

Acu-Trac® Smart 485 Level Transducer Configuration Kit With USB Adapter User's Guide

SSI TECHNOLOGIES, INC.
Controls Division
2643 W. Court Street
Janesville, WI 53548-5011
Phone: (608)758-1500
Fax: (608) 758-2491
www.ssitechnologies.com



SSI Technologies, Inc.

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Revision 1



SSI Technologies – Application Note AT-AN13

Acu-Trac® Smart 485 Level Transducer Configuration Kit with USB Adapter User's Guide

Acu-Trac® Smart 485 Technical Assistance

We can be reached online, via email, or by telephone and will be happy to assist you with any question you may have installing or using this product.

Online

On our website at <http://ssitechnologies.com/aculib.htm> you'll find a comprehensive technical library containing, product data sheets and application notes covering all of our Acu-Trac® products.

Email

If your question is technical in nature, we recommend emailing our technical service engineers at: **Acu_service@ssitech.com**. Please include your phone number, availability and a detailed description of your question and we'll get back to you with in one business day. Please specify that you are using the Smart 485 Acu-Trac.

Direct

If your need immediate assistance please call us direct, Monday through Friday from 8:00 AM to 5:00 PM CST at **(608) 758-1500**. Ask for Acu-Trac® Smart 485 Technical Assistance.

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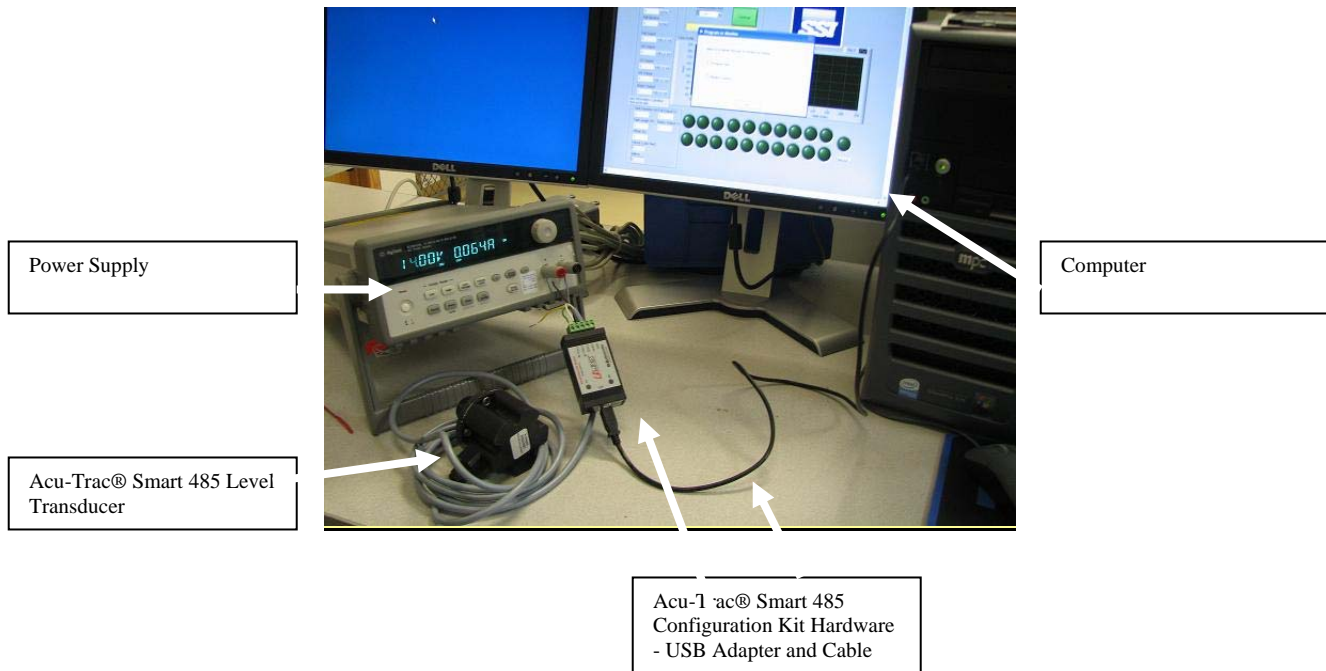


1 Introduction

Thank you for purchasing a SSI Acu-Trac® Smart 485 Level Transducer Configuration Kit. The system provides the user the following flexibility:

- The ability to re-configure the Acu-Trac® Smart 485 Level Transducer to support virtually any tank/container size or shape up to 2.5 meters in depth.
- The ability to easily set up the Acu-Trac® Smart 485 Level Transducer's analog output.

SSI's Acu-Trac® Smart 485 technology optimizes the level transducer's operating parameters for level, motion, and ambient temperature, which improves performance, while delivering accurate level measurements day in and day out.



2 Acu-Trac® Smart 485 Level Transducer Configuration Kit Overview

The Acu-Trac® Smart 485 Level Transducer Configuration Kit is designed to allow you to set up the Acu-Trac® Smart 485 level transducer's tank configuration and analog output from the convenience of your desk using a conventional Windows based PC. The kit comes complete with hardware, software, and application information.

