

AUTOMATION

PRODUCTS
GROUP, INC.

Operator's Manual

MNU **series** **Ultrasonic Sensors**

Rev. B1 5/13



Automation Products Group, Inc.

APG...Providing tailored solutions for measurement applications

Tel: 1/888/525-7300 • Fax: 1/435/753-7490 • www.apgsensors.com • E-mail: sales@apgsensors.com

Table of Contents

<i>Warranty</i>	3
<i>Understanding Ultrasonics</i>	4-5
<i>Installation</i>	6-8
<i>Wiring</i>	9
<i>Sensor Communications</i>	10-17
<i>Parameter Descriptions</i>	16-32
<i>Web Alarming</i>	33-34
<i>Inspection and Maintenance</i>	35
<i>Specifications</i>	36
<i>Dimensions</i>	37

- **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.

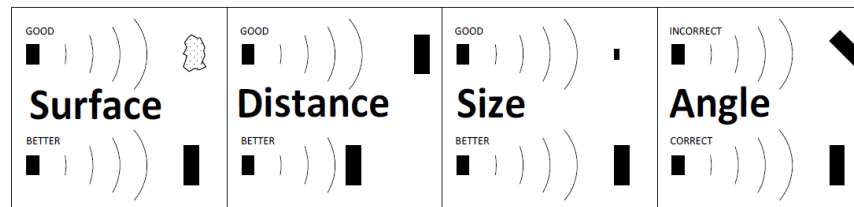
Warranty is specifically at the factory. Any on site service will be provided at the sole expense of the Purchaser at standard field service rates.

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".

• Understanding Ultrasonics

Ultrasonic sensors use a transducer to transmit bursts of ultrasonic sound waves. Each burst contains a series of pulsed sound waves that emit in the shape of a cone, reflect off the target, and are detected by the sensor. The time required for the sound waves to travel to and from the target is converted into a distance measurement by the sensor. Ultrasonic sensing is affected by several factors including the target surface, distance, size, and angle. The following considerations will help ensure the best possible target conditions.



Surface

The ideal target surface is hard and smooth. This type of surface will reflect a greater amount of signal than a soft or uneven surface. Sound wave absorbent materials, such as granules and powders, will reduce the operating range of the sensor and decrease measurement accuracy.

Distance

Sound wave attenuation increases as the distance traveled increases.

Therefore, targets at longer ranges require better reflective characteristics than targets that are closer to the sensor.

Size

A large object will have a greater surface area to reflect the signal than a smaller one. Therefore, a large target will be detected at a greater distance than a small target. The surface area recognized as the target will generally be the portion closest to the sensor.

Angle

The inclination of the object's surface in relation to the sensor face will affect the strength of the reflected sound waves. Surfaces perpendicular to the sensor will reflect more signal directly back to the sensor. If a surface is more than a few degrees off perpendicular, enough of the signal will be reflected away from the sensor that the target will not be detected. Generally speaking, a target angle greater than 5 degrees off perpendicular will not be detected. The target angle becomes increasingly critical as the distance to the target increases.

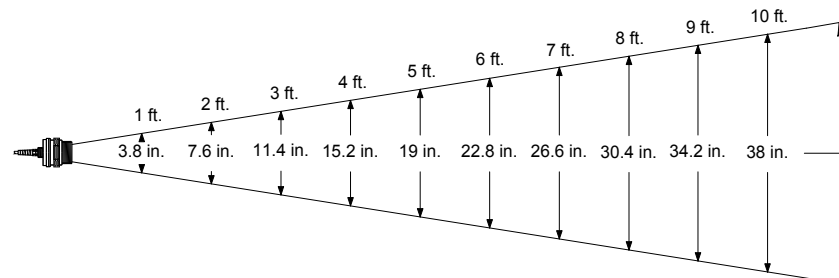
Environmental Conditions

Temperature, humidity, vapors, dust, and pressure can affect the sensor's performance. APG ultrasonic sensors are designed to compensate for many of these conditions. However, if the conditions are extreme, sensor performance can be degraded enough to require the use of a longer-range sensor than normal conditions would require. Ultrasonic sensors may not be suitable for applications with heavy chemical vapors (such as solvents or gasoline), heavy dust or when significant surface foam is present.

• Installation

Proper sensor mounting is critical for successful operation of an ultrasonic sensor. Using the following guidelines can help ensure trouble free installation and operation:

- Ensure that the sensor face is perpendicular to the target surface. If the target is more than a few degrees off perpendicular, it may not be detected. Targets at greater distances will require more precise sensor alignment.
- Mount the sensor in a location that provides an unobstructed column of air from the sensor to the target. The required width of the air column depends on several factors, including the angle and reflective characteristics of any potential targets on the edge of the column, the sensitivity setting of the sensor, the maximum distance to the target, and the reflective characteristics of the target itself. Generally speaking a 3 to 4 foot diameter unobstructed column is sufficient even at longer ranges.

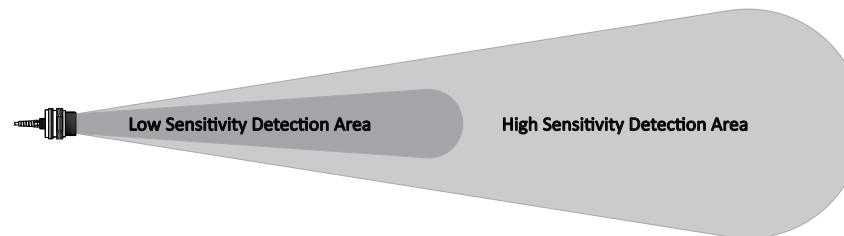


Typical beam spread of a sensor operating at maximum sensitivity

NOTE: Stilling pipes are an excellent solution for liquid level applications where an unobstructed path to the target is not feasible (see stilling pipe mounting on page 9 for details).

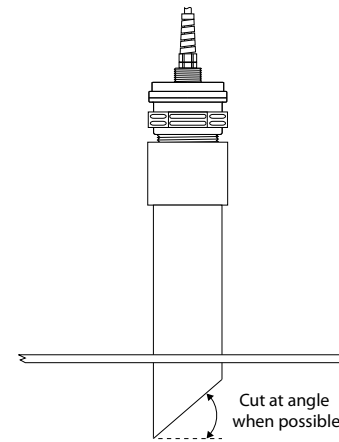
- When mounting outdoors, it's best to shade the sensor from direct sunlight. Direct sunlight can warm the sensor housing above the ambient temperature causing false temperature readings and overcompensation by the sensor.

