

AUTOMATION PRODUCTS GROUP, INC.

Operator's Manual

LPU-2428 **Loop Powered Ultrasonic Level Sensor**

Rev. A3, 11/08
Doc. 9002999



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>Introducing</i>	4
<i>Understanding Ultrasonics</i>	5
<i>Installation</i>	7
<i>Hazardous Mounting</i>	8
<i>Wiring</i>	10
<i>Programming</i>	11
<i>Basic Setup</i>	14
<i>Application Setup</i>	15
<i>4-20 mA Setup</i>	24
<i>Calibration</i>	25
<i>Advanced</i>	26
<i>Utilities</i>	28
<i>Totalization</i>	29
<i>Programming Example</i>	29
<i>Specifications</i>	32
<i>Certificate of Compliance</i>	33

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".

Introducing

The LPU-2428 is a loop-powered ultrasonic sensor. The LPU provides a low-power, non-contact level measurement solution. These units are completely sealed and are programmed via an RST-4001 programming module. The module has 5-tactile switches and a 2 line by 8 character LCD display to provide the user feedback in programming and sensor performance data.

Sensor features include:

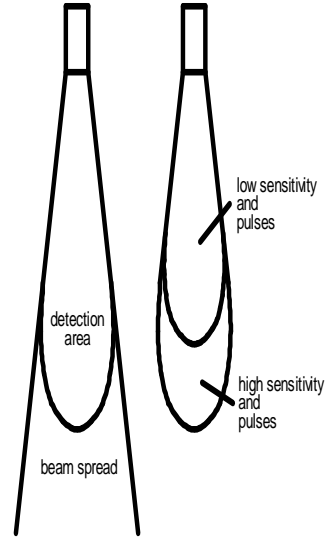
- Loop powered for low power consumption.
- Remote programming.
- Rugged Kynar transducer housing for harsh environments and high degree of chemical compatibility.
- Microprocessor-controlled.
- Listed by CSA for operation in Class 1 Division 1 Groups C & D and Class 1 Zone 0 A Ex ia IIB hazardous areas.
- IP65 rating for outdoor applications.



Understanding Ultrasonics

Ultrasonic sensors measure distance using a transducer to send out ultrasonic bursts. Each burst contains a series of 1-20 pulsed sound waves that emit in the shape of a cone, reflect off the target, and are received by the sensor. The time required for the sound burst 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, angle, and the environment. The following considerations will help ensure the best possible target conditions.



Surface

The ideal target surface is hard and smooth and perpendicular to the sensor. This surface will reflect a greater amount of signal than a soft, sound wave absorbent surface. A target with poor sound wave reflection characteristics will reduce the operating distance of the sensor and decrease its accuracy.

<p>GOOD</p> <p>surface</p>	<p>GOOD</p> <p>distance</p>	<p>GOOD</p> <p>size</p>	<p>INCORRECT</p> <p>angle</p>
<p>BETTER</p>	<p>BETTER</p>	<p>BETTER</p>	<p>CORRECT</p>

Distance

The shorter the distance from the sensor to an object, the stronger the returning echo will be. Therefore, as the distance increases, the object requires better reflective characteristics to return a sufficient echo.

Size

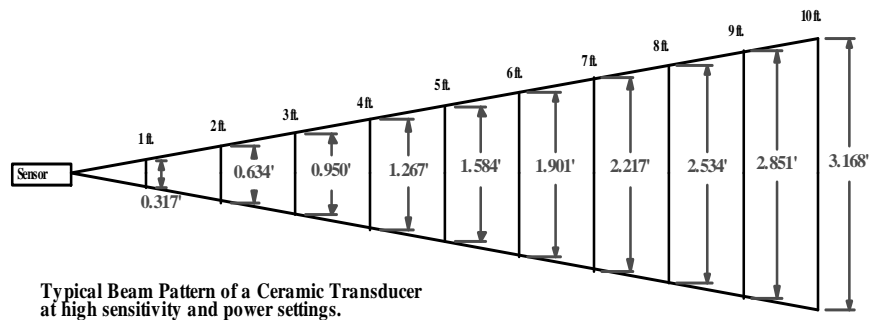
A large object will have a greater surface area to reflect the signal than a small one, therefore, a large target will be detected at a greater distance than a small target. The surface area recognized as the target is generally the portion closest to the sensor.

Angle

The inclination of the object's surface facing the ultrasonic sensor affects the reflectivity of the object. The portion perpendicular to the sensor returns the echo. If the entire surface is at a great enough angle, the signal will be reflected away from the sensor and no echo will be detected. Generally a target at an angle greater than 5° off perpendicular will not be detected.

Environmental Conditions

Temperature, humidity, gases, dust, and pressure may also affect the sensor's performance. APG ultrasonic sensors automatically compensate for many of these conditions. However, these conditions can degrade the sensor's performance enough it may be necessary to use a longer-range sensor than normal conditions would require.

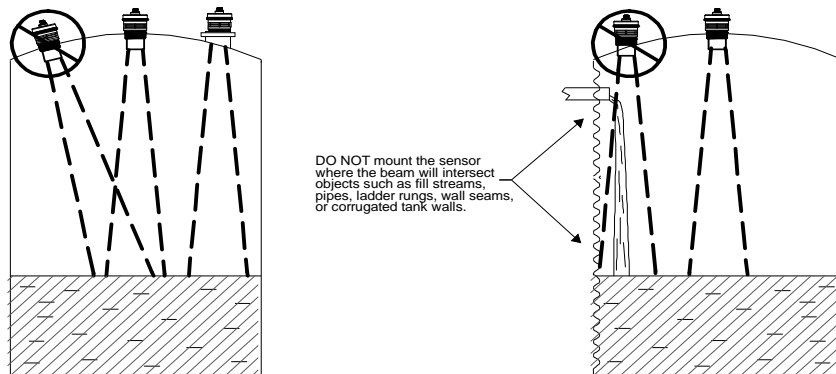


Installation

The LPU sensor should be mounted so that it has a clear sound path to the level monitored. Mount the sensor away from tank walls and inlets. The path should be free from obstructions and as open as possible for the 9° off axis beam pattern. Follow the guidelines mentioned in "Understanding Ultrasonics". When using a stand pipe to mount the sensor above the tank, the stand pipe should be seamless and no longer than 4 inches to provide a smooth path for the sound waves to propagate into the tank. Seams from couplers, nipples or gaskets can cause erroneous echoes and degrade the sensors performance. The LPU can be mounted in a coupler, or flange using the 2" NPT threaded case.

