Starrett®

Touchscreen Electronic Indicator
W4900-1

USER MANUAL

W4900-1 Touchscreen Electronic Indicator

READ THIS MANUAL BEFORE USING THE INSTRUMENT

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All specifications in this document are correct at time of production and are subject to change.

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1.0 Precautions ⚠

- Remember, only charge the Indicator when the battery symbol is showing one bar, see Section 5 Rechargeable Battery, for details.
- Avoid extreme temperatures, direct sunlight, excessive heat, or below freezing for extended periods.
- Avoid dropping the Indicator. Avoid shocks to the contact point and spindle. Do not apply any radial force to the spindle.
- If the Indicator is stem-mounted, protect the Indicator from being struck or bumped to prevent stem/case mechanical alignment damage.
- Do not over-tighten the mounting mechanism. Use clamp mounting rather then set screws, if possible, to prevent damage to the lower bushing and spindle.
- Frequently clean the spindle using a dry cloth or a chamois to prevent sluggish or sticky movement. Isopropyl alcohol may be used to remove gummy deposits on metallic parts. Do not apply any type of lubricant to the spindle and do not use harsh solvents.
- Avoid any disassembly or modification of the Indicator, other than objects outlined in Section 6.0 Accessories.
- Avoid using anything hard or sharp that might damage the screen when in use. Use finger tip or a soft tipped capacitive stylus. The stylus should be recommended for use on a capacitive touch screen surface.
- Don’t press hard on the touchscreen, pressure is not how a capacitive touch screen works. The touch screen works by sensing a small electrical current from a finger tip or stylus that completes an electric circuit at the point where the contact is made. The change is registered as a “touch event” similar to a click event when using a mouse.
- Use the appropriate gage stand or Indicator holder for the job intended.
- To clean the screen, turn off the tool and use light pressure with a clean microfiber cloth, or a pre-moistened screen cleaner wipe.
- To clean the tool overall, use a chamois or microfiber cloth. The cloth can be moistened with mild detergent or a 50/50 mixture of water and isopropyl alcohol.

Table 1: Sequence of Options in the Settings Menu

Settings Menu Options							
Dial Configuration	*Dial Reading* Set Dial Reading	*Graduation* Set Graduations	*View All* Back to Dial				
Preset	Set the Preset						
Limits	Set the Limits						
Advanced	*Language* Back to Language Selection	*Color* Select Dial Color Automatic White Yellow Black Red	*Rotation* Set the Display Orientation	*Lock* Enter 4 Digit Passcode In/mm Lock Off/On Direction Lock Off/On Datum Lock Off/On Mode Lock Off/On	*Scale Factor* Set multiplier or divisior to scale the measure-ment	*Profiles* Select Profile Name Default_ (ABC) (DEF) (GHI) (JKL) (MNO) (PQR) (STU) (VWX) (YZ) (YZ)	*Zero Delay* Zero Delay Off Zero Delay On
Wireless	On/Off	OTA	Reset Security Settings				

Note: Items in red indicate that a selection from a table is required or an adjustment of a setting is necessary.

Table 2: Sequence of Options in the Power Menu

Power Menu Options	
Off	Turns display Off
Sleep Timer	Select a duration of time before display shuts down
Never *5 minutes* *10 minutes* *15 minutes* *30 minutes*	
Backlight	Adjust light intensity
Help	QR Code for online help using a cell phone, tablet or computer
Glossary	Description of screen icons

1.1 Touch Screen Interface

Capacitive Touch Screen Terms:

Tap – Lightly place a finger tip onto the screen and raise it again, quickly. The quick tap, less then a second, will register a "touch event" like a click event when using a mouse. A single finger tap selects items and links. Tap the center of the icon. Just the tap of a finger tip is all that is needed, there is no reason to press down on the display.

Swipe - Touch and hold the surface of the screen while moving a finger tip to slide the option list (up or down). To pick an option move the desired option to the selection box and then tap the OK or right arrow icon to go to that screen.

Right Arrow Icon - Use this icon to:

- Navigate to the next screen
- Select an option
- Toggle the state of an option on or off.

Icon - A graphic or area on screen used to:

- Select an item
- Link to another screen
- Initiate a mode
- Toggle the state of an option (on/off)
- Send a wireless reading
- Show that a mode is active.

Fig 2A displays the Indicators Settings menu that allows the user to configure or change many of the Indicator features. Swipe the options list to move up and down. To select an option, move it to the center selection box and tap the right arrow icon to open the next screen. Tapping an item in the options list will automatically move it to the selection box.

Fig 2B displays areas of the screen used as links to other screens. The top left quarter of the screen when tapped opens the English Dial Indicator screen. The top right quarter opens the Metric Dial Indicator screen and the bottom half opens the Digital Indicator screen. **Fig 2C**, tap the digital readout to go to the Digital Indicator screen.

Fig 2C displays an example of the icons that are available on the English Dial Indicator screen. Each screen will be explained in depth throughout this manual.

Fig 2A Settings Menu Screen

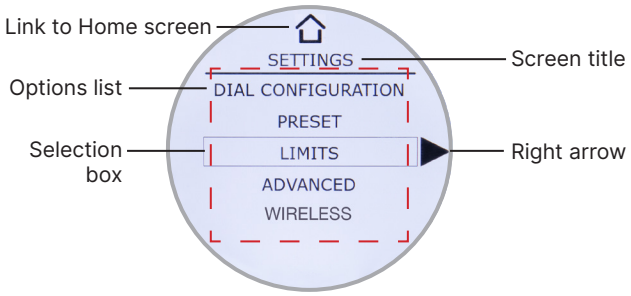


Fig 2B Home Screen

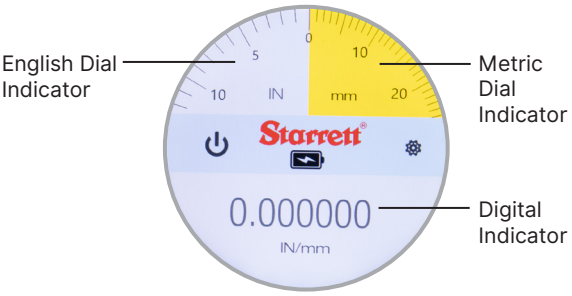
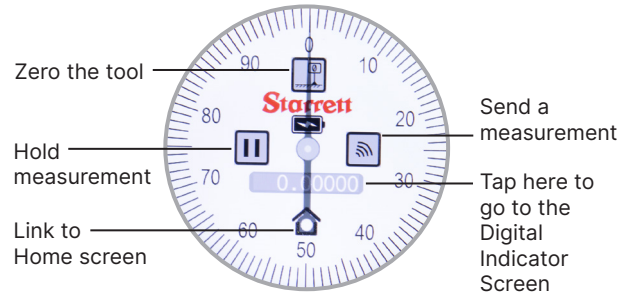


Fig 2C English Dial Indicator



1.2 Quick Start Basics

This Quick start is intended to get the user up and measuring with the tool as soon as possible. Refer to Table 1 to become familiar with the Menu Options available on the screens. Explore the different screens to get a feel for the tool. Operations like Preset, Limits and TIR may be familiar, while some icons may need explaining. This manual will go over details the user may need to know to become proficient in the operation of this Indicator.

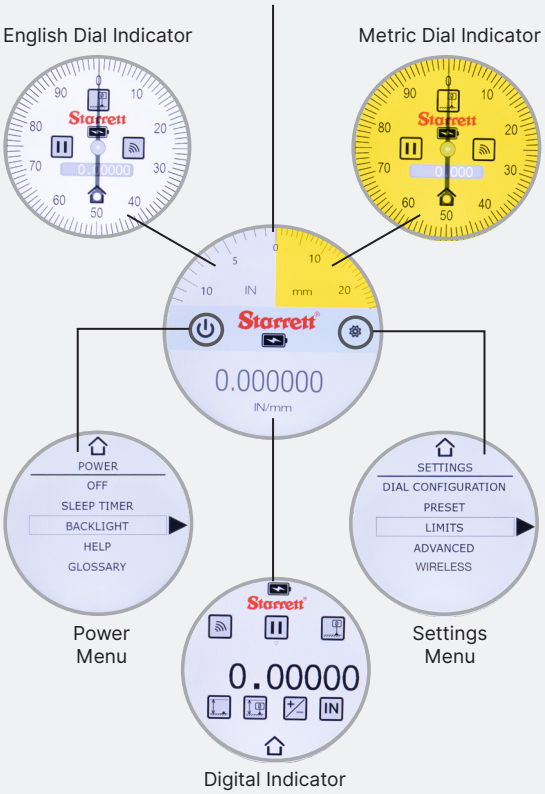
1. Move the spindle or tap the screen to turn the Indicator ON. The Startup screen will be displayed, Fig 3A. Tap the center of the screen to open the Language menu screen, Fig 3C.
2. Pick the language by swiping the list up or down, placing the selected language into the selection box in the middle of the screen or tap the language to automatically move it to the selection box. To complete selection, press the Home Icon, Fig 3B, at the top of the list. Pressing the Home Icon opens the Home Screen, Fig 3D, or if in a Settings menu the previously opened page.
3. The Home Screen is subdivided into four sections. The top left quarter of the screen is a link to the English Dial Indicator screen. The top right quarter is linked to the Metric Dial Indicator screen. The bottom half of the screen is linked to the Digital Indicator screen. The center of the screen contains the control icons.
4. The gear icon on the right links to the Settings Menu screen with the options; Dial Configuration, Preset, Limits, Advanced, Features and Wireless menus.
5. The icon on the Left links to the Power menu screen with the options; Off, Sleep Timer, Backlight, Help and Glossary.
6. The Digital Indicator screen is used to initiate Preset, Limits, and TIR Mode.

Fig 3A
Startup Screen

Fig 3B
Home Icon

Fig 3C
Language Menu Screen

Fig 3D Home Screen



2.0 Startup and Language Menu Screen

1. Refer to Fig 4A to view the Startup screen. Tap the center of the screen and the Language menu will appear.
2. Seven Language options are available in the Language screen (refer to Fig 4B) that may be selected by:
   - Swiping the list up and down to move language into the selection box in the middle of the screen.
   - Tapping the option to automatically move the selection box into the selection box.
3. Press the HOME Icon to select the option and return to the Home Screen.