2.1 Hardware

The hardware items included in this kit are a RS485 to USB Converter, USB cable and a Level Transducer Interface Harness.

2.2 Software

The kit contains an easy to use software package that can be simply installed off of the Acu-Trac® Smart 485 Level Transducer Configuration Software CD ROM supplied with your kit. The software provides you with the ability to reconfigure the Smart 485 transducer for different container/tank sizes, and reconfigure the Smart 485 analog output. The software application tools contained within this kit are as follows:

USB to Serial Driver Disk:

Driver to setup the PC's serial ports.

Acu-Trac® Level Transducer Configuration Software Disk:

1. **Acu-Trac® Level Transducer Configuration Install Program:**

Provides a standard Windows® install shield used to install the software.

2. **Acu-Trac® Level Transducer Configuration Software:**

The main application allows the user:

a. ***Program the Level Transducer***

- Change the settings for the tanks size and shape.
- **Write** the changes back to the transducer.

b. ***Monitor the Level Transducer***

2.3 Documentation

Acu-Trac® technical documents are available on our website at www.ssitechnologies.com/aculib.com

3 System Requirements

The Acu-Trac® Level Transducer Configuration software requires that you have a minimum system, which meets or exceeds the following:

Pentium® Processor-based personal computer or Laptop
Windows® NT, Windows® XP, Windows 2000, Vista and above operating system
CD-ROM Drive
64 MB of RAM memory



4 Acu-Trac® Smart 485 Level Transducer Configuration Kit Contents & Description

The Acu-Trac® Smart 485 Level Transducer Configuration Kit works with the Acu-Trac Smart 485 Level Transducer (sold separately) and contains the following components:

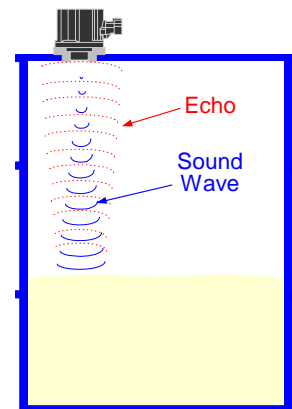
- Acu-Trac® Smart 485 Level Transducer Configuration CD ROM
- RS485 to USB Adapter
- RS485 to USB Driver CD ROM
- 1 meter USB cable
- Level Transducer Interface Harness (if applicable)

4.1 Acu-Trac® Smart 485 Ultrasonic Level Transducer (Sold Separately)

The Acu-Trac® Smart 485 transducer is the heart of the level measurement system. The transducer calculates the distance to the target by generating a sound wave and then measuring the time necessary for the sound wave to travel from the transducer to the target and then back to the transducer again. The time of flight of the sound wave, or echo, provides the basis for the distance measurement. The speed of sound is constant; therefore, the distance is directly proportional to the measured time.

The Acu-Trac® Smart 485 Ultrasonic Level Transducer used with this kit provides a RS485 digital communications output in addition to a re-configurable voltage or current output.

Acu-trac™ Sensor



4.2 RS485 to USB Adapter

The RS485 to USB Adapter converts the RS485 transducer broadcasts into a conventional USB signal readable through your computer's serial I/O port.

4.3 Acu-Trac® Smart 485 Level Transducer Configuration CD-ROM

The Acu-Trac® Smart 485 Level Transducer Configuration CD provides the software tools which will enable you to reconfigure the transducer for different tank sizes and analog outputs.

The Software Installation Guide in section 7 provides a step by step tutorial to guide you through the installation process.

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4.4 One Meter USB Interface Cable

Provides the USB serial data connection between your PC and the RS485 to USB Adapter.

4.5 Level Transducer Interface Harness Assembly (if applicable)

This harness (P/N 2436.3) is used on Smart 485 Level Transducer that has 5 pin Packard connector. It connects the Acu-Trac® Smart 485 Level Transducer to the RS485 to USB Adapter, and supplies power to the part (see Photo # 1).

5 Mounting the Transducer to the Tank

5.1 Mounting the Transducer to the Tank using the SAE bolt pattern

Position the level transducer gasket over the Acu-Trac® level transducer assuring the proper screw hole alignment.

Note: On a cylindrical tank the gasket is thinner in the middle than on the ends. Gasket alignment can be assured by holding the level transducer and gasket up to the light and rotate the gasket until light can be seen through all of the holes.

Insert the Acu-Trac® level transducer into the tank with the metal can facing down. Align the screw holes to the existing holes in the tank. Attach the level transducer to the tank using five screws.



5.2 Checking the installation

The Acu-Trac® level transducer uses sound wave reflections to measure the level of the tank. For proper operation, the transducer must be mounted perpendicular to the target with a clear line of sight to the target.

To assure proper operation, verify the tank is not tilted by using a level. Check to see that the level transducer is level with respect to the tank. The suggested angle of tilt should be less than 5 degrees. If the transducer is more than 5 degrees off of level, the tank must be rotated to assure proper performance from the level transducer.



