

# AUTOMATION PRODUCTS GROUP, INC.

## Operator's Manual

# RST-5000 Series

## Web Enabled Input Module

Rev. A2, 1/12



Automation Products Group, Inc.

*APG...Providing tailored solutions for measurement applications*

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## Table of Contents

*Warranty* ..... 3

*System Connections* ..... 4

*Powering the RST*..... 5

*Basic Parameters*..... 6-7

*Trip Point Control*..... 8-11

*Application Parameters* ..... 12-16

*Modbus* ..... 17-19

*Using the Level and Flow Website* ..... 20-24

*Specifications* ..... 25

- **Warranty and Warranty Restrictions**

APG warrants its products to be free from defects of material and workmanship and will, without charge, replace or repair any equipment found defective upon inspection at its factory, provided the equipment has been returned, transportation prepaid, within 24 months from date of shipment from factory.

THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES NOT EXPRESSLY SET FORTH HEREIN, WHETHER EXPRESSED OR IMPLIED BY OPERATION OF LAW OR OTHERWISE INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

No representation or warranty, express or implied, made by any sales representative, distributor, or other agent or representative of APG which is not specifically set forth herein shall be binding upon APG. APG shall not be liable for any incidental or consequential damages, losses or expenses directly or indirectly arising from the sale, handling, improper application or use of the goods or from any other cause relating thereto and APG's liability hereunder, in any case, is expressly limited to the repair or replacement (at APG's option) of goods.

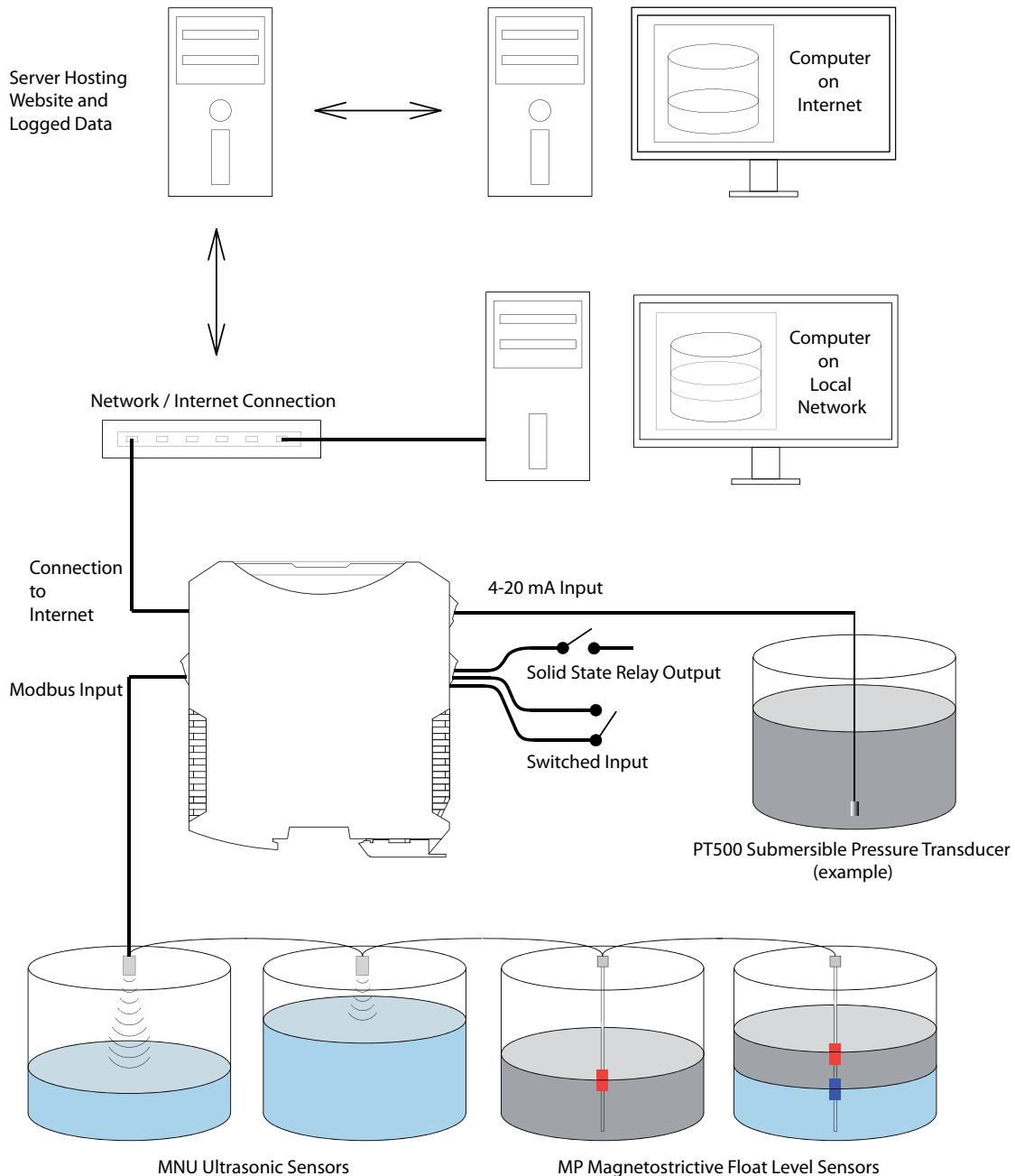
Warranty is specifically at the factory. Any on site service will be provided at the sole expense of the Purchaser at standard field service rates.