Fig 4A
Startup Screen

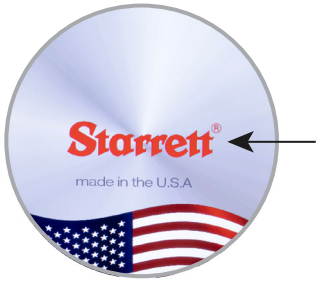
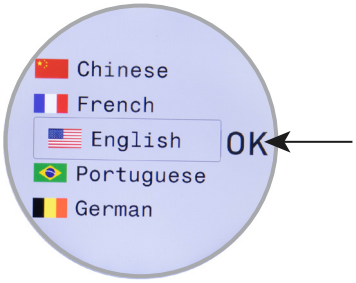


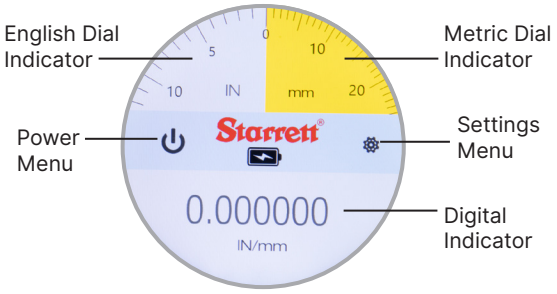
Fig 4B
Language Menu



2.1 Home Screen

Fig 5A, The Home Screen has links to the Dial and Digital Indicator screens, the Power Menu and the Settings Menu. Tap the top quarters of the screen to open the English or Metric Dial Indicator screens. Tap the bottom half of the screen to open the Digital Indicator screen. Located to the left of the screen is the Power Menu icon and on the right is the Settings Menu icon. Each linked screen is described in the following text.

Fig 5A Home Screen



2.1.1 Power Menu

Refer to Table 2 for an overview of the Sequence of Options in the Power Menu. Fig 6, the Power Menu, has links to the Sleep Timer, Backlight, Help and Glossary screens. The OFF option turns the tool off. In this mode the battery use is reduced.

The Home icon returns to the Home screen.

Fig 6 Power Menu

Sleep Timer

Use the Sleep Timer screen to adjust the amount of time before the tool goes to sleep, ranging from never to 30 minutes. To wake up the tool, tap the screen. Tap the Home icon to go back to the Power screen.

Fig 7A Sleep Timer

Backlight

The Backlight screen allows the user to adjust the screen brightness. Swipe the blue box to the right to increase the brightness and to the left to decrease the brightness. Tap the OK icon to save and return to the Power screen.

Note: Increased brightness increases power usage, reducing battery life.

Fig 7B Backlight

Help

The Help screen contains a QR link to access a PDF of the user manual at the Starrett web site. Connect to the Starrett web site then scan code using a cell phone, computer or tablet to open the manual.

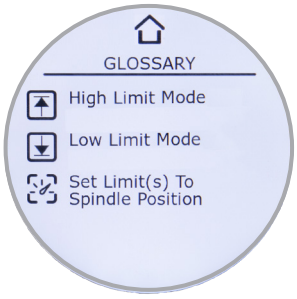
Take note, the sequence of numbers and letters at the bottom of the screen is called a MAC address, this is unique to the radio inside the tool and will be important when enabling the wireless function of the tool. Refer to Section 4 Wireless Overview. Tap the Home icon to go back to the Home screen.

Fig 7C QR and Mac Address

Glossary

Refer to Table 6.4 for a list of icons and descriptions. The Glossary Menu contains brief descriptions, actions and indications of the featured icon. Swipe the screen to move through the menu. Tap the Home icon to go back to the Home screen.

Fig 7D Glossary



2.1.2 Settings Menu

To open the Settings menu, tap the gear icon. This menu has links to: Dial Configuration, Preset, Limits, Advanced, Features and Wireless menu screens. The Home icon returns the user to the Home screen.

2.1.2.1 Dial Configuration Menu

The Dial Configuration menu, Fig 9, has links to the Dial Reading and Graduation menu screens. The View All link brings the user back to the Dial Indicator screen to check the changes that have been made. The Home icon returns to the Settings screen.

2.1.2.2 Dial Reading and Graduation

The Graduation menu screen will be in English or Metric, depending on the units that have been selected.

The Dial Reading menu has options that enable the user to change the range of dial screen tick marks, ie. a setting of 0-100, will show the dial numbering as: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90 around the dial, with the number of minor tick marks between the number set by the Graduations.

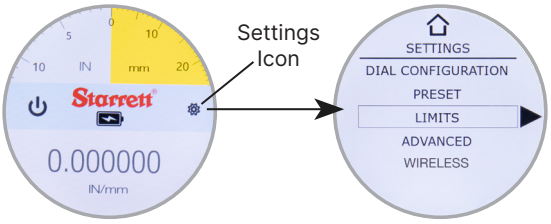
The Home icon returns to the Dial Configuration menu.

The Graduation menu screen will be in English or Metric depending on the selected units. The Graduation offers a list of resolutions that can be selected by moving the value to the selection box, i.e. 0.001mm is the distance between tick marks.

The Home icon returns to the Dial Configuration menu.

The maximum travel distance around the dial is calculated by multiplying the Dial Reading and the Graduations. Dial set to 100. Graduation set to .001in. Total distance around the dial is 0.100mm.

Fig 8 Settings



Home Screen

Fig 9 Dial Configuration Menu

Fig 10 Dial Reading

Fig 10A Inch

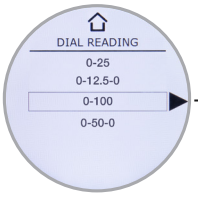
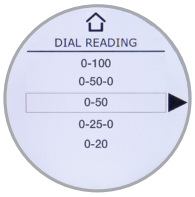


Fig 10B mm



0-100

Fig 11 Graduation

Fig 11A Inch

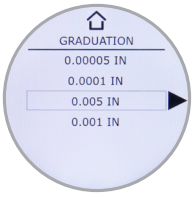
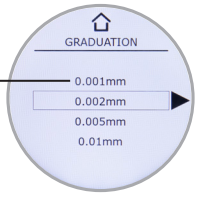


Fig 11B mm



0.001 mm

2.1.2.3 Preset Screen

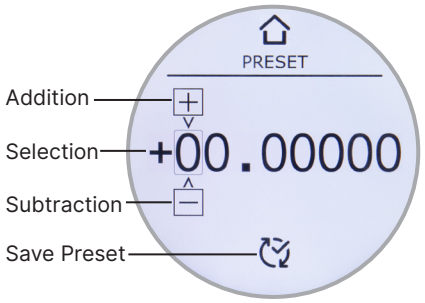
The Preset is a value set to represent a non-zero origin. Open the preset screen from the Settings screen.

1. Tap on the digit to be changed to automatically move the selection box to the digit.
2. Use the addition and subtraction boxes to change the digits value.
3. When finished tap the Save Preset icon.

Preset is explained in detail in Section 3.0 Setting Preset.

The Home icon returns to the Settings screen.

Fig 12 Preset



2.1.2.4 Limits Screen

The Limits screen process is similar to the Preset screen. The Limits screen is explained in detail in Section 3.1 Setting the Limits.

The Home icon returns to the Settings screen.

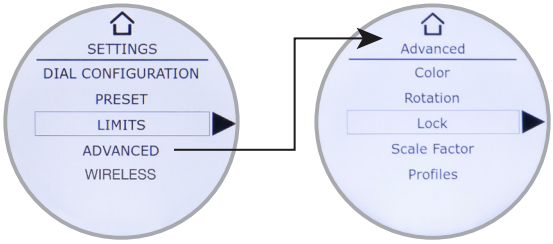
Fig 13 Limits

2.1.2.5 Advanced Menu

The Advanced menu has links to the Language, Color, Rotation, Backlight and Lock menu screens.

The Home icon returns to the Settings screen.

Fig 14 Advanced Menu



2.1.2.5.1 Language Menu

The Language menu has the following options; Portuguese, German, Spanish, Italian, Chinese, French and English.

Pick the language by swiping the list up or down to move the language into the selection box, in the middle of the screen, or tap the language to automatically move it to the selection box. Press the Home icon at the top of the screen to save and return to the Language selection page.

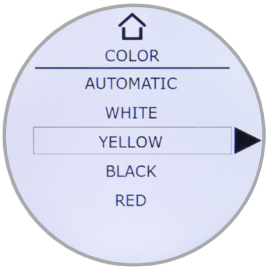
Fig 15 Language

2.1.2.5.2 Color Menu

The Color menu screen allows the user to change the background color of the Dial Indicator screens. To add a color, move the color to the selection box and tap the right arrow. The color selected will be the background for both Indicator screens. The automatic option (Default) is white for the English Indicator and yellow for the metric Indicator screen.

The Home icon returns to the Advanced menu.

Fig 16 Color Menu



2.1.2.5.3 Rotation Screen

The Rotation screen allows for the adjustment of the screen orientation. Touching one of the graduation marks on the screen will automatically reposition the direction of the screen. Tap the Home icon to accept the change and go back to the Advanced menu.

Fig 17 Rotation Screen

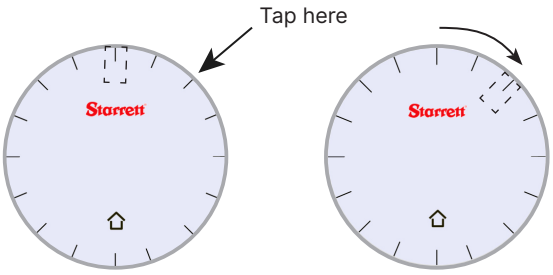


Fig 17A Fig 17B

2.1.2.5.4 Lock Screen

The Lock screen is used to add a four digit passcode to lock out the Settings menu. There are four options that can be locked out individually. The options are In/mm, Direction, Datum and Mode.

Add four numbers and then tap the lock icon to save the passcode. Tapping the lock icon will open the Locks menu screen. Record the 4 digit code as it will be required to re-enter the Locks screen or make changes.

The Locks screen allows the user to lock out one or more of the options listed. The right arrow icon toggles the option, On/Off, default is Off. In Fig 18B, a lock has been selected for the IN/mm icon. The mode in which the indicator is currently set to, inch or metric, will be the locked setting. Tap the Home icon to accept the changes and return to the Home screen.

When any of the options are locked the Main screen, the Settings icon is replaced by the locked icon. Refer to Fig 19A/B.

