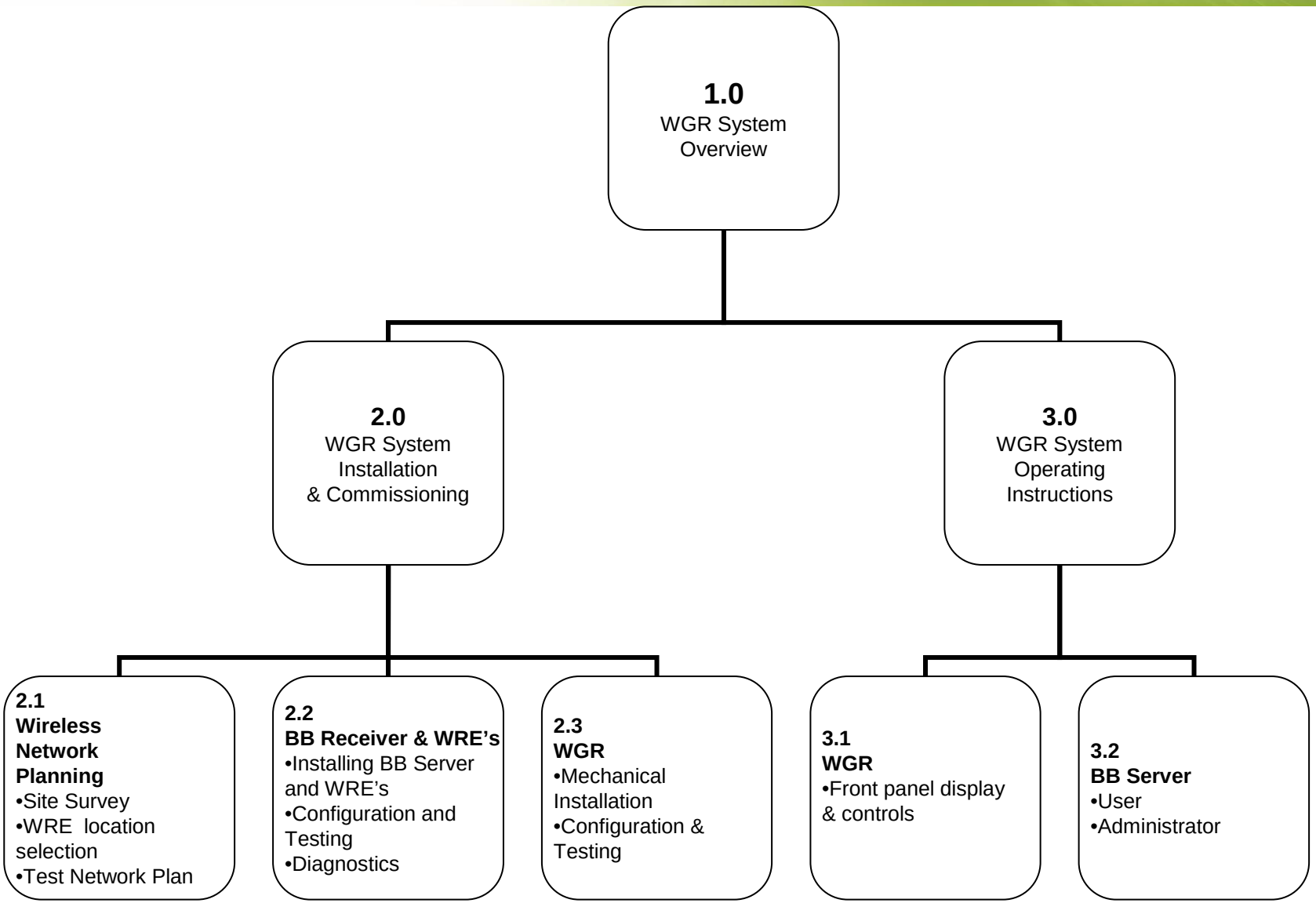
WGR Installation Training

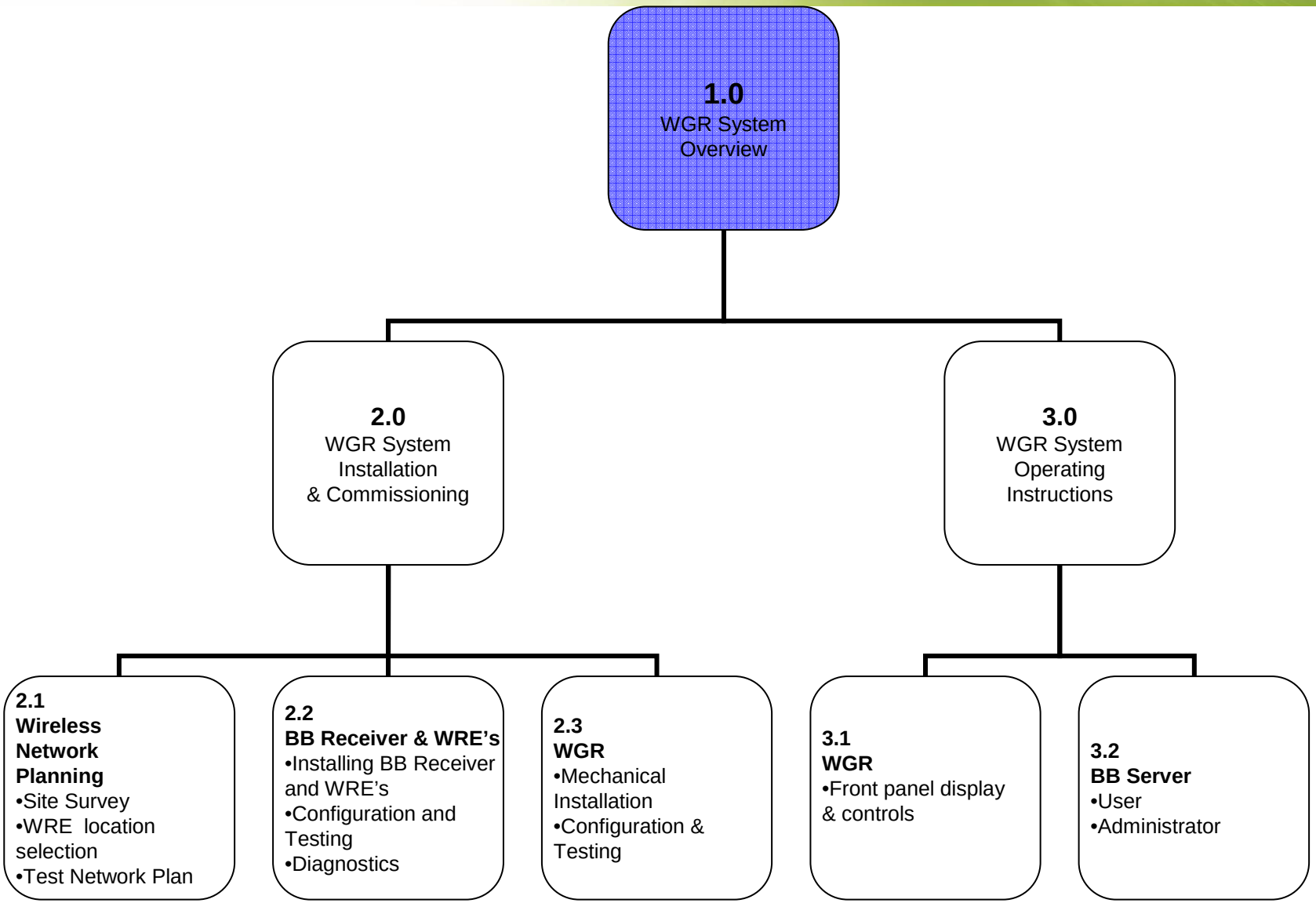
CYPRESS
ENVIROSYSTEMS

Revision 1.0

WGR System Training Modules



WGR System Training Modules

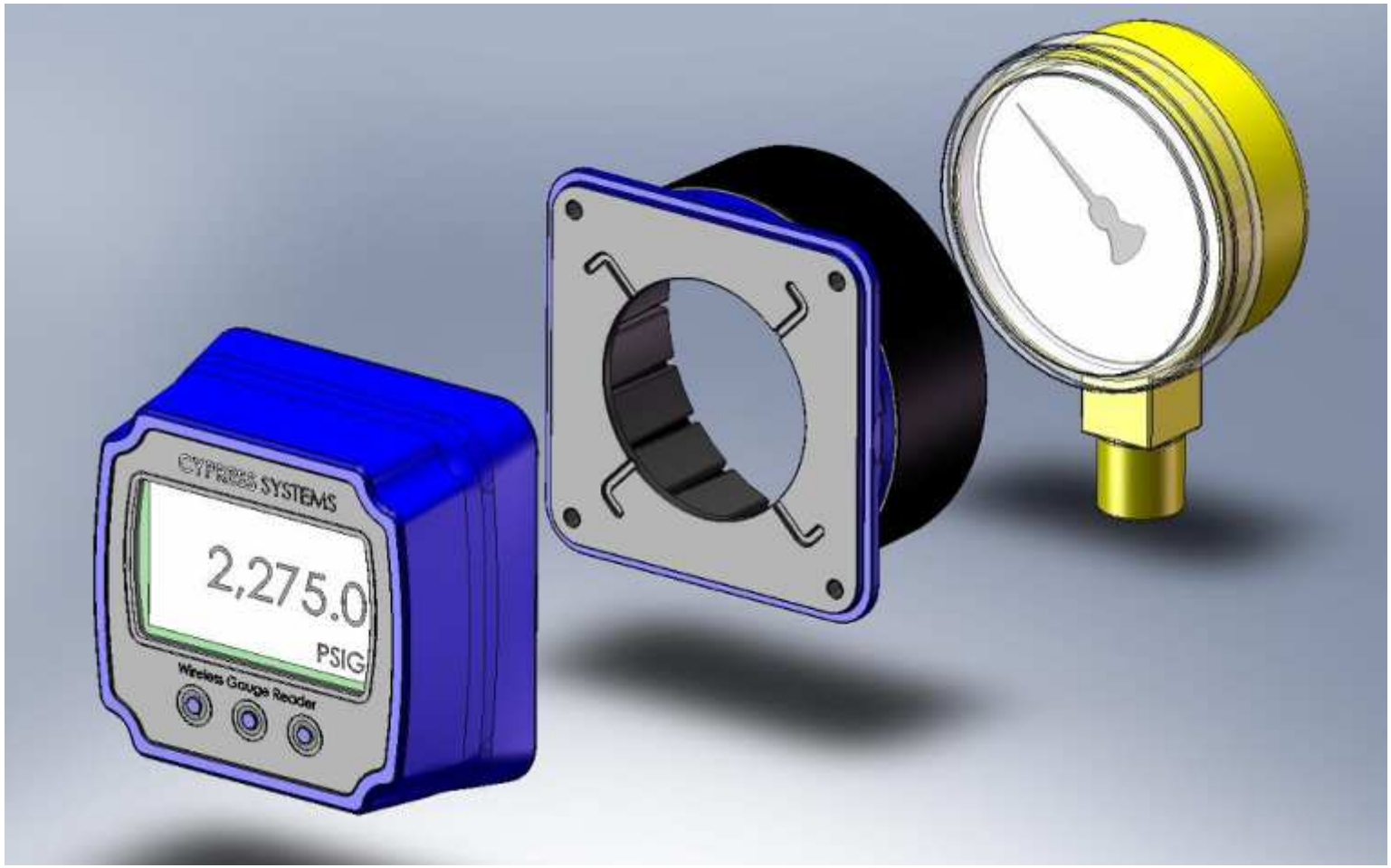


Wireless Gauge Reader (WGR)

- Non-invasive, clamp-on to existing gauges in minutes
- Enables remote wireless monitoring of gauge
- No downtime
- No leak check
- No audit/requalification (e.g. FDA, OSHA)
- No running wires
- No drawings and approvals
- Minimal retraining of staff
- No new enterprise software
- Battery life of 3+ years at typical sample rates
- IP65/NEMA 4 rated for outdoor use
- Optional OPC or BACnet interface to existing building or plant automation system

Non-Intrusive Reader Mounts On Top of Existing Gauge in Minutes…
Enables Alarming, Trending, Historization for Process/Asset Monitoring and Troubleshooting

Wireless Gauge Reader – Exploded View



Key Components

Wireless Gauge Reader (WGR)

Wireless Range Extender (WRE)

Blue Box Receiver and Server (BBR)

Handheld Configuration Tool (HH)

