSURE SmartTrol IS SET TO COMMUNICATION PROGRAM VALUES. CHECK WIRING.
LOCATE 10,
R$= "X"

INPUT" DO YOU WANT TO RESTART (Y=YES, N=NO)" ; R$
IF R$="Y" THEN 430 : IF R$= "N" THEN 2090
LOCATE 10,
PRINT STRINGS (79, 32)
LOCATE 10,
INPUT" DO YOU WANT TO QUIT (Y=YES, N= NO)"; S$
IF S$= "Y" THEN 2580 : IF S$="N" THEN 2140
LOCATE 10,
PRINT STRINGS$(79, 32))
GOTO 2050
A$= INPUT$(LOC (1), #1)
PRINT A$

SEND THE SmartTrol ALL PREVIOUSLY SELECTED COMMANDS AND VALUES. USE SMALL SOFTWARE PAUSES BETWEEN EACH COMMAND TRANSMITTED.

IF DC=1 THEN PRINT #1, "DC: + CHR$ (32)
IF DC=1 THEN 2240 ELSE 2250
FOR I=1 TO 100 : NEXT
IF DR + 1 THEN PRINT #1, "DR" + CHR$ (32)
IF DR = 1 THEN 2270 ELSE 2280
FOR I = 1 TO 100: NEXT
2280 IF DT = 1 THEN PRINT #1, "DT" + CHR$ (32);
2290 IF DT = 1 THEN 2300 ELSE 2310
2300 FOR I = 1 TO 100: NEXT
2310 IF PA = 1 THEN PRINT #1, "PA" + CHR$ (32);
2320 IF PA = 1 THEN 2230 ELSE 2340
2330 FOR I = 1 TO 100: NEXT
2340 IF PAS = 1 THEN PRINT #1, "PA" + PAS$ + CHR$ (32);
2350 IF PAS = 1 THEN 2360 ELSE 2370
2360 FOR I = 1 TO 100: NEXT
2370 IF PB = 1 THEN PRINT #1, "PB" + CHR$ (32);
2380 IF PB = 1 THEN 2390 ELSE 2400
2390 FOR I = 1 TO 100: NEXT
2400 IF PBS = 1 THEN PRINT #1, "PB" + PBS$ + CHR$ (32);
2410 IF PBS = 1 THEN 2420 ELSE 2460
2420 FOR I = 1 TO 100: NEXT
2430 ' ———————————————————————————————————
2440 ' END SmartTrol COMMAND STRING WITH CARRIGE RETURN FOR SmartTrol PROCESSING
2450 ' ———————————————————————————————————
2460 PRINT #1, CHR$ (13):
2470 SEC = VAL (MID$ (TIME$, 7, 2))
2480 IF SEC = VAL (MID$ (TIME$, 7, 2)) THEN 2480
2490 SEC = VAL (MID$ (TIME$, 7, 2))
2500 IF SEC = VAL (MID$ (TIME$, 7, 2)) THEN 2500
2510 IF LOC (1) > 0 THEN 2520
2520 A$ = INPUT$ (LOC (1), #1)
2530 PRINT A$
2540 INPUT" ARE YOU THROUGH (Y=YES, N= NO) ":; R$
2550 IF R$ = "N" THEN 2570
2560 IF R$ = "Y" THEN 2580
2570 GOTO 1230
2580 CLOSE
2590 END
### Performance Data

Available switch closure rates

<table>
<thead>
<tr>
<th>METER</th>
<th>1</th>
<th>10</th>
<th>100</th>
<th>1000</th>
<th>1</th>
<th>10</th>
<th>100</th>
<th>1000</th>
<th>0.1</th>
<th>1</th>
<th>10</th>
<th>100</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾&quot;-1&quot;T-10</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>1½&quot;-2&quot;T-10</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>Y</td>
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<td></td>
<td>Y</td>
<td>Y</td>
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<td>Y</td>
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<tr>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>1½&quot;-6&quot;HPT</td>
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<td>Y</td>
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<td>Y</td>
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</tr>
</tbody>
</table>

*Units of Litres per contact not available for 1½"-10" HPT.
APPENDIX D  REGISTER TRACKING

Making The Total Agree With The Register

After programming the SmartTrol with the appropriate K Factor and operating parameters, you may set the SmartTrol so that the value of Total agrees with the current quantity indicated on the meter register. However, the meter must be static for the duration of the following procedure. Either stop the flow through the meter or remove the register from the meter until the procedure is complete. Note the current register reading.

