

3D Level Scanner

English > Quick installation guide

Spanish > Guía rápida de instalación

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Quick Installation Guide

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- > **Dust-Penetrating**
- > **Level Measurement**
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BinMaster 3DLevelScanner S/M/MV Quick Installation Guide

Version 2.0

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Overview

The BinMaster 3DLevelScanner™ is the only device presently available that delivers accurate measurement of bulk solids and powders – regardless of the type of material or product characteristics, type and size of storage silo, bin or container, and harshness of the storage environment. It incorporates unique dust-penetrating technology to achieve an unrivalled degree of process measurement and inventory control.

The 3DLevelScanner employs an array of three antennas to transmit low frequency pulses and to receive echoes of the pulses from the contents of the silo, bin, or other container. Using these antennas, the unit measures not only the time/distance of each echo, but also its direction. The device's Digital Signal Processor samples and analyzes the received signals to provide accurate measurements of the level, volume, and mass of the stored contents and generates a 3D representation of the actual allocation of the product within the container for display on remote computer screens. This unique device measures practically any kind of material stored in a great variety of containers, including silos, large open bins, bulk solid storage rooms, stockpiles, and warehouses. It maps build-up loads and other irregularities that randomly form over time, offering solutions for this and many other previously inaccessible challenging applications.

The Quick Installation Guide describes, step by step, how to quickly setup and safely operate the BinMaster 3DLevelScanner. The quick installation guide is designed for trained personnel only. Please read it carefully before proceeding with the installation.



Installing and using the 3DLevelScanner requires strict observance of standard safety regulations and guidelines. Follow all safety instructions in the quick installation guide and the operation manual. In addition, adhere to all country-specific installation standards (for example, the VDE regulations in Germany) and all common safety regulations and accident prevention rules.

Inappropriate or incorrect use of the 3DLevelScanner can cause application-specific hazards such as overfilling the vessel. Incorrect mounting or adjustments can cause damage to system components.

Installation Kit

The BinMaster 3DLevelScanner installation kit contains the following items:

- ① Documentation (Software, Operation, Quick Installation, and Safety Manuals).
- ① 3DLevel Manager Software CD.
- ① 3DLevelScanner Special Horn Antenna – see Figure 2.
- ① 3DLevelScanner Electronics Housing – see Figure 4.

Components

Figure 1 shows the 3DLevelScanner Sensor.



Figure 1 3DLevelScanner Sensor

The 3DLevelScanner Sensor contains the following components:

- ① Special horn antenna.



Figure 2 Special Horn Antenna

- ① Process fitting (the type depends on flange or thread version).



Figure 3 Process Fitting

- ① Electronics housing.



Figure 4 Electronics Housing.

Site Preparations

This chapter describes how to prepare the site for installation of the 3DLevelScanner. It includes guidelines for optimal positioning and fitting of the scanner.



The site preparations described in this section must be verified and completed before starting installation. To enable optimal installation, ensure that the 3DLevelScanner can be positioned and fitted according to the guidelines described in this section.



For a list of items recommended to prepare before installing the 3DLevelScanner, refer to *Recommended Tools and Materials* on page 41.

Power

A 24VDC (2W) power supply must be prepared and ready to use close to the place where the scanner will be mounted. (Use a 1A fuse.) The 3DLevelScanner is a 4W device. The voltage supply and data output are carried along separate two-wire connection cables.

Communication

The communication cables provide the digital communication (HART/RS485, etc.).

An 8-13 mm two-wire, shielded twisted pair communication cable must be prepared and ready to use between the following:

- ⦿ The installation position on top of the vessel where the scanner will be mounted.
- ⦿ The control room/place where the PLC/computer will be placed.

Installing the Scanner

This chapter describes how to physically install the 3DLevelScanner and connect the communication cables.

Part I: Installing the Flange in the Scanner

1. Take the scanner's body out of the box.



When removing or reinstalling the scanner head, you must perform the tasks in the order described in the following procedures.



Ensure that the O-ring on the neck tube remains in place (see *Figure 5*).



Figure 5 Neck Tube O-Ring



2. Use an 18" adjustable wrench to remove the nut from the neck tube.



Figure 6 Remove the Neck Tube Nut

3. Insert the flange onto the neck tube.

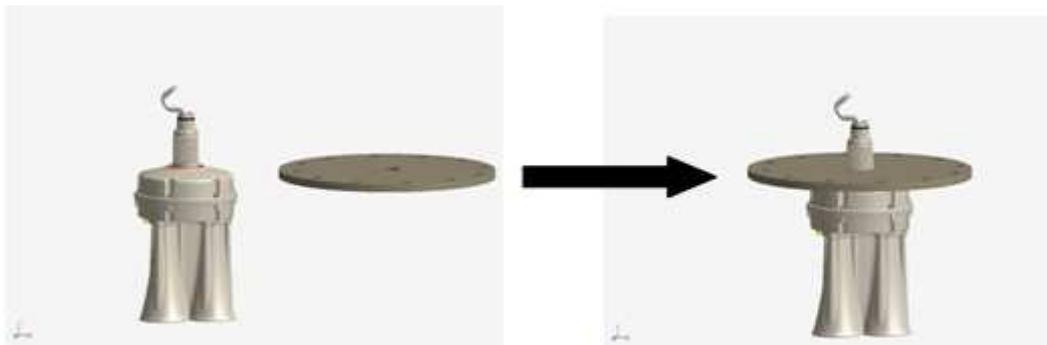


Figure 7 Insert the Flange

4. Screw the nut back onto the neck tube and tighten using an 18" adjustable wrench.



Figure 8 Screw Nut onto the Neck Tube

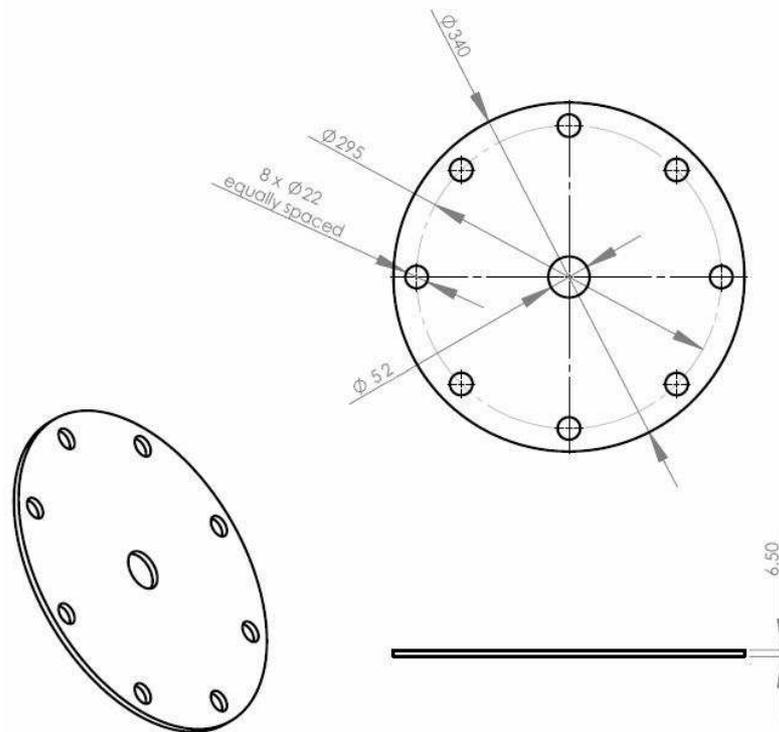


Figure 9 Flange DN200

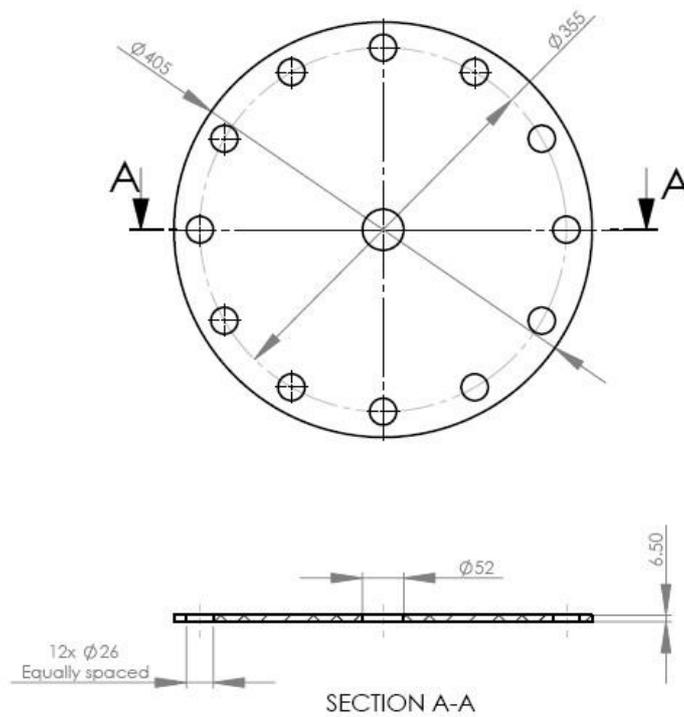


Figure 10 Flange DN250



If a flange has not been supplied, contact BinMaster's local distributor or go directly to BinMaster's website (under Accessories) to find drawings of possible flanges.

Part II: Installing the Scanner Head

After installing the flange you must install the scanner head.



Before installing the scanner head, it is recommended to grease the rubber o-ring on the neck tube (see *Figure 5*). This makes it easier to push the scanner head into the correct position on the neck tube.

1. Take the scanner's head out of the box
2. Loosen the four screws of the scanner rear panel on the back of the scanner head and remove the rear panel. The screws are captive and will not fall off.