6 Electrical Connections

The electrical interface connection to the Acu-Trac® Smart 485 level transducer is illustrated below. Figure 1 is for Acu-Trac® Smart 485 with integral harness and Figure 2 is for Acu-Trac® Smart 485 with Packard connector and Harness P/N 2436.3 (supplied in the configuration kit).

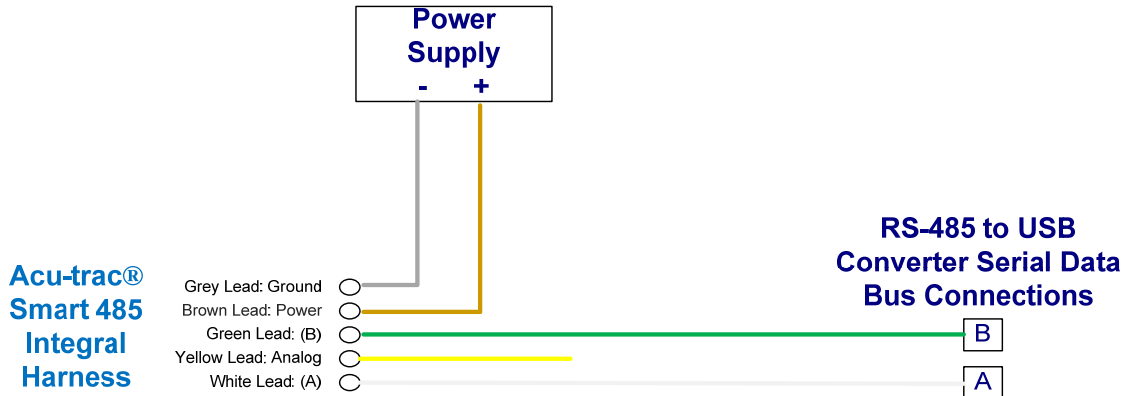


Figure 1 Acu-Trac® Smart 485 with integral harness

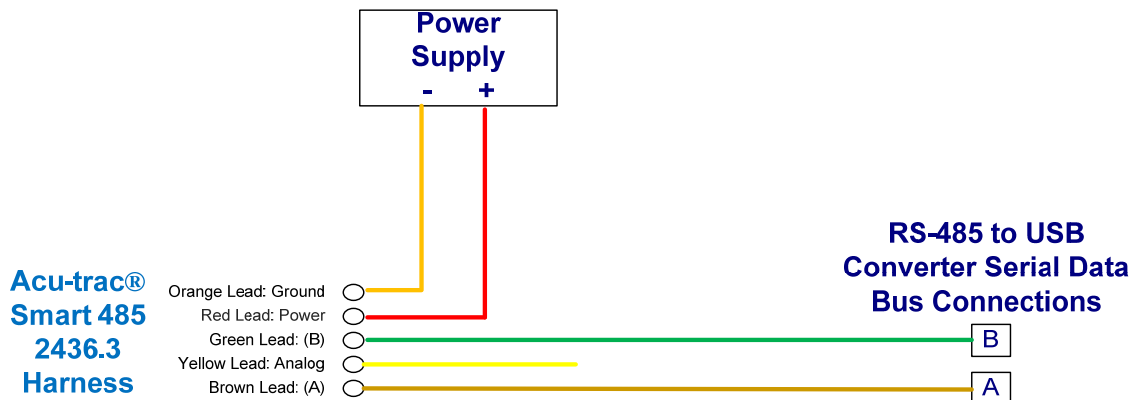


Figure 2 Acu-Trac® Smart 485 with Packard connector

6.1 Ground

The ground lead must be connected to ground (battery negative) for the level transducer to function. The level transducer's internal electronics are ground isolated from the tank to prevent ground loops. All sinked current will be returned through this connection.

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6.2 Supply Voltage

The power lead must be connected to DC Power (Battery Positive) for the level transducer to function. The power source to the level transducer should contain a fuse with minimum amperage rating of 1 Amp and maximum amperage rating of 5 Amps. The level transducer will function when the supply voltage is between 11 and 16 Volts for the 12 Volt transducer and between 11 and 34 Volts for the 24 Volt transducer. This connection is protected from over voltage, load dumps, and other electrical transients.

6.3 Analog Output Connection

The Yellow lead is the analog output. Two different analog outputs are available depending on which level transducer was purchased. The voltage output part is primarily used to drive a gauge. The current output part is primarily used to interface with industrial equipment.

6.4 Data Link Positive (A) Connection

Connect the Data Link Positive (A) wire to the data link positive (A) connection on the RS-485 to USB adapter (A) position.

6.5 Data Link Negative (B) Connection

Connect the data link negative (B) wire to the data link negative (B) connection on the RS-485 to USB adapter (B) position.

6.6 Data Link Adapter to PC Connection

Prior to using the Level Transducer Configuration software, connect the USB B Plug Connector to the RS-485 to USB adapter and the USB A Plug Connector to your PC. Refer to figure 3 below for USB Plugs.