All associated equipment must be protected by properly rated electronic/ electrical protection devices. APG shall not be liable for any damage due to improper engineering or installation by the purchaser or third parties. Proper installation, operation and maintenance of the product becomes the responsibility of the user upon receipt of the product.

Returns and allowances must be authorized by APG in advance. APG will assign a Return Material Authorization (RMA) number which must appear on all related papers and the outside of the shipping carton. All returns are subject to the final review by APG. Returns are subject to restocking charges as determined by APG's "Credit Return Policy".

### System Connections

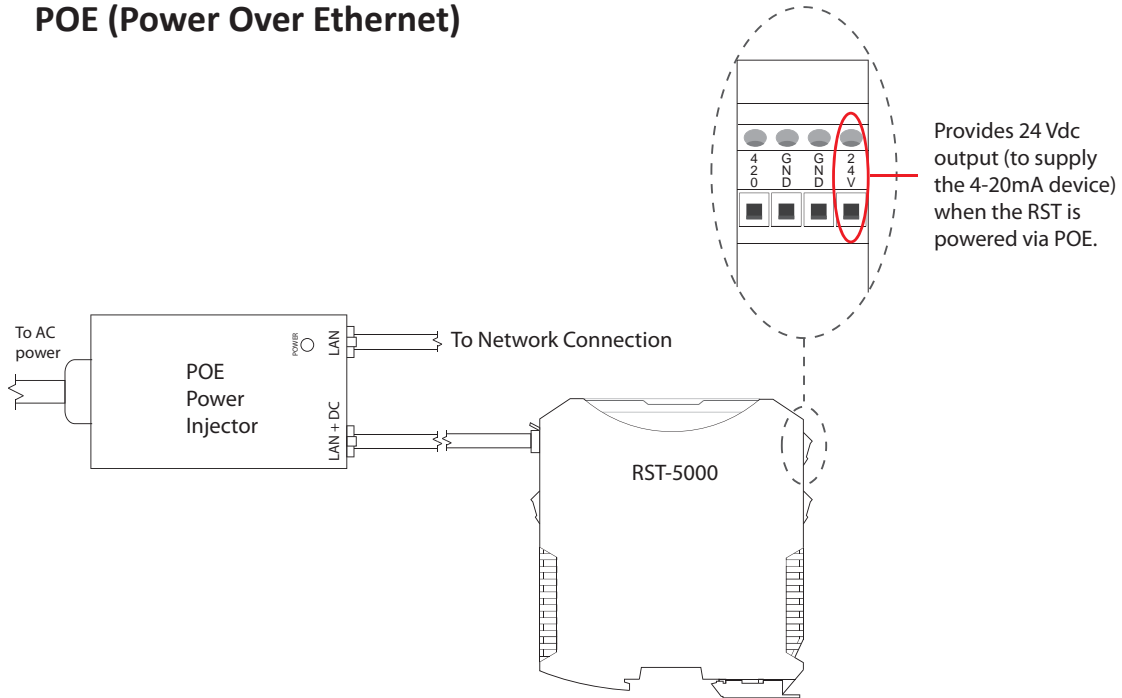
The RST-5000 is designed to add remote monitoring capabilities to almost any 4-20mA device. Sensor readings are transmitted via the internet and saved to a web server, giving the user access to the data from almost anywhere. In addition, the RST-5002 add the capability of interfacing with to 10 of APG's Modbus based sensors, such as the MNU ultrasonic sensors or MP magnetostrictive level sensors.



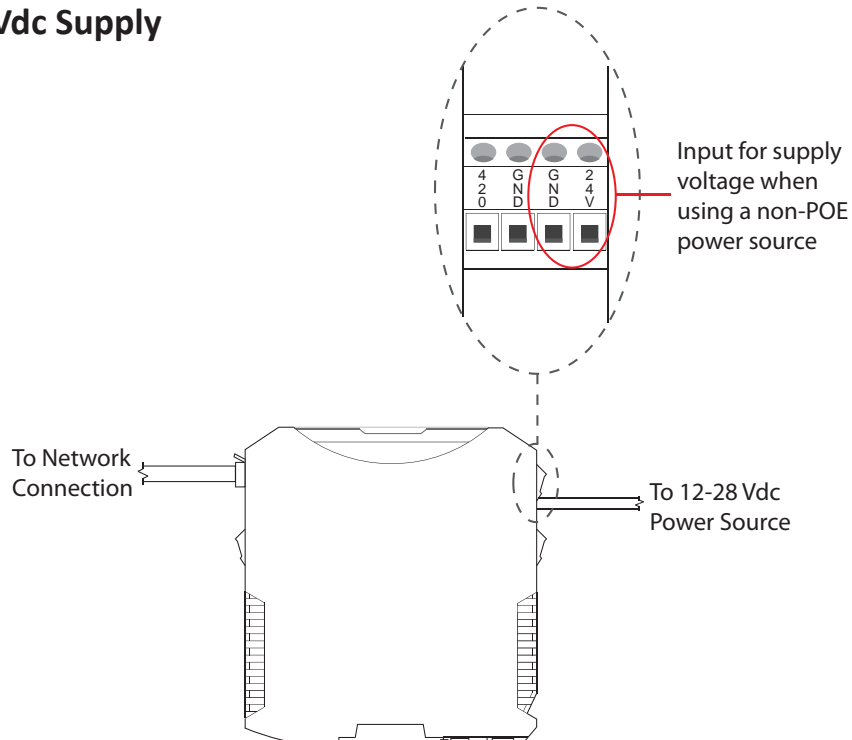
### Powering the RST-5000

The RST can be powered using a 12-28 Vdc power supply or via Power Over Ethernet (POE), using either a power injector or a POE enabled Ethernet switch.