Figure 11 Unscrew Four Screws on Rear Panel

3. Remove the cable clamp.

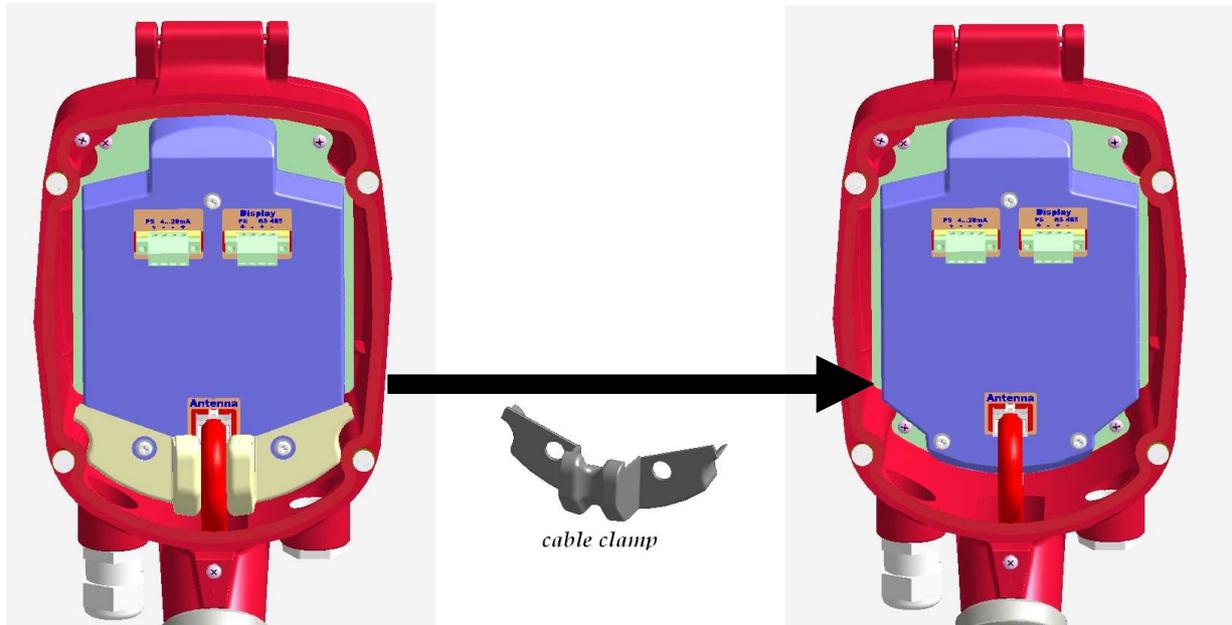


Figure 12 Remove the Cable Clamp

4. Insert the scanner's head onto the neck tube.



Insert the antenna's cable in a gentle way through the scanner's head to make sure not to damage the (white) cable connector.

When placing the scanner head onto the neck tube, it is important to push the scanner head all the way down on the neck tube until the top of the neck tube reaches the head's inner surface (as shown in *Figure 13*).

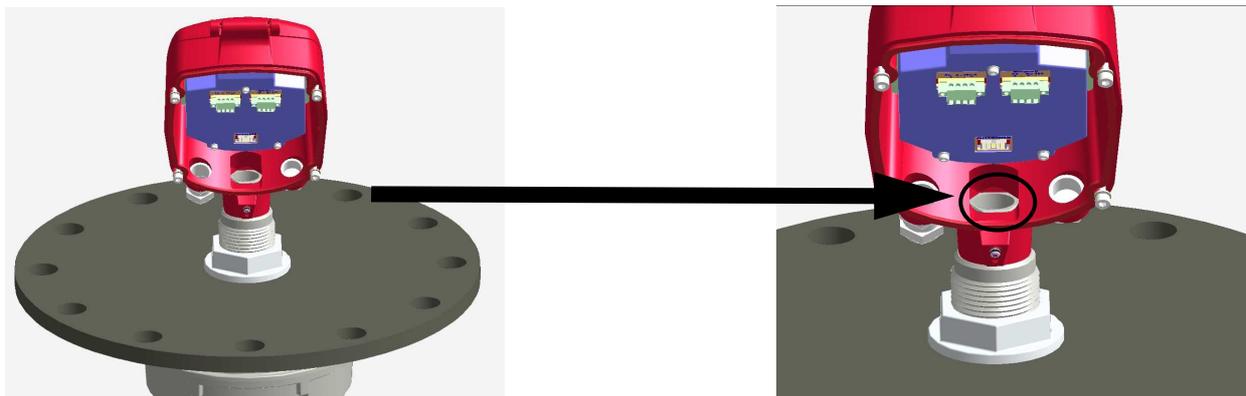


Figure 13 Reinstall the Scanner Head

5. Tighten the front screw using a #4 Allen Key and a size 13 wrench.



Figure 14 Tighten the Front Screw

6. Place the cable clamp back between the antenna's cable and the electronic card.

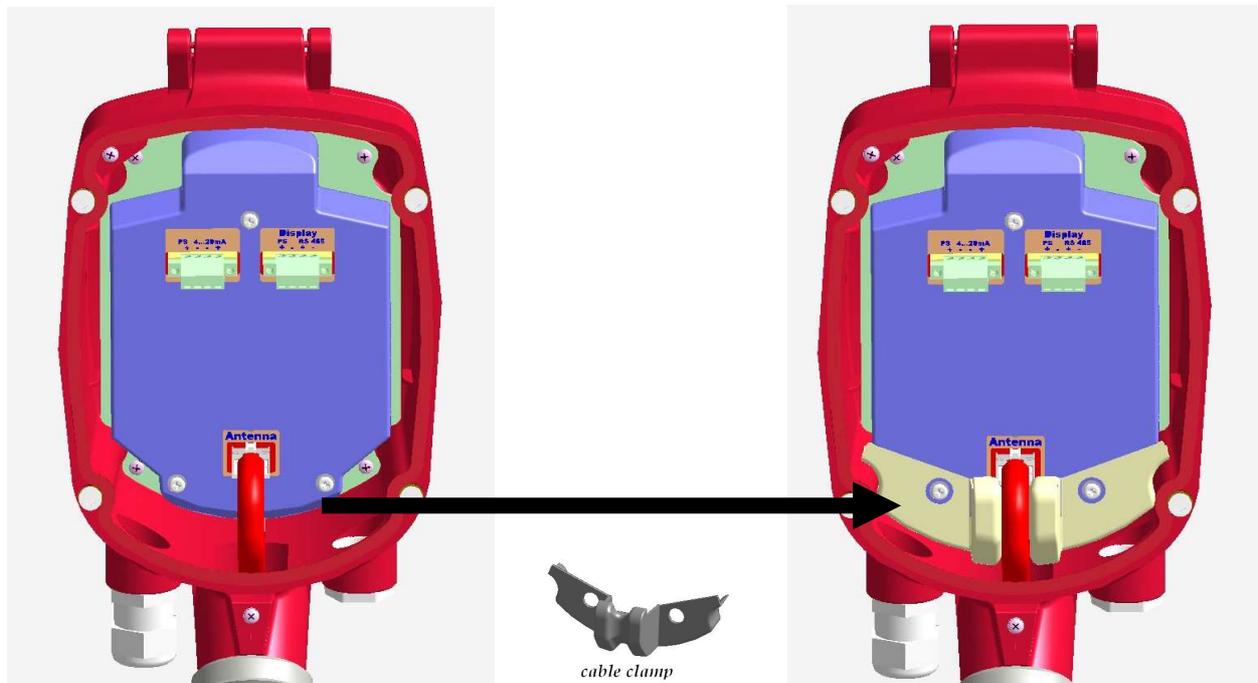


Figure 15 Place the Cable Clamp Back

7. Gently connect the (white) cable connector back to the electronic card.



Figure 16 Connect the Cable Connect to the Electronic Card

8. Reinstall the rear panel onto the rear of the scanner head and tighten the four screws that secure it in place using a #4 Allen Key.



Figure 17 Screw Rear Panel to Rear of the Scanner Head

The 3DLevelScanner is ready to be mounted.

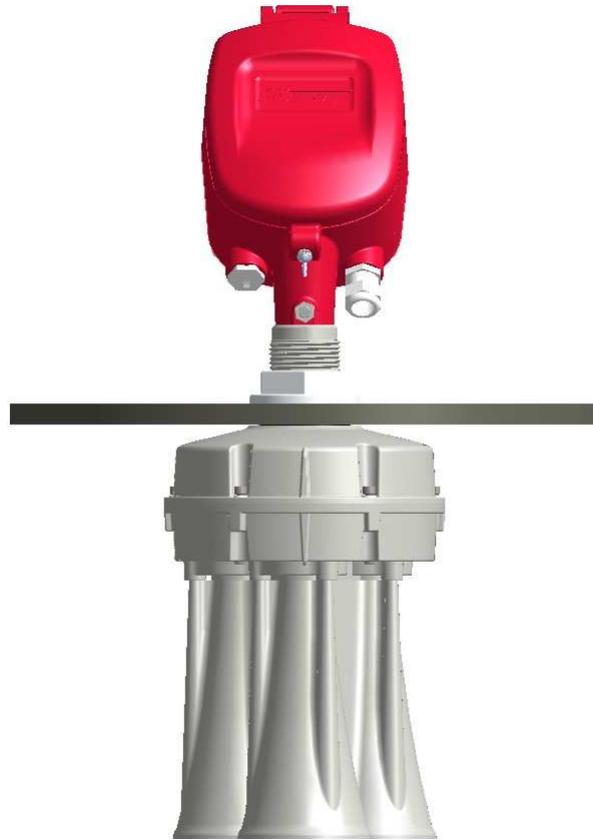


Figure 18 3DLevelScanner Ready for Mounting

Mounting the Scanner

To mount the scanner:

- ① Mount the scanner according to the guidelines described below.

Positioning

Prepare the installation point according to the following guidelines:

- ① The scanner should be installed as far away as possible from the inflowing material, as shown in Figure 19.

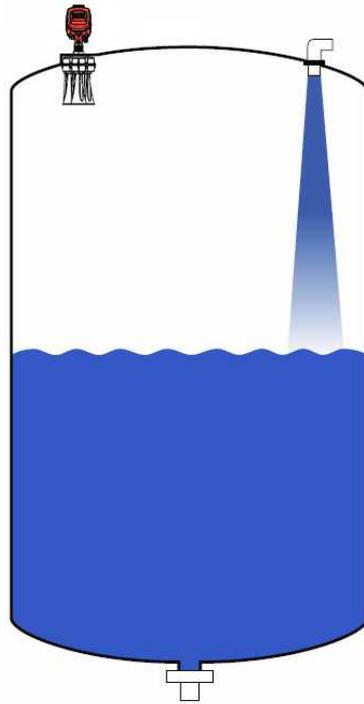


Figure 19 Installation Point

- ① The installation point in the vessel must be at least 0.5m (1.64ft.) from the center of the scanner to the side of the vessel, as shown in Figure 20.