- Always mount above the highest anticipated target level by at least the published minimum blanking distance. If a target enters into the blanking area, error in the detection will occur. It is always advisable to allow for sufficient headroom to ensure that the target does not enter the blanking area.
- Generally it is advisable to mount the sensor away from any vessel fill spouts. However, if heavy foam is expected, it is often helpful to mount the Sensor near a fill spout where the foam is being dispersed.
- Avoid mounting the sensor in the direct center of a tank with a significantly domed top. A domed top can act as parabolic dish, amplifying small undesired signals that may be present inside the tank.
- Avoid mounting the sensor in close proximity to tank walls, especially on tanks with corrugated walls or in applications where product buildup on the tank walls may occur.



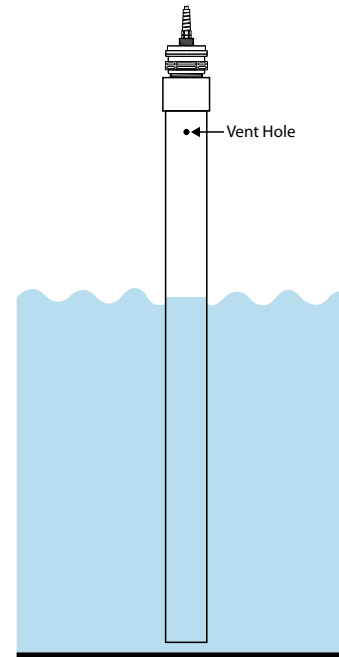
Stand Pipe Mounting

Stand pipes are used to provide headroom at the top of a tank when the target is expected to come closer to the sensor than the minimum blanking distance. It's very critical that the stand pipe be installed perpendicular to the target. This is especially important on longer range applications. The pipe must have smooth walls (no joints) and no burrs or obstructions. If possible, cut the end of the pipe at a 10°-45° angle (see drawing). Use the largest diameter pipe and shortest length possible. As a general rule, the diameter of the pipe should be 1/2 the length. The pipe ID must remain the same through it's entire length.



Stilling Pipe Mounting

Stilling pipes provide access to difficult areas and help eliminate problems with foam. The pipe must have smooth walls (no burrs or joints). Because the sound waves will concentrate and propagate down the inside walls of the tube, any irregularities on the tube walls may produce echo returns and cause false readings. Stilling pipes are limited to liquid targets that will not leave heavy deposits on the tube walls. Because the sound waves are confined inside the pipe, it is usually necessary to greatly reduce the sensors sensitivity and pulses settings. A vent hole must be provided at the top of the pipe. Be sure to keep the vent hole inside of the blanking area.

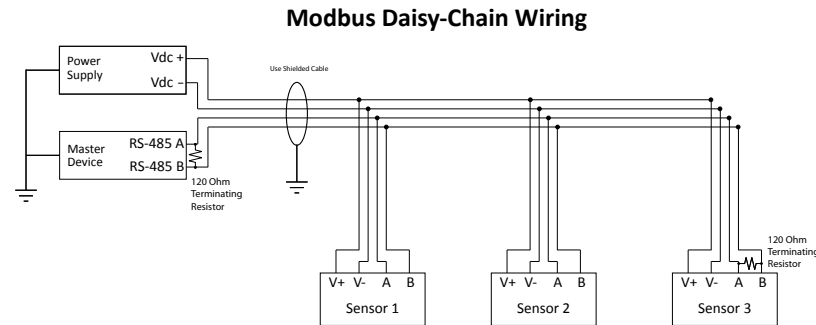


• Wiring

Always use shielded cable. It is recommended that twisted-pair cable be used between sensors when connecting multiple sensors to the Modbus network.

NOTE: Always use a high quality power supply that will deliver clean, stable voltage.

The MNU series sensors are wired in a daisy-chain configuration, as shown below. Each sensor should be connected individually and assigned a unique address before wiring the sensor into the Modbus network.



Mirco Connector:

Pin 1 (Brown)	+24 VDC
Pin 2 (White)	RS-485 A
Pin 3 (Blue)	DC Common
Pin 4 (Black)	RS-485 B

4-Conductor Cable:

Red	+24 VDC
Black	DC Common
White	RS-485 A
Green	RS-485 B

• Sensor Communications

The MNU sensor utilizes standard Modbus RTU protocol (RS-485). The MNU sensor can only operate as a slave device. For more information about Modbus RTU, please visit www.modbus.org.

The MNU sensor will transmit at (allow a minimum delay of 300 ms between transactions):

9600 bps
8 data bits
No parity
1 stop bit

Input Registers (0x04):

<u>Register</u>	<u>Returned Data</u>
30300	Raw Distance/Level Reading (in mm, unsigned)
30302	Temperature Reading (in °C, signed)
30303-30304	Calculated Reading (in selected units, without decimal place)

NOTE: the Calculated Reading will be returned as a whole number. In order to attain the true result, the Decimal Place setting must be taken into account. Refer to Decimal Place setting on page 21 for more information.

Holding Registers (0x03):

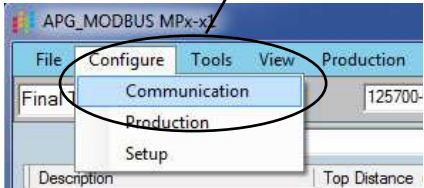
<u>Register</u>	<u>Function</u>	<u>Value Range</u>
40400	Device Address	1 to 255
40401	Units	1 to 3
40402	Application Type	0-10
40403	Volume Units	0 to 6
40404	Decimal Place	0 to 3
40405	Max Distance	0 to 10364 mm
40406	Full Distance	0 to 10364 mm
40407	Empty Distance	0 to 10364 mm

(continued)

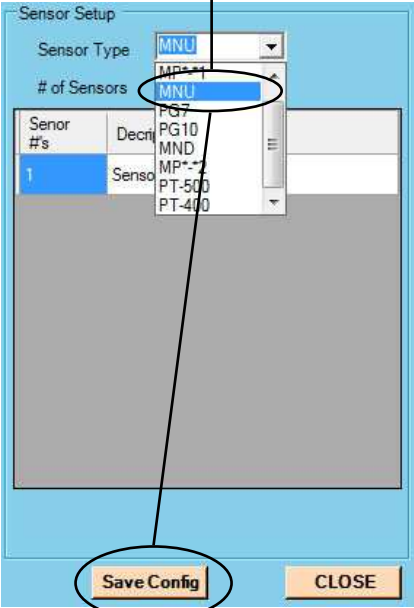
<u>Register</u>	<u>Function</u>	<u>Value Range</u>
40408	Sensitivity	0 to 100
40409	Pulses	0 to 20
40410	Blanking	0 to 10364 mm
40411	Gain Control	0 to 4
40412	Averaging	0 to 100
40413	Filter Window	0 to 10364 mm
40414	Out of Range Samples	0 to 255
40415	Sample Rate	50 to 1000 msec.
40416	Multiplier	1 to 1999
40417	Offset	+/- 10364 mm
40418-40419	reserved	n/a
40420	Temperature Compensation	0 = off, 1 = on
40421-40435	reserved	n/a
40436-40437	Parameter 1 Data	0 to 100,000 mm
40438-40439	Parameter 2 Data	0 to 100,000 mm
40440-40441	Parameter 3 Data	0 to 100,000 mm
40442-40443	Parameter 4 Data	0 to 100,000 mm
40444-40445	Parameter 5 Data	0 to 100,000 mm

Configuring Software Communications

Step 1: select "Communication" from the "Configure" menu.