Figs. 18-19 Lock Screen

Fig 18A

Fig 18B

Fig 19A

Fig 19B

2.1.2.5.5 Scale Factor

Scale Factor allows the user to multiply or divide the measurement by a set value. The mathematical functions are accessed at the bottom, leftmost, button of the screen. Pressing the button will toggle between the * or / symbol. The "/" symbol will divide the value. The "*" symbol will multiply the reading by the set value. Refer to Fig 20A/B.

To add a value to the Scale number, tap on a digit to move the selection box to the location. Tap on the addition or subtraction boxes to change the number value or to change the negative/positive sign. The addition and subtraction boxes, cycle through the available numbers in a location: example: 0-9-0. Depending on the resolution the last digit may be 0-5.

Press the Save icon to save settings. Fig 20A-2

To reset the value to 1.0 press the Unity Icon. Fig 20A-3

The Home icon returns to the Advanced menu.

Fig 20A/B Scale Factor

Fig 20A

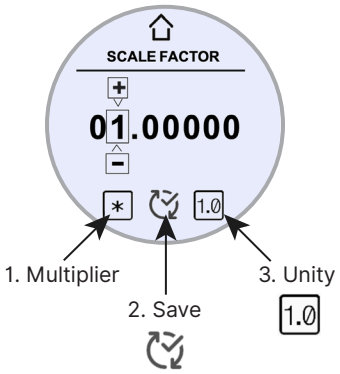
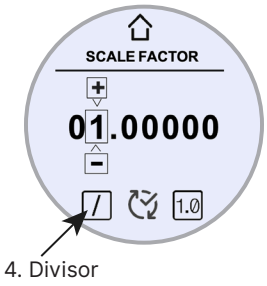


Fig 20B



2.1.2.5.6 Profiles

The Profiles option allows the user to label up to 10 profiles with varying functionalities.

Set all Indicator parameters, such as Preset, Limits, Units, Advanced Settings, Dial Configuration, Features and Wireless Status.

In the Advanced Setting, scroll down to Profiles. The rectangular field in the center of the screen holds the Profile to be saved or modified. Three icons at the bottom of the screen, viewed from left to right are: delete, add and edit. See Fig 21.

Select the Edit icon to change the profile title. See Fig 21-3.

The Edit Screen displays the alpha buttons. Each button contains 2 or 3 letters. To select a letter within the button, press the button once, for the first letter, twice, for the second and a third time, for the last letter. See Fig 22.

To move the cursor to the next space on the

Fig 21 Profiles

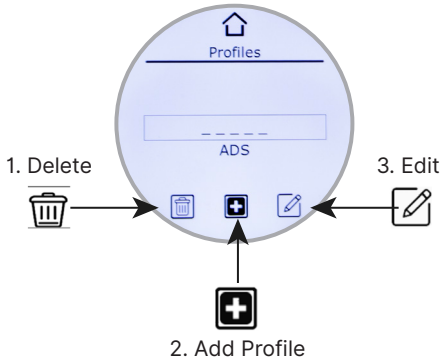
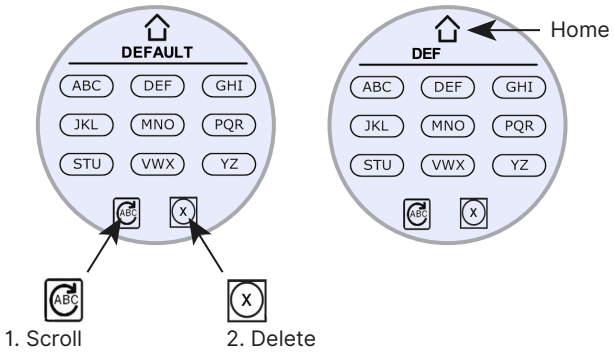


Fig 22 Profile Titles



title bar, press the Scroll Letter icon. See Fig 22-1.

To delete an incorrect letter, press the Delete button. See Fig 22-2. The last letter will be deleted.

To Save and return to the previous menu, press the Home Button.

To add a profile, press the Add Profile Button Fig 21-2 and Repeat the Edit Instructions.

To delete or edit a profile scroll through the list of profiles to align the profile to be deleted or edited into the rectangular field. Press the Delete button to delete or the Edit button to modify the profile name. Fig 23A/B.

Press the Home button to return to the Advanced menu. Press Home again to advance to the Settings menu. Press Home to return to the Main Screen.

NOTE: Latin alphabetic characters are the only script available in the Profiles Menu.

2.1.2.5.7 Zero Delay

Zero Delay is a three second delay that occurs while the tool is being zeroed. The spindle should not be moved to ensure an accurate zero reference. The measurement will be replaced by dashes across the measuring field, see Fig 24, to be replaced by the zeroed value.

2.4.2.7 Wireless Menu

The Wireless menu has the following options:

- OTA stands for Over the Air update. It is used to update the tools firmware.
- Reset Security Key is explained in detail in Section 4.0 Wireless Functions.
- On/Off toggles to turn the Wireless mode on or off. When the wireless is Off the screen will show OFF, as seen in Fig 25B.
- The Home icon accepts the changes and returns to the Advanced screen.

Refer to Section 4.0 for additional details.

Fig 23 Delete/Edit Profiles

Fig 23A

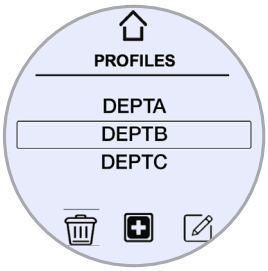


Fig 23B

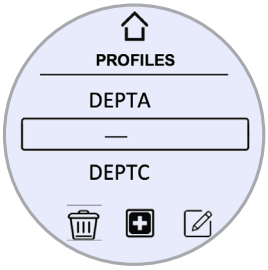


Fig 24 Zero Delay

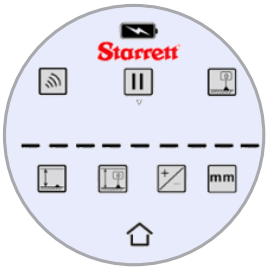


Fig 25 Wireless

Fig 25A

Fig 25B

2.4.3 Dial and Digital Indicator Screens

The English and Metric Dial Indicators are a faithful digital representation of our customary Dial Indicators with some helpful digital options added. It is possible to move from dial to digital and back by tapping the center of the digital readout. The dial Indicator screens can be modified in Dial Reading, Graduation and Color.

NOTE: The Modes for the Dial Indicator need to be initiated in the Digital Indicator screen before they can be accessed in the Dial screen.

English Dial

The English Dial Indicator shown in Fig 26, has the Dial reading of 0-100 and the Graduation of 0.0001 IN. The Dial reading is the number of graduation marks the dial is divided into 100 graduations. The graduation marks on the dial are 0.0001" apart, Fig 26 displays 13 marks. The distance is: 13 marks x 0.0001"= 0.00130"

Metric Dial

The Metric Dial Indicator shown in Fig 27 has the Dial reading of 0-50-0 and the Graduation of 0.01 mm. The Dial reading is the number of graduation marks the dial is divided into, 100 graduations. The markers on the dial are 0.01mm apart. The distance traveled is 67 Marks x 0.01mm = 0.670mm. A 0-50-0 dial indicates direction of travel.

Digital

Figs 28-29 shows Inch and Metric modes.

The Digital Indicator screen can access all of the modes with the icons on screen. The on screen icons will change depending on what mode is active.

Refer to Section 3.3 Graduation and Dial Reading for additional details.

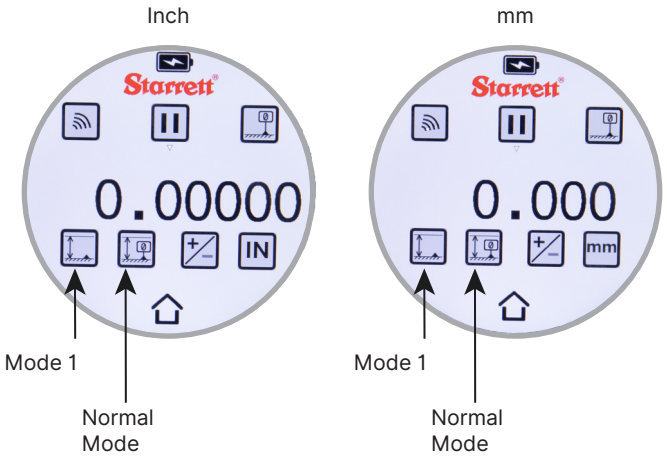
Fig 26 English Dial

White (Default)
0-100, 0.0001 IN

Fig 27 Metric Dial

Yellow (Default)
0-50-0, 0.01 mm

Fig 28-29 Digital Indicator



3.0 Setting Preset

1. Go to: Home > Settings > Preset
2. Fig 30A, to add a value to the preset number tap on a position to move the selection box to that location. Tap on the addition or subtraction boxes to change the number value or to change the negative/positive sign. The addition and subtraction boxes cycle through the available numbers in a location, from 0—9. Depending on the resolution the last digit may be 0-5-0.
3. Tap the Set Value icon to save the preset number then return to the Settings screen by pressing the Home Icon.
4. Go To: Settings Screen > Home Screen (Tap the Bottom of the screen) > Digital Indicator.
5. The Digital Indicator may display a value or be zeroed. Refer to Fig 30B for the description of the icons on the screen. Icon 1 turns the Preset on or off. The icon will change to a P instead of a 0 when the preset is on. If icon labeled 1 is set to P, the top Icon, 2, will be set to P, Fig 30B.
6. Fig 30B, the normal function of the top Icon 2 is used to zero the tool. Fig 30C, when Preset is active, the top Icon 3 is used to return the tool back to the preset value.