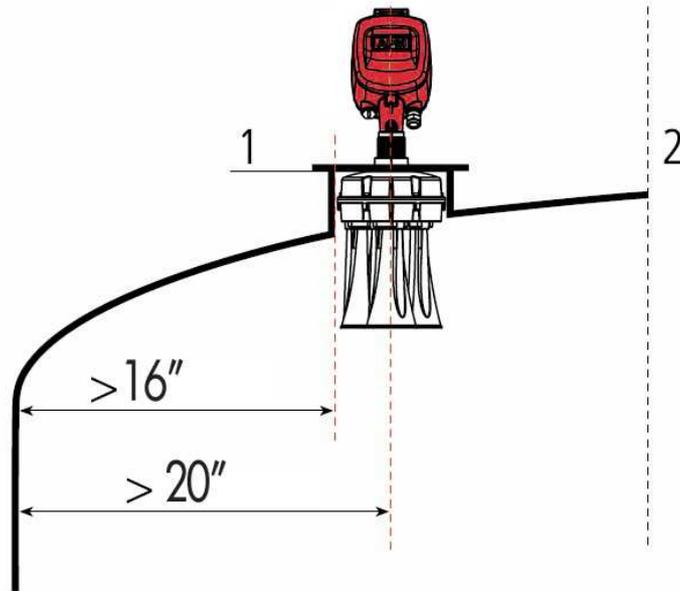


Figure 20 Closed Vessel Installation

- ① The optimal position for the scanner is halfway between the center and the side of the vessel, as shown in Figure 21.

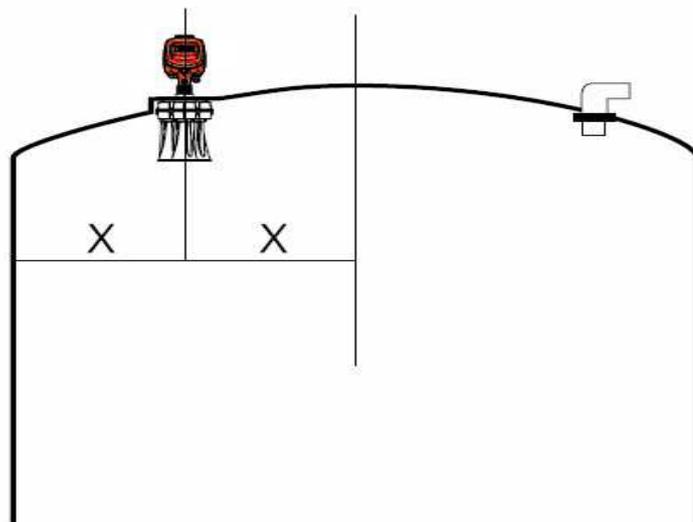


Figure 21 Optimal Position

- ① When mounted in a closed vessel (for example a silo), the hole for the scanner must be at least 200mm.

Fitting

Prepare the fitting area for the scanner according to the following guidelines:

- ① The scanner must be mounted in a vertical position so that the horns/antennas are at a 90° angle to the ground, as shown in Figure 22.

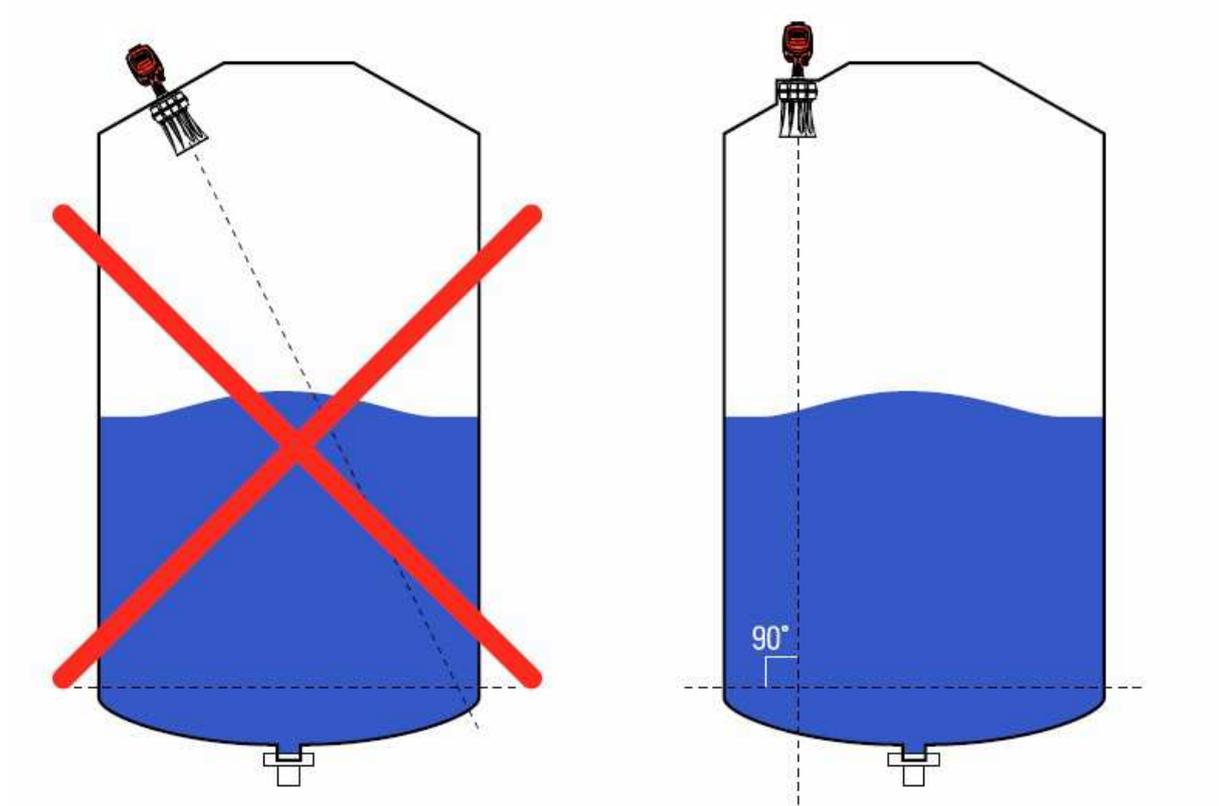


Figure 22 Mounting Positions

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- ① Ensure that the bottom of the scanner (antennas) protrudes at least 10 mm (0.4 inch) out of the socket, as shown in Figure 23. Ensure that no rails or frames interfere with the beam (opening angle) of the scanner, as shown in Figure 24. Interference can reduce the signal to noise ratio (SNR) and damage signals coming back to the scanner.

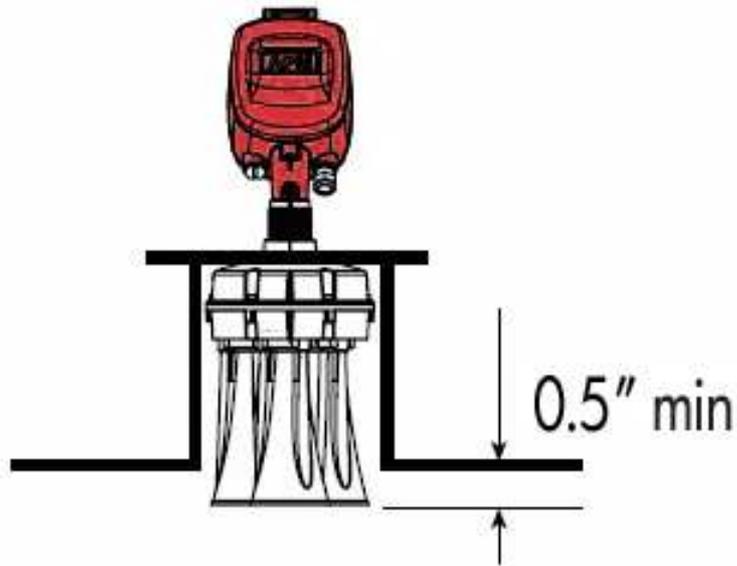


Figure 23 Antennas Location

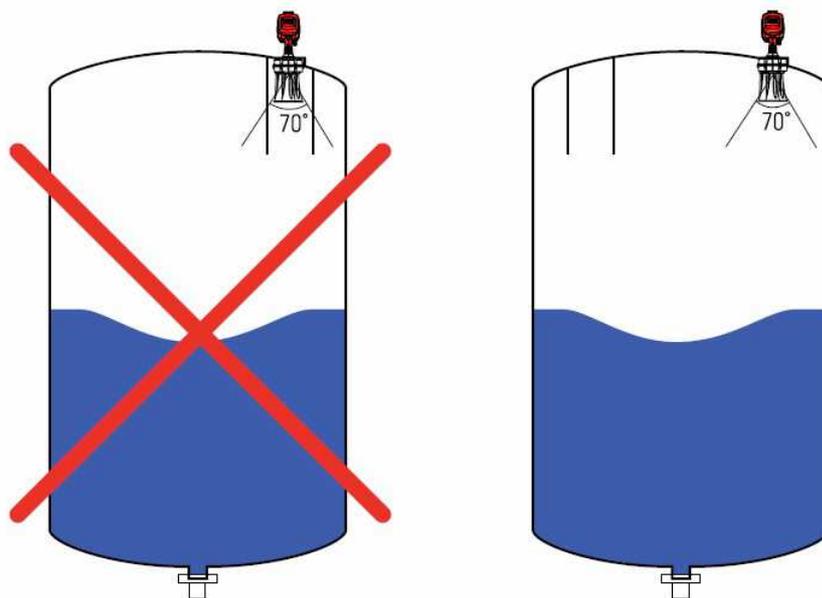


Figure 24 Scanner Beam

Mounting Direction

- ⦿ The mounting direction is indicated by a tenon on the unit (see middle image of Figure 25).
- ⦿ The 0° should point to the center of the vessel (including square vessels and open bins).

