

BenchMike Pro

ID/OD/WALL

Addendum



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a **spectris** company

Making Light Work

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BenchMike Pro ID/OD/WALL Addendum

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Revision: C

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Contact NDC

Online Support

You can access the NDC Customer Support portal, myNDC at <https://ndc.custhelp.com>.

myNDC is a cloud-based portal that allows you to get product support by phone, ask a question, provide feedback, submit an RMA request or access information in our on-line knowledge database. You can browse the myNDC site or create a myNDC account.

- To create a myNDC account, click the **Log in or Sign up** button. After creating the account, you will be immediately logged in. To log in on subsequent visits to myNDC, click the **Log in or Sign up** button, enter your user name and password, and then click **Log in**.
- To submit an RMA, click on the **RMA Request** tab and follow the on-screen instructions.

The screenshot displays the myNDC Customer Support portal. At the top left is the NDC TECHNOLOGIES logo. To the right is the myNDC logo. Below the logo is a navigation bar with tabs for 'Support Home', 'Answers', 'Ask a Question', and 'RMA Request'. A 'Log in or Sign up' button is highlighted with a red box. Below the navigation bar is a search bar with the text 'We're here to help' and a search icon. To the right of the search bar is a 'Contact Us' section with three options: 'By Phone', 'Ask a Question', and 'Give Feedback'. Below the search bar is a 'Help Topics by Product Range' section with two product categories: 'Metals Systems Range (Accuray, IRM)' and 'Infrared Sensors Range'.

NDC Contact Numbers

Please have your sales order number at hand before contacting NDC.

– **Beta LaserMike Gauges**

| | Beta LaserMike Gauges |
|---|---|
| Americas | +1 937 233 9935 |
| Asia Pacific | India: +91-124-2789507 Alternative number +91-124-2789508 |
| | Japan: +81 (0)3 3255 8157 |
| | All other countries: +1 937 233 9935 Alternative number +44 1621 852244 |
| China | +86 21 61133609 |
| EMEA (Europe, Middle East, Africa) | Germany: 0800 1123194 |
| | France: 0810 600 400 |
| | Italy: +39 0331 454 207 |
| | All other countries (English speaking): +44 1621 852244 Please select option 3 to be connected to the service team |

Caution

- This equipment must be earthed/grounded.
- Under NO circumstances should the earth safety connections be broken – internal damage to sensitive electronic components may occur and at worst electrocution to personnel may result.
- Digital outputs are open - collector outputs, with maximum specs of 35 V DC and 250ma. These levels must not be exceeded.
- Maintenance, repairs and electrical connections should be performed by a suitably qualified person for the country of installation.
- The equipment contains a slow blow type fuse to protect against input power overloads and is not user replaceable.

Intended Use

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Laser Safety Precautions

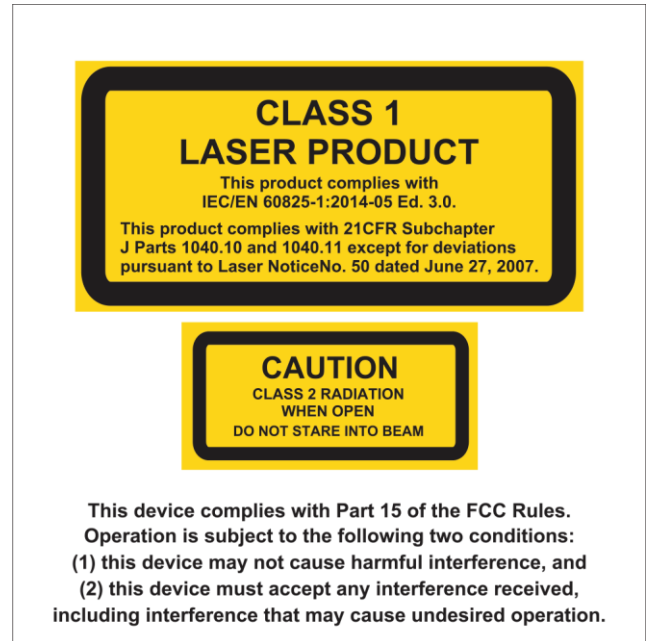
The BenchMike Pro uses a Collimated Diode laser which emits red light at a wavelength of 635nm. No invisible or otherwise harmful radiation is emitted.

The radiant output power of either internal laser (whether it be a laser diode or gas laser) and of the entire BenchMike Pro is relatively low. The laser beam will not harm your skin, and your eyes are protected by a natural aversion response that will cause you to blink or look away. However, the laser light emitted from the BenchMike Pro should be treated with caution and common sense. Do not attempt to look into the BenchMike Pro, and avoid staring at reflections of the beam.

The American National Standard for the Safe Use of Lasers (ANSI Z136.1 — 2014) classifies this laser product as Low Power — Class II and provides reasonable and adequate guides for its safe use. The user of the BenchMike Pro and other personnel responsible for its safe use should consult this ANSI standard. It is available from:

American National Standards Institute
1430 Broadway
New York, New York 10018

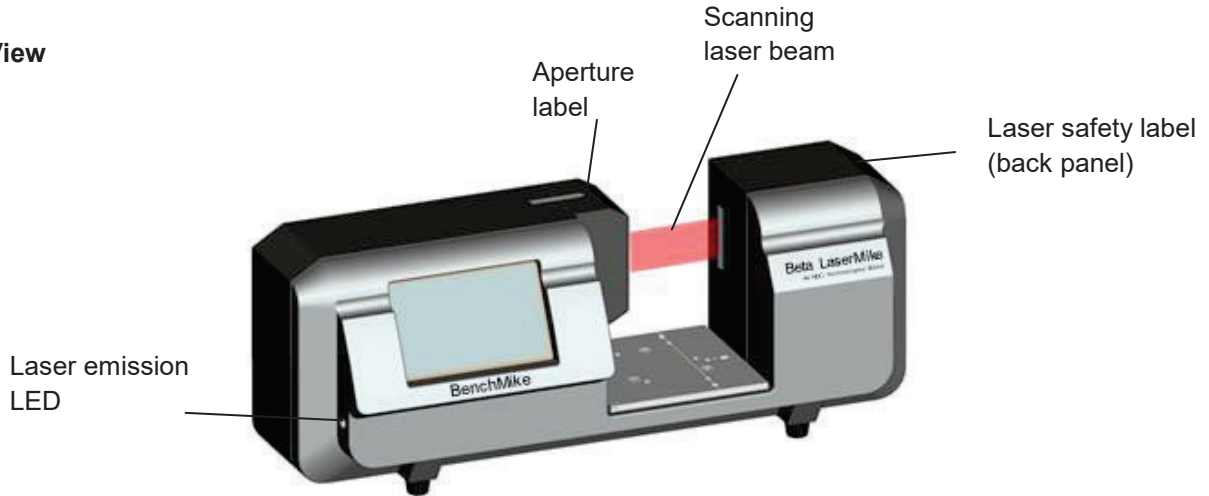
The Center for Devices and Radiological Health (CDRH) of the Food and Drug Administration has established regulations for manufacturers of laser products. All laser products sold in the U.S.A. since August, 1976 must be certified by the manufacturer as meeting certain product performance (safety) standards, and each laser must bear a label indicating compliance with the standard and denoting laser hazard classification.



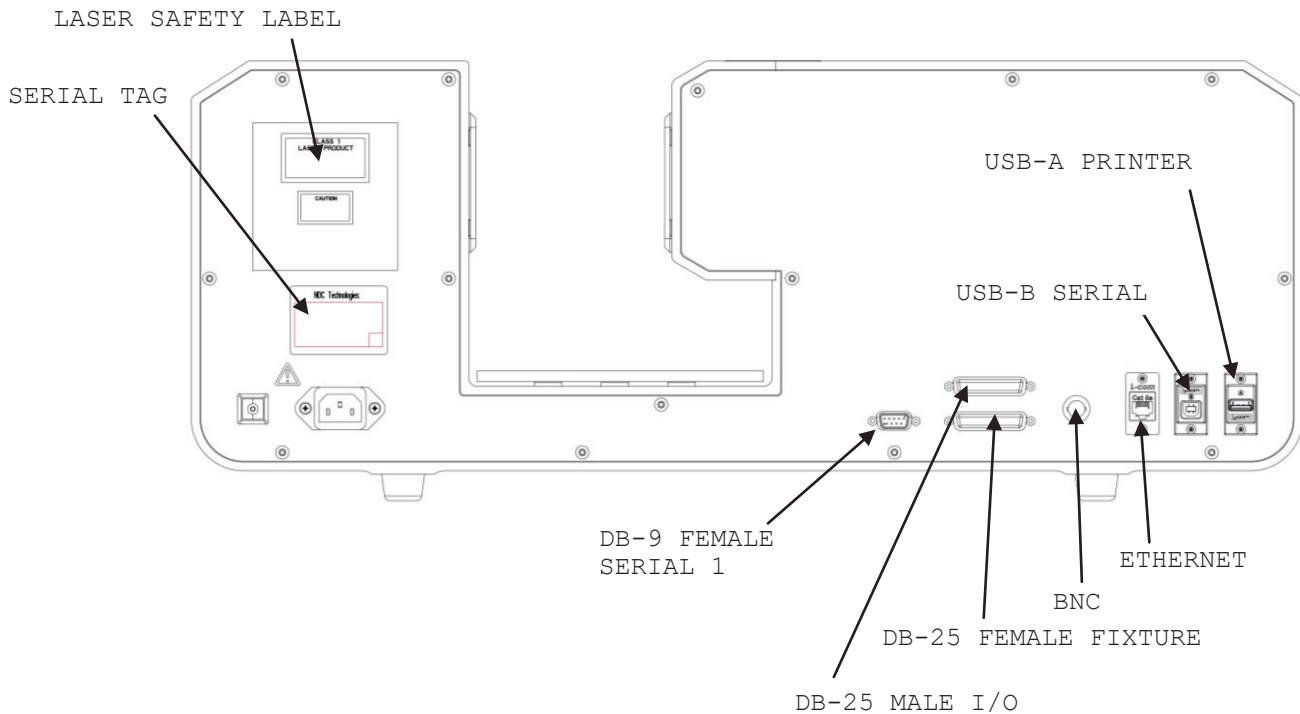
Labels and Safety Features

This section acquaints you with the advisory and identification labels on the instrument and the safety features incorporated into the design of the instrument. The following figures show the identification and advisory labels on the BenchMike Pro.

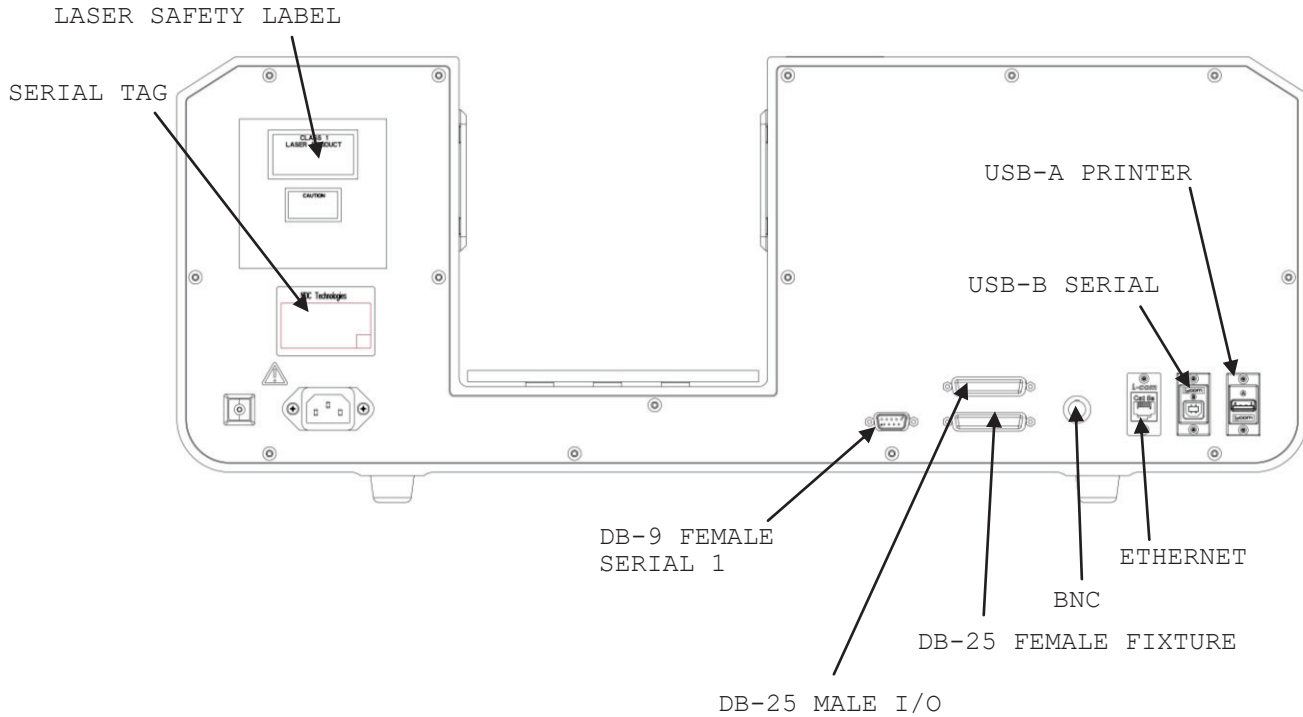
Front View



Model 2025



Model 2050



FCC Manual Digital Devices Statement

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of the equipment in a residential area is likely to cause harmful interference, in which case, the user will be required to correct the interference at his own expense.

