

PT-405

Explosion Proof, Heavy Duty Pressure Transmitter

User Manual



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 **NOTE:** Find additional product documents, specifications, accessories, and more on the PT-405 online product page.
Go to: apgsensors.com/product/pt-405

INTRODUCTION

Thank you for purchasing a Series PT-405 Explosion Proof Heavy Duty Pressure Transmitter from APG. We appreciate your business! Please take a few minutes to familiarize yourself with your PT-405 and this manual.

Series PT-405 pressure transmitters offer reliability over a wide range of pressures and in harsh industrial conditions and hazardous locations. It is certified explosion proof for hazardous areas in the US and Canada by CSA for Class 1, Division 1 environments and has a single seal for the highest safety factor. The integrated electronics, wide operating temperature range, and durability make the PT-405 the perfect instrument for static and dynamic pressure measurements with an amplified output signal.

Reading your label

Every APG instrument comes with a label that includes the instrument's model number, part number, serial number, and a wiring pinout table. Please ensure that the part number and pinout table on your label match your order. The following electrical ratings and approvals are also listed on the label. Please refer to the Certificate of Compliance on our website for further details.

Electrical ratings



Rated: 9 to 28 Volts DC, 4-20mA / 0-5VDC / 0-10VDC / RS485

Class I Division 1, Groups C, D T4

$-40^{\circ}\text{C} \leq T_a \leq 85^{\circ}\text{C}$

Single Seal.

Maximum Working Pressure: 30,000 psi

Conditions of Acceptability

1. The equipment must be connected to a certified class 2 SELV power supply.
2. The conduit connected to the equipment must be sealed within 18 inches of the equipment enclosure.
3. The "x" in the model designation may be any alpha-numeric character, to denote minor mechanical or electrical options, not affecting safety.

ⓘ IMPORTANT: Your PT-405 MUST be installed as indicated in Physical Installation Notes (page 3) to meet listed approvals. Faulty installation will invalidate all safety approvals and ratings.

WARRANTY STATEMENT

This product is covered by APG's warranty to be free from defects in material and workmanship under normal use and service of the product for 24 months. For a full explanation of our Warranty, please visit <https://apgsensors.com/warranty-returns/>. Contact Technical Support to receive a Return Material Authorization before shipping your product back.

Repair and Returns

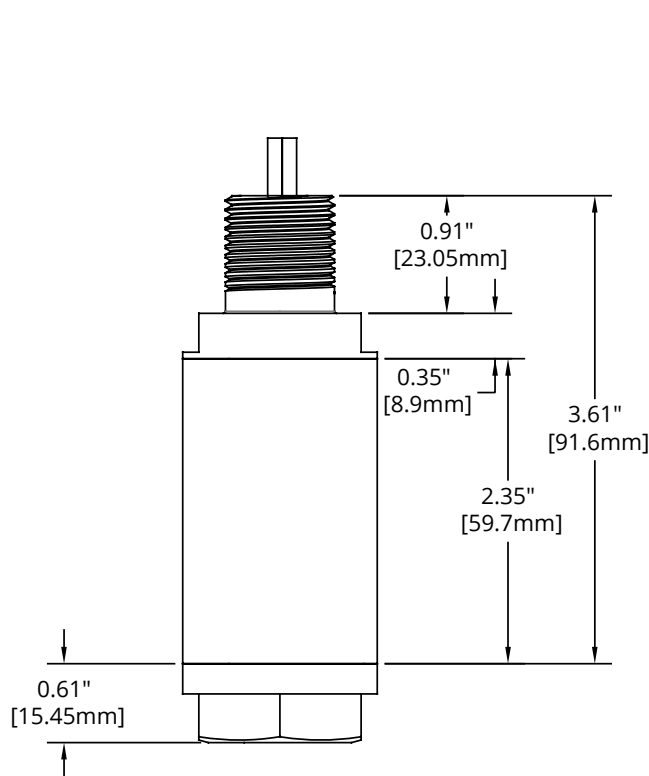
Should your PT-405 series pressure transmitter require service, please contact the factory via phone, email, or online chat. We will issue you a Return Material Authorization (RMA) number with instructions.