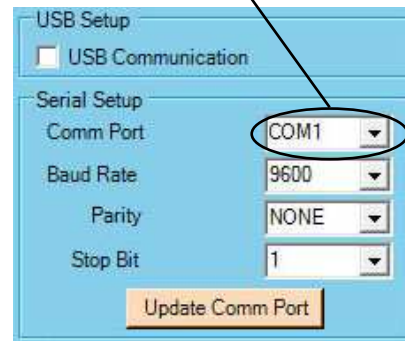


Step 2: select "MNU" from the Sensor Type menu, then click the "Save Config" button at the bottom of the screen.



Step 3: set the mode of communication by selecting the .

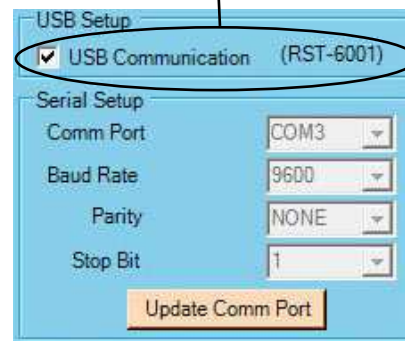
Select the appropriate Comm Port when using direct serial communications.



The screenshot shows the 'USB Setup' dialog box. Under the 'Serial Setup' section, the 'Comm Port' dropdown menu is selected and circled, showing 'COM1'. Other settings include 'Baud Rate' at 9600, 'Parity' at NONE, and 'Stop Bit' at 1. An 'Update Comm Port' button is located at the bottom of the dialog.

OR

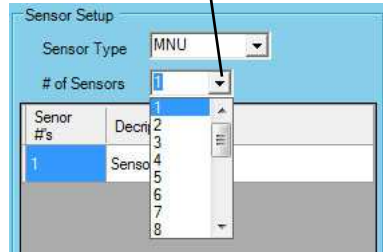
Check the “**USB Communications (RST-6001)**” box when using the RST-6001 communications module.



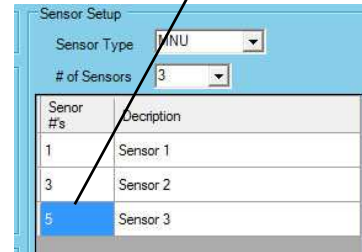
The screenshot shows the 'USB Setup' dialog box. The 'USB Communication (RST-6001)' checkbox is checked and circled. Under the 'Serial Setup' section, the 'Comm Port' dropdown menu is selected and shows 'COM3'. Other settings include 'Baud Rate' at 9600, 'Parity' at NONE, and 'Stop Bit' at 1. An 'Update Comm Port' button is located at the bottom of the dialog.

Configuring Software Communications for Multiple Sensors

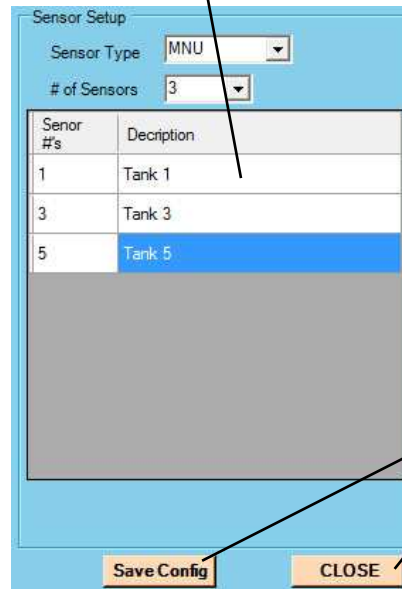
Step 1: select the total number of sensors you wish to read.



Step 2: change the "Sensor #" boxes to match the address' of the target sensors.



Step 3: Change the Description labels as desired. The Description is used to differentiate between sensors in other areas of the software.



Step 4: Click "Save Config" then "Close".

(continued)

Step 5: Click on “Start”. The sensor readings should populate as the software cycles through each sensor.



File Configure Tools Help STOP

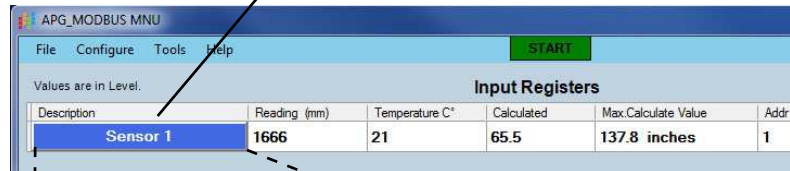
Input Registers

Description	Reading (mm)	Temperature C*	Calculated	Max. Calculate Value	Addr	Chart
Tank 1	491	22	19.33	180.00 inches	1	<input type="checkbox"/>
Tank 3	1172	20	384	0.00 inches	3	<input type="checkbox"/>
Tank 5	798	23	261	0.00 inches	5	<input type="checkbox"/>

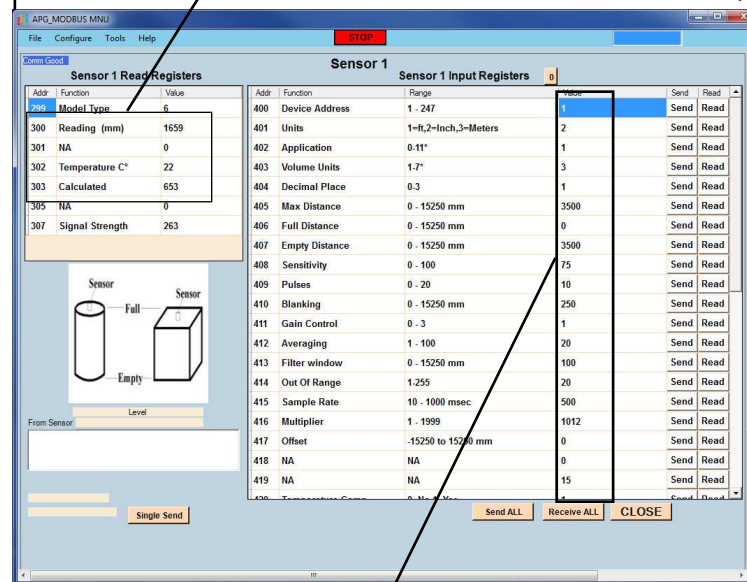
Step 6: Click on a sensor description to access that sensor’s parameters. Refer to “Using the Software Programming Window” on the next page for information on adjusting sensor parameters.

