Honeywell

OneWireless Gauge Reader

Installation and Configuration Guide

34-XY-25-32
Revision 2
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Honeywell Process Solutions

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About This Document

This manual is designed to be a step by step guide as well as a reference used to install and configure the OneWireless Gauge Reader (WGR) and OneWireless Gauge Reader Application Gateway. Formal training is required for all installers.

Honeywell does not recommend using this product for critical control where there is a single point of failure or where single points of failure result in unsafe conditions. OneWireless is targeted at open loop control, supervisory control, and controls that do not have environmental or safety consequences. As with any process control solution, the end-user must weigh the risks and benefits to determine if the products used are the right match for the application based on security, safety, and performance. Additionally, it is up to the end-user to ensure that the control strategy sheds to a safe operating condition if any crucial segment of the control solution fails.

Reference Information

Document Name	Document ID	Revision Number	Publication Date
OneWireless Gauge Reader Installation and Configuration Guide	34-XY-25-32	1	April 09
		2	July 09

References

The following list identifies all documents that may be sources of reference for material discussed in this publication.

Document Name	Document Part Number
OneWireless Gauge Reader Specification	34-XY-03-37
OneWireless Gauge Reader Application Gateway Manual	34-XY-25-33
OneWireless Gauge Reader User Manual	34-XY-25-31
OneWireless Gauge Reader Model Selection Guide	34-XY-16-80

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Symbol Definitions

The following table lists those symbols used in this document to denote certain conditions.

Symbol	Definition
	**ATTENTION:** Identifies information that requires special consideration.
	**TIP:** Identifies advice or hints for the user, often in terms of performing a task.
CAUTION	Indicates a situation which, if not avoided, may result in equipment or work (data) on the system being damaged or lost, or may result in the inability to properly operate the process.
	**CAUTION**: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. **CAUTION** symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
	**WARNING**: Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or death. **WARNING** symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
	**WARNING, Risk of electrical shock**: Potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 VDC may be accessible.
	**ESD HAZARD:** Danger of an electro-static discharge to which equipment may be sensitive. Observe precautions for handling electrostatic sensitive devices.
	**Protective Earth (PE) terminal**: Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	**Functional earth terminal**: Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national local electrical code requirements.
	**Earth Ground**: **Functional earth connection.** NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.
	**Chassis Ground**: Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.
	For radio equipment used in the European Union in accordance with the R&TTE Directive the CE Mark and the notified body (NB) identification number is used when the NB is involved in the conformity assessment procedure. The alert sign must be used when a restriction on use (output power limit by a country at certain frequencies) applies to the equipment and must follow the CE marking.

Table of Contents

Introduction

The OneWireless Gauge Reader (WGR) is capable of non-invasively reading a gauge and transmitting the data to a central Application Gateway. To perform this task you must use a Configuration Tool to calibrate each WGR to work with the specific gauge it is mounted on.

The WGR attaches to the front of existing analog gauges and uses a camera to capture an image of the gauge, convert the image into a gauge reading and transmit the results wirelessly. This process requires the proper settings of several parameters that configure the camera, communication settings, and image processing routines.

A Configuration Tool must be used to setup these parameters. All WGR configuration parameters are entered on the Configuration Tool and sent wirelessly to the WGR.

This manual will describe how to configure and use the WGR, and Configuration Tool. This manual can be used as a reference or step by step guide.

1 Safety and Regulatory Information

- Do not immerse the WGR in water.
- Do not expose the WGR Application Gateway to water.
- Always wear personal protective equipment appropriate to the system on which the WGR is being installed.
- Do not try to repair the WGR or WGR Application Gateway yourself as they contain no user-serviceable parts. Contact Honeywell for any required repairs. See the *Support* section below for details.

1.1 Radio Information

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with the FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be located or operating in conjunction with any other antenna or transmitter.

2 WGR Overview

The OneWireless Gauge Reader (WGR) is designed to read manual gauges and transmit the data to a data acquisition system. The WGR optically reads the gauge face and wirelessly transmits the reading. This value is also displayed locally on the LCD.

The WGR is designed to be non-invasive. It is attached over the face of an existing analog gauge, as shown in Figure 1. Each WGR comes with an adapter that is sized for the gauge it is reading. Adapters range in size to fit over gauge faces that are 1.5 to 4.5 inches in diameter.

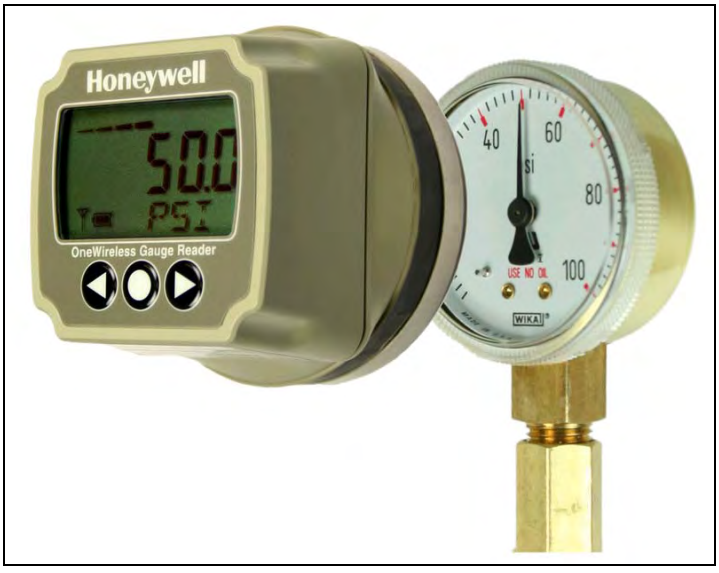

Figure 1 : Wireless Gauge Reader

The battery operated WGR is specifically configured to the gauge that it is reading. During installation, the WGR is positioned per the customer specifications. The WGR can be positioned at a different angle than the gauge. For example, a gauge could be mounted at an angle for a gas bottle monitoring system, but the WGR could be positioned upright for easier reading. Refer to Figure 2 as an example. Once the WGR is in position, it is secured in place for calibration.

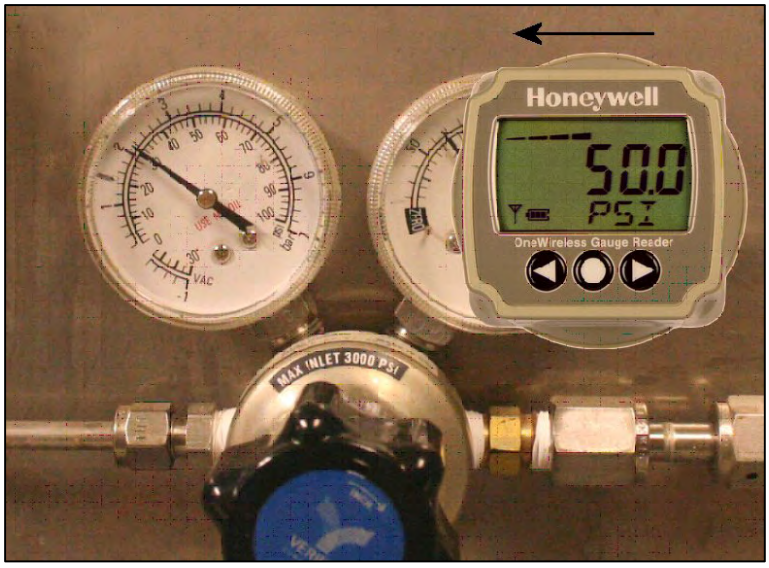

Figure 2 : WGR being placed horizontally on gauge that is mounted at an angle

2.1 WGR LCD Display

The WGR's LCD display provides multiple pieces of information about the operation of the system.

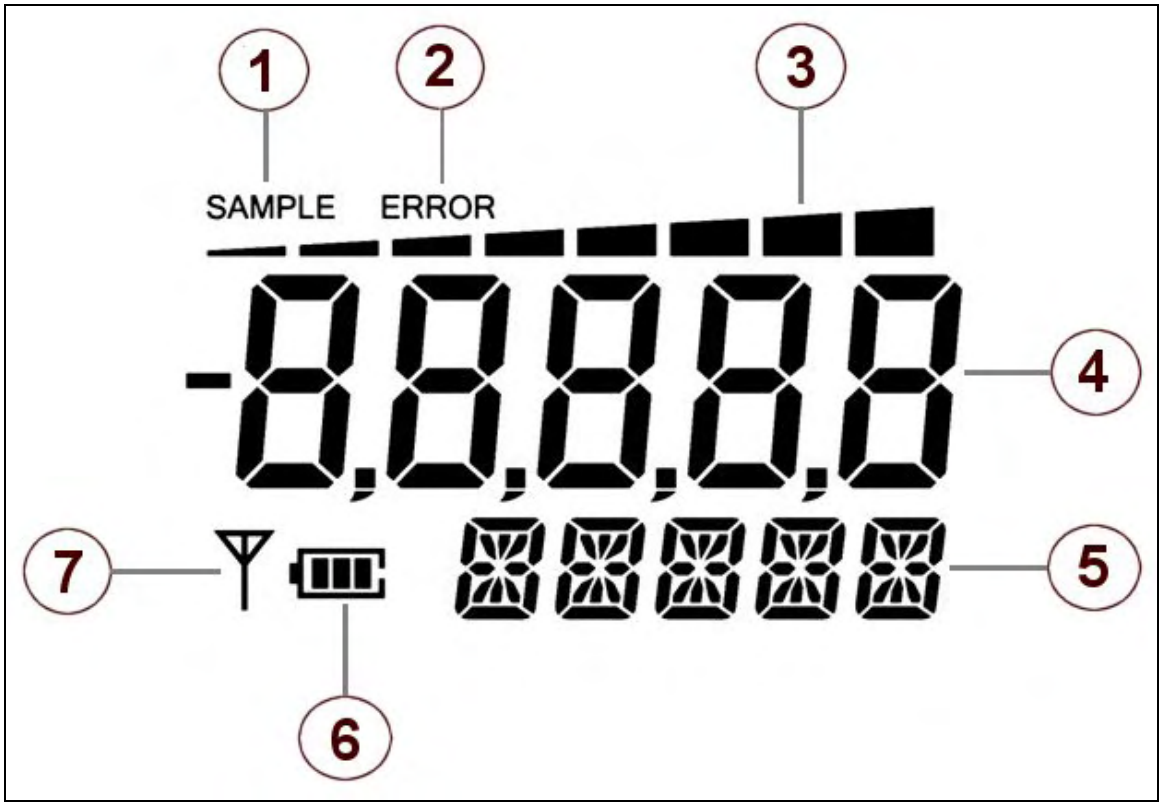

Figure 3 : WGR LCD

1. **Sample Icon:** This icon will turn on and stay on while the WGR is actively processing a sample. When this icon is turned off the WGR is in low power mode.
2. **Error Icon:** This icon will turn on and stay on when the WGR did not properly process the last sample.
3. **Bar Graph:** This graph is a visual representation of the latest gauge reading. The graph grows from zero to eight bars as the needle moves from its minimum to maximum position.
4. **7-Segment Section:** This section normally displays the gauge reading numerically. It is also used to display status information when WGR is in special operating modes.
5. **14-Segment Section:** This section normally displays the gauge units. It is also used to display status information when WGR is in special operating modes.
6. **Battery Status:** This icon will show the power left in the WGR batteries.
7. **Wireless Status:** The Antenna Icon will appear when a wireless connection is successful.

2.2 WGR Menu Structure

Figure 4 shows the menu structure of the WGR LCD. The three buttons on the front of the WGR are used to navigate through the structure. Each mode and button sequence is labeled in the diagram below.

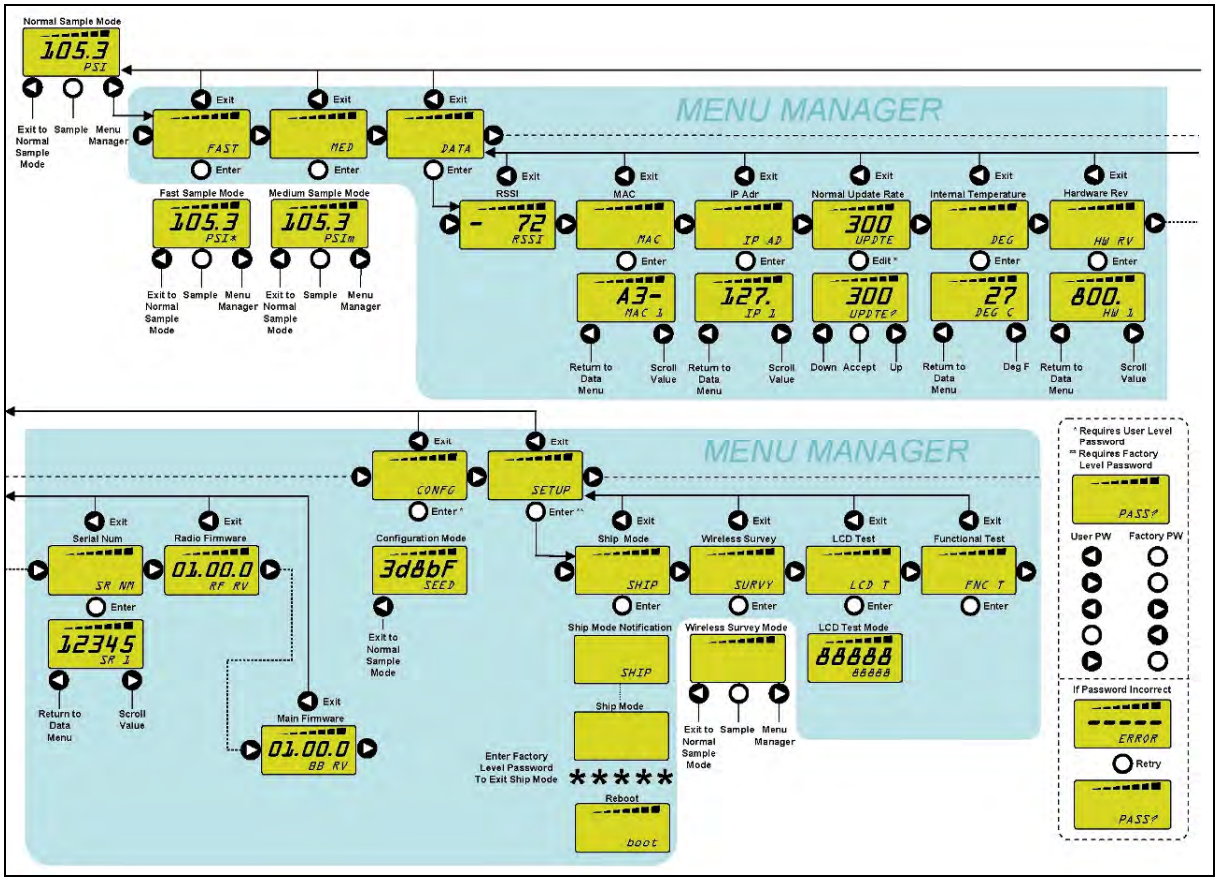

Figure 4 : WGR LCD Menu Structure

1. **Normal Sample Mode:** When the WGR is not in any special operating mode it is in the Normal Sample Mode. In this mode the WGR will periodically wake up, sample the gauge, transmit the reading, and update the 7-segement section on the LCD to the latest reading value. The time between samples (update rate) is set up using the Configuration Tool.

2. **Fast Sample Mode:** In this mode the WGR will process samples just as in the Normal Sample Mode except that the time between samples is only 5 seconds. This mode will remain active for 5 minutes, before automatically returning back to Normal Sample Mode. This mode is used to monitor a short-term activity that is likely to cause faster gauge movements, or for diagnostics.

3. **Medium Sample Mode:** In this mode the WGR will process samples just as in the Normal Sample Mode except that the time between samples is 30 seconds. This mode will remain active for 8 hours, before automatically returning to the Normal Sample Mode. This mode is used to monitor a medium-term activity that is likely to cause faster gauge movements, or for diagnostics.

4. **Data Mode**

    a. **RSSI:** (Receive Signal Strength Indication). The RSSI value is displayed in this mode. This is the strength of the wireless signal received by the WGR from the Access Point.

b. **MAC Address:** (Media Access Control Address). The MAC address for the WGR can be viewed in this mode.

c. **IP Address:** (Internet Protocol Address) The assigned IP address for the WGR can be viewed in this mode.

d. **Normal Update Rate:** The update rate for Normal Sample Mode can be viewed and edited in this mode.

e. **Temperature – Celsius:** Displays the current temperature reading from an internal WGR sensor.

f. **WGR Firmware Version:** Displays the WGR firmware version number.

g. **Serial Number:** Displays the serial number of the WGR.

h. **Hardware Version:** Displays the hardware version of the WGR.

5. **Configuration**

a. **Configuration Mode:** This mode is used to configure the WGR with a Configuration Tool.

6. **Setup**

a. **Ship Mode:** This mode will effectively power down the WGR. The WGR is in an ultra low power consumption state. This mode is used when storing or transporting WGRs while not in service.

b. **Wireless Survey:** This mode is used when performing a wireless survey at a customer site.

c. **LCD Test:** This mode is used during manufacturing to test the LCD.

d. **Functional Test:** This mode is used during manufacturing to perform a burn in test.

3 Installation Preparations

3.1 Installation Overview

The WGR mounts to a gauge using one of several different sizes and types of mounting adapters. The installer will need to determine the proper adapter required for each gauge. The WGR can be ordered with any standard adapter pre-mated to the WGR main body for easier field installation.

3.2 Measuring Each Gauge

Prior to installing WGRs, you must measure each gauge in order to determine the proper WGR mounting adapter required for the gauge. Use a caliper to determine the largest outside diameter of the gauge in the area between its front surface, and up to 3/8 inches (10 mm) back from the front face. This is the area where the adapter will grasp the gauge. Refer to the diagram in Figure 5. It may help to tilt the caliper slightly in order to make sure that the caliper is spanning the entire range of interest.

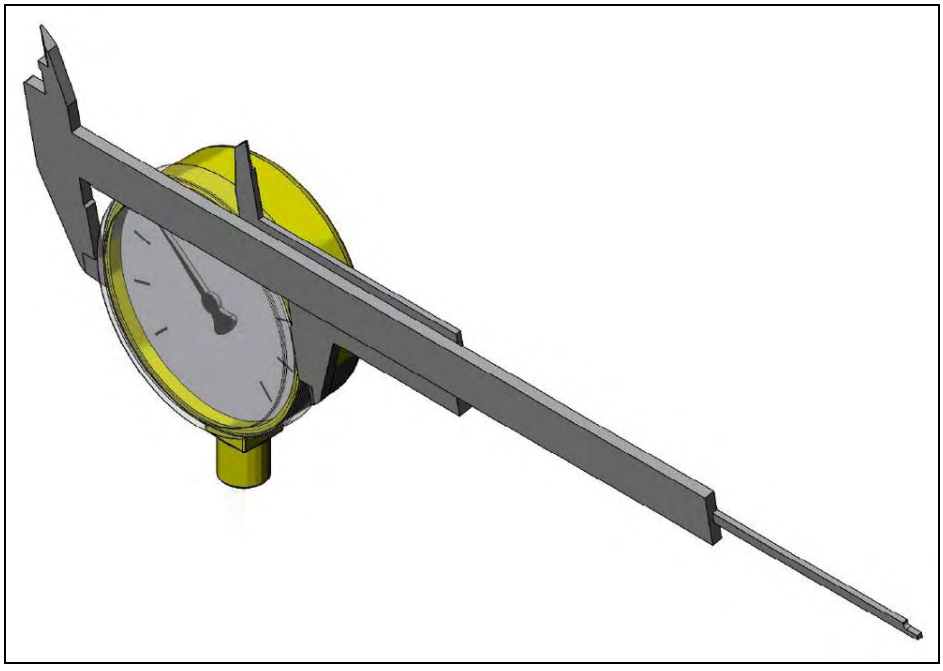

Figure 5 : Measuring a Gauge with a Caliper

Refer to Figure 6 for the range of gauge sizes supported by each standard WGR gauge mounting adapter. Note that the special mounting adapters for Magnehelic, Photohelic, and Process Gauges are not shown in this table, since they are designed to fit a specific gauge type.

Adapter size	Dimensions		
	ID @ Gauge Interface	Max OD of Gauge	Min OD of Gauge
Mini	1.955″	1.995″	1.600″
	[49.66mm]	[50.67mm]	[40.64mm]
Small	2.350″	2.390″	1.995″
	[59.69mm]	[60.71mm]	[50.67mm]
Medium	2.782″	2.822″	2.390″
	[70.66mm]	[71.68mm]	[60.71mm]
Large	3.245″	3.285″	2.820″
	[82.42mm]	[83.44mm]	[71.63mm]
Extra Large	3.675″	3.715″	3.285″
	[93.35mm]	[94.36mm]	[83.44mm]
Grande	4.083″	4.123″	3.715″
	[103.71mm]	[104.72mm]	[94.36mm]
Extra Grande	4.600″	4.680″	4.181″
	[116.84mm]	[118.87mm]	[106.20mm]

Figure 6 : Table of Standard Gauge Mounting Adapter Sizes

3.3 WGR Adapter Selection Guide

Refer to the Model Section Guide in the WGR Specification sheet for a list of all of the WGR adapters that are available. The WGR can be ordered with an adapter pre-mated, which will save installation time in the field.

3.4 Standard WGR Adapters

Figure 7 shows all of the standard style WGR adapter sizes for free-standing gauges.