#### POE (Power Over Ethernet)



#### 9-28 Vdc Supply



## Basic Parameters

Parameters	Information	Values	
▶ Reference Position	Not Used	<input type="text" value="0"/>	
▶ 4ma Value	0.00-50.00 Feet	<input type="text" value="1.00"/>	
▶ 20ma Value	0.00-50.00 Feet	<input type="text" value="20.00"/>	<input type="button" value="Change"/>
▶ 4ma Calibration	0 to 4095	<input type="text" value="819"/>	
▶ 20ma Calibration	0 to 4095	<input type="text" value="4095"/>	
▶ Average	1 to 32	<input type="text" value="20"/>	<input type="button" value="Undo"/>
▶ Window	0.00-50.00 Feet	<input type="text" value="0.25"/>	
▶ Out of Range Samples	0 to 250	<input type="text" value="20"/>	
▶ Sample Rate	1 to 15 Hertz	<input type="text" value="4"/>	
▶ Calculated Reading	0.00-50.00 Feet	<input type="text" value="1.00"/>	<input type="button" value="Refresh"/>
▶ Trip1 Status	Green=ON Red=OFF	<input type="text" value="Trip1 ON"/>	<input type="button" value="Home"/>

**Reference Position:** sets the zero-reference point (top or bottom) for the 4-20mA input device. For example, an ultrasonic sensors reference from the top down, while a submersible pressure transducer references from the bottom up.

**4mA Value:** assigns the value associated with a 4 mA input signal.

**20mA Value:** assigns the value associated with a 20 mA input signal.

**4mA Calibration:** (adjustment not typically required) used to true or calibrate the Calculated Reading with a 4 mA input signal.

**20mA Calibration:** (adjustment not typically required) used to true or calibrate the Calculated Reading with a 20 mA input signal.

**Average:** defines the number of input signal readings that will be averaged together to become the Calculated Reading. Each qualified readings is placed into a First-In First-Out (FIFO) buffer memory and averaged with the previous readings. The higher the Average setting, the greater the smoothing effect on fluctuating readings. A higher the Average, the slower the response to rapid changes in the input signal. A fast moving target typically requires a lower average setting.

**Window:** defines the width of the target acceptance Window. Any reading that falls within the Window will be accepted as valid and averaged with previous readings. Any reading that falls outside the Window will be ignored as determined by the Out of Range Samples parameter setting. The acceptance Window starts at the Calculated Reading and extended in both directions the distance in the Window parameter. For example, if the Calculated Reading shows 100 and the Window is set at 10, then any reading between 90 and 110 will be accepted.

**Out of Range Samples:** defines the consecutive number of readings that must fall outside of the acceptance Window before the “out of range” readings are recognized as legitimate and included in the averaging buffer. For example, suppose the Window is set at 25, the Out Of Range Samples is set to 10, and the Calculated Reading is 300. If a input signal suddenly jumps to a value calculated to be 400, which falls outside of the Window ( $300 \pm 25$ ), then the RST will ignore the new reading unless it remains for 10 consecutive samples. However, if the “out of range” signal were sampled only 9 consecutive times and then signal returned to within the Window, then the RST would retain the original Calculated Reading and the 9 out of range readings would simply be ignored.

**Sample Rate:** adjusts how often the RST reads the 4-20mA input signal.

## Basic Parameters (continued)

Parameters	Information	Values
▶ Trip1 Value	0.00-50.00 Feet	<input type="text" value="2.50"/>
▶ Trip1 Window	0.00-50.00 Feet	<input type="text" value="1.00"/>
▶ Trip1 Type	0-8 or 10-17 or 20-27	<input type="text" value="0"/>
▶ Trip2 Value	0.00-50.00 Feet	<input type="text" value="3.00"/>
▶ Trip2 Window	0.00-50.00 Feet	<input type="text" value="1.00"/>
▶ Trip2 Type	0-8 or 10-17 or 20-27	<input type="text" value="0"/>
▶ Retry Time	30 to 180 Seconds	<input type="text" value="30"/>
▶ Remote Call in Time	1 to 86400 Seconds	30
▶ Remote Bytes	8 or 160	8
▶ Current Reading	4.00 to 20.00 milliamps	4.00
▶ Trip2 Status	Green=ON Red=OFF	Trip2 ON

**Trip Value:** defines the Calculated Reading at which the trip output will change states (dependent on Trip Type setting).

**Trip Window:** defines the value between the Trip Value and the secondary trip function for Trip Types 1,2,4,5. For example: if the Trip Value is 250, and the secondary trip function is desired at 350, then the Trip Window should be set at 100.

**Trip Type:** determines the function of the trip output. The 10 options are illustrated in the chart on page 10 and in the descriptions below.

**Type 0 (Near)** trip type will activate the output when Calculated Reading is less than the Trip Value setting. NOTE: the Trip Window setting is not applicable to this Trip Type and can be ignored.

**Type 1 (Exclusive)** trip type will activate the output when the Calculated Reading is less than the Trip Value OR greater than the Trip Value + Trip Window. The output is always deactivated inside the Trip Window.



**Type 2** (*Hysteresis Near*) trip type will activate the output until the Calculated Reading increases beyond the Trip Value + Trip Window, at which point the output deactivates and remain in that state until the Calculated Reading falls below the Trip Value.