Caution: Do not over tighten! The sensor should be threaded in only hand tight.

The minimum detection range of the LPU is approximately 1 ft. **The sensor should be mounted to ensure the target does not come closer than the minimum range or erroneous readings may result.**



**Installation in Class I Division 1 Groups C and D
Class I Zone 0 A EXnA IIB**

ZONE	REV	DESCRIPTION	REVISIONS	DATE	APPROVED
All	A1	Update P1, L1 and Electronic Wiring	CO/Max	3-4-08	RNR

- Install in accordance with CEC, NEC articles 504, 506 and ISA RP12.8 Recommended Practice for the Installation of Intrinsically Safe Circuits.
- **WARNING: EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER IS OFF.** (AVERTISSEMENT: DANGER D'EXPLOSION - NE PAS DÉCONNECTER L'ÉQUIPEMENT SAUF SI LE COURANT DU S'ASSURER QUE L'EMPLACEMENT EST DÉSIGNÉ NON DANGEREUX).
- **WARNING - POTENTIAL ELECTROSTATIC CHARGING HAZARD - Clean only with a damp cloth**

APG Automation Products Group, Inc.
 Logan, Utah USA 7 1262257-7000

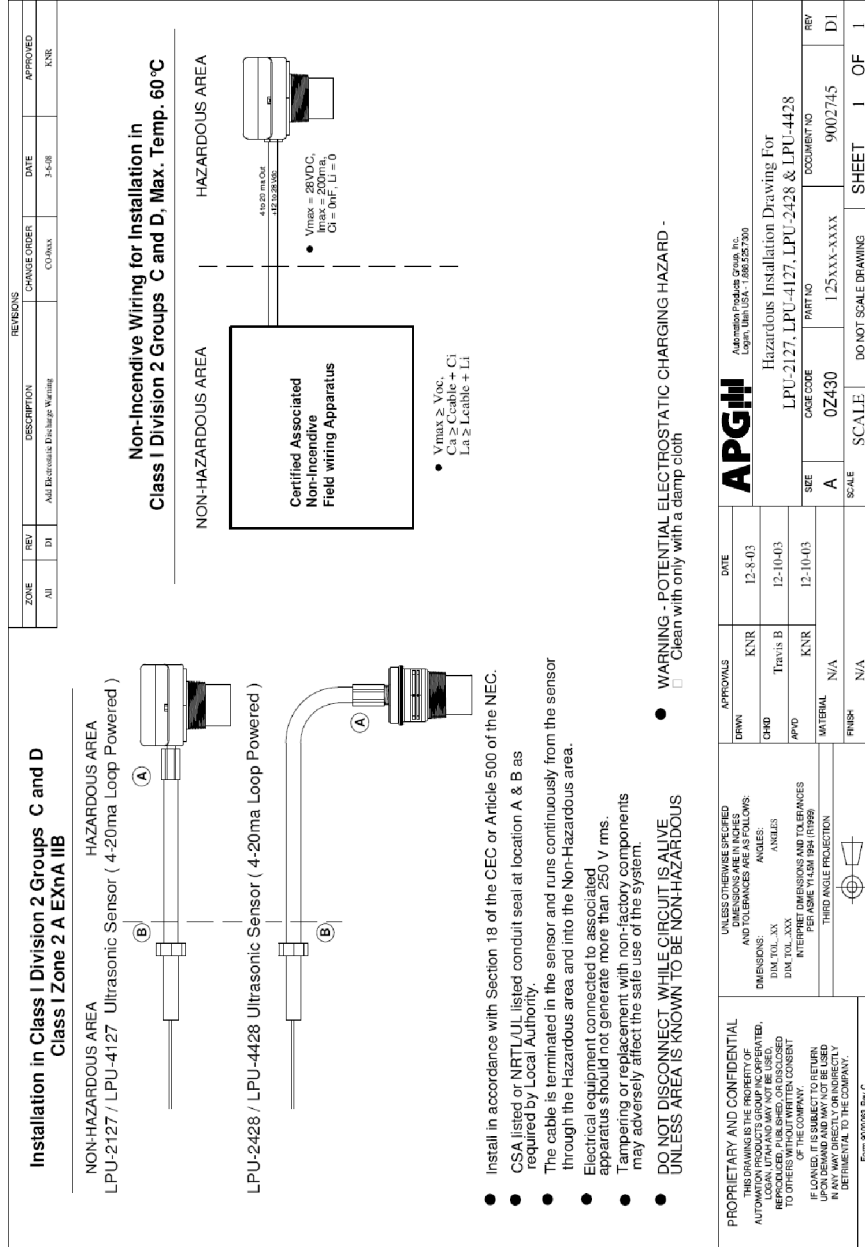
**Hazardous Installation Drawing For
 LPU-2428 & LPU-4428**

DATE	4-6-07
APPROVALS	K.N.R.
DRWN	TRAVIS B
CHKD	K.N.R.
APVD	K.N.R.
MATERIAL	N/A
FINISH	N/A

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERANCES ARE AS FOLLOWS:
 DIMENSIONS: FRACTIONS: ±.005
 DECIMALS: ±.01
 DIM TOL: XXX
 INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M (1994) (R1999)
 THIRD ANGLE PROJECTION

