

# *Wireless Gauge Reader Installation & Calibration Training*



Minimize Operator Rounds  
Monitor and Detect Faults  
Optimize Production Efficiency  
Enhance Safety and Compliance  
Lower Maintenance Effort



**CYPRESS**  
ENVIROSYSTEMS™

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2. How to calibrate a WGR to read a gauge
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# **Physically Attaching WGR to Gauge**

# 1.0 How to Attach a WGR to a Gauge

Select Attachment Method According to Gauge Type

## Method A Conventional

WGR Adapter clamps around outside of gauge



## Method B Flush (Panel) Mounted or Large Diameter Gauge

WGR adhesive adapters affix to panel or gauge lens



# How to attach a WGR to a Gauge – Method A

**Method A – for conventional gauges up to 4” outside diameter**



- 1) Attach **Rubber Shims** to gauge (as needed)



- 2) Attach **WGR Mounting Adapter** to gauge



- 3) Note alignment mark on **WGR Mounting Adapter** should be at upper left corner.
- 4) Tighten **Hose Clamp** to hand torque using slot screwdriver

# How to attach a WGR to a Gauge – Method A

## Method A – continued



- 5) Attach **WGR Sensor** to WGR Mounting Adapter using 1/8 turn quickdisconnect.

Note: start with WGR Sensor rotated counterclockwise 1/8 turn and attach to WGR Mounting Adapter. Then turn WGR Sensor clockwise till you hear a click to lock the quick disconnect.

Fully Mounted  
**WGR Assembly**

# How to attach a WGR to a Gauge – Method B

Method B – for flush (panel) mounted gauges, or gauges with outside diameter greater than 4” diameter



Large  
Diameter  
Gauge

UHB  
Double  
Sticky  
Tape

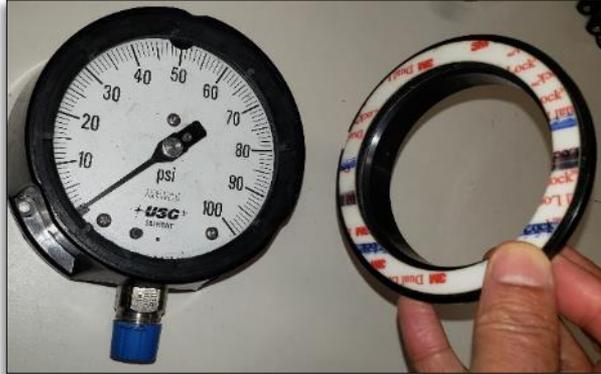
WGR  
Adhesive  
Ring

WGR  
Mounting  
Adapter &  
Hose Clamp

WGR  
Sensor

# How to attach a WGR to a Gauge – Method B

## Method B – continued -1



- 1) Using UHB tape, attach **WGR Adhesive Ring** to:
  - a. Gauge Lens  
(if mounting on large diameter gauge)
  - b. or front panel  
(if mounting on panel mounted gauge)



- 2) Attach **WGR Mounting Adapter** to WGR Adhesive Ring



- 3) Note alignment mark on **WGR Mounting Adapter** should be at upper left corner.
- 4) Tighten **Hose Clamp** to hand torque using slot screwdriver

# How to attach a WGR to a Gauge – Method B

## Method B – continued - 2



- 5) Attach **WGR Sensor** to WGR Mounting Adapter using 1/8 turn quick disconnect.

Note: start with WGR Sensor rotated counterclockwise 1/8 turn and attach to WGR Mounting Adapter. Then turn WGR Sensor clockwise till you hear a click to lock the quick disconnect.



Fully Mounted  
**WGR Assembly**

# Different Size Adapters Available

## WGR Mounting Adapters

Part Numer	Description
GRA-110-005	WGR Adapter, for gauges from 1.600" to 1.955" Outside Diameter
GRA-110-010	WGR Adapter, for gauges from 1.955" to 2.390" Outside Diameter
GRA-110-015	WGR Adapter, for gauges from 2.390" to 2.822" Outside Diameter
GRA-110-020	WGR Adapter, for gauges from 2.820" to 3.285" Outside Diameter
GRA-110-025	WGR Adapter, for gauges from 3.285" to 3.715" Outside Diameter
GRA-110-030	WGR Adapter, for gauges from 3.715" to 4.123" Outside Diameter
GRA-110-035	WGR Adapter, for gauges from 4.181" to 4.860" Outside Diameter