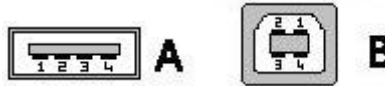


Figure 3 USB Plug Connectors

7 Installing the Acu-Trac® Smart 485 Level Transducer Configuration Software

To Install the **Level Transducer Configuration Software**, insert the Acu-Trac® Smart 485 Level Transducer Configuration CD into your CD ROM drive. Double click on the CD ROM drive icon located in **MY Computer**. Double click on the **setup.exe** file.

We recommend that you close all Windows® applications before proceeding with the setup. To begin the installation process click **next** this will bring up the Software License Agreement window.

7.1 Directory Location

The installation software provides a directory and folder recommendation for installing the Configuration software based on your system. If acceptable, click on **Next** to continue.

Note: If you wish to change the location that the software is installed you may do so by clicking on the Browse button.

7.2 License Agreement

This program is protected by copyright law and international treaties. The unauthorized reproduction and distribution of this program may result in sever civil and criminal penalties and will be prosecuted to the maximum extent possible under law. Please read the licensing agreement carefully. Click **I Accept the License Agreement** to continue the installation.

Click **Next** to continue the installation.

7.3 Load Program on your Hard Drive

At this point the installation software has enough information to install the Level Transducer Configuration software onto your hard drive. Click on **Next** to automatically load the Level Transducer Configuration software onto your system.

7.4 Complete the Installation

Upon completion the finished window will appear indicating that the installation has been completed. Click on **Finish** button when ready.

Remove the Acu-Trac® Smart 485 Level Transducer Configuration CD ROM from your CD ROM drive.

7.5 Restart Selection

Depending on your PC's operating system, the installation may require you to restart your system to save the installed settings. You have the option to restart your system through the installation window by clicking on the **Restart** button or to restart your system manually using your **Shut Down** button at a later time.

Click on the **Restart** button to restart your system. The installation is now complete. The software will automatically shut down and restart your computer.

Note:

The Level Transducer Configuration software is installed onto your hard drive. The program name will now be displayed in All Programs menu of windows.



8 Set Up

8.1 RS-485 to USB Adapter

Set the RS-485 to USB Adapter internal dip switch settings per the photo below



Connect the Acu-Trac® Smart 485, power supply and RS-485 to USB adapter per Figure 1 or Figure 2.

Install the RS-485 to USB adapter driver disk into the CD. The new hardware wizard will guide you through the installation for both the Model USPTL4 and RS-485 port.

Select **Start** and then **Control Panel**, double click on **System**. On the **Hardware Tab**, click **Device Manager**. Expand the **Ports (Com & LPT)** to determine the RS-485 port by checking the Device Manager.

8.2 Starting the Acu-Trac® Smart 485 Level Transducer Configuration Software

If you haven't already installed the Acu-Trac® Smart 485 Level Transducer Configuration software, you'll need to do so before you can bring up the application.

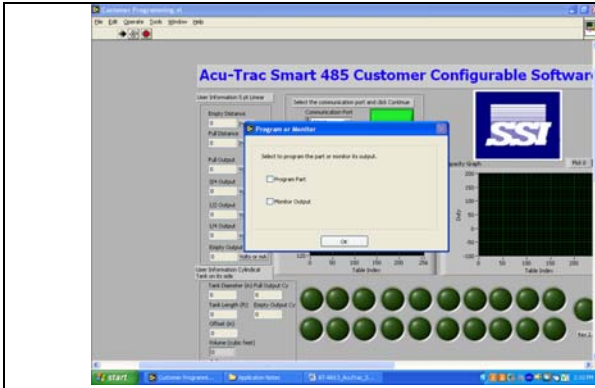
To run the Smart 485 Level Transducer Configuration software: on the Windows® Taskbar click the **Start** button, point to **Programs**, point to **Customer Programming**, slide over and then click on **Acu-Trac Customer Programming**. The Acu-Trac® Smart 485 Level Transducer Configuration Software window will automatically open up.

9 Acu-Trac® Smart 485 Level Transducer Configuration Software Features & Description

9.1 Communication Port Selection

	<p>The system setup dialog asks if you are using the Com 1 port. If you are using the COM 1 port then click on Yes. Note: You can check the port setting in your device manager.</p> <p>If you are using a different port then click on No. Click the pull down menu and click on the port that you wish to use (near the flashing yellow light). Once you have selected the correct port, click the Continue button.</p>
--	--

9.2 Software Mode Selection

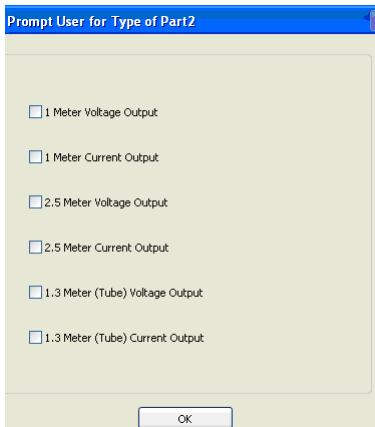


The system setup dialog asks if you would like to program the Smart 485 level transducer or monitor the output.