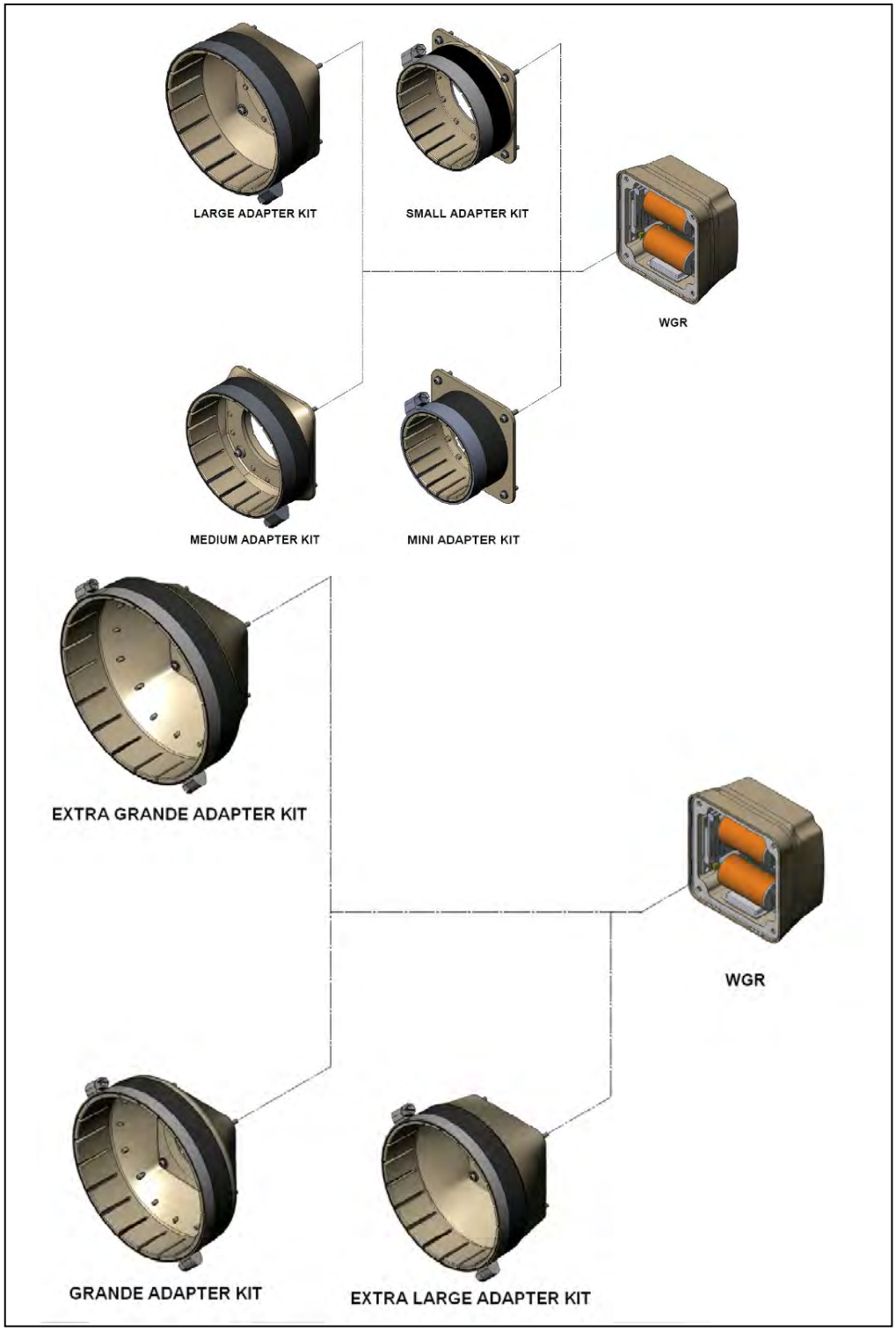

Figure 7 : WGR Standard Mounting Adapters

Figure 8 shows how a standard small adapter attaches to the WGR. The WGR can be ordered with any standard adapter pre-installed, to save time in the field.

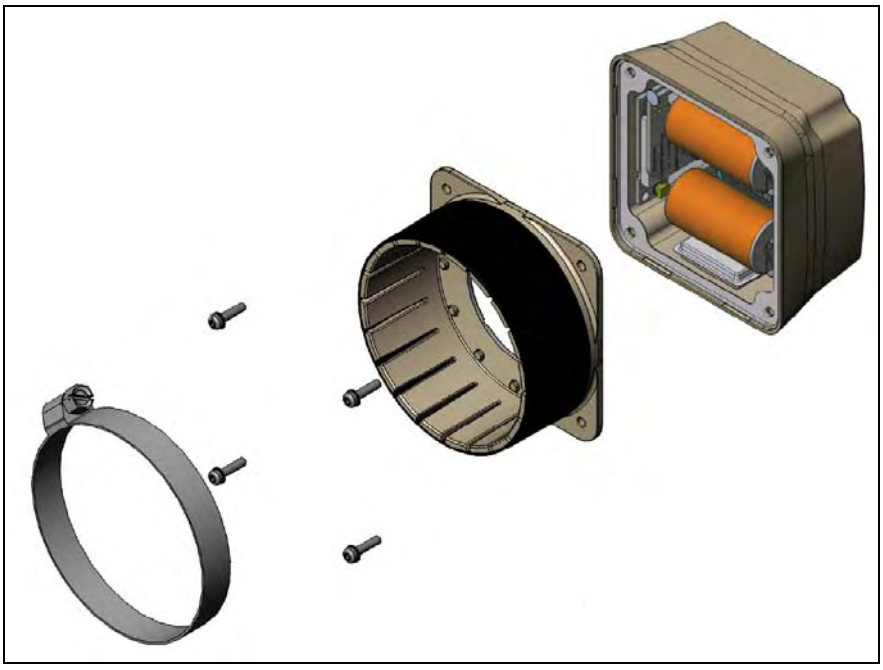

Figure 8 : Exploded View of Small Adapter Connection to WGR

Figure 9 shows how a medium standard adapter attaches to the WGR. The medium adapter is somewhat special, since it requires a thin interface plate in order to obtain proper fastener alignment. The WGR can be ordered with any standard adapter pre-installed, to save time in the field.

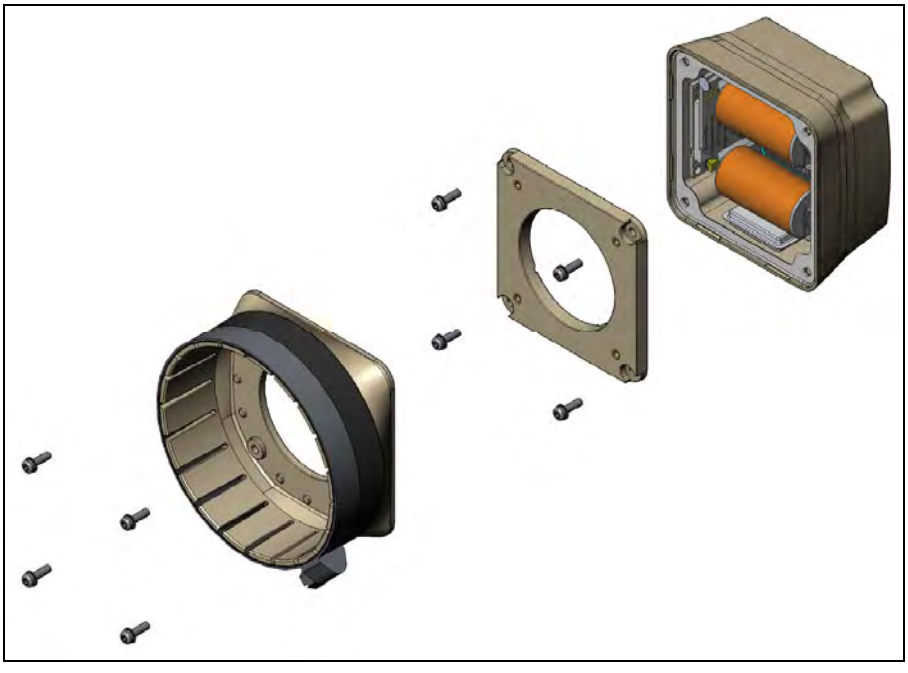

Figure 9 : Exploded View of Medium Adapter Connection to WGR

3.5 Special Panel Mount Adapters

Figure 10 shows an exploded view of a WGR with a standard large adapter mating with a special panel mount adapter. The panel mount adapter is used when the gauge is mounted flush in a panel, and there is no way for the regular adapter to grasp the outside of the gauge. The panel mount adapter uses a ring of 3M Dual-Lock Fastener material with VHB (very high bond) adhesive to adhere to the panel surrounding the gauge. It provides a collar for the regular WGR mounting adapter to grasp. The panel mount adapter is used in addition to a standard WGR mounting adapter.

Figure 10 : Exploded View of Panel Mount Adapter

3.6 Special Magnehelic and Photohelic Adapter

Figure 11 shows an example of a special adapter style that is used for Magnehelic and Photohelic gauges, due to their unique shape. Note that there is a slight size difference between the Magnehelic and Photohelic kit, so please order the appropriate kit for each gauge.

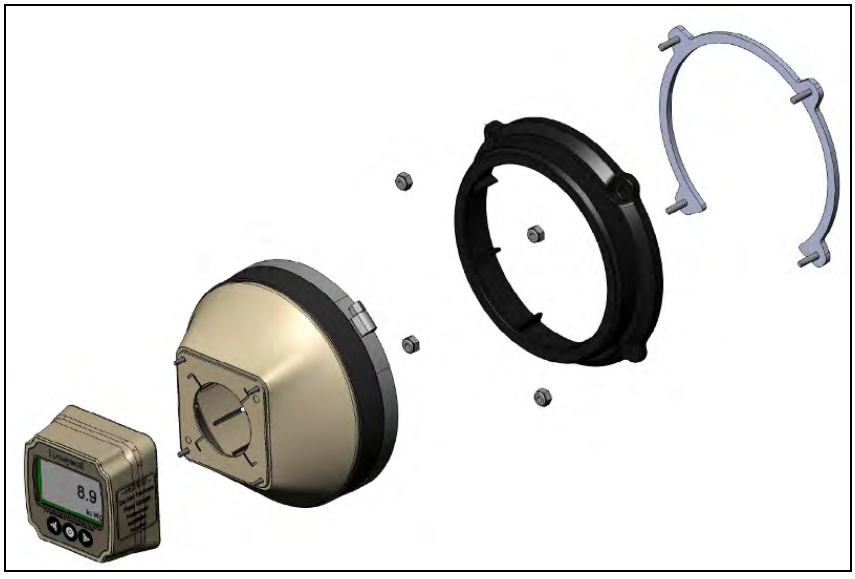

Figure 11 : Exploded View of Magnehelic/Photohelic Mounting Adapter

3.7 Process Gauge Adapter

Figure 12 shows an example of a special adapter that is used to mount to process gauges, since they have a sloped surface along their circumference that would normally be difficult for a standard style adapter to grasp.

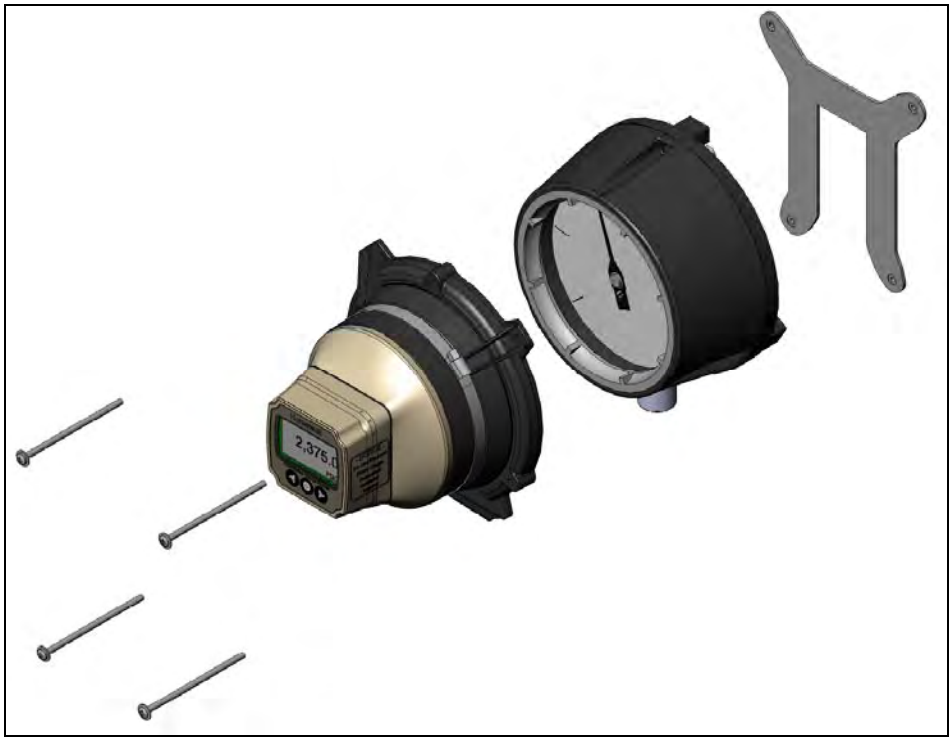

Figure 12 : Mounting the WGR to a Process Gauge

3.8 Mounting Shim Bands

Various size and thickness silicone or EDPM rubber shim bands are provided with each of the standard WGR mounting adapter kits. They are not used with the Magnehelic, Photohelic, and Process Gauge Adapters. The shim bands are used for a variety of purposes.

1) They can be used to provide the proper fit for the mounting adapter.
   a) The standard style mounting adapters may sometimes be slightly too large for a gauge.
      i) If you find that the mounting adapter is slightly too small for a gauge, it is better to switch to the next larger size adapter, since the adapter will not always remain securely attached to the gauge if the adapter's fingers have to flex outward.
   b) The addition of one to three shim bands to the circumference of the gauge will allow the WGR adapter to fit properly on the gauge.
   c) If you find that more than 3 shims are required, then please verify the selection of the WGR adapter.
      i) It is not advisable to use more than 3 shim bands on a single gauge, since the mounting will not be secure.
2) The shims can also be used to provide additional grip, to ensure that the adapter will remain securely fastened to the gauge, even during vibration.
   a) Even if the adapter fits properly on the gauge without any shim bands, it is advisable to try to use one of the thin shim bands in order to provide additional friction between the adapter and the gauge.

3) The shims can also be used to provide a wider surface area for the WGR to grip the gauge.
   a) Some gauges have a very narrow lip along their outside circumference.
   b) This provides a poor contact surface for the WGR.
   c) It is advisable to install 1-3 shim bands next to the thin lip, in order to provide a much deeper mounting surface for the WGR adapter to grasp.
      i) Refer to the cross-section view in Figure 13 for an example of shim band placement on this type of gauge.

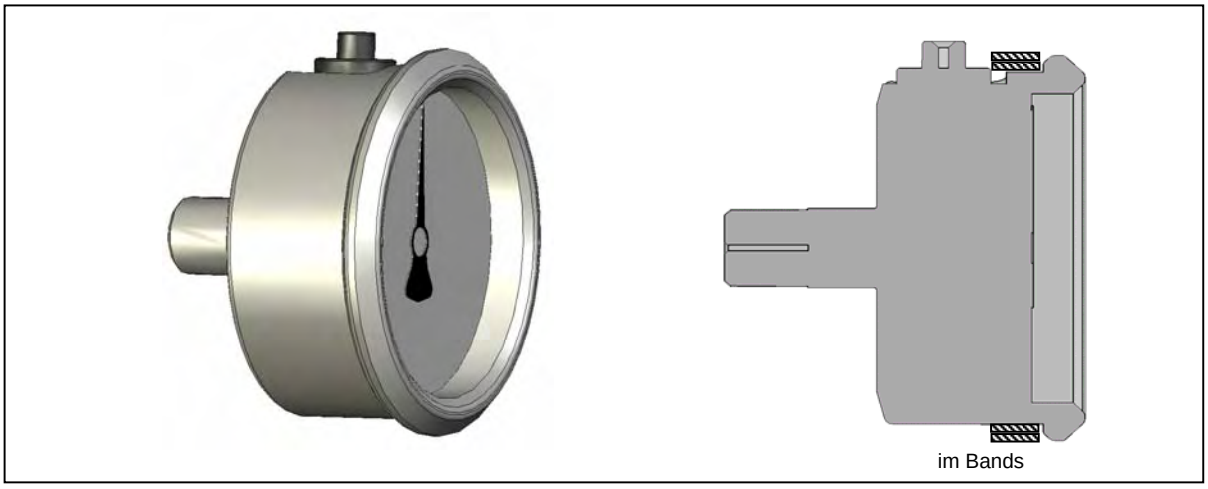

Figure 13 : Shim Band Placement for Gauge with Thin Lip

3.9 Verify Gauge Functionality

1) Prior to WGR installation, ensure that there are no visual obstructions between the WGR and gauge face (stickers, marks, etc.).
   a) Use an appropriate cleaning agent, such as isopropyl alcohol to clean the gauge face prior to installing the WGR.
   b) Also, make sure there are no deep scratches on the gauge window that could affect the WGR's imaging system.
   c) For liquid filled gauges, please make sure the gauge is filled as completely as possible, so that the liquid level line does not obscure the needle, and so there are no liquid droplets on the gauge face.

Figure 14 : Examples of a Clean Gauge and Two Obstructed Gauges

2) Calibrate the mechanical gauge itself, if required.
   a) The WGR reading is only as accurate as the gauge it is reading, since the WGR views the gauge needle position.

4 Mounting the WGR

4.1 Final Preparation for Mounting

1) Prior to mounting the WGR, verify that you have the appropriate type and size mounting adapter for the gauge.
2) Determine if the gauge is a free-standing gauge or a panel mounted gauge, since this will determine the type of mounting adapters and mounting method required.
3) For a panel mounted gauges, there are a few options depending on the size and type of panel mounted gauge.
   a) For Magnehelic and Photohelic panel mounted gauges, a special adapter is provided to securely fasten to these gauges.
   b) For other panel mounted gauges, different adapters are provided that adhere to the panel surface around the circumference of the gauge.
4) For normal free-standing gauges, a standard WGR mounting adapter is all that is required.
   a) The fingers on the adapters are designed to flex outward no more than 0.040 inches [1 mm] across the diameter.
   (b) Outward flex beyond this amount is not very secure; Select a larger adapter, if this is the case.

1) Ensure the gauge face is clean
   a) Follow the instructions in Section 3.9 to ensure the gauge can be read properly
2) Monitor gauge needle.
   a) The goal is to get an idea of the actual gauge reading so it can be used as a reality check against the WGR reading after it has be calibrated.
   b) Once the WGR is mounted you must perform a Get Image to see what the gauge is actually reporting, but it is good to have a frame of reference by viewing the actual gauge beforehand.
   c) Record the current gauge reading.
3) Determine the needle dynamics.
   a) Does it seem stable? Is it moving slowly? Does it flutter?
   b) Take note of this, since this information can later be used later to verify that the WGR is reporting correctly.
4) Record gauge information: Units, Min/Max Value
   a) Once a WGR is mounted onto a gauge it may be difficult or impossible to see the entire gauge surface due to the camera's field of view.
   b) Record the information from the gauge face prior to mounting the WGR.
5) Cover up potentially troubling background writing.
   a) Sometimes writing or graphics on the gauge face may corrupt the image processing routine attempting to identify the needle position.
   b) For gauges with removable lens covers, it may be worth the effort to remove the gauge cover and use non-gloss white tape to cover up some of the background writing to ensure reliable WGR image processing and performance.

4.2 Mounting the WGR

4.2.1 Standard Free-Standing Gauge

1) A free standing gauge is one that is not installed into a panel, and has adequate spacing around its circumference to accommodate a standard WGR mounting adapter.
2) Loosen the stainless steel band clamp on the mounting adapter to make sure it is not prematurely compressing the adapter mounting fingers, and that it will not interfere with the initial installation steps.
3) Determine if silicone bands or “shims” will be required for the adapter to properly grasp the gauge.
   a) Better adhesion is obtained if at least one thin silicone band is used to mount to a free standing gauge.
   b) Some gauges have a very narrow lip around their face, and it is helpful to build up 1-3 silicone bands next to the lip to give the WGR adapter a wider surface to grasp securely.
      i) Refer to Figure 13 for an example of this situation.
4) Install the silicone shim bands onto the front edge of the gauge.
5) Slide the WGR with adapter onto the gauge so that the front edge of the mounting adapter overlaps approximately 3/8 inches (10 mm) of the gauge circumference.
   a) Do not push the WGR too far onto the gauge, since the field of view will not be correct, and the WGR standard mounting adapter fingers are designed to grasp the front portion of the gauge.
   b) If it is a tight fit, it helps to lever the WGR into place by first engaging the bottom lip of the WGR adapter, and then applying upward force to flex the fingers while sliding the top of the adapter over the gauge face.
6) Position the WGR as desired, typically with the LCD oriented perfectly horizontal for easy human readability.
   a) Make sure it is as straight as possible, to avoid additional calibration steps required later.
   b) The WGR does not need to be directly aligned with the direction of the gauge.
   c) For example, a gauge that is mounted at an angle can have a WGR mounted with the LCD horizontal, so that the display can be read easily.
7) Verify that the WGR is installed evenly on the gauge (perfectly parallel with the gauge face), by viewing and/or feeling the entire edge of the adapter to ensure an even overlap around the entire gauge circumference.
   a) This is important to provide a non-distorted image and a glare-free image.
8) Position the stainless steel band clamp even with the front edge of the WGR standard mounting adapter, and carefully tighten the clamp while holding the WGR in place.
   a) The recommended tightening torque for the band clamp is 130-150 oz-in [92-106 N-cm].

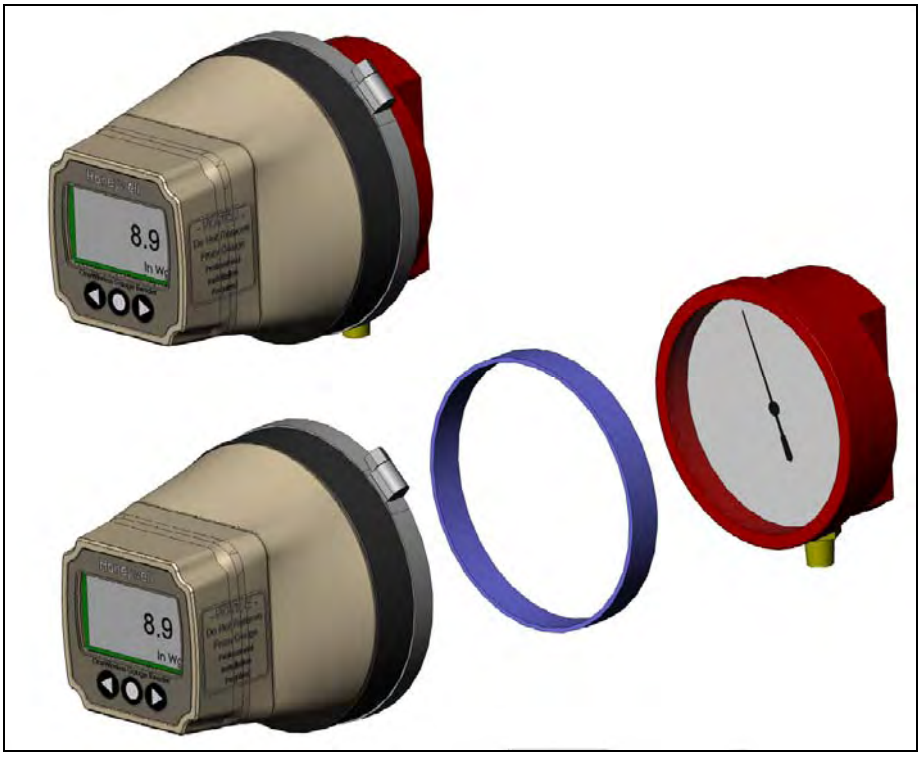

Figure 15 : Assembly of WGR with Shim Band onto Free-Standing Gauge

4.2.2 Panel Mount Gauge

1) Verify that you have the proper size panel mount adapter and standard WGR mounting adapter for the gauge.
   a) Hold the adapters up to the gauge to verify the size and clearance around the gauge.
2) Make sure that the panel surface is clean and smooth, and that there is enough available surface area for the adapter without interference from neighboring gauges or other objects.
   a) Generally an area of at least 5/8 inches (16 mm) wide is required around the gauge's outside circumference.
   b) Isopropyl alcohol is recommended to clean the panel surface prior to mounting the panel mount adapter.
      i) It is important to remove all dust, dirt, and grease from the surface to ensure reliable adhesion.
3) The next step is to fasten the panel mount adapter to the panel.
   a) Make sure that the WGR is not yet fastened to the panel mount adapter.
4) The panel mount adapter has two layers of 3M Dual-Lock fastener. One half is adhered to the panel mount adapter, and the other half will adhere to the panel with the integral VHB adhesive.
   a) Keep the two halves joined at all times during installation, in order to ensure proper alignment.
   b) Peel off the protective cover of the VHB adhesive, and carefully center the adapter over the gauge.
   c) Try to orient the small notch in the back of the panel mount adapter towards the bottom, in order to minimize the intrusion of dust or water from the bond.
   d) Then press the panel mount adapter to the panel so that the VHB contacts the surface.
   e) Continue applying strong and even pressure of 50 lbs (23 kg) for at least 20 seconds in order to form a good bond.
   f) If possible, it is recommended to allow the VHB adhesive 24-48 hours to cure at room temperature before any further mounting steps, in order to ensure a reliable bond.
5) The next step is to mate the WGR with its standard mounting adapter to the panel mount adapter's collar.
   a) No silicone bands should be used when fastening the WGR to a panel mount adapter.
6) Loosen the stainless steel band clamp on the WGR mounting adapter, and slide the adapter completely onto the collar of the panel mount adapter.
7) Orient the WGR carefully, and then tighten the band clamp to 130-150 oz-in [92-106 N-cm].
   a) The band clamp should be aligned even with the front edge of the WGR Adapter, as shown in Figure 16.