## WGR Adhesive Rings

Part Numer	Description
GRP-100-005	Adhesive mounting ring for panel mount - 2.0" OD
GRP-100-010	Adhesive mounting ring for panel mount - 2.3" OD
GRP-100-015	Adhesive mounting ring for panel mount - 3.625" OD
GRP-100-020	Adhesive mounting ring for panel mount - 4.0" OD
GRP-100-025	Adhesive mounting ring for panel mount - 4.375" OD
GRP-100-030	Adhesive mounting ring for panel mount - 4.625" OD
GRP-100-035	Adhesive mounting ring for panel mount - 5.625" OD

# **How to Calibrate a WGR to Read a Gauge**

# Overview of Optical Algorithm

Takes picture of gauge face

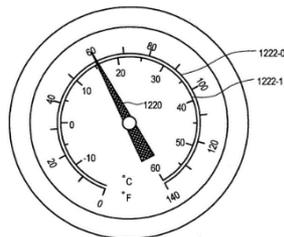
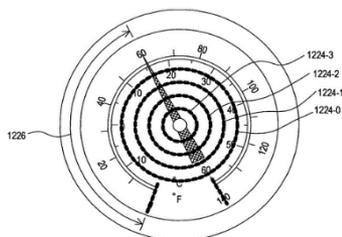


FIG. 12B

Scans pixels at predefined radius "circles" from center (5 rings)



Detects needle along radius of circles

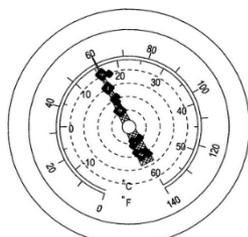
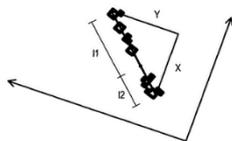


FIG. 12D

Use a linear regression algorithm to detect needle angle, convert angle to gauge reading



- Choosing the right "circles" is the key
- Need to choose 5 concentric circles with different radius
- Ideally each circle should see the needle, but nothing else (i.e. no labeling, marks or screws)

# Overview - Key Steps in Calibration Process

1. Choose your “circles” (i.e. radius)
2. Put WGR into Calibration Mode
3. Calibration Process
  - a) Start Calibration Tool
  - b) Get image of gauge and enter circles
  - c) Get sample and adjust as needed
  - d) Enter gauge units and range
  - e) Correct for Tilt (if needed)
  - f) Finish and Exit tool
4. Take test sample and verify reading

# Step 1: Choose Your Circles

- Before starting to calibrate, decide where you want to choose the circles. Particularly:
  - Will each circle see both the tip and tail of the needle, or only the head?
  - Are they close-in to the center of the gauge or towards to outer edge?
- Note your responses to the two questions above. You are now ready to start the calibration steps.



Example:  
ALL circles see both head  
and tail of needle



Example:  
SOME circles only see the  
head and not the tail.

# Step 2: Put WGR in Calibration Mode

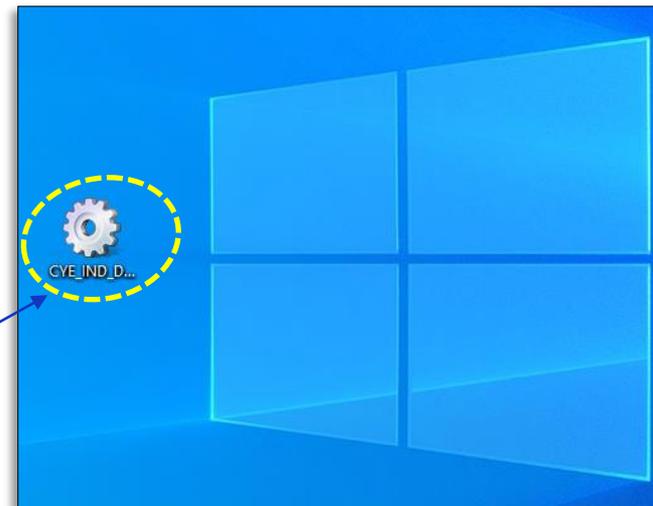
- Press the right button on the WGR four times to “CONFIG” menu
- Press center button to select. You will be prompted for a password
- Enter password: Center, Center, Right, Left, Center
- WGR should now be in Calibration Mode ready to receive commands from the Calibration Dongle. The last five digits of the MAC address is displayed on the lower right corner.