**Type 3** (*Far*) trip type will activate the output once the Calculated Reading increases beyond the Trip Value. NOTE: the Trip Window setting is not applicable to this Trip Type and can be ignored.

**Type 4** (*Inclusive*) trip type activates the output only inside the Trip Window. The output is deactivated when the Calculated Reading is less than the Trip Value or greater than the Trip Value + Trip Window.

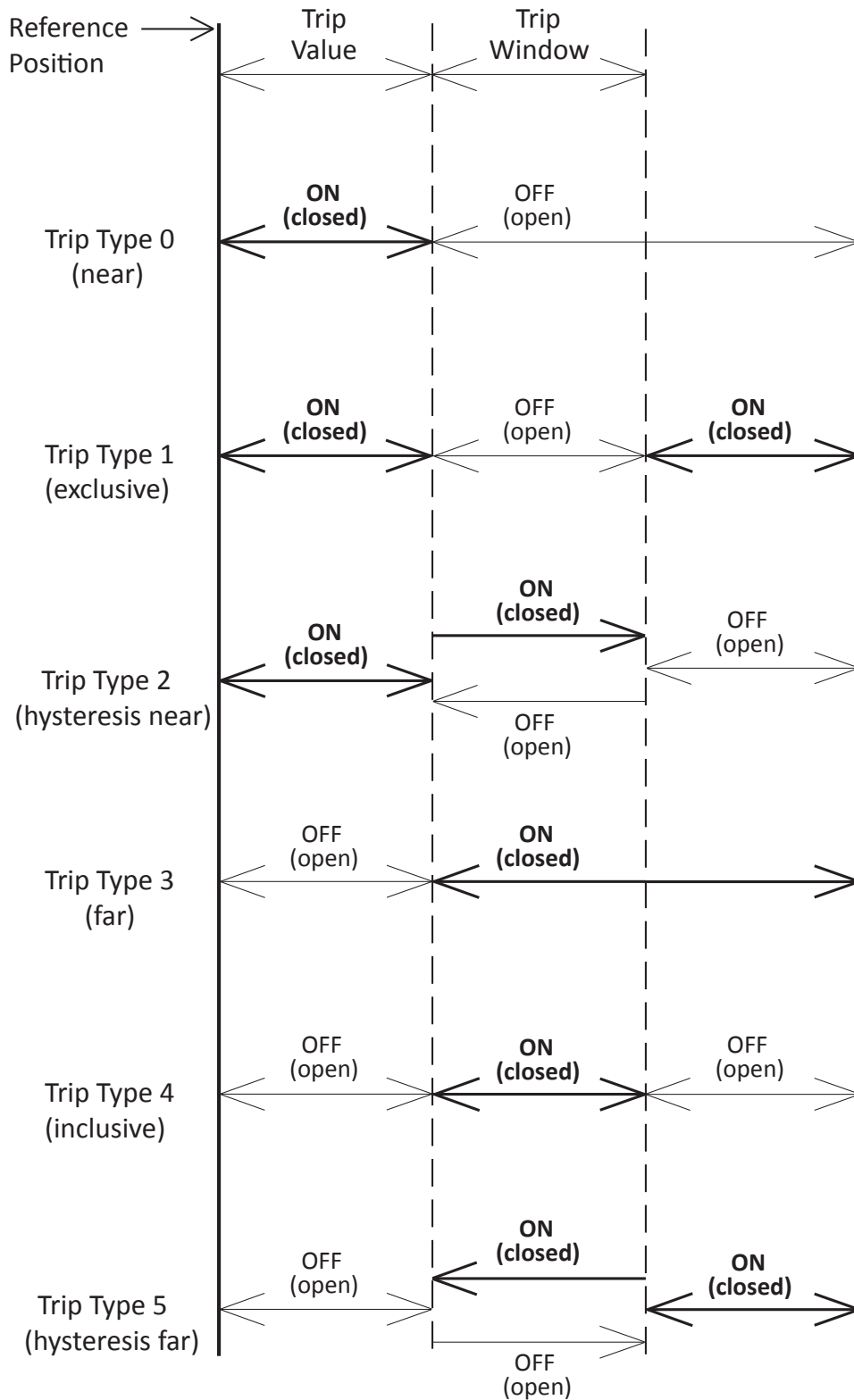
**Type 5** (*Hysteresis Far*) trip type will activate the output when the Calculated Reading increases beyond the Trip Value + Trip Window, and remain active until the Calculated Reading falls below the Trip Value.

**Type 6** (*Output Disabled*)

**Type 7** (*Loss of Echo*) activates the output whenever the furthest analog distance is reached (either the 4mA or 20mA value, whichever is greater).

**Type 8** (*Timed Interval*) allows the user active the output on a timed interval. The Trip Value parameters set the interval time, and the Trip Window sets the length of time that the output will remain active at each interval.

**Type 9** (*Abrupt Change*) allow the user to set a rate of change (distance/time) in the target readings, which if exceeded, with active the output. The Trip Value sets the time value, and the Trip Window set the distance value.



**Activating Website Alarms:** the trip outputs can be used as an alarm that will report to the website whenever the alarm condition is detected, regardless of the call-in time interval.

Placing a “1” in front of any of the Trip Types designates a closed or active output as an alarm condition. For example; Trip Type 5 would be designated as 15. Placing a “2” in front of any of the Trip Types designates an open or inactive output as an alarm condition. For Example; Trip Type 3 would be designated as 23.