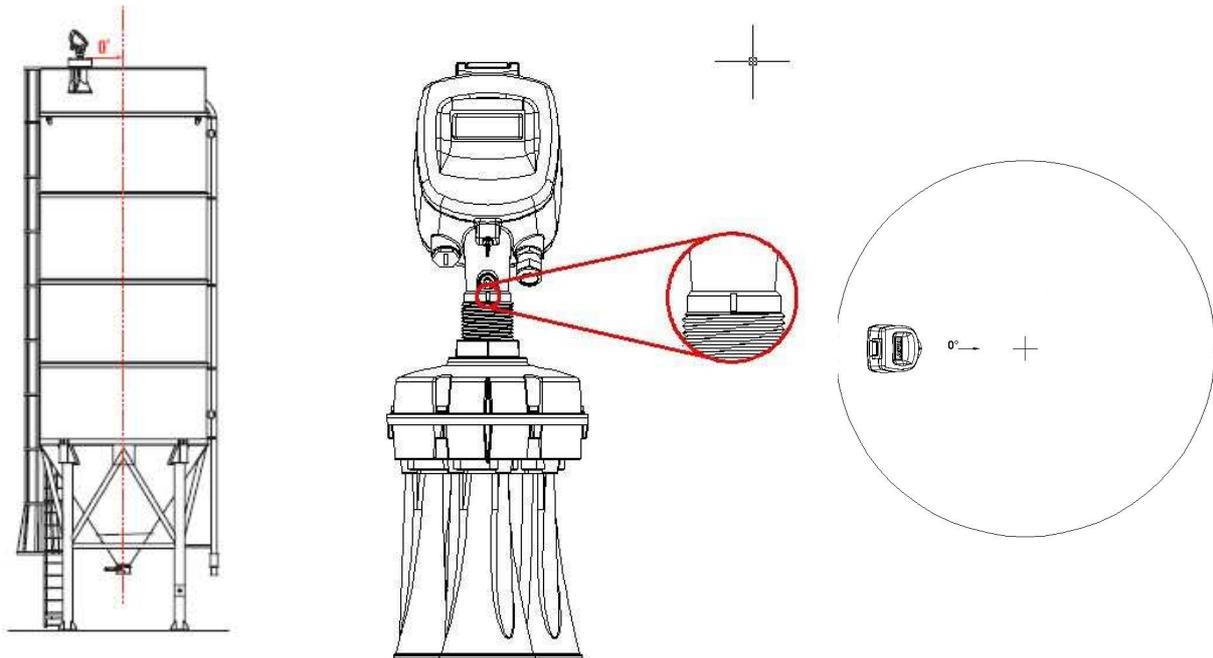


Figure 25 Mounting Direction

Wiring and Communicatoins

An outer cable diameter of 8...13 mm (0.3...0.5 inch) ensures that the cable entry point is effectively sealed. If electromagnetic interference is expected, it is recommended to use a screened and twisted wired cable for the signal lines.

To connect the scanner communications:

1. Loosen the four screws of the scanner rear panel on the back of the scanner head and remove the rear panel (see *Figure 11*). The screws are captive and will not fall off.
2. Loosen the compression nut of the cable entry point.



Figure 26 Loosening the Compression Nut

3. Remove approximately 10 cm (4 inch) of the cable mantle and strip approximately 1 cm (0.4 inch) of the insulation from the ends of the individual wires.

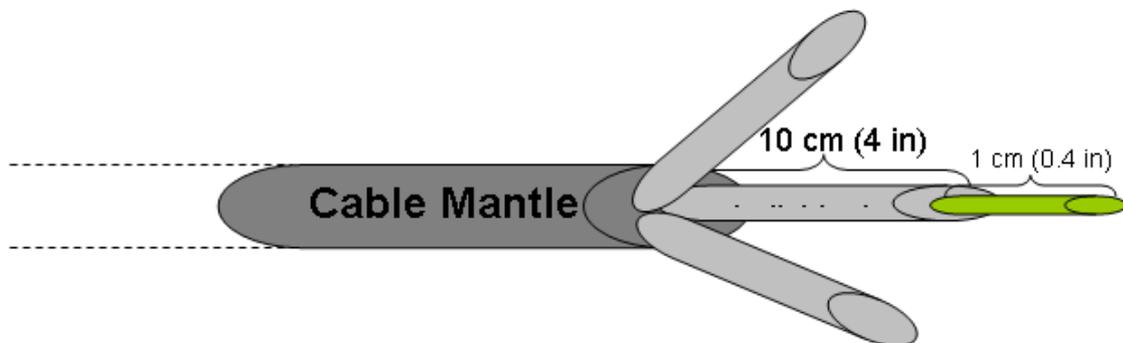


Figure 27 Preparing the Cable

4. Insert the cable into the scanner through the cable entry point.



Figure 28 Inserting the Cable

5. Inside the rear of the scanner head, open the terminal screws using a screwdriver.
6. Insert the wire ends into the open terminals according to the wiring plan (see *Figure 30*), and fasten the terminal screws.

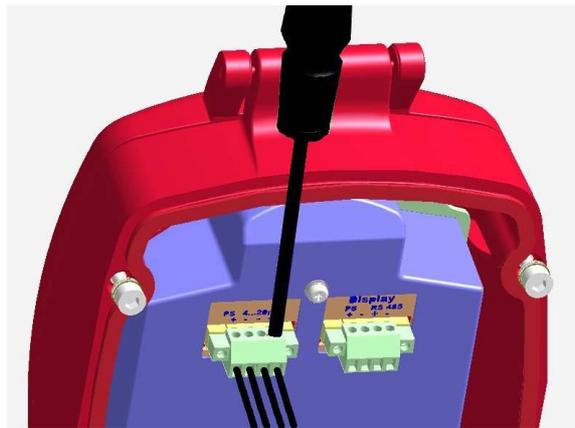


Figure 29 Connecting the Cable to the Terminals

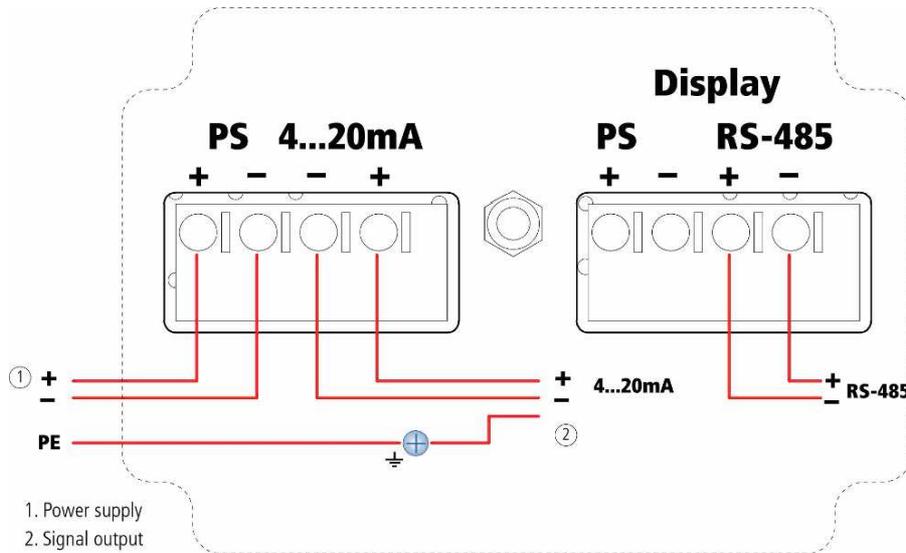


Figure 30 Wiring Plan (4...20 mA/Hart 4-wire/RS485)



A local connection could be made using 3DLinkPro as shown in figure 31.
Using multidrop connection is explained in figure 32.



Caution: Do Not connect the power to the 4...20mA / HART input or to the RS485 ports.
It is not a loop powered device – it is a 4W device.

Note: the PS ports in the right connector are Power Supply OUT. Do not plug IN power supply in those ports.

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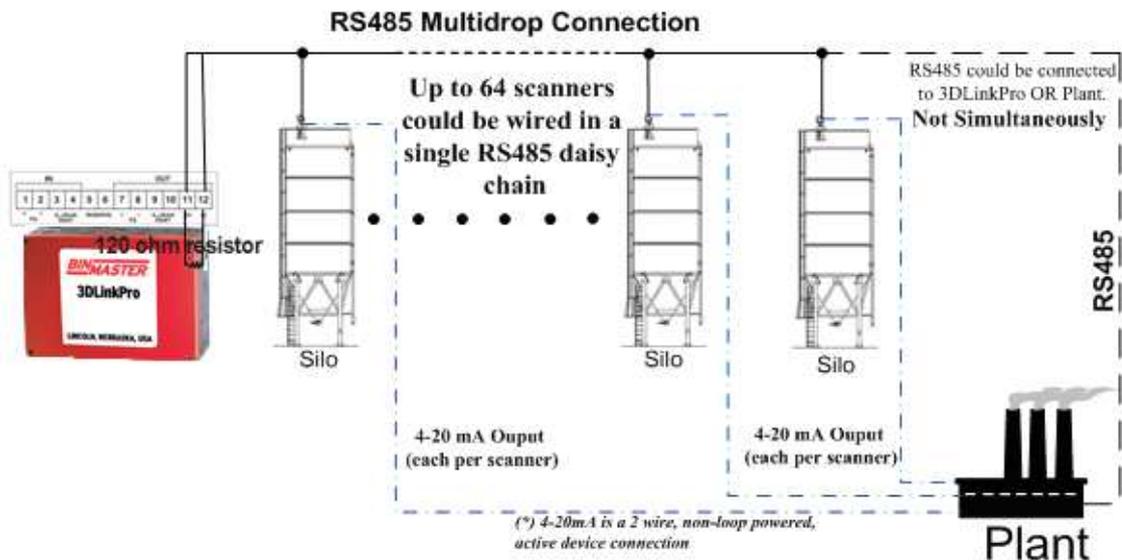
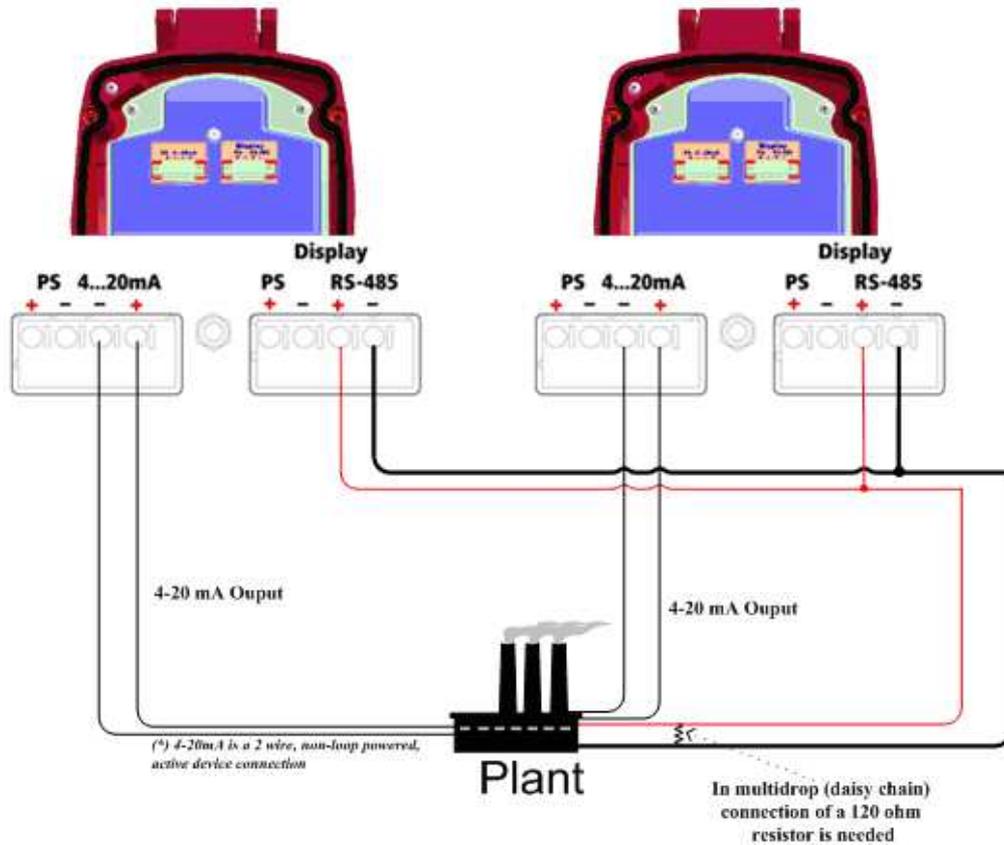


Figure 32 – Multidrop Connection

Fig



Note: The 4...20mA / HART lines could NOT be daisy chained connected (multidrop).