**WGR in Calibration Mode**

# Step 3a: Start Calibration Tool

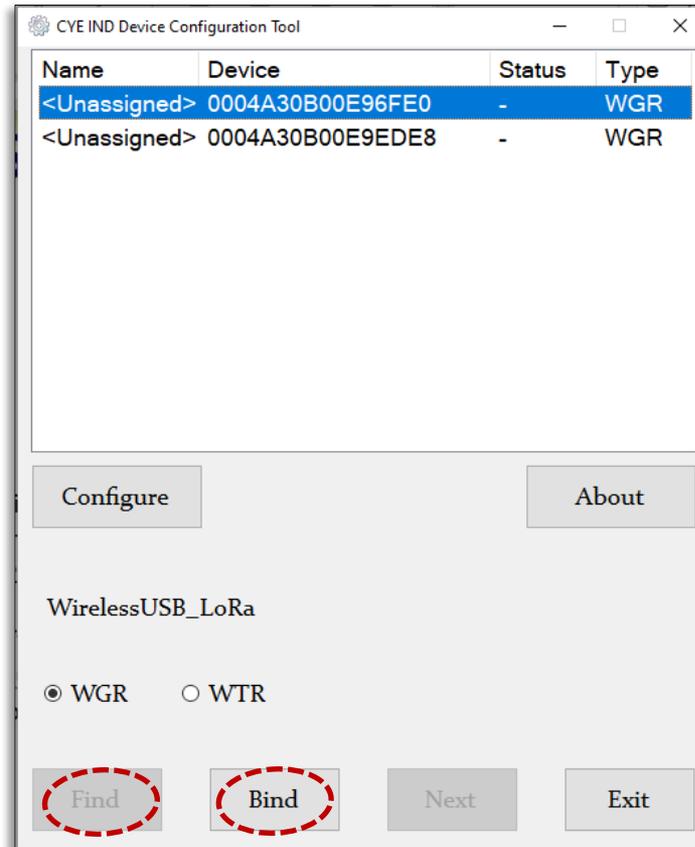
- Attach Calibration Dongle to Calibration Tablet using USB cable provided.
- Power up Calibration Tablet (Windows username/password is: cypress/cypress123)
- Open application “WGR Calibration” by doubleclicking the icon on the desktop



*Doubleclick this icon to start calibration application*

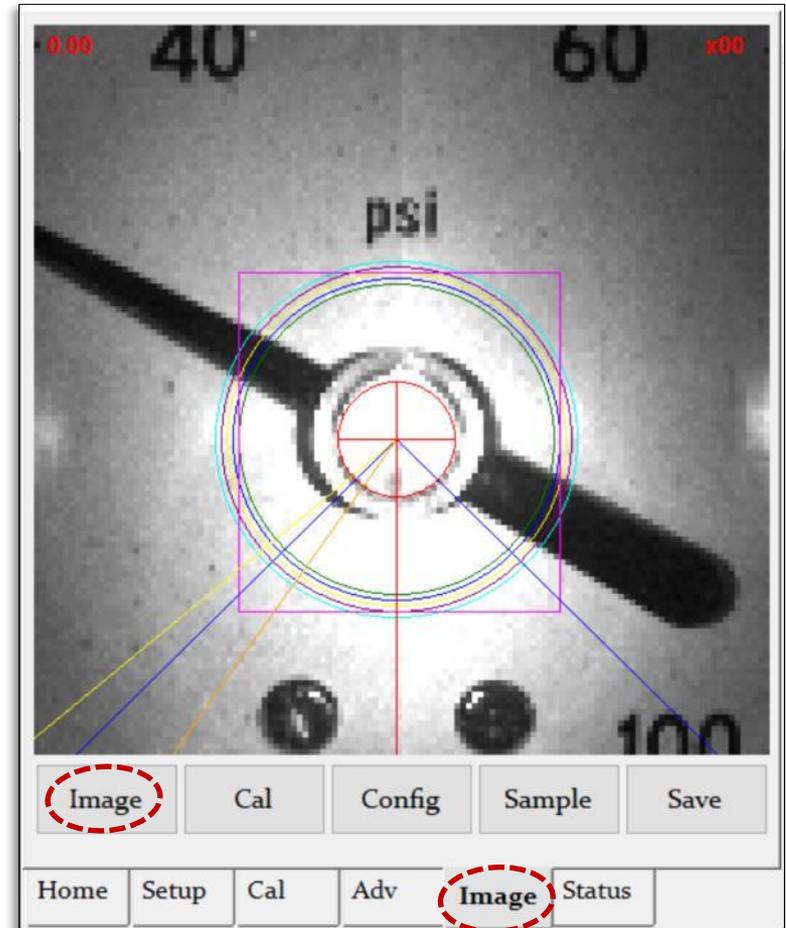
# Step 3a: Start Calibration Tool - continued