A website alarm can then be setup to automatically send out an email and/or text message if an alarm is reported. The website alarm can also be set to run through a delay before reporting the condition. If the alarm condition clears during the delay, the call for the alarm will be canceled. This will help prevent erroneous calls.

NOTE: any delay will come from the time it takes to connect to the website, which may vary depending on the local internet connection.

**For more information, see Website Alarms on pages 21-24.**

## Application Parameters

Application Parameters		
Parameters	Information	Values
▶ Full Distance	Not Used	1.00
▶ Empty Distance	Not Used	10.00
▶ Application Type	Value	0
▶ Volume Units	Not Used	1
▶ Tank Parameter 1	Not Used	1.000
▶ Tank Parameter 2	Not Used	1.001
▶ Tank Parameter 3	Not Used	1.002
▶ Tank Parameter 4	Not Used	1.003
▶ Tank Parameter 5	Not Used	1.004
▶ Units	1=feet,2=inches,3=meters	1

Change      Undo      Home

### Full Distance

Sets the distance (beginning from the Reference Position; see Basic Parameters) to the point where the tank is considered full.

### Empty Distance

Sets the distance (beginning from the Reference Position; see Basic Parameters) to the point where tank is considered empty.

### Application Type

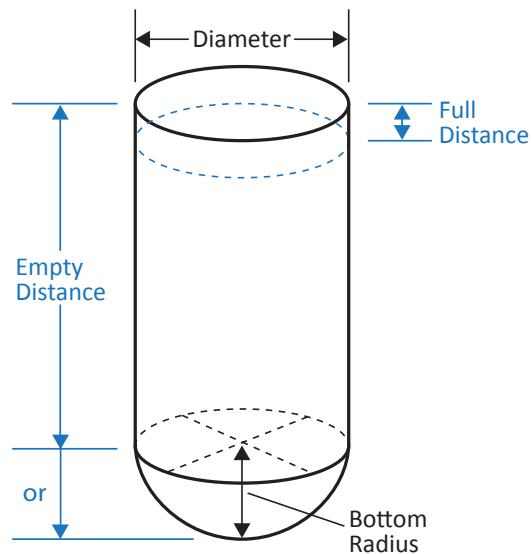
Determines how the RST calculates the measurement. The RST can be setup to convert the sensor readings into a volumetric calculation (refer to pages 13-16) for common nonlinear tank types.

**0 = Value** (factory default): the reading will be calculated based solely on the assigned 4mA and 20mA Values in the Analog Parameters page.

**1 = Level:** subtracts the measured target distance from the user defined Empty Distance to provide a depth of level measurement. Required parameter settings: Units, Full Distance, Empty Distance.

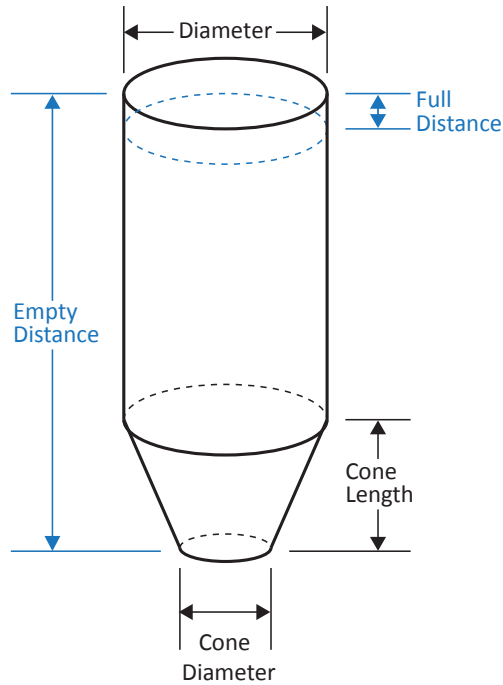
**2 = Standing Cylindrical Tank with Hemispherical Bottom**

Enter all dimensions shown below into the Tank Parameter fields and select the desired Volume Units.



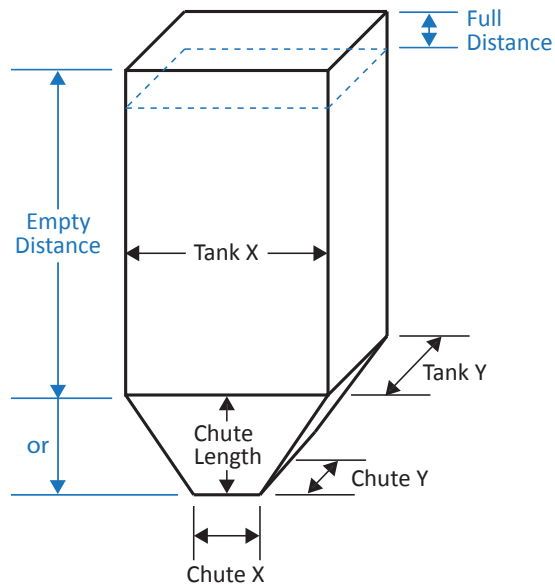
**3 = Standing Cylindrical Tank with Conical Bottom**

Enter all dimensions shown below into the Tank Parameter fields and select the desired Volume Units.