PROPRIETARY AND CONFIDENTIAL
 THIS DRAWING IS THE PROPERTY OF APG... AUTOMATICALLY ARCHIVED, LOCAL, UT-14 AND MAY NOT BE LOANED, REPRODUCED, PUBLISHED, OR DISCLOSED TO OTHERS WITHOUT THE WRITTEN CONSENT OF THE COMPANY.
 IF LOANED, IT IS SUBJECT TO RETURN TO THE COMPANY AND IS NOT TO BE REPRODUCED IN ANY MANNER OR INDIRECTLY DETRIMENTAL TO THE COMPANY.
 Form: 9000008 Rev. C

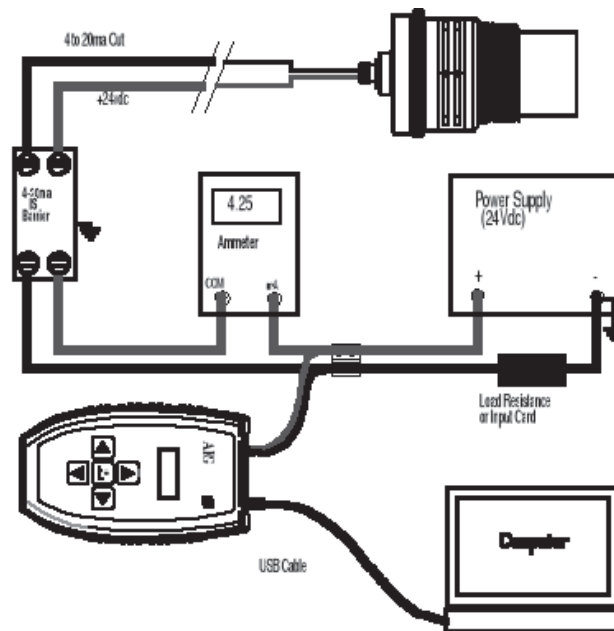
SIZE	A	DWG CODE	125XXX-XXXX	DOCUMENT NO	9002747	REV	A1
SCALE	SCALE	DO NOT SCALE DRAWING	SHEET		1	OF	1



Wiring

1. Sensor has two wires:
Red - +24V DC
Black - 4-20ma output
2. Connect Red wire to +24V DC supply.
3. Connect Black wire to "Load" (input of PLC or other type of load that is greater than 150 ohms)
4. To program sensor connect positive terminal of RST to the sensor red wire and connect the negative terminal to the sensor black wire.
5. To program using the computer software connect USB cable between the RST-4001 and the computer.

Note: Use the following wiring diagram when connecting to an intrinsically safe barrier (only required for operation in hazardous locations). Recommended barrier is the Stahl 9001/51-280-110-141, or equivalent.



Programming

The LPU is programmed using the RST-4001 programmer via the keypad & display or the USB interface & computer software.

RST Programming:

The LCD display shows the distance measurement. The display is also used to view the individual modes and their values when programming.

The LPU has five programming or navigation buttons, LEFT Arrow, RIGHT Arrow, UP Arrow, DOWN Arrow, and ENTER (I/O). The arrow buttons allow the user to move through the pages in order to access and change parameters. Once a parameter has been changed press the I/O to save.

To select a page, press the UP Arrow or DOWN Arrow button until the desired page is displayed. Press the Right arrow to move into that page. Then press the UP or DOWN Arrow button to move to the desired parameter. When the parameter is shown press the RIGHT Arrow button. The display will show the name of this parameter on the lower line and the current value on the upper line of the display. To change the parameter's value, press the UP Arrow or DOWN Arrow button until the desired value is displayed.

To store or save the changed value, press the I/O button once. At this point, the parameter value has been saved. The values are stored in nonvolatile memory, and will not be lost when power is turned off.



Use the provided terminal strip and resistor to establish communication with the RST-4001. Follow the wiring diagram shown on the previous page.

• Computer Programming

The utility program used for setting up the sensor is supplied on a 3.5 inch CD. Install the software by running the Windows Installer Package titled, "Setup". The installation process will prompt you as needed to complete the installation. This will load the operating program to your hard drive. The setup program can be run from the Windows "START" menu "RUN" option by entering the file location and name, or by going to Windows Explorer, locating the file and double clicking on "LPU-2428.EXE". The setup program will create an "APG" folder under the Windows program menu.

When the program screen comes up, there are several buttons and windows to view information. The lower right side of the screen contains two windows indicating the communication status of the sensor and computer. It will indicate "Sensor NO Communication", or "Sensor Communicating". If an error is indicated, then check for proper connections. Allow a moment for the communication to be established while watching the status window to indicate "Sensor Communicating". If this fails to establish communication, plug the USB cable into the second port on the back of the computer. After communication is established, click on the "Receive" button to load the sensor settings into the programming windows. Changes to the parameters are accomplished by clicking in the appropriate text box window, entering the desired value, then clicking the "Send" button. The "Reset" button will load the factory settings into the sensor. The program is closed by clicking on the "Exit" button.



Automation Products Group, Inc.

APG...Providing tailored solutions for measurement applications

For software users the LPU can be set up using the following seven pages.

Note: When entering parameter changes in the software, be sure to SEND these changes to the sensor before exiting the software. Failure to do so will result in unchanged parameter values.

Main:

Displays distance or level. A graphical representation is displayed if measuring level, volume, or flow.

Basic Setup:

Submenu contains Units, Application, Flow/Volume Units, Flow Rate, and Response Time.

Note: Changing unit and rate values in Basic Setup will NOT update values found in the App. Setup and 4-20 Setup pages.

App. Setup:

Submenu contains Volume Tank Type, Flow Type, Max/Full Distance, Zero/Empty Distance, and values for flow or volume.

4-20 Setup:

Submenu contains Min & Max mA Setpoints, Fail Safe, and Fail Safe Delay.

Calibration (not required on most applications):

Submenu contains Min & Max mA Value, Min & Max mA Trim, Multiplier, and Offset.