- Place the Calibration Dongle close to the WGR (ideally attach to the WGR using provided calibration clip or use tape).
- Click “FIND”, and a list of nearby WGR’s will appear on the top window. Select the WGR on the drop down list (check that the MAC address matches the one displayed on the WGR display).
- Click “BIND”, and after few seconds, you should see “BOUND”



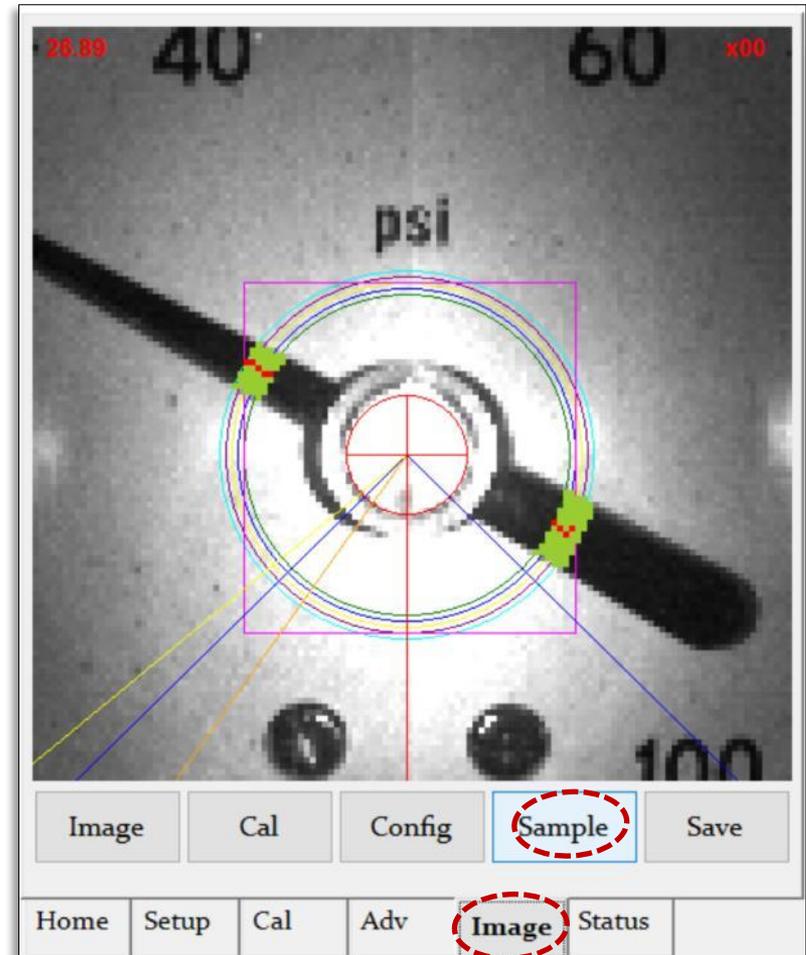
# Step 3b: Get Image and Enter Circles

- Select the tab marked “Image” on the bottom row.
- Click the “Image” button on the left top row to capture an image of the gauge. It takes about 20-30 seconds.
- Now click the Cal button on the top row, next to the Image button.
- You will be asked to click the middle of the gauge, then choose five rings. Make sure you click each ring in a sequentially larger radius.
- If you are not satisfied with the center point and/or the rings, you can redo it by clicking the Cal tab on the top row again.



# Step 3c: Get Sample

- Click the “Sample” button. You should see green pixels indicating where the needle is, and should not see green pixels elsewhere. Click “Sample” a few times to verify.
- If there are too many green pixels besides on the needle, then go to the Adv tab, and increase the “threshold” by 10 and click “Send” on the upper right corner.
- If there are too few green pixels (needle not found), then go to the Adv tab, and decrease the “threshold” by 10 and click “Send” on the upper right corner.
- Repeat last three steps till you have a green pixels on the needle and not anywhere else.
- The upper right corner of the screen should show X00 to indicate there is no error.