Fig 30A Preset

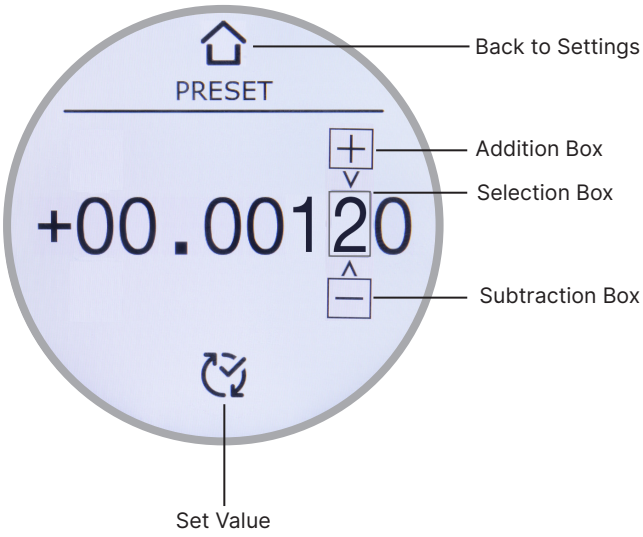


Fig 30B

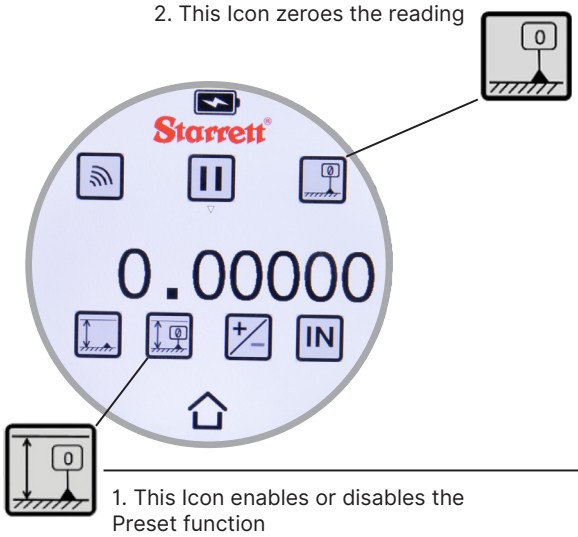
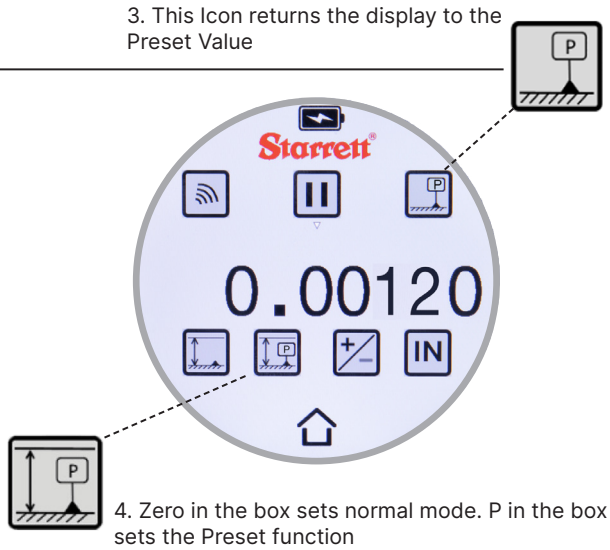


Fig 30C



3.1 Setting the Limits

The Limit is equivalent to setting a tolerance. When set, the Indicator warns the user of proximity to the MIN or MAX values and danger of the part exceeding tolerance.

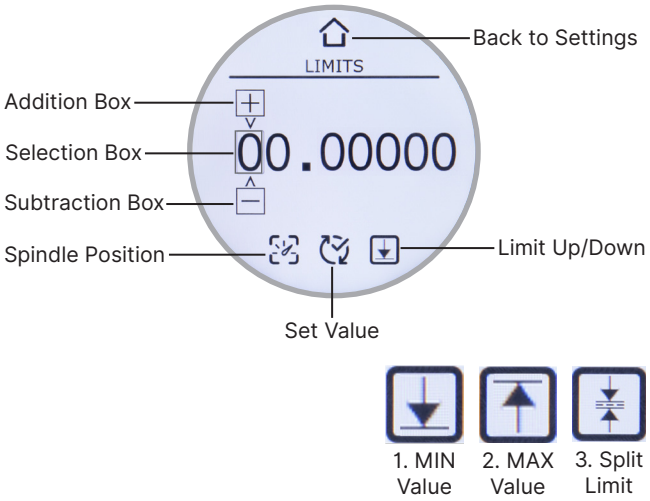
There are three options available to set Limits on the tool:

1. Manual option
2. Using the spindle position option
3. Using the split limit option

When using options 2 and 3 the number values can always be changed using the manual method before saving them with the Set Value icon.

Note: High Limit must be greater than Low Limit otherwise the Indicator will automatically set the low limit to a negative value.

Fig 31A



Manual Option

1. Start: Home > Settings > Limits (Fig 31A)
2. To add a value to the Limits number tap on a position to move the selection box to that location. Tap on the addition or subtraction boxes to change the number value or to change the negative/positive sign. The addition and subtraction boxes, cycle through the available numbers in a location example: 0-9-0. Depending on the resolution the last digit may be 0-5.
3. The first number to add will be the MIN number, Fig 31A-1. When finished with the MIN number, tap the Set Value icon, Fig 31B-4, then tap the MIN value icon Fig 31A-1. The icon will change to MAX value icon, Fig 31A-2.
4. Enter the MAX value. Tap the Set Value icon, Fig 31C. **DO NOT TAP the Limits button again.** Press the Home Icon to return to the Settings Menu. Press Home Icon to open the Main Menu.

Fig 31B

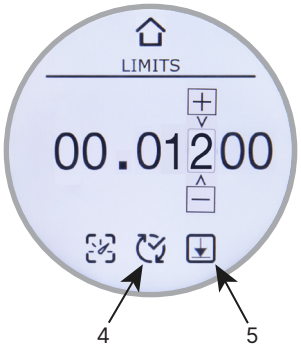


Fig 31C

Spindle Position Option

1. Fig 32A, set the tool to a gage block or part to be measured that is within the limits to

Fig 32A

be detected. Do not remove the gage block or part and tap the home icon to go back to the home screen.

2. Go to: Home > Settings > Limits
3. The value set at the digital Indicator can be set to either the MIN or MAX limits by entering either screen and tapping the Spindle Position icon Fig 32B/C-4. Tap the set value icon to save it Fig 32A/B-5.
4. Fig 32C, if MIN was set as the Spindle position manually set the MAX value to complete the Limits setting. **DO NOT TAP the Limits button again. Press the Home Icon**.

Note: Tapping the Limits icon three times may enable the Split Limit if followed by the Save button. Refer to next section.

Split Limit Option

1. Split Limit allows for setting a limit to +/- of the same value. Example is +/- 1.000 in. or +/- 0.0100mm. The Split Limit Option will override any previous settings.
2. Start: Home > Digital Indicator.
3. Set the tool to a gage block selected within the required limit or to a part being checked. Do not remove the gage block or part. Tap the home icon to go back to the home screen.
4. Go to: Home > Settings > Limits
5. In the limits screen cycle through the MIN/MAX icons to the Split Limit icon (Fig 33A-1) then press the Set Value icon (Fig 33A-2).
6. The number from the digital Indicator will be added to both the MIN (Fig 33B-3) and MAX (Fig 33C-4) values at the same time. The MIN and MAX number will be the same but the MIN number will be negative (Fig 33B-5).
7. Setting the Split Limit can be manually adjustments by setting the MIN value and selecting the Split Limit icon. Press the Set Value Icon to Save.
8. Tap the Home Icon > Settings (Home Icon) > Home Screen.

Fig 32C **Fig 32B**

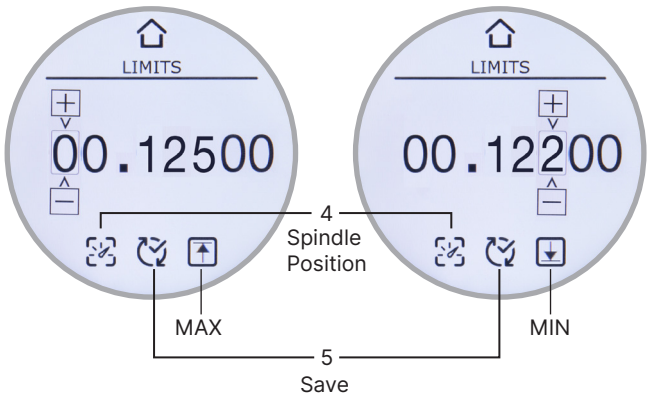


Fig 33A

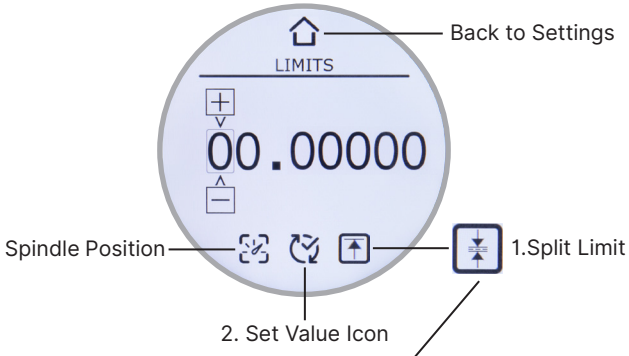
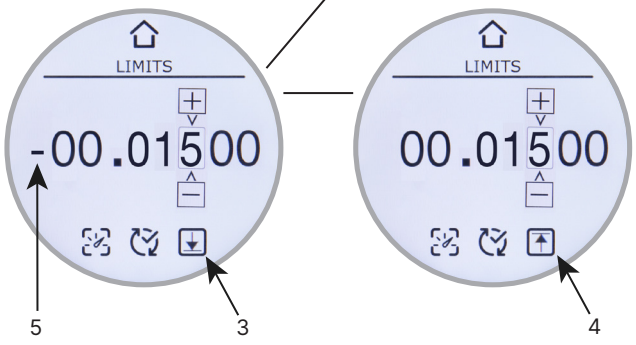


Fig 33B **Fig 33C**



Example: Digital Indicator, Limits

1. Start: Home > Digital Indicator.
2. Set the tool to a gage block that is the equivalent of the dimension to be checked, in this case .125” with the tolerance of +/- .003”. Leave the block in place.
3. Go to Home > Settings > Limits
4. Set the limits using one of the three methods outlined in the beginning of this section. The MIN value will be .122” and the MAX value will be .128”. Remember to Set/Save the values before going to the next one.
5. Go to: Home > Digital Indicator.
6. The Digital Indicator screen should display a dimension of .125”. Remove the block and replace it with the first part to be measured. Fig 34A. Tap the Mode icon Fig 34A-6.
7. Fig 34B, shows the first part dimension is slightly larger and within tolerance. The Visual limits TIR Scale Bar is showing green to the right of center. The limits active icon Fig 34B-7 is pointed out in the bottom left corner.
8. Fig 34C, shows the dimension of the second part is larger and the scale bar is showing yellow meaning the measurement is within 20% of the maximum tolerance. Notice the ring around outer diameter of the display is yellow and the high limit warning icon has turned on Fig 34C-8.
9. Fig 34D, shows the dimension of the third part is too large. The scale bar is showing red, meaning the measurement is over the maximum tolerance. Notice the ring around the display is red.
10. The Scale Bar works the same with a part that is smaller than .125” and the color bars will be displayed left of center.