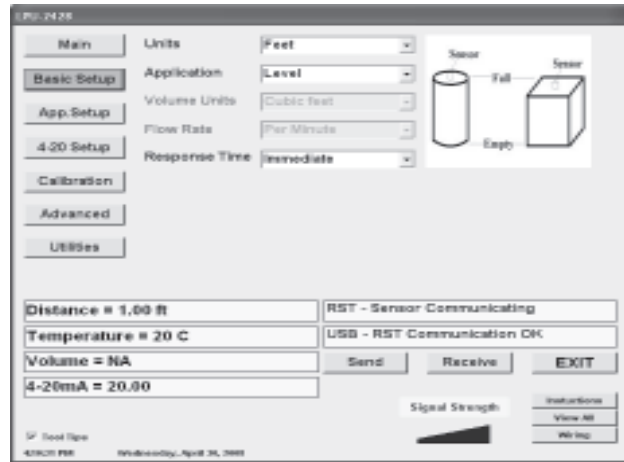
Advanced:

Submenu contains Temperature Compensation, Gain Control, Sensitivity, Pulses, and Blanking.

Utilities:

Submenu contains Low & High Distance Simulation, Simulation Cycle Time, Reset, File System, and Software Version.

Basic Setup (*BasicSet*)



Units (*Units*)

Selects the unit of measure that will be used throughout the setup process.

Feet, Inches, Meters, Millimeters
Default: Feet

Application (*Out Func*)

Selects function of measurement.

Distance, Level, Volume, Flow,
Linearization Table, Submersible
Default: Distance

Volume Units (*Vol Unit*)

Selects the units of volumetric measurements.

Cubic Feet, Million Cubic Feet,
Gallons, Cubic Meters, Liters
Default: Cubic Feet

Flow Rate (*TimeUnit*)

Selects the time unit to be used in the flow rate calculation.

Per Second, Per Minute,
Per Hour, Per Day
Default: Per Minute

Response Time (*Response*)

Selects the desired response time. Faster response times equate to a less stable output.

Standard (most filtering)
Fast
Immediate (least filtering)
Default: Standard

Application (App.) Setup (*Applicat*)**Max Distance - Distance Mode** (*Max Dist*)

Selects the maximum operating range of the sensor.

1.00 – 25.00 ft
Default: 25.00 ft

Full Distance - Level & Volume Mode (*Ful Dist*)

The distance from the sensor face to the top of the tank. This parameter is usually set to zero if the sensor is mounted at the top of the tank.

0.00 – 25.00 ft

Default: 1.00 ft

Empty Distance - Level & Volume Mode (*Emp Dist*)

The distance from the sensor face to the bottom of the tank.

1.00 – 25.00 ft

Default: 25.00 ft

Volume Tank Type - Volume Mode (*TankType*)

Standing Cylindrical Tank with Hemispherical Bottom (*SCTWHB*)

Full Distance

0.00 – 25.00 ft

Default: 1.00 ft

Empty distance

1.00 – 25.00 ft

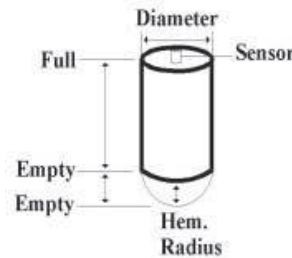
Default: 25.00 ft

Tank Diameter

0.00 – 100.00 ft

Radius of Hemisphere

0.00 – 100.00 ft



Standing Cylindrical Tank with Conical Bottom (*SCTWCB*)

Full Distance

0.00 – 25.00 ft

Default: 1.00 ft

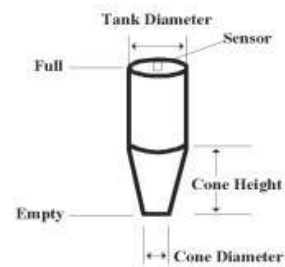
Empty distance

1.00 – 25.00 ft

Default: 25.00 ft

Tank Diameter

0.00 – 100.00 ft



Cone Diameter
0.00 – 100.00 ft

Cone Height
0.00 – 25.00 ft

Standing Rectangular Tank with or without Chute (*SRT*)

Full Distance
0.00 – 25.00 ft
Default: 1.00 ft

Empty distance
1.00 – 25.00 ft
Default: 25.00 ft

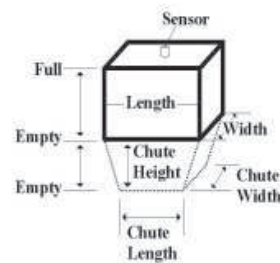
Tank Length
0.00 – 100.00 ft

Tank Width
0.00 – 100.00 ft

Chute Length
0.00 – 25.00 ft

Chute Width
0.00 – 25.00 ft

Chute Height
0.00 – 25.00 ft

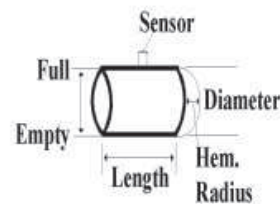


Horizontal Cylindrical Tank (*HCT*)

Full Distance
0.00 – 25.00 ft
Default: 1.00 ft

Empty distance
1.00 – 25.00 ft
Default: 25.00 ft

Tank Length
0.00 – 100.00 ft



Tank Diameter
0.00 – 100.00 ft

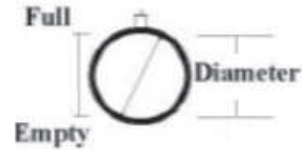
Radius of Hemisphere
0.00 – 25.00 ft

Spherical Tank (*ST*)

Full Distance
0.00 – 25.00 ft
Default: 1.00 ft

Empty Distance
1.00 – 25.00 ft
Default: 25.00 ft

Tank Diameter
0.00 – 100.00 ft



Flow Type - Flume (*FlowType*)

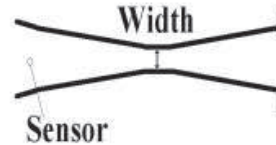
Parshall (*Parshall*)

Max Flow
0.00 – 25.00 ft
Default: 1.00 ft

Zero Flow
1.00 – 25.00 ft
Default: 25.00 ft

Constant K
0.00 – 12000.00

Exponent n
0.00 – 2.00



Cutthroat (*CutThroat*)