# Step 3c: Get Sample - continued

File	Get	Send
Background Color	White	▼
Camera Exposure	90	
Pixel Threshold	40	
Tip Width	2	
Tail Width	10	
Number of Non-Tail Circles	5	
<input type="checkbox"/> Subtle Needle Taper		
<input checked="" type="checkbox"/> Find Tip and Tail (keep on)		
<b>Magnehelic / Photohelic Only:</b>		
Left LED Boost	0	
Right LED Boost	0	
Home	Setup	Cal
Adv	Image	Status

# Step 3d: Enter Gauge Units and Range

- Click the Setup tab.
- Select proper units from the drop down menu (e.g. PSI, deg F, etc.)
- Select Sample Rate, in seconds
- Select Minimum and Maximum Gauge Values (the minimum and maximum markings on the gauge face).
- Click the “Send” button on the upper right hand corner.

The screenshot displays a web-based configuration interface for a device. At the top, there are three buttons: 'File', 'Get', and 'Send'. The 'Send' button is circled in red. Below these buttons are several input fields and dropdown menus. The 'Units' dropdown is set to 'PSI' and is also circled in red. Other fields include 'Sample Rate (sec)' set to 300, 'Min Gauge Value' set to 0, and 'Max Gauge Value' set to 100. There is a checked checkbox for 'Zoom Enabled'. Below these are three radio button options: 'Long Tail Needle' (selected), 'Short Tail Needle', and 'Taper Detection'. Further down, there are fields for 'Node ID' (2562), 'Mode' (Standalone), 'Sub ID' (1), 'Port Number' (1), 'Sub Channel' (0), and 'Frequency Sub Band' (3). A 'Generate LoRa Security Keys' button is located at the bottom of the main configuration area. At the very bottom, there is a navigation bar with tabs for 'Home', 'Setup', 'Cal', 'Adv', 'Image', and 'Status'. The 'Setup' tab is currently selected.

# Step 3e: Correct for Tilt

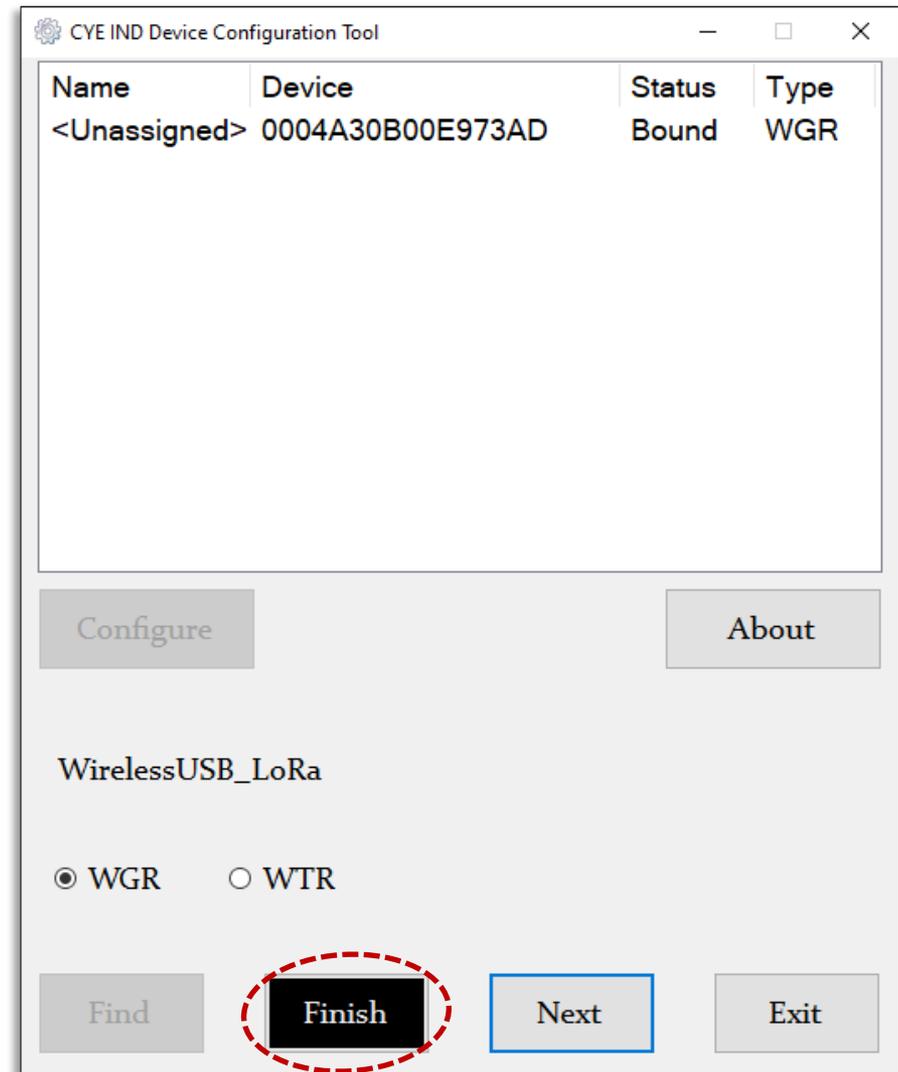
- This step checks and corrects if the WGR is tilted:
- Step 1: Click the Image tab and then click the Sample button.
- The WGR reading is on the upper left corner of the display – compare with the actual needle reading.
- If necessary, adjust the “Gauge Tilt Angle” as follows:
  - Select the Cal tab on the bottom row.
  - If the WGR reading is less than the needle reading, increase the Gauge Tilt Angle by 1 or 2 degrees
  - If the WGR reading is more than the needle reading, decrease the Tilt Angle by 1 or 2 degrees (enter negative value to rotate tilt counterclockwise).
  - Click “Send”
- Go to Step 1 on this page and repeat process

