Series PT–400 and PT–405

Heavy Duty Pressure Transmitters

Modbus Programming Manual

CONTENTS

> **NOTE:**
> Wiring information in this User Manual is specific to the Modbus Series of the PT–400 and the PT–405. If you have a 0–5V, mV/V, or 4–20 mA Series sensor, please consult the factory at 1–888–525–7300 or our website at https://www.apgsensors.com/resources/product-resources/user-manuals/ for the appropriate manual for your sensor.

INTRODUCTION

Thank you for purchasing a PT–400 and/or a PT–405 Modbus series pressure transmitter from APG. We appreciate your business! Please take a few minutes to familiarize yourself with this manual.

This manual covers the Modbus application for the PT–400 and the PT–405 pressure transmitters.

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.

WARRANTY

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://www.apgsensors.com/resources/warranty-certifications/warranty-returns/. Contact Technical Support to receive a Return Material Authorization before shipping your product back.

WIRING

Modbus System Wiring

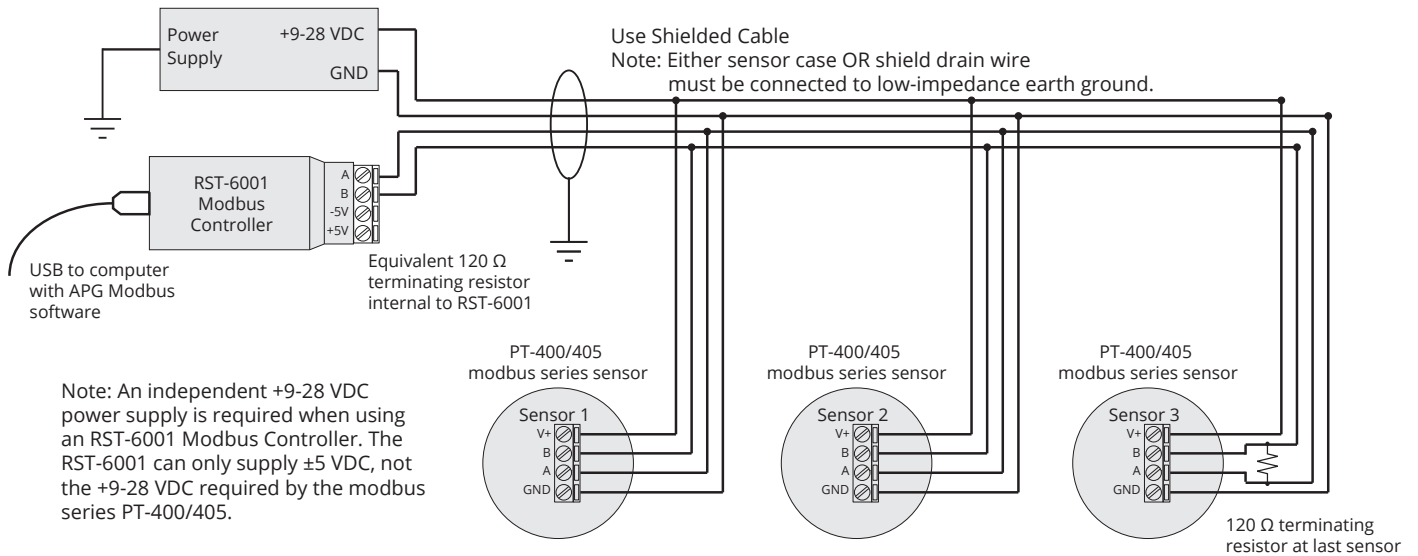Power Supply — +9-28 VDC / GND

Server Device — RS-485 A (TX+) / RS-485 B (TX-)

120 Ω terminating resistor

Use Shielded Cable
Note: Either sensor case OR shield drain wire
must be connected to low-impedance earth ground.

Note: When connecting PT-400/405 sensors to your system, reversing A and B connections may be necessary if sensors do not communicate with controller.