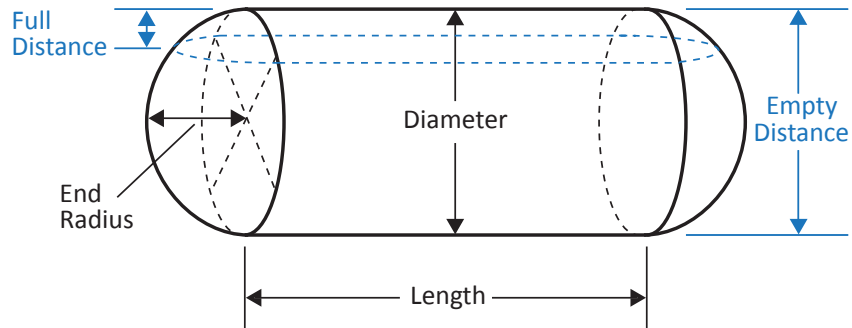
**4 = Standing Rectangular Tank with Chute**

Enter all dimensions shown below into the Tank Parameter fields and select the desired Volume Units.



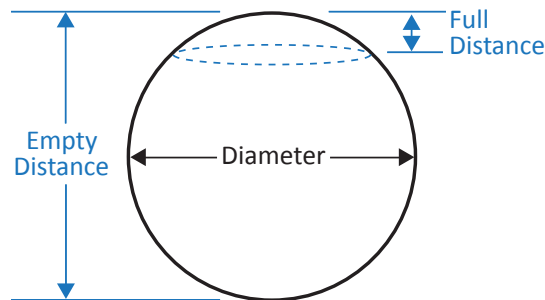
### 5 = Horizontal Cylindrical Tank with Spherical Ends

Enter all dimensions shown below into the Tank Parameter fields and select the desired Volume Units.



### 6 = Spherical Tank

Enter all dimensions shown below into the Tank Parameter fields and select the desired Volume Units.

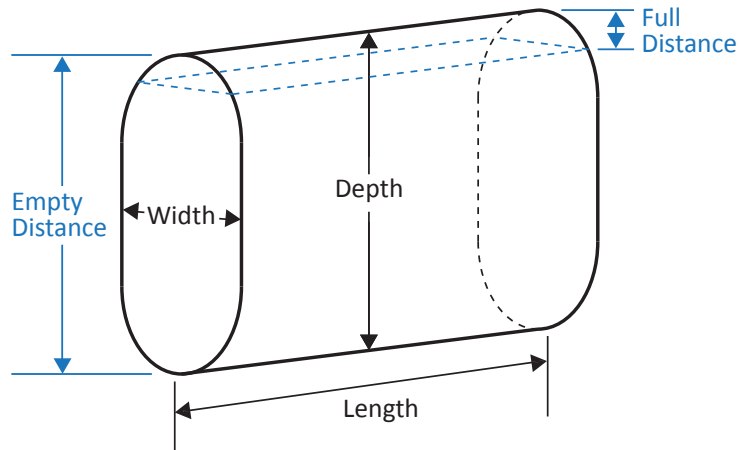


**7 = Pounds:** allows the user to apply a conversion multiplier to the calculated level reading. The conversion Multiplier is entered in Tank Parameter 1.

Example: suppose the level depth is calculated to be 5.45 feet (based on the Empty Distance setting). If the conversion Multiplier is set to 7.150, the calculated result would be  $(7.15 \times 5.45) 38.968$ .

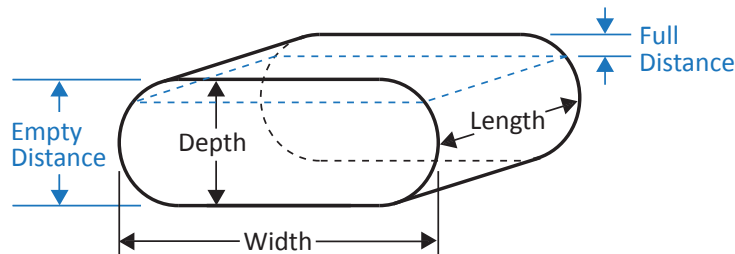
### 9 = Vertical Oval Tank

Enter all dimensions shown below into the Tank Parameter fields and select the desired Volume Units.



### 10 = Horizontal Oval Tank

Enter all dimensions shown below into the Tank Parameter fields and select the desired Volume Units.



**Volume Units:** used to select the units of measure when operating in one of the volumetric application types.

**Tank Parameters:** used to enter tank dimensions that are applicable to the application type selected.

**Units:** selects the unit of measure for all sensor parameters requiring dimensional measurement values.



## Modbus

The RST-5002 has the capability to interface (via RS-485) with up to 10 of APG's Modbus based sensors, such as the MNU and MP series level sensors. The RST acts as the Master device, querying each Modbus sensor and posting the readings to the Website on an assigned interval.

NOTE: each Modbus sensor will show up on the Website as a sub-sensor to it's RST master. For example, if the RST's serial number is L00001259, then Modbus sensor 1 would be displayed as L00001259\_1, while Modbus sensor 2 would be displayed as L00001259\_2, and so forth.

## Modbus TCP/IP

Using the RST's IP address and port number 502, the RST's readings can be polled at address number 11 on registers 30303-30304.