Figure 16 : Panel Mount Adapter Installation

4.2.3 Magnehelic and Photohelic Gauge

1) If the gauge is mounted in a panel, then the gauge will need to be loosened slightly from its current mount in order to provide room to fasten the mounting adapter to the font lip of the gauge.
2) Place one edge of the metal circular thread plate under the front flange of the gauge and then gently flex the plate into position under the gauge flange.
   a) Use caution to avoid deforming the circular thread plate.
   b) Make sure that the threaded studs are facing forward.
   c) If this is a panel mounted gauge, then re-tighten the gauge into it's panel mounting at this time, which will pinch the circular thread plate between the gauge flange and the panel.
3) Place the black plastic collar over the 4 threaded studs, and secure the 4 lock nuts.
   a) Torque the nuts to 4-20 oz-in [3-14N-cm] above running torque.
   b) Be careful not to over-tighten the nuts causing the adapter to flex.
4) Loosen the stainless steel band clamp on the standard mounting adapter, and slide the adapter over the black collar.
   a) No silicone bands should be used when fastening the adapter to the collar.
5) Orient the WGR carefully, and then tighten the band clamp to 130-150 oz-in [92-106 N-cm].
   a) The band clamp should be aligned even with the front edge of the WGR Adapter, as shown in Figure 17.

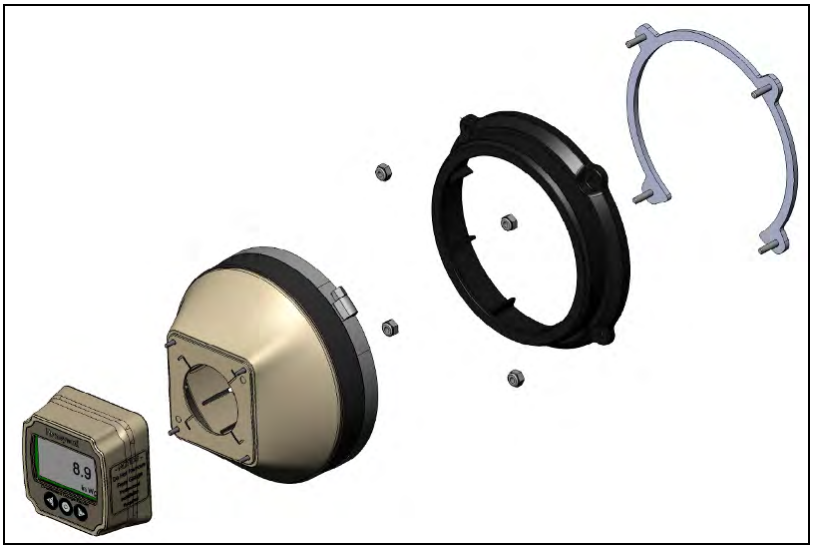

Figure 17 : Installation of a Magnehelic or Photohelic Gauge

4.2.4 Process Gauge

1) Many 4 inch Process Gauges require a special adapter since they have sloped surfaces along their circumference, which makes it impossible to use a standard WGR mounting adapter.
2) The metal thread plate is designed to fit against the back of the various brands of process gauges, even for gauges that are back-mounted.
3) Position the black plastic collar over the front of the gauge, and insert the long screws provided so that it mates with the rear metal mounting plate.
   a) Tighten the screws in a gradual crisscross pattern.
   b) Torque the screws to 2.5 oz-in [2-4 N-cm] above running torque
   c) Be careful not to over-tighten the screws causing the adapter to flex
4) Loosen the stainless steel band clamp on the standard mounting adapter, and slide the adapter over the black collar.
   a) No silicone bands should be used when fastening the adapter to the collar.
5) Orient the WGR carefully, and then tighten the band clamp to 130-150 oz-in [92-106 N-cm].
   a) The band clamp should be aligned even with the front edge of the WGR Adapter, as shown in Figure 18 and Figure 19.

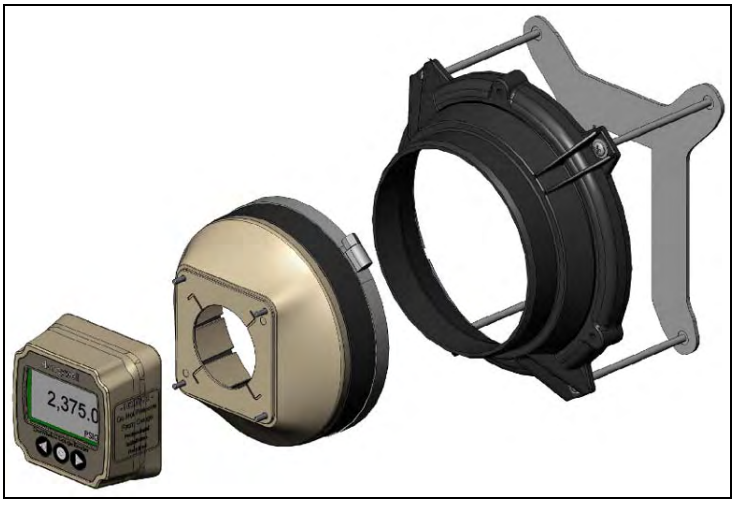

Figure 18 : Installation of a Process Gauge

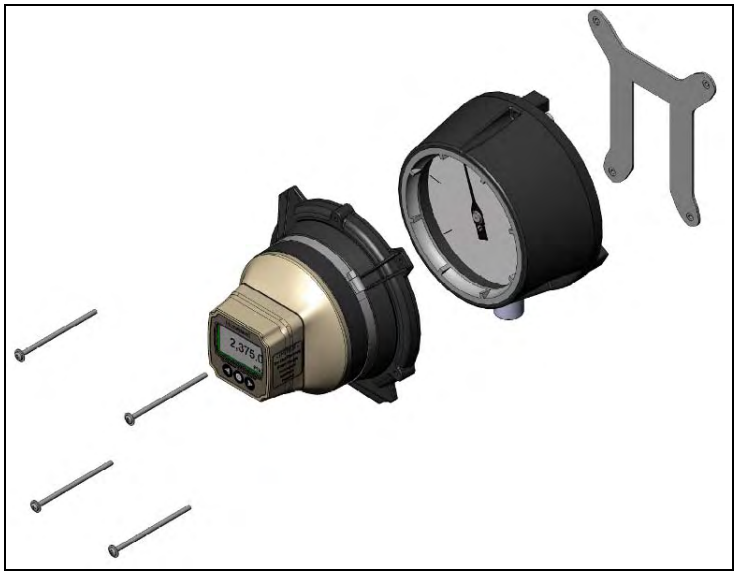

Figure 19 : Installation of a Process Gauge Adapter

5 WGR Application Gateway Installation

1) Application Gateway location selection
   a) The WGR Application Gateway will need to be located in a climate controlled room, preferably where other servers are housed.
   b) The Application Gateway can be mounted on the wall with an optional wall mounting bracket shown in Figure 20, or it can be placed on a sturdy horizontal surface.
2) The Application Gateway will need access to a power outlet and an Ethernet connection.
3) The WGR Application Gateway (WGRAG) requires a static IP Address assignment from the IT department, so that the Application Gateway can be easily accessed by both the WGRs and by any clients retrieving data from the Application Gateway.
4) The unit has two Ethernet ports.
   a) The top port is configured as a Static IP port, with a default IP address of 192.168.254.1, and is intended to be connected to the customer LAN.
   b) The bottom port is configured for DHCP, and is only intended to be used for connecting a laptop during installation or for diagnostics.
5) The WGRAG can optionally be connected to an uninterruptable power source (UPS) in order to ensure that there is no loss or corruption of data in the event of a facilities power outage.
6) To install the optional WGR wall mounting bracket, hold the bracket against the wall, and install one screw into one of the four diagonal slots.
   a) Make sure that the spring clip is facing upwards
   b) Then use a level to align the bracket before installing the remaining three screws in the other diagonal slots.
   c) Hold the Application Gateway with the bottom of the Application Gateway facing the bracket, and align the four studs through the four slotted holes on the bottom of the Application Gateway.
   d) Slide the Application Gateway downward until the spring clip locks it in place.

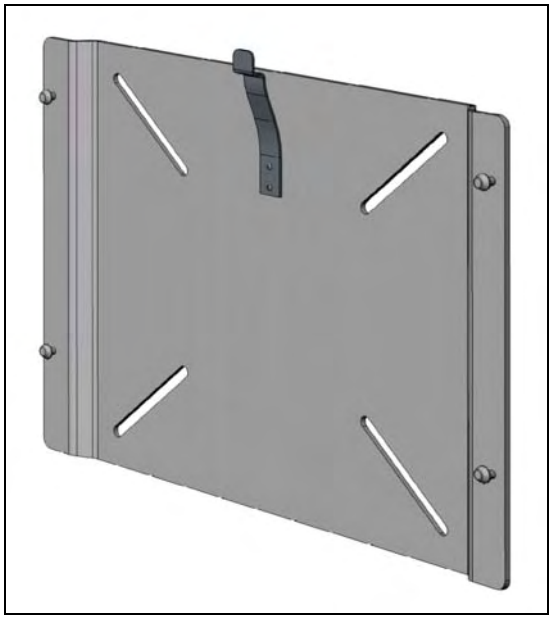

Figure 20 : WGR Application Gateway Wall Mount Bracket

6 WGR Application Gateway Setup

6.1 Network Connection

1) Connect the WGR Application Gateway to the network.
   a) On the back of the gateway, there are two Ethernet ports.
      i) The top port is configured with a static IP address (**192.168.254.1** by default), and should be connected to the customer's LAN.
      ii) The bottom port is configured for DHCP, and should be used only for connecting directly to a laptop during installation or diagnostics.
   b) The host name of each WGRAG has the following format: "**WGRAGxxxx**", where xxxx is a serialized number (such as "**WGRAG1234**").
      i) The unique host name of each WGRAG is printed on a label on the bottom of the machine.
      ii) This host name can not be changed, since several software components and licenses are dependent on the assigned host name.
2) For connection and configuration with the Honeywell OneWireless Multinode, please refer to the Multinode User Manual. Also refer to the "OPC Server" section of this user manual.
3) Connect the power cord to the WGR Application Gateway.
4) To turn the unit on, simply press the power rocker switch on the back.
5) The machine automatically launches all of the appropriate services.
   a) The machine will also auto-boot and resume functionality in the event of a power failure.

6.2 Configuring Advanced Settings

1) There are some cases which require access to the Windows XP™ desktop of the WGR Application Gateway
   a) Examples include:
      i) Changing the default static IP Address of the machine
      ii) Changing passwords used by the machine
      iii) Configuring network time synchronization (NTP)
2) The desktop of the computer can be accessed using a virtual desktop access method (described in the sections below) by connecting to the machine over the network, or by creating a peer-to-peer network.
   a) This is only necessary if advanced settings of the WGR Application Gateway need to be modified from their default values.
   b) If the settings need to be changed before connecting to the customer network, then a peer-to-peer connection should be created, which is described below.

6.2.1 Creating a Temporarily Peer-to Peer Connection

Follow these instructions only if advanced settings on the WGR Application Gateway need to be changed from their default values prior to connecting the WGRAG to the LAN (for example, when changing the static IP Address of the WGRAG).

1) Establish a temporary network by plugging an Ethernet cable directly between a laptop and the bottom port of the WGR Application Gateway.
   a) For modern laptops, it is not required to use a cross-over Ethernet cable, since the port will auto-detect the proper connection
2) Make sure the Laptop is configured for receiving a dynamic IP Address (DHCP)

3) Most modern versions of Microsoft Windows™ operating systems support “Automatic Private IP Addressing” (APIPA)
   a) This feature allows machines to assign themselves temporary IP addresses in order to support basic network connectivity when no DHCP server can be found.
   b) This feature will be used automatically to establish a connection between the laptop and the WGRAG.
   c) This automatic connection process typically requires 30-60 seconds to complete
4) After the connection has been established, the remaining advanced setup tasks described in this section can be performed.

6.2.2 Virtual Desktop Access

Follow these instructions only if advanced settings on the WGR Application Gateway need to be changed from their default values.

1) Open a web browser on the laptop, and enter the WGRAG’s host name (which is printed on a label on the bottom of each machine) followed by “:5800” into the web browser address field, such as **http://WGRAG1234:5800/**
2) The browser may display the warning message shown in Figure 21. This message indicates that a Java application will be run on the Laptop in order to access the virtual desktop functionality of the WGR Application Gateway. Click Run to accept.

Figure 21 : VncViewer Warning Message

3) Then enter the password to log onto the machine.
   a) The default password is “**systems”**
4) The Windows™ login screen of the WGR Application Gateway should then be visible.
5) Log on to the “WGRAG” account with the default password **“systems”**
6) The Windows desktop should now be visible

6.2.3 Changing the Static IP Address

Follow these instructions to optionally change the static IP address of the top Ethernet port of the WGR Application Gateway. This should only be required if the customer IT department requests a different address from the default address of **192.168.254.1**. Note that the server’s Static IP address needs to be edited in two places.

1) After accessing the virtual desktop, right-click on My Network Places, and select Properties.
   a) To configure the Static IP address of the top Ethernet port, right-click on the “Local Area Connection” and select Properties.
   b) To configure the bottom Ethernet port, click on “Local Area Connection 2” instead.
2) The select “Internet Protocol (TCP/IP)” and click Properties.
3) Modify the Static IP address as desired and click OK.
4) You must also change the Static IP address entered into the “Admin” page of the Web Application to match the new Static IP address assigned to the top Ethernet port.

6.2.4 Changing the default passwords

Follow these instructions to optionally change the default passwords used to access the WGR Application Gateway. This is only required if new passwords are desired for security reasons.

1) In order to change the Windows account password:
   a) After accessing the virtual desktop, then click on the Start menu and select “Control Panel”
   b) Then select “User Accounts”
   c) Then select “Change An Account”
   d) The select the “WGRAG” account”
   e) Then select “Change my password”
   f) Enter a new password for the account
2) In order to change the virtual desktop access (UltraVNC) password:
   a) After accessing the virtual desktop, then right-click on the UltraVNC icon in the taskbar, and select “Admin Properties”
      i) Refer to Figure 22.

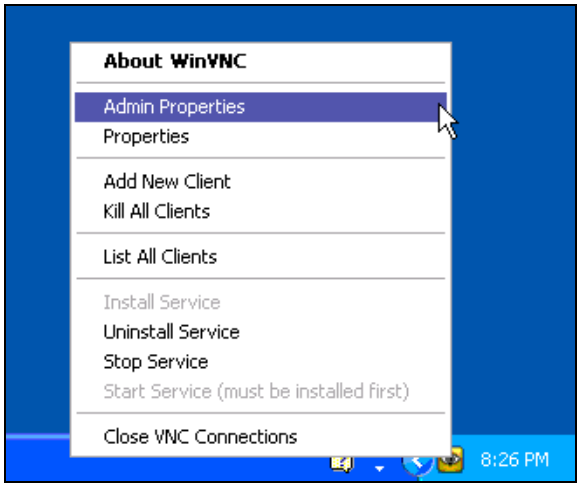

Figure 22 : Configure UltraVNC Password

   b) When the Admin Properties Page appears, enter a new password and click OK.
   c) Another dialog titled “Run As” may appear after this process. Simply click OK to retain the default settings.
   d) The WGR Application Gateway must now be restarted in order for the new password to take effect.
   e) Select “Turn off Computer” from the Start menu, and select “Restart”.
   f) The virtual desktop connection will then be lost.

6.2.5 Configuring Network Time Synchronization Protocol (NTP)

1) Refer to the following document for detailed information about configuring network time synchronization:
   a) "Getting Started with Honeywell OneWireless OW-CDX010"
2) Install and execute the Honeywell Utility "NTPSetup.exe" on the WGR Application Gateway in order to configure the desired settings for the time source for the machine.
   a) A USB flash drive may be used along with the UltraVNC remote desktop control procedure to transfer and install files onto the WGR Application Gateway.

Follow the instructions in the Getting Started document to complete the setup appropriate for the specific network topology used in the customer facility.

6.3 Administration Page

There is a special web page on the Application Gateway Web Application that provides additional setup and diagnostic capabilities to the installer.

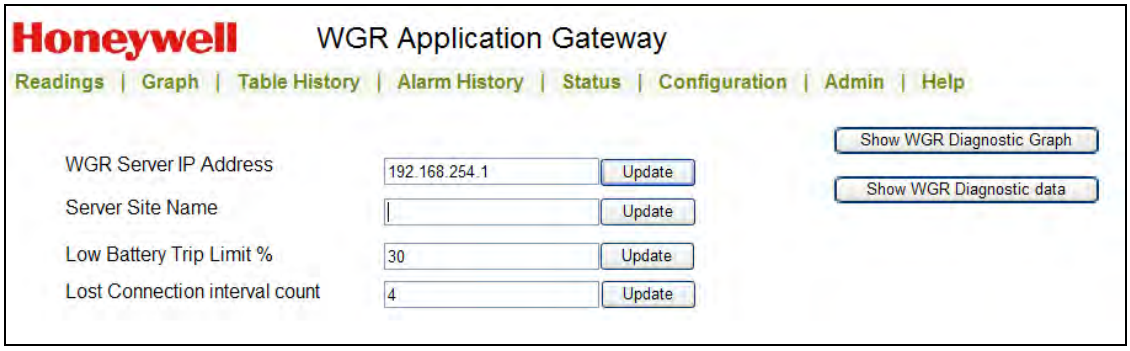

Figure 23 : Admin Web Page

1) Launch a web browser on a client machine, and enter the IP Address of the Application Gateway.
2) Click on the Admin button in the web page toolbar to access the Admin page.
   a) You must log in with user = admin, password = wgradmin.
3) The WGR Server IP Address must match the configuration of the top Ethernet port of the Application Gateway machine.
4) The Site Name can be customized
   a) This is the banner text displayed on the top of each web page).
5) The trip limit (%) of the low batter detection feature can be adjusted.
6) The Lost Connection Interval count can be adjusted. This is the number of sample intervals used to determine if a connection has been lost with a WGR.
7) The Diagnostic Graph button on the right will provide a special graph that is useful for monitoring wireless connectivity.
   a) It graphs time on the X-axis, and Node ID on the Y-axis.
   b) It is a clean and convenient method to evaluate the wireless performance of several nodes in one graph.
8) The Diagnostic Data button on the right provides a special table that is useful for saving and sending detailed information to support personnel.
   a) The table includes all relevant data for each node selected.
   b) The table can be saved to an Excel file.

6.4 OPC Connectivity

The WGR Application Gateway provides an OPC DA Server. Please refer to the OPC section of the Honeywell Document: “Getting Started with Honeywell OneWireless OW-CDX010” for detailed information about OPC access. This section contains only some general guidelines to help establish the OPC connection.

6.4.1 Set up the WGR Application Gateway

1) Make sure that the physical network between the Experion server and WGR Application Gateway is established, and they are on the same subnet.
2) Create a "mngr" user account on the WGR Application Gateway.
    a) Make sure the account has the same credentials as on the Experion
    b) Go to User Accounts in the control panel in order to create the account.
3) On the Application Gateway, select “Run” from the start menu and enter "dcomcnfg" to start the DCOM configuration utility.
    a) Open Component services->Computers->My Computer->DCOM Config.
    b) Under DCOM config, select WGR OPC server and right click on it to access properties.
    c) In the properties window, go to the security tab and customize all the three security options to add the new mngr account and select the check boxes to allow appropriate permissions for the mngr account.
    d) Reboot the WGRAG after making these changes.

6.4.2 Set up the OPC Client

Here are some general guidelines for the Experion OPC client settings:

1) Using Quick Builder, configure a channel by providing a system progID and local host name of the WGR OPC server and download this channel to the Experion server after configuration.
2) Using Quick Builder, build all of the required points (same as the parameters on the OPC server).
    a) Use the source address that is shown on the OPC client.
3) Once the points are built, log on to the Experion station with mngr account.
4) In the command tab in the top left corner, enter the item name (this is name assigned when points are built) and then press F12.
5) At this point, you should see a screen with the current value for that WGR parameter.

7 Honeywell One Wireless Multinode Security settings

7.1 Security settings

The OneWireless Gauge reader is designed to communicate with a OneWireless Multinode. There are two security key settings for the Multinode that support communications with the OneWireless Gauge Reader:

7.1.1 802.11i (WPA2) – AES Pairwise Key and AES Group Key

7.1.2 WPA – TKIP Pairwise Key and TKIP Group Key

8 Configuration Tool Overview

This section will introduce the Configuration Tool application that performs the configuration functions. The WGR Configuration Tool is defined as a handheld device listed below with WGR Configuration Software. The application program can run on most Windows Mobile 5.0 and 6.0 devices. The devices that are specifically supported include the following Honeywell handheld devices:

- HP iPAQ hx2490, hx2490b, hx2490c, hx2495
- MC Toolkit (MCT202)

8.1 Installing the Configuration Tool Software

The application program used to configure the WGR must first be installed onto the handheld device. The application installation file is distributed on the media provided, and is called: WGR_Config.CAB. In order to install the file:

1) Connect your handheld device to a PC or laptop
2) Make sure that the computer has Microsoft ActiveSync installed
   a) If it is not already installed, then you must first install this program.
   b) It is included on the media provided.
   c) Launch the ActiveSync installer, and follow the step by step instructions.
3) Connect your handheld device to the PC or Laptop using a USB cable.
4) Turn on your handheld device.
5) ActiveSync should recognize that you have connected a handheld.
   a) You may cancel any initial windows that ActiveSync displays after connecting your device.
6) On your PC, using Windows File Explorer, you should be able to locate a new virtual drive under “My Computer” called “Mobile Device.”
7) Copy the WGR_Config.CAB file from the installation media to any desired folder on the Mobile Device.
8) Then, on the Handheld, open File Explorer, and navigate to the same folder location.
9) Tap the stylus on the WGR_Config.CAB file, and it will launch the installer.
10) After the installer is finished on the handheld, you can then copy the shortcut to the WGR Configuration Application to the Start Menu folder under the Windows directory.
11) You may then launch the WGR Configuration Application from the Windows Start Menu as shown in Figure 24 .