- Phone: 888-525-7300
- Email: sales@apgsensors.com
- Online chat at www.apgsensors.com

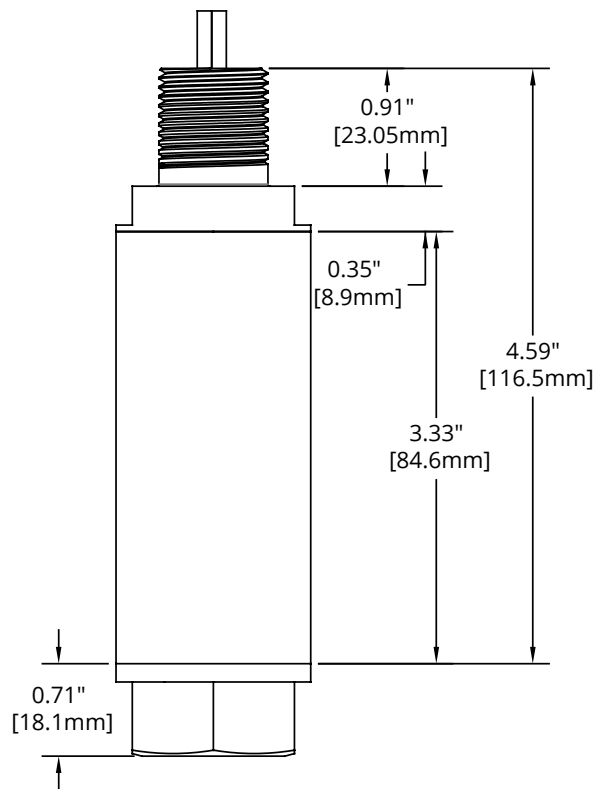
Please have your PT-405's part number and serial number available.

CHAPTER 1: DIMENSIONS AND WIRING

Dimensions



PT-405 Short Can (E60 option)
with female NPT Process connection



PT-405 Long Can (E60L option)
with female NPT Process Connection

Total length of PT-405 is dependent on Process Connection

Electrical Connectors, Pinout Table, and Supply Power Table

PT-405 Series Pin Out Table

Pigtail		4-20 mA	0-5 / 0.5-4.5 / 1-5 VDC	0-10 VDC	RS-485
	Red	+ Excitation	+ Excitation	+ Excitation	+ Excitation
	Grn	No wire	+ Output	+ Output	B (Tx-)
	Wht	No wire	- Output	- Output	A (Tx+)
	Blk	- Excitation	- Excitation	- Excitation	- Excitation
	Grn/Ylw	Case Ground	Case Ground	Case Ground	Case Ground

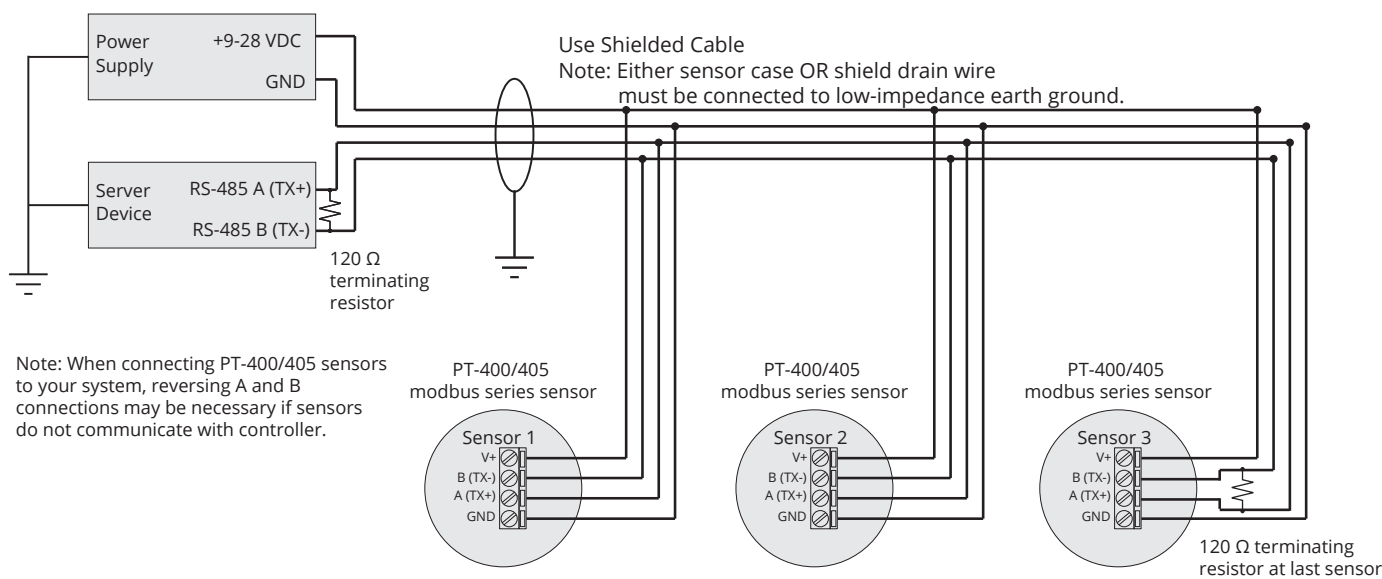
N/C indicates no connection
For alternate pinouts, please consult factory