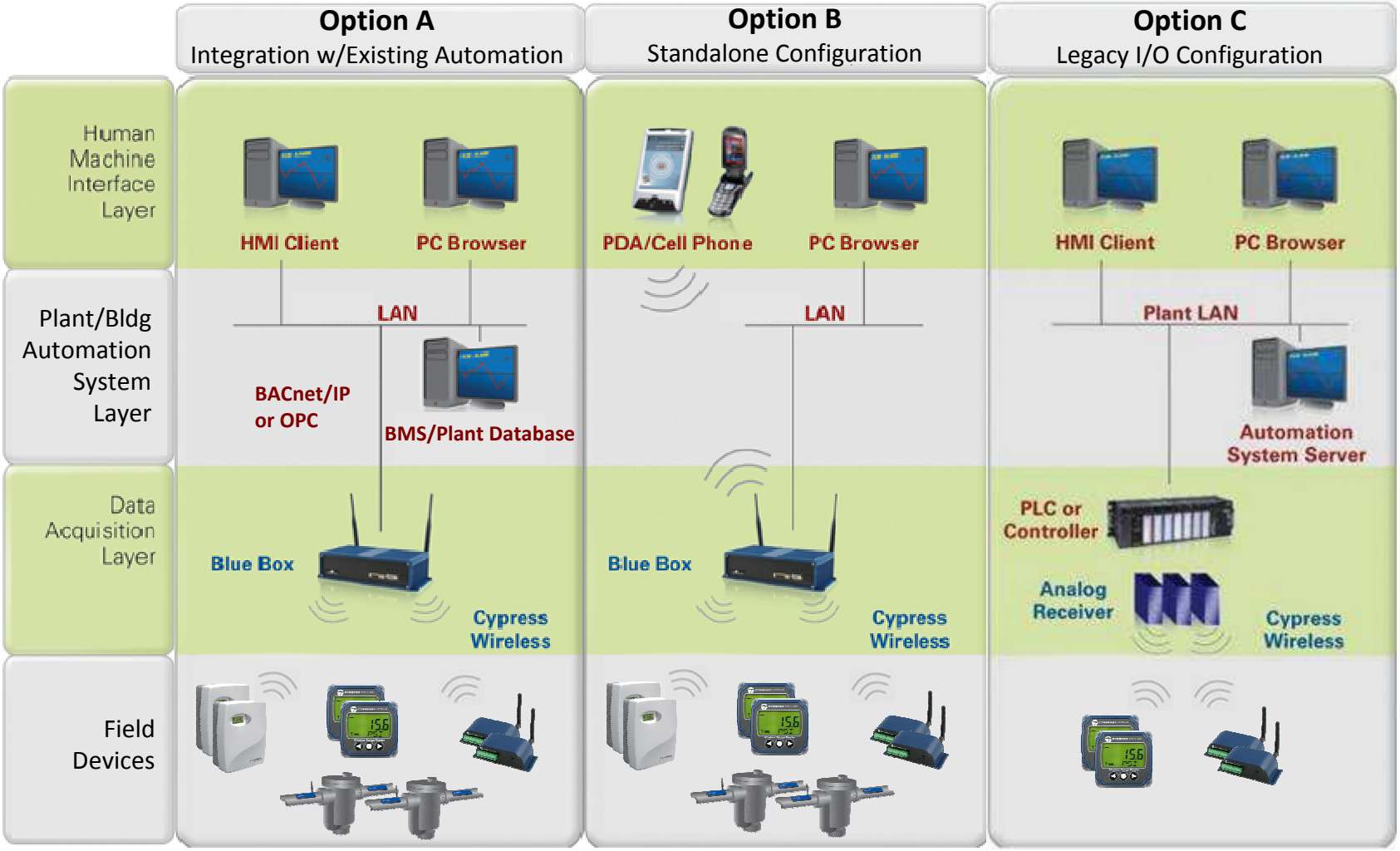
WGR adapters

Small Medium Large

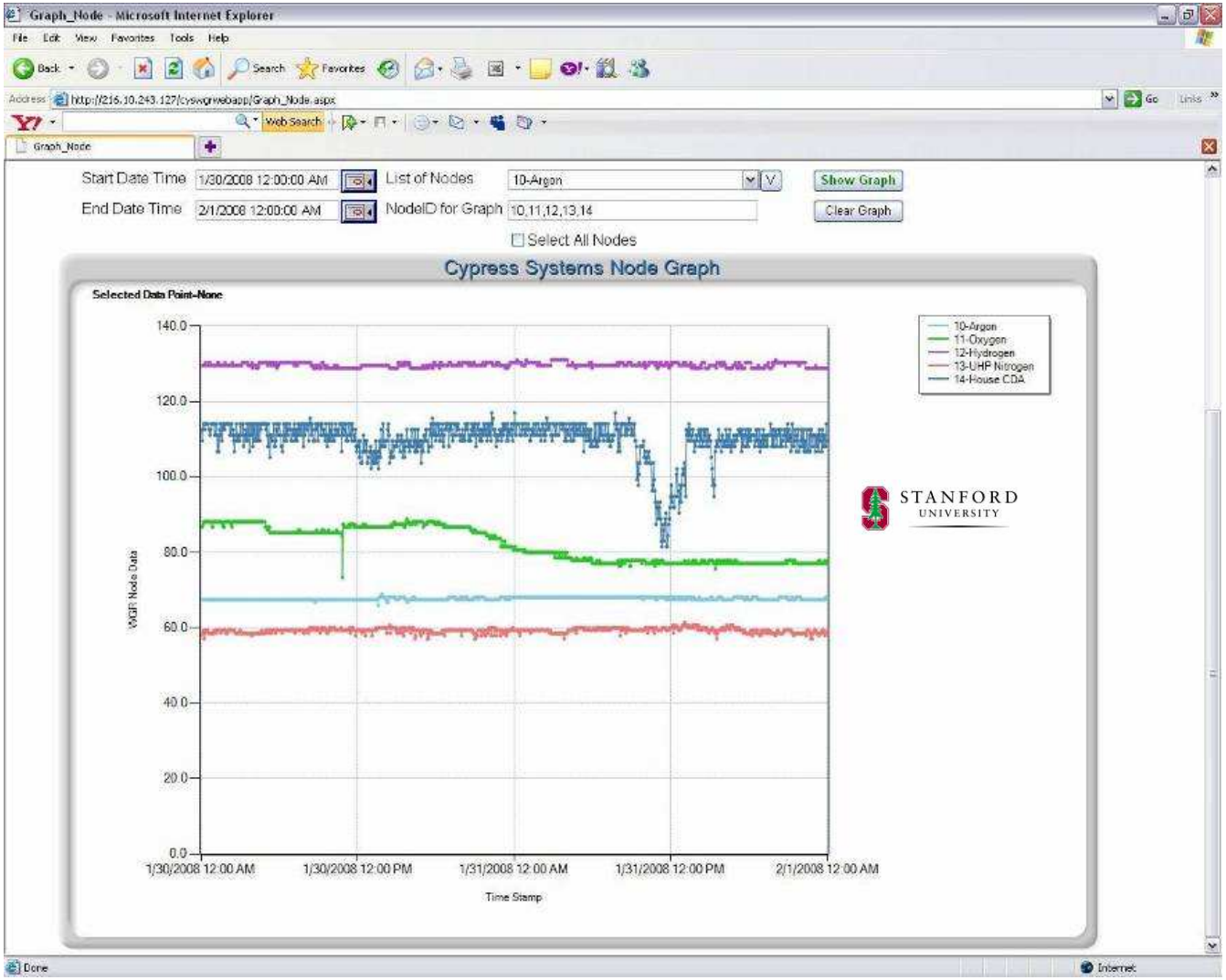
Extra Large Grande Extra Grande

Magnehelic Process Gauge

Wireless System Architecture Options



Built-in “Zero-Footprint” Web-Based HMI



Web Interface Allows History Trending, Graphs, Alarming/Notification, Remote Commands