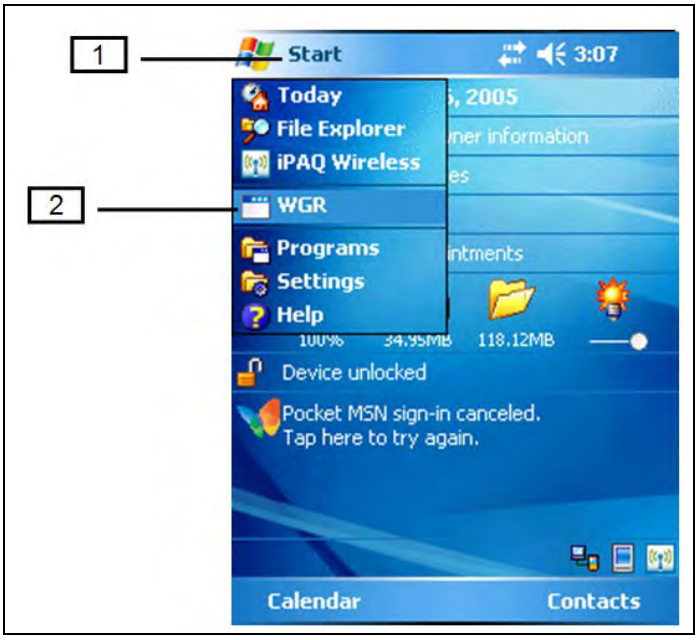

Figure 24 : Windows Desktop on Handheld Device

1. **Windows Start:** Tap the Start Icon with the stylus to access the WGR Configuration Tool.

2. **Configuration Tool Application:** This is the shortcut to the Configuration Tool. Tap on WGR with the stylus to launch the application.

8.2 Basic Handheld Settings

Before launching the WGR Configuration Application, there are additional steps that should be taken to ensure that the handheld device is properly set up to work with the WGR.

8.2.1 Handheld Wireless Setup

From the Handheld Windows Desktop, click on the Wireless icon in the lower right of the desktop. Refer to Figure 25. Then click on the Wi-Fi circular button in the Wireless Control Panel window to enable the Wi-Fi radio in the Handheld.

Figure 25 : Accessing the Wireless Control Panel

Click on the Settings button to configure the Wi-Fi radio for either an Ad Hoc connection, or an Infrastructure Connection (advanced users only).

Figure 26 : Wi-Fi Settings for Ad Hoc Mode

For Ad Hoc configuration, select the option called “Only computer-to-computer” under the “Networks to access” field on the Settings page.

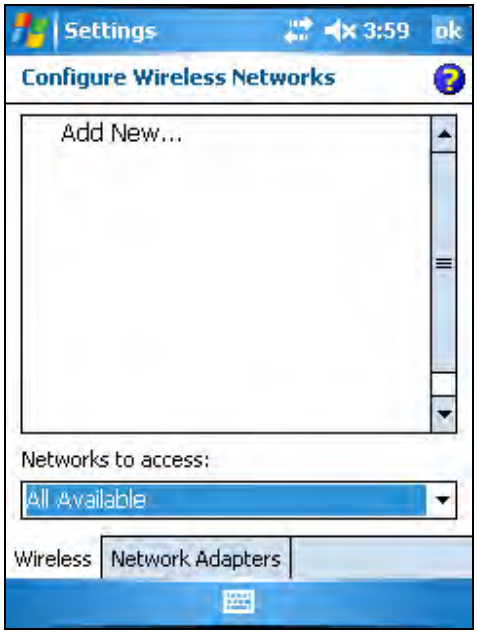

Figure 27 : Wi-Fi Settings for Infrastructure Mode (Advanced Users Only)

For Infrastructure mode, select the “All Available” option in the “Networks to access” field on the Wireless Settings page.

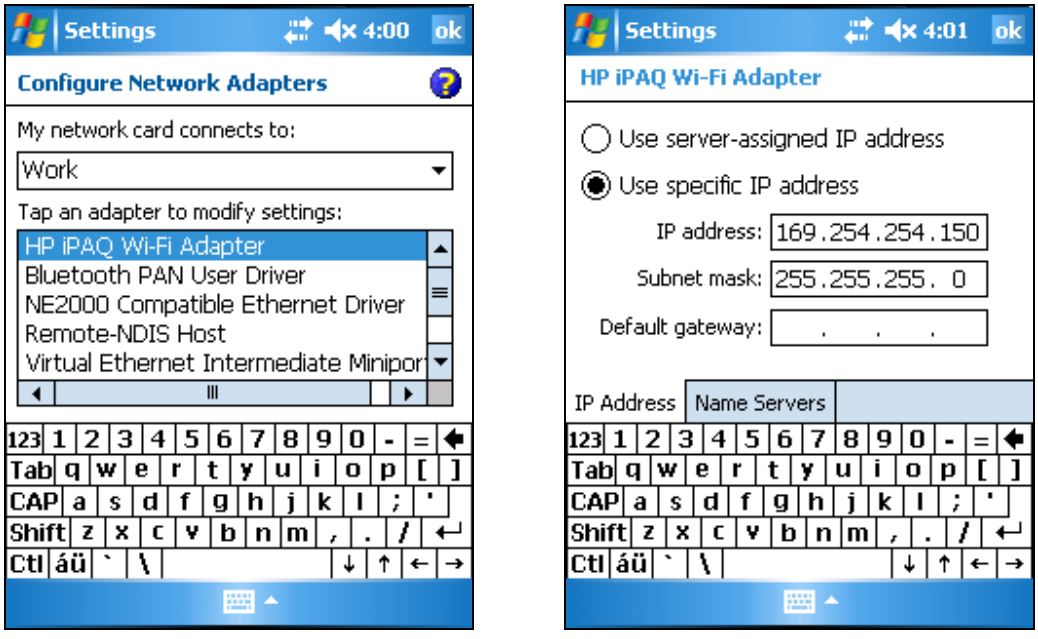

Figure 28 : IP Address Selection for Infrastructure Mode

The IP Address mode for the Handheld can then be specified in the “Network Adapters” tab. Select either server-assigned or static IP for the Handheld depending on the customer’s network architecture.

8.2.2 Handheld Notifications Setup

In order to eliminate some annoying pop-up messages every time a Wi-Fi network is detected, you can customize the notification preferences. Go to the Handheld Settings window (accessible from the Start Menu). Select “Sounds and Notifications.” Then, click on the “Notifications” tab. Select “Wireless network detected” from the bottom of the pull-down list. Then clear all of the check-boxes to avoid receiving interrupting notifications about all new wireless networks detected.

Figure 29 : Disable Wireless Network Detection Notifications

8.3 Home Page

The Home Page is viewed after the program is launched. It is used to establish a connection with a WGR.

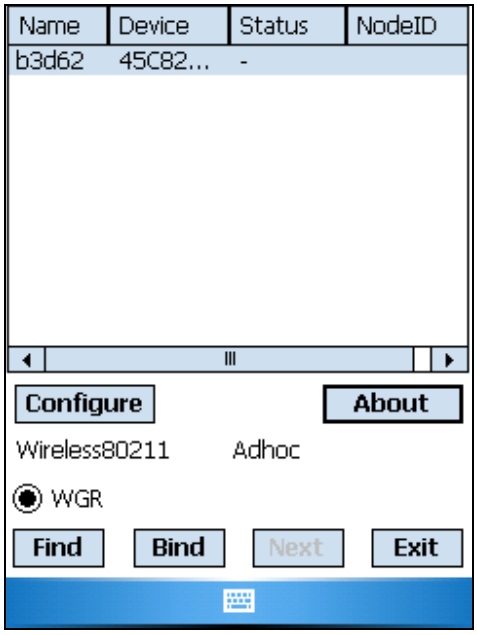

Figure 30 : Home Screen

1. **Name Column:** This column contains a code name for the WGR, which is the WGR's session key (described later).
2. **Device Column**: This column contains an ID of the WGR, depending on the communication mode.
3. **Status Column:** This column shows the connection status between the WGR and the Configuration Tool.
    - o "-" → Configuration Tool cannot detect WGR
    - o "Bound" → Configuration Tool and WGR are connected
4. **Device Selection**: Select the device by clicking on the row.
5. **Configure Comm Button**: Clicking on this button will launch a dialog that will allow the user to select the desired communication mode between the Configuration Tool and the WGR. The currently selected mode is displayed to the right of the button.
6. **About Button:** This opens a dialog box that displays the version number of the Configuration Tool Application Software.
7. **Find Button**: The Configuration Tool will open a dialog to enter additional data in order to locate the desired WGR.
8. **Bind/Finish Button**: Bind is used to connect the Configuration Tool to the highlighted WGR in the Device Name column. After binding to a WGR, the button changes to "Finish". Click on Finish to terminate the connection between the Configuration Tool and WGR. Use this button when you have completed configuration and want the WGR to save all the settings. The WGR will not save its configuration settings if the connection is terminated any other way.
9. **Next Button**: Navigates to the main set of window tabs used to perform the detailed configuration steps.
10. **Exit Button**: Exits the WGR Configuration Tool application program.

8.4 Configure Comm Dialog

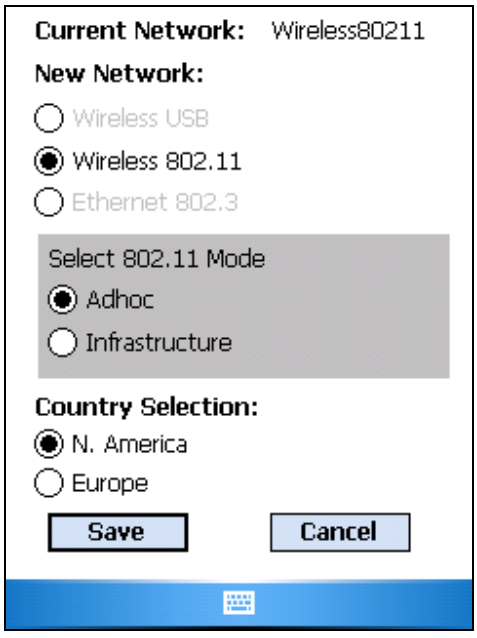

Figure 31 : Configure Comm Dialog

The Configure Comm dialog can be opened by clicking on the "Configure Comm" button on the home screen.

1. **Current Network:** Displays the currently selected communication interface for the Configuration Tool.
2. **New Network:** Select a new desired communication mode, based on the available options. Depending on the specific Configuration Tool being used, not all communication modes may be available.
3. **Select 802.11 Mode:** When selecting 802.11 Network mode, you must also select between Ad-Hoc and Infrastructure mode.
    a. **Ad-Hoc:** Ad-Hoc mode is the required mode to use when first commissioning a WGR, and is also the most common mode to use for further configuration updates to the WGR after commissioning. Ad-Hoc creates a peer-to-peer connection between the Configuration Tool and the WGR.
    b. **Infrastructure:** Infrastructure mode allows you to communicate to the WGR through the 802.11 infrastructure network, so that you can access the WGR from other areas of the facility. This is a more advanced mode, and can only be used after the WGR has already been commissioned.
4. **Country Selection:** Specify the geographic region where the WGRs are being installed, so that the WGR can be tailored to specific requirements for that region.
5. **Save Button:** Click Save to accept the selected options.
6. **Cancel Button:** Click Cancel to return to the previously selected options.

8.5 Ad-Hoc Find Dialog

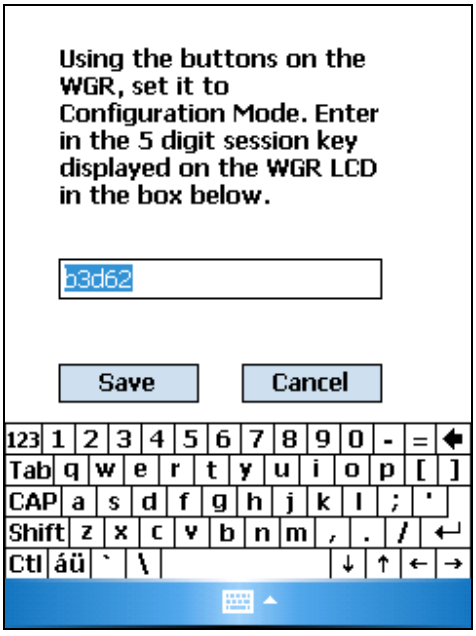

Figure 32 : Ad-Hoc Find Dialog

The *Ad-Hoc Find* dialog appears when an *Ad-Hoc Wi-Fi* connection mode is selected, and then the *Find* button is pressed on the home screen.

1. **Session Key:** Enter the 5-digit session key into this text box that is displayed on the WGR LCD. This session key is used as a seed to establish a secure communication link between the Configuration Tool and the WGR.
2. **Save:** Click Save to accept the new session key.
3. **Cancel:** Click Cancel to ignore the new session key.

8.6 Infrastructure Find Dialog

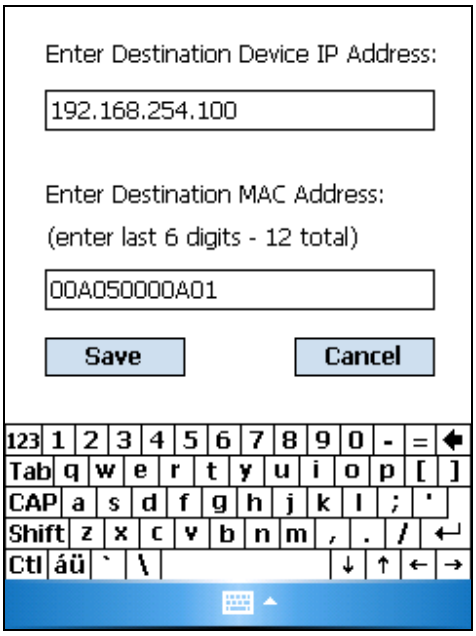

Figure 33 : Infrastructure Find Dialog

The *Infrastructure-Hoc Find* dialog appears when an *Infrastructure Wi-Fi* connection mode is selected, and then the *Find* button is pressed on the home screen.

1. **Destination IP Address:** Enter the IP address of the target WGR (the WGR must already be commissioned).
2. **Destination MAC Address:** Enter the last 6 digits of the MAC address of the target WGR.
3. **Save:** Click Save to accept the changes.
4. **Cancel:** Click Cancel to ignore the changes to the address entries.

8.7 Setup Tab

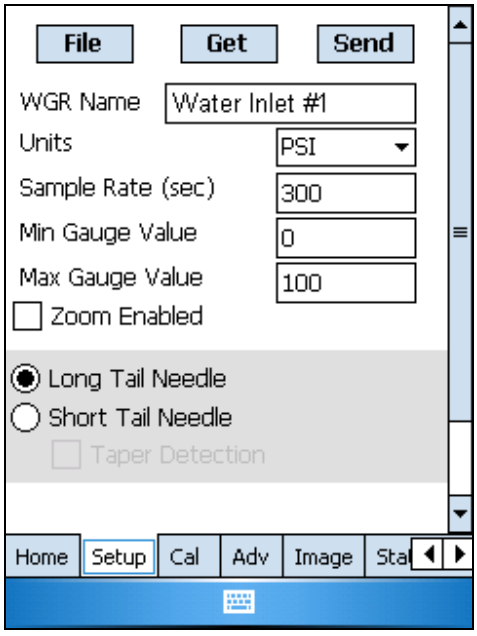

Figure 34 : Setup Tab

1. **File**: Opens a dialog box allowing the user to load or save ALL of the current configuration parameters to a file on the Configuration Tool.
2. **Get**: Requests all parameters from the WGR and fills them into the Configuration Tool fields.
3. **Send**: Sends all current parameters from the Configuration Tool to the WGR. Remember that the parameters are not permanently saved on the WGR until you select Finish on the Home screen after you are satisfied with all of the settings.
4. **Units**: Pull-down menu to select the units of data the gauge represents.
5. **Sample Rate (sec)**: The time in seconds between samples when the WGR is in Normal Sample Mode.
6. **Min Gauge Value**: Minimum value on the gauge scale.
7. **Max Gauge Value**: Maximum value on the gauge scale.
8. **Zoom Enable**: The camera will capture the image with a 2x zoom.
9. **Long-Tail Needle**: Specifies the type of gauge needle as a long-tail version.
10. **Short-Tail Needle**: Specifies the type of gauge needle as a short-tail version.
11. **Taper Detection**: Enables needle taper detection in addition to using the short-tail needle method.

8.8 Cal (Calibration) Tab

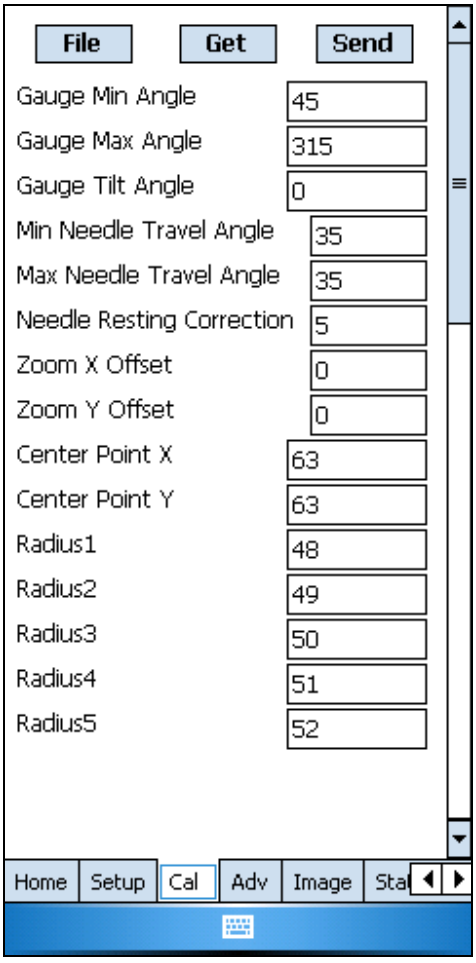

Figure 35 : Cal (Calibration) Tab

1. **File**: This will open a dialog allowing the user to load or save ALL of the current configuration parameters to a file on the Configuration Tool.
2. **Get**: This will request all parameters from the WGR and fill them in the Configuration Tool.
3. **Send**: This will send all current parameters from the Configuration Tool to the WGR.
4. **Gauge Min Angle:** Angle, with respect to Gauge Bottom, at which the Minimum Gauge Value resides.
5. **Gauge Max Angle:** Angle, with respect to Gauge Bottom, at which the Maximum Gauge Value resides.
6. **Gauge Tilt Angle:** The angle between the WGR and Gauge Bottom. Example: -30 means that the gauge face is tilted 30 degrees counterclockwise. +30 means that the gauge face is tilted 30 degrees clockwise.
7. **Min Needle Travel Angle:** For the WGR, this is the angle (with respect to Gauge Bottom) at which the gauge value will switch from Maximum to Minimum or vise versa. Must be between Gauge Min and Max Angle. This value has a different meaning for the Magnehelic version of the WGR. Refer to the Magnehelic section of this manual for more information.
8. **Max Needle Travel Angle:** For normal gauges where the needle rotates about the center of the gauge face, set this to the same angle as the Min Needle Travel Angle. This value has a different meaning for the Magnehelic version of the WGR. Refer to the Magnehelic section of this manual for more information.

9. **Needle Resting Correction:** Offset angle from Gauge Min Angle where the value will always read the Min Gauge Value. If the needle is between the Gauge Min Angle and Gauge Min Angle + Needle Rest Corr, the value will read Minimum.
10. **Center Point X:** Defines the center of the needle axis in the X direction. The concentric circles are centered at this X location.
11. **Center Point Y:** Defines the Y dimension center of the needle axis.
12. **Radius 1:** Innermost circle radius.
13. **Radius 2:** Circle 2 radius.
14. **Radius 3:** Circle 3 radius.
15. **Radius 4:** Circle 4 radius.
16. **Radius 5:** Outermost circle radius.

8.9 Advanced Settings Tab

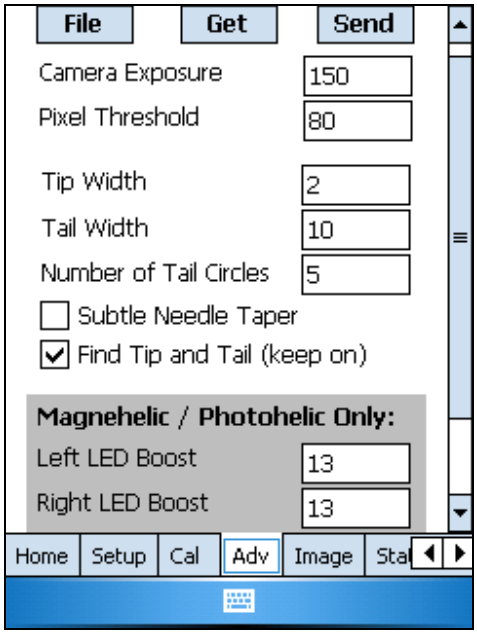

Figure 36 : Adv (Advanced Settings) Tab

1. **File**: This will open a dialog allowing the user to load or save ALL of the current configuration parameters to a file on the Configuration Tool.
2. **Get**: This will request all parameters from the WGR and fill them in the Configuration Tool.
3. **Send**: This will send all current parameters from the Configuration Tool to the WGR.
4. **Camera Exposure:** Adjusts the brightness of the image. The larger the number the brighter the image.
5. **Pixel Threshold:** Defines the sensitivity of dark pixels stored. Decreasing the Pixel Threshold will increase the number of pixels picked up. Increasing the Pixel Threshold will decrease the number of pixels picked up.
6. **Tip Width:** The approximate needle tip width in pixels.
7. **Tail Width:** The approximate needle tail width in pixels.
8. **Number of Tail Circles:** For the short-tail needle method only, this specifies how many of the five circles intersect the tail.
9. **Subtle Needle Taper:** Specifies a needle with a very slight taper, which will modify the behavior of the algorithm.
10. **Left LED Boost:** (For Magnehelic/Photohelic gauges only.) Specifies brightness for the left LED. This is used to balance the brightness of the two halves of the image, to provide a clean image for processing.
11. **Right LED Boost:** (For Magnehelic/Photohelic gauges only.) Specifies brightness for the right LED.