7. Gently pull the wires to ensure that they are secured in the terminals.



8. Connect the external ground terminal with potential equalization to the external ground terminal of the scanner.



Figure 33 External Ground Terminal



Note that there is a possibility to connect an inner ground as shown in Figure 34.

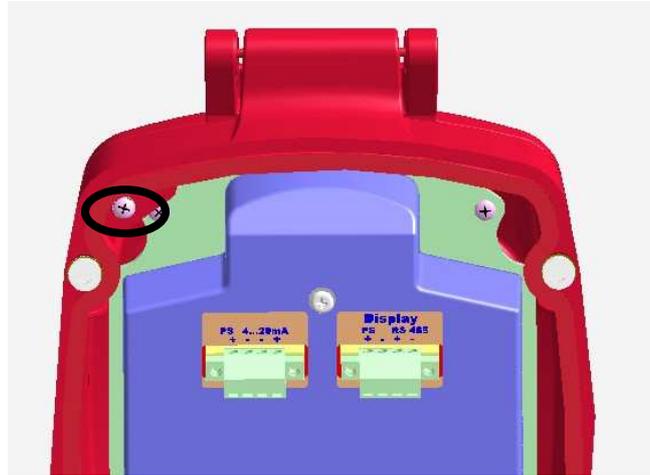


Figure 34 Internal Ground Terminal

9. Tighten the compression nut of the cable entry point (gland). The seal ring must completely wrap the cable.
10. Reinstall the rear panel onto the rear of the scanner head and tighten the four screws that secure it in place using a #4 Allen Key.



Figure 35 Tighten Screws on Scanner Head Rear Panel

After mounting, and connecting the power and data communication, the scanner is ready for configuration.

Configuring the Scanner

This chapter describes how to set up and operate the 3DLevelScanner.

Configuration Tools

You can set up and operate the 3DLevelScanner using one of the following:

- The LCD panel (see Figure 48 on page 39).
- Adjustment software tools (see *Configuring the 3DLevelScanner using the 3DLevel Manager Software* on page 26):
 - Via an RS-485 connection.
 - Via a HART modem.
 - Via 3DLink Pro (through GSM/GPRS communication).

Configuring the 3DLevelScanner using the 3DLevel Manager Software

To use the 3DLevel Manager, you must first connect the scanner to the computer and install the software.

Connection via the RS485 Interface

If connecting via the RS485 interface, use a RS485 to USB / RS232 converter.

Use a termination resistor of 120 ohm between the positive and negative lines of the RS485 as shown below.

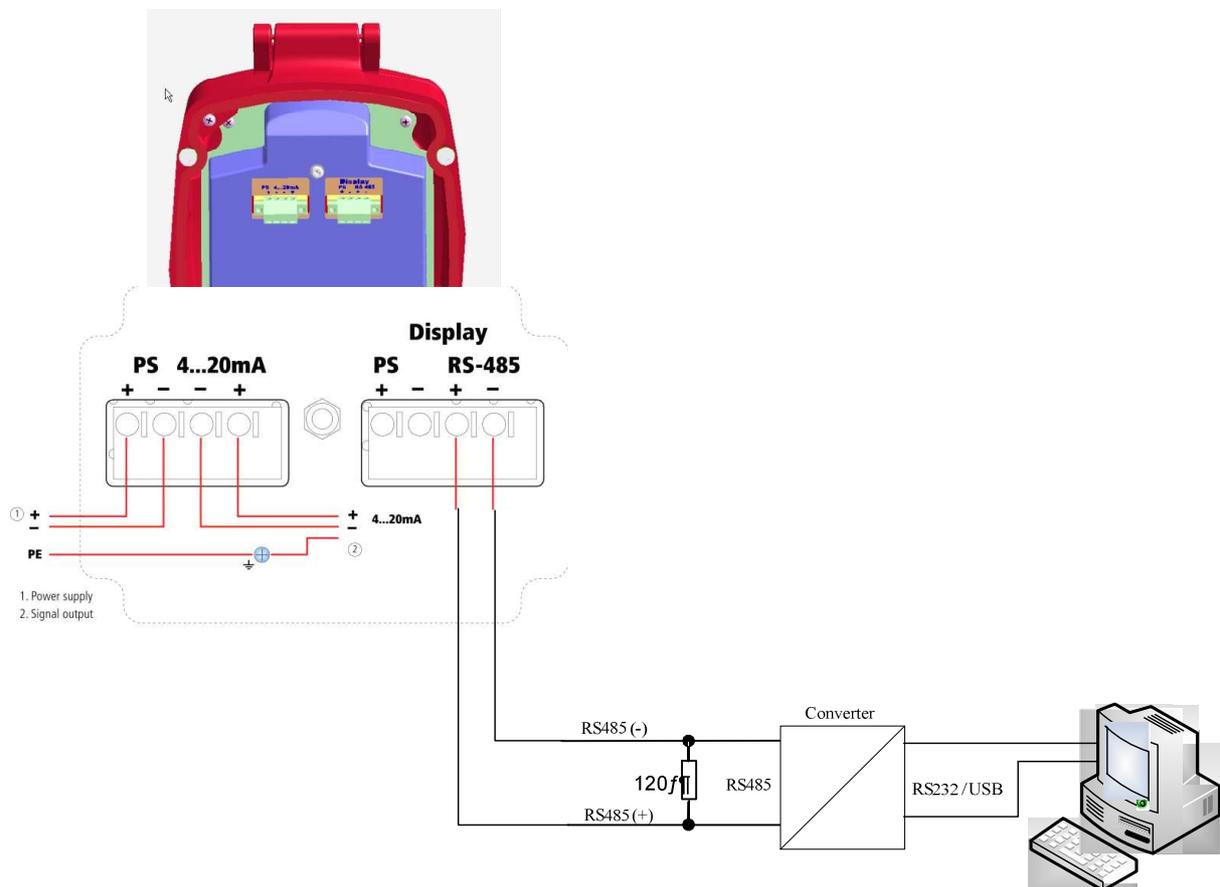


Figure 36 Connecting via the RS485 Interface

For detailed instructions about adjusting parameters using the 3DLevel Manager Software, refer to the *BinMaster 3DLevelScanner Software Operation Manual*.



Installing the Software

To install the software:

1. Insert the software CD into the PC/Laptop connected to the scanner.
2. The installation will start to run automatically. If not, browse to the CD folder and double-click **BinMaster Level Scanner.msi** to start the installation.
3. Follow the instructions of the installation wizard. When installation is complete, the following icon is added on the desktop:



Figure 37 3DLevel Manager Icon

Manually Connecting to the Scanner

To manually connect to the scanner:

1. Double-click the 3DLevel Manager icon. The 3DLevel Manager is displayed.
2. From the 3DLevel Manager menu, select **Device > Manually Connect**.

Or

Press **Ctrl+m**.

3. Select the relevant connection type and port number.
When connection is established, a green light appears in the right pane of the application.



Figure 38 Connection Established Indicator



1. Refer to the “*Different ways of connecting to 3DLevelScanner*” document for additional help in connecting to the 3DLevelScanner using various communication interfaces (HART / RS485 / GSM / GPRS / Ethernet / Modbus).



2. After installing the 3DLevel Manager for the first time, the software is in *Viewer Mode*. The password for switching to technician mode is “techAPM”. Note that the password is case sensitive.

Configuring the Scanner using the Configuration Wizard

To configure the 3DLevelScanner for the first time:

1. Select **Tools > Configurations Wizard** (Figure 39).

Or

Press the F4 key.

The Configuration Wizard is displayed (Figure 40).