PT-405 Series Supply Power Table

	4-20 mA	0-5 / 0.5-4.5 / 1-5 VDC	0-10 VDC	RS-485
Power Supply	9-28 VDC	9-28 VDC	12.5-28 VDC	9-28 VDC

ⓘ IMPORTANT: Some Modbus manufacturers use reversed Tx+/Tx- pins. When connecting to your system, ensure A to A and B to B connections.

Modbus System Wiring



CHAPTER 2: INSTALLATION AND REMOVAL PROCEDURES AND NOTES

Tools Needed

- Wrench sized appropriately for your PT-405's process connection.
- Thread tape or sealant compound for threaded connections.

Physical Installation Notes

The PT-405 should be installed in an area--indoors or outdoors--which meets the following conditions:

- Ambient temperature between -40°C and 85°C (-40°F to +185°F)
- Relative humidity up to 100%
- Altitude up to 2000 meters (6560 feet)
- IEC-664-1 Conductive Pollution Degree 1 or 2
- IEC 61010-1 Measurement Category II
- No chemicals corrosive to stainless steel (such as NH_3 , SO_2 , Cl_2 etc.)
- Ample space for maintenance and inspection
- Explosion proof conduit, with seal installed within 18 inches, must be used for cable connection to PT-405
- Class 2 SELV power supply

❗ IMPORTANT: Incorrectly connecting your PT-405 Pressure Transmitter to explosion proof conduit, or using unapproved conduit, will void the protection rating of your PT-405.

Mounting Instructions

Mounting your pressure transmitter is easy if you follow a few simple steps:

- Ensure that the fitting on your sensor matches the fitting on your tank/vessel/pipe/etc. If the fittings do not match, do not attempt to install the sensor. Contact the factory immediately.
- Never over-tighten the sensor. This can compress the diaphragm, changing how it reacts to pressure. In all cases, tighten the sensor as little as possible to create an adequate seal. On straight threads, tighten only until you feel the o-ring compress - making sure you don't damage or extrude the o-ring.
- Always use thread tape or sealant compound on tapered threads. Wrap thread tape in the opposite direction of the threads so it does not unravel as you screw the sensor into place. Unraveling can cause uneven distribution and seal failure. For straight threads, use an o-ring.
- Always start screwing in your sensor by hand to avoid cross-threading. Thread failure can be a problem if you damage threads by over-tightening them or by crossing threads.

Electrical Installation

- Check the pinout table on your PT-405 against your order.
- Check that your electrical system wiring matches the pinout table on your PT-405.
- Connect cable from PT-405 to your control system.

 **DANGER:** Incorrectly connecting your PT-405 Pressure Transmitter to your control system could result in injury or death.

Removal Instructions

Removing your PT-405 from service must be done with care. It's easy to create an unsafe situation, or damage your sensor, if you are not careful to follow these guidelines:

- Make sure the pressure is completely removed from the line or vessel where your sensor is installed. Follow any and all procedures for safely isolating any media contained inside the line or vessel.
- Remove the sensor with an appropriately sized wrench (per your process connection).
- Clean the sensor's fitting and diaphragm of any debris (see General Care) and inspect for damage.
- Store your sensor in a dry place, at a temperature between -40°C and 85°C (-40°F to +185°F).