Fig 34A

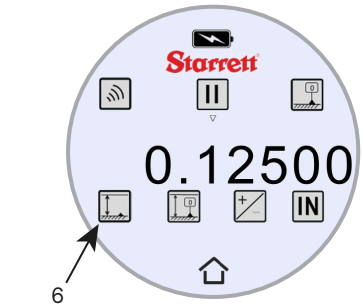


Fig 34B

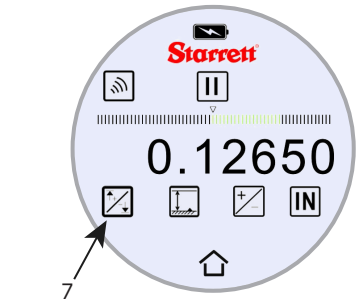


Fig 34C

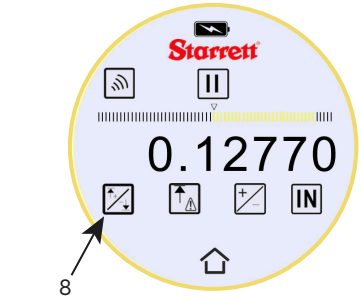
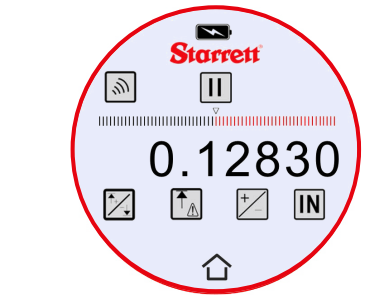


Fig 34D



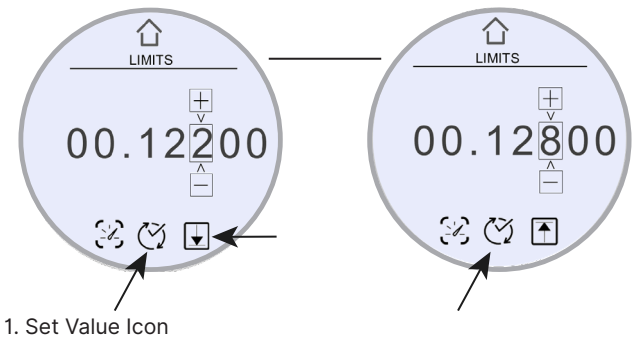
Example: Digital Indicator, Limits

An example for settings Limits to Measure numerous parts.

- Set up the Limits.
- Go to the Digital Indicator screen and turn on Limits.
- Go to the Dial Indicator screen to start measuring.

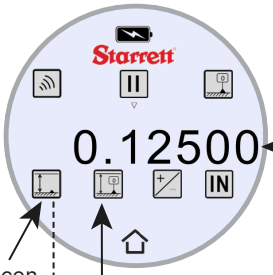
1. Place the Indicator on a stable stand.
2. Start: Home > Digital Indicator.
3. Zero the display. Place a gage block, equivalent to the dimension to be checked under the spindle. In this example: .125” with the tolerance of +/- .003”. Leave the block in place. Go to Home > Settings > Limits
4. Fig 35A/B, Set the limits using one of the three methods described in Section 3.1. The MIN value is set to: .12200” and the MAX value is set to: .12800”. Tap the Set Value icon Fig 35A-1 before proceeding to the next dimension.
5. Go to: Home > Digital Indicator.
6. Fig 35C, the Digital Indicator screen should show the .125” dimension. Tap the Mode icon Fig 35C-2 and the Limits Icon will be shown in its place Fig 35C-3. The Limits mode is now active.
7. Go to: Home > English Dial Indicator “or” (shortcut) tap the digital reading on the display Fig 35C-4.
8. Remove the gage block and replace it with the first part to be measured.
9. The MIN and MAX limits are marked in red graduations.
10. Fig 36A, displays the dimension of the first part being slightly larger and within tolerance.
11. Fig 36B, shows the dimension of the second part is smaller and within tolerance.
12. Fig 36C, illustrates the dimension of the third part.
13. The High Limit Warning icon is displayed, see Fig 36C-5, before the measurement is

Fig 35A **Fig 35B**



1. Set Value Icon

Fig 35C



4. Digital Reading

2. Mode Icon

5. High and Low Limit Warning

3. Limits

Fig 36A, 0.12635”

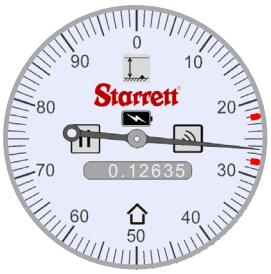
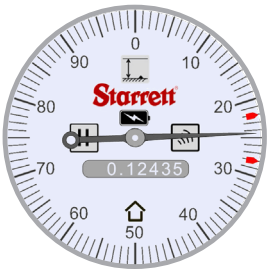


Fig 36B, 0.12435”



over the maximum tolerance.

14. Fig 36D, identifies the values of the graduation mark set as Limits.

3.2 The TIR Mode

The TIR (Total Indicator Reading or Run-out) mode measures the minimum and the maximum values of a surface (usually rotating) and then calculates the difference between them.

Note: Care must be taken; to make sure the difference between the high and low measurements are not outside of the travel of the Indicator at setup. A low measurement might be wrong or a high measurement might jam the spindle and damage the Indicator.

1. Start: Home > Digital Indicator.
2. Select the units to be displayed, Fig 37A-1.
3. Bring the Indicator spindle down to the part being measured, to a height that is around half the travel of the Indicator (.5”). Lock in the Indicator at this height and zero the tool, Fig 37A-2.
4. Tap the Mode icon (First Position) to open the TIR mode screen. Fig 37A-3.
5. Fig 37B-4, notice the visual limits/TIR Scale Bar above the read out. This gives a graphical representation of the movement of the spindle and marks the MIN and MAX measurements of the part with red segments.
6. Measure the part.
7. Fig 37B, Tap the Mode 2 Icon 6 (Second Position) to cycle through the MIN, MAX and TIR numbers.

Fig 36C, 0.12945”

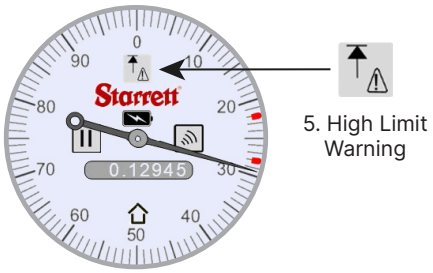


Fig 36D, 0.12740”

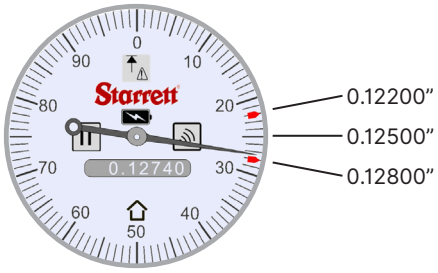


Fig 37A

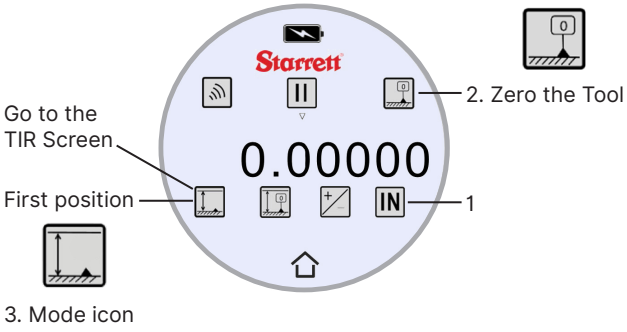


Fig 37B

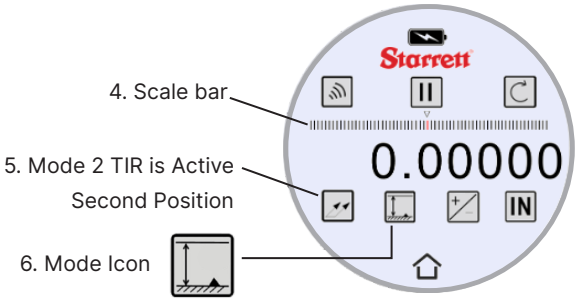


Fig 37BC, Bar Scale Segments

8. Fig 38, the MIN icon and the MIN reading is displayed. Tap the MIN icon to view the MAX reading.
9. Fig 39, the MAX icon and the MAX reading is displayed. Tap the MAX icon to view the TIR reading.
10. Fig 40, the TIR icon and the TIR reading is displayed.
11. If more than one part is to be inspected, replace the part and then tap the TIR Active icon, Fig 37B-5. Return to the Mode Icon Fig 37A-3 (First Position).
12. Tap the Set Zero icon, Fig 37A-2, to zero the tool, tap the Mode icon, Fig 37A-3 to return to the TIR mode.
13. Tap the Reset icon, Fig 40-7, to reset the Scale Bar and zero the tool, Fig 41.
14. Measure the next part. Repeat Step 7 through 13, above until all the parts are inspected.