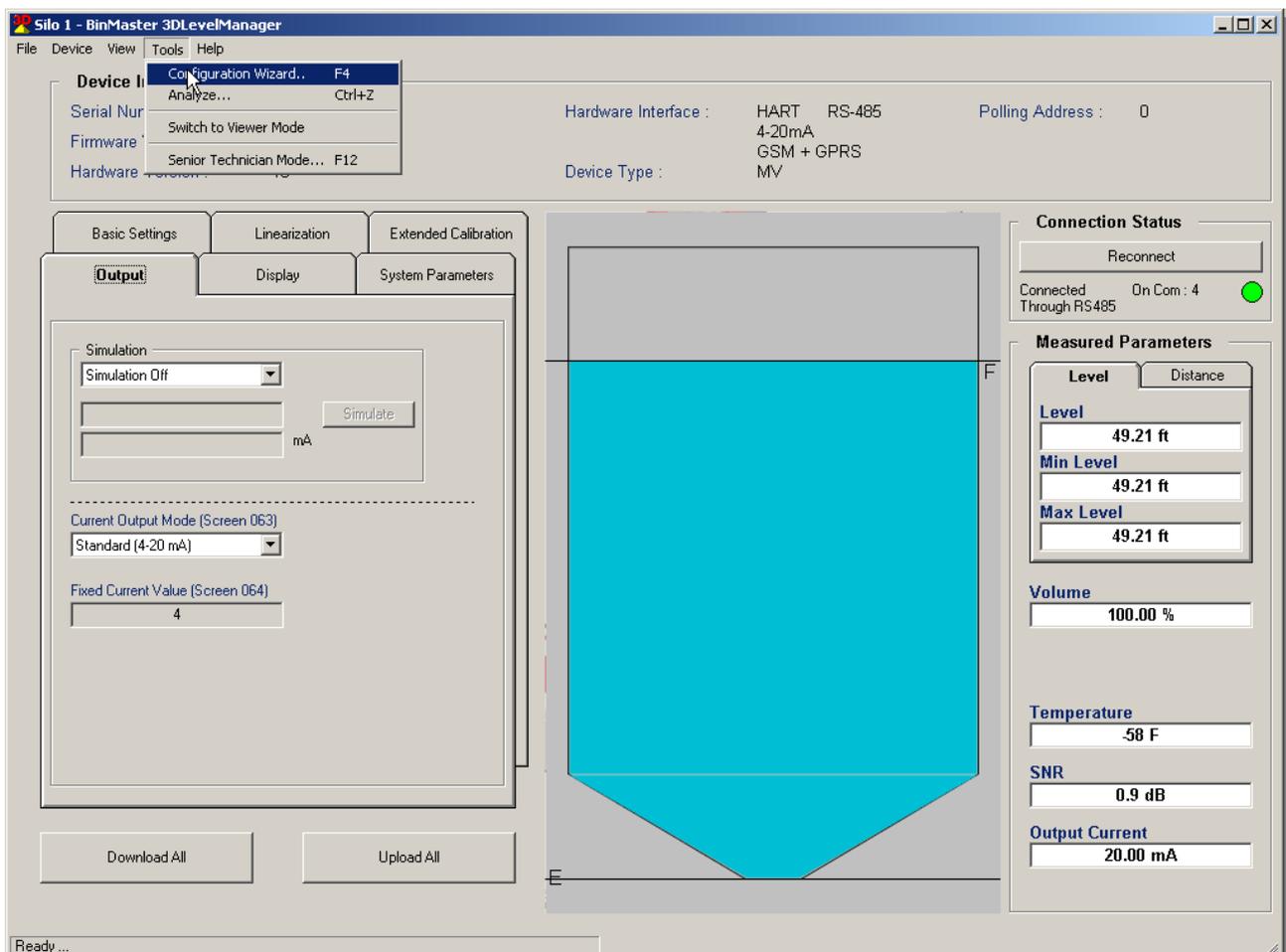


Figure 39 Starting the Configuration Wizard

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When you navigate the wizard, in any screen you can:
Click **Previous** to go back and change any parameter settings.
Click **Cancel** to close the wizard without configuring any parameter.

Step 1/7: Set System Parameters

Step 1/7 (Figure 40) controls the system parameters of the device.

Configuration Wizard

Step 1/7: Set System Parameters

Tag Name (Screen 0C0)
Silo 1

Distance Unit (Screen 0C5)
ft

Temperature Unit (Screen 0C6)
Fahrenheit

Note:

When configuring 3DLevelScanner for the first time, it is important to take the following actions:

1. Make sure the most up-to-date firmware version is loaded to the scanner;
2. Reset to Factory Settings.

Non-Contact, Dust-Penetrating 3DLevel Measurement™

Upload All Cancel <- Previous Next ->

Figure 40 Configuration Wizard – Step 1/7: Set System Parameters

1. Set the device name or identity in the **Tag Name** field. This name is displayed in the LCD and in the header of the 3DLevel Manager when connecting to the device.
2. Set the unit of measurement in the **Distance Unit** field. The options are: meters, centimeters, feet, or inches.
3. Set the unit of temperature in the **Temperature Unit** field. The options are: Celsius, Fahrenheit.
4. Click **Next**.

Step 2/7: Set Vessel Parameters

Step 2/7 (Figure 41) configures the vessel geometry with a specific shape, allowing exact volume calculation.

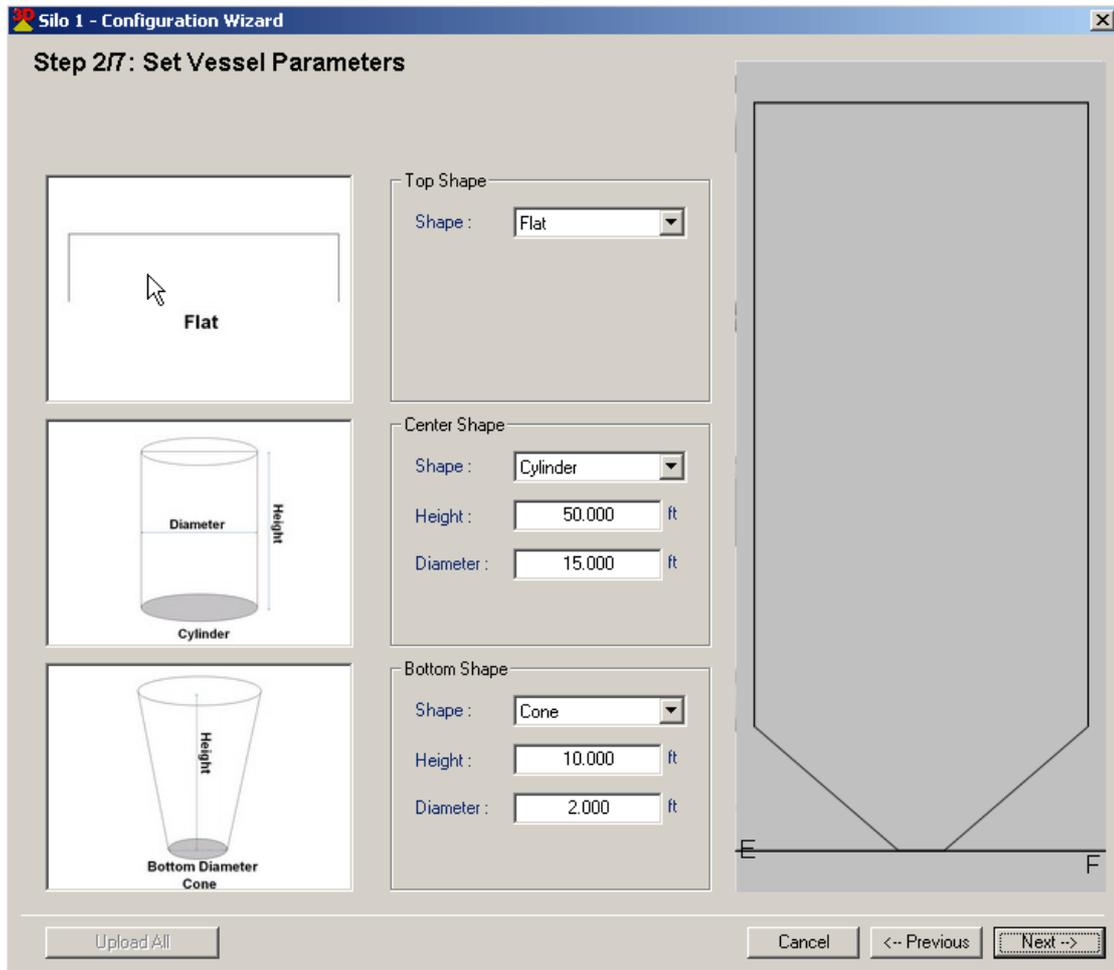


Figure 41 Configuration Wizard – Step 2/7: Set Vessel Parameters

The vessel is drawn in sections: top, center and bottom.

1. Define the top shape of the vessel in the **Top Shape** field. The options are: Flat, Cylinder, Dome, or Pyramid.
 - For a cylinder shape, define the height and the top diameter.
 - For a dome shape, define the radius of the dome.
 - For a pyramid shape, define the top height, and the width and length of the top of the vessel according to the X and Y axes, respectively.
2. Define the shape of the center part of the vessel in the **Center Shape** field. The options are: Cylinder or Cube.
 - For a cylinder shape, define the height and the diameter.



- For a cubic shape, define the height, and the width and length of the vessel according to the X and Y axes, respectively.
3. Define the bottom shape of the vessel in the **Bottom Shape** field. The options are: Flat, Cone, Dome, or Pyramid.
 - For a cone shape, define the height and the outlet radius of the vessel.
 - For a dome shape, define the radius of the dome.
 - For a pyramid shape, define the bottom height, and the width and length of the bottom of the vessel according to the X and Y axes, respectively.
 4. Click **Next**.

Step 3/7: Set the Device Position

Step 3/7 (Figure 42) specifies the device's exact location on the vessel.

1. Set the device location according to the top vessel shape using either of the following methods:

- Scroll the device on screen.

or

- Enter the X, Y and Z values in **Device Position** at the top right corner.



For a specified (X,Y) position, you can set the device's Z position in the Z axis on the vessel's ceiling, by clicking **Set Device Z-Position to Ceiling**.