Max Flow
0.00 – 25.00 ft
Default: 1.00 ft

Zero Flow

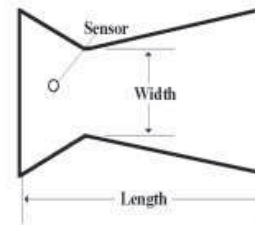
1.00 – 25.00 ft
 Default: 25.00 ft

Constant K
 0.00 – 480.00

Exponent n1
 0.00 – 2.00

Throat Width
 0.00 – 25.00 ft

Exponent n2
 0.00 – 2.00



Flow Type - Weir (Weir)

California Pipe (Californ)

Max Flow
 1.00 – 25.00 ft
 Default: 1.00 ft

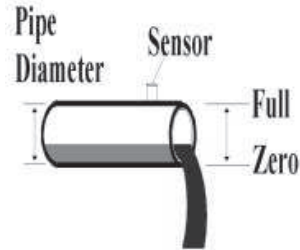
Zero Flow
 1.00 – 25.00 ft
 Default: 25.00 ft

Constant K
 0.00 – 1200.00

Exponent n1
 0.00 – 2.00

Diameter of Pipe
 0.00 – 25.00 ft

Exponent n2
 0.00 – 3.00



Rectangular w/ constrictions (Rect w/c)

Max Flow
 0.00 – 25.00 ft
 Default: 1.00 ft

Zero Flow

1.00 – 25.00 ft
Default: 25.00 ft

Constant K

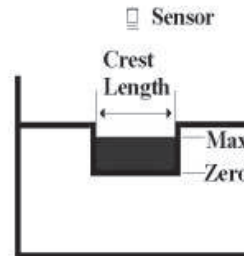
0.00 – 420.00

Exponent n

0.00 – 2.00

Crest Length

0.00 – 25.00 ft

Rectangular w/o constrictions (*Rect w/o*)

Max Flow

0.00 – 25.00 ft
Default: 1.00 ft

Zero Flow

1.00 – 25.00 ft
Default: 25.00 ft

Constant K

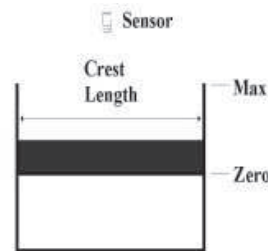
0.00 – 420.00

Exponent n

0.00 – 2.00

Crest Length

0.00 – 25.00 ft

Trapezoidal (*Trapezod*)

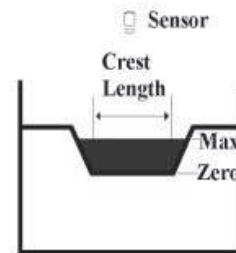
Max Flow

0.00 – 25.00 ft
Default: 1.00 ft

Zero Flow

1.00 – 25.00 ft
Default: 25.00 ft

Constant K



0.00 – 420.00

Exponent n

0.00 – 2.00

Crest Length

0.00 – 25.00 ft

Triangular or V-Notch (*Triangul*)

Max Flow

0.00 – 25.00 ft

Default: 1.00 ft

Zero Flow

1.00 – 25.00 ft

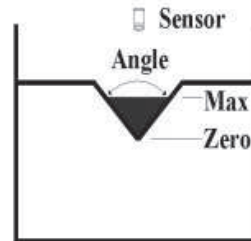
Default: 25.00 ft

Constant K

0.00 – 270.00

Exponent n

0.00 – 3.00

**Equation (*Equation*)**

$$Q = KH^n \quad (1)$$

Max Flow

0.00 – 25.00 ft

Default: 1.00 ft

Zero Flow

1.00 – 25.00 ft

Default: 25.00 ft

Constant K

0.00 – 10e308

Exponent n

0.00 – 10e308

$$Q=KLH^n \quad (2)$$

Max Flow

0.00 – 25.00 ft

Default: 1.00 ft

Zero Flow

1.00 – 25.00 ft

Default: 25.00 ft

Constant K

0.00 – 10e308

Exponent n

0.00 – 10e308

Length

0.00 – 10e308

$$Q=K[L-XH]H^n \quad (3)$$

Max Flow

0.00 – 25.00 ft

Default: 1.00 ft

Zero Flow

1.00 – 25.00 ft

Default: 25.00 ft

Constant K

0.00 – 10e308

Exponent n

0.00 – 10e308

Length

0.00 – 10e308

Constant X

0.00 – 10e308

$$Q=K[B-A/D]^{n1}P^{n2} \quad (4)$$

Max Flow

0.00 – 25.00 ft

Default: 1.00 ft

Zero Flow

1.00 – 25.00 ft
 Default: 25.00 ft

Constant K

0.00 – 10e308

Exponent n1

0.00 – 10e308

Constant D

0.00 – 10e308

Exponent n2

0.00 – 10e308

Linearization Table (Only available through computer software)

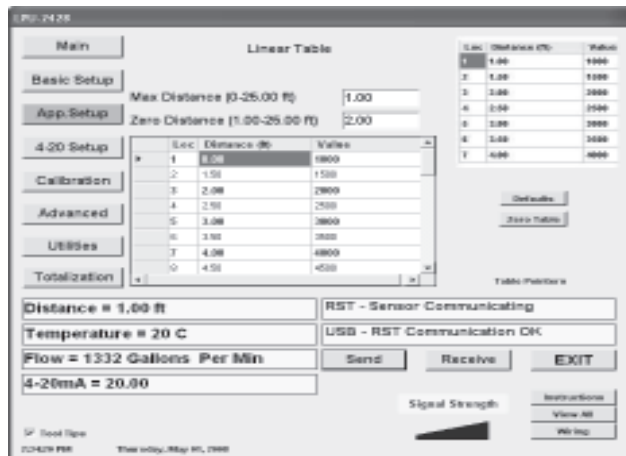
Used for non-linear open channels and tanks. Linearization table holds up to 32 entries.

Max Distance

0.00 – 25.00 ft
 Default: 1.00 ft

Zero Distance

1.00 – 25.00 ft
 Default: 25.00 ft



Submersible (*Submersi*)

Used to directly replace a pressure transducer.