10 Monitor Mode

10.1 Part Selection

Select one of the five types of parts by clicking in the box. Reference the part number to determine the part type.



The 1st character determines the output range.

A is either a 1 meter or 1.3 meter part with tube attachment.
C is a 2.5 meter part.

The 10th character determines the output type.

V has a voltage out.
C has a current output.

Note: This software will not be able to calibrate a ratio-metric part (9th character is an A).

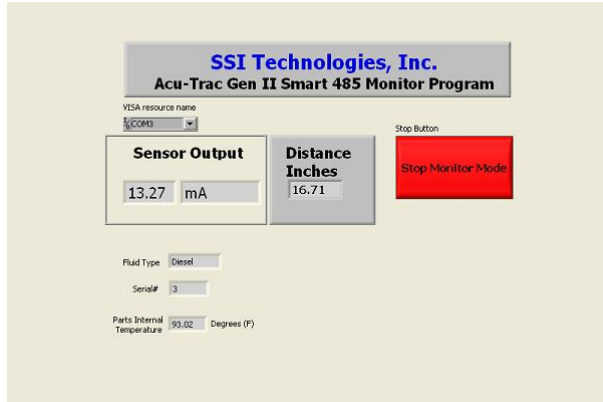
Note: If you receive a “Part is not responding” error message. Verify the communication port selected is correct.



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10.2 Part Monitoring



The program will refresh the data on the screen based on the update rate that is programmed into the part.

Note: The Smart 485 level reading may not instantaneously update to the proper current level. The update rate is based on the update rate and filtering programmed into the part.

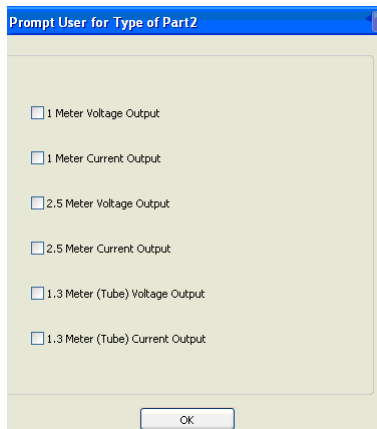
Click on the Red Stop Monitoring Button when you are done.

You will have the choice to either quit the program or continue on (monitor or program parts)

11 Programming Mode

11.1 Part Selection

Select one of the five types of parts by clicking in the box. Reference the part number to determine the part type.



The 1st character determines the output range.

A is either a 1 meter or 1.3 meter part with tube attachment.
C is a 2.5 meter part.

The 10th character determines the output type.

V has a voltage out.
C has a current output.

Note: This software will not be able to calibrate a ratio-metric part (9th character is an A).

Note: If you receive a “Part is not responding” error message. Verify the communication port selected is correct.



11.2 Enter in the tank information

Three tank calibration options are available:

Standard Tank 5 point Calibration is the standard method of calibration by entering in the full, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{1}{4}$, and empty points. The software will linearly interpolate between these five points to create the tank profile.

Cylindrical Tank on its side Calibration is calibrating the transducer to fit a cylindrical tank on its side.

20 point Nonlinear table Calibration is to calibrate the part by manually entering in 20 non-linear points. The software will default to a linearly interpolation between these 20 points to create the tank profile.

11.2.1 Standard Tank 5 point Calibration

The screenshot shows a software window titled "User Information 5 pt Linear". It contains the following fields and values:

- Empty Distance: 10 Inches
- Full Distance: 4 Inches
- Full Output: 4 Volts or mA
- 3/4 Output: 8 Volts or mA
- 1/2 Output: 12 Volts or mA
- 1/4 Output: 16 Volts or mA
- Empty Output: 20 Volts or mA

A description of the tank variables are shown below.

Note: Refer to Table 1 for the valid inputs that are allowable for these tank variables.

Empty Distance - the distance between the transducer face and the empty level in the tank. Enter in the empty distance in inches and click OK.

Full Distance - the distance between the transducer face and the full level. Enter in the full distance in inches and click OK.

Gauge configuration – Full, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{1}{4}$, and Empty output values. This program assumes the gauge has been previously characterized (Vin vs. Display). Enter in the output required by the level transducer in the condition (Full, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{1}{4}$, and Empty) to set the gauge to Full, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{1}{4}$, and Empty and click OK.

The program will interpolate the output between these 5 points. The program will then ask you if the information you have entered is correct, if the part is powered up, and if you wish to program the part. Review the information you have just entered displayed towards the left hand of the screen. If the information is correct and you are ready to program the part, click on Yes.

The program now asks if you want to change the update time, digital output type, total gallons of the tank or the serial number.

Note: The part can be re-programmed until the desired output has been achieved. If you are not using the analog output then put in output numbers which are simply representative of the tank capacity. The software will use these numbers to calculate the percent capacity and gallons remaining.