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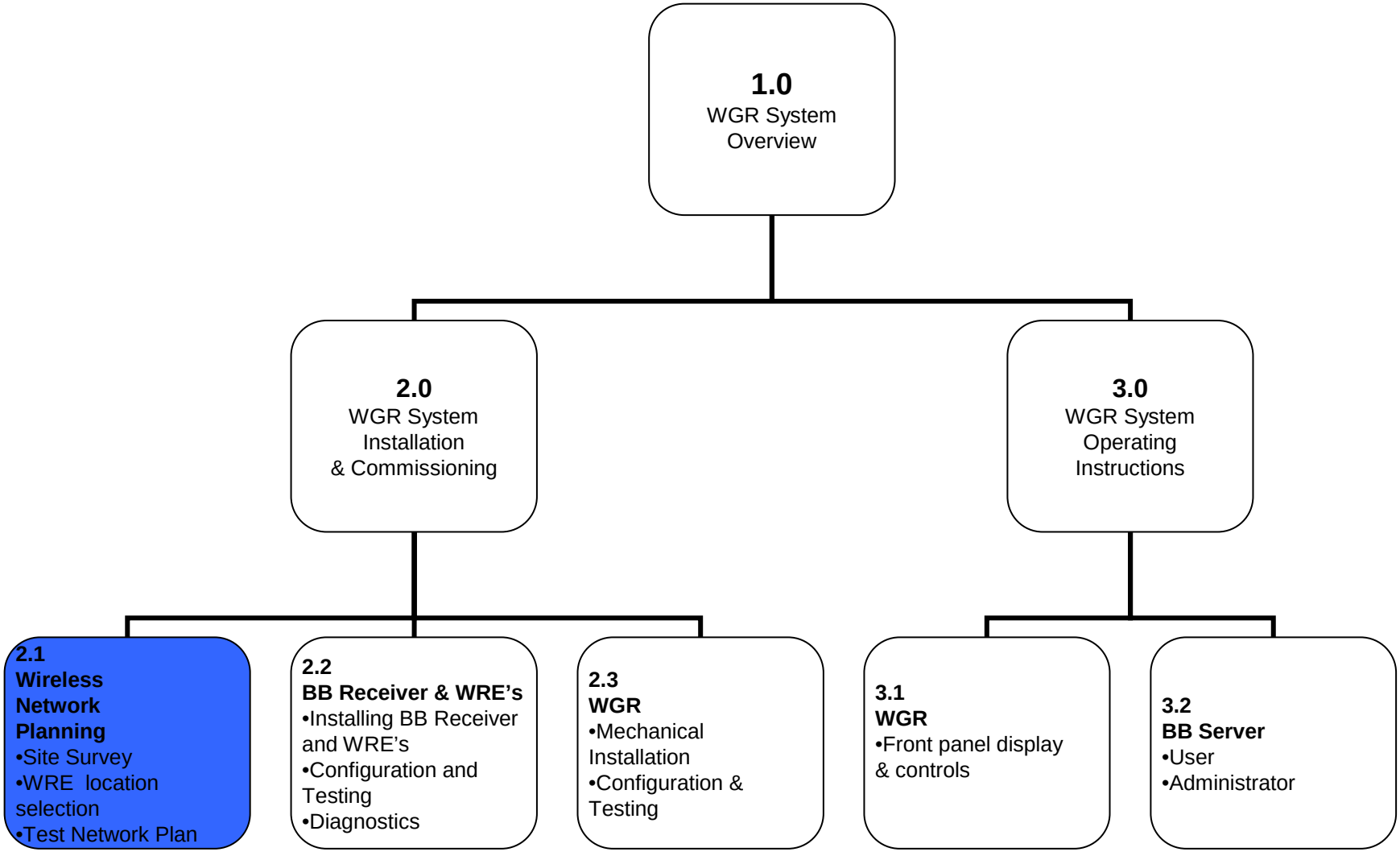
Recommended Installation Procedure

- Site survey
  1. If possible, have paper copy of floor plan
  2. View the gauge and mark location on floor plan
  3. Take picture of each gauge (close-up and surrounding area)
  4. Note any possible issues (dirty gauge, tight mechanical area, etc.)
  5. Look for power outlets and receiver location
     - Is there a network port near the receiver?

- Install prep
  1. Summarize all gauges and determine required adapters
  2. Determine initial wireless plan based on marked-up floor plan
     - Identify possible locations for repeaters (WRE)
     - Determine if more than 1 receiver is needed (BBR)
  3. Prepare install kit (HW, tools, etc.)