Submersible Range

0.00 – 25.00 ft

Default: 1.00 ft

Depth Distance: this parameter is used to limit the high end of the analog output so that it will not go above a programmed value. This setting becomes the output that is selected at the 20 mA distance. It can be used if it is desired for the sensor to directly replace a pressure transducer.

1.00 – 25.00 ft

Default: 25.00 ft

Transducer PSI to Milliamp Chart											
0-5 PSI	milliamp	Feet	0-10 PSI	milliamp	Feet	0-15 PSI	milliamp	Feet	0-100 PSI	milliamp	Feet
0	4.0	0.0	0	4.0	0.0	0	4.0	0.0	0	4.0	0.0
1	7.2	2.3	1	5.6	2.3	1	5.1	2.3	5	4.8	11.6
2	10.4	4.6	2	7.2	4.6	2	6.1	4.6	10	5.6	23.1
3	13.6	6.9	3	8.8	6.9	3	7.2	6.9	15	6.4	34.7
4	16.8	9.2	4	10.4	9.2	4	8.3	9.2	20	7.2	46.2
5	20.0	11.6	5	12.0	11.6	5	9.3	11.6	25	8.0	57.8
			6	13.6	13.9	6	10.4	13.9	30	8.8	69.3
			7	15.2	16.2	7	11.5	16.2	35	9.6	80.9
			8	16.8	18.5	8	12.5	18.5	40	10.4	92.4
			9	18.4	20.8	9	13.6	20.8	45	11.2	104.0
			10	20.0	23.1	10	14.7	23.1	50	12.0	115.5
						11	15.7	25.4	55	12.8	127.1
						12	16.8	27.7	60	13.6	138.6
						13	17.9	30.0	65	14.4	150.2
						14	18.9	32.3	70	15.2	161.7
						15	20.0	34.7	75	16.0	173.3
									80	16.8	184.8
									85	17.6	196.4
									90	18.4	207.9
									95	19.2	219.5
									100	20.0	231.0

4-20 Setup (*4-20 Set*)

In Distance mode, the zero reference is from the face of the sensor. In Level, Volume, or Flow modes, zero is referenced from the Zero Distance, Empty Distance, or Zero Flow.

Minimum (Min) mA Setpoint (*MinMaSet*)

Sets the minimum mA distance, level, volume, or flow.



0.00 – 25.00 ft (Distance/Level)
Default: 1.00 ft

Maximum (Max) mA Setpoint (*MaxMaSet*)

Sets the maximum mA distance, level, volume, or flow.
0.00 – 25.00 ft (Distance/Level)
Default: 25.00 ft

Fail Safe (*FailSafe*)

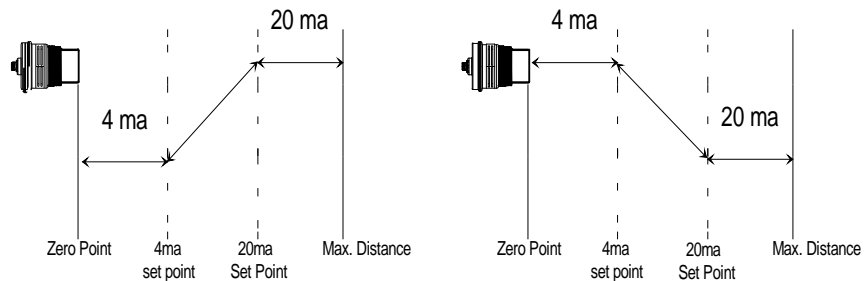
Determines the output condition of the sensor in the event of a Loss of Echo.

Hold, 3.8 mA, 22 mA
Default: Hold

Fail Safe Delay (*FS Delay*)

Sets the delay in seconds before the sensor will output a Fail Safe condition.

15 – 9999 Seconds
Default: 15 Seconds



Calibration (*Calibrat*)

Min mA Value (*MinMaVal*)

Limits the low end of the mA output.
4.00 – Max mA Value
Default: 4.00

Max mA Value (MaxMaVal)

Limits the high end of the mA output.

Min mA Value – 20.00

Default: 20.00

Min mA Trim (Min Trim)

Fine tunes the minimum mA current. For example, if the 4 mA on the input device is reading 3.95 mA, increasing this parameter will increase the minimum mA output.

0 – 999

Default: 500

Max mA Trim (Max Trim)

Fine tunes the maximum mA current. For example, if the 20 mA on the input device is reading 20.15, decreasing this parameter will decrease the maximum mA output.

0 – 999

Default: 500

Multiplier (Multipli)

Calibrates the sensor for variations in the speed of sound due to irregular atmospheric conditions.

0 – 1.999

Default: 1.000

Offset (Offset)

Adjusts the zero reference at the sensor face.

-3.00 ft to +3.00 ft

Default: 0.00

Advanced (Advanced)**Temperature Compensation** (TempComp)

Compensates for changes in the speed of sound due to temperature changes. Note: if the internal temperature compensation is used, care must be taken that the sensor is not exposed to direct sunlight. The

radiant heat of the sun can heat the sensor above the ambient temperature causing the sensor to over compensate for temperature changes.

ON/OFF
Default: ON

Gain Control (*GainCont*)

Selects the gain control functions in the sensor.

Manual = user controls the Sensitivity & Pulses
AutoSense = sensor controls Sensitivity & Pulses
Hard Target = user controls the Sensitivity & Pulses
but the gain comes up slower
Soft Target = user controls the Sensitivity & Pulses
but the gain comes up faster
Default: AutoSense

Sensitivity (*Sensitiv*)

Sets the maximum level of gain that is applied to the echo. If Gain Control is set to AutoSense, this parameter limits the maximum gain used by the AutoSense feature.

0 to 100 %
Default: 100%

Pulses (*Pulses*)

Sets the number of pulses per transmit burst. If Gain Control is set to AutoSense, this parameter limits the maximum pulses used by the AutoSense feature. In acoustically active applications or small enclosed areas, decreasing the number of pulses helps to reduce multiple echoes.