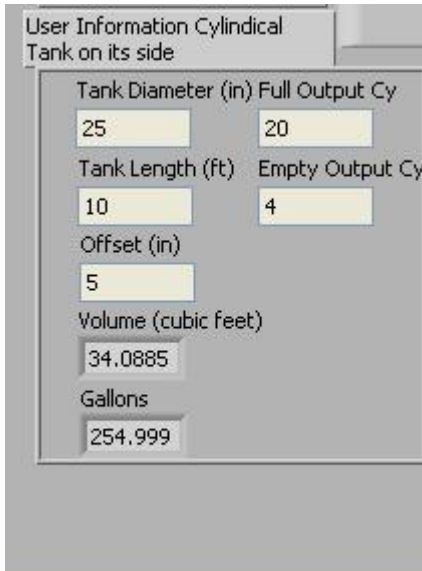
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	Non-Ratiometric Voltage Output Part			Current Output Part	
	1.0 Meter	1.3 Meter (Tube)	2.5 Meter	1.0 Meter	2.5 Meter
Empty Distance (inches)	< 35.4 inches	< 52 inches	< 98 inches	< 35.4 inches	< 98 inches
Full Distance (inches)	> 4 inches	> 4 inches	> 8 inches	> 4 inches	> 8 inches
Full, ¾, ½, ¼, Empty Output (Volts or mA)	0 to 9.5 Volts			4-20 mA	

Table 1. Valid Data Inputs for Standard 5 Point Calibration

11.2.2 Cylindrical Tank on its side Calibration



A description of the cylindrical tank variables are shown below.

Note: Refer to Table 2 for the valid inputs that are allowable for these tank variables.

Tank Diameter – the inside diameter of the tank in feet

Tank Length – the tank length in feet.

Mounting Offset – the distance in inches from the mounting face of the Smart 485 level transducer to the top of the tank.

Note: The software will calculate the total tank volume.

Full Output and Empty Output - Enter in the gauge full and empty analog output. This program assumes the gauge has been previously characterized (Vin vs. Display).

The program will now create the non-linear tank profile. If you are not using the analog output then put in output numbers which are simply representative of the tank capacity. The software will use these numbers to calculate the percent capacity.



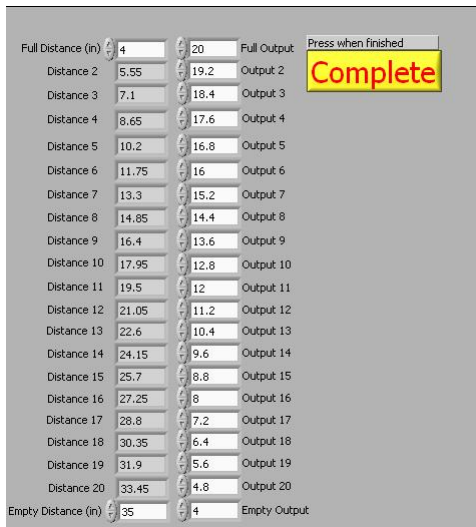
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	Non-Ratiometric Voltage Output Part			Current Output Part	
	1.0 Meter	1.3 Meter (Tube)	2.5 Meter	1.0 Meter	2.5 Meter
Tank Diameter (Inch)	< 35.4 inches	< 52 inches	< 98 inches	< 35.4 inches	< 98 inches
Tank Length (feet)	-	-	-	-	-
Mounting Offset (inches)	> 4 inches	> 4 inches	> 8 inches	> 4 inches	> 8 inches
Full Output (Volts or mA)	0 to 9.5 Volts			4-20 mA	
Empty Output (Volts or mA)					

Table 2. Valid Data Inputs for Cylindrical Tank on Side Calibration

11.2.3 20 Point Nonlinear Table Calibration



A description of the 20 point nonlinear tank variables are shown below.

Note: Refer to Table 3 for the valid inputs that are allowable for these tank variables.

Empty Distance – distance from the face of the Smart 485 transducer at Empty as shown in the standard tank diagram on page 18.

Full Distance – distance from the face of the Smart 485 transducer at Full as shown in the standard tank diagram on page 18.