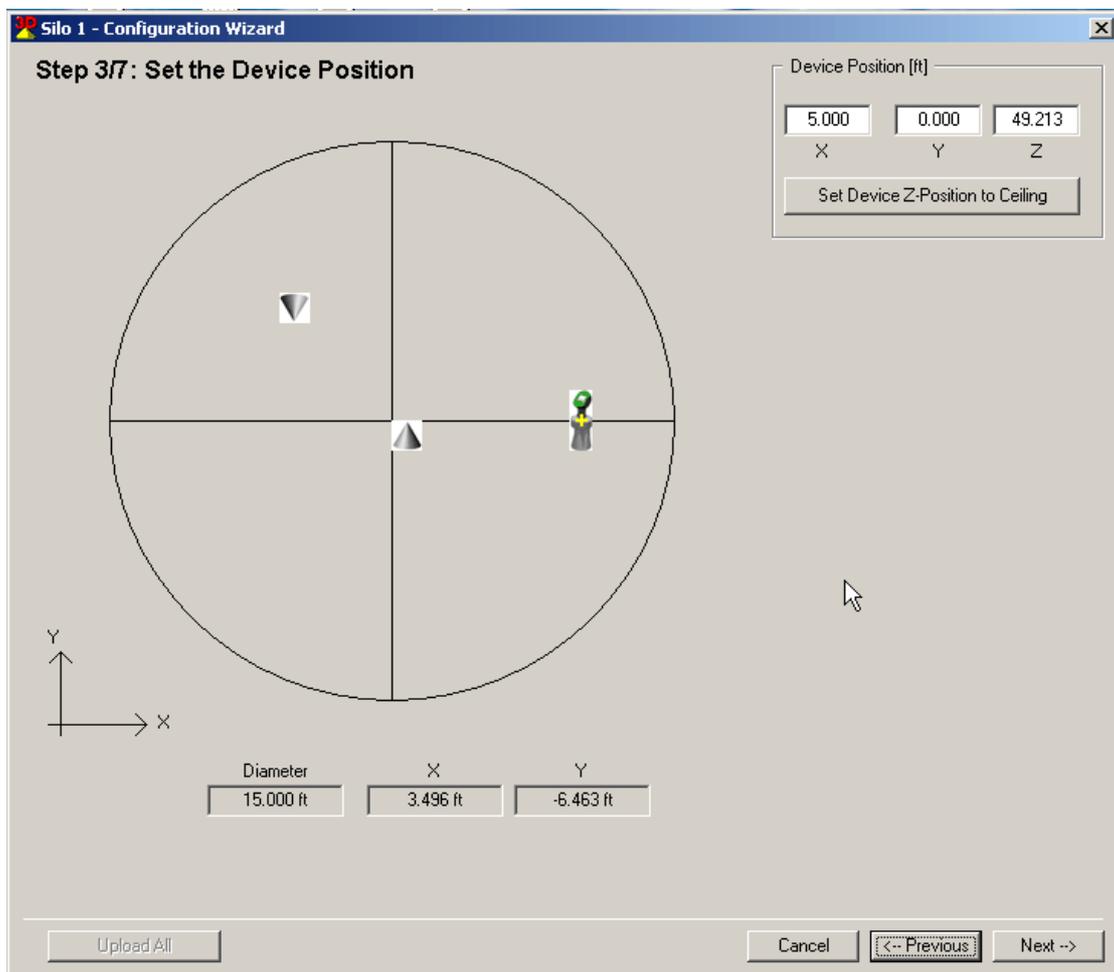


Figure 42 Configuration Wizard – Step 3/7: Set the Device Position

2. Click Next.

Step 4/7: Set the Device View Point

Step 4/7 (Figure 43) specifies the device's horizontal angle.



According to the mounting instructions in the *Operation Manual*, it is recommended that the device always point to the center and be located on the positive X axis.

1. Set the direction of the 0° of the device using either of the following methods:

- Scroll the arrow onscreen to the direction of the 0°.
- or
- Enter the degree value in **Device Horizontal Angle** at the top right.



If you wish to set the direction of the 0° automatically to the center of the vessel, click **Set Horizontal Angle Towards Center**.

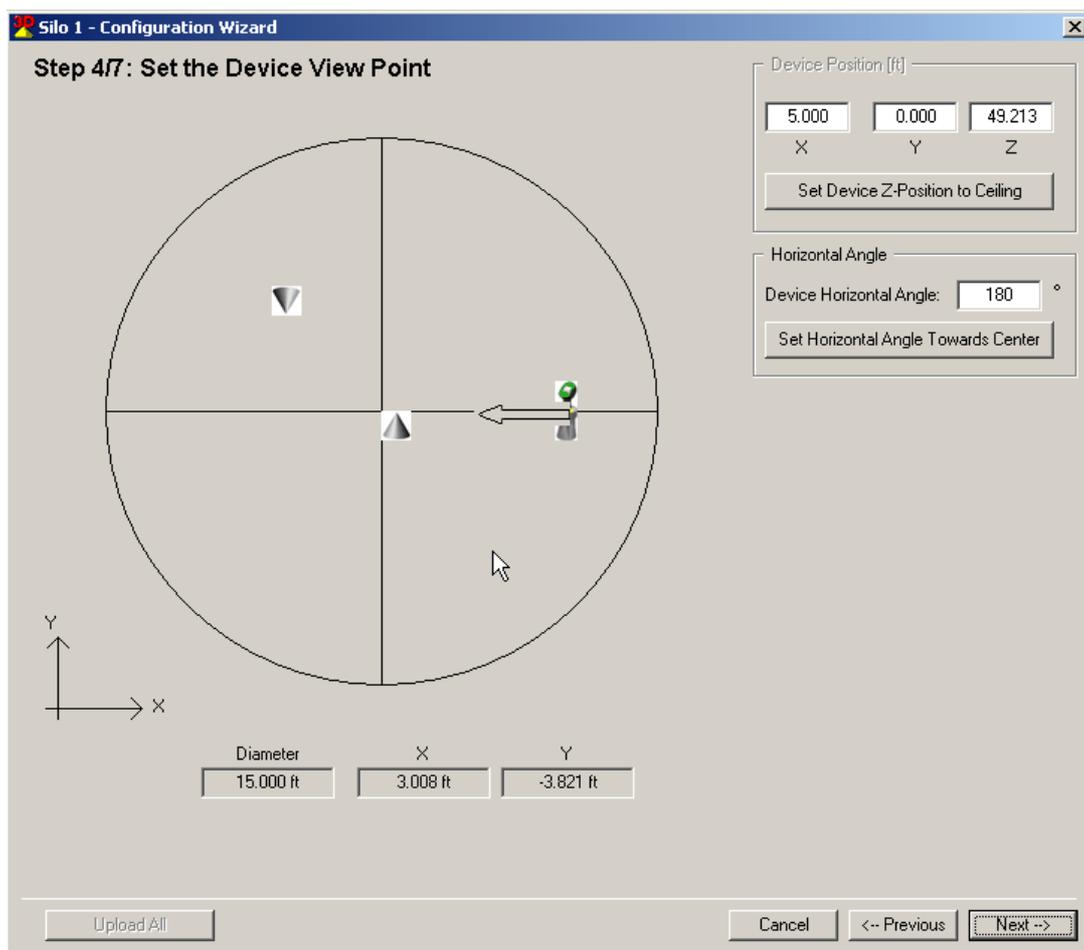


Figure 43 Configuration Wizard – Step 4/7: Set the Device View Point

2. Click **Next**.

Step 5/7: Set Filling Points

Step 5/7 (Figure 44) configures the filling input points to the vessel. You can set more than one filling point.

1. Set the filling point or points using either of the following methods:
 - Left click the mouse in the exact location in the top shape in the window.
 - or
 - Enter the (X,Y,Z) points in the **Filling Points** table. Press **Enter** after entering a value.

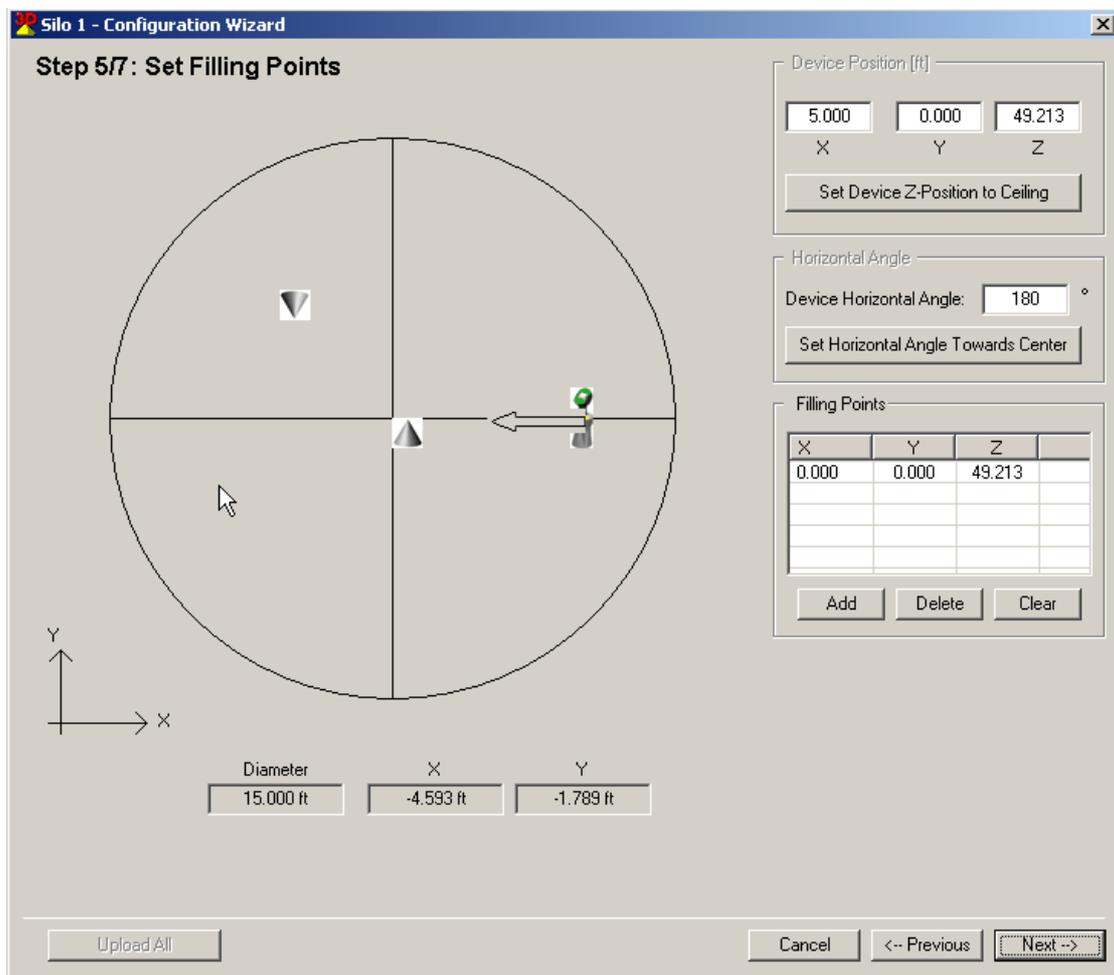


Figure 44 Configuration Wizard – Step 5/7: Set Filling Points



To delete a filling point, mark the row and click **Delete**.
To delete the full list of filling points, click **Clear**.

Note: Do not delete the default filling and emptying points.

2. Click **Next**.

Step 6/7: Set Emptying Points

Step 6/7 (Figure 45) configures the emptying output points in the vessel. You can set more than one emptying point.

1. Set the emptying point or points using either of the following methods:
 - Left click the mouse in the exact location in the top shape in the window.
 - or
 - Enter the (X,Y,Z) points in the **Emptying Points** table. Press **Enter** after entering a value.