0 – 16 pulses
Default: 16

Blanking (*Blanking*)

Sets a dead band distance in front of the sensor. Because of the physical properties of an ultrasonic sensor, objects cannot be detected approximately one foot from the face of the transducer. The Blanking

can be extended and used to ignore unwanted targets close to the sensor such as welds, seams, pipe fittings, and gaskets.

1.00 – 25.00 ft

Default: 1.00 ft

Utilities (*Utilitie*)

Simulation allows the user to input a simulated low level, high level and the cycle time of the simulation. After these parameters are entered and the simulation is activated the level reading will move linearly between the programmed points at the specified interval.

Low Distance Simulation (*LoDisSim*)

1.00 – 25.00 ft

Default: 1.00

High Distance Simulation (*HiDisSim*)

1.00 – 25.00 ft

Default: 25.00

Simulation Cycle Time (*SimCycle*)

ON/OFF 0 – 9 seconds = OFF, 15 – 9999 = ON

Default = OFF

Reset (*Reset*)

Resets the sensor to factory defaults.

No Reset – Sensor Reset

Default: No Reset

File System (*Only available through computer software*)

Allows the user to save, load and edit text files that contain sensor parameters.

Sensor to File

File to Sensor

Compare Sensor to File

Default: none

Software Version (*Version*)

Displays the current software version running in the sensor.

Totalization (*Totalize*)

The sensor will have 2 flow totalizers. Totalization will update to software in increments of one minute.

Non resettable totalizer

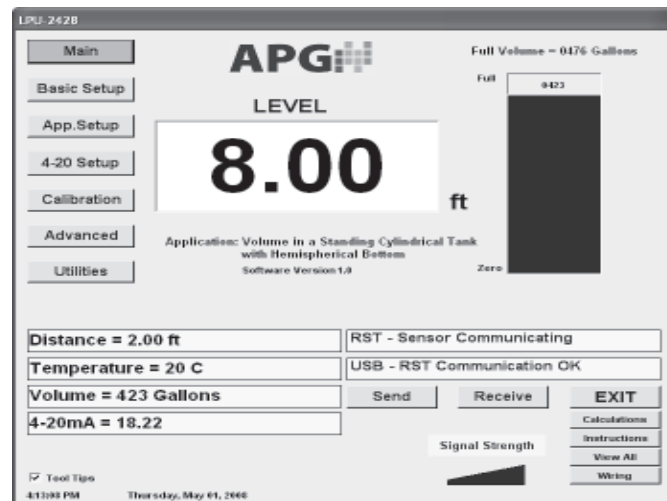
Resettable totalizer

Reset - Option to reset one totalizer

Programming Example:

Examples for each set of application (i.e., distance, level, volume, flow, linearization table, and submersible) can be found by clicking the Instructions button in the computer software. The following Volume application is taken from these examples.

The LPU-2428 is mounted at the top of a 10 ft standing cylindrical tank with diameter of 3 ft. The sensor needs to be setup to monitor volume in gallons from 1 to 9 ft (remember sensor has a 1 foot blanking distance).



Click Basic Setup.
 Select Units to Feet.
 Set Application to Volume.
 Select Volume Units to Gallons.
 Press Send to save (Wait until progress bar completes).

The screenshot shows the 'Basic Setup' screen of the LPU-2428 software. The 'Units' dropdown is set to 'Feet', 'Application' is 'Volume', and 'Volume Units' is 'Gallons'. The 'Flow Rate' is 'Per Minute' and 'Response Time' is 'Immediate'. A diagram of a tank with a hemispherical bottom is shown, with labels for 'Full', 'Empty', 'Empty', 'Diameter', 'Sensor', and 'Hem. Radius'. Below the setup options, the current 'Distance' is 2.00 ft, 'Temperature' is 20 C, and 'Volume' is 0 Gallons. The '4-20mA' output is 4.00. A progress bar labeled 'SENDING' is visible. The status bar at the bottom indicates 'RST - Sensor Communicating' and 'USB - RST Communication OK'.

Click App. setup.
 Set Tank Type to SCTWBH (Standing Cylindrical Tank with Hemispherical Bottom).
 Set Full Distance to 1 ft.
 Set Empty Distance to 10 ft.
 Set Tank Diameter to 3 ft. and set Radius of Hemi. to 0 ft.

The screenshot shows the 'App. Setup' screen of the LPU-2428 software. The 'Tank Type' is set to 'SCTWBH' (Standing Cylindrical Tank with Hemispherical Bottom). The 'Full Distance (0-25.00 ft)' is 1.00, 'Empty Distance (1.00-25.00 ft)' is 10.00, 'Tank Diameter (0-100.00 ft)' is 3.00, and 'Radius of Hemi. (0-25.00 ft)' is 0.00. A diagram of a tank with a hemispherical bottom is shown, with labels for 'Full', 'Empty', 'Empty', 'Diameter', 'Sensor', and 'Hem. Radius'. Below the setup options, the current 'Distance' is 2.00 ft, 'Temperature' is 20 C, and 'Volume' is 423 Gallons. The '4-20mA' output is 20.00. A progress bar labeled 'SENDING' is visible. The status bar at the bottom indicates 'RST - Sensor Communicating' and 'USB - RST Communication OK'.

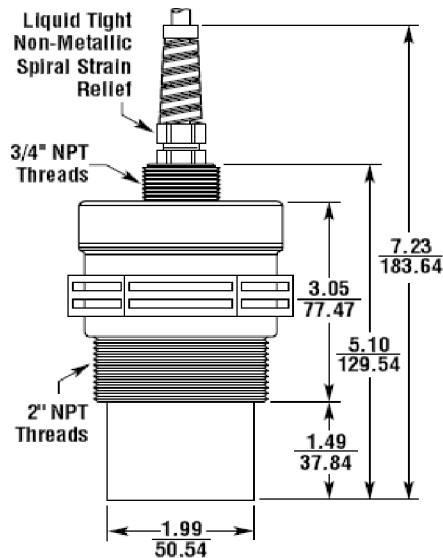
Click 4-20 setup.
Set Min Ma Set point (4mA). This value is usually set to zero.
Set Max Ma set point (20mA).
Press Send to save (wait until progress bar completes).