PT-400/405 modbus series sensor

Sensor 1 — V+ / B (TX-) / A (TX+) / GND

PT-400/405 modbus series sensor

Sensor 2 — V+ / B (TX-) / A (TX+) / GND

PT-400/405 modbus series sensor

Sensor 3 — V+ / B (TX-) / A (TX+) / GND

120 Ω terminating resistor at last sensor

Modbus System Wiring with RST–6001

Power Supply — +9-28 VDC / GND

RST-6001 Modbus Controller — A / B / -5V / +5V

USB to computer with APG Modbus software

Equivalent 120 Ω terminating resistor internal to RST-6001

Use Shielded Cable
Note: Either sensor case OR shield drain wire
must be connected to low-impedance earth ground.

Note: An independent +9-28 VDC power supply is required when using an RST-6001 Modbus Controller. The RST-6001 can only supply ±5 VDC, not the +9-28 VDC required by the modbus series PT-400/405.

PT-400/405 modbus series sensor

Sensor 1 — V+ / B / A / GND

PT-400/405 modbus series sensor

Sensor 2 — V+ / B / A / GND

PT-400/405 modbus series sensor

Sensor 3 — V+ / B / A / GND

120 Ω terminating resistor at last sensor

IMPORTANT:

Some manufacturer's Modbus equipment uses reversed TX+/TX– pins. When making connections between APG equipment, reversing connections may be necessary if sensor does not communicate with controller.

PROGRAMMING

Modbus Programming

PT–400 and 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–400 and PT–405 Modbus Register Lists on pages 3 to 6 for more details.

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

Modbus Programming with RST–6001 and APG Modbus Software

APG RST–6001 Modbus Controller can be used in tandem with APG Modbus to program and control up to 20 sensors. Through APG Modbus, you can monitor the raw readings from the sensor, including level or pressure, temperature and battery voltage, or configure the sensor. See PT–400 and PT–405 Modbus Register Lists on pages 3 to 6 for more details.

> **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/.

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PT–400 and 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 ^{0}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–400 and 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–400 and 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–400 and PT–405 Modbus Sensor Parameters—L5 pressure series

40401—Units

Determines the units of measure for the calculated reading.

0 = PSI	5 = mmH2O[†]	10 = mmHG[‡]	14 = inSW
1 = BAR	6 = cmH2O[†]	11 = cmHG[‡]	15 = ftSW
2 = mBAR	7 = mH2O[†]	12 = inHG[‡]	16 = mSW
3 = kPa	8 = inH2O[†]	13 = kg/cm^2	
4 = MPa	9 = ftH2O[†]		

[†] 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–400 and 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

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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–400 and PT–405 Modbus Application Parameters—L31 level series
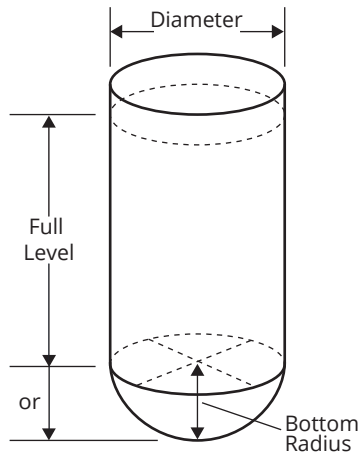
Application 0—Distance

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

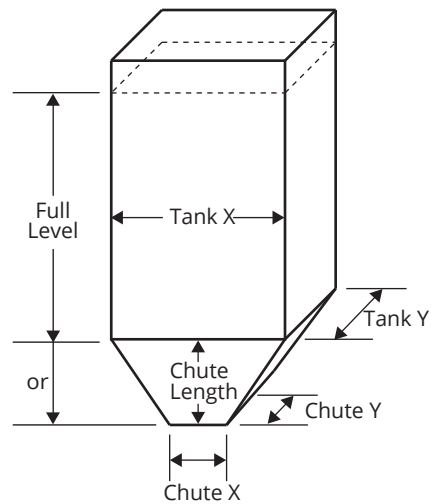| Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	—
40402	Application Type	2
40403	Volume Units	1 to 7
40404	Decimal (Calculated)	0 to 3
40405	Max Level	(factory set)
40406	Full Level	0 to 65,535 mm
40436–40437	Tank Diameter	0 to 1,000,000 mm
40438–40439	Radius of Bottom Hemisphere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