Using the Software Programming Window

Click on the desired sensor description to open that sensor's programming window.



Sensor readings are displayed in the Input Registers table.



The register values should automatically populate. If not, click "Receive All" to retrieve the register values from the sensor.

(continued on next page)

To change an individual parameter, click on the value you wish to change, enter the desired value, then click the adjacent "Send" button to implement the change.

Addr	Function	Range	Value	Send	Read
400	Device Address	1 - 247	1	Send	Read
401	Units	1=ft,2=Inch,3=Meters	2	Send	Read
402	Application	0-11*	1	Send	Read
403	Volume Units	1-7*	3	Send	Read
404	Decimal Place	0-3	1	Send	Read
405	Max Distance	0 - 15250 mm	3500	Send	Read
406	Full Distance	0 - 15250 mm	0	Send	Read
407	Empty Distance	0 - 15250 mm	3500	Send	Read
408	Sensitivity	0 - 100	75	Send	Read
409	Pulses	0 - 20	10	Send	Read
410	Blanking	0 - 15250 mm	250	Send	Read
411	Gain Control	0 - 3	1	Send	Read
412	Averaging	1 - 100	20	Send	Read
413	Filter window	0 - 15250 mm	100	Send	Read
414	Out Of Range	1-255	20	Send	Read
415	Sample Rate	10 - 1000 msec	500	Send	Read
416	Multiplier	1 - 1999	1012	Send	Read
417	Offset	-15250 to 15250 mm	0	Send	Read
418	NA	NA	0	Send	Read
419	NA	NA	15	Send	Read
420	Temperature Comp	0 - 1.4	0	Send	Read

Send ALL Receive ALL CLOSE

To send all the register values as currently listed, click "Send All"

To retrieve the register values saved in a sensor, click "Receive All"

A green window indicates successful communication.

A yellow window indicates a communication failure.

A red window indicates a value outside the allowable limits for the parameter.



• Parameter Descriptions

Device Address (1 to 255) (40400)

Each device within the Modbus network must be assigned a unique address. Each MNU sensor should be connected to the network individually and assigned an address. By default the each sensor is set to address 1.

Units (1 to 3) (40401)

Determines the unit of measure for the Calculated Reading (input registers 30303-30304) when in Application Types 1, 2 or 7 (see below).

Application Type (0 to 11) (40402)

Determines how the sensor calculates the readings.

Application Type 0: Distance to target

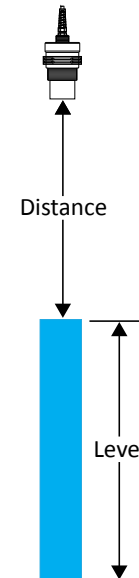
(measurement result in register 30300)

<u>Register</u>	<u>Function</u>	<u>Value Range</u>
40401	Units	1 to 3
40402	Application Type	0
40404	Decimal Place	0 to 3
40405	Max Distance	0 to 10364 mm

Application Type 1: Depth of level

(measurement result in register 30300)

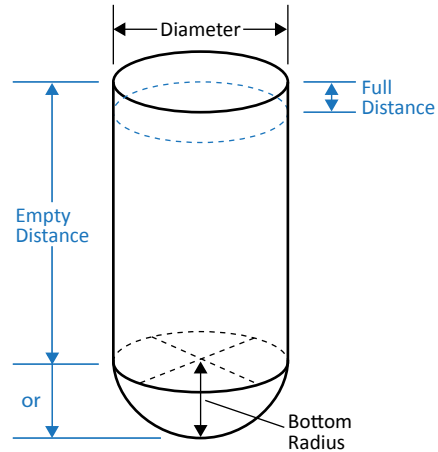
<u>Register</u>	<u>Function</u>	<u>Value Range</u>
40401	Units	1 to 3
40402	Application Type	1
40404	Decimal Place	0 to 3
40405	Max Distance	≥ Empty Distance
40406	Full Distance	Typically = Blanking Distance
40407	Empty Distance	0 to 10364 mm



Application Type 2: Volume of cylindrical tank with or without hemispherical bottom (measurement result in register 30303-30304)

Register	Function	Value Range
40402	Application Type	2
40403	Volume Units	1 to 7
40404	Decimal Place	0 to 3
40405	Max Distance	\geq Empty Distance
40406	Full Distance	Typically = Blanking Distance
40407	Empty Distance	0 to 10364 mm
40436-40437	Tank Diameter	0 to 100,000 mm
40438-40439	Bottom Radius	0 to 100,000 mm

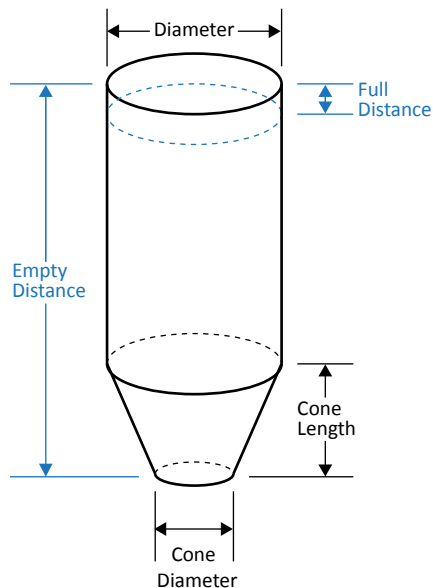
NOTE: for flat bottom tanks, set the Bottom Radius to 0.