Important Note

This BenchMike Pro ID/OD/WALL Addendum is designed to be used in conjunction with the BenchMike Pro Instruction Handbook and BenchMike Pro Operator Guide. This Addendum contains only specific information about the BenchMike Pro ID/OD/WALL, while the Instruction Handbook and Operator Guide contain information about all BenchMike Pros, with and without special fixtures.

Your questions about the use of the ID/OD/WALL features of the BenchMike Pro should be answered by this Addendum, while your more general questions about the use of the BenchMike Pro should be answered by the Instruction Handbook and Operator Guide.

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1 Quick Start

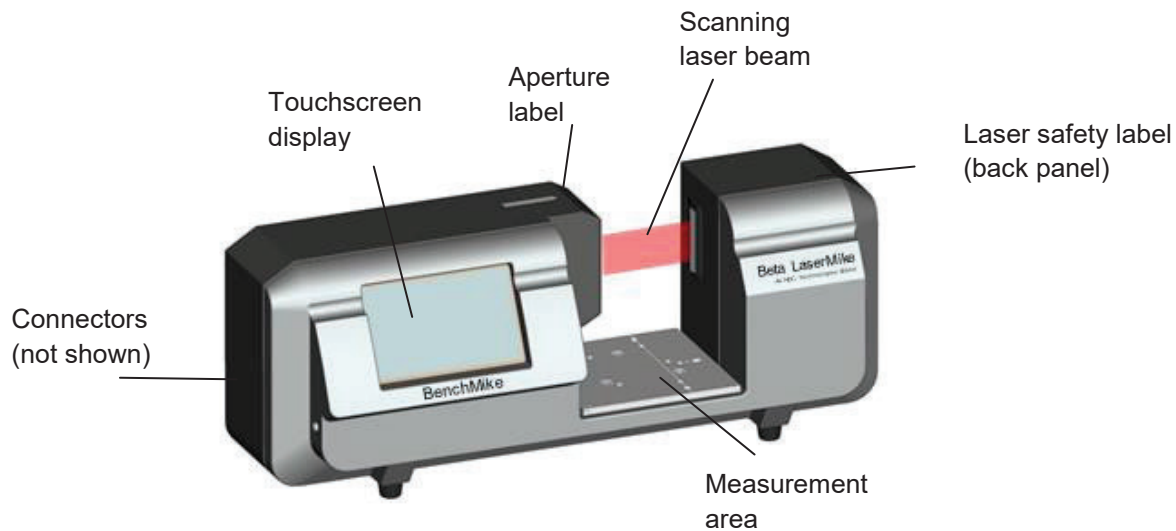
1.1 Introduction

This manual contains information about the operation of the NDC Technologies BenchMike Pro Benchtop Laser Micrometers with the ID/OD/WALL option. This includes the following two models:

- BenchMike Pro Model 2025
- BenchMike Pro Model 2050

1.2 Quick Start Procedure

This Quick Start is designed to help those who are somewhat familiar with the operation of benchtop laser micrometers during installation, setup, and initial operation.



Model 2025 BenchMike Pro

Note: Your BenchMike Pro is configured at the factory for the following parameters:

- Transparent product measurement
- Automatic rotation of product for 360° with Intelligent Fixture, taking measurements every 90° (4 position measurement)
- ID/OD/WALL measurement
- Home fixture at end of measurement cycle

To alter these settings, see the detailed descriptions of each setup page in [Setup](#).

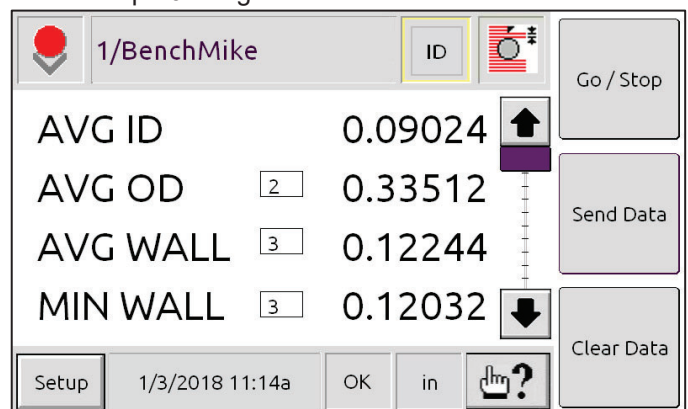
Note: You can scroll through the data items that have been created in the default setup by touching the scroll arrow on the right side of the screen.

Note that this Supplemental Manual contains information about the BenchMike Pro ID/OD/WALL only. For more general information about all BenchMike Pro models, consult the BenchMike Pro Instruction Handbook or Operator Guide.

1.3 Installation

Please follow these steps when unpacking, installing, and operating your BenchMike.

1. Inspect the exterior of the shipping container for damage. If the container is damaged, do not open it. Contact the carrier and NDC Technologies immediately.
2. If the shipping container is intact, remove and read the packing list.
3. Carefully open the container, remove the shipping spacers, and unpack the BenchMike.
4. Inspect the BenchMike for damage. If damage is suspected, contact the carrier immediately.
5. Check the packing list to ensure that all items have been received.
6. If all items appear undamaged, install the BenchMike by placing it on a horizontal surface in a location free of excessive physical vibration and where it will not accumulate any amount of dust, dirt, or mist.
7. Check the serial tag on the BenchMike for the correct line voltage. Using the supplied power cord, plug the BenchMike into the appropriate power source.
8. Mount the desired ID/OD/WALL Fixture in the measurement area, and leave the mounting screws loose enough for the fixture to move. These will be tightened in Step 10. Plug the fixture's connector into the rear panel connector marked **FIXTURE** (if an Intelligent Fixture is used). Do not screw the Fixture in place in the BenchMike's measurement area yet. Ensure that the correct mandrel is installed in fixture. The mandrel must be smaller than the product to be measured. Place the product to be measured in the measurement area on the mandrel.
9. Turn the power on via the switch on the rear of the BenchMike. Within two minutes, the touch screen will display as shown.
10. Place your index finger or other similar object next to the pulleys on the right side of the ID/OD/WALL Fixture. Ensure that the laser beam passes mid-



way between the pulleys. Make sure that the Fixture is mounted square by pushing on the right side of the Fixture's mounting base to take up the clearance in the mounting holes. Tighten the mounting screws, and ensure that the beam still passes midway between the pulleys on both sides.

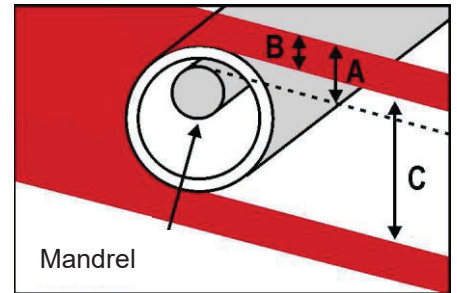
11. Touch the Mode icon in the upper left hand corner of the screen, then touch **Fixture**, and then select **Master ID/OD/WALL** if you are performing ID/OD/WALL measurements. Follow on-screen instructions.
12. Touch the Go button to begin taking measurements. The Mode icon will change from red to green, indicating that measurements are being taken and processed, and values will appear on the touch screen.

1.4 Operation

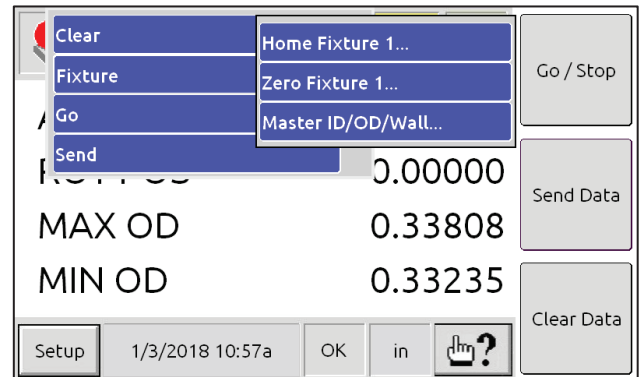
1.4.1 Mastering for ID/OD/WALL Measurements

When a mandrel or fixture is changed, removed, or installed, or if the BenchMike's power has been turned off, the fixture must be mastered. In the mastering process, the dimension **A** (distance between the top of the mandrel and the fixture's upper reference edge) is measured and stored so that the ID and WALL dimensions can be calculated.

To perform ID, OD, and WALL measurements, you must first perform this fixture mastering process.



1. Check to ensure that the mandrel is fitted properly in the fixture and is clean.
2. Remove any part from the mandrel.
3. To master the fixture, select the Mode icon, then **Fixture**, and then **Master ID/OD/WALL**. While the master gap is being measured, the Mode icon will be green. When it has been measured, you may follow the next procedure: setting up the BenchMike for ID/OD/WALL measurements.



1.4.2 Taking Measurements

Once the fixture has been installed and mastered, measurements can be taken using factory default settings.

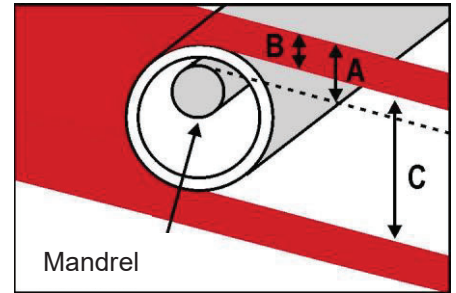
Place the product on the mandrel, and touch the Go button. The Mode icon in the upper left hand corner will turn from a red circle to a green circle. The belts will rotate the product, and measurements will be taken at each location.

You can view OD, ID, or WALL measurements by touching the Feature icon in the upper right hand corner of the screen, and selecting the desired feature from the drop down list.



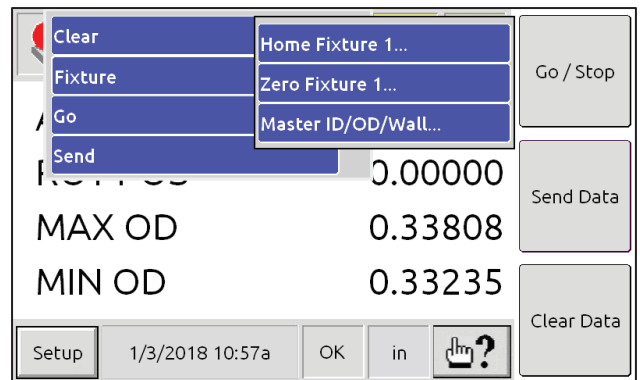
1.4.3 Mastering for ID/OD/WALL with Force Gauge measurements

When a mandrel or fixture is changed, removed, or installed, or if the BenchMike's power has been turned off, the fixture must be mastered. In the mastering process, the dimension **A** (distance between the top of the mandrel and the fixture's upper reference edge) is measured and stored so that the ID and WALL dimensions can be calculated.



To perform ID, OD, and WALL measurements, you must first perform this fixture mastering process.

1. Select a mandrel that is close in size to the ID of the sample to be measured. Make sure the sample can rotate freely on the mandrel.
2. Ensure that the mandrel is fitted properly in the fixture and is clean.
3. Put a straight sample piece on the mandrel.
4. Lower the drive belts onto the sample.
5. Adjust the downward force on the same as low as possible to provide a reliable rotation of the sample on the mandrel.
6. Zero the force gauge.
7. Remove the sample from the mandrel.
8. Lower the drive belts onto the mandrel with the top screw to get the force gauge to read zero.
9. Master the gap.