8.10 Gauge Image Tab

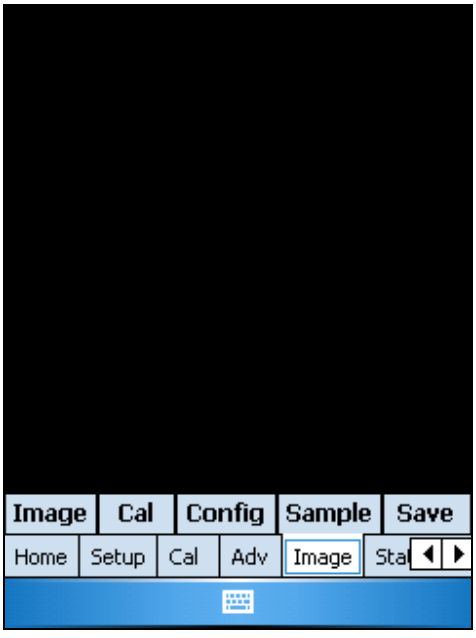

Figure 37 : Image Tab (Prior to Image Capture)

1. **Image** (Capture Image): Requests an image capture from the WGR and displays it on the screen.
2. **Cal** (Image Calibration): Initiates the step by step image calibration for defining the gauge center and the image processing circles.
3. **Config:** Opens an option dialog allowing the installer to determine what graphical guidelines are displayed in the screen.
4. **Sample:** Requests that the WGR perform its normal sampling routine using the last set of parameters sent to it, in order to verify proper system calibration and operation.
5. **Save:** This will allow the user to save the gauge image to a file.

8.11 Config Dialog

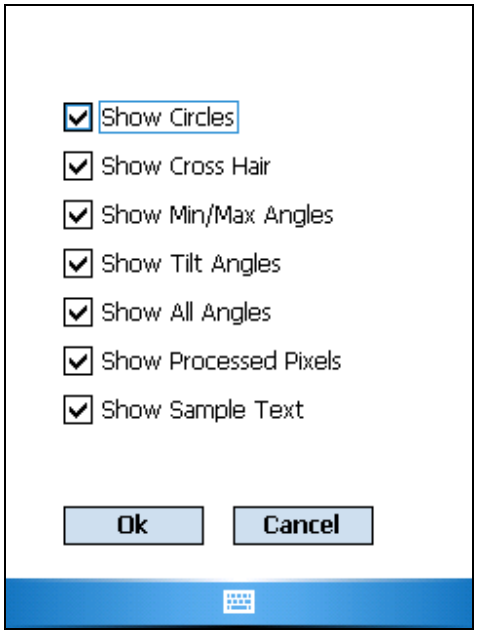

Figure 38 : Image Config Tab

1. **Show Circles:** Enables the display of the image processing circles on the gauge image display .
2. **Show Cross Hair:** Enables the display of the center cross-hair on the gauge image.
3. **Show Min/Max Angles:** Enables the display of the min/max angle vectors on the gauge image.
4. **Show Tilt Angles:** Enables the display of the Tilt Angle vector on the gauge image.
5. **Show All Angles:** Enables the display of all angle vectors on the gauge image.
6. **Show Processed Pixels:** Enables the display of green and red pixels to indicate the pixels that were selected for processing based on their location and intensity.
7. **Show Sample Text:** Enables the display of the sample reading value in the upper left of the screen, and any error code detected in the upper right of the screen.

8.12 Status Tab

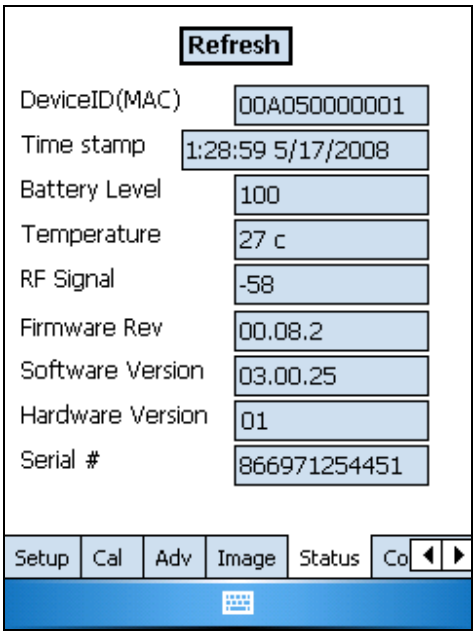

Figure 39 : Status Tab

1. **Refresh:** Requests an updated set of status data from the WGR.
2. **Device ID (MAC):** MAC address of the WGR.
3. **Time Stamp:** The time and date when the last Sample was captured with the Configuration Tool.
4. **Battery Level:** Approximate percentage of battery life remaining.
5. **Temperature**: Internal temperature of the WGR.
6. **RF Signal:** Signal strength received by the WGR from the Access Point (dBm units).
7. **Firmware Rev:** Version number of the embedded software loaded into the WGR.
8. **Software Version**: Version number of the Configuration Tool Software.
9. **Hardware Version:** Version number of the internal WGR electronic hardware.
10. **Serial Number:** Serial number of the WGR.

8.13 Conn (Connection Setup) Tab

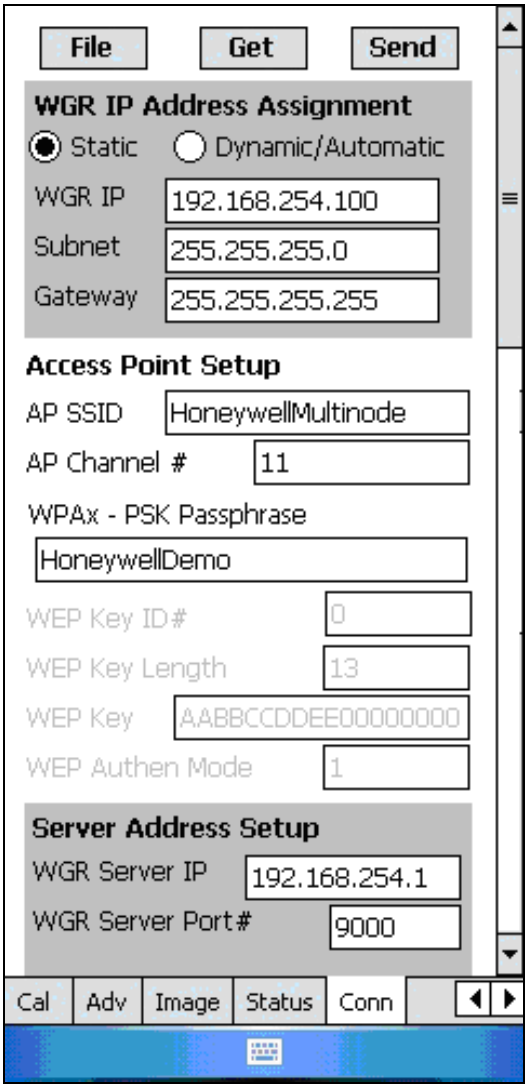

Figure 40 : Conn (Connections) Tab

1. **File**: This will open a dialog allowing the user to load or save ALL of the current configuration parameters to a file on the Configuration Tool.
2. **Get**: This will request all parameters from the WGR and fill them in the Configuration Tool.
3. **Send**: This will send all current parameters from the Configuration Tool to the WGR.

WGR IP Address Assignment

4. **Static:** Specifies that the installer will assign a fixed IP address to this WGR.
    a. **WGR IP:** Fill in the WGR IP box with the static IP address.
    b. **Subnet:** Fill in this box with the Subnet Mask.
    c. **Gateway**: Fill in the IP address of the network Gateway.
5. **Dynamic / Automatic:** Specifies that the WGR's IP address will be assigned automatically by the network. Do not fill in any of the three boxes in this section.

Access Point Setup

6. **AP SSID:** (Access Point Service Set Identifier). Enter the SSID of the network that the WGR will join.
7. **AP Channel #:** Specify the 802.11 channel number used by the Access Point.
8. **WPAx-PSK Passphrase:** Enter the security passphrase for the 802.11 network.

Application Gateway Address Setup

9. **WGR Application Gateway IP:** Enter the IP address of the WGR Application Gateway.
10. **Subnet Mask:** Enter the subnet mask for the WGR Application Gateway.
11. **WGR Application Gateway Port#:** Enter the Application Gateway port# for UDP traffic.

9 WGR Configuration Concepts

Certain configuration settings require a deeper understanding of how the WGR works. This section contains descriptions of several WGR concepts and how to set related parameters.

9.1 Defining the Gauge Angles

Related Parameters:

- *Gauge Min Angle*
- *Gauge Max Angle*
- *Gauge Tilt Angle*
- *Min/Max Needle Travel Angle*
- *Needle Resting Correction*

The WGR is designed to read many different types of gauges. Gauge features such as minimum value, start angle, units, etc. vary from one another. You must configure the WGR to work with a specific gauge.

The following gauge characteristics do not depend on how the WGR is mounted on a gauge. These parameters could be set prior to mounting a WGR. However, for each WGR you must know which gauge it will be mounted on and the specific characteristics of the gauge.

All angles are defined with respect to the gauge face. A vertical line cutting down the center of a gauge when the gauge is right side up for a human to read defines the 0° and 180° markers. See the Red Line below. All angles start from 0° and turn clockwise to 359°.

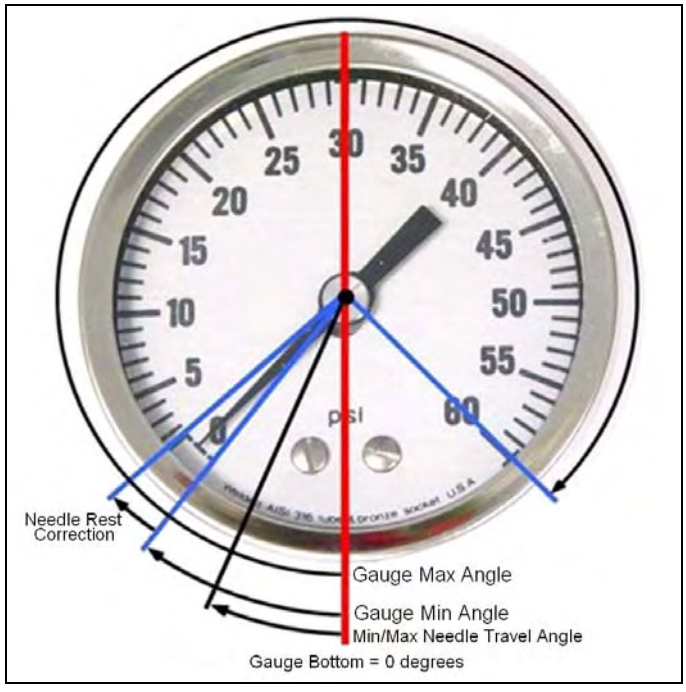

Figure 41 : Gauge Angles

Often a gauge is installed at an angle. It makes sense to mount the WGR right side up for readability. It is also possible that a WGR must be mounted at angle if obstacles exist. In either case the WGR must be setup with the correct tilt angle between itself and the gauge.

The following gauge characteristics can only be set AFTER the WGR is mounted on a gauge.

The Gauge Tilt Angle is defined with respect to the WGR. A vertical line cutting down the center of the WGR when the WGR is right side up for a human to read defines the 0° and 180° markers. See the Blue Lines in Figure 42. Positive angles start from 0° and turn clockwise to 180°, negative angles start from 0° and turn counterclockwise to 180°.

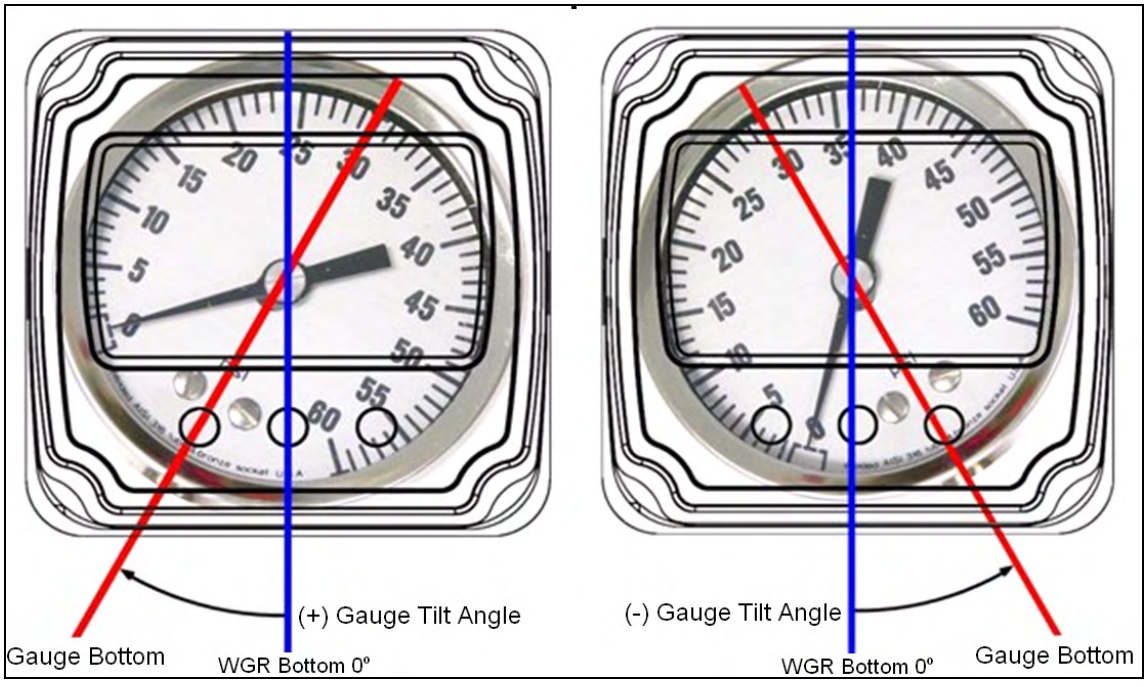

Figure 42 : Gauge Tilt Angle

The WGR Configuration Application displays the angle vectors on top of the image of the gauge, in order to allow for precise angle definition. Refer to Figure 43. The blue vectors represent the Min and Max Gauge Angle. The yellow vector represents the Needle Resting Correction. The orange vector represents the Min/Max needle travel angle. The red vector represents the bottom of the gauge face (which is the zero degree reference vector).

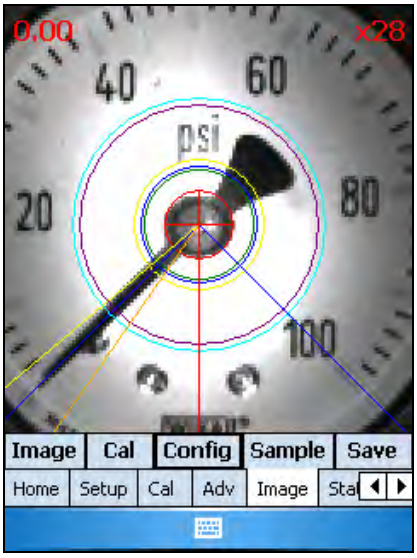

Figure 43 : Gauge Angle Vector Display

9.2 Circle Calibration

The following configuration parameters are referenced in this section:

- *Center Point X*
- *Center Point Y*
- *Radius 1*
- *Radius 2*
- *Radius 3*
- *Radius 4*
- *Radius 5*

To find the needle, the WGR image processing algorithm looks for the darkest pixels in the image. Any writing, markings, graphics etc. dark enough will be picked up by the software as part of the needle. To avoid a majority of these background objects, the algorithm will only process the pixels contained in a set of user defined Concentric Circles. You must setup these circles to avoid as much background as possible, while still overlapping the needle. The parameters: *Center Point X and Y* and *Radius 1-5* define the size and location of the circles.

Figure 44 shows concentric circles improperly calibrated (green pixels). Notice the five circles overlap the PSI symbol, the numbers, the graphic in the center, and even the rivets at the bottom. The green pixels represent what the image processing algorithm considers the needle. Notice all green pixels outside of the needle. These could confuse the image processing algorithm and distort the reading.

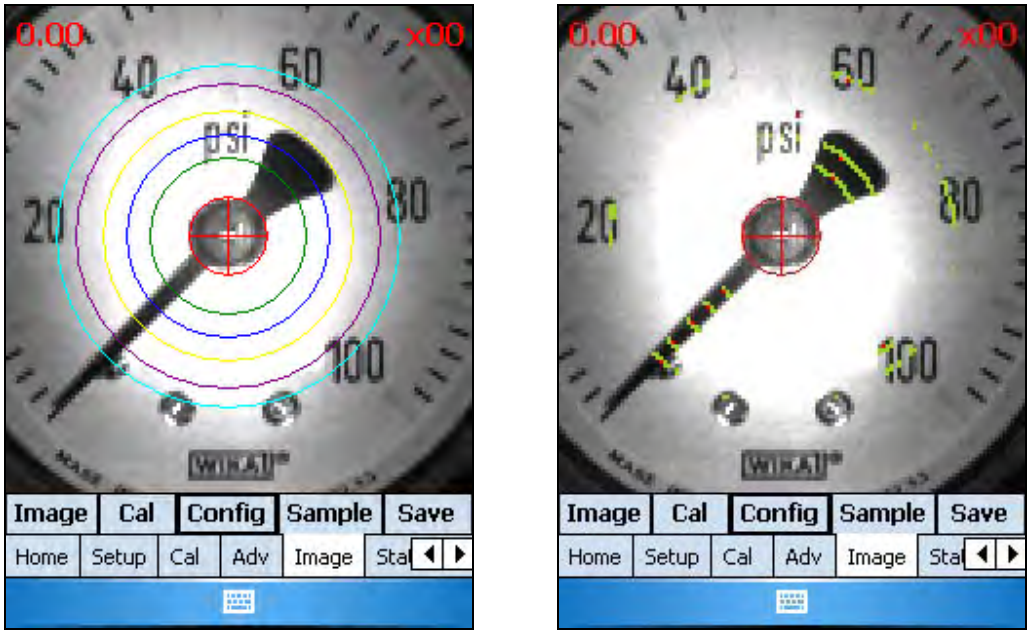

Figure 44 : Improperly calibrated circles

Figure 45 is an example of concentric circles properly calibrated. It may be impossible to avoid all background markings but you must attempt to minimize them. Because of the proper circle alignment, the image processing algorithm will be able to ignore the numbers, rivets and the large graphic in this example. It is acceptable to have minor overlaps with some background writing, if it cannot be avoided. The image algorithm includes processing steps to attempt to filter out as much noise as it can, so a certain amount can be tolerable. This result on the right image is much better than the previous example. The majority of the green pixels are concentrated only on the needle.

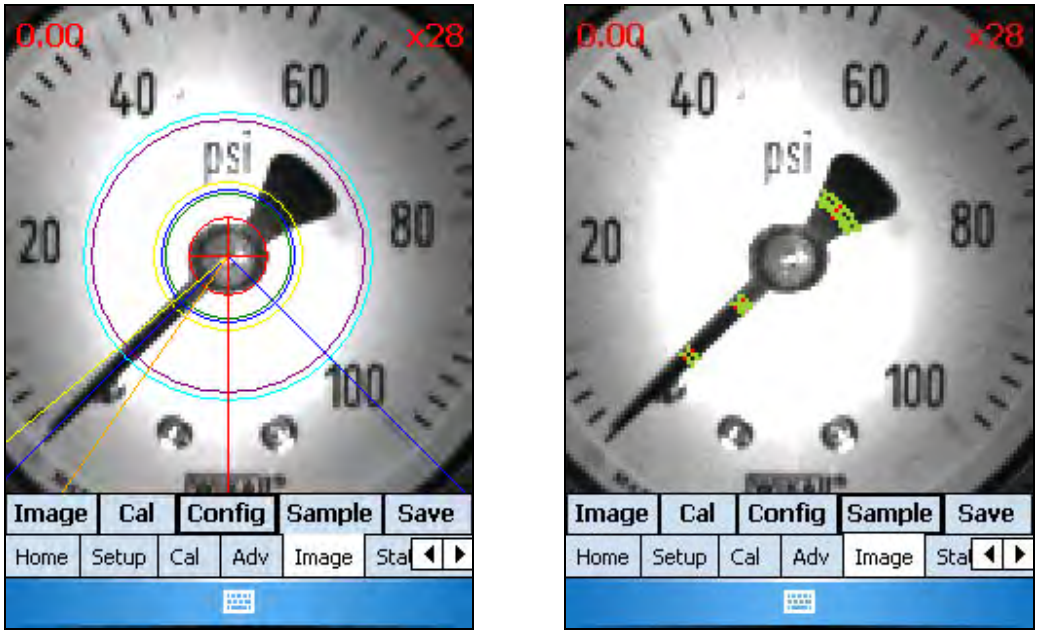

Figure 45 : Properly calibrated circles

9.3 Image Zoom

The following configuration parameters are referenced in this section:

- *Zoom Enable*
- *Zoom X Offset*
- *Zoom Y Offset*

In most cases it is beneficial to have the camera zoom in on the image. Anytime the circles can still be properly configured within the field of view when zoomed in, you should zoom in. This will effectively increase the pixel resolution of the needle, and allow more accurate and reliable needle readings. To enable zoom, select *Zoom Enabled* on the *Setup* tab**,** capture a new image, and then calibrate the circles based on the zoomed-in image.

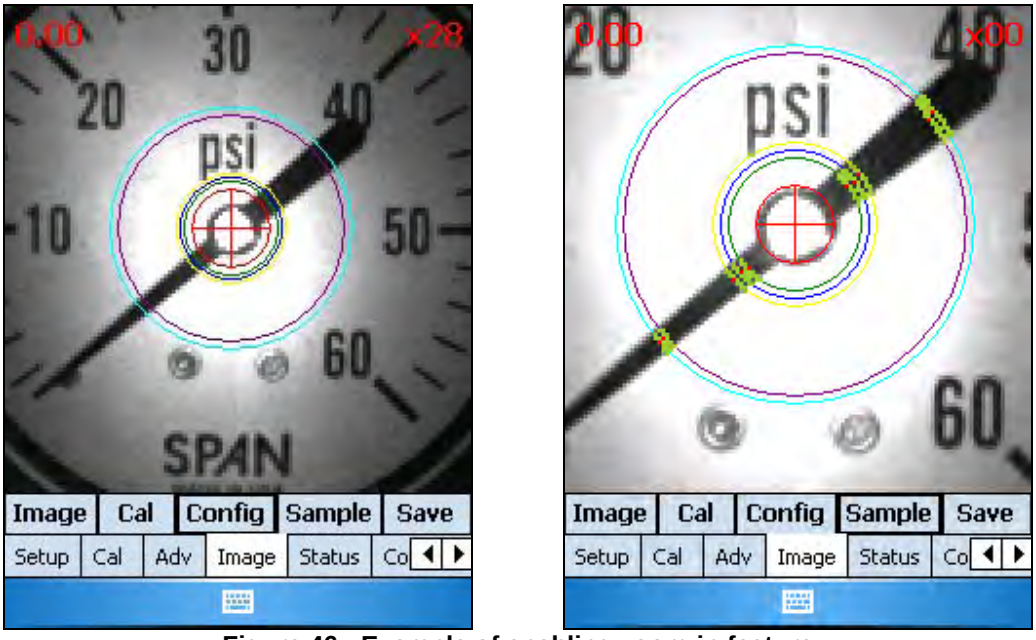

Figure 46 : Example of enabling zoom-in feature

9.3.1 Zoom X Offset

There is room in the camera's field of view to capture an offset image. Instead of moving the circles to the center of the needle by adjusting the Center Point X parameter, we can move the needle to the center of the image and center the circles. This is the preferred method of centering the circles. This will work when both zoomed in or out.