Application Type 3: Volume of cylindrical tank with conical bottom

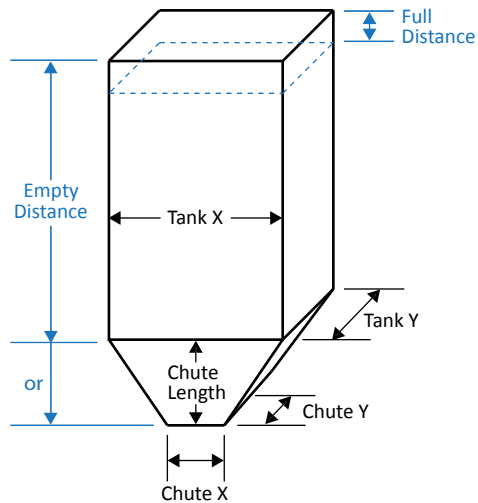
(measurement result in register 30303-30304)

<u>Register</u>	<u>Function</u>	<u>Value Range</u>
40402	Application Type	3
40403	Volume Units	1 to 7
40404	Decimal Place	0 to 3
40405	Max Distance	≥ Empty Distance
40406	Full Distance	Typically = Blanking Distance
40407	Empty Distance	0 to 10364 mm
40436-40437	Tank Diameter	0 to 100,000 mm
40438-40439	Cone Diameter	0 to 100,000 mm
40440-40441	Cone Length	0 to 100,000 mm



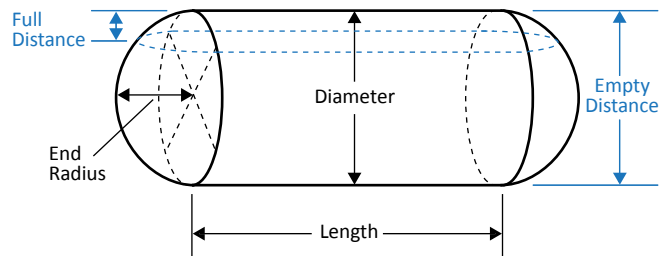
Application Type 4: Volume of rectangular tank with or without chute bottom
bottom (measurement result in register 30303-30304)

Register	Function	Value Range
40402	Application Type	4
40403	Volume Units	1 to 7
40404	Decimal Place	0 to 3
40405	Max Distance	≥ Empty Distance
40406	Full Distance	Typically = Blanking Distance
40407	Empty Distance	0 to 10364 mm
40436-40437	Tank X	0 to 100,000 mm
40438-40439	Tank Y	0 to 100,000 mm
40440-40441	Chute X	0 to 100,000 mm
40442-40443	Chute Y	0 to 100,000 mm
40444-40445	Chute Length	0 to 100,000 mm



Application Type 5: Volume of horizontal cylindrical tank with or without hemispherical ends (measurement result in register 30303-30304)

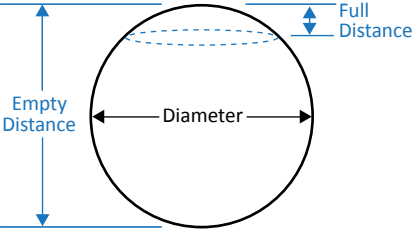
Register	Function	Value Range
40402	Application Type	5
40403	Volume Units	1 to 7
40404	Decimal Point	0 to 3
40405	Max Distance	\geq Empty Distance
40406	Full Distance	Typically = Blanking Distance
40407	Empty Distance	0 to 10364 mm
40436-40437	Tank Length	0 to 100,000 mm
40438-40439	Tank Diameter	0 to 100,000 mm
40440-40441	End Radius	0 to 100,000 mm



Application Type 6: Volume of spherical tank

(measurement result in register 30303-30304)

<u>Register</u>	<u>Function</u>	<u>Value Range</u>
40402	Application Type	6
40403	Volume Units	1 to 7
40404	Decimal Point	0 to 3
40405	Max Distance	≥ Empty Distance
40406	Full Distance	Typically = Blanking Distance
40407	Empty Distance	0 to 10364 mm
40436-40437	Tank Diameter	0 to 100,000 mm



Application Type 7: Pounds

Allows the user to apply a conversion multiplier to the calculated level reading.
(measurement result in register 30303-30304)

NOTE: the decimal place for the Multiplier is always assumed to be in the thousands position, therefore a setting of 206250 = 206.250 actual multiplier.

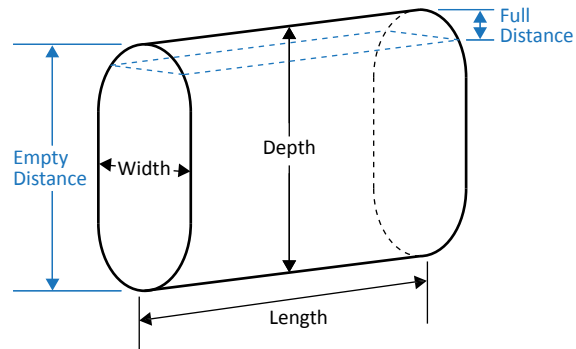
Example: suppose the product in a tank weighs 206.25 pounds for every inch of level. Assuming the Units are set to inches (Units = 2), the Multiplier would be 206250.

<u>Register</u>	<u>Function</u>	<u>Value Range</u>
40401	Units	1 to 3
40402	Application Type	7
40404	Decimal Place	0 to 3
40405	Max Distance	≥ Empty Distance
40406	Full Distance	Typically = Blanking Distance
40407	Empty Distance	0 to 10364 mm
40436-40437	Multiplier	0 to 1000000 (1000 = 1.000)

Application Type 9: Volume of vertical oval tank

(measurement result in register 30303-30304)

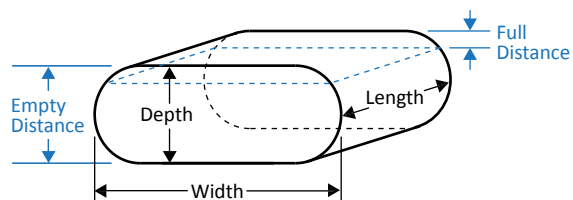
Register	Function	Value Range
40402	Application Type	9
40403	Volume Units	1 to 7
40404	Decimal Place	0 to 3
40405	Max Distance	\geq Empty Distance
40406	Full Distance	Typically = Blanking Distance
40407	Empty Distance	0 to 10364 mm
40436-40437	Tank Length	0 to 100,000 mm
40438-40439	Tank Depth	0 to 100,000 mm
40440-40441	Tank Width	0 to 100,000 mm



Application Type 10: Volume of horizontal oval tank

(measurement result in register 30303-30304)

Register	Function	Value Range
40402	Application Type	10
40403	Volume Units	1 to 7
40404	Decimal Place	0 to 3
40405	Max Distance	\geq Empty Distance
40406	Full Distance	Typically = Blanking Distance
40407	Empty Distance	0 to 10364 mm
40436-40437	Tank Length	0 to 100,000 mm
40438-40439	Tank Depth	0 to 100,000 mm
40440-40441	Tank Width	0 to 100,000 mm



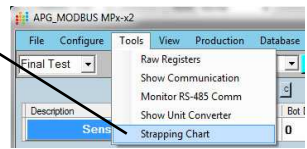
Application Type 11: Curve Fit (Strapping Chart)

Allows the sensor to mimic a tank strapping chart by using a 3rd degree polynomial equation to produce a “curve fit” approximation.