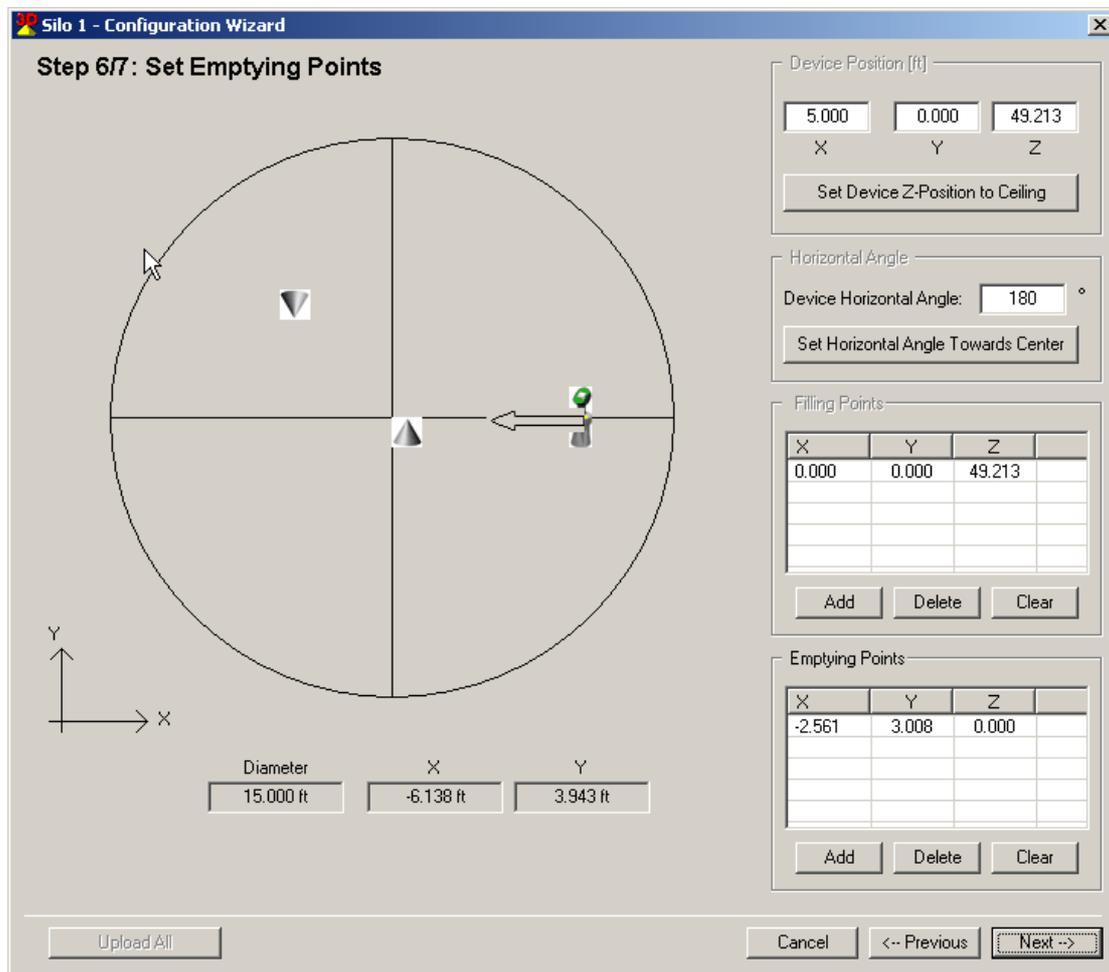


Figure 45 Configuration Wizard – Step 6/7: Set Emptying Points



To delete an emptying point, mark the row and click **Delete**.
To delete the full list of emptying points, click **Clear**.

Note: Do not delete the default filling and emptying points.

2. Click **Next**.

Step 7/7: Set Basic Settings and Linearization

Step 7/7 (Figure 46) configures the basic settings and the linearization of the vessel.

Silo 1 - Configuration Wizard

Step 7/7: Set Basic Settings and Linearization

Basic Settings

Media Type (Screen 001)
Solid

Process Condition (Screen 00C)
Standard

Full Calibration [ft] (Screen 006)
0.000

Empty Calibration [ft] (Screen 005)
49.213

Distance from Flange to Bottom
49.213 ft

Process Description

Max. Emptying Rate [ton/hour]
7.500

Max. Filling Rate [ton/hour]
15.000

Max. Capacity [ton]
212.000

Max Scale Information

Max Scale in m³
246.26

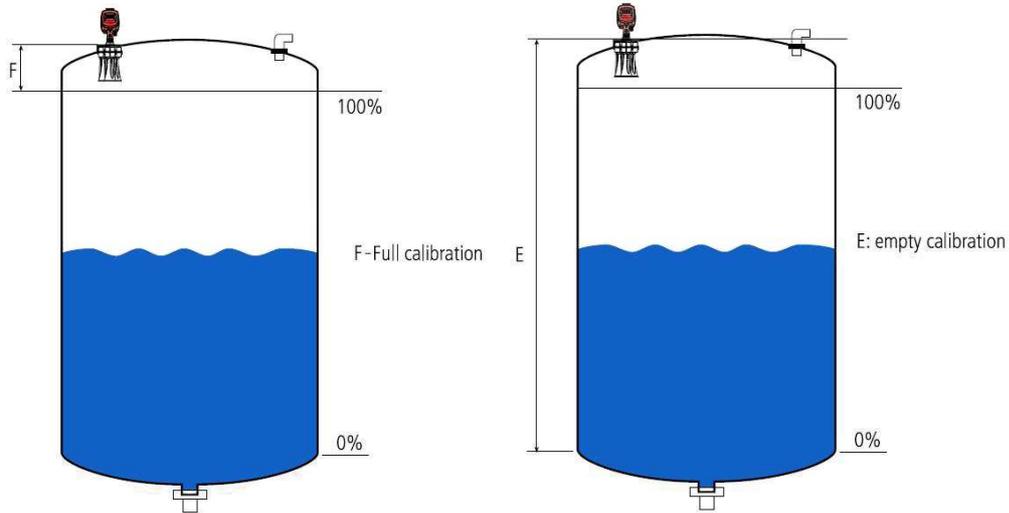
Max Scale in ft³
8,696.66

Upload All Cancel <-- Previous OK

Figure 46 Configuration Wizard – Step 7/7: Set Emptying Points

1. Select the type of the measured material in the **Media Type** field. The options are:
 - HF
 - Solid (default value)
 - Solid SA
2. Select the filling rate or emptying processes in the **Process Condition** field. This parameter controls how fast the device produces an output value. The options are:
 - Standard (default value)
 - Slow change
 - Fast change

3. Define the distance from the flange to the 100% level of material in the silo defined by the user, using the **Full Calibration** field.



4. Define the distance from the flange to the 0% level of material in the silo defined by the user, using the **Empty Calibration** field.
5. Set the process description:
 - Set the *maximal* emptying rate inside the vessel in the **Max Emptying Rate [tons/hour]** field.
 - Set the *maximal* filling rate inside the vessel in the **Max Filling Rate [tons/hour]** field.
 - Set the total capacity of material within the vessel in the **Max Capacity [tons]** field.



The Max Capacity parameter in this screen has no relation to the Max Capacity parameter setting in the Linearization tab of the BinMaster 3DLevel Manager. The Max Capacity in this screen is only used to calculate the rate of volume change based on the rate of emptying/filling values.

For example: Suppose in this screen you set the Max Capacity to 1000 tons, restrict the emptying rate to no more than 200 tons/hour, and restrict the filling rate to no more than 100 tons/hour. The result is that the change of material will NOT be more than 10%/hour for the filling direction, and NOT more than 20%/hour for the emptying direction.

6. Click **Upload All** to upload all the parameters configured in the wizard, or click **OK** to temporarily save the parameters locally and close the wizard.

If a parameter's value was changed but not uploaded to the device, a window appears (Figure 47) querying whether you wish to upload all parameters to the device.

- Click **Yes** to upload parameters from the wizard to the device and automatically close the wizard.



- Click **No** to close the wizard without uploading any parameters to the device.
- Click **Cancel** to close the window and remain in the wizard.



Figure 47

Configuring the Scanner in Multidrop Mode using RS485/Modbus

Figure 48 shows the LCD panel. The adjustment keys are described in Table 1.

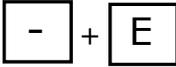


Figure 48 Scanner Front Panel - LCD

Table 1 Adjustment Keys

Adjustment Key	Description
	This key enables you to: <ul style="list-style-type: none"> ⦿ Navigate to the left within a function group. ⦿ Hold for 3 seconds to go back to the default screen.
	This key enables you to: <ul style="list-style-type: none"> ⦿ Navigate upwards in the selection list. ⦿ Edit numeric values within a function.
	This key enables you to: <ul style="list-style-type: none"> ⦿ Navigate downwards in the selection list. ⦿ Shift to the right within a function.
	This key enables you to: <ul style="list-style-type: none"> ⦿ Navigate to the right within a function group. ⦿ Confirmation.
 +  Simultaneously	Increases the contrast of the LCD display.



Adjustment Key	Description
 Simultaneously	Decreases the contrast of the LCD display.

To configure the polling address of the scanner:

7. Press **E** to get to the main menu.
8. Scroll to the *Output* submenu
9. Press **E** to get to the *Commun. Address* submenu.
10. Set the polling address (legal values are 00 to 64). Use the '+' and '-' keys to edit the numeric value or shift to the right/left digit respectively.



By default, the scanners are configured to polling address 00. When connecting scanners in a Daisy Chain, use this function to change the polling address for each scanner.



Recommended Tools and Materials

Table 2 lists the tools for installing the BinMaster 3DLevelScanner S/M/MV.

Table 2 Recommended Tools and Materials

Description
The site application documents, including the Silo drawing.
Large Phillips screwdriver (2x100).
Medium Phillips screwdriver (1x100).
Set of small precision screwdrivers (for the green connectors).
13" wrench.
Allen Key #4 (preferably with a handle).
Large adjustable wrench 18" .
Stanley knife.
Cutter.
Pointed pliers.
Insulating tape.
* Laser measurement device (or other device to ensure correct positioning and distance to the material).
PC/Laptop.
USB HART modem.
Software drivers for the HART modem.
RS485 to USB converter
Software drivers for the RS485 converter
238 Ohm resistors.

* - This device is required to measure the true distance from the flange to the material during the installation, and for the false echoes mapping process. It could also aid, if necessary, to measure the dimensions of the vessel and the position of the device from the center of the vessel.

Quick Installation Guide

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