To set the *Zoom X Offset*:

1. Center the circles on the Needle.
2. Take the difference: [*Center Point X* – 63] and enter the result in the *Zoom X Offset* field.
3. Set *Center Point X* to 63.
4. The next time a *Get Image* is performed, the needle will have moved so that it is centered under the circles.

Zoom X Offset Range	**Min**	**Max**
When Zoom Enable = 0	-24	24
When Zoom Enable = 1	-63	63

9.3.2 Zoom Y Offset

Zoom Y Offset can be set the same way as the *Zoom X Offset* except that it can only be used when *Zoom* mode is enabled.

Zoom Y Offset Range	**Min**	**Max**
When Zoom Enable = 0	NA	NA
When Zoom Enable = 1	-30	30

9.4 Get Sample

Once the circles and zoom settings have been set, perform a Get Sample to verify the settings. Get Sample will superimpose Green and Red pixels on the gauge image in the Gauge Image tab. The Green represents pixels the WGR will treat as potential needle locations. The Red pixels represent the final needle location for each circle. The red pixels should be centered along the width of the needle. From these red pixels the software will calculate an angle.

Note: Red pixels for circles outside of the tail of a short-tail needle will not be shown.

Note: if the needle has moved since the time you performed a Get Image, the green and red pixels will not match the image. You can either continue as-is or request a new image.

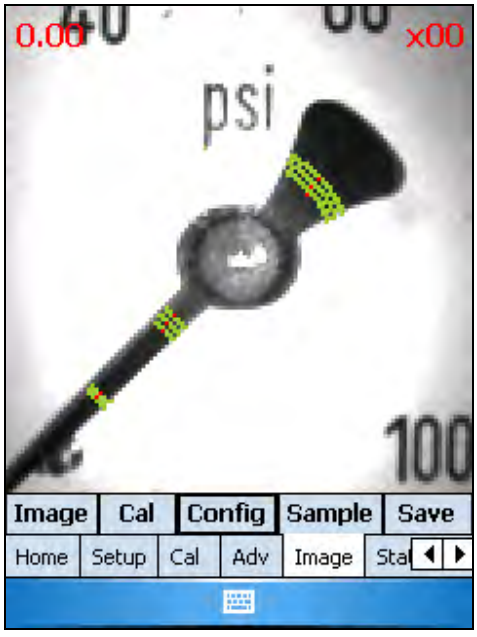

Figure 47 : Red pixels identifying needle

9.5 Needle Tip/Tail Width

Related Parameters:

- *Tip Width*
- *Tail Width*

It is possible that in some rare cases, the WGR will confuse a group of green pixels overlapping background objects as the needle. This can cause the WGR to report incorrect readings. To check for and avoid this issue you can perform the following:

- Perform a *Get Sample*. Check the location and group size of all green pixels in the image. If any exists that are close to the group size of the green pixels overlapping the needle, you may need to make the following adjustments:
    - If possible, adjust the *Circle Radii* to avoid the background writing.
    - Adjust the Pixel *Threshold*. This will only work if the background writing is not as dark as the needle in the image.
    - Adjust the *Tip Width*. If the erroneous group of green pixels is slightly smaller than the width of the green pixels over the tip of the needle, increase the Tip Width. This will tell the WGR to ignore groups of green pixels smaller than this value.
- Perform a *Get Sample*. Check the location of all red pixels; make sure they are all centered along the needle. If you notice red pixels off the needle you can make the same adjustments listed above. If you notice the red pixels are on the needle but not centered along the needle width, make the following adjustments
    - If the off centered red pixels are within a wide tail, you may consider increasing the *Tail Width*. This will tell the WGR that the group of green pixels that should be considered the needle is wider. The WGR will treat all of the green pixels along the tail as a single group and properly center the red pixel.

Note: Red pixels for circles outside of the tail of a short-tail needle will not be shown. Refer to the *Long-Tail / Short-Tail Selection* section for more information.

9.6 Pixel Threshold

Related Parameters:

- *Pixel Threshold*

To further isolate the background from the needle you can adjust what the image processing algorithm considers a dark pixel. In most cases, the needle is somewhat darker than its background. The *Pixel Threshold* parameter can be used to adjust the sensitivity to keep just the needle and reject the background. Decreasing the *Pixel Threshold* will increase the number of pixels picked up. Increasing the *Pixel Threshold* will decrease the number of pixels picked up.

Here is an example of when the *Pixel Threshold* needs to be increased. Notice that the software is picking up the white background as dark pixels.

Figure 48 : Threshold set too low

Here is an example of when the *Pixel Threshold* needs to be decreased. Notice the entire needle is not being picked up.

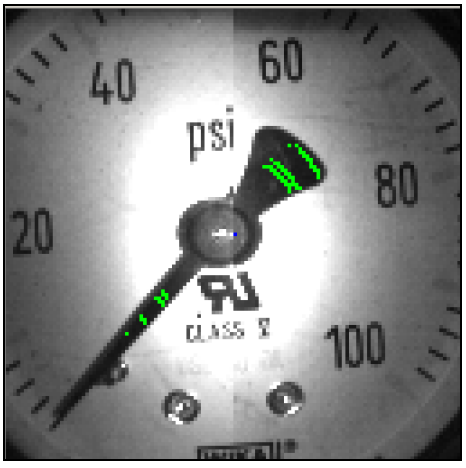

Figure 49 : Threshold set too high

To ensure a robust setup we must set the *Pixel Threshold* so it is not at the edge of picking or dropping extra pixels. The camera exposure and lighting can vary depending on temperature, remaining battery power, and other parameters. If the *Pixel Threshold* is at the edge, a slight change in exposure or lighting can cause problems.

The following steps describe this process.

1. Set the *Pixel Threshold*. Perform a *Get Sample* and make sure only the needle is picked.
2. Lower the *Pixel Threshold* by 40 and perform a *Get Sample*. Make sure too many extra pixels were not picked.
3. Restore the *Pixel Threshold* to the original value.
4. Increase the *Pixel Threshold* by 40 and perform a *Get Sample*. Make sure extra pixels beyond just the needle were selected.
5. If steps 2 and 4 passed, your original setting is robust (in the sweet spot, near the middle of the threshold range). If step 2 failed you must increase your *Pixel Threshold* value. If step 4 failed you must decrease your *Pixel Threshold* value.

9.7 Long-Tail//Short-Tail Selection

Related Parameters:

- *Long-Tail Enable*
- *Short-Tail Enable*
- *Taper Detection*
- *Num Tail Circles*

In general there are two types of needles; those that are considered *Short-Tail* and those that are considered *Long-Tail*.

9.7.1 Short-Tail

These are needles where at least one of the concentric circles can be position beyond the end of the tail without overlapping background objects. In other words, the circles can be positioned to only overlap the tip but not the tail of the needle. To know which direction the needle is pointing the software uses the position of the red pixel(s) along the circles that only overlap the tip.

For this case, select *Short-Tail Enable.*

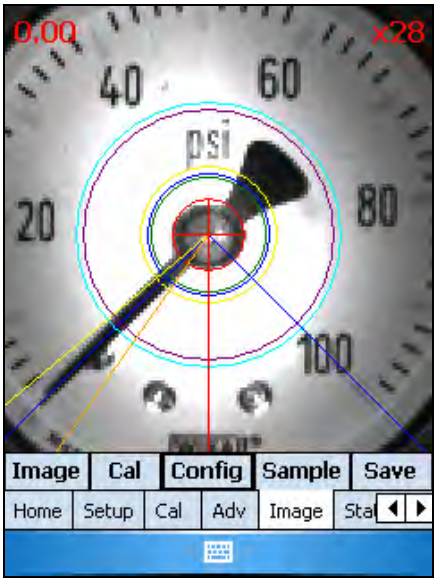

Figure 50 : Circle calibration for short-tail needle

9.7.1.1 Num Tail Circles

For Short-Tail, some of the outer circles will not overlap both sides of the needle. In this case you want the software to ignore any secondary dark sections that may be encountered on the outer circles. In the image above, the three innermost circles overlap both the tip and the tail. In this case, set the *Num Tail Circles* to 3, meaning that the inner three circles intersect the tail.

9.7.1.2 Short-Tail and Taper Detection

If the circles overlap a lot of background, it is possible the outer circle will pick up the background instead of the needle and report the wrong tip. In this case it may be useful to combine the *Short-Tail* method with an additional *Taper Detection* method. The algorithm will use information from both methods to try to more reliably determine the needle orientation. This will only work if the needle taper is significant. The WGR will compare the results from the two methods and report the value or error if they do not match. It is possible that this method may cause the WGR to issue more conversion error codes (since multiple algorithms have to be satisfied), but there is extra reassurance it will not report tip-tail failures. To enable, set the *Short-Tail Enable* and *Taper Detection* check-boxes.

9.7.2 Long-Tail

These needles are those with no room to place the circles beyond the end of the tail. To find the tail the software will measure the taper of the needle at every point where the circles overlap it. The side with the bigger overall width (widest part of the taper) is the tail.

To enable this feature set the *Long-Tail Enable* checkbox.

This approach relies on the fact that most needles are tapered. However, the taper on some needles are finer than others. To maximize the accurately of this approach:

- Make sure the concentric circles always overlap the needle. Attempt to position the circles such that they take advantage of large difference in the tip and tail width.
- Ensure the *Num Tail Circles* parameter is set to 5 so all of the pixels on the tip and tail are included in the angle calculation.
- Enable the *Zoom Enable* in order to zoom-in on the needle. This will give you more resolution to measure the taper more accurately.
- Enable the *Subtle Needle Taper* parameter. See the *Subtle Needle Taper* section.

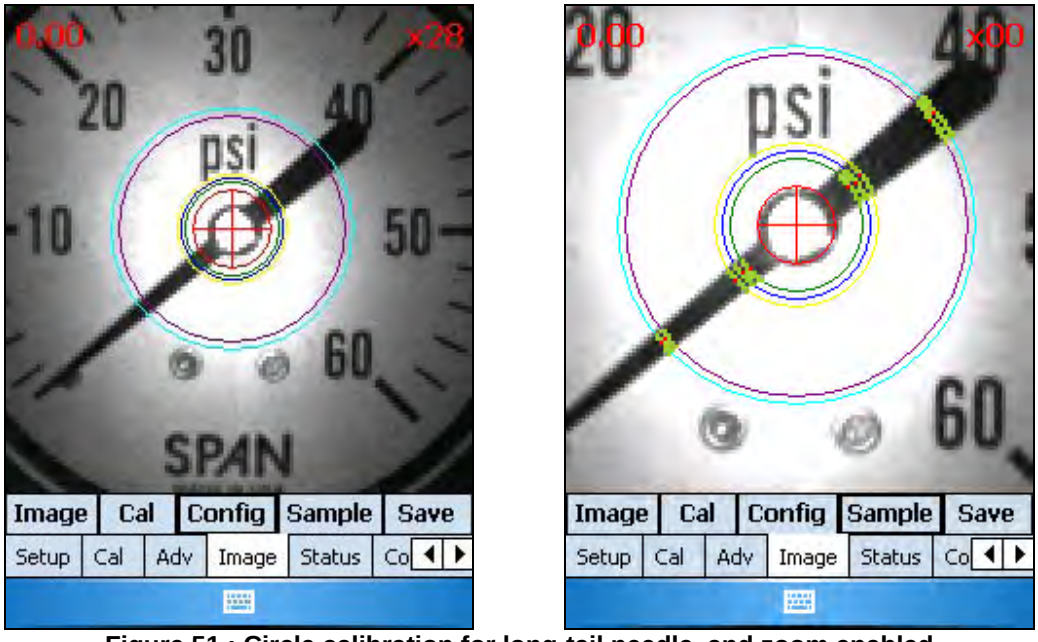

Figure 51 : Circle calibration for long-tail needle, and zoom enabled

No-Tail / No-Tip Needles
You may run into gauges that either do not have a tail or the tip is too thin to process. In this case you can define a No-Tip or No-Tail Needle.

For a No-Tail Needle such as the one in the image below, follow the same steps as the Short-Tail method. You must set the *Num Tail Circles* parameter to 0 if no circles overlap the tail. If one circle did overlap the tail, set *Num Tail Circles* parameter to 1.

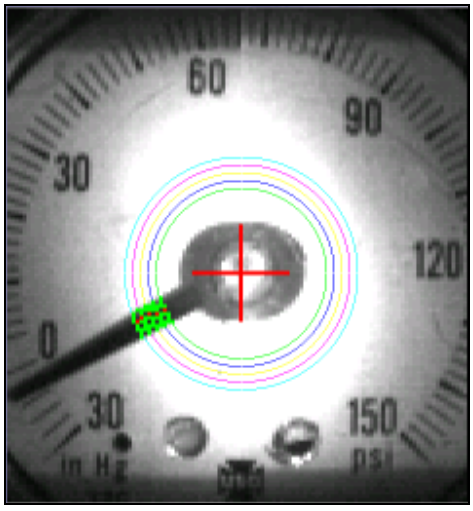

Figure 52 : Circle calibration for no-tail needle

For a No-Tip Needle, do the same as a No-Tail. To reverse the readings you must rotate the Gauge Min, Gauge Max, and Min/Max Needle Travel Angle by 180 degrees in your setup.

9.8 Subtle Needle Taper / Dynamic Stitching

Related Parameters:

- *Subtle Needle Taper*

LEDs reflecting off the WGR plastic cover and the gauge lens produces glare. Glare restricts the image processing algorithm from processing segments of the image. To remove the glare, the WGR uses a patent pending image capturing and processing technique. The WGR uses two LEDs and takes two half–image captures. For each half image, the opposite LED is illuminated to avoid glare in the area of interest. The resulting half images are stitched together to form one glare-free image, see Figure 53. Stitching solves problems related to glare but introduces new issues.

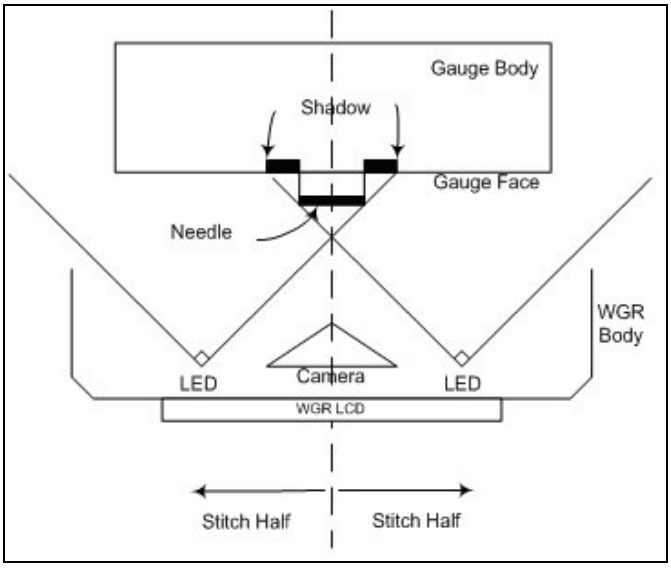

Figure 53 : Illustration of Stitching two halves of an image using two LEDs

For Long-Tail Gauges, the needle taper is used to determine the orientation of the needle (tip versus tail). Therefore, and accurate reading of the needle's width is required for this algorithm. Using two separated LEDs for light sources causes a shadow effect on the needle. If the needle is aligned vertically with the image seam, the image will contain two shadows on either side of the needle, which may compromise the accuracy of the taper detection algorithm. In order to minimize the shadow effect, the WGR can employ a special patent pending image stitching mode called *Dynamic Stitching*.

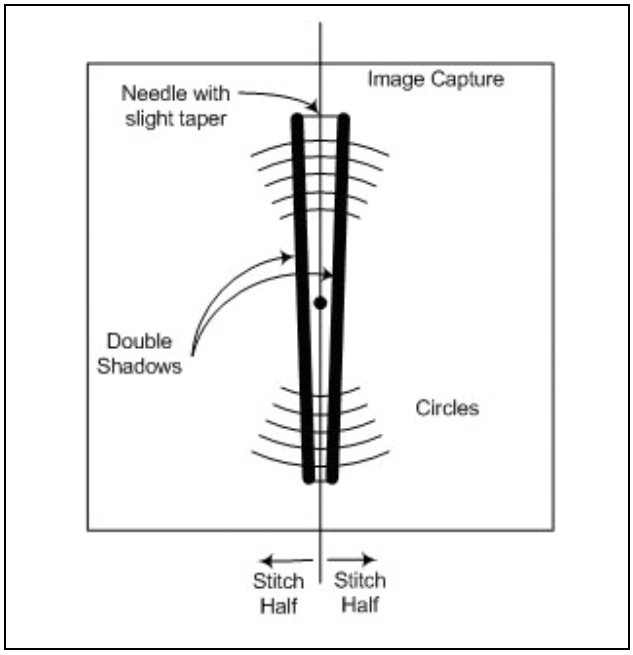

Figure 54 : Diagram of two shadows from normally stitched image with vertical needle

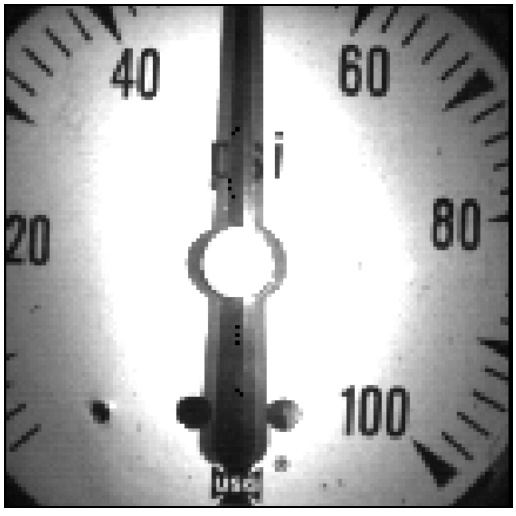

Figure 55 : Photo of normally stitched image showing a needle with two shadows

The *Dynamic Stitching* technique eliminates double shadows but requires some extra processing time and power consumption. Instead of stitching down the middle of the image, the WGR stitches using one of two special patterns. The stitch will start offset to one side, then cut diagonally to the other side, and all the way down. See Figure 56 and Figure 57. The opposing stitch offsets in the top and bottom half of the image eliminates double shadows.

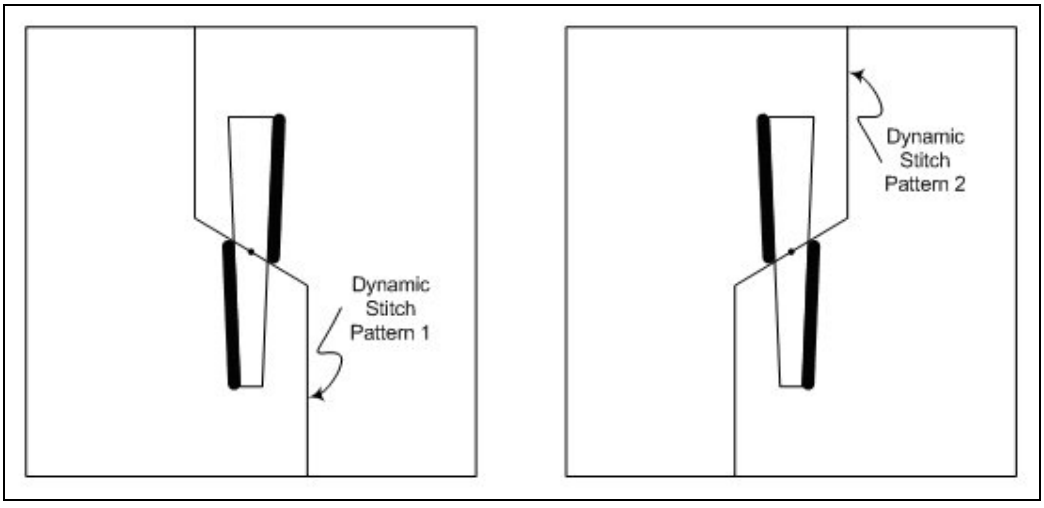

Figure 56 : Diagram showing Dynamic Stitching Technique

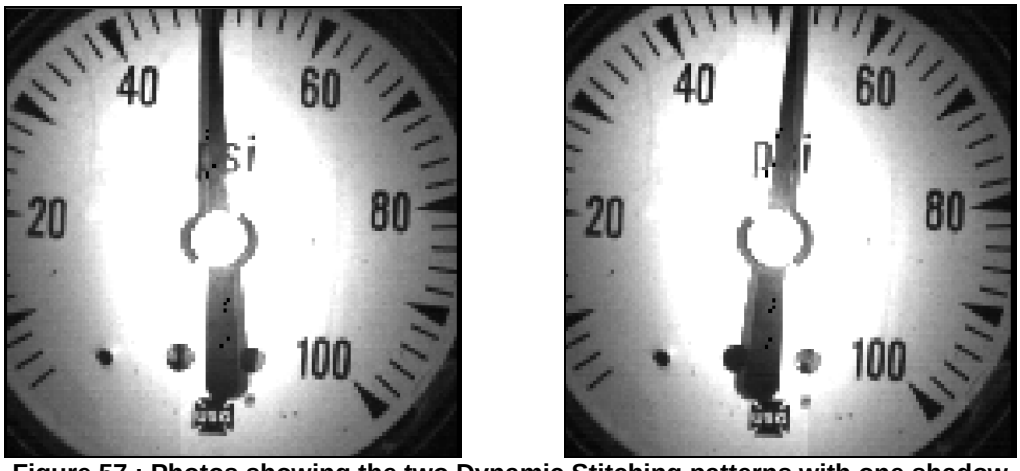

Figure 57 : Photos showing the two Dynamic Stitching patterns with one shadow

Two different stitching patterns are required to properly cover all possible needle positions. The pattern must be reversed depending on the current angle of the needle. Figure 58 shows the range of needle angles for each pattern.

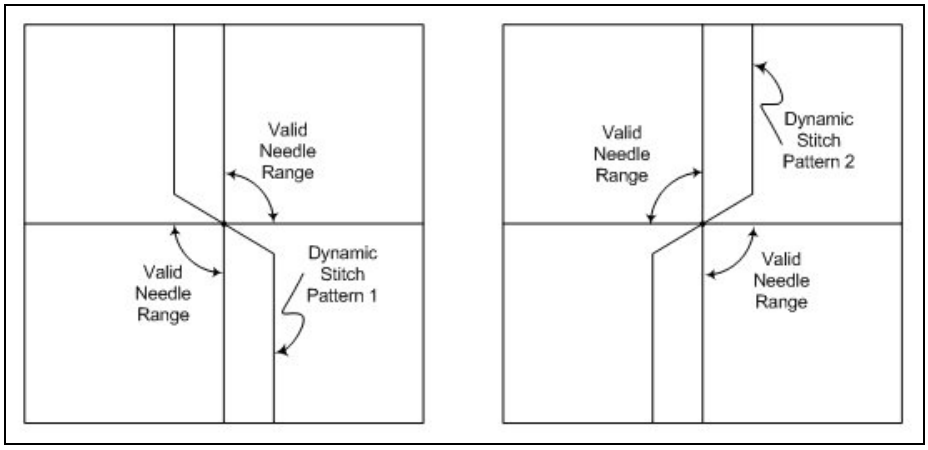

Figure 58 : The possible needle angles for each pattern

To dynamically determine which pattern to use, the WGR defaults to the last pattern used, processes the image, and determines if the needle is out of range. If so, the WGR stitches the image with the new pattern and reprocesses it. When the needle moves enough to require the stitch pattern to change, then the processing time and power consumption is doubled. Typically, most needles won't move between the two different dynamic stitching zones very frequently, so the overall power impact will be low.