Example:

0001: Transaction Identifier  
 0000: Protocol Identifier  
 0006: Message Length (6 bytes to follow)  
 0B: The Unit Identifier (11 = 0B hex) Note: 0B is for the LOE/RST and 01 through 08 would be for the sensors attached to the LOE/RST  
 04: The Function Code (read Analog Output Holding Registers)  
 012E: The Data Address of the first register requested. (303 = 12E hex)  
 0002: The total number of registers requested. (read 2 registers 303 to 304)

Byte order (hex values)

00 01 00 00 00 06 0B 04 01 2E 00 02

RS485 Settings		
Definition	Range	Value
2400 Baud	Checked or UnChecked	<input type="checkbox"/> 2400 Baud
9600 Baud	Checked or UnChecked	<input checked="" type="checkbox"/> 9600 Baud
Numb of Sensors On Line	0 to 10	<input type="text" value="1"/>
Sensor Number to View	1 to 10	<input type="text" value="1"/>
New Sensor Number	0=No Change or 1 to 10	<input type="text" value="0"/>
RS485 Sample Rate	1 to 20 Seconds	<input type="text" value="1"/>

Change      Undo      Refresh      Home

### RS-485 Network Settings

**Baud Settings:** selects the communication baud rate between the RST and the attached Modbus sensors. Refer to the Modbus sensor's documentation for the appropriate setting (typically 9600 Baud).

**Number of Sensors On Line:** sets the number of Modbus sensors that are connected to the RST.

**Sensor Number to View:** used to select the sensor number to be viewed or programmed. The parameters of the selected sensor will populate the [RS-485 Modbus Input](#) pages, and it's readings can be viewed in the [RS-485 Holding Register](#) page.

**New Sensor Number:** used to change the address number of the sensor currently being viewed. Each Modbus sensor connected to the RST must be assigned a unique sensor address number (0 to 10). Duplicate sensor address numbers will cause communication errors.

**RS485 Sample Rate:** determines how often the RST polls any attached Modbus sensors.



## **Using the levelandflow.com website**

APG's levelandflow.com website provides access to sensor readings, as well as the capability to setup email/text-message alerts and remotely adjust sensor parameters (dependent on assigned user access rights).

### **General Navigation**

**Sites Tab:** displays the list of sites assigned to the user.

Click on a site box to view the list of the sensors that are assigned to that site.

Click on an individual sensor to access the readings data as well as to adjust sensor parameters (for those with access rights).

**Profile Tab:** allows the user to manage their profile.

NOTE: the Latitude, Longitude and Zoom setting are for setting your default view when entering the Google Maps feature. Simply click the Set button, find your location on the map and click on the location to set a marker. Ensure the zoom at the desired level and click the "Set User's Google map start location" button to save the location.

### **Data Logging and Retrieval**

**Begin Date and End Date:** used to set the time period for the data to be retrieved.

**Chart:** retrieves the data in the form of a line chart.

**Excel:** retrieves the data as an Microsoft Excel file.

**View Data:** retrieves a list of sensor readings along with the associated time stamp.

**Alarm History:** displays a list of alarms that have previously occurred.

**View Parameters:** displays a list of all sensor parameters as of the last time the sensor logged into the website.

## **Sensor Settings**

**Edit Info:** allows the user to assign description tags, set time zone information, and set a sensor location on the Google Maps feature.

Setting the Sensor Google Maps Locations: click on the “Edit Info” button and then click the “Set” button, find the sensor’s location on the map and click on it’s location to set a marker. Ensure the zoom at the desired level and click the “Set sensors Google map location” button to save the location.

**Edit Parameters:** allows users (with access rights) to adjustment sensor parameters.

NOTE: parameter changes made from the website will only take effect after the LOE reports to the website at the next scheduled call-in interval.

**Edit Alarms:** allows users (with access rights) to add alarms to send email or text message alerts whenever an alarm condition occurs and when the alarm condition clears (see website “Setting Website Alarms” section below).

## **Website Alarms**

There are three different types of website alarms: Immediate, Interval, and Heartbeat. Refer to descriptions below.

**Immediate Alarms:** results from an alarm condition on one of the RST’s solid state relays (Trip 1 & Trip 2). If one of the trip relays enters an alarm condition, the RST will report the alarm to the website without waiting for the next scheduled call-in interval.

NOTE: in addition to setting an alarm on the website, the RST’s trip relays must also be configured for website alarming. See “Activating Website Alarms” on page 11 for details.

**Interval Alarms:** alarm condition is based solely on the sensor readings as reported at the scheduled call-in interval. i.e. the alarm is a function of the website and is not generated by the sensor itself.

**Heartbeat Alarm:** once every 4 hours the website checks the call-in status of all sensors that have been assigned a heartbeat alarm. If the RST missed the last scheduled login, an alert message would then be sent to notify the user(s) that the sensor is not reported to the website.

### **Immediate Alarm Settings**

NOTE: the trip relay(s) must be configured for website alarming. See “Activating Website Alarms” on page 11 for details.

**Label:** sets the alarm label that will be included in the alert message title.

**Message:** allows the user to enter a brief message that will be included in the body of the email or text alert message.

**Call Type:** selects the type of alert message to be sent. If “None” is selected, the alarm condition will show on the website but no message will be sent.

**Sent:** (view only) shows the status of the Delay count (see Delay below).

**Delay:** sets the number of times the alarm must activate before an alarm message will be sent. Setting the Delay to 0 will disable the alarm.

**Auto Clear:** when checked, the Delay count will reset to 0 and begin again at the end of each cycle, resulting in a new alert message each time the Delay count is reached. If Auto Clear is unchecked, the alert message will be sent when the Delay count is reached, but no further messages will be sent unless the alarm condition clears and then reactivates and is processed though the Delay count filter. If the alarm condition clears and Auto Clear is unchecked, an “Alarm Clear” message will be sent to the contact.

**Contact:** selects the user to receive the alert message (based the email address and/or cell phone number in their user profile).

## **Interval Alarm Settings**

**Label:** sets the alarm label that will be included in the alert message title.

**Message:** allows the user to enter a brief message that will be included in the body of the email or text alert message.