The image shows a software interface for gauge calibration. At the top, there are three tabs: 'File', 'Get', and 'Send'. The 'Send' tab is highlighted with a red dashed circle. Below the tabs is a list of calibration parameters, each with a corresponding input field. The 'Gauge Tilt Angle' field is also circled in red and contains the value '0'. At the bottom of the screen, there is a row of navigation tabs: 'Home', 'Setup', 'Cal', 'Adv', 'Image', and 'Status'. The 'Cal' tab is currently selected.

Parameter	Value
Gauge Min Angle	45
Gauge Max Angle	315
Gauge Tilt Angle	0
Min Needle Travel Angle	35
Max Needle Travel Angle	35
Needle Resting Correction	5
Zoom X Offset	0
Zoom Y Offset	0
Center Point X	62
Center Point Y	72
Radius1	27
Radius2	28
Radius3	29
Radius4	30
Radius5	31

# Step 3f: Finish and Exit Calibration Tool

- VERY IMPORTANT – You must go back to the “Home” tab and click “Finish” to properly save and exit from the configuration process, or else the settings will not be saved.



# Step 4: Take Test Sample

- Press the Middle button of the WGR to take a sample, and note the reading.
- Now remove the WGR Sensor from the WGR Mounting Adapter (turn counterclockwise 1/8 turn and remove), and read the physical needle.
- Compare with the reading on the WGR Sensor to confirm it is accurate. If not accurate, then repeat calibration process.
- Reattach the WGR Sensor to the Mounting Adapter.



# **Special Case: Zoom Out**

# Special Case: Zoom Out to See Rings

- In some cases, you may want to avoid zoom-in to see a bigger part of the gauge. This is true when you want to select circles farther away from the center.



Original Gauge



Zoomed-in  
Image



Zoomed-out  
Image

# Special Case: Zoom Out to See Rings – continued

- To Zoom Out, go to the Setup tab, and deselect the “Zoom Enabled” checkbox, then click Send.

The screenshot displays a configuration interface with the following elements:

- Buttons: File, Get, and Send (circled in red).
- Device Name: Text input field.
- Units: Dropdown menu set to PSI.
- Sample Rate (sec): Text input field set to 300.
- Min Gauge Value: Text input field set to 0.
- Max Gauge Value: Text input field set to 100.
- Zoom Enabled: Checked checkbox (circled in red).
- Needle Selection: Radio buttons for Long Tail Needle (selected), Short Tail Needle, and Taper Detection.
- Node ID: Text input field set to 2562.
- Mode: Dropdown menu set to Standalone.
- Sub ID: Dropdown menu set to 1.
- Port Number: Dropdown menu set to 1.
- Sub Channel: Dropdown menu set to 0.
- Frequency Sub Band: Dropdown menu set to 3.
- Generate LoRa Security Keys: Button.
- Navigation Bar: Home, Setup (active), Cal, Adv, Image, Status.

# **Special Case: Short Tail Needles**

# Special Case: Short Tail Needles

- In some gauges, the needle has a short tail. When you select the circles, some or all of the circles may NOT see a tail.
- In this case, you must use the Short Tail algorithm.



Example: Two of Five Circles do NOT see the Tail

# Special Case: Short Tail Needles - continued

- Go to Setup tab, select the “Short Tail Needle” button, and click Send.
- Go to Adv tab, enter the number of circles which see a tail, i.e. 3 in the last example, and click Send.