The following is a list of considerations when deciding whether or not to use *Subtle Needle Taper*:

1. Is the *Long-Tail* Method being used?
    a. *Dynamic Stitching* matters only when we are looking at the needle taper in *Long-Tail* mode. When using *Short-Tail* method disable *Subtle Needle Taper*.
2. Is the needle taper slight, or reversed?
    a. If the needle has a significant taper, double shadows are not much of a concern, so *Subtle Needle Taper* can be disabled to save battery life.
    b. If the needle has a slight or even somewhat reversed taper, then enable *Subtle Needle Taper*, to help ensure reliable readings. See Figure 59 for an example of a reverse tapered needle.

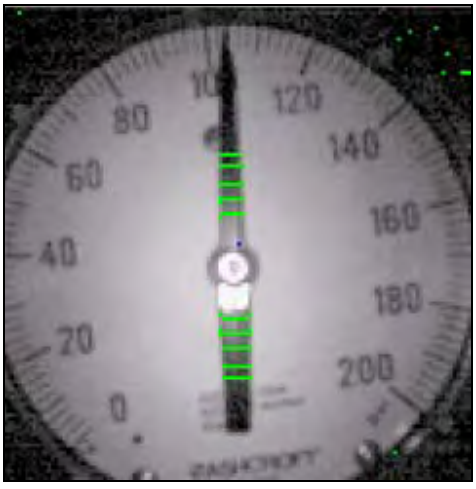

Figure 59 : Example needle with reverse taper.

3. Is there glare near the center of the needle?
    a. Since *Dynamic Stitching* uses a special offset stitching pattern, it is prone to some additional glare near the center of the needle. See Figure 60 for an example.
    b. This is only a concern if the rings are defined near the glare/washed-out area.
    c. If it is affecting the pixel selection in the area, then try turning down the *Camera Exposure* to see if the glare is reduced or eliminated.

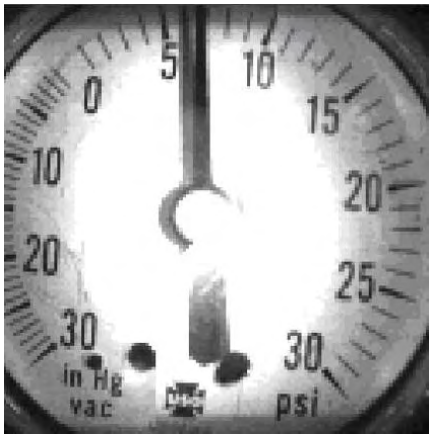

Figure 60 : Glare from the left LED on the bottom of needle.

When *Subtle Needle Taper* has been enabled, the Configuration Tool can be used to see the resulting image from both stitch patterns.

Image Request: Every time an image is requested from the WGR using the Configuration Tool, the WGR will toggle between the two stitch patterns. This allows the installer to examine both patterns for potential glare issues, regardless of the needle location.

Get Sample: When requesting a sample reading, the WGR will process the image using the appropriate stitch pattern for the current needle position. The red and green pixels from the sample are always a result of the actual pattern the WGR would use when normally processing. Note that depending on the last time that a new image capture was requested, the green and red pixel pattern seen in the Image tab may not match the image accurately, since the opposite stitch pattern may have been used to process the image. If this is the case, then simply request a new image capture to clarify the results.

10 WGR Configuration Procedure

This section presents a step by step guide to calibrate and configure the WGR for a specific gauge. It provides information about all of the steps necessary to ensure the WGR will process accurate readings. Please refer to the section as needed to accomplish the required steps.

Any time a WGR is mounted onto a gauge it must be calibrated before it will accurately process gauge readings. Calibration of a WGR is relatively sensitive; small errors can result in inaccurate readings. Physical changes in the way a WGR is mounted may require it to be recalibrated. For example, if a WGR is removed from a gauge, remounted on the same or different gauge, or accidently knocked out of its initial mounting position, then it must be recalibrated.

10.1 Establish Communication to the WGR

Once the WGR is mounted, then it is ready to be configured. The first step is to establish a communication link between the Configuration Tool and the WGR.

1. Make sure the WGR is out of *Ship Mode*.
    a. If the WGR LCD screen is blank, then it is likely in "*Ship Mode*".
    b. Follow the steps in Figure 4 on page 5 to exit *Ship Mode*, by entering the appropriate password.
2. Transition the WGR into *Configuration Mode*:
    a. After successfully booting the WGR, then follow the steps in the *Menu Manager* to enter *Configuration Mode*.
3. Prepare the Configuration Tool for use.
    a. Power the Configuration Tool
    b. Launch the WGR Configuration application by selecting the *Windows Start Menu*, and then selecting the WGR Icon
    c. This should launch the application and then display the *Home Screen*.
4. From the *Home Screen,* select the desired communication mode by clicking on the *Config Comm* button, which will bring up a selection window.
    a. For a new WGR that has not been commissioned, then select 802.11 with Ad-Hoc mode. Otherwise, you have the option of selecting either Ad-Hoc or Infrastructure mode.
    b. Click Save, which returns to the Home Screen.
5. Ad-Hoc Connection Mode
    a. On the Home Screen, select Find.
        i. This will bring up the Ad-Hoc Find Dialog
        ii. Enter the session key seed number (which is displayed on the WGR LCD).
        iii. Click on Save.
    b. On the Home Screen, you should now see an entry in the table with the name showing the session key that you just entered.
    c. Make sure that the table entry is highlighted (by default, it already is), and then click Bind.
        i. This will attempt to make a connection with the WGR.
        ii. If the connection is successful, then the Status in the Table will change to Bound.
        iii. If the connection fails and times out, then the Status in the table will show "-".
6. Infrastructure Connection Mode (optional alternate method, after a WGR is commissioned)
    a. On the Home Screen, select Find.
        i. This will bring up the Infrastructure Find Dialog
        ii. Enter the IP address and MAC address of the target WGR.

    The WGR must already be commissioned and communicating with the Wi-Fi network.

        iii. Click on Save.
    b. On the Home Screen, you should now see an entry in the table with the IP and MAC addresses that were just entered.
    c. Make sure that the table entry is highlighted (by default, it already is), and then click Bind.
        i. This will attempt to make a connection with the WGR.
        ii. If the connection is successful, then the Status in the Table will change to Bound.

iii. If the connection fails and times out, then the Status in the table will show ”-“.

10.2 Initial Configuration

After establishing communication between the Configuration Tool and the WGR, the configuration steps can begin.

1. After successfully binding to a WGR, then click on the Next button on the Home Screen.
2. There are multiple options for selecting the default parameters for a WGR.
    a. The Configuration Tool application will remember all of the parameters that were used to configure the prior WGR.
    b. The default values can be read from the current WGR, by clicking the *Get* button.
    c. The default values can be read from a file, by clicking the *File* button.
3. By strategically selecting the source of the default parameters, you can speed up the configuration process for multiple similar gauges.
    a. For example, after configuring the first gauge, you can save the parameters to a file on the Configuration Tool, and then load that file for any subsequent similar gauge.
    b. If you plan to configure several similar gauges in succession, then the Configuration Tool will remember the parameters from the prior gauge without requiring you to save them in a file.

10.3 Configure the additional Connection settings

This section describes how to configure the networking settings to inform the WGR how to connect to the Access Point and to the WGR Application Gateway.

1. Select the *Conn* tab to configure the connection settings between the WGR, Access Point, and Application Gateway. Refer to page 43 for the screen shot.
    c. This typically only needs to be done one time per installation site, since most or all of the settings will remain the same for all WGRs at a single installation site.
2. WGR IP Address Assignment. This configures how the WGR will obtain an IP address.
    a. Select *Static* or *Dynamic*
    b. For *Static* configuration
        i. Enter the fixed unique *IP address* for this WGR.
            1. Note that this must be unique to each WGR in the network.
        ii. Enter the *Subnet Mask*, which is typically 255.255.0.0 or 255.255.255.0.
        iii. Enter the *Gateway* IP address
    c. For *Dynamic* configuration
        i. The WGR will attempt to obtain an IP address automatically from the network DHCP server when the WGR connects to the wireless network.
        ii. Do not enter anything in the remaining fields of this top section.
3. Access Point Setup
    a. Enter the *SSID* of the Access Point / Multinode with which the WGR will communicate
    b. Enter the Wi-Fi channel number used by the Access Point.
    c. Enter the *WPA-PSK* or *WPA2-PSK passphrase* used to establish a secure connection with the Access Point.
4. Application Gateway Address Setup
    a. The following settings will be shared by all WGRs that communicate to the same WGR Application Gateway.
    b. Enter the *IP Address* of the WGR Application Gateway.
        i. The WGR Application Gateway will always be assigned a static IP address on the network, so that it can easily be found by the WGRs
    c. Enter the *Subnet Mask* for the Application Gateway.
        i. Again, this is typically 255.255.0.0 or 255.255.255.0.
    d. Enter the Application Gateway *Port* number.
5. You may now wish to save these settings in a file on the Configuration Tool, since they will not likely change for any other WGR in the network (unless you select Static IP method for the WGR addresses). Saving the settings will allow you to avoid entering them again, in case the parameters on this page are erased or over-written inadvertently.
    a. Click on *File*, and then select a filename to use for the saved settings.
6. Send the updated parameters to the WGR by clicking on the *Send* button.

10.4 Basic Gauge Parameters

This section describes how to determine and enter several basic parameters that describe the characteristics of a gauge.

1. Request a Gauge Image capture by navigating to the *Image* tab, and selecting the *Image* button to request an image capture.
2. Based on the image of the gauge face, record the following information (if you haven't already done so prior to mounting the WGR):
    a. Gauge Units
    b. Min and Max Gauge Value
    c. Gauge Min and Max Angle
    d. Min/Max Needle Travel Angle
    e. Needle Rest Correction
    f. Gauge Tilt Angle
    g. Current Reading
3. Looking at the gauge image, determine if you will use the Long-Tail or Short-Tail method. Refer to the section as necessary.
4. Go to the Setup tab.
    a. Select the Gauge Units from the pull-down menu.
    b. Enter the Sample Rate.
    c. Enter the Minimum and Maximum gauge values (such as 0 and 100 for a 0-100 PSI gauge).
    d. Check the Zoom Enabled box if you believe that the image calibration can benefit from a zoomed image. Please refer to section Circle Calibration on page 47 for more details about the Zoom feature.
    e. Select the Long-Tail mode or Short-Tail Mode depending on the gauge's needle geometry
        i. When selecting Short-Tail mode, also decide if Taper Detection should be activated. This is used when the Short-Tail needle has a reasonably significant taper, in order to provide additional robustness to the image processing algorithm.
5. Send the updated parameters to the WGR by clicking on the *Send* button.

10.5 Gauge Calibration Parameters

This section describes how to configure several gauge calibration parameters.

1. Select the Cal tab.
    a. Refer to Figure 35 on page 37 for screen shots of the parameters on the Cal tab.
2. Enter the following angles based on the information from section Defining the Gauge on page 45.
    - *Gauge Min Angle*
    - *Gauge Max Angle*
    - *Gauge Tilt Angle*
    - *Min/Max Needle Travel Angle*
    - *Needle Resting Correction*
3. Enter 0 for the Zoom X and Y Offset initially, until further calibration is completed to determine if an offset is needed.
4. The Center Point and Radii will be calibrated later, so leave the default values for now.
5. Send the updated parameters to the WGR by clicking on the *Send* button.

10.6 Advanced Settings Tab

This section describes the parameters in the Advanced Settings Tab. Refer to Figure 36 for screen shots.

1. Adjust the *Camera Exposure* if the gauge image did not have the desired contrast.
2. The Pixel Threshold will be adjusted later in the calibration process, so leave the default for now.
3. Enter an approximate Tip Width and Tail Width for the needle
    a. This helps the algorithm make judgments about filtering out pixels that do not belong to the needle.
4. If you are using the Short-Tail algorithm, then select the Num Tail Circles.
    a. This is usually set to 3 for most Short-Tail needles, where the inner 3 circles cross the tail of the needle.
5. If using the Long-Tail algorithm, and the needle has a subtle taper, then enable the Subtle Needle Taper option.
6. Magnehelic / Photohelic Settings
    a. The Left and Right LED Boost settings can be adjusted if the exposure between the two halves of the image capture is not even.
    b. Enter a value between 0-21, with higher numbers indicating higher brightness.
7. Send the updated parameters to the WGR by clicking on the *Send* button.

10.7 Circles and Camera Configuration

With the initial set of configuration complete, the interactive calibration steps can now begin. In this section, the circles and the camera will be configured.

1. If you made changes to the *Zoom Enable* or *Camera Exposure* parameters, perform a new Image request to see an updated image based on the new settings.
    a. Click on the *Image* button in the *Image* tab.
2. In order to calibrate the gauge center and the circle radii, click on the Cal button in the *Image* tab.
    a. Instructions appear at the bottom of the window guiding you through the calibration process.
        i. The first step is to set the Center X and Y location.
            1. Using the stylus, tap on the center of the needle in the gauge image
            2. The center point will be defined where you release the stylus
            3. You may tap and drag the stylus to better align the center.

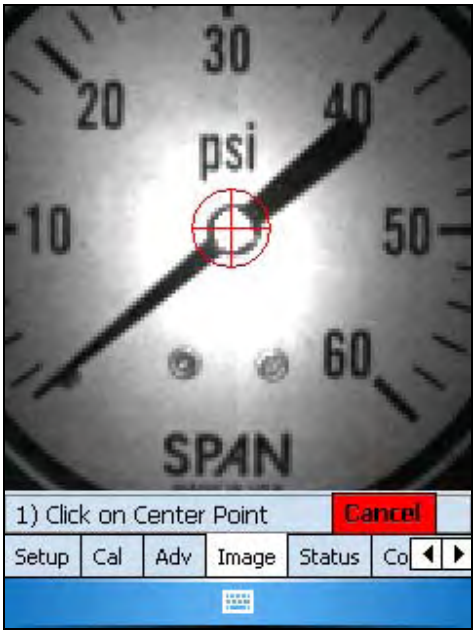

Figure 61 : Gauge Center Calibration

    b. Once the center is set, the Configuration Tool will ask for the first or smallest circle Radius 1.
        i. Tap on the image where you want to define Radius 1, in relation to the center point previously defined.
        ii. You may tap and drag the stylus in order to adjust each radii precisely.
        iii. Release the stylus when you are satisfied with the circle radius.
    c. After you set Radius 1 the Configuration Tool will continue in the same way for each circle up to Radius 5.
        i. Each time tap and drag the stylus on the gauge image to set the radius.
        ii. The Radii must be defined in increasing sizes.
    d. When complete, the Configuration Tool will display all of the circles.

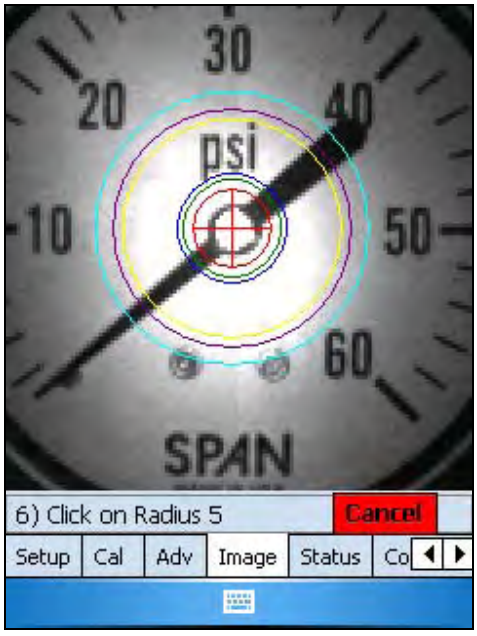

Figure 62 : Radii and Center Point Calibration

3. The touch screen does not always provide the exact locations desired, so you can switch back to the Cal tab, in order to tweak the Center and Radii values manually.
    a. Each time you adjust a value, you can switch back to the Image to view the updated position of the circles and center cross-hair based on your edits.
4. If you notice glare on the needle, or the contrast difference between the needle and the background is not clear, adjust the *Camera Exposure*, and then re-capture an updated image until the settings are optimal.
5. Send the updated parameters to the WGR by clicking on the *Send* button.

10.8 Final Adjustments

At this point all parameters should be set with initial values, some of which may require additional adjustments in order to ensure a robust installation.

1. On the *Image* tab, request a new image by clicking the *Image* button to ensure that you have a latest image using all of the updated parameters that have already been configured.
2. On the *Image* tab, request a sample reading by clicking the *Sample* button. This should be performed twice any time that parameters have been updated, in order to ensure that the WGR has adapted properly to all of the new settings.
3. You will see the Green and Red pixels superimposed on the image. Note: if the needle has moved since the time you performed a Get Image, the green and red pixels will not match the location of the needle in the image. You can either continue as-is or get a new image.

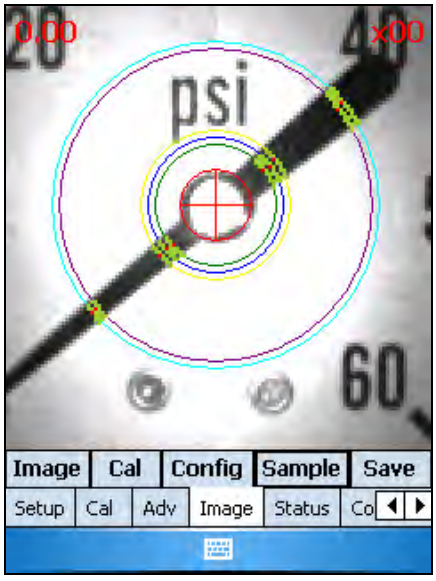

Figure 63 : Green and Red Pixels Superimposed on Image

4. Adjust the Pixel Threshold as described in the Pixel Threshold section.
5. Adjust the Tip and Tail Width as described in the Circle Calibration section.
6. Finally, check the WGR Reading in the upper-left portion of the image to verify the proper reading value
    a. Ensure that the error code superimposed in the upper-right portion of the image shows x00 to indicate no error.
    b. If the gauge is slightly tilted, and the WGR is showing a reading with a slight offset, you can adjust the offset by modifying the Gauge Tilt Angle accordingly.

10.9 Final Steps

1. Review all parameters in the Gauge Image tab. Make sure all settings are correct and they make sense.
2. Send all parameters to the WGR (required).
    a. From any of the Setup, Cal, or Adv tabs, click the Send button.
    b. Note that all parameters are sent, regardless of which tab you are currently viewing.
3. Save the parameters to the Configuration tool (optional).
    a. From any of the Setup, Cal, or Adv tabs, click the File button.
    b. This will bring up a traditional file open/save dialog that will allow you to save the parameters in a file on the Configuration Tool for later use.
    c. Note that all parameters are saved, regardless of which tab you are currently viewing.
4. Save the gauge image (optional).
    a. On the Image tab, you can click Save to save an image of the gauge to the Configuration Tool for later review or for record keeping.
5. Complete the configuration mode (required)
    a. On the Home screen, click on Finish.
    b. This will tell the WGR to commit all changed parameters to permanent memory.
    c. Note that if you exit configuration mode on the WGR before completing this step, that the changed parameters are not permanently saved on the WGR.
    d. After completing this step, you should see the WGR automatically enter Normal Sample Mode.

11 Magnehelic and Photohelic Gauges

This section describes special configuration to handle Magnehelic and Photohelic type gauges. For convenience, they will simply be referred to has Magnehelic gauges in this section. Note that a special WGR must be used with a Magnehelic gauge. Standard WGRs are not compatible with Magnehelic type gauges.

Figure 64 : Magnehelic Gauge

Magnehelics differ from standard gauges in ways that effect the configuration of a WGR. The following table contains key differences and their effect on configuration.

Normal Versus Magnehelic Gauges	**Configuration Changes**
Magnehelics have Bottom Mount Needles.	Semi-Circles or arcs are used instead of full circles to process the gauge. The Min/Max Needle Travel Angle will define the arc.
The Magnehelic needle is very thin compared to standard gauge needles. The contrast difference is sometimes very slight between the needle and the background	Pixel Threshold is no longer used to find the needle. An edge detection method is used instead.
The Magnehelic gauge has a large surface area.	The Zoom mode should almost always be disabled for Magnehelic gauges.
The Magnehelic Needle does not have a “Tail”.	Long/Short-Tail, Subtle Needle Taper, Tip/Tail Widths are not required for configuring Magnehelic gauges

11.1 Background

Most of the steps required to configure Magnehelic gauges are unchanged from the standard gauge process. The differences are limited to circle setup and parameter usage.

The WGR does not require full circles to process Magnehelic gauges. Instead semi-circles or arcs are used to process only the area of needle travel. For Magnehelic gauges the circle radii will be much larger, and the Center Y location will be lower (larger value).The images below contrast the circles for a regular and Magnehelic gauge.

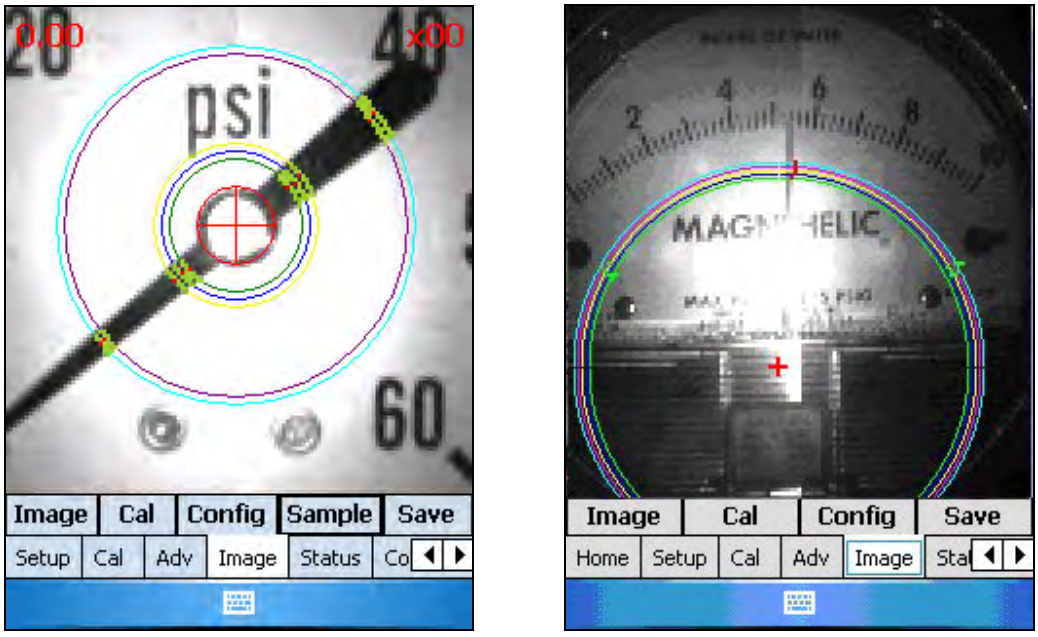

Figure 65 : Circles for a Traditional Gauge Compared to a Magnehelic

11.1.1 Creating Arcs

To create arcs, use the traditional method to define circles, then define the start and stop location of the Arc using the *Minimum Needle Travel Angle* and *Maximum Needle Travel Angle*. These angles specify the range within which the needle can travel.