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Application 3—Volume of Standing Cylindrical Tank ± Conical Bottom

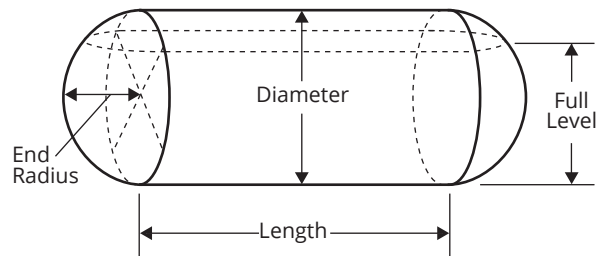| Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	—
40402	Application Type	3
40403	Volume Units	1 to 7
40404	Decimal (Calculated)	0 to 3
40405	Max Level	(factory set)
40406	Full Level	0 to 65,535 mm
40436–40437	Tank Diameter	0 to 1,000,000 mm
40438–40439	Cone Diameter (at bottom of cone)	0 to 1,000,000 mm
40440–40441	Length (height) of Cone	0 to 1,000,000 mm
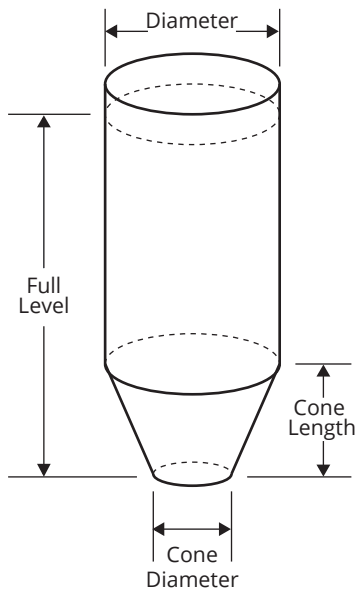
Application 4—Volume of Standing Rectangular Tank ± Chute Bottom

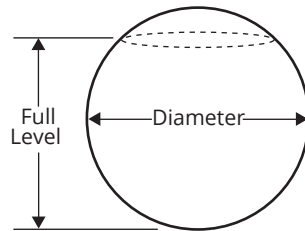| Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	—
40402	Application Type	4
40403	Volume Units	1 to 7
40404	Decimal (Calculated)	0 to 3
40405	Max Level	(factory set)
40406	Full Level	0 to 65,535 mm
40436–40437	Tank X Dimension	0 to 1,000,000 mm
40438–40439	Tank Y Dimension	0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

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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

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Application 7—Pounds (Linear Scaling)

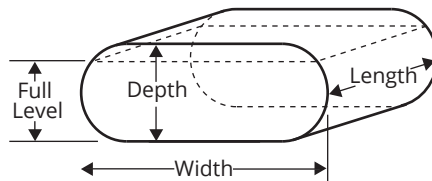| Register	Function	Value Range
40400	Device Address	1 to 247
40401	Units	1 = Feet, 2 = Inches, 3 = Meters
40402	Application Type	7
40403	Volume Units	—
40404	Decimal (Calculated)	0 to 3
40405	Max Level	(factory set)
40406	Full Level	0 to 65,535 mm
40436–40437	Multiplier (linear scalar)	0 to 1,000,000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

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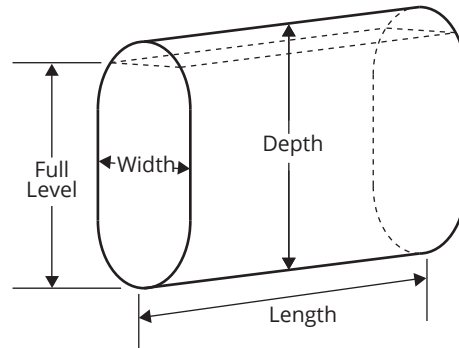
Application 10—Volume of Horizontal Oval Tank

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

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