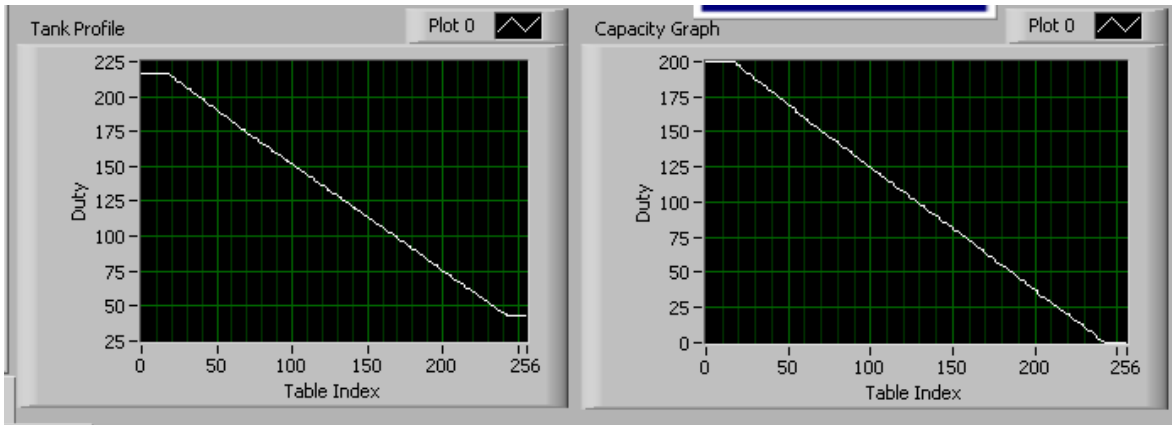
Empty Output and Full Output - Enter in the analog full and empty outputs.

This program assumes the gauge has been previously characterized (Vin vs. Display). The software will then allow you to change any of the analog outputs. If you are not using the analog output then put in output numbers which are simply representative of the tank capacity.



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The software will use these numbers to calculate the percent capacity and gallons remaining.

	Non-Ratiometric Voltage Output Part			Current Output Part	
	1.0 Meter	1.3 Meter (Tube)	2.5 Meter	1.0 Meter	2.5 Meter
Empty Distance (inches)	< 35.4 inches	< 52 inches	< 98 inches	< 35.4 inches	< 98 inches
Full Distance (inches)	> 4 inches	> 4 inches	> 8 inches	> 4 inches	> 8 inches
Empty Output (Volts or mA)	0 to 9.5 Volts			4-20 mA	
Full Output (Volts or mA)					

Table 3. Valid Data Inputs for 20 Point Nonlinear Calibration

11.3 Programming the part

The program will begin to program the part to the tank configuration you have just entered. The row of lights on the bottom of the screen should begin to sequentially turn green as the Smart 485 part is programmed. It normally takes a few minutes to program the part.

11.4 Configuration Information

You have the option to change the following:

- **Transducer's updating time** (Slosh Filtering)
- **Digital Output Configuration** (RS 485 or J1708),
- **Total gallons of the tank**
- **Serial Number**

Simply select yes to change any of this information or select No and the part will not program any of this information.

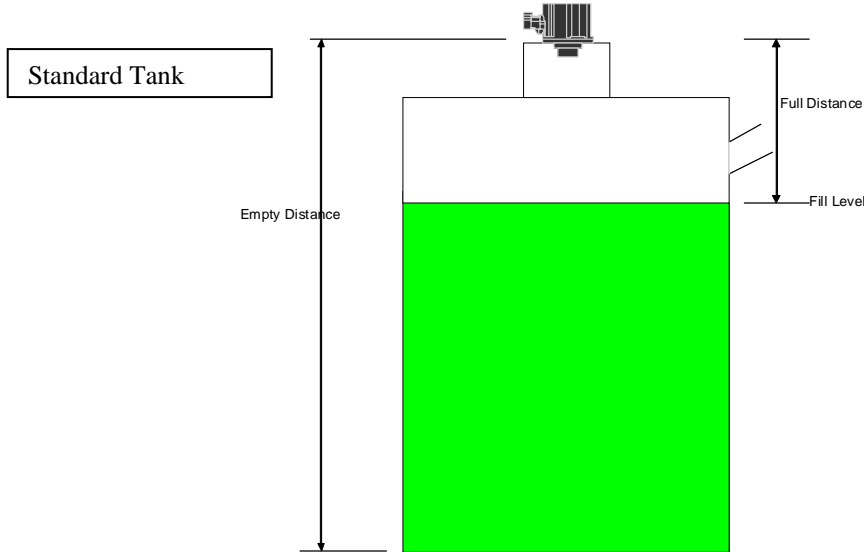
If the program was successful, the program will display the part program complete and ask you if you wish to program another part. Click No when you are done programming to exit the program. Proceed to the section 12 if the part does not program successfully.