Fig 38, MIN Screen

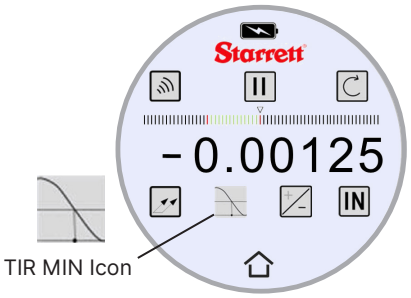


Fig 39, MAX Screen

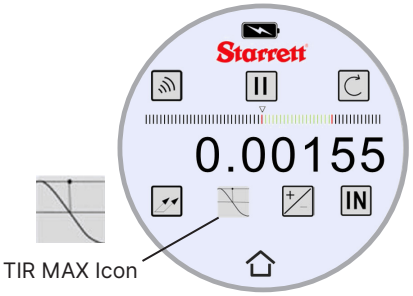


Fig 40, TIR Screen

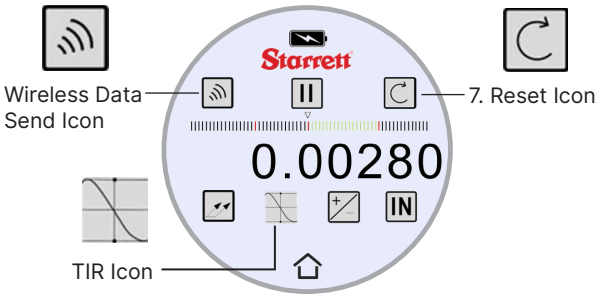
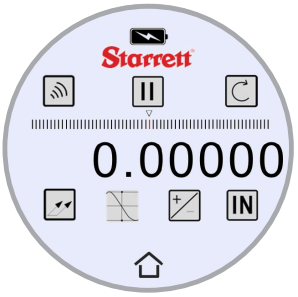


Fig 41, TIR Screen Reset



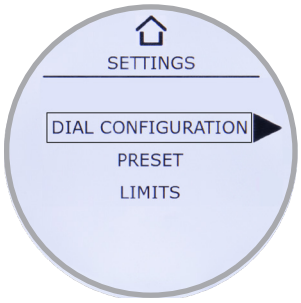
3.3 Graduation and Dial Reading

1. To begin, the units of measure must be selected. Two methods include setting the units from the Digital Indicator page. Home > Digital Indicator > IN or mm. Refer to the Home Screen and the Digital Indicator Screen to the right. A second method is to adjust the display via Graduation and Dial Reading.
2. Open the Home > Settings > Dial Configuration > Graduation.
3. Fig 42A, the Graduation option represents the line to line distance displayed on the dial screen.
4. Fig 42B, the Dial Reading menu options shows sets of number combinations like 0-100 or 0-50-0 to indicate the number of graduation lines to be displayed around the dial.
5. The Dial Reading option represents the number of segments or graduation marks dissecting a dial, the range of graduation marks and whether the dial is divided into a positive and negative range, like in Fig 43A, 0-50-0.
6. Fig 43A, shows a graduation of 0.01mm and the Dial Reading set to 0-50-0.
7. Fig 43A, the dial screen is segmented to 0-50-0. The 50th line is .5mm and each line to line distance is 1 hundredths of a millimeter (0.01mm).
8. Fig 43B, the dial screen is segmented from 0-100 with the line to line distance equal to .0001".

Home Screen

Digital Indicator

Dial Configuration



Dial Reading

Fig 42A, mm

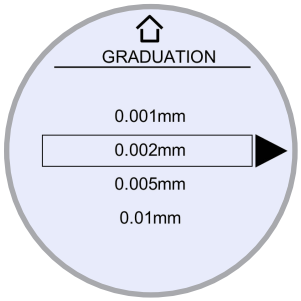
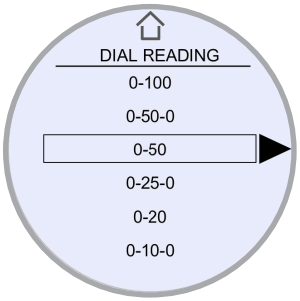


Fig 42B, IN



Graduation 0.01mm

Fig 43A, 0.01 mm / 0-50-0

Fig 43B, 0.0001" / 0-100

3.4 Lock Mode

The Lock Mode will prevent intended or unintended operator changes to the Indicator settings. The lock mode works by locking the current state of the options in the Locks menu, Fig 44A-1.

Lock Mode Activation:

Start: Home > Settings > Advanced > Lock

- The first time the lock screen, Fig 44B-2 is opened, the lock icon is closed, this indicates the pass code has not been set.
- Enter a pass code, pick a four digit code and make sure to document it Fig 44C-3.
- Tap the Lock icon to save the pass code and open the Locks menu screen, Fig 44C-4.

Note: Before a Locks option is enabled, the Indicator settings must be established. This includes the Profiles.

For example, before toggling the IN/mm lock to ON, make sure the current unit of measure is the intended unit to lock. The default setting for all options is OFF.

The Locks menu screen options, Fig 44A-1;

- Inch/mm
- Direction (Plus/Minus)
- Datum (Preset)
- Mode (Limits, TIR and Preset)

- The options are turned on by moving the option to the selection box and toggling Off to On with the right arrow icon, Fig 44A-5. The same process is used to turn the option Off.
- When any of the Locks screen options are enabled the Settings screen is locked, Fig 45 – 6. The lock icon is shown unlocked in the Settings page. When the unlock icon is tapped, the lock screen opens to allow the user to enter the pass code. Changes to the options can be made if the pass code is correct. If all of the options are off, the Settings icon will replace the Lock icon on the Home Screen.
- The condition of the locked options: Inch, Direction, Datum and Modes, is reflected in icons viewed in the Digital Indicator screen.

Fig 44A

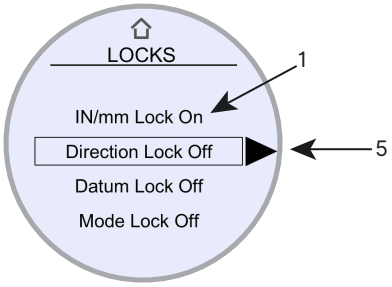


Fig 44B

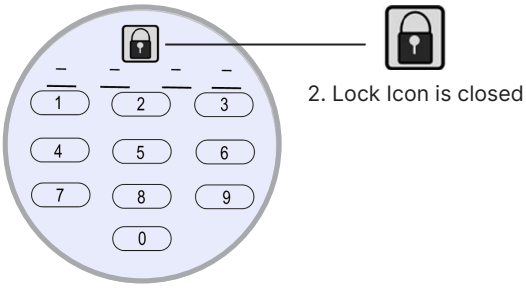


Fig 44C

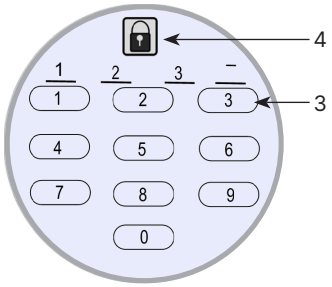
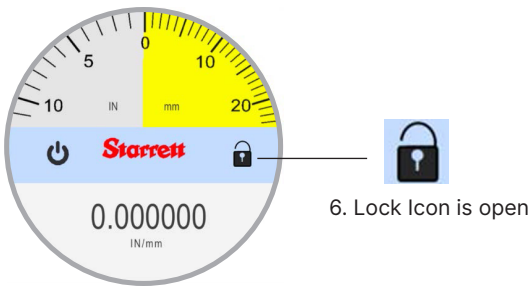


Fig 45



A small Lock icon is added to the Icon representing the option. Refer to Fig. 46-7. In this manner the user is aware of the settings that are locked.

4.0 Wireless Functions

The wireless button is used to send a reading to either the DataSure® Advanced 4.0 program or to the Starrett Mobile Application that may be downloaded to a phone or tablet.

1. To turn the wireless On or Off, open the wireless screen. Home Screen > Settings > Wireless. There are three options: OTA, Reset Security Key and Off/On. If the wireless is ON, then the condition shown is “ON” Fig 47A, the condition shown is “OFF” when the wireless is off, Fig 47B.
2. The wireless symbol is visible on the screen when the wireless function is active, Fig 47C, otherwise it is Off, Fig 47D.
3. Pressing the Wireless icon will cause the Indicator to transmit or attempt to transmit data to either the DataSure application or the Starrett phone app. The display will momentarily change to green when a measurement has been successfully transmitted, Fig 48A. A yellow display indicates the data transfer was unsuccessful, Fig 48B. A flashing blue display corresponds to a request from DataSure to locate the device, Fig 48C. The flashing will continue until the locate command from DataSure is disabled.

4.1 Wireless Communication

Starrett Wireless Tools communicate wirelessly using encryption techniques that prevent outsiders from ‘listening in’ to the data being sent. The first time a wireless tool connects to a Gateway or Mobile App a set of security keys is established. Both sides remember the key and use it to reestablish communications even if the tool has been turned off or moved out of range.

Once the tool is within range and turned on, the Wireless Tool and the Gateway will use the security keys to automatically resume communicating.

Fig 46

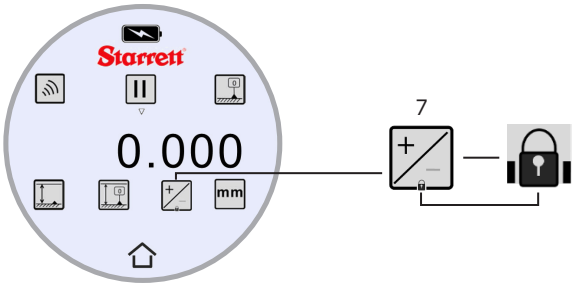


Fig 47A, Wireless On

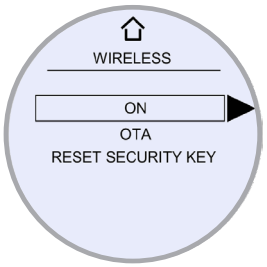
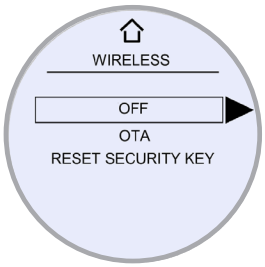


Fig 47B, Wireless Off



47C, Wireless On

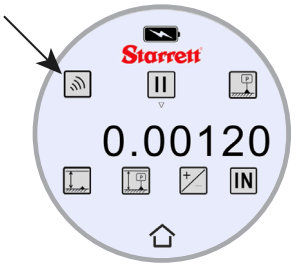
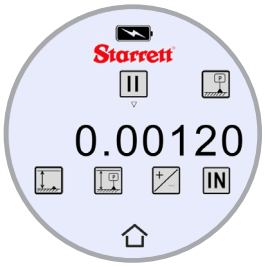
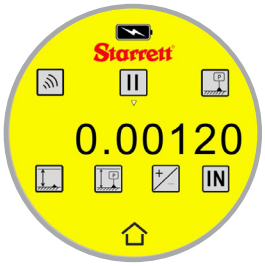


Fig 47D, Wireless Off



48A, Reading Received

Fig 48B, Not Received



48C, Locate the Tool

4.1.1 Establishing First Communications

Make sure the DSA 4.0 system is on and communicating with the Gateway (1). Activate the wireless radio by following instructions in Section 4.0 of this manual. After a little while the tools MAC address (UID) will appear in the DSA 4.0 application on the Gateway Tab. Locate the UID number on the tool with one in DSA 4.0.Gateway page. The Permissions column will be Red and labeled “Blocked”. Click on the Blocked Button. The Button will immediately turn Gray and display “Updating”. After a slight delay the button will turn green and display Allowed. At this time the wireless tool has a blank security key and after a slight delay the Connection Status column will change to Online and show Green. This means the gateway and tool have exchanged keys and successfully established a secure link.