File Get **Send**

Device Name

Units

Sample Rate (sec)

Min Gauge Value

Max Gauge Value

Zoom Enabled

Long Tail Needle  
 **Short Tail Needle**  
 Taper Detection

Node ID

Mode  Sub ID

Port Number  Sub Channel

Frequency Sub Band

Home **Setup** Cal Adv Image Status

File Get **Send**

Background Color

Camera Exposure

Pixel Threshold

Tip Width

Tail Width

Number of Non-Tail Circles

Subtle Needle Taper

Find Tip and Tail (keep on)

**Magnehelic / Photohelic Only:**

Left LED Boost

Right LED Boost

Home Setup Cal **Adv** Image Status

# **Special Case: Unusual Gauge Angles**

# Special Case: Unusual Gauge Min/Max Angles

- Most gauges have angles like this one.



- But what if you have angles like this instead?



# Special Case: Unusual Gauge Min/Max Angles

- Go to Cal tab, enter the Gauge Min Angle and Gauge Max Angle, and click “Send”.

The screenshot shows a software interface with a menu bar at the top containing 'File', 'Get', and 'Send'. The 'Send' button is circled in red. Below the menu bar is a list of calibration parameters, each with a text input field. The 'Gauge Min Angle' field contains the value 45 and is circled in red. The 'Gauge Max Angle' field contains the value 315 and is also circled in red. Other parameters include Gauge Tilt Angle (0), Min Needle Travel Angle (35), Max Needle Travel Angle (35), Needle Resting Correction (5), Zoom X Offset (0), Zoom Y Offset (0), Center Point X (62), Center Point Y (72), and five Radius values (27, 28, 29, 30, 31). At the bottom of the interface is a tabbed menu with 'Home', 'Setup', 'Cal', 'Adv', 'Image', and 'Status'. The 'Cal' tab is currently selected.

Parameter	Value
Gauge Min Angle	45
Gauge Max Angle	315
Gauge Tilt Angle	0
Min Needle Travel Angle	35
Max Needle Travel Angle	35
Needle Resting Correction	5
Zoom X Offset	0
Zoom Y Offset	0
Center Point X	62
Center Point Y	72
Radius1	27
Radius2	28
Radius3	29
Radius4	30
Radius5	31

# **Special Case: Black Background Gauges**

# Special Case: Black Background Gauges

- If black background....



- Go to Adv tab, select Black Background, and click Send.

File	Get	Send
Background Color	White	▼
Camera Exposure	90	
Pixel Threshold	40	
Tip Width	2	
Tail Width	10	
Number of Non-Tail Circles	5	
<input type="checkbox"/> Subtle Needle Taper		
<input checked="" type="checkbox"/> Find Tip and Tail (keep on)		
<b>Magnehelic / Photohelic Only:</b>		
Left LED Boost	0	
Right LED Boost	0	
Home	Setup	Cal
Adv	Image	Status

# Special Case: Magnehelic Gauges



# Setup Tab

- Units: InH2O
- Min Gauge Value: 0
- Max Gauge Value: XX
- Zoom Enabled Checked
- Short Tail Checked

The screenshot displays a configuration window with the following elements:

- Buttons: File, Get, Send
- Device Name: [Empty text field]
- Units: InH2O (dropdown menu)
- Sample Rate (sec): 300 (text field)
- Min Gauge Value: 0 (text field)
- Max Gauge Value: 10 (text field)
- Zoom Enabled
- Long Tail Needle
- Short Tail Needle
- Taper Detection
- Node ID: 2815 (text field)
- Mode: Standalone (dropdown menu)
- Sub ID: 1 (dropdown menu)
- Port Number: 1 (dropdown menu)
- Sub Channel: 0 (dropdown menu)
- Frequency Sub Band: 3 (dropdown menu)
- Generate LoRa Security Keys (button)

At the bottom, a navigation bar contains the following tabs: Home, Setup (active), Cal, Adv, Image, Status.