 **DANGER:** Removing your PT-405 Pressure Transmitter while there is still pressure in the line could result in injury or death.

CHAPTER 3: MAINTENANCE

General Care

Your PT-405 series pressure transmitter is very low maintenance and will need little care as long as it is installed correctly. However, in general, you should:

- Keep the transmitter and the area around it generally clean.
- Avoid applications for which the transmitter was not designed, such as extreme temperatures, contact with incompatible corrosive chemicals, or other damaging environments.
- Inspect the threads whenever you remove the transmitter from duty or change its location.
- Avoid touching the diaphragm. Contact with the diaphragm, especially with a tool, could permanently shift the output and ruin accuracy.
- Clean the diaphragm or the diaphragm bore with extreme care. If using a tool is required, make sure it does not touch the diaphragm.

Zero Trimming

- Remove unit from Hazardous Location prior to performing Zero Trimming procedure.
- Remove protective screw(s) with 5/64 allen wrench.
- Ensure that the transmitter is at 0 psig or 0 psia (vacuum if absolute).
- Using a jeweler's screwdriver or a suitable instrument, adjust the "Z" pot until you have a 4 mA, 0 V, 0.5 V, or 1 V output.
- Replace protective screws(s) when finished.

❗ IMPORTANT: Do not make changes to the Span adjustment (the "S" pot to the right, see Figure 3.1) as part of the zero trimming. The Span should only be changed as part of the recalibration of a gauge with a known pressure source.

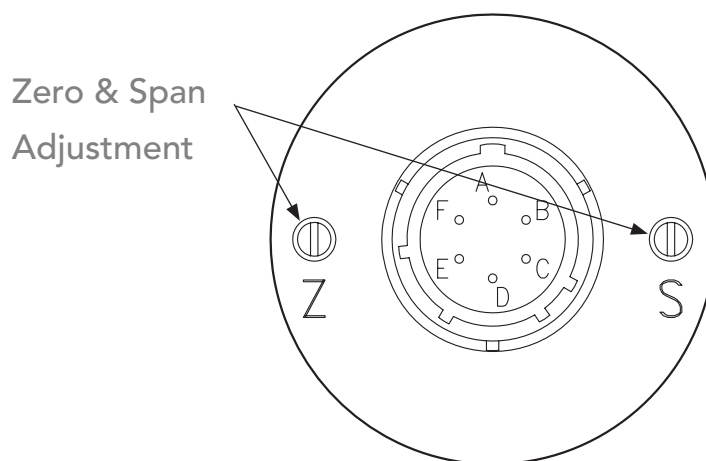


Figure 3.1

⚠ DANGER: Protective screws must be replaced using 28 oz-in of torque to create seal.

Re-Calibration

This procedure requires a known pressure source of at least $\pm 0.1\%$ accuracy in order to fully utilize the accuracy potential of the PT-405. (If not available, you can return it to the factory for re-calibration.)

- Remove unit from Hazardous Location prior to recalibration.
- Ensure that the transmitter is at 0 psig or 0 psia (vacuum if absolute), and adjust zero as per instructions for zero trimming.
- Apply full scale pressure to the pressure port and adjust the Span ("S") pot (on the right of Figure 3.1) until the full scale signal is reached.
- Re-check zero and re-adjust the zero ("Z") pot if required.
- Repeat previous two steps until no further adjustment is required.

 **NOTE:** You may also return the PT-405 to the factory for repair and/or adjustment.

 **IMPORTANT:** Do not adjust Zero or Span potentiometer while your PT-405 is installed in a Hazardous Location. Removing the protective screws to access the potentiometers invalidates the Hazardous Location approvals until they are replaced.

Repair and Returns

Should your PT-405 series pressure transmitter require service, please contact the factory via phone, email, or online chat. We will issue you a Return Material Authorization (RMA) number with instructions.

- Phone: 888-525-7300
- Email: sales@apgsensors.com
- Online chat at www.apgsensors.com

Please have your PT-405's part number and serial number available. See Terms & Conditions (www.apgsensors.com/warranty-returns/) for more information.