(measurement result in register 30303-30304)

Register	Function	Value Range
40401	Units	1 to 3
40402	Application Type	11
40404	Decimal Place	0 to 3
40406	Full Distance	Typically = Blanking
40407	Empty Distance	0 to 10364 mm
40436-40437	Parameter 1	0 to 100,000 mm
40438-40439	Parameter 2	0 to 100,000 mm
40440-40441	Parameter 3	0 to 100,000 mm
40442-40443	Parameter 4	0 to 100,000 mm

Open the APG Modbus software and select “Strapping Chart” from the “Tools” menu.



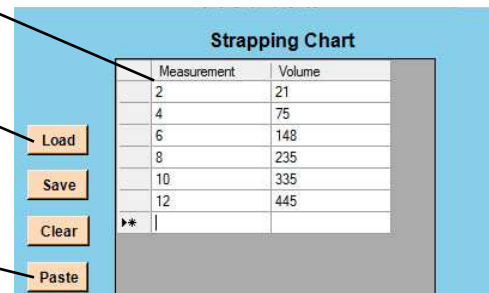
Enter the desired data points into the table.

OR

Use the “Load” button to recall a previously saved table.

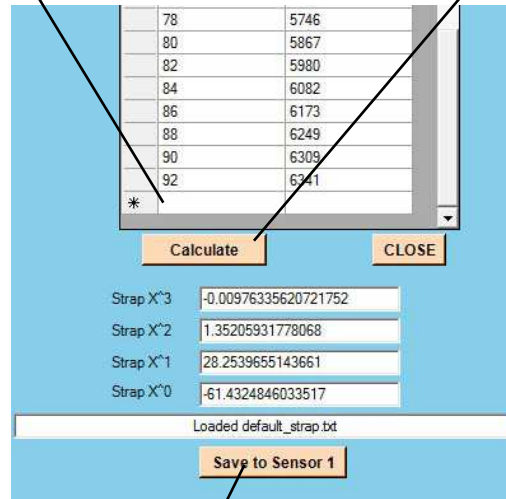
OR

Import data from an electronic document by copying the data and then using the “Paste” button to populate the table.



Once the all data points have been entered, click the "Calculate" button to determine the values required for the "curve fit" calculation.

NOTE: before clicking "Calculate" ensure that there is only one empty row following the last line of data (as shown). Use the keyboard "Delete" key to remove any addition empty rows.



Click the "Save to Sensor" button to populate the appropriate Holding Register fields (see below) and close the Strapping Chart window.

435	t2t	NA	0	Send	Read
436	Strap X ³	0 - 1000000 mm	-0.00976335620721752	Send	Read
438	Strap X ²	0 - 1000000 mm	1.35205931778068	Send	Read
440	Strap X ¹	0 - 1000000 mm	28.2539655143661	Send	Read
442	Strap X ⁰	0 - 1000000 mm	-61.4324846033517	Send	Read
444	NA	0 - 1000000 mm	0	Send	Read

Send ALL Receive ALL

Click the "Send All" button at the bottom of the Holding Register page to write the curve fit values to the sensor.

Volume Units (0 to 6) (40403)

Determine the unit of measure for the volumetric Application Types.

1 = Cubic Feet	4 = Cubic Meters	7 = Barrels
2 = Million Cubic Feet	5 = Liters	
3 = Gallons	6 = Cubic Inches	

Decimal Place (0 to 3) (40404)

Used to set the number of decimal places included in the Calculated Reading. The Calculated Reading will always be returned as a whole number.

Example: a Calculated Reading of 1126.658 (gallons, ft³, etc.) will be returned as follows:

Decimal Place = 0	Volume = 1127 (rounded to nearest whole number)
Decimal Place = 1	Volume = 11267 (divide by 10 to get true result)
Decimal Place = 2	Volume = 112666 (divide by 100 to get true result)
Decimal Place = 3	Volume = 1126658 (divide by 1000 to get true result)

Maximum Distance (0 to 10364 mm) (40405)

Sets the distance (beginning from the sensor face) to the point where the sensor will stop looking for target signals. Targets detected beyond the Maximum Distance value will be ignored by the sensor.

Full Distance (0 to 10364 mm) (40406)

Sets the distance (beginning from the sensor face) to the point where the tank is considered full.

Empty Distance (0 to 10364 mm) (40407)

Sets the distance (beginning from the sensor face) to the point where tank is considered empty. This will typically be the same as the tank depth unless the sensor is mounted on a stand pipe.

Sensitivity (0 to 100%) (40408)

Controls the level of amplification applied the returning target echoes (signals). The sensitivity setting is expressed as a percentage; 0 to 100%. When operating in Autosense mode, the Sensitivity setting acts as an upper limit constraint (refer to Gain Control below for more information on Autosense).

Pulses (0 to 20) (40409)

Controls the number of sound wave pulses being sent in each ultrasonic burst. The greater the number of pulses, the stronger the transmitted signal. When operating in Autosense mode, the Pulses setting acts as an upper limit constraint (refer to Gain Control below for more information on Autosense).

Blanking (0 to 10364 mm) (40410)

Sets the distance, beginning at the sensor face, to the point where the sensor will begin looking for target signals. All targets closer than the blanking distance will be ignored. The blanking should never be set to less than the minimum range specification of the sensor. If the target enters the blanking area, errant readings will occur.

Gain Control (0 = Manual Mode; 1 = Autosense Mode) (40411)

Determines how the sensor applies gain (amplification) to returning target echoes. In Manual mode the Sensitivity and Pules settings are applied as a static values. In Autosense Mode, the sensor self-adjusts the Pulses and Sensitivity levels (within the bounds of their respective settings) in order to optimize the signal level.

Averaging (1 to 20) (40412)

Defines the number of readings that will be averaged together to become the Calculated Value. Each qualified reading (see Filter Window and Out of Range Samples on next page) is placed into a first-in, first-out (FIFO) buffer and averaged with previous readings. A higher Averaging setting will result in smoother readings, but will also slow the response to rapid target changes.