**Call Type:** selects the type of alert message to be sent. If “None” is selected, the alarm condition will show on the website but no message will be sent.

**Alarm Point:** defines the value (in the unit of measure of the sensor reading) for the alarm condition. If the box below is checked, the alarm condition will occur whenever the sensor reading is greater than the Alarm Point value. If left unchecked, the alarm condition will be whenever the sensor reading is less than the Alarm Point value.

**Offset Clear:** sets an offset, starting from the Alarm Point and extending away from the alarm zone, that must be reached before the alarm condition will clear. This is to prevent repeated alarm chatter if the target is fluctuating back and forth across the Alarm Point.

**Sent:** (view only) shows the status of the Delay count (see Delay below).

**Delay:** sets the number of times the alarm must activate before an alarm message will be sent. Setting the Delay to 0 will disable the alarm.

**Auto Clear:** when checked, the Delay count will reset to 0 and begin again at the end of each cycle, resulting in a new alert message each time the Delay count is reached. If Auto Clear is unchecked, the alert message will be sent when the Delay count is reached, but no further messages will be sent unless the alarm condition clears and then reactivates and is processed through the Delay count filter. If the alarm condition clears and Auto Clear is unchecked, an “Alarm Clear” message will be sent to the contact.

**Contact:** selects the user to receive the alert message (based the email address and/or cell phone number in their user profile).

## **Heartbeat Alarm Settings**

**Label:** sets the alarm label that will be included in the alert message title.

**Message:** allows the user to enter a brief message that will be included in the body of the email or text alert message.

**Call Type:** selects the type of alert message to be sent. If “None” is selected, the alarm condition will show on the website but no message will be sent.

**Sent:** (view only) shows the status of the Delay count (see Delay below).

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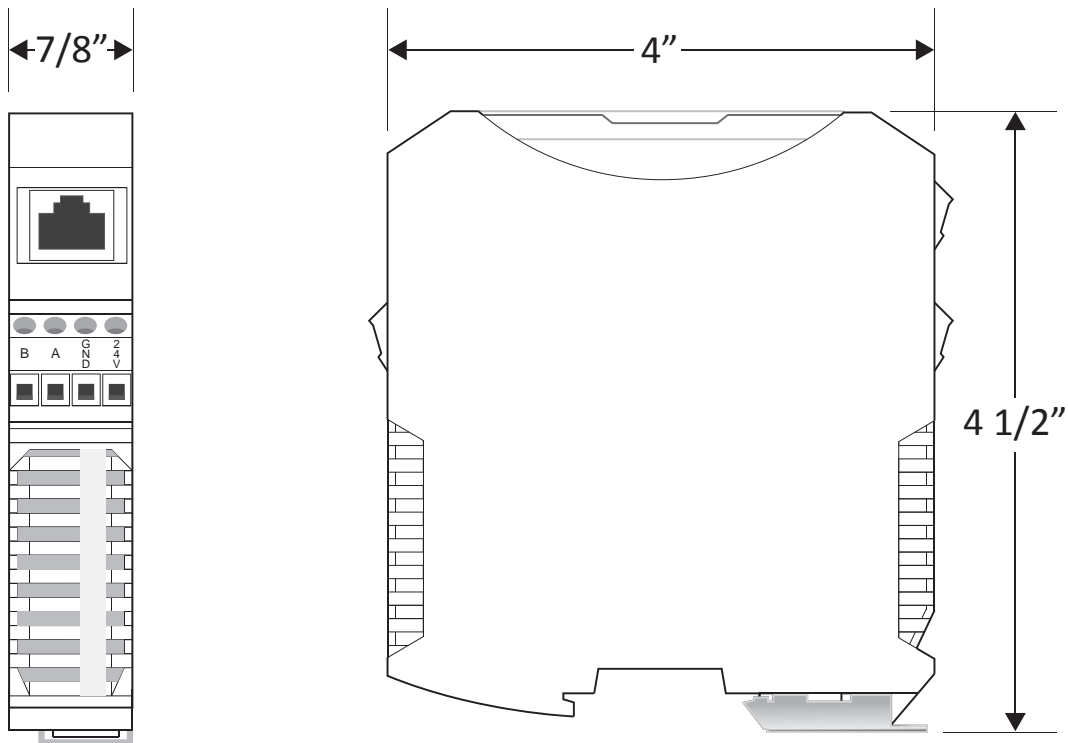
### **Adding a new contacts to an existing alarm**

If more than one contact needs to receive an email and/or text message alert, a duplicate alarm must be added and assigned to the new contact. Simply select the alarm you wish to duplicate, click on the “Copy” button, select the new “Contact”, and click the “Add” button.



## Specifications

Operating Voltage.....	48 Vdc POE (requires injector or switch) or 12-28 Vdc supply
Inputs .....	(1) 4-20 mA Up to 10 of APG’s Modbus based sensors (optional switched inputs available)
Total Current Draw .....	40 mA @ 48 Vdc
Maximum Power Rating .....	2.0 W
Available Outputs .....	Modbus TCP/IP (2) Isolated Solid State Relays (130 mA max.)
Housing .....	Polyamide
Mounting.....	33 mm Din-Rail
Resolution .....	12 bit
Adjustments .....	via internal webpage or levelandflow.com
Operating Temperature .....	-40 to 140°F (-40 to 60°C)
Cable Connection .....	RJ-45 + terminal strip for relays





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*APG...Providing tailored solutions for measurement applications*

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