# Cal Tab

- Min Gauge Angle: ~130
- Max Gauge Angle: ~230

File	Get	Send
Gauge Min Angle	130	
Gauge Max Angle	230	
Gauge Tilt Angle	0	
Min Needle Travel Angle	35	
Max Needle Travel Angle	35	
Needle Resting Correction	5	
Zoom X Offset	0	
Zoom Y Offset	0	
Center Point X	63	
Center Point Y	127	
Radius1	77	
Radius2	78	
Radius3	79	
Radius4	80	
Radius5	82	

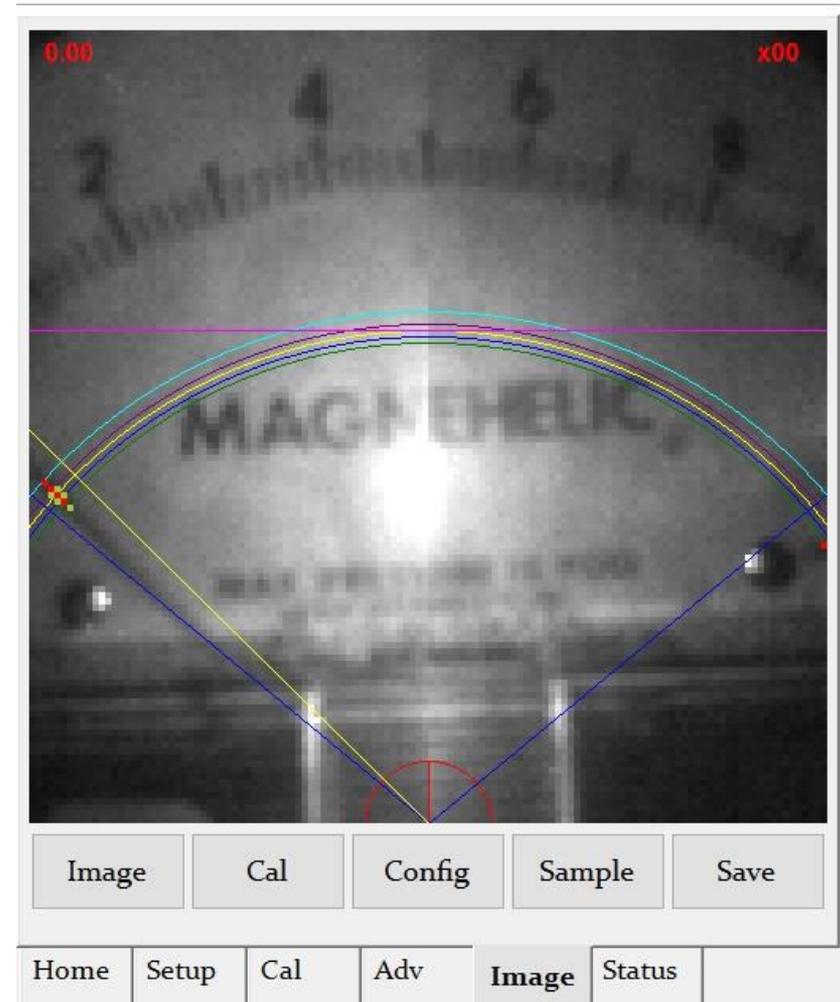
Home Setup **Cal** Adv Image Status

# Image Tab

- Center: all the way to the bottom, middle
- 1<sup>st</sup> ring: just beyond “C” in Magnehelic
- 2<sup>nd</sup> – 5<sup>th</sup> rings increment by 1 pixel each

Note: This picture is from a “near-focus” WGR, which is why the picture is blurry. But algorithm still works.

The WGR should be adjusted for “far-focus” ideally to make the image sharper.



# Adv Tab

- Exposure: 220
- Threshold: ~30
- Tip Width: 2
- Tail Width: 2
- Number of Non-Tail Circles: 0

File Get Send

Background Color White

Camera Exposure 220

Pixel Threshold 30

Tip Width 2

Tail Width 2

Number of Non-Tail Circles 0

Subtle Needle Taper

Find Tip and Tail (keep on)

**Magnehelic / Photohelic Only:**

Left LED Boost 0

Right LED Boost 0

Non-linear Gauge

Angle Percentage / Gauge Value:

10 % 0 20 % 0 30 % 0

Home Setup Cal Adv Image Status

# **Special Case: Process Gauge Adapter**

# Process Gauge Adapter

GRA-110-130: Adapter for process gauges 4.5 inch diameter, with tapered sides.  
Important: Must have access to back of gauge to use this adapter. NOT for panel or flush mounted gauges.



# **Special Case: Magnehelic Adapter**

# Magnehelic Gauge Adapter

GRA-110-135: Adapter for Dwyer Magnehelic and Photohelic Gauges.

Important: Must have access to back of gauge to use this adapter. NOT for panel or flush mounted gauges.