Filter Window (0 to 10364 mm) (40413)

Sets the width of the target acceptance window. The target acceptance window is a zone, centered around the current target reading, within which any target detected will be considered legitimate and figured into the averaging buffer. Any target detected outside of the Window will be considered “out of range” and will be ignored based on the setting in the Out of Range Samples parameter (see below). The Filter Window extends in both directions from the current target reading. For example, if the sensor is detecting a target at 5 ft. and the Filter Window is set at 1 ft., then any target detected between 4 ft. and 6 ft. will be accepted.

Out of Range Samples (1 to 255) (40414)

Determines the number of consecutive target readings that fall outside of the acceptance window before the “out of range” target is recognized as being legitimate and figured into the averaging buffer. For example, suppose the Out Of Range Samples is set to 10. If a target is suddenly detected outside of the acceptance window, it will be ignored until it has been detected for 10 consecutive samples, at which point it will be qualified as a legitimate target. If the “out of range” target was detected for only 9 consecutive samples before moving out of the sensing area, it would never be acknowledged as a target and the reading would stay with the last qualified target sample.

Sample Rate (50 to 1000 msec) (40415)

Sets the interval between target readings. Options allow rates from 50 to 1000 msec. A higher Sample Rate will result in a more rapid response to target movements. Lowering the Sample Rate will help increase sensor lifespan and decrease the chance of detecting errant echoes. It is highly recommended that the Sample Rate be set only as fast as is necessary for the application. A sample rate of 500 to 1000 msec. is usually appropriate for slow moving level sensing applications.

Multiplier (0 to 1999) (40416)

Sets the conversion Multiplier that will be applied to the sensor readings. The default is 1000 (see note below) and typically does not need to be adjusted. However, since the speed of sound is not constant through all environments, the multiplier parameter allows the user to adjust for variations in atmosphere when maximum accuracy is required.

NOTE: the decimal place for the Multiplier is always assumed to be in the thousands position, therefore a setting of 1025 = 1.025 actual multiplier.

Offset (-10364 to 10364 mm) (40417)

Used to adjust the zero reference point of the sensor. When the Offset is set to 0, the zero reference of the sensor is at the face of the transducer. Setting the Offset to a negative number will move the zero reference backward (behind the sensor face), while a positive setting will move the reference forward (in front of the sensor face).

Temperature Compensation (0 = Off, 1 = On) (40420)

Used to enable or disable the internal temperature compensation of the sensor. Enabling the internal temperature compensation can reduce the effects of temperature changes by 50% or more, depending on the temperature gradient through the sensing range.

Parameter Data (0 to 100,000 mm) (40436 to 40445)

The Parameter Data registers are used to enter tank dimension or conversion multipliers for all the volumetric Application Types (types 2-10).

•Web Alarming (40430 to 40435)

When the MNU is interfaced with an LOE or RST-5002 web-enabled master device, it can be configured to generate website alarms via levelandflow.com (refer to the LOE or RST-5002 user manual for more information about website alarms and using levelandflow.com).

Trip Alarm 1 (40430) or Alarm 2 (40433) Distance

Sets the level (in mm), beginning the bottom of the stem, to the first (lowest) actuation point (refer to next page for more information).

Trip Alarm 1 Window (40431 or 40434)

Sets the level (in mm), beginning from the Trip Distance location, to the secondary actuation point (refer to next page for more information).

Trip Alarm 1 Type (40432 or 40435)

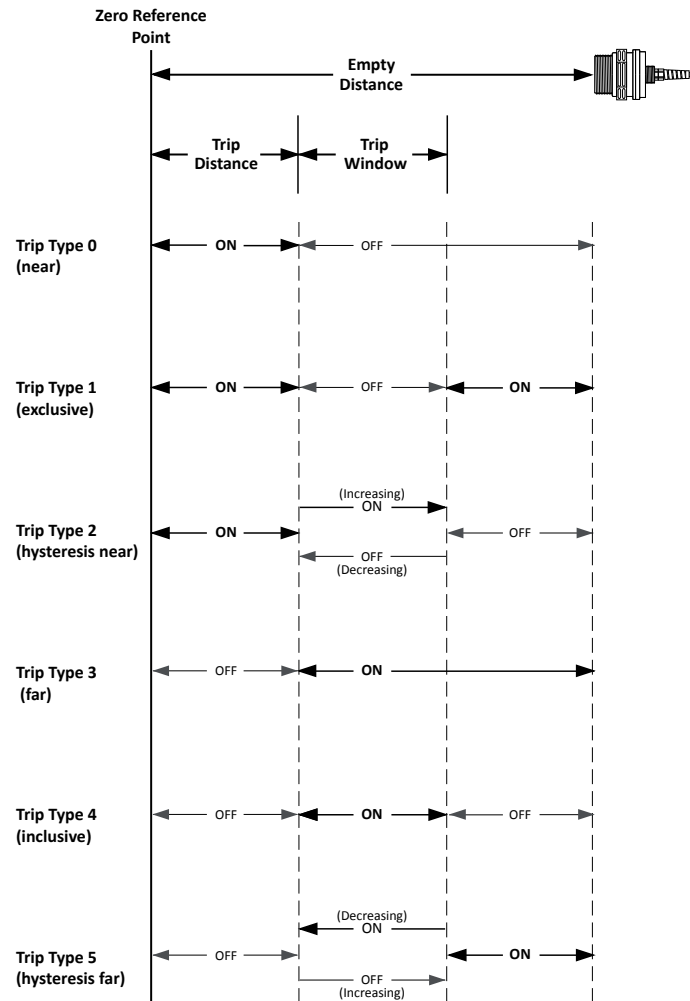
Determines the operational logic performed by the Trip Alarm (refer to chart on next page for more information).

Configuring Trip Alarm Types for Website Alarming:

(refer to Trip Types chart on next page)

Placing a “1” in front of any of the Trip Types designates an active trip point as an alarm condition. For example; Trip Type 3 would be designated as **13**, and would initiate a website alarm whenever the trip is active (on).

Placing a “2” in front of any of the Trip Types designates an inactive trip point as an alarm condition. For Example; Trip Type 3 would be designated as **23**, and would initiate a website alarm whenever the trip is inactive (off).



Type 6: n/a

Type 7 (Loss of Echo): the relay will activate if the sensor enters a loss of echo condition (no targets detected).

Type 8 n/a

Type 9 (Rate of Change): allows the user to define a maximum rate of change (distance over time), which if exceeded will activate an alarm. The Trip Distance parameter is used to define the time value, and the Trip Window parameter is used to define the distance value.

- **Inspection and Maintenance**

The MNU series sensor requires little maintenance, but should be inspected periodically to ensure the sensor remains in good working order. Keep the sensor clean from heavy buildup on the sensing face. On models equipped with a micro-connector cable connection, ensure that the connection is securely tightened and sealed against the elements.