Overview of Procedure:

- Set the SmartTrol to Set to Preset (count down mode)
- Set Preset A to register reading value
- Reset to Preset by depressing “CLR” key
- Reset the SmartTrol to Reset to Zero (count up mode)

Preparing the SmartTrol to accept the current register reading.

<table>
<thead>
<tr>
<th>PRESS</th>
<th>DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>MENU (Displays 1 second)</td>
</tr>
<tr>
<td></td>
<td>DEV TYPv</td>
</tr>
<tr>
<td>ENT</td>
<td>RTv CNTv</td>
</tr>
<tr>
<td>D</td>
<td>K FACT A (Displays 1 second)</td>
</tr>
<tr>
<td></td>
<td>####### (Current Value blinks)</td>
</tr>
<tr>
<td>ENT</td>
<td>K Fact B (Displays 1 second)</td>
</tr>
<tr>
<td></td>
<td>####### (Current value blinks)</td>
</tr>
<tr>
<td>ENT</td>
<td>ROv SPv</td>
</tr>
<tr>
<td></td>
<td>Press D for Set to Preset</td>
</tr>
<tr>
<td>ENT</td>
<td>ATv MANv</td>
</tr>
<tr>
<td></td>
<td>Press D for Manual Reset</td>
</tr>
<tr>
<td>ENT</td>
<td>DEC LOC</td>
</tr>
<tr>
<td>ENT</td>
<td>SmartTrol returns to normal operating mode</td>
</tr>
</tbody>
</table>
Keying in the current register reading.

<table>
<thead>
<tr>
<th>PRESS</th>
<th>DISPLAY</th>
</tr>
</thead>
</table>
| A     | PRESET A (Displays 1 second)  
######## (Current value blinks) |

<table>
<thead>
<tr>
<th>PRESS</th>
<th>DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLR</td>
<td>Key in the current register reading</td>
</tr>
<tr>
<td>ENT</td>
<td>SmartTrol returns to normal operating mode</td>
</tr>
<tr>
<td>CLR</td>
<td>SmartTrol displays the current register reading, but still is in countdown mode</td>
</tr>
</tbody>
</table>

Setting the SmartTrol to increment Total keeping pace with the meter register.

<table>
<thead>
<tr>
<th>PRESS</th>
<th>DISPLAY</th>
</tr>
</thead>
</table>
| D     | MENU (Displays 1 second)  
DEV TYPv |
| ENT   | RTV CNTv |
| D     | KFACT A (Displays 1 second)  
######## (Current value blinks) |
| ENT   | FACT B (Displays 1 second)  
######## (Current value blinks) |
| ENT   | ROv SPv  
Press B, Reset to 0, and Total will now increase along with the register |
| ENT   | ATv MANv  
Press D for Manual Reset |
| ENT   | DEC LOC |
| ENT   | SmartTrol returns to normal operating mode |
Start the flow or reattach the register to the meter. As the register advances, so will Total as displayed on the SmartTrol.

This procedure may need to be performed periodically due to rounding errors in the K Factor. To improve the matching of the percentage difference between Total and the register, the K Factor may be adjusted by the percentage difference between Total and the register reading.

The adjustment is determined by the following formula:

\[
\text{New K Factor} = \text{Old K Factor} \times \frac{\text{Current Total} - \text{previous Total}}{\text{Current Register} - \text{previous Reg.}}
\]

**Example:**

10” Trident Turbine K Factor = .16
Start register reading = 106400
SmartTrol Total reading = 106400

**After some period of operation:**

Current register reading = 408000
Current SmartTrol Total = 408257

Applying the formula,

\[
\begin{align*}
\text{New K Factor} & = .16 \times \frac{408257 - 106400}{408000 - 106400} \\
& = .1601363
\end{align*}
\]

Use the value of .1601363 and reset the Counter K Factor using the procedures in Paragraph 10.1. Then repeat the preceding procedure to make Total agree with and track the register reading.

**NOTE:** After the SmartTrol has been set up with Total tracking the register reading, DO NOT touch CLR when Total is displayed. If you do, Total will return to “0” and start counting up.