1.4.3.1 Taking Measurements

1. Place the product on the mandrel.
2. Lower the drive belts onto the product.
3. Adjust the screw at the top of the fixture to read near zero.
4. Touch the GO button. The Mode icon in the upper left hand corner will turn from a red circle to a green circle. The belts will rotate the product, and measurements will be taken.

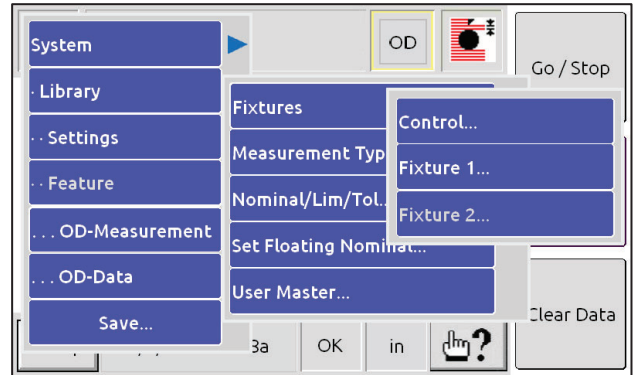


1.5 Factory Defaults

1.5.1 Changing the Fixture Default Settings

If you are using an Automatic ID/OD/WALL Fixture and you wish to change the factory default fixture settings, follow these steps.

1. Select **Setup** from the lower left corner of the screen, then **System**, and then **Fixture**. Select the desired Fixture.
2. Select **Setup**, then **Measurement**, then **Fixtures**, then **Fixture 1**. If **Fixture 1** cannot be selected, select **Control** and then enable the ID/OD/Wall fixture on the Control page.



3. From the **Mode** tab, ensure the following items are set correctly.

Select one of the following options for measurement mode:

Auto

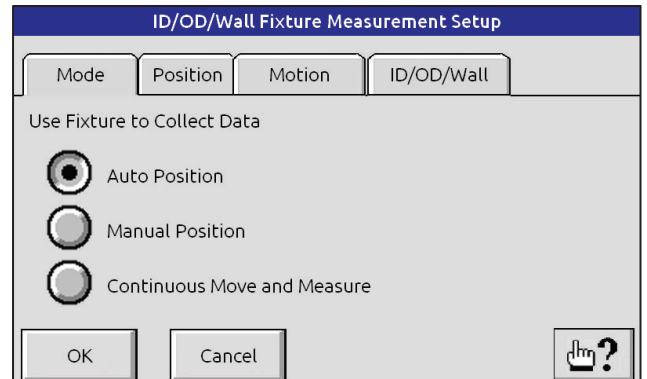
For automatic rotating fixtures: Measurement is initiated by the **Go** command. At the end of each averaging period (defined in Measurement Setup), the fixture rotates to the next position and takes measurement data. The number of measurements may be from 2 to 360 and can be entered as a number of positions or as the angular increment between positions. Measurements are **not** taken during rotation.

Manual

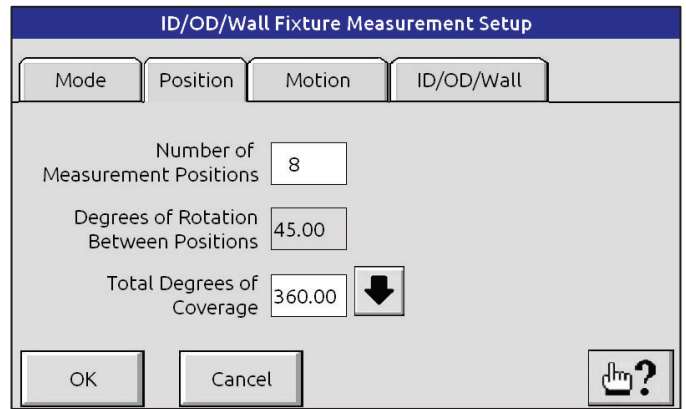
For manual and automatic rotating fixtures: Measurement is initiated by the **Go** command. At the end of each averaging period (defined in Measurement Setup), the user is prompted to rotate the sample to the next position and press **Go** to take the next measurement. Graphical displays are **not** available in this mode because the position is not known reliably unless the fixture has a position encoder.

Continuous

For automatic rotating fixtures: Measurement is initiated by the **Go** command. Measurements are captured while the fixture is rotating. This mode can be used to capture the Maximum, Minimum, or Maximum-Minimum (Diff). The user enters the speed and amount of rotation. Graphical displays are **not** available in this mode.



- From the **Position** tab, you can define either the number of positions (from 2 to 360) or number of degrees of rotation (from 1 to 360). You can also select total degrees of rotation values of: 360, 180, or a custom value.



- From the **Motion** tab, select the desired values for the following.

Motion Speed

Sample rotation speed

Enable Half-Stepping

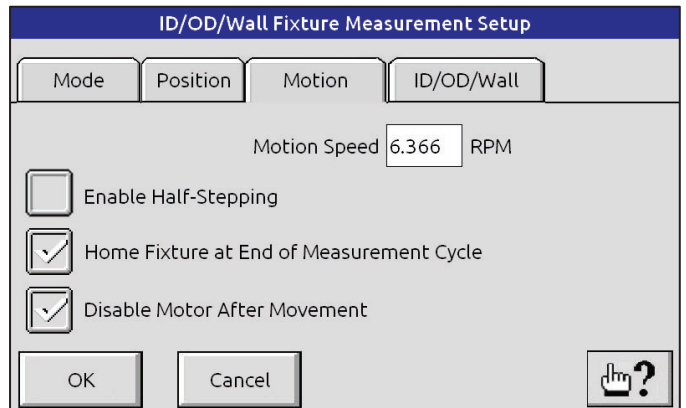
Permits smoother sample rotation

Home Fixture and End of Measurement Cycle

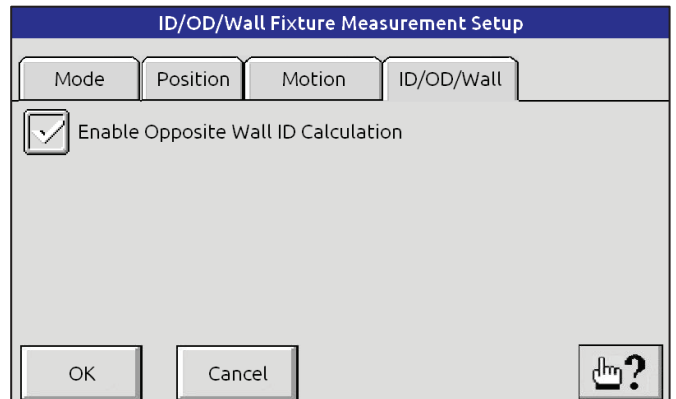
Returns fixture to starting position at end of cycle

Disable Motor After Movement

Turns off fixture's motor at end of cycle



- From the **ID/OD/WALL** tab, determine whether you wish the Opposite Wall Calculation to be enabled or disabled.
When **enabled**, ID measurements are calculated by subtracting the two opposite wall sizes from the diameter. In this mode an even number of measurement positions must be entered. This mode is not operable in Manual or Continuous Modes.
When **disabled** (not checked), ID measurements are calculated by subtracting two times the wall thickness value from the diameter.



1.5.2 Changing Main Screen Defaults

When you start your BenchMike for the first time, the data page will appear as previously shown. You can change the displayed items to suit your requirements. However, see the section on Advanced Screen Capabilities before changing the ID pages. You can change the OD and WALL data pages as described below because Advanced Screen Capabilities are not required in their default settings.

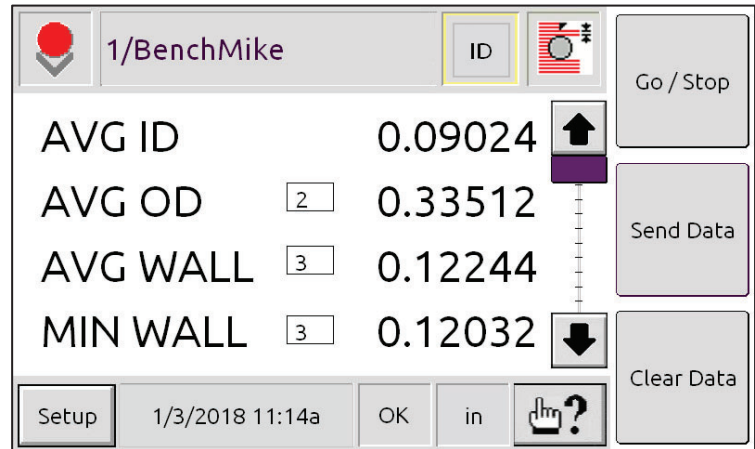
1. Touch the **Setup** button.
2. Touch the **Data** button.
3. Add or delete any of the following items by changing the **Display** setting.

The items in the following table can all be displayed on the main page shown above; that is, all the following data items are sent out via the Serial/Ethernet port. Only these items can be displayed on this page.

Note that you can use the Advanced Screen Option to display items from other features on the main page. Otherwise, only items from the currently loaded feature will be shown on the main page.

| | | |
|---------------------------|--------------------|----------|
| Fixture Position | Fixture 1 Position | |
| | Fixture 2 Position | |
| Nom/Lim/Tol | Deviation | |
| | Nominal | |
| | Limits | +Reject |
| | | +Warning |
| | | -Warning |
| | | -Reject |
| | Tolerances | +Reject |
| | | +Warning |
| | | -Warning |
| | | -Reject |
| Part Count | | |
| Position | | |
| Size | | |
| Size Offset | | |
| SQC | Average | |
| | Count | |
| | Diff/TIR | |
| | Maximum | |
| | Minimum | |
| | Std Dev | |
| Environmental Comp | Optical Plate Temp | |
| | CPU Temperature | |
| | Part Temp. | |
| | Actual Pressure | |
| | Barometric Temp. | |

However, the ID/OD/WALL BenchMike has advanced display capabilities which allow you to display up to 32 data items per Feature. The boxes with numbers inside (shown as 2 for AVG OD) indicate the feature that this data is from. Feature1 is ID, 2 is OD and 3 contains Wall data. If you wish to make use of the capabilities shown to the right, see the [Advanced Capabilities](#) section.



1.5.3 Default Settings

The following settings are the factory defaults for your ID/OD/WALL BenchMike.

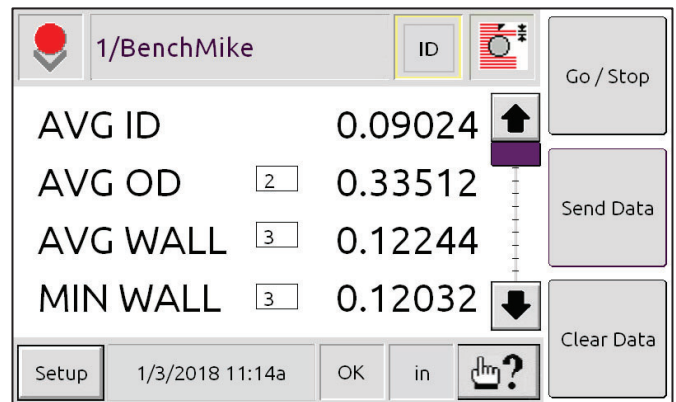
| | |
|---|---|
| Measurement\Measurement Type | Measurement Type 53 (Transparent) |
| Settings\SQC Batch | Batch Count = 0 |
| Data\SIZE\SQC\Average (Avg ID) | Send Serial Data & Limit Checking Enabled |
| Feat 2 Data\SQC\Average\ (Avg OD) | Send Serial Data & Limit Checking Enabled |
| Feat 3 Data\SQC\Average (Avg WALL) | Send Serial Data & Limit Checking Enabled |
| Measurement\Fixtures\Control | Collect Data From ID OD Wall Fixture |
| Measurement\Fixtures\Fixture 1 Mode Tab | Auto selected |
| Measurement\Fixtures\Fixture 1 Position Tab | Number of Positions = 4, Total Degrees of Rotation = 360 |
| Measurement\Fixtures\Fixture 1 Motion Tab | Motion Speed = 5 RPM, Half Stepping = Enabled (checked), Home Fixture = Disabled (unchecked), Disable Motor = Enabled (checked) |
| Measurement\Fixtures\Fixture 1 ID/OD/Wall Tab | Opposite wall ID calculation = Disabled (unchecked) |
| Advanced Screen Capabilities | Disabled to prevent accidental changes to displays Scroll on Warning or Reject |
| ID Feature Page Items | AVG ID AVG OD AVG WALL DIF ID |

| | |
|-------------------------|----------|
| OD Feature Page Items | DIF OD |
| | DIF WALL |
| | MAX ID |
| | MIN ID |
| | MAX OD |
| | MAX WALL |
| | MIN WALL |
| | PARTS |
| | AVG OD |
| | DIF OD |
| WALL Feature Page Items | MAX OD |
| | MIN OD |
| | AVG WALL |
| | DIF WALL |
| | MAX WALL |
| MIN WALL | |

2 Introduction

The BenchMike Pro ID/OD/WALL is designed to provide you with the inside diameter, outside diameter, and wall thickness of tubular products, as gathered by one of the NDC Technologies' ID/OD/WALL measurement fixtures. Typical products are hose, metal tubing, glass tubing, and medical tubing.