- **Specifications**

Operating Range

- MNU-5400:** 4 to 72 in. (101 to 1829 mm)
- MNU-7400:** 6 to 144 in. (150 to 3658 mm)
- MNU-6400:** 10 to 180 in. (178 to 4572 mm)
- MNU-2400:** 1 to 25 ft. (305 to 7620 mm)
- MNU-3400:** 1.5 to 40 ft. (458 to 12192 mm)

Operating Voltage: 12-24 Vdc

Operational Current Draw: 35 mA @ 12 Vdc; 20 mA @ 24 Vdc

Housing: PBT/Polycarbonate blend

Mounting

- MNU-2424, 5424, 6424, 7424:** 2 in. NPT
- MNU-3434:** 3 in. NPT

Transducer Type

- MNU-2424, 5424, 6424, 7424:** PVDF faced ceramic
- MNU-3434:** PBT/Polycarbonate faced ceramic

Environmental Rating: NEMA 6P

Sample Rate: 1 to 50 Hz (programmable)

Response Time: Programmable (50 ms minimum)

Resolution: 0.1 in. (2.5 mm)

Accuracy: +/- 0.25% of detected range (with no temperature gradient)

Sensor Adjustments: Modbus RTU (RS-485).

Operating Temperature: -30 to 140 °F (-34 to 60 °C)

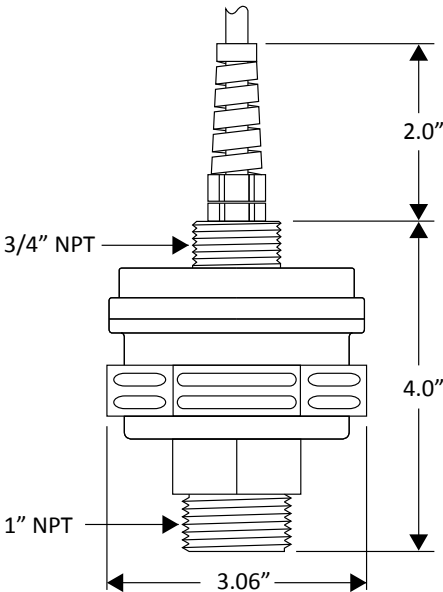
Beam Pattern: 9° off-axis (maximum)

Electrical Connection: 4-conductor twisted-pair cable or 4-pin micro-connector

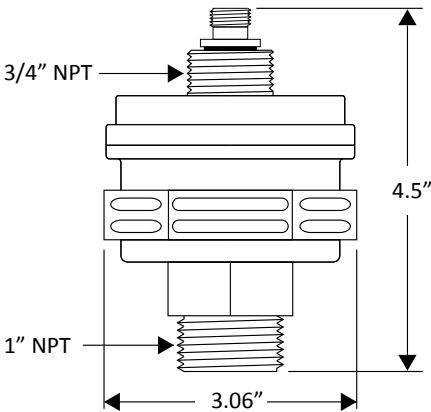
Frequency

- MNU-5424:** 170 kHz
- MNU-7424:** 90 kHz
- MNU-6424 & 2424:** 69 kHz
- MNU-3434:** 43 kHz

MNU-5414

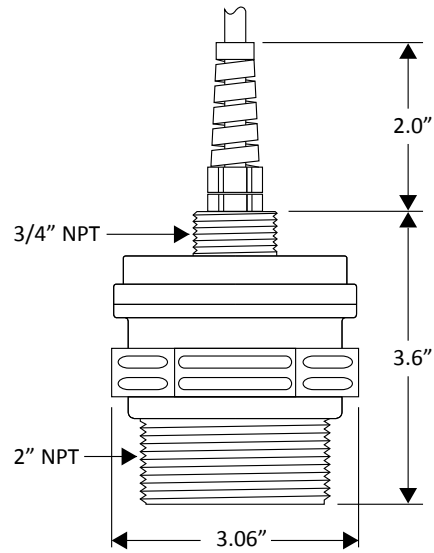


MNU-5414-M

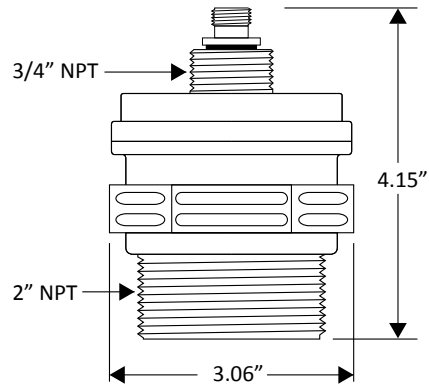


• Dimensions

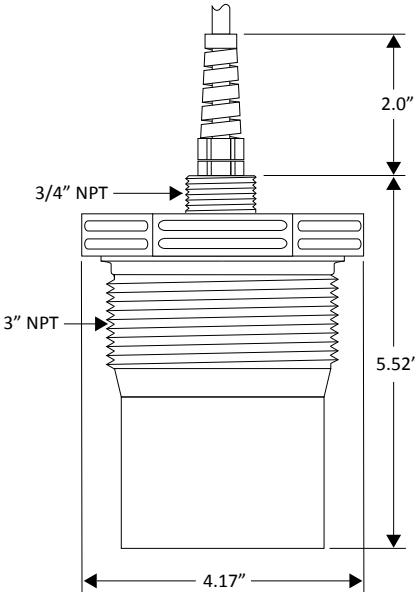
MNU-2424, 5424, 6424, 7424



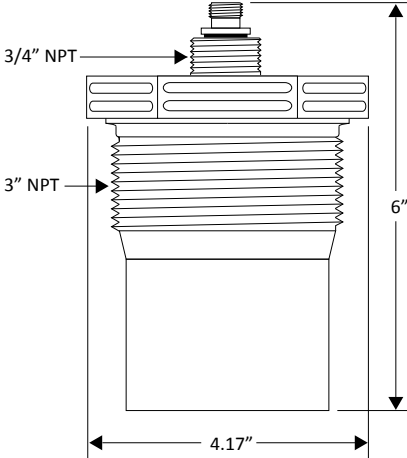
MNU-2424-M, 5424-M,
6424-M, 7424-M



MNU-3434



MNU-3434-M



AUTOMATION

PRODUCTS
GROUP, INC.

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



Automation Products Group, Inc.

Tel: 1/888/525-7300

1/435/753-7300

Fax: 1/435/753-7490

e-mail: sales@apgsensors.com

www.apgsensors.com

Automation Products Group, Inc.

1025 W. 1700 N.

Logan, UT 84321