PROGRAMMING

Modbus Programming

PT-405 Modbus series sensors use standard Modbus RTU protocol (RS-485). The sensors can only operate as client devices. Sensor default transmission settings are 9600 Baud, 8 Bits, 1 Stop Bit, No Parity, and require a minimum delay of 300 ms between transactions to return the contents of all registers. Commands returning fewer registers will require shorter delays. See PT-405 Modbus Register Lists for more details.

NOTE: For more information about Modbus RTU, please visit www.modbus.org.

NOTE: For APG Modbus programming instructions, or to download APG Modbus software, please visit our website at: <https://www.apgsensors.com/resources/product-resources/software-downloads/>.

PT-405 Modbus Register Lists

The registers listed below are reference addresses. To convert a reference address to an offset address, remove the first digit then subtract one.

Example 1: Reference address = 30300 → Offset register = 299

Example 2: Reference address = 40400 → Offset register = 399

Input Registers (0x04)

Register	Returned Data
30299	Model Type
30300	Pressure (L5 – PSI; L31 – mmH ₂ O)
30301	N/A
30302	Temperature Reading (in °C, signed)
30303–30304	Calculated (raw)
30305–30306	N/A
30307	N/A
30308	Battery Voltage
30309	Trip 1 Status
30310	Trip 2 Status

NOTE: The Calculated Readings will be returned without a decimal place. In order to obtain the true result, the Decimal Place setting must be taken into account.

Holding Registers (0x03)—PT-405 L5 pressure series

Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	0 to 16
40402	Application Type	0 or 8
40403	N/A	N/A
40404	Decimal (Calculated)	0 to 3
40405	Max Pressure	*0 to 32,000 PSI
40406	Full Pressure	0 to 32,000 PSI
40407	Zero Offset	-15,000 to 30,000 PSI
40408	Pressure Decimal	0 to 3
40409	A/D Gain	*1, 2, 4, 8, 16, 32, 64, or 128
40410	N/A	N/A
40411	Parameter Default	0 = No; 1 = Restore Defaults
40412	Averaging	0 to 10
40413	Calibration Value	*-32,767 to 32,767
40414	Calibration Flag	*0 to 300
40415	Sample Rate	10 to 1000 milliseconds
40416	Scale	*0 to 65,535
40417	Offset	-20,000 to 20,000
40418	Voltage Offset	-20 to 20
40419	Baud Rate	0 to 3 (2400, 9600, 19200, 38400)
40420	Parity	0 to 2 (none, even, odd)
40421	Stop Bit	0 or 1 (0 = 1 stop bit; 1 = 2 stop bits)
40422–40423	Pressure X ³	*N/A
40424–40425	Pressure X ²	*N/A
40426–40427	Pressure X ¹	*N/A
40428–40429	Pressure X ⁰	*N/A
40430	Trip 1 Pressure	-15,000 to 30,000 PSI
40431	Trip 1 Window	0 to 30,000 PSI
40432	Trip 1 Type	0 to 29
40433	Trip 2 Pressure	-15,000 to 30,000 PSI
40434	Trip 2 Window	0 to 30,000 PSI
40435	Trip 2 Type	0 to 29
40436–40437	Multiplier	0.0001 to 99.9999 (float)
40438–40439	Description	A to Z, 0 to 9, /, -, +* (16 char)
40446	Temperature Offset	-20 to 20
40447–40448	Temperature X ³	*N/A
40449–40450	Temperature X ²	*N/A
40451–40452	Temperature X ¹	*N/A
40453–40454	Temperature X ⁰	*N/A

*Setting is factory calibrated. Do not adjust.