Two ID/OD/WALL Automatic Rotating Fixtures are available, and one ID/OD/WALL Manual Rotating Fixture is available. These three fixtures allow you to measure different product sizes and types.



2.1 BenchMike Options

The BenchMike Pro Model 2025 covers the measurement range 0.004-1.00 inch, and the BenchMike Pro Model 2050 covers the measurement range 0.010-2.00 in. There are two types of optional BenchMike equipment that are commonly used with the ID/OD/WALL Fixture.

2.1.1 Interfaces

The BenchMike ID/OD/WALL comes standard with the following interfaces: 8 digital inputs, 12 digital outputs, 2 stepper motor ports, 2 quadrature encoder inputs, and 1 footswitch input.

2.1.2 Measurement Fixtures

One manual and three automatic ID/OD/WALL fixtures are available for the BenchMike Pro and should accompany your order. Other workholding fixtures are also available for the BenchMike Pro, as described in the [Workholding Fixtures](#) section.

2.2 Using the BenchMike

When the BenchMike is turned on, the last saved configuration is displayed on the touch screen. The graphical user interface includes a touch screen which allows the screen to be used to select items. Use your finger to select commands, menus, help, or enter numbers.

To avoid scratching the coating on the touch screen, do not use any sharp object on the display. Remember to clean the screen regularly, using a household window cleaner. Ensure that the lower rim of the screen is kept clean of dust and other contaminants to avoid degrading the gasket around the display.

2.3 Measuring a Product

The BenchMike measures a part by sweeping a beam of laser light across its measurement area. Each sweep of the beam is called a scan. The BenchMike scans the part 100 times per second.

As the beam sweeps through the BenchMike's measurement area, it is alternately blocked by the part, or allowed to pass through to the receive side of the BenchMike. This breaks each scan up into segments of light (when the beam passes over the product) and dark (when the beam is blocked by the product). The BenchMike measures the diameter of a part by detecting the size of this "shadow" (dark segment) created by the part.

Note: The number of segments created by the laser beam will vary based on the number of part(s) placed in the measurement area.

In general, you can measure an object placed in the scanning laser beam if it creates a "shadow". However, to obtain maximum accuracy, a certain portion has been defined as the measurement area. This area represents the location where specifications apply and performance is consistent with factory calibration and alignment.

The measurement area surrounds the Pass Line of the gauge and covers of the full measurement range of the unit (1.0 in. for the BenchMike Pro Model 2025 and 2.0 in. for the BenchMike Pro Mode 2050). The Pass Line of the gauge is located halfway between the transmitter and the receiver. These areas are defined as follows:

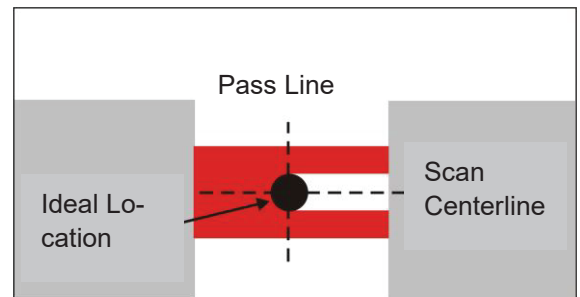
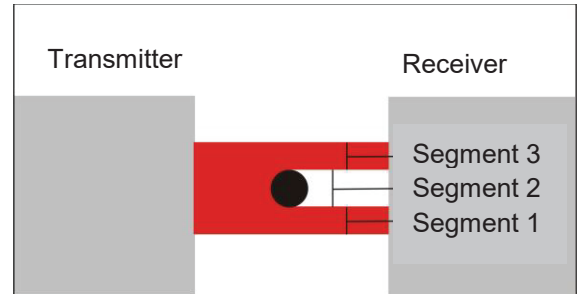
BenchMike Pro Model 2025: ± 0.030 in. from the Pass Line

BenchMike Pro Model 2050: ± 0.060 in. from the Pass Line

You will obtain the most accurate measurements from your BenchMike when the part is placed in this area.

Note: Specifications apply at the intersection of the Scan Centerline and the Pass Line.

With an ID/OD/WALL Fixture mounted in the BenchMike's measurement area and with a product placed on the Fixture's reference mandrel, your product is measured as shown.



When the BenchMike's scanning laser beam passes over the reference mandrel with no product, it measures the reference dimension indicated as A. By placing your product on the reference mandrel, the BenchMike is able to measure the distance from the top of the beam to the top of the product (B) and the product diameter (C). The BenchMike then computes the dimensions you wish as follows:

$$\text{Outside Diameter (OD)} = C$$

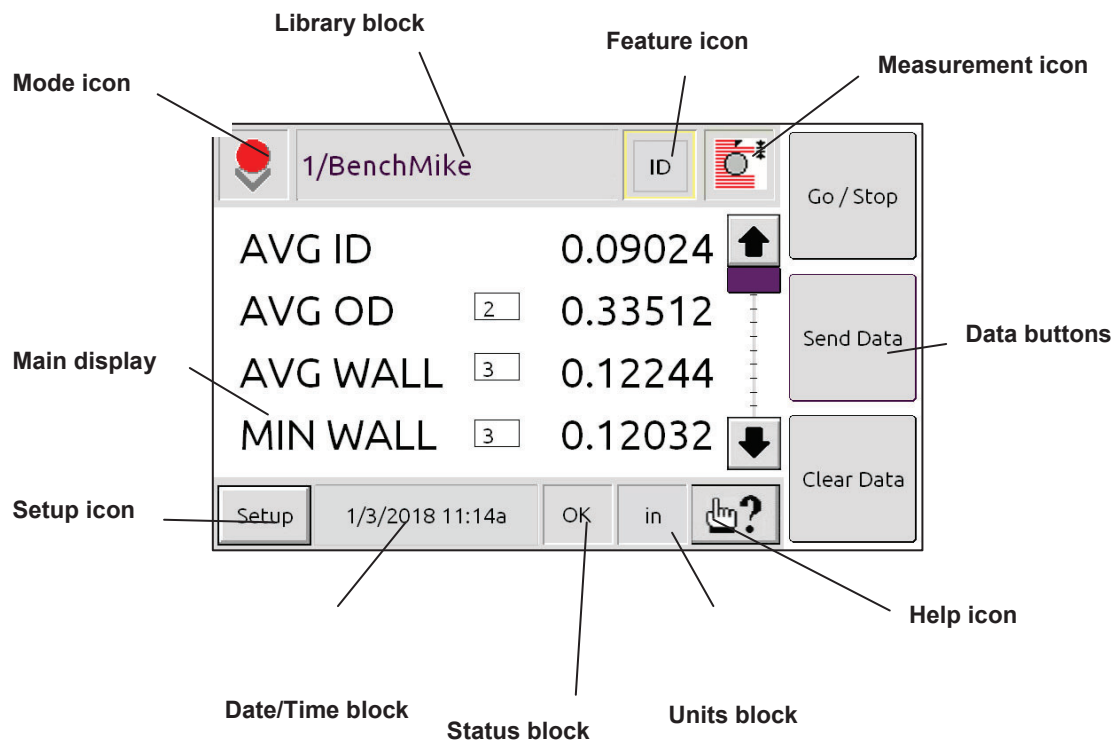
$$\text{Inside Diameter (ID)} = C - 2 (A - B)$$

$$\text{Wall Thickness (WALL)} = A - B$$

With the Manual and Automatic ID/OD/WALL Fixtures, your product can be rotated and measured at many positions.

2.4 Understanding the Data Display

You can access many functions from the BenchMike's main data display.



When the ID/OD/WALL Fixture and software are in use, the Features are identified as ID (Feature #01), OD (Feature #02), and WALL (Feature #03). Due to space limitations on the display, only these short names (or Feature numbers) are displayed in the upper right hand corner.

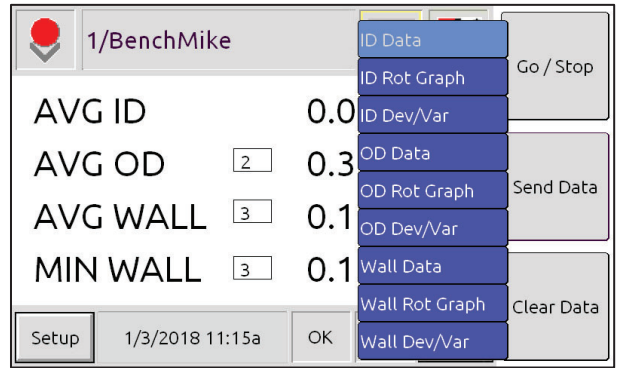
2.4.1 What are Libraries?

Libraries allow you to store the measurement, display, fixture and other settings. By defining libraries for each product to be measured, you can shorten setup times for various parts or applications. See also the information about Libraries in the BenchMike Pro Instruction Handbook.

2.4.2 What are Features?

The ID, OD, and WALL dimensions can be thought of as “Features” of a tubing sample or part. The ID/OD/WALL BenchMike has separate data display pages for each of these part “Features”. You can access each of these pages by touching the Feature icon in the upper right hand corner of the main data display. The Feature pages and all associated functions (such as tolerance checking) are independent of one another.

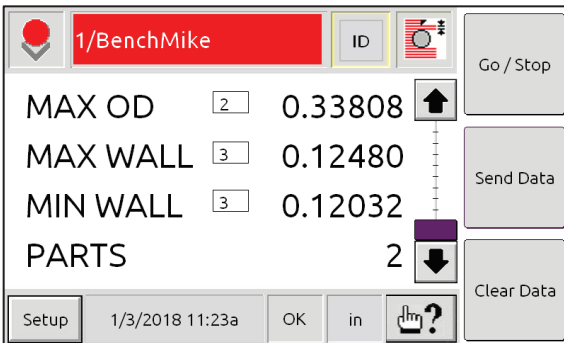
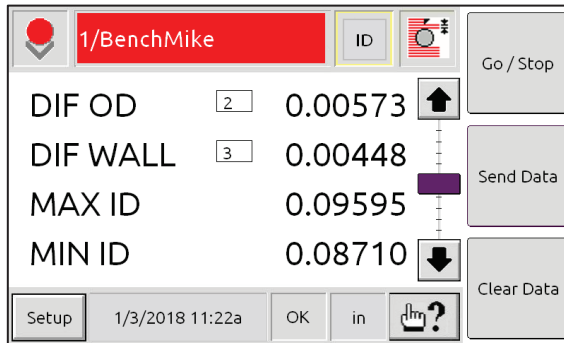
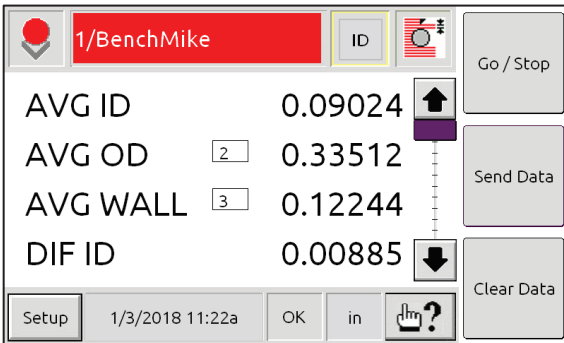
For each Feature, you can display a Data page, a Graph page, and a Dev/Var page. Touch the Feature icon to display the options as shown. Note that the page currently shown in the main data display (ID Data) is not shown in this list.



2.4.3 ID, OD, and WALL Features

Each BenchMike is shipped with the following display defaults for ID, OD, and WALL Features. Note that there are more than 4 data items selected for display on the ID Data page, so you will need to scroll through the items as shown.