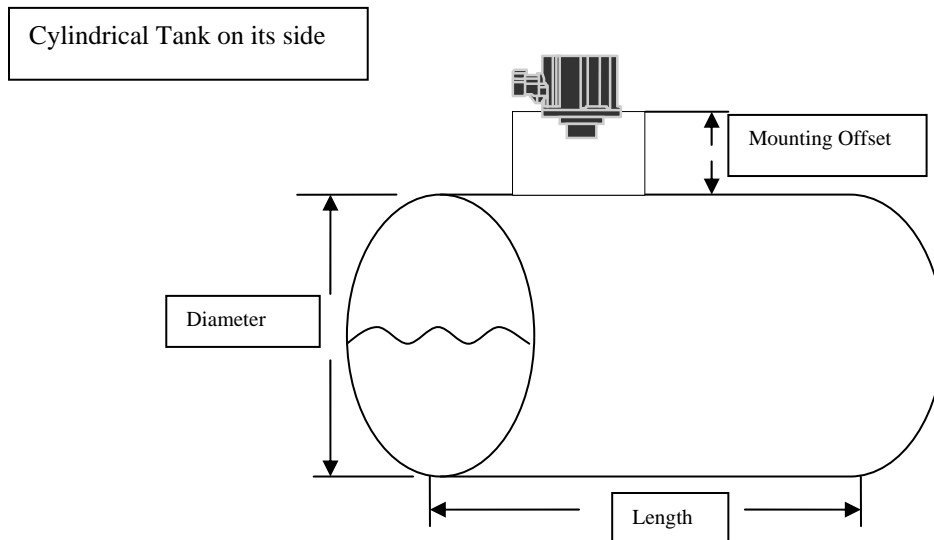
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The Level Transducer Configuration Software allows you to change the tank's size, depth and to compensate for offset mounting conditions. The picture below illustrates a standard tank application and defines the empty and full distances as referenced from the face of the transducer.



The Level Transducer Configuration Software allows you to configure the part for a cylindrical tank on its side. The picture below illustrates a cylindrical tank application and defines the tank diameter, tank length, and mounting offset as referenced from the face of the transducer.



12 Error Messages

The Acu-Trac® Smart 485 Level Transducer Configuration software provides the following error messages in response to the conditions noted below:

12.1 RS232 Communication Error

This error message occurs when the Acu-Trac® Smart 485 Level Transducer Configuration software is unable to communicate with the COM port. The software requires exclusive use of the COM port in order to communicate with the transducer. This error will occur if the COM port you selected is in use by another program. Typically Palm pilot software and some modem drivers automatically engage the COM port when your PC is turned on.

To correct click **Ok** on the error message and close out the Acu-Trac® Smart 485 Level Transducer Configuration software. Locate and close out any Palm pilot, PDA, modem or any other applications that may be running that shares the COM port you selected at install. Reopen the Acu-Trac® Level Transducer Configuration window and resume operation.

To avoid this occurrence in the future, close out any applications that share the COM port prior to pulling up the Acu-Trac® Smart 485 Level Transducer Configuration software.

12.2 Communication Failed. Check Connections. Verify part is on.

This error message occurs when the Level Transducer Configuration software is unable to read or write the configuration parameters.

If this error message occurs, check to make sure that all the electrical connections are present and that the transducer that you wish to configure is powered up. Verify you are using the correct communications port of your computer. Unplug all other transducers that may be on the communications port. To correct click **Ok** on the error message, click the run arrow in the top left hand corner of the screen and re-enter the configuration variables. Check all the possible problems below if the problem persists.

- **No Electrical Power** - Check the DC power to the level transducer. DC power can be measured between pins A and B of the level transducer harness. Verify the supply voltage is within range of the specification.
- **COM Port Selection entered incorrectly during installation**- Pull up the PC system configuration of your computer from the control panel. Verify you are using the correct port number and the port is working correctly.
- **Level Transducer Harness Damaged or Unplugged** – Check the level transducer harness and the connection from the RS485 to USB Adapter to the level transducer harness to make sure that the harness is not damaged. Check that it is plugged into the transducer.
- **USB Interface Cable Damaged or Unplugged** – Check the USB Interface Cable connections from the RS485 to USB Adapter to your PC.
- **Bad PC Communications Port** – Switch the USB Interface Cable connection to another COM port on your PC. Select the new port at the beginning of the program.
- **Damaged or Bad Transducer** – Disconnect the transducer and replace.



Appendix A: Acu-Trac[®] Ultrasonic Transducer Family Analog Output Options

The Acu-Trac[®] Smart 485 family of transducers offers a voltage, and current loop analog output option. Each option provides an analog output, which is proportional to the measured volume. The following is a brief description of the various output options.

□ Voltage Output

The Voltage Output is a highly accurate voltage drive capable of sourcing 5 mA's of current. The voltage output is also field configurable and can be programmed for operation between 0.5 to 9.5 volts.

□ Current Loop Output

The Current Loop Output configuration is a highly accurate 4 to 20 mA instrumentation current loop. The Current Loop Output can drive resistive loads ranging from 100 to 410 ohms.



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Glossary

COM Port	Common PC term used to designate a USB serial interface port built into a personal computer.
Diagnostics	Term used to designate the testing of a products operational status.
Echo	Refers to the returned sound wave after it reflects off an object.
Percent of Capacity	Numeric value applied to level sensing applications wherein the level is reported as a percentage of the vessel's total capacity.
RS485	TIA/EIA Standard defining the communications protocol for sending messages over a 2 wire bi-directional serial data interface. See TIA/EIA Standard TIA/EIA-485-A, "Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems."
Serial Number	Refers to the 8-digit identification number which is uniquely coded into every Acu-Trac® Smart 485 transducer.
Serial port	Same as COM Port
USB	Common PC based serial interface protocol enabling communications between microcomputers.