Holding Registers (0x03)—PT-405 L31 level series

Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	1 = Feet, 2 = Inches, 3 = Meters
40402	Application Type	0 to 11
40403	Volume Units	1 to 7
40404	Decimal (Calculated)	0 to 3
40405	Max Level	*0 to 65,535 mm
40406	Full Level	0 to 65,535 mm
40407	Zero Offset	0 to 610 mm
40408	N/A	N/A
40409	A/D Gain	*1, 2, 4, 8, 16, 32, 64, or 128
40410	Specific Gravity	1 to 2,000
40411	Parameter Default	0 = No; 1 = Restore Defaults
40412	Averaging	0 to 10
40413	Calibration Value	*0 to 65,535
40414	Calibration Flag	*0 to 300
40415	Sample Rate	10 to 1000 milliseconds
40416	Scale	*0 to 65,535
40417	Offset	-20,000 to 20,000
40418	Voltage Offset	-20 to 20
40419	Baud Rate	0 to 3 (2400, 9600, 19200, 38400)
40420	Parity	0 to 2 (none, even, odd)
40421	Stop Bit	0 or 1 (0 = 1 stop bit; 1 = 2 stop bits)
40422–40423	Pressure X ³	*N/A
40424–40425	Pressure X ²	*N/A
40426–40427	Pressure X ¹	*N/A
40428–40429	Pressure X ⁰	*N/A
40430	Trip 1 Level	0 to 65,535 (mm)
40431	Trip 1 Window	0 to 65,535 (mm)
40432	Trip 1 Type	0 to 29
40433	Trip 2 Level	0 to 65,535 (mm)
40434	Trip 2 Window	0 to 65,535 (mm)
40435	Trip 2 Type	0 to 29
40436–40437	Parameter 1	0–1,000,000 mm
40438–40439	Parameter 2	0–1,000,000 mm
40440–40441	Parameter 3	0–1,000,000 mm
40442–40443	Parameter 4	0–1,000,000 mm
40444–40445	Parameter 5	0–1,000,000 mm
40446	Temperature Offset	-20 to 20
40447–40448	Temperature X ³	*N/A
40449–40450	Temperature X ²	*N/A
40451–40452	Temperature X ¹	*N/A
40453–40454	Temperature X ⁰	*N/A

*Setting is factory calibrated. Do not adjust.

PT-405 Modbus Sensor Parameters—L5 pressure series

40401—Units

Determines the units of measure for the calculated reading.

0 = PSI	5 = mmH ₂ O [†]	10 = mmHG [‡]	14 = inSW
1 = BAR	6 = cmH ₂ O [†]	11 = cmHG [‡]	15 = ftSW
2 = mBAR	7 = mH ₂ O [†]	12 = inHG [‡]	16 = mSW
3 = kPa	8 = inH ₂ O [†]	13 = kg/cm ²	
4 = MPa	9 = ftH ₂ O [†]		

[†] All H₂O pressure measurements @ 20° C.

[‡] All HG pressure measurements @ 0° C.

40402—Application Type

Determines the units of measure for the calculated reading.

0 = Standard (units selected in 40401 are displayed)

8 = Custom (units selected in 40401 and multiplier in 40436–40437 are used to compute desired units; description in 40438–40439 is label for measurement)

PT-405 Modbus Sensor Parameters—L31 level series

40401—Units

Determines the units of measure for the calculated reading when Application Type is set to 0, 1, or 7.

1 = Feet 2 = Inches 3 = Meters

40402—Application Type

Determines the type of calculated reading performed by the sensor.

0 = Distance

1 = Level

2 = Standing Cylindrical Tank with or without Hemispherical Bottom

3 = Standing Cylindrical Tank with or without Conical Bottom

4 = Standing Rectangular Tank with or without Chute Bottom

5 = Horizontal Cylindrical Tank with or without Spherical Ends

6 = Spherical Tank

7 = Pounds (Linear Scaling)

8 = N/A

9 = Vertical Oval Tank

10 = Horizontal Oval Tank

11 = Strapping Chart

40403—Volume Units

Determines the units of measure for the calculated reading when Application Type is set to 2 to 6 or 9 to 11.