4.1.2 Moving Tools Between Gateways

When it is necessary to move a tool from one Gateway (1) to another Gateway (2) it is imperative the tool’s security key be reset.

4.1.2.1 Resetting a Wireless Tool’s Security Key

1. Stop Wireless Off.
2. Turn the Tool Off.
3. In DSA 4.0 Gateway (1) Block the tool with the corresponding Device UID.
4. Wait for DSA 4.0 to report the tool is offline.
5. Move tool within range of Gateway (2). Turn the tool On.
6. Perform a reset security key in the Wireless screen. Home > Settings > Wireless > Reset Security Key. Back to Home screen and digital or analog screens.
7. Start the Wireless on the tool and follow instructions 4.1.1 Establishing First Communications.

4.1.2.2 Moving to Another Gateway (1)

It may be necessary to reset both the Gateway and the tool if a wireless tool has been moved to a gateway that had previously exchanged security keys.

1. Follow “Resetting a Wireless Tools Security Key” above steps 4.1.2.1. Keep the Wireless Tool on. In the DSA 4.0 application, navigate to the Gateways page.
2. Locate the tool UID number in the Gateways page. If Permission is Blocked (RED) press to Allowed (GREEN).
3. In Device Selection drop down menu located to the right of the Gateways page, select the UID for the tool.
4. Press the “Reset Security Key” button below the drop down. The tool should change to Online and a secure link has been established. Occasionally it is necessary to Add Association and repeat these steps.

For more information about the DSA 4.0 software please consult the DataSure® Advanced 4.0 User Guide.

5.0 Rechargeable Battery Care and Maintenance

The LiPo rechargeable battery will last longer when maintained properly. A battery symbol, reflecting the battery condition is always visible on the active display screens, see Fig 49A. A low battery symbol, Fig 49A-1, warns the user the instrument should be charged. To charge the battery attach the USB Micro B cable into the tool as seen in Fig 49B.

Connect the USB 2.0 end of the cable to the supplied 5 Volt AC/DC power adapter or to an available USB port on the computer. The USB cable is keyed to plug in one orientation. Check the orientation of the tool cable end and the USB port before plugging the cable. The tool may be used while the battery is recharging. Fig 49A-1 through 4 displays various battery conditions, from discharged to fully charged.

The tool will completely shut down if the battery is below 3.2 volts. The shutdown prevents the battery from reaching a critical low discharge level thereby conserving the battery. The battery should have a minimum charge to be recharged, so it is recommended the battery not be allowed to reach the critical condition.

Tapping the screen will restart the tool unless the battery has reached a critical low discharge. The display, not turning on, when tapped, indicates that the battery needs charging. We recommend that the tool be charged when the battery icon is visible to help prolong battery life. Depending on use, the time between charges could be daily under heavy use or weekly under light use. Battery life is dependent on the length of time the display is kept on, the intensity of the backlight, screen color, use of the wireless data transfer and speed of data transfer set by the DataSure application.

Fig 49A

1		Low Battery Charging
2		Charging to 33 percent
3		Charging to 67 percent
4		Full charge with USB cable attached
5		Full charge not charging
6		67 percent charged not charging
7		33 percent charged not charging
8		Low charge not charging

Battery Icon charge conditions

Fig 49B

Fig 49C

6.0 Accessories

The W4900-1 series comes standard with a Lug-On-Center back Fig 50-2. The back is easily removed by unscrewing the four screws as shown in Fig 50-1. Examples of different back-lugs can be seen in the Starrett catalog or on the Starrett Website.

NOTE: Do not touch any of the inner workings of the Indicator and protect them from liquids, dust or any other foreign matter.

Replace the back-lug as soon as possible.

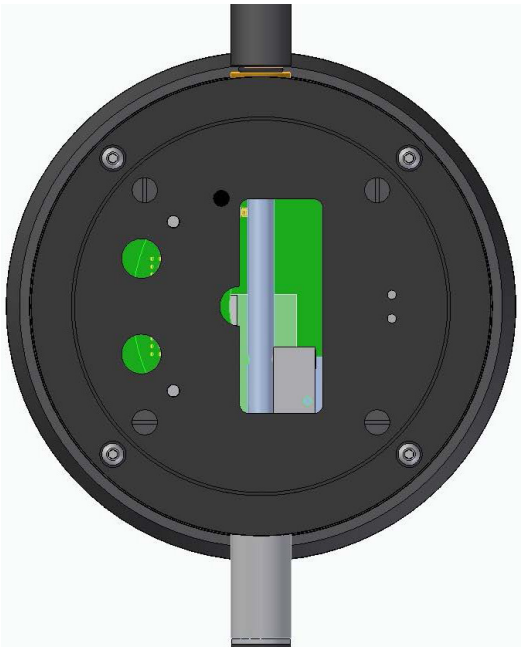
The Contact Point, Fig 50A-4 may be removed by carefully holding the spindle, Fig 50-3 firmly with one hand and then unscrewing counter-clockwise with the other. Replace the contact point the same way, turning the tip on clockwise. Remember to tighten the tip finger tight. Excessive radial rotation of the spindle shaft may cause the Indicator to stop measuring properly.

Special contact points are listed on the next page.

All of the available Indicator accessories can be found in the Starrett catalog or at starrett.com.

Fig 50A

Fig 50B



6.1 Hardware Reset

A hardware reset has been provided in the event the tool locks up and is unable to start due to unforeseen circumstances.

Before performing the reset confirm that the battery has been charged for a minimum of 1 hour. If the tool does not turn on perform a reset as described below.

1. Remove the Lug Back as described in the Section 6 Accessories.
2. Using a small wood or metal rod of 0.080 inches in diameter with a minimum depth of 1.0 inches, apply light pressure to the RESET switch, located through the hole in Fig 50B.
3. Hold momentarily for display reset.
4. Hold for 24 seconds to reset all functions to default settings.
5. The display will turn on momentarily, shut down until all memory is erased then turn on displaying the Startup screen. The Reset button may be released.

6.2 AGD Dial Indicator Backs

Part Number	Description	EDP#
PT06966-1	LUG OFF CENTER, #25	70888
PT06878M	ADJUSTABLE BRACKET, #25	70874
PT24078	SCREW-TYPE LUG BACK, 1/4-20 THREAD	72484
PT06878E	SCREW-TYPE LUG BACK, 3/8-24 THREAD	72224
PT24077	SCREW-TYPE LUG BACK, 1/4-28 THREAD	72488
PT06878F	POST-TYPE LUG BACK, #25	71992
PT06878J	FLAT BACK, #25	70873

6.3 Contact Points, Adaptor, and Extensions

Part Number	Description		EDP#
PT06632-2	CONTACT POINT, #2		70790
PT06632-3	CONTACT POINT, #3		70791
PT06632-4	CONTACT POINT, #4		70792
PT06632-5	CONTACT POINT, #5		70793
PT06632-6	CONTACT POINT, #6		70794

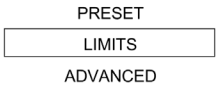
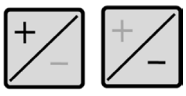
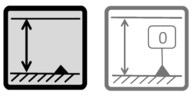
6.3 Contact Points, Adaptor, and Extensions (CONTINUED)

Part Number	Description		EDP#
PT06632-7	CONTACT POINT, #7		70795
PT06632-8	CONTACT POINT, #8		70796
PT06632-9	CONTACT POINT, #9		70797
PT06632-10	CONTACT POINT, #10		70798
PT06632-11	CONTACT POINT, #11		70799
PT06632-12	CONTACT POINT, #12		70800
PT06632-13	CONTACT POINT, #13		70801
PT06632-14	CONTACT POINT, #14		70802
PT06632-15	CONTACT POINT, #15		70803

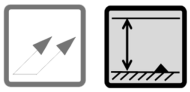
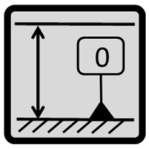
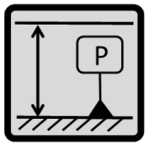
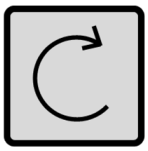
6.3 Contact Points, Adaptor, and Extensions (CONTINUED)

Part Number	Description		EDP#
25W	ROLLER CONTACT POINT		53916
25R	CONTACT POINT SET OF 14 POINTS	----------	50153
PT24728	CONTACT POINT ADAPTOR, MM TO INCH		64963
PT24729	CONTACT POINT ADAPTOR, INCH TO MM		64964
PT21697-1/2	CONTACT POINT EXTENSION, 1/2”		64632
PT21697-1	CONTACT POINT EXTENSION, 1”		64633
PT21697-2	CONTACT POINT EXTENSION, 2”		64634
PT21697-3	CONTACT POINT EXTENSION, 3”		64635
PT21697-4	CONTACT POINT EXTENSION, 4”		64636

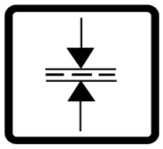
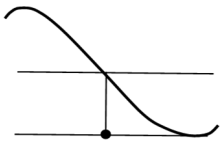
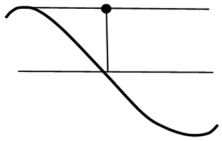
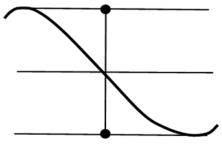
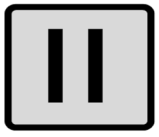
6.4 Icons, Descriptions and Modes

Icon	Name	Indicates	Actions
	Menu options	Multiple options available	Move the option to the center selection box and select it by tapping the right arrow.
	Right arrow	The acceptance or change of an option	Tap to navigate to the selected option screen, or to toggle the state of an option
	Ok	The acceptance of an option	Tap to select an option and go to the previous or next screen.
	Power	The power menu is available	Tap to enter the Power menu
	Settings menu	Locks are disabled. Opens Links to Dial Configuration, Preset, Limits, Advanced, Wireless	Opens selected subcategories options
	Home	Go to Home or to a previous screen	Tap to Go to the Home or previous screen
	Radio is enabled send measurement	The radio is enabled	Tap to transmit dis-played measurement
	Plus /minus sign	A positive or negative measurement value.	Tap to change the direction of the measurement
	Normal mode	Spindle position (first position) Mode 1—normal mode.	Tap to go to limits/TIR mode.