ID Feature Data Pages



OD Feature Data Page

| | | | | |
|--------|-----------------|----|----|------------|
| | 1/ID/OD/WALL | OD | | Go / Stop |
| AVG OD | 0.33512 | | | |
| DIF OD | 0.00583 | | | Send Data |
| MAX OD | 0.33807 | | | |
| MIN OD | 0.33224 | | | Clear Data |
| Setup | 1/3/2018 11:40a | OK | in | |

WALL Feature Data Page

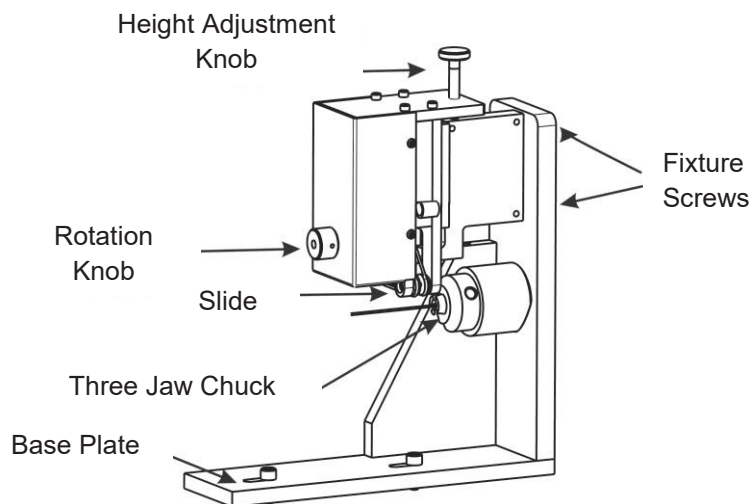
| | | | | |
|----------|-----------------|------|----|------------|
| | 1/ID/OD/WALL | Wall | | Go / Stop |
| AVG WALL | 0.12291 | | | |
| DIF WALL | 0.00419 | | | Send Data |
| MAX WALL | 0.12514 | | | |
| MIN WALL | 0.12095 | | | Clear Data |
| Setup | 1/3/2018 11:45a | OK | in | |

3 | Workholding Fixtures

3.1 ID/OD/WALL Fixtures

3.1.1 Terminology

Your ID/OD/WALL BenchMike has a unique fixture designed specifically to directly measure the outside diameter, indirectly measure the wall thickness, and compute the inside diameter of your products. Note the following features of the ID/OD/WALL fixture:



The **slide** has two rotating pulleys and rubber belts to hold the product in place and rotate it as desired.

The **height adjustment knob** allows you to raise and lower the upper section of the fixture. Adjust this knob so that the mandrel is located roughly in the center of the measurement area (see the Diagnose Page in the BenchMike Pro Instruction Handbook) and so that the belt of the slide rests lightly on the product.

The **three-jaw chuck** holds the mandrel. Note that the jaws of the chuck can be opened or closed for different mandrel sizes.

Your product is placed over the **mandrel** during measurement. Note that the mandrel used should be matched to the product. The mandrel should not be so large that the product is stretched and should not be so small that the product slips on the mandrel during rotation.

The **rotation knob** rotates the product by moving the rubber belts on the slide. With the slide lowered in place, the product is automatically rotated during measurement.

The **fixture connector** should be connected to the BenchMike's Fixture port, located on the rear panel.

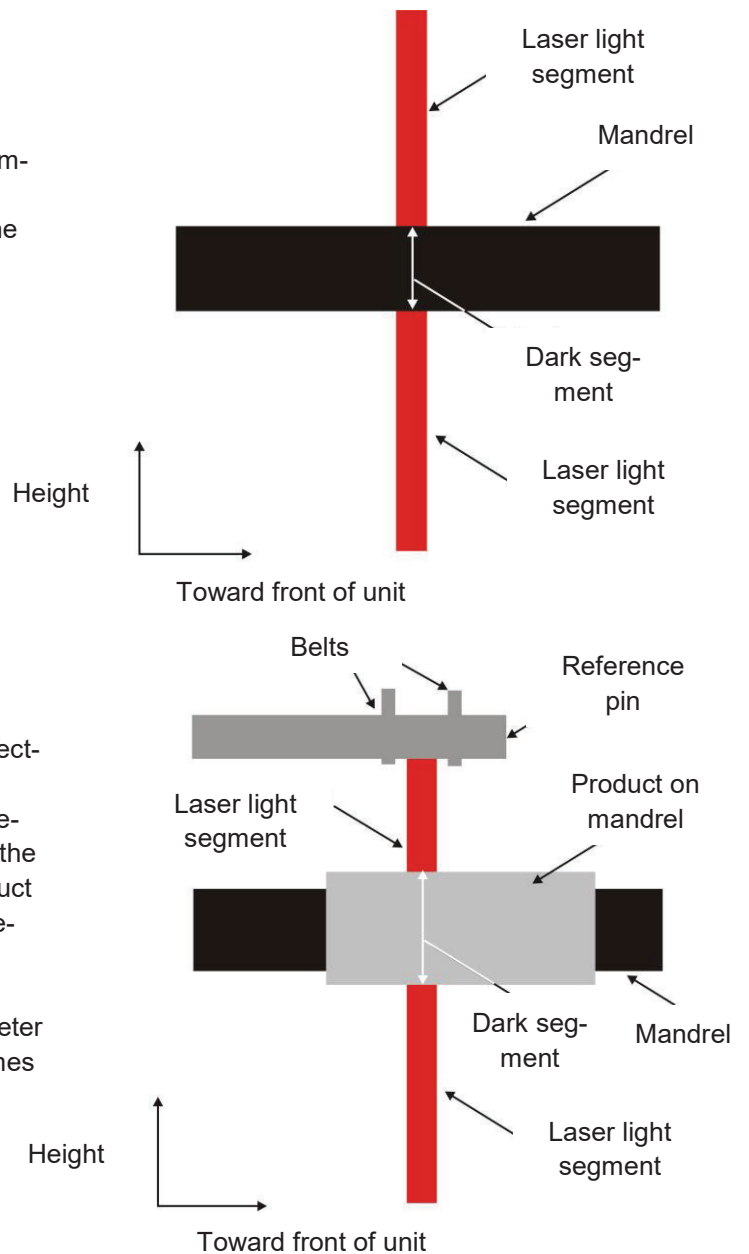
The **base plate** of the fixture is bolted in place in the BenchMike's measurement area. It is important for the base plate to be properly secured to ensure measurement accuracy.

Two **fixture screws** on the back side of the fixture are used to raise and lower the entire fixture assembly.

The **reference pin** (not shown in drawing) is a fixed pin located above the slide. This pin is used during wall thickness measurements.

3.1.2 How the ID/OD/WALL Fixture Measures

The ID/OD/WALL Fixture measures the outside product diameter (OD) directly. With your product placed on the mandrel and with the mandrel located in the scanning laser beam, the product obstructs the path of the beam, creating two light segments and one dark segment, as shown. The dark segment corresponds to the outside diameter of your product.



The wall thickness (WALL) of the product is measured indirectly. The ID/OD/WALL Fixture has a reference pin which is located between the two pins on which the slide belts rest. As shown, the upper laser light segment will decrease in size when a product is placed on the mandrel. The amount of the decrease corresponds to the wall thickness of the product.

With the OD and WALL dimensions known, the inside diameter (ID) can be calculated. ID is calculated as OD minus two times WALL.

3.1.3 Installing the Fixture

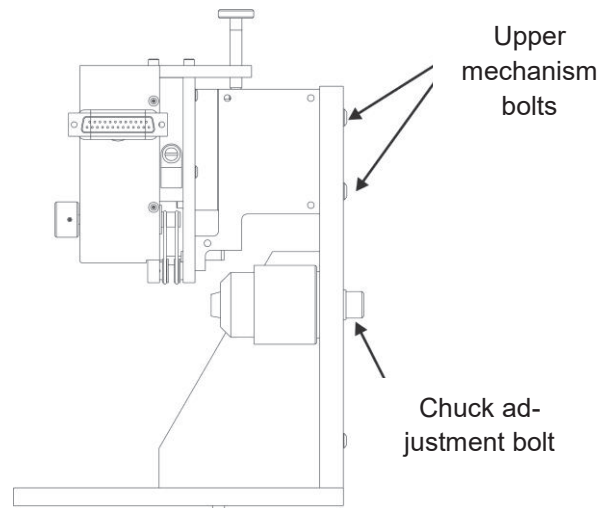
Follow this procedure to install the ID/OD/WALL Fixture.

Note: When using the Manual ID/OD/WALL Fixture, see the instructions under Manual ID/OD/WALL Fixture for Small Tube and Hose.

1. Attach the fixture firmly to the BenchMike, using the two screws to position the fixture on the base plate. Make sure that the laser beam passes **between** the two slide belts, not over one of them. To verify this, place a piece of paper over the receiver window (right window when looking at BenchMike from the front). The upper laser light segment will shorten or disappear if the slide is blocking the beam.
2. Connect the **FIXTURE** connector to the marked connector port on the rear of the BenchMike.
3. Raise or lower the fixture using the height adjustment knob and/or the fixture screws on the rear of the fixture so that the mandrel is roughly centered in the laser beam.
4. Select the mandrel which most closely matches the inside diameter of your product but which will not stretch or deform your product. Place the mandrel in the three-jaw chuck, and tighten it in place.
5. Place the product on the mandrel.
6. Use the height adjustment knob to ensure that the slide belts rest slightly on the product. Use the rotation knob, if desired, to rotate the product to an initial measurement location.
7. Based on the size of your product and the size of the mandrel, you **may** need to make further adjustments to the fixture. Your product — not the mandrel — should be measured, and the laser beam must pass both above and below the product. To verify this, place a piece of paper over the receiver window. Two bars of red light should appear on the paper, separated by the product diameter. If this is shown, go to the next step. If not, you will need to adjust the height of the chuck and/or the upper mechanism. (Alternatively, you may select a mandrel better suited to the size of the product.) To make these adjustments, loosen the bolt to adjust the height of the chuck and/or loosen the two bolts holding the upper mechanism and adjust its position in the slotted holes (see drawing to right). Verify that the two bars of red light appear on the paper again. You may need to repeat this procedure from step #1 if you have altered the position of the upper mechanism relative to the chuck significantly.

3.1.4 Taking Measurements

Once the fixture has been installed as described above, the fixture can be operated as described in the [Operation](#) section.



3.2 Description of Fixtures

3.2.1 Auto-Rotating ID/OD/WALL Fixture for Small Tube & Hose

The **Auto-Rotating ID/OD/WALL Fixture for Small Tube & Hose** automatically rotates to enable measurements of inside diameter, outside diameter, and wall thickness for small tubular products. Features include:

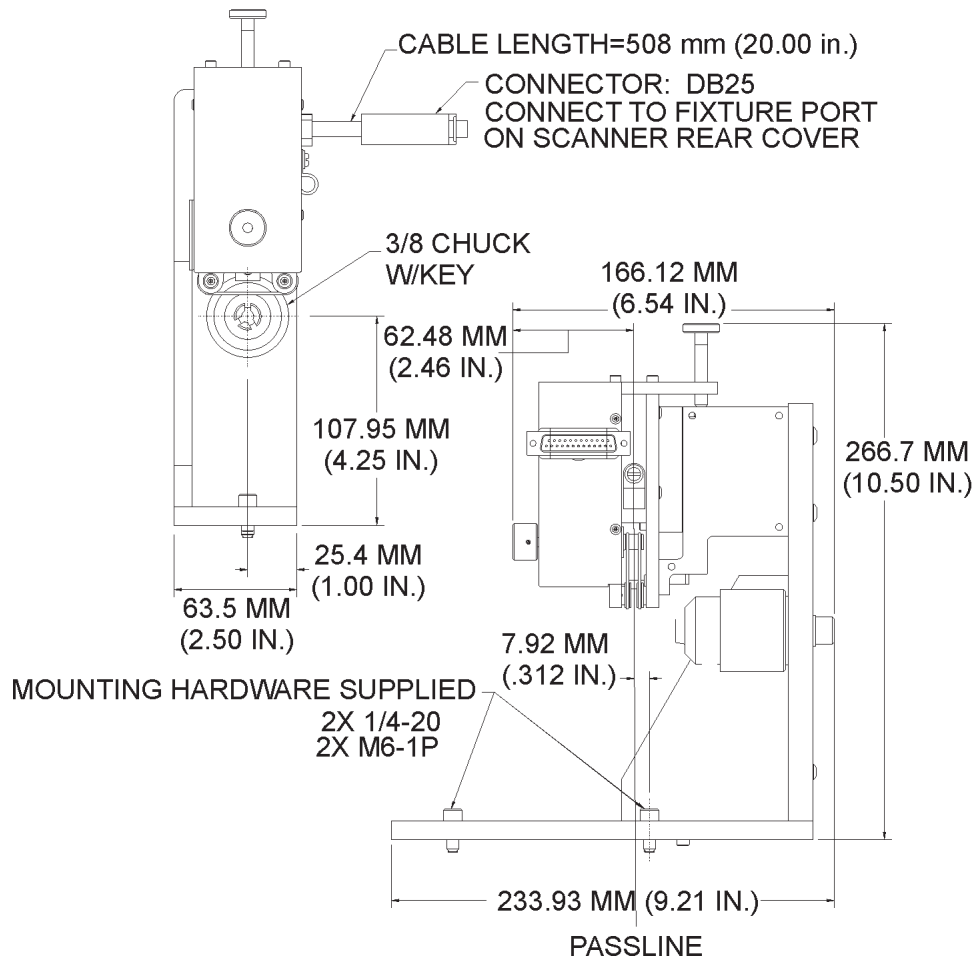
- Measurement range* with BenchMike Pro Model 2025
 - ID: 2.54-24.64 mm (0.100-0.97 in.)
 - OD: 2.54-24.77 mm (0.100-0.975 in.)
 - WALL: 0.025-12.07 mm (0.001-0.475 in.)
- ** Measurement ranges can be affected by the wall thickness, ratio of ID to OD, and material type.*
- Measurement range* with BenchMike Pro Model 2050
 - ID: 2.54-49.28 mm (0.100-1.940 in.)
 - OD: 2.54-49.53 mm (0.100-1.950 in.)
 - WALL: 0.025-24.13 mm (0.001-0.950 in.)
- Plugs into the Fixture Port of the BenchMike
- Intelligent Fixture identification and setup via I²C bus interface
- Multiple radial measurements of a single sample allows for the collection of average, range, difference, maximum, and minimum data values for ID, OD, and WALL
- Mandrel height is adjustable to permit measurements of a wide variety of product sizes
- Adjustable drive belt tension
- Mandrel chuck capacity is 9.52 mm (0.375 in.)
- Slotted mounting holes for aligning fixture to scan beam
- Supplied with 5 standard stainless steel mandrels:
 - Diameter: 7.93 mm (0.3122 in.), Length: 63.5 mm (2.500 in.)
 - Diameter: 6.34 mm (0.2497 in.), Length: 63.5 mm (2.500 in.)
 - Diameter: 4.75 mm (0.1872 in.), Length: 63.5 mm (2.500 in.)
 - Diameter: 3.17 mm (0.1247 in.), Length: 63.5 mm (2.500 in.)
 - Diameter: 2.36 mm (0.093 in.), Length: 63.5 mm (2.500 in.)
- Belts are replaceable without any tools, with one extra set included
- Special rotating bearing mandrels are available for products that are difficult to rotate

Notes:

Measurement ranges can be affected by the wall thickness, the ratio of the I.D. to O.D., and material type.

Measurement ranges stated are for the Model 2025; the upper end of the measurement ranges is half that value with the Model 2050.

3.2.1.1 Drawing of Auto-Rotating ID/OD/WALL Fixture for Small Tube & Hose



3.2.2 Auto-Rotating ID/OD/WALL Fixture with Force Gauge for Very Small Tube & Hose

The Auto-Rotating ID/OD/WALL Fixture with Force Gauge for Very Small Tube & Hose automatically rotates to enable measurements of inside diameter, outside diameter, and wall thickness for small tubular products. Features include:

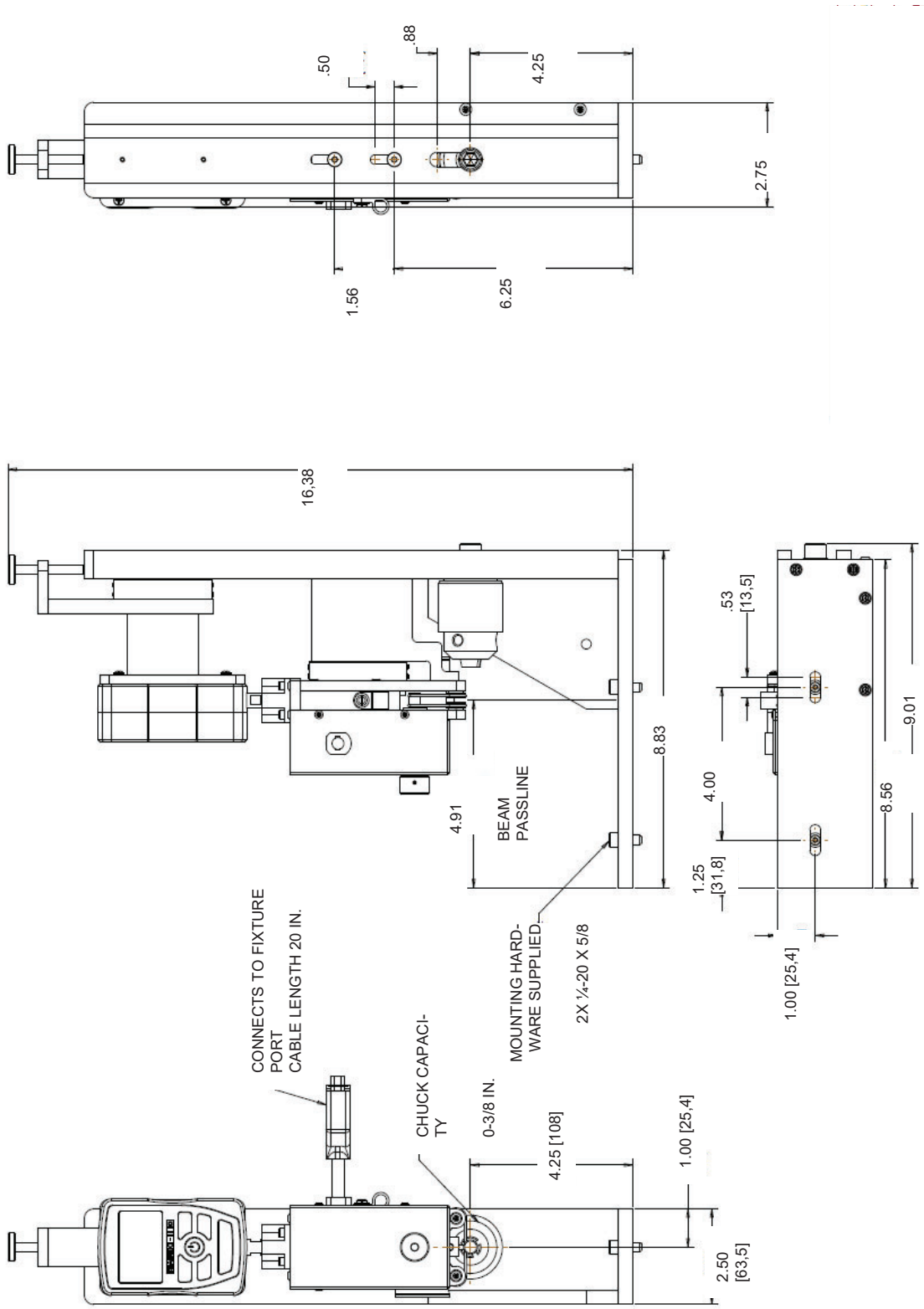
- Measurement range* with BenchMike Pro Model 2025
 - ID: 1.0-24.64 mm (0.040-0.97 in.)
 - OD: 1.0-24.77 mm (0.040-0.975 in.)
 - WALL: 0.010-12.07 mm (0.001-0.475 in.)
- * Measurement ranges can be affected by the wall thickness, ratio of ID to OD, and material type.
- Measurement range* with BenchMike Pro Model 2050
 - ID: 1.00-49.28 mm (0.040-1.940 in.)
 - OD: 1.00-49.53 mm (0.040-1.950 in.)
 - WALL: 0.025-24.13 mm (0.001-0.950 in.)
- Plugs into the Fixture Port of the BenchMike
- Intelligent Fixture identification and setup via I²C bus interface
- Multiple radial measurements of a single sample allows for the collection of average, range, difference, maximum, and minimum data values for ID, OD, and WALL
- Mandrel height is adjustable to permit measurements of a wide variety of product sizes
- Adjustable drive belt tension
- Mandrel chuck capacity is 9.52 mm (0.375 in.)
- Slotted mounting holes for aligning fixture to scan beam
- Supplied with 7 standard stainless steel mandrels:
 - Diameter: 0.80 mm (0.032 in.), Length: 63.5 mm (2.500 in.)
- Diameter: 1.20 mm (0.048 in.), Length: 63.5 mm (2.500 in.)
- Diameter: 7.93 mm (0.3122 in.), Length: 63.5 mm (2.500 in.)
 - Diameter: 6.34 mm (0.2497 in.), Length: 63.5 mm (2.500 in.)
 - Diameter: 4.75 mm (0.1872 in.), Length: 63.5 mm (2.500 in.)
 - Diameter: 3.17 mm (0.1247 in.), Length: 63.5 mm (2.500 in.)
 - Diameter: 2.36 mm (0.093 in.), Length: 63.5 mm (2.500 in.)
- Belts are replaceable without any tools, with one extra set included
- Special rotating bearing mandrels are available for products that are difficult to rotate

Notes:

Measurement ranges can be affected by the wall thickness, the ratio of the I.D. to O.D., and material type.

Measurement ranges stated are for the Model 2025; the upper end of the measurement ranges is half of the value with the Model 2050.

3.2.2.1 Drawing of Auto-Rotating ID/OD/WALL Fixture for Very Small Tube & Hose



3.2.3 Auto-Rotating Heavy Duty ID/OD/WALL Fixture for Large Tube & Hose

The Auto-Rotating Heavy Duty ID/OD/WALL Fixture for Large Tube & Hose automatically rotates to enable measurements of inside diameter, outside diameter, and wall thickness for large, heavy tubular products. Features include:

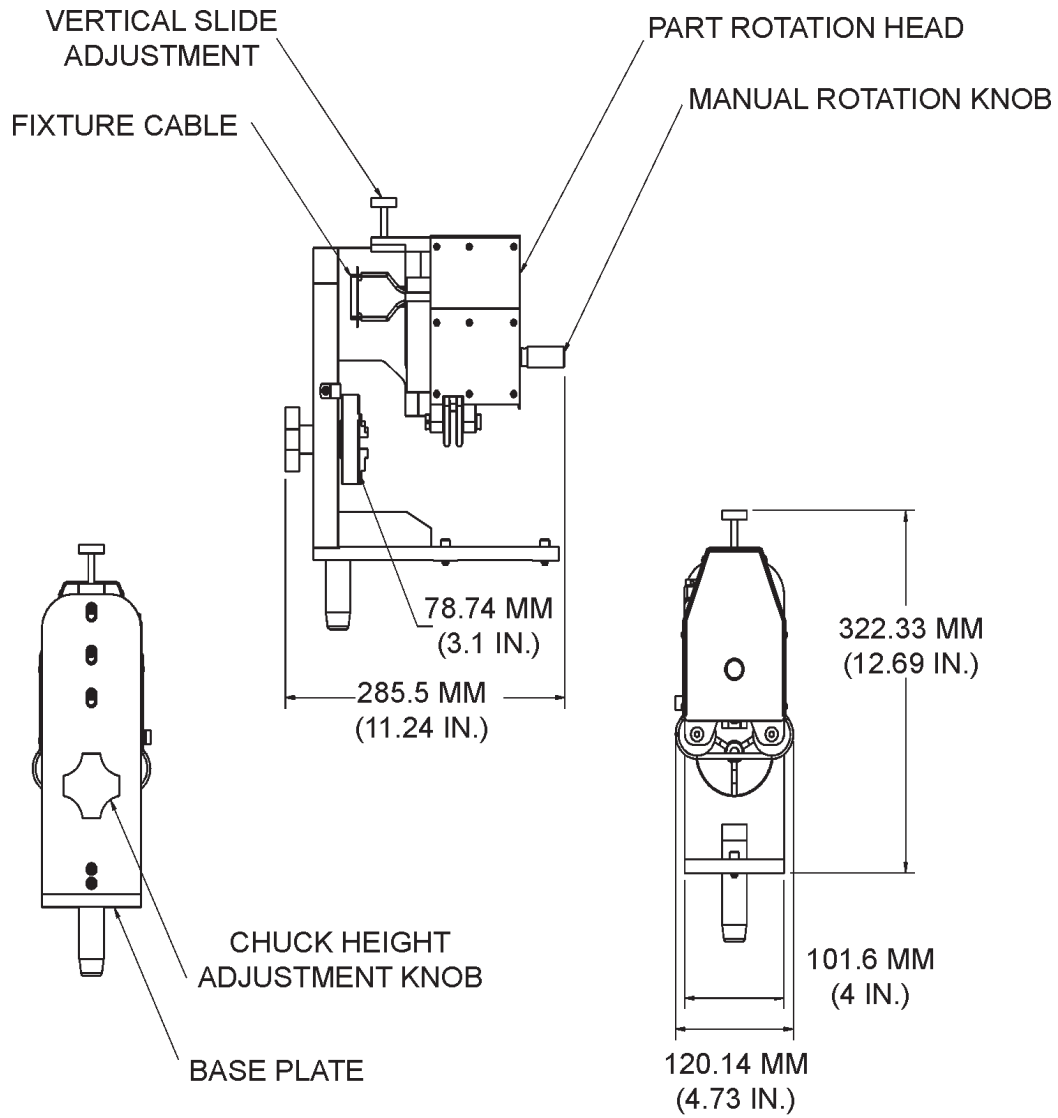
- Measurement range* with BenchMike Pro Model 2025
 - ID: 6.35-24.64 mm (0.250-0.97 in.)
 - OD: 6.60-24.77 mm (0.260-0.975 in.)
 - WALL: 0.25-12.07 mm (0.010-0.475 in.)
- Measurement ranges can be affected by the wall thickness, ratio of ID to OD, and material type.
-
- Measurement range* with BenchMike Pro Model 2050
 - ID: 6.35-49.28 mm (0.250-1.940 in.)
 - OD: 6.60-49.53 mm (0.260-1.950 in.)
 - WALL: 0.25-24.13 mm (0.010-0.950 in.)
- Plugs into the Fixture Port of the BenchMike
- Intelligent Fixture identification and setup via I²C bus interface
- Multiple radial measurements of a single sample allows for the collection of average, range, difference, maximum, and minimum data values for ID, OD, and WALL
- Mandrel height is adjustable to permit measurements of a wide variety of product sizes
- Adjustable drive belt tension
- Mandrel chuck capacity is 78.7 mm (3.10 in.)
- Slotted mounting holes for aligning fixture to scan beam
- Supplied with 4 standard stainless steel mandrels:
 - Diameter: 6 mm (0.236 in.) Length: 125 mm (4.92 in.)
 - Diameter: 8 mm (0.315 in.) Length: 125 mm (4.92 in.)
 - Diameter: 12 mm (0.472 in.) Length: 125 mm (4.92 in.)
 - Diameter: 20 mm (0.787 in.) Length: 125 mm (4.92 in.)
- Special rotating bearing mandrels are available for products that are difficult to rotate

Notes:

Measurement ranges can be affected by the wall thickness, the ratio of the I.D. to O.D., and material type.

Measurement ranges stated are for the Model 2025, the upper end of the measurement ranges is half of the value with the Model 2050.

3.2.3.1 Drawing of Auto-Rotating Heavy Duty ID/OD/WALL Fixture for Large Tube & Hose



3.2.4 Manual ID/OD/WALL Fixture for Small Tube & Hose

The **Manual ID/OD/WALL Fixture for Small Tube & Hose** enables measurements of inside diameter, outside diameter, and wall thickness for small tubular products. Features include:

- Measurement range* with BenchMike Pro Model 2025
 - ID: 2.54-24.64 mm (0.100-0.97 in.)
 - OD: 2.54-24.77 mm (0.100-0.975 in.)
 - WALL: 0.025-12.07 mm (0.001-0.475 in.)
- * Measurement ranges can be affected by the wall thickness, ratio of ID to OD, and material type.
- Measurement range* with BenchMike Pro Model 2050
 - ID: 2.54-49.28 mm (0.100-1.940 in.)
 - OD: 2.54-49.53 mm (0.100-1.950 in.)
 - WALL: 0.025-24.13 mm (0.001-0.950 in.)
- A hold-down mechanism keeps samples in contact with the mandrel. Removable weights allow for adjustment of hold-down force.
- Multiple radial measurements of a single sample allows for the collection of average, range, difference, maximum, and minimum data values for ID, OD, and WALL
- Mandrel height is adjustable to permit measurements of a wide variety of product sizes
- Mandrel chuck capacity is 9.52 mm (0.375 in.)
- Supplied with 5 standard stainless steel mandrels:
 - Diameter: 7.93 mm (0.3122 in.), Length: 63.5 mm (2.500 in.)
 - Diameter: 6.34 mm (0.2497 in.), Length: 63.5 mm (2.500 in.)
 - Diameter: 4.75 mm (0.1872 in.), Length: 63.5 mm (2.500 in.)
 - Diameter: 3.17 mm (0.1247 in.), Length: 63.5 mm (2.500 in.)
 - Diameter: 2.36 mm (0.093 in.), Length: 63.5 mm (2.500 in.)

Notes:

Measurement ranges can be affected by the wall thickness, the ratio of the I.D. to O.D., and material type.

Measurement ranges stated are for the Model 2025; the upper end of the measurement ranges is half of the value with the Mode 2050.

3.2.4.1 Setup

When using the Manual ID/OD/WALL Fixture for the first time or after the library has been initialized, you must first define settings for the fixture. To do so, select **Setup/System/Fixture/Configuration**. On the **Setup** tab, enter the number **3921** in the Fixture ID box.

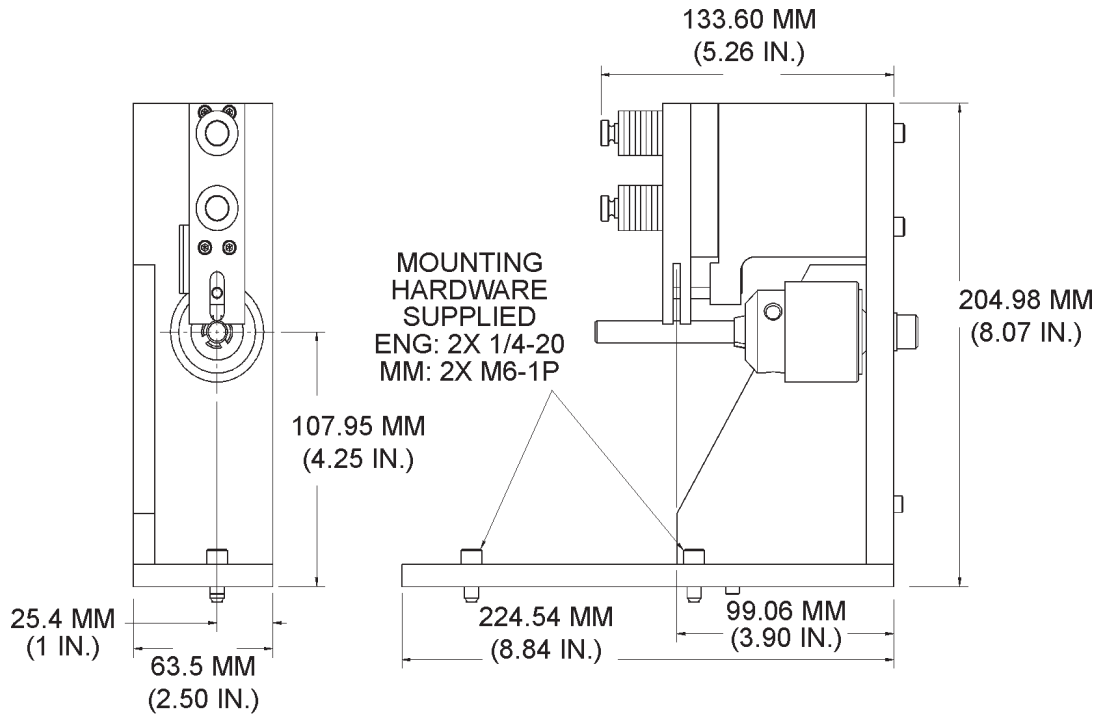
3.2.4.2 Measurement Setup

Select **Setup/Measurement/Fixture/Control**, leading to the **Mode** tab. Check the **Collect Data from Fixture** box, and select the **Manual** button. Next, select the **Position** tab, and enter the position number.

3.2.4.3 Example for Four Measurement Positions

1. Press the GO button to measure the first position. You will be prompted as follows to measure the remaining positions.
2. For the second position, select Move Fixture to Position 2 and press the GO Button.
3. For the third position, select Move Fixture to Position 3 and press the GO Button.
4. For the fourth position, select Move Fixture to Position 4 and press the GO Button.

3.2.4.4 Drawing of Manual ID/OD/WALL Fixture for Small Tube & Hose



3.3 Other Fixtures

All other BenchMike fixtures, detailed in the BenchMike Pro Instruction Handbook, are also compatible with the BenchMike Pro ID/OD/WALL.

4 | Setup

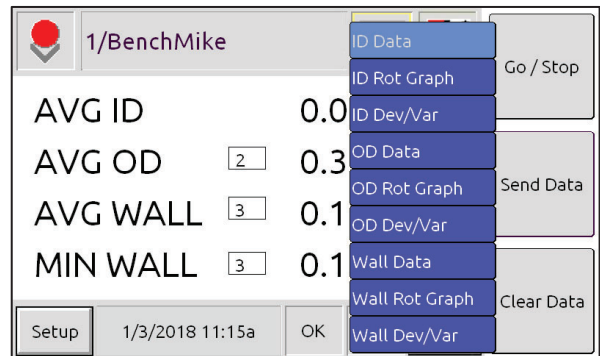
Note that this section **only** contains information about setup functions which are specific to the ID/OD/WALL BenchMike. For all other setup information, consult the BenchMike Pro Instruction Handbook.

4.1 Feature Icon

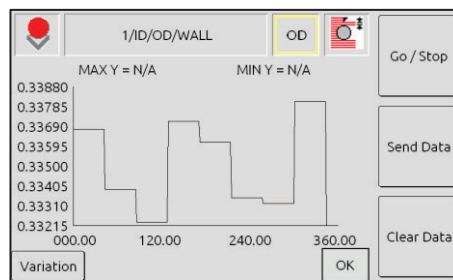
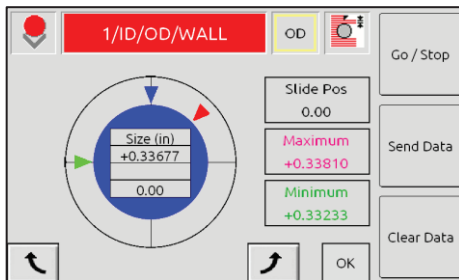
Touch the **Feature** icon in the upper right hand corner of the screen to display the menu shown.

You can display either Data values, a Graph of data, or Deviation/Variation graphs of your accumulated data. To move between the displays and graphs, touch the Feature icon and select the desired view.

Note: With the ID/OD/WALL BenchMike, Features (as described in the BenchMike Pro Instruction Handbook) are already defined for you. The Feature Functions section in the BenchMike Pro Instruction Handbook is therefore not applicable to the ID/OD/WALL BenchMike because they are predefined.



Sample Graph and Deviation screens are shown below.



4.2 System Functions

When an ID/OD/Wall fixture is attached to the Benchmike, a new option called Master ID/OD/Wall will appear in the following system setup pages.

- Button Setup
- Digital Inputs
- Digital Outputs

4.3 Settings Functions

When an ID/OD/WALL fixture is attached to the BenchMike, the Fixture Reports contain information about the ID, OD, and Wall measurements.

4.3.1 Batch Report

The Batch Report for the ID/OD/Wall BenchMike differs from the report shown in the Instruction Handbook. This companion report to the Sample Report summarizes the statistical results for all the measured parts, as shown in the example below.

Notes:

- A maximum of 31 characters is permitted for the header in the top line.
- This report may be printed multiple times by selecting Print on the Mode icon drop-down menu.
- The headers are option and can be turned on and off from the Report Setup/Output page.

| | |
|---------------------------------|------------------------------|
| Your Information Here | Batch Report |
| Library 03/Untitled | 07/02/2018 8:34a Page 1 of 2 |
| ----- | |
| Mode: Type 7, Units:Inches (in) | |
| Average 0.049816 | |
| Diff/TIR 0.000006 | |
| Maximum | 0.049818 |
| Minimum | 0.049812 |
| Standard Deviation | 0.0000032 |
| Undersize Samples | 0 |
| Oversize Samples | 0 |
| Total Number of Samples | 3 |

4.3.2 Fixture Sample Report

The Fixture Sample Report for the ID/OD/Wall BenchMike differs from the report shown in the Instruction Handbook. The sample shown below lists data taken from an ID/OD/WALL Fixture. You will notice data for ID, OD, and Wall measurements.