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

PT-405 Modbus Application Parameters—L31 level series

Application 0—Distance

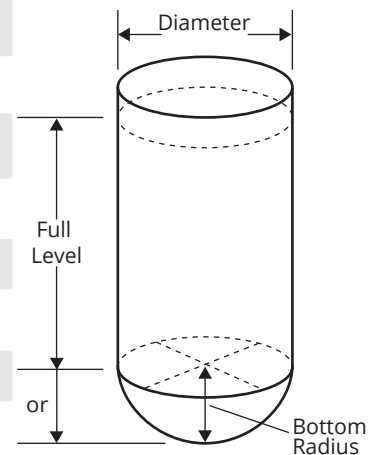
Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	1 = feet, 2 = Inches, 3 = Meters
40402	Application Type	0
40403	Volume Units	—
40404	Decimal (Calculated)	0 to 3

Application 1—Level

Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	1 = feet, 2 = Inches, 3 = Meters
40402	Application Type	1
40403	Volume Units	—
40404	Decimal (Calculated)	1 to 3

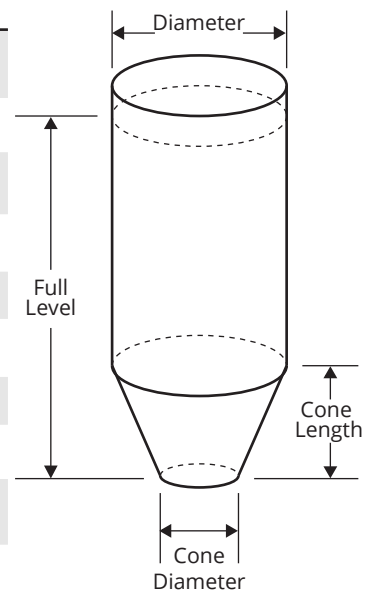
Application 2—Volume of Standing Cylindrical Tank ± Hemispherical Bottom

Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	—
40402	Application Type	2
40403	Volume Units	1 to 7
40404	Decimal (Calculated)	0 to 3
40405	Max Level	(factory set)
40406	Full Level	0 to 65,535 mm
40436–40437	Tank Diameter	0 to 1,000,000 mm
40438–40439	Radius of Bottom Hemisphere	0 to 1,000,000 mm



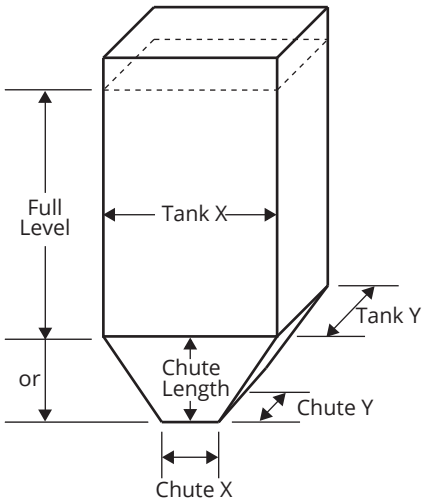
Application 3—Volume of Standing Cylindrical Tank ± Conical Bottom

Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	—
40402	Application Type	3
40403	Volume Units	1 to 7
40404	Decimal (Calculated)	0 to 3
40405	Max Level	(factory set)
40406	Full Level	0 to 65,535 mm
40436–40437	Tank Diameter	0 to 1,000,000 mm
40438–40439	Cone Diameter (at bottom of cone)	0 to 1,000,000 mm
40440–40441	Length (height) of Cone	0 to 1,000,000 mm



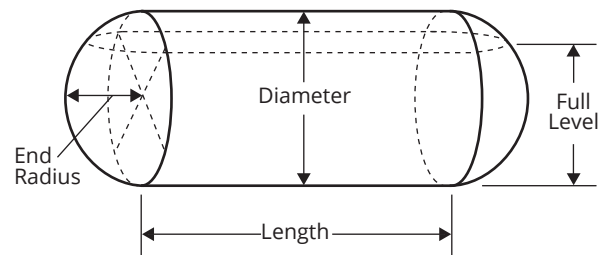
Application 4—Volume of Standing Rectangular Tank ± Chute Bottom

Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	—
40402	Application Type	4
40403	Volume Units	1 to 7
40404	Decimal (Calculated)	0 to 3
40405	Max Level	(factory set)
40406	Full Level	0 to 65,535 mm
40436–40437	Tank X Dimension	0 to 1,000,000 mm
40438–40439	Tank Y Dimension	0 to 1,000,000 mm
40440–40441	Chute X Dimension	0 to 1,000,000 mm
40442–40443	Chute Y Dimension	0 to 1,000,000 mm
40444–40445	Length (height) of Chute	0 to 1,000,000 mm