To view the Arc you must request a *Sample* on the *Image* tab. Unlike regular gauges, the *Sample* request will return green pixels representing the ends of the Arc. Because thresholds are not used, the green pixels do not indicate the needle location. Instead they are used to ensure the *Min* and *Max Needle Travel Angles* have been correctly set. Figure 65 shows an example image after a *Sample* request.

Notice also the Red Pixels in the images above. They represent the needle location determined by the WGR image processing algorithm. The Red Pixels behave the same for a *Sample* request as they did for regular gauges.

11.1.2 Circle Setup

The goal is to get the circles lined up underneath the hash marks making sure they overlap the needle along the entire span.

Unfortunately there is not enough room between the hash marks and the needle stops to properly fit five arcs. The image below shows this situation. If the needle was resting on either of the needle stops, the WGR would not be able to process it correctly. The green pixels along the circles show the end of the arcs. Because the arcs stop before the needle stops, the needle it would not be processed (outside of the area of interest for the algorithm).

Note: it is very important that the *Needle Travel Angles* encompass the entire range of possible needle travel, and not just the scale hash marks. The needle can move in the entire span between the two needle stops. If the needle ever travels outside the defined arcs, the WGR will consistently report an error, since it will not be able to locate the needle in that position.

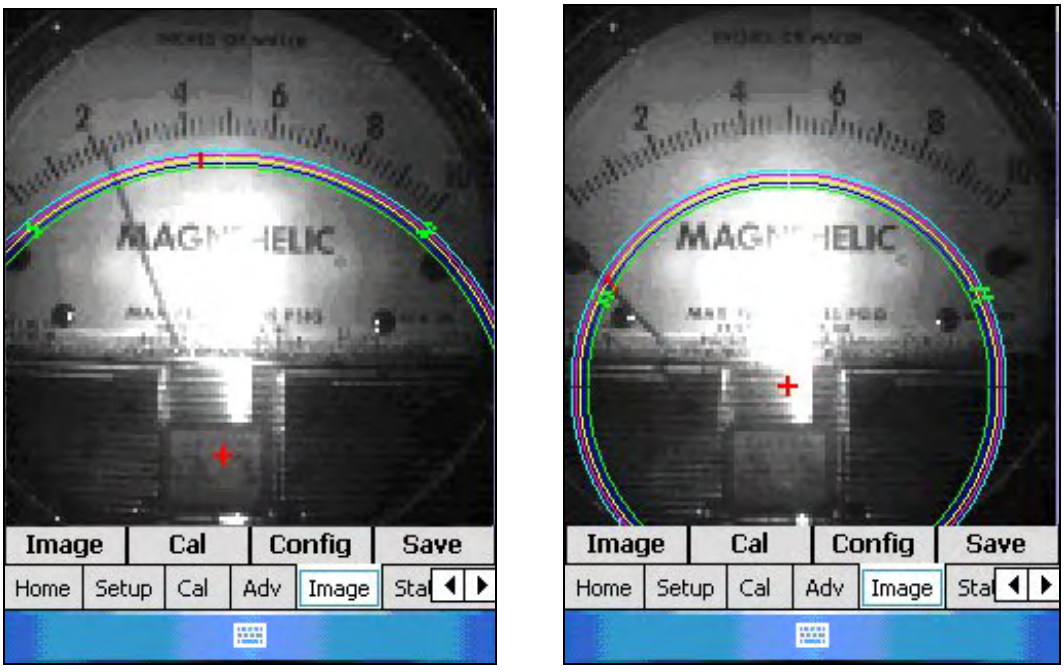

Figure 66 : Incorrect (left) and Correct (right) Circle Definition for Magnehelics

It is recommended to configure the circles as seen in Figure 66 on the right image. In this case, the arcs are defined extending past the physical needle stops. If a needle were resting on the stops it would still be processed correctly.

The *Center Point X* of the circle should match the center of the gauge face. The *Center Point Y* of the circles, in conjunction with the circle radii should be adjusted as needed such that the circles are properly spaced between the needle stops and the Magnehelic text.

Note: An attempt should be made to match the circle center position to the needle pivot location on the gauge. A reading error could be introduced if the circle center and needle pivot position are not properly matched.

11.2 Configuration Steps for Magnehelics

1. Enter configuration mode on the WGR and the Configuration Tool, as described in the previous section for configuring traditional gauges.
2. The following parameters are not used
    - *Needle Resting Correction*
    - *Long-Tail Enable*
    - *Short-Tail Enable*
    - *Taper Detection*
    - *Subtle Needle Taper*
    - *Num Non-Tail Needles*
    - *Pixel Threshold*
    - *Tip Width*
    - *Tail Width*
3. Ensure that the following parameters are configured as defined
    a. *Zoom Enable* should be disabled for almost all Magnehelic type gauges
        i. You must ensure a complete field of view for all needle positions
    b. *Zoom X Offset* should be set to 0
    c. *Gauge Tilt Angle* must be set to 0
4. Parameters with special functions for Magnehelic gauges
    a. The *Gauge Min Travel Angle* and *Gauge Max Travel Angle* have a special meaning
        i. They define the absolute maximum travel physically allowed for the needle between the needle stops, not the angles for zero-scale and full-scale
    b. *Left LED Boost* and *Right LED Boost*
        i. These are used to help balance the brightness between the two halves of the image.
5. Arc calibration
    a. Use the touch screen to calibrate the center and radii for the arcs
    b. Switch to the *Cal* tab to manually fine-tune the *Radii* values to place the arcs exactly where desired.
    c. Switch back to the *Image* tab to verify the placements of the center and all *Radii*.
6. Angle calibration
    a. To accurately configure the *Min* and *Max Needle Travel Angles* you must use a trial and error method.
    b. First set estimates for the angles (typically they are approximately 115 and 245)
        i. The *Min Needle Travel Angle* is limited to: 90°-180°.
        ii. The *Max Needle Travel Angle* is limited to: 180°-270°.
    c. Send the parameters to the WGR and then request a *Sample* from the *Image* Tab .
    d. The green pixels superimposed on the gauge image will indicate the angles for verification of their proper location
    e. The image below shows the arcs end in the proper location.
        i. They should not overlap the needle stops or the black circles at the ends.

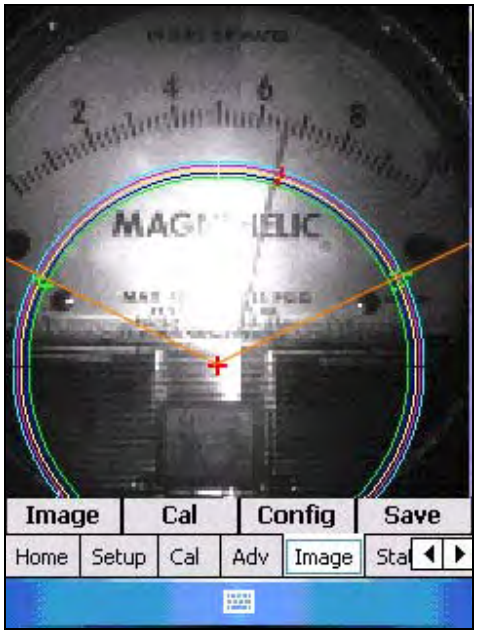

Figure 67 : Properly Defined Min and Max Needle Travel Angles

7. Lighting adjustments
   a. Since even lighting is required for accurately finding the thin needle of Magnehelic gauges, there are special parameters that allow the installer to fine-tune the lighting
   b. Use the *Left LED Boost* and *Right LED Boost* parameters to adjust the lighting for each half of the image
      i. Decreasing the value will make the image half darker; increasing the value will make the image half brighter.
   c. Additionally, for Magnehelic gauges with fast moving needles, it is better to increase the LED brightness (of both halves equally), instead of increasing the *Camera Exposure* parameter
      i. Increasing the exposure will cause a fast-moving needle to become blurred.
      ii. Increasing the LED brightness will slightly reduce battery life.

8. Final Steps
   a. Follow the same steps as descried for standard gauges to complete the configuration process properly.

12 Parameter and Error Code Summary

12.1 Standard Configuration Parameters

Configuration Parameter	Description	Min Value	Max Value	Default Value
Units	The units of data the gauge represents. (Pull-down selection menu)	-	-	-
Sample Rate (Sec)	The time in seconds between samples when the WGR is in Normal Sample Mode.	0	16384	900
Min Gauge Value	Minimum value on the gauge scale	-32767	32767	0
Max Gauge Value	Maximum value on the gauge scale	-32767	32767	100
Gauge Min Angle	Angle, with respect to Gauge Bottom, at which the Min Gauge Value resides.	0	359	45
Gauge Max Angle	Angle, with respect to Gauge Bottom, at which the Max Gauge Value resides.	0	359	315
Gauge Tilt Angle	The angle between the WGR and Gauge it is mounted on. Example: -30 = Guage is -30 degrees counterclockwise. +30 Guage is +30 clockwise.	-180	180	0
Min Needle Travel Angle	For standard gauges, this is the angle, with respect to gauge bottom, at which the gauge value will switch from maximum to minimum or vise versa. Must be between Gauge Min and Max Angle. For the Magnehelic this defines the minimum arc angle	0	359	35
Max Needle Travel Angle	For standard gauges, this is equal to the *Min Needle Travel Angle*. For the Magnehelic this defines the maximum arc angle.	0	359	35
Needle Resting Correction	Offset angle from Gauge Min Angle where the value will always read Min Gauge Value. If the needle is between the Gauge Min Angle and Gauge Min Angle + Needle Rest Corr, value will read Minimum.	0	255	2
Center Point X	Defines the X direction center of the circles. This should match the center of the pivot point of the needle (may not always be center of image sensor).	0	127	63
Center Point Y	Defines the Y direction center of the circles. This should match the center of the pivot point of the needle (may not always be center of image sensor).	0	127	63
Radius 1	Innermost Radius in pixels of each circle	0	63	49
Radius 2	Radius in pixels of each circle	0	63	50
Radius 3	Radius in pixels of each circle	0	63	51
Radius 4	Radius in pixels of each circle	0	63	52
Radius 5	Outermost Radius in pixels of each circle	0	63	53
Camera Exposure	This will adjust the brightness of the image. The larger the number the brighter the image.	0	230	150
Pixel Threshold	Defines the sensitivity of dark pixels stored. Decreasing the Luminosity Threshold will increase the number of pixels picked up. Increasing the Luminosity Threshold will decrease the number of pixels picked up.	0	255	80
Tip Width	Minimum number of pixels that are close together to be considered a valid group. This allows us to easily filter out individual pixels of noise or numerals or hash marks etc. This is an advanced feature. Consult Honeywell Systems.	0	255	2
Tail Width	Max delta in X or Y direction to consider two points in the same group/pixel. This is an advanced feature. Consult Honeywell Services.	0	255	10
Num Tail Circles	The number of circles that intersect the tail of the needle	0	5	5
Left LED Boost	Controls the left LED brightness. For model that do not support this feature it will be ignored	0	21	13
Right LED Boost	Controls the right LED brightness. For model that do not support this feature it will be ignored	0	21	13

12.2 Magnehelic Configuration Parameters

This table indicates differences for configuring Magnehelic gauges compared to standard gauges.

Configuration Parameter	Usage, Relative to Standard Parameters	Min Value	Max Value	Default Value
Units	SAME	-	-	-
Sample Rate (Sec)	SAME	0	16384	900
Min Gauge Value	SAME	-32767	32767	0
Max Gauge Value	SAME	-32767	32767	100
Gauge Min Angle	SAME	0	359	128
Gauge Max Angle	SAME	0	359	232
Gauge Tilt Angle	MUST BE 0	-180	180	0
Min Needle Travel Angle	This defines the minimum arc angle	0	359	115
Max Needle Travel Angle	This defines the maximum arc angle	0	359	245
Needle Resting Correction	NOT USED	0	255	-
Center Point X	SAME	0	127	63
Center Point Y	SAME	0	127	93
Radius 1	SAME	0	63	49
Radius 2	SAME	0	63	50
Radius 3	SAME	0	63	51
Radius 4	SAME	0	63	52
Radius 5	SAME	0	63	53
Camera Exposure	SAME	0	230	150
Pixel Threshold	NOT USED	0	255	-
Tip Width	NOT USED	0	255	-
Tail Width	NOT USED	0	255	-
Num Tail Circles	NOT USED	0	5	-
Left LED Boost	Controls the left LED brightness.	0	21	13
Right LED Boost	Controls the right LED brightness.	0	21	13

12.3 Table of Error Codes

Error Code	Description	Resolution
0x21	Not enough points on the needle. The WGR is picking up dark pixels that are not part of the needle.	The circles are most likely overlapping background noise (text, graphics, etc) causing the WGR to pick them over the needle. Adjust the circles so they do not overlap the background. The WGR has moved and the circles are no longer centered on the needle. Re-center the circles. The WGR *Pixel Threshold* is set too low causing the algorithm to pick up more pixels (green pixels) than it should. Adjust the threshold.
0x22	Either the tip or the tail of the needle does not contain any “Red Pixels”. One side of the needle is completely missing.	Make sure the circles overlap both sides of the needle, regardless of the needle angle. If the tip of the needle is very thin, reduce the Tip Width parameter. The WGR threshold is set too high causing the algorithm to lose pixels (green pixels). Adjust the *Pixel threshold*.
0x23	Only when using the *Short-Tail* method. Circles 4 and 5 are both overlapping the tip but their “Red Pixels” are on opposite sides of the needle. The WGR cannot find the tip.	Make sure circles 4 and 5 only overlap the tip and avoid all background. The WGR *Pixel Threshold* is set too low causing the algorithm to pick up more pixels (green pixels) than it should. Adjust the *Pixel Threshold*.
0x24	(Only when using the *Short-Tail* method.) The WGR cannot find the needle along circles 4 and 5. There are no Red Pixels. The WGR cannot find the tip	Make sure circles 4 and 5 are both overlapping the tip of the needle. If the tip of the needle is very thin, reduce the *Tip Width* parameter. The WGR threshold is set too high causing the algorithm to lose pixels (green pixels). Adjust the *Pixel Threshold*.
0x25	(Only when using the *Short-Tail* method and *Taper Detection* enabled) The WGR is attempting to find the tip of the needle using the long tail method in addition to the short tail method. The long tail method is failing because the difference between the tip and tail thickness is too small. The needle has a slight taper.	Check the taper of the needle, if it is slight, enable *Subtle Needle Taper*. Check for any glare on the needle. This can cause missing green pixels on the tail. If glare is discovered, make sure the WGR is mounted parallel to the gauge face and centered to the needle. Turn down the *Camera Exposure* and adjust the *Pixel Threshold*. If possible use *Short-Tail* method alone (disable *Taper Detection*).
0x26	(Only when using the *Short-Tail* method and *Taper Detection* enabled) The WGR is attempting to combine the results of the *Short-Tail* and *Taper Detection* methods but they contradict each other. Cannot determine the tip versus tail.	Check the taper of the needle, if it is slight, enable *Subtle Needle Taper*. Check for any glare on the needle. This can cause missing green pixels on the tail. If glare is discovered, make sure the WGR is mounted parallel to the gauge face and centered to the needle. Turn down the *Camera Exposure* and adjust the *Pixel Threshold*. The WGR *Pixel Threshold* is set too low causing the algorithm to pick up more pixels (green pixels) than it should. Adjust the *Pixel Threshold*. If the tip of the needle is very thin, reduce the *Tip Width* parameter. If possible use Short-Tail method alone. Disable *Taper* and Short-Tail Enable.
0x27	(Only when using the *Long-Tail* method.) The WGR is attempting to find the tip of the needle by analyzing the taper of the needle. The difference between the tip and tail thickness is too small. The needle has a slight taper.	Check the taper of the needle, if it is slight, enable *Subtle Needle Taper*. Check for any glare on the needle. This can cause missing green pixels on the tail. If glare is discovered, make sure the WGR is mounted parallel to the gauge face and centered to the needle. Turn down the *Camera Exposure* and adjust the *Pixel Threshold*. If possible use *Short-Tail* method.
0x28	The WGR cannot find the needle. The WGR does not have enough Red Pixels.	The WGR has been removed from the gauge. Re-mount the WGR. The *Pixel Threshold* is set too high causing missing green pixels. Turn down the *Pixel Threshold* and adjust the *Camera Exposure* so the WGR has enough green pixels along the needle.

13 Care and Maintenance

13.1 Calibration

Calibration is performed when the WGR is configured during installation. Calibration is performed based on the position of the WGR with respect to the gauge face.

Re-calibration is not required if the WGR is not removed from gauge or the position of the WGR with respect to the gauge face has not shifted.

If the WGR is removed from gauge face, the WGR must be re-calibrated. Simply repositioning the WGR on the gauge will affect the accuracy and reliability of the WGR readings.

13.2 Batteries

13.2.1 Battery Life

Each WGR comes with two lithium batteries. Battery status can be monitored on the LCD of the WGR, or through the OPC or Web interface connected to the WGR Application Gateway. Battery change-out must be performed by a qualified service technician, since calibration must be verified after the batteries are replaced to ensure reliable operation. See the *Support* section below for contact information.

The battery life of the WGR is dependent on the sampling frequency and operating environment. Typical ranges for room temperature applications are listed below. Extended operation at cold temperatures will reduce the expected battery life.

Sampling Frequency	Estimated Battery Life
1 sample per 5 minutes	1 year
1 sample per 15 minutes	2 years
1 sample per 18 hours	3 years

13.2.2 Battery Replacement

1) Please be sure to replace the batteries with the same approved type and model from the same manufacturer.
   a) Not all CR123 batteries are certified to operate the WGR over the entire temperature range.
2) In order to replace the batteries, the WGR must be un-mounted from the gauge.
3) Loosen the stainless steel band clamp, and slide the WGR assembly off of the gauge.
4) Move the WGR to a clean work area, and clean the outside surface of the WGR prior to opening it to replace the batteries.
   a) It is important to prevent debris from entering the WGR.
5) Remove the four T-8 Torx screws that fasten the adapter to the WGR.
   a) Retain the screws for reassembly.
6) Remove the adapter and retain it for reassembly.

7) Carefully remove the main window of the WGR without damaging the silicone gasket.
   a) Insert the tip of theT-8 Torx driver into one of the fastener holes in the corner of the main window
      i) Insert the tip about 2/3 of the way through the window plus gasket, without touching the brass threaded insert.
   b) Gently pry the main window to remove it from the housing.
8) Remove the two batteries from their holders, and recycle or dispose of them properly.
9) Insert new batteries into the holders ensuring that the polarity matches the diagram molded into the bottom of the battery holders.
   a) The positive ends should be pointed towards the rectangular antenna.
10) Examine the gasket on the main window
   a) If there are any signs of de-lamination or other damage to the main window, contact the Honeywell to request a replacement.
11) Clean any debris or residue off of the window before re-installing it, to make sure that the camera has a clear view of the gauge.
12) With the silicone gasket facing the WGR body, press the main window back onto the housing.
13) Line up the gauge adapter with the WGR, and lightly insert the four Torx screws
14) In a crisscross fashion, tighten the gauge adapter to the main housing using gradually increasing torque to apply even pressure to the silicone gasket, in order to ensure a proper weather seal.
15) The final torque of the four screws should be 55 oz-in +/- 5 [39.3 N-cm +/- 3.6] above the running torque of the screws (which is typically 4 - 8 oz-in [3 - 6 N-cm]).
16) Now you are ready to install the WGR assembly back onto the gauge.
   a) Take this opportunity to clean the gauge face to ensure that there is a clear view.
   b) You may also wish to verify the mechanical calibration of the gauge at this time.
   c) Re-install the WGR based on the instructions earlier in this document.
   d) Note that you will be required to re-calibrate the WGR since it is not likely that you will be able to install it in the identical position where it was during the last calibration.
      i) Failure to follow this step will affect the accuracy and reliability of the WGR readings.

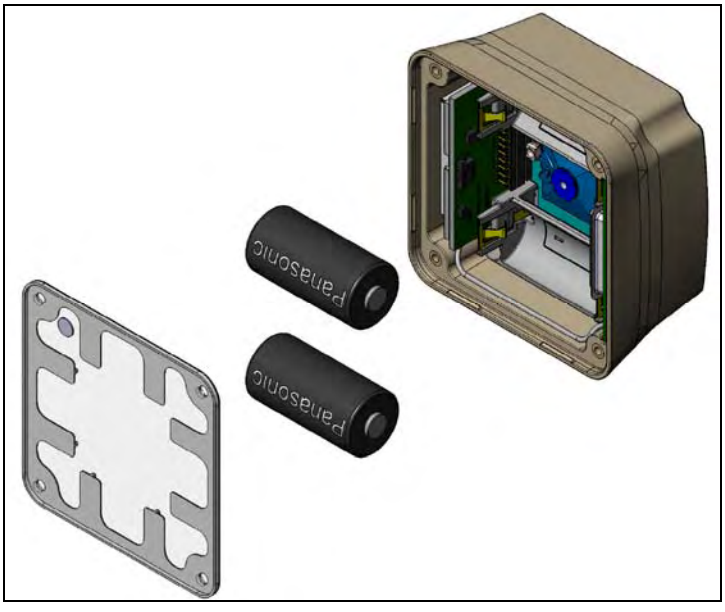

Figure 68 : Battery Replacement

14 Product Disposal

The WGR is recycled by Honeywell. Contact Honeywell to recycle the WGR. See the *Support* section below for contact information.

15 Warranty Information

Every product comes with a full one-year parts and labor warranty.

16 Support Services / Contact Information

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

ASIA PACIFIC

Control Products
Asia Pacific Headquarters
Phone: +(65) 6355-2828
Fax: +(65) 6445-3033

Asia Pacific Global Technical Support

Field Instruments
Phone: +65 6580 3156
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Process Instruments
Phone: (603) 76950 4777
Fax: (603) 7958 8922

Australia
Honeywell Limited
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Honeywell China Inc.
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China – PRC - Chengdu
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SE Asia Countries

see Honeywell Pte Ltd (Singapore)
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SE Asia Countries

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India Ltd for:
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