ID

0.11949 0.12178 0.12346 0.12285 0.12090 0.11851 0.11800
0.11935

MAX: 0.12346 MIN: 0.11800 DIFF: 0.00546 AVG: 0.12054 SD 0.002022
READINGS: 8

OD

0.24995 0.24969 0.24974 0.25008 0.24982 0.24970 0.24991
0.24999

MAX: 0.25008 MIN: 0.24969 DIFF: 0.00039 AVG: 0.21986 SD: 0.000145
READINGS: 8

Wall

0.06523 0.06395 0.06314 0.06362 0.05446 0.06559 0.06595
0.06532

MAX: 0.06595 MIN: 0.06314 DIFF: 0.00281 AVG: 0.064766 SD: 0.001016
READINGS: 8

4.3.3 Fixture Batch Report

The Fixture Batch Report for the ID/OD/Wall BenchMike differs from the report shown in the Instruction Handbook. The Fixture Batch Report is a companion report to the Fixture Sample Report and summarizes the statistical results for all the measured parts, also taken by an ID/OD/WALL Fixture.

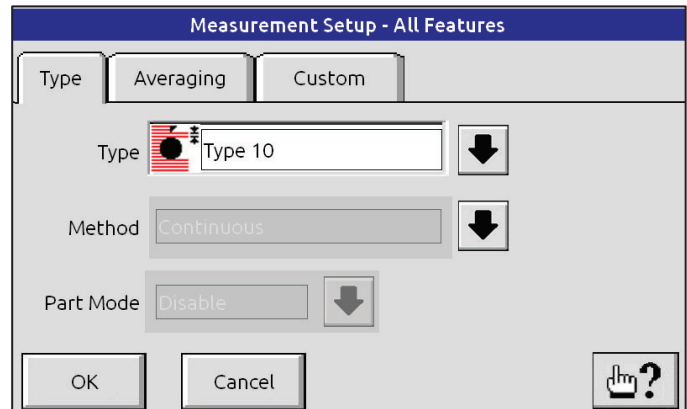
Notes:

- ID in the second header line indicates that this section of the report refers to the ID measurements only.
- This report information will repeat for OD and WALL measurements, as shown below.

| | |
|---|--|
| Your Information Here Library 03/Untitled/ID | Fixture Batch Report 07/03/2018 8:40a Page 1 of 1 |
| ----- | |
| Mode: Diameter, Units:Inches(in) | |
| Report on All Readings | |
| Average | 0.355690 |
| Std Dev | 0.0036261 |
| Highest | 0.362025 |
| Lowest | 0.350075 |
| Range | 0.011950 |
| Oversize | 0 |
| Undersize | 0 |
| Report on Sample/Part Summaries | |
| Average | 0.355616 |
| Std Dev of Sample Averages | 0.0001111 |
| Highest Sample Average | 0.355699 |
| Lowest Sample Average | 0.355490 |
| Highest-Lowest Sample Average | 0.000209 |
| Average Range/R-Bar | 0.010957 |
| Oversize Samples | 0 |
| Undersize Samples | 0 |
| Total Number of Samples | 8 |
| Your Information Here Library 03/Untitled/OD | Fixture Batch Report 07/03/2018 8:40a Page 1 of 1 |
| <i>Information repeats for OD measurement . . .</i> | |
| Your Information Here Library 03/Untitled/WALL | Fixture Batch Report 07/03/2018 8:40a Page 1 of 1 |
| <i>Information repeats for WALL measurement . . .</i> | |

4.4 Measurement Functions

Measurement settings can be accessed through the **Setup/Measurement** menu. Note that only the Measurement Type can be changed when an Intelligent Fixture is used. If your ID/OD/Wall fixture uses a top-mounted reference edge, only measurement types 10 and 53 apply. ID/OD/Wall fixtures with bottom-mounted reference edges use measurement types 11 and 52. Types 52 and 53 are used with transparent objects (ie glass tubes). Your BenchMike may not have this option installed.

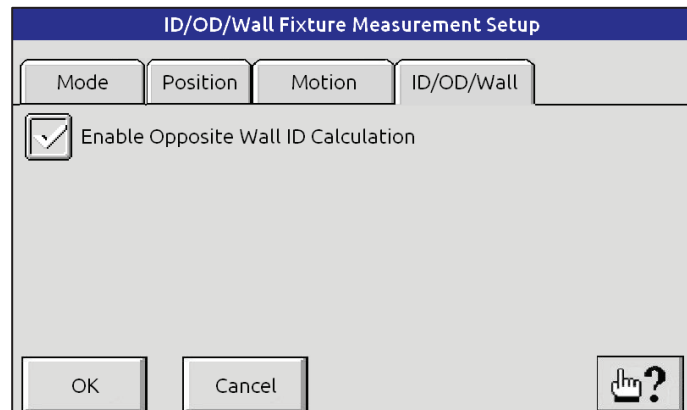


Fixture Measurement settings can be accessed through the **Setup/Measurement/Fixtures/Fixture 1** menu. When an ID/OD/Wall fixture is attached to the BenchMike a new tab appears on this page.

The ID/OD/WALL tab allows you to enable or disable the Opposite Wall Calculation.

When **enabled**, ID measurements are calculated by subtracting the two opposite wall sizes from the diameter. In this mode an even number of measurement positions must be entered. This mode is not operable in Manual or Continuous Modes.

When **disabled** (not checked), ID measurements are calculated by subtracting two times the wall thickness value from the diameter.

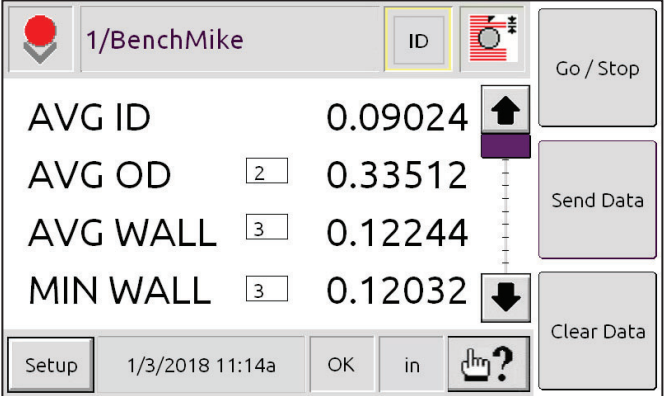


5 | Advanced Capabilities

5.1 Advanced Screen Capabilities

On the main display, if any of the items selected for display are from a different Feature, they will be identified by the Feature number to the right of the data label. When an ID/OD/Wall fixture is attached there are only three features containing ID, OD, and Wall measurements. ID is Feature 01, OD is Feature 02, and WALL is Feature 03.

The sample page shown is for the ID Feature, but note that additional values have been set to be displayed on other pages. These are indicated by the numbers 2 and 3 shown next to the AVG OD, AVG WALL, and MIN WALL values.



6 | Servicing Your Equipment

Your instrument was carefully inspected electrically and mechanically prior to shipment. It should be free of surface marks and scratches, and it should be in perfect working order upon receipt. If any indication of damage is found, file a claim with the carrier immediately, prior to using the instrument. If no damage is apparent, proceed by using this manual to install and setup this instrument.

Save the shipping carton and packing material for future storing or shipment of the instrument. If, at some future time, the instrument must be returned to the factory for service, include a full description of the instrument failure and the mode of operation the instrument was in at the time of failure. Also include a contact person to discuss the instrument failure.

When returning equipment for service, it is important to first obtain a Return Material Authorization (RMA) number. The RMA number is needed for proper handling of returned equipment.

To obtain an RMA...

- Go to <https://ndc.custhelp.com/>
- Select **Service**
- Select **Equipment Return / RMA** from the drop-down menu. Follow the instructions to obtain an RMA.

Ship the instrument in the original carton, or, if the original carton is unavailable, ship in a carton providing sufficient protection. Send the instrument to the Asia, Europe, or USA office (addresses listed in the supplied Contacts/CE Compliance Manual), whichever is closest to you or to the office indicated by your sales engineer. Place the RMA number on the outside of the carton, and include a purchase order number and any other information specific to your instrument.

Field warranty service is available, if the customer pays travel expenses by advance purchase order. All service operations should be performed by skilled electronics technicians, who have been trained by NDC Technologies. For more information, see the Proprietary Statement at the beginning of this manual.

Warranty

1. All sales of NDC Technologies products are subject to the contractual terms and conditions of the Order pursuant to which they were sold to Buyer, including Warranty terms. The following terms are a general summary of the contractual Warranty terms, NOT a revision or alternative to the contractual terms, and are presented as merely a point of reference for your information. The contractual Warranty is the complete and exclusive statement of all NDC Technologies warranties to Buyer. In the event the following terms are in conflict with any of the contractual Warranty terms, the contractual Warranty terms shall be deemed to control.

The warranty terms contained herein are expressly in lieu of any and all other warranties, expressed or implied, including any warranty of merchantability or fitness for a particular purpose. In no event shall NDC Technologies be liable for any incidental, consequential or special damages, including but not limited to, any loss of business, income or profits, expenses incurred for time when the system is not in operation, and any labor costs relating to or arising out of the performance, functioning or use of the system.

Purchaser assumes the risk for use of this product and agrees to indemnify and hold NDC Technologies harmless for any and all damage to person or to property resulting therefrom.

NDC Technologies grants no license under any patent rights except the right, under only such patents as may be owned or acquired by NDC Technologies, to use the product sold hereby for the purpose for which it is sold. NDC Technologies does not warrant that the product or its use does not infringe any patent owned by persons other than NDC Technologies.

2. For a period of one (1) year from the date of delivery, NDC Technologies guarantees all products to be free from defects in material and workmanship. During this period, NDC Technologies will repair or at its option replace, free of all charges for parts and labor, any NDC Technologies parts determined by it to have been broken or damaged due to causes other than improper application, abuse or negligence. NDC Technologies' obligation to repair or replace shall not extend to expendable parts which are subject to normal operating wear. Nothing in this paragraph 2 will require NDC Technologies to make repairs or replacements where:
 - A. The product has been repaired, other than by an authorized NDC Technologies dealer or an NDC Technologies employee, or altered in any way without the prior written consent of NDC Technologies; or
 - B. The product has not been properly maintained in accordance with any operating and maintenance manual supplied therewith; or
 - C. The product has been damaged as a result of fire, flood, war, insurrection, civil commotion, acts of God or any other cause beyond the control of NDC Technologies or Buyer.
3. NDC Technologies' liability shall be limited to the obligations set forth in Paragraph 2. These shall be the Buyer's sole and exclusive remedies, whether in contract, tort or otherwise, provided, however, that in lieu thereof, NDC Technologies at its option may replace the entire product on an exchange basis or refund the purchase price against the return of the defective product.
4. NDC Technologies will not be responsible for failure to provide service or parts due to shortage of materials, labor or transportation strikes or delays, or any causes beyond NDC Technologies' control.

5. Unless otherwise specified by NDC Technologies, all warranty repairs will be made at NDC Technologies' facility. The customer shall be responsible for all expenses of packing, freight and insurance in connection with the shipment of products to NDC Technologies for repair. NDC Technologies will pay the cost of returning the equipment to customer.

If it is mutually determined by the buyer and NDC Technologies that the examination, replacement or repair takes place at the buyer's facility, then the buyer will be responsible for NDC Technologies' travel and living expenses incurred in traveling to and from the buyer's facility, and during the time of the visit, as well as the cost of field labor and replacement parts unless the parts being repaired or replaced are determined to have been defective, in which event the cost of said repaired or replacement parts shall be borne by NDC Technologies. These travel and living expenses will be billed to the buyer at actual cost to NDC Technologies.

6. No person, including any NDC Technologies distributor, agent or representative, is authorized to assume any liability on behalf or in the name of NDC Technologies, and NDC Technologies shall not be bound to any understandings, representations, or agreements with respect to warranties except as set forth in this policy.
7. NDC Technologies requests immediate notification of any claims arising from damage in transit in order to determine if carrier responsibility exists. If damaged equipment arrives, save the shipping container for inspection by the carrier and telephone NDC Technologies as soon as possible.

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