Specifications - LPU-2428

Operating Range	1 ft. to 25 ft. (0.3 m - 7.62 m)
Supply Voltage	12 to 28 VDC
Output	4-20 mA (Max 600 ohms @ 24 VDC) 4-20 mA (Max 150 ohms @ 12 VDC) (Includes barrier resistance)
Resolution	0.1 in. (2.54 mm)
Accuracy	+/- 0.25% of range with no temp gradient
Sensor Adjustments	Interface through RST-4001
Maximum Current Draw	4-20 mA (22 mA max in Fail Safe)
Transducer Type	Flat ceramic sealed PVDF face
Operating Temperature	-40 to 60°C
Internal Temp. Compensation	Yes
Sample Rate	3 sec at 4 mA - 0.6 sec at 20 mA
Beam Pattern	9° off axis
Enclosure	NEMA 4X , IP65
Cable Connection	2 terminals
Approvals	Class I, Div. 1, Groups C & D Class I, Zone 0, AEx ia IIB, T3; IP65

Dimensions - in./mm





Certificate of Compliance

Certificate: 1911747	Master Contract: 237484
Project: 1911747	Date Issued: 2008/03/25
Issued to: Automation Products Group Inc 1025 West 1700 North Logan, UT 84321 USA Attention: Karl Reid	

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US'



Issued by: Wesley Van Hill, C.E.T.

Authorized by: Patricia Pasenko, Operations Manager

PRODUCTS

- CLASS 2258 02** - PROCESS CONTROL EQUIPMENT - For Hazardous Locations
- CLASS 2258 82** - PROCESS CONTROL EQUIPMENT - For Hazardous Locations - Certified to US Standards
- CLASS 2258 04** - PROCESS CONTROL EQUIPMENT - Intrinsicly Safe, Entity - For Hazardous Locations
- CLASS 2258 84** - PROCESS CONTROL EQUIPMENT - Intrinsicly Safe, Entity - - For Hazardous Locations - Certified to US Standards
- CLASS 2258 02** - PROCESS CONTROL EQUIPMENT - For Hazardous Locations

The 'C' and 'US' indicators adjacent to the CSA Mark signify that the product has been evaluated to the applicable CSA and ANSI/UL Standards, for use in Canada and the U.S., respectively. This 'US' indicator includes products eligible to bear the 'NRTL' indicator: NRTL, i.e. National Recognized Testing Laboratory, is a designation granted by the U.S. Occupational Safety and Health Administration (OSHA) to laboratories which have been recognized to perform certification to U.S. Standards.

DQD 507 Rev. 2004-06-30





Certificate: 1911747

Master Contract: 237484

Project: 1911747

Date Issued: 2008/03/25

CLASS 2258 82 - PROCESS CONTROL EQUIPMENT - For Hazardous Locations - To U.S. Requirements

Class I, Division 2, Groups C and D, T6

Ex nA IIB T6 (Canada); IP65

Class I, Zone 2; AEx nA IIB T6 (USA); IP65

LPU Series Ultrasonic Sensors, Models LPU-2127, LPU-4127, LPU-2428 and LPU 4428; Rated input 12 to 28Vdc, Outputs 4-20mA; Ambient temperature range -40°C to +60°C.

CLASS 2258 04 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe, Entity - For Hazardous Locations**CLASS 2258 84 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe, Entity - For Hazardous Locations - Certified to US Standards**

Class I, Division 1, Groups C and D, T3

Ex ia IIB, T3 (Canada); IP65

Class I, Zone 0; AEx ia IIB, T3 (USA); IP65

LPU-2428 and LPU-4428 ultrasonic sensors; Rated input 12 to 28VDC, Outputs 4-20mA, Ambient temperature range -40°C to +60°C. Entity Parameters Vmax = 28VDC, Imax = 130mA, Pi = 0.91W, Ci = 0nF, Li = 110µH, intrinsically safe when connected in accordance with Installation drawing 9002747

APPLICABLE REQUIREMENTS

CSA Standard C22.2 No. 0-M1991 - General Requirements Canadian Electrical Code Part II

CSA Standard C22.2 No.0.4-M2004 - Bonding and Grounding of Electrical Equipment (Protective Grounding)

CSA Standard C22.2 No.142-M1987 - Process Control Equipment

CSA Standard C22.2 No. 157-M1992 - Intrinsically Safe and Non-Incendive Equipment for Use in Hazardous Locations

CSA Standard C22.2 No. 213-M1987 - Non-Incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations

CAN/CSA E60079-0:02 - Electrical apparatus for explosive gas atmospheres - Part 0: General requirements

CAN/CSA E60079-11:02 - Electrical apparatus for explosive gas atmospheres - Part 11: Intrinsic safety "i"

CAN/CSA E60079-15:02 - Electrical apparatus for explosive gas atmospheres - Part 15: Type of protection "n"

DOD 507 Rev. 2004-06-30

**Automation Products Group, Inc.****APG...Providing tailored solutions for measurement applications**



Certificate: 1911747

Master Contract: 237484

Project: 1911747

Date Issued: 2008/03/25

CAN/CSA-C22.2 No. 60529:05 - Degrees of protection provided by enclosures (IP Code)

UL Standard 508, Seventeenth Edition – Industrial Control Equipment

UL Standard 913, Seventh Edition - Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, II, III, Division 1, Hazardous (Classified) Locations

ANSI/ISA-12.12.01-2007 – Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations

UL 60079-0, Fourth Edition - Electrical Apparatus for Explosive Gas Atmospheres – Part 0: General Requirements

UL 60079-11, First Edition - Electrical apparatus for explosive gas atmospheres – Part 11: Intrinsic safety "i"

UL 60079-15, First Edition - Electrical Apparatus for Explosive Gas Atmospheres – Part 15: Electrical Apparatus with Type of Protection "n"

IEC60529:04 - Degrees of protection provided by enclosures (IP Code)

DOD 507 Rev. 2004-06-30

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