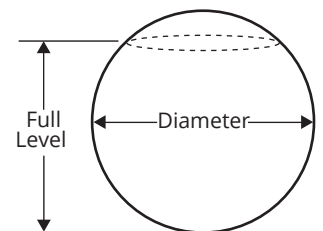
Application 5—Volume of Horizontal Cylindrical Tank ± Hemispherical Ends

Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	—
40402	Application Type	5
40403	Volume Units	1 to 7
40404	Decimal (Calculated)	0 to 3
40405	Max Level	(factory set)
40406	Full Level	0 to 65,535 mm
40436–40437	Tank Length	0 to 1,000,000 mm
40438–40439	Tank Diameter (at bottom of cone)	0 to 1,000,000 mm
40440–40441	Radius of End Hemispheres	0 to 1,000,000 mm



Application 6—Volume of Spherical Tank

Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	—
40402	Application Type	6
40403	Volume Units	1 to 7
40404	Decimal (Calculated)	0 to 3
40405	Max Level	(factory set)
40406	Full Level	0 to 65,535 mm
40436–40437	Tank Diameter	0 to 1,000,000 mm

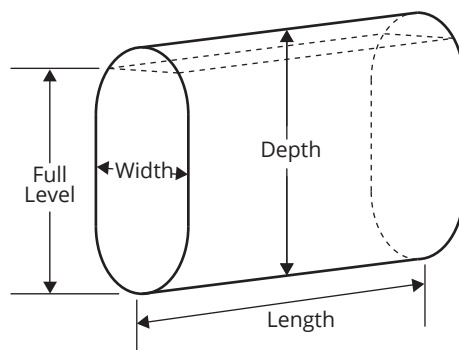


Application 7—Pounds (Linear Scaling)

Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	1 = Feet, 2 = Inches, 3 = Meters
40402	Application Type	7
40403	Volume Units	—
40404	Decimal (Calculated)	0 to 3
40405	Max Level	(factory set)
40406	Full Level	0 to 65,535 mm
40436–40437	Multiplier (linear scalar)	0 to 1,000,000 mm (1000 = 1.000)

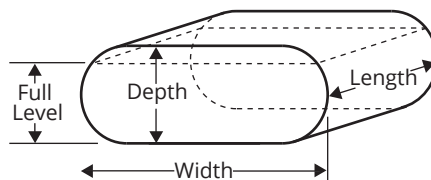
Application 9—Volume of Vertical Oval Tank

Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	—
40402	Application Type	9
40403	Volume Units	1 to 7
40404	Decimal (Calculated)	0 to 3
40405	Max Level	(factory set)
40406	Full Level	0 to 65,535 mm
40436–40437	Tank Length	0 to 1,000,000 mm
40438–40439	Tank Depth	0 to 1,000,000 mm
40440–40441	Tank Width	0 to 1,000,000 mm



Application 10—Volume of Horizontal Oval Tank

Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	—
40402	Application Type	10
40403	Volume Units	1 to 7
40404	Decimal (Calculated)	0 to 3
40405	Max Level	(factory set)
40406	Full Level	0 to 65,535 mm
40436–40437	Tank Length	0 to 1,000,000 mm
40438–40439	Tank Depth	0 to 1,000,000 mm
40440–40441	Tank Width	0 to 1,000,000 mm



Application 11—Strapping Chart (Polynomial Values)

Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	1 = Feet, 2 = Inches, 3 = Meters
40402	Application Type	11
40403	Volume Units	1 to 7
40404	Decimal (Calculated)	0 to 3
40405	Max Level	(factory set)
40406	Full Level	0 to 65,535 mm
40436–40437	X ³ Coefficient	0 to 1,000,000
40438–40439	X ² Coefficient	0 to 1,000,000
40440–40441	X ¹ Coefficient	0 to 1,000,000
40442–40443	X ⁰ Coefficient	0 to 1,000,000



Automation Products Group, Inc.
Tel: 1 (888) 525-7300 or 1 (435) 753-7300

e-mail: sales@apgsensors.com
www.apgsensors.com

Automation Products Group, Inc.
1025 W. 1700 N.
Logan, UT 84321