6.4 Icons, Descriptions and Modes (CONTINUED)

Icon	Name	Indicates	Actions
	Spindle position (second position)	Mode 2—TIR mode.	Tap to cycle through the MIN, MAX and TIR numbers
	Limits	The Min/Max limits mode is active.	Tap to go to TIR mode
	TIR mode	Total Indicator Runout (TIR) mode is active	Tap to go to Zero (Normal) mode
	Zero mode change	Zero mode is active	Tap to turn on the Preset mode
	Preset mode	Preset is active.	Tap to turn on Zero (Normal) mode
	Set zero	Zero mode value at any distance	Tap to Zero tool
	Preset datum	Set preset value at any distance	Tap to set the preset datum to the current spindle position
	Reset	TIR is active reset	Tap to reset the TIR values
	Save displayed or preset limit	Preset or Limits is active	Tap to save the displayed preset or limit

6.4 Icons, Descriptions and Modes (CONTINUED)

Icon	Name	Indicates	Actions
	Spindle Position	Set limit(s) to spindle position	Tap to set the current spindle position to the current limit
	Set scale factor to Unity	Sets scale factor to one	none
	Low limit mode	Low limit set mode	Tap to go to high limit
	High limit mode	High limit set mode	Tap to go to split limit.
	Split limit mode	Sets limit to equal values of positive and negative	Tap to go to low limit
	MIN value is displayed	Indicates MIN value is reached	Tap to go to MAX value
	MAX value is displayed	Indicates MAX value is reached	Tap to go to TIR value
	TIR value is displayed	Indicates TIR is displayed	Tap to go back to Mode 2 (Second Position)
	Active measure	Measuring is active	Tap to hold measurement (pause)

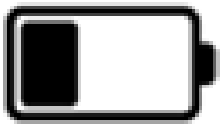
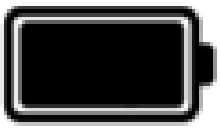
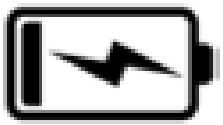
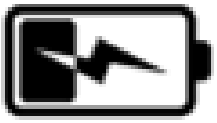
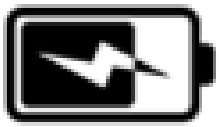
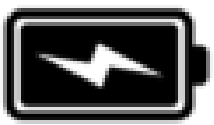
6.4 Icons, Descriptions and Modes (CONTINUED)

Icon	Name	Indicates	Actions
	Hold	Measuring is on hold	Tap to reactivate measuring (play)
	Set lock passcode	Add a passcode	Tap to save passcode and go to the locks screen
	Locked	Mini icon located at the bottom of a mode icon when the mode is locked	None
	Unlock	Lock is enabled, enter passcode	Tap to go to locks screen, add the passcode, then go to locks menu
	Low limit warning	The measurement is within 20% of the low limit	None
	High limit warning	The measurement is within 20% of the high limit	None
	Scale bar	A visual indication of Limits/TIR modes	None
	Inch mode	Measurements in English	Tap to change to Metric mode
	Metric mode	Measurements in metric	Tap to change to Inch mode

6.4 Icons, Descriptions and Modes (CONTINUED)

Icon	Name	Indicates	Actions
	Dial marker	Limits or TIR mode is active on a dial Indicator screen	None
	Delete profile	Deletes the highlighted profile. The first profile can be edited but not deleted	None
	Scroll letter	Scrolls to the next location of the profile label field	None
	Delete	During editing of the profiles the function deletes the last letters entered	None
	Add profile	Add profile opens the alpha keys. Up to six profiles may be saved	Each alpha key contains up to three letters. Enter a profile label.
	Edit profile	Allows user to modify the profile settings	Opens the alpha keys display
	Save	Saves displayed limits, preset, scale factor	None
	Multiplier	Symbol to multiply scale factor	None
	Divider	Symbol to divide scale factor	None

6.4 Icons, Descriptions and Modes (CONTINUED)

Icon	Name	Indicates	Actions
	Reset TIR values	Resets the Total Indicator Reading	Readjusts the MIN/MAX on the scales
	Low charge icon	Indicates the battery charge is low	Attach the USB cable to charge
	1/4 charge	Indicates the battery is 1/4 charged	Attach the USB cable to charge
	3/4 charge	Indicates the battery is 3/4 charged	none
	Full charge	Indicates the battery is fully charged	none
	Low battery charging	Indicates the battery is low and charging	none
	1/4 charged	Indicates the battery is charging at 1/4 percent	none
	3/4 charged	Indicates the battery is charging at 3/4 percent	none
	Full charge	Battery is fully charged with USB connected	none

7.0 W4900-1 Hardware Specifications

Environmental Consideration		
Temperature		10-30º C, 50-86º F
Humidity		30-85%RH (no condensation)
Atmosphere		Non-corrosive, non-flammable
IP67 Rating		Ingress Protection
6	Dust Tight	No ingress of dust, complete protection against dust
7	Immersion up to 1 meter	Up to 1m of submersion for up to 30 minutes

Note: Remember, to ensure the specified IP67 performance, the following items will need to be intact and securely assembled onto the Indicator.

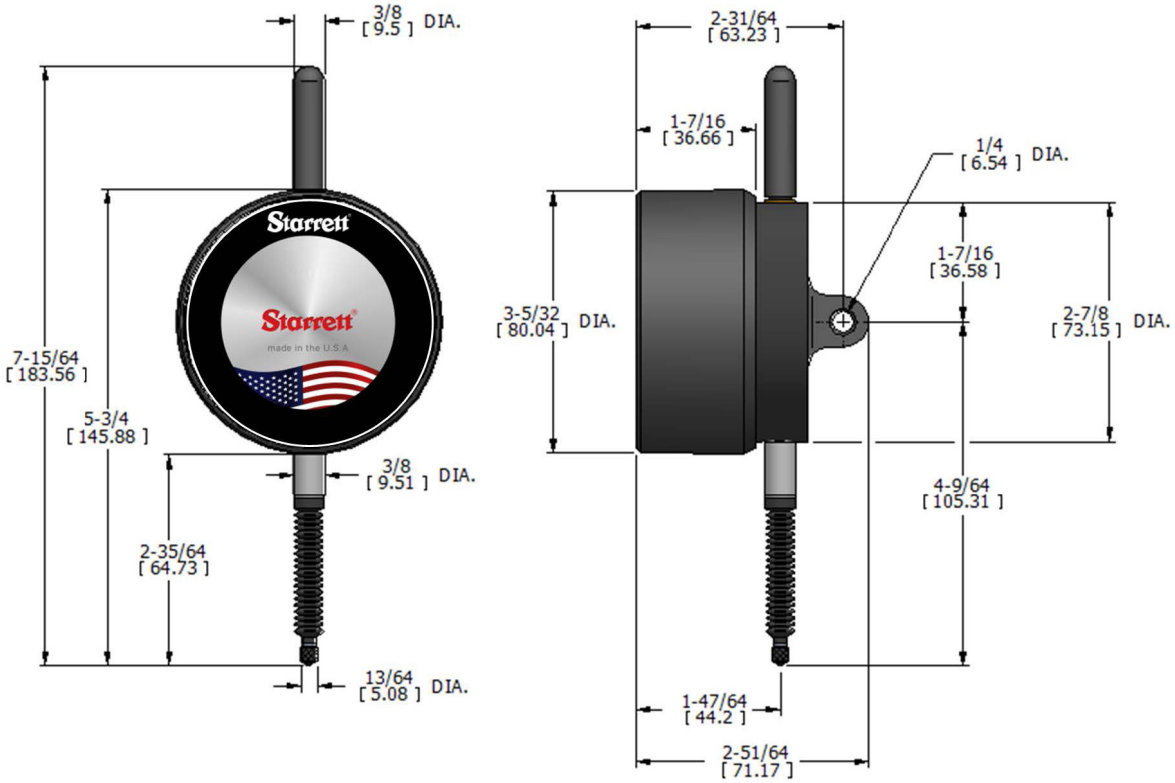
- Spindle Bellows
- Back lug with Gasket
- Stem Cap

Note: All items that have screws will need to be secured at least finger tight.

7.1 W4900-1 Electrical Specifications

Parameters	
Range (in)	1”
Range (mm)	25mm
Resolution (in)	.001”/.0005”/.0001”/.00005”
Resolution (mm)	0.01mm/0.001mm
Accuracy (in)	0.00012”
Accuracy (mm)	.003mm
Stem Diameter (in)	.375”
Feature Set	Full
Wireless	Yes

7.2 Dimensions



Weight 0.817lb./370.5 g

7.3 Trouble Shooting

Problem	Solution
The low level limit resets to a negative number	The unit will automatically adjust the Low Limit to a value lower than the high limit. Set the High Limit first then adjust the low limit.
Indicator Locks Up	Remove the Back lug to expose the spindle mechanism. Locate the top leftmost screw hole closest to the spindle. Place a small diameter rod of .080 inches thru the hole to reset the tool. This will restart the microcontroller. Refer to Section 6.1 Hardware Reset.

8.0 Qualifications and Approvals

8.1 United States (FCC)

Contains FCC ID: 2AA9B05

8.2 Canada (ISED)

Contains transmitter module IC: 12208A-05

8.3 European Union (RED)

Complies with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2014/53/EU.

8.4 Japan (MIC)

Contains transmitter module with certificate number:

8.5 Brazil (ANATEL)

Contains ANATEL approved module # 00857-21-05903

8.5 Mexico (IFETEL)

Este equipo contiene el módulo con IFT #: RCPRIBM18-1491

8.6 China (SRRC)

CMIIT ID: 2018DJ7255

8.7 Complies with Australia/New Zealand (RCM) AS/NZS 4268:2017

8.8 South Korea (KCC) R-C-Rgd-BMD-350

R-C-Rgd-BMD-350

8.9 Eurasia (EAC)

ЕАЭС N RU Д-US.HA27.B.00650/18

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CNPJ 56.994.700/0001-01

China
www.starrett.com.cn

user manuals available online
starrett.com