- Installation
  1. Test wireless plan w/ WGRs (survey mode) and Diagnostic Survey Tool
  2. Install and calibrate WGRs
  3. Train customer on how to look at data

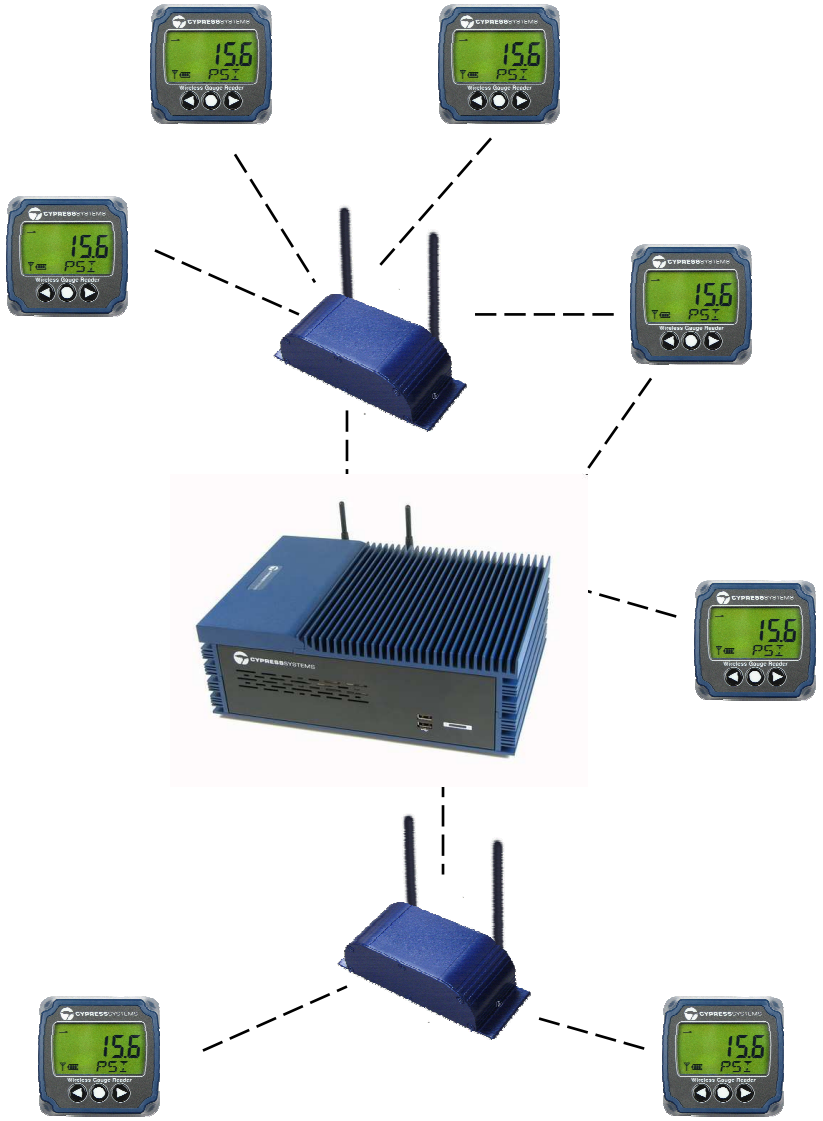
WGR System Training Modules



Wireless Network Planning Overview

- Wireless network planning is needed to select optimal locations for repeaters and receiver's)

- Installation environment and building layout may change the number of repeaters required



Guidelines for Maximizing Wireless Range

Wireless Performance

- Cypress wireless has been installed in many different sites including industrial plants, concrete bunkers, clean rooms and commercial high rises

- Typical wireless ranges for a single “hop” are:

Line of sight	300 ft (91m) open halls 150 ft (46m) in open office floor 100 ft (30m) in corridors
Sheet Rock / Dry wood	100 ft (30m), through five walls
Brick Walls	60 ft (18m), through three walls
Ceilings	25 ft (7.5m), through single ceiling

- Repeaters allow for multiple “hops” which extend the communications range of the system

Factors Reducing Wireless Range

- Wireless range is particularly affected when metal obstacles are in the line of transmission.
- A solid sheet of metal presents the greatest obstacle, while rebar reinforced concrete is less.
- Try to note the following objects and avoid in the line of transmission:
  - Elevator shafts and stairwells
  - Hollow lightweight walls filled with insulating metal foil
  - Metal reinforced concrete walls, pillars and columns
  - Plumbing and electrical risers

Bigger the metal obstacles in the transmission path shorter the wireless coverage

Where to Place Receiver and Repeaters

Do

- Try to place the Blue Box Receiver in a central location on the site with power and preferably nearby LAN drop
- Mount repeaters (WREs) at eye-level or higher to avoid obstructions
- Use wireless survey tool to determine where the signal is the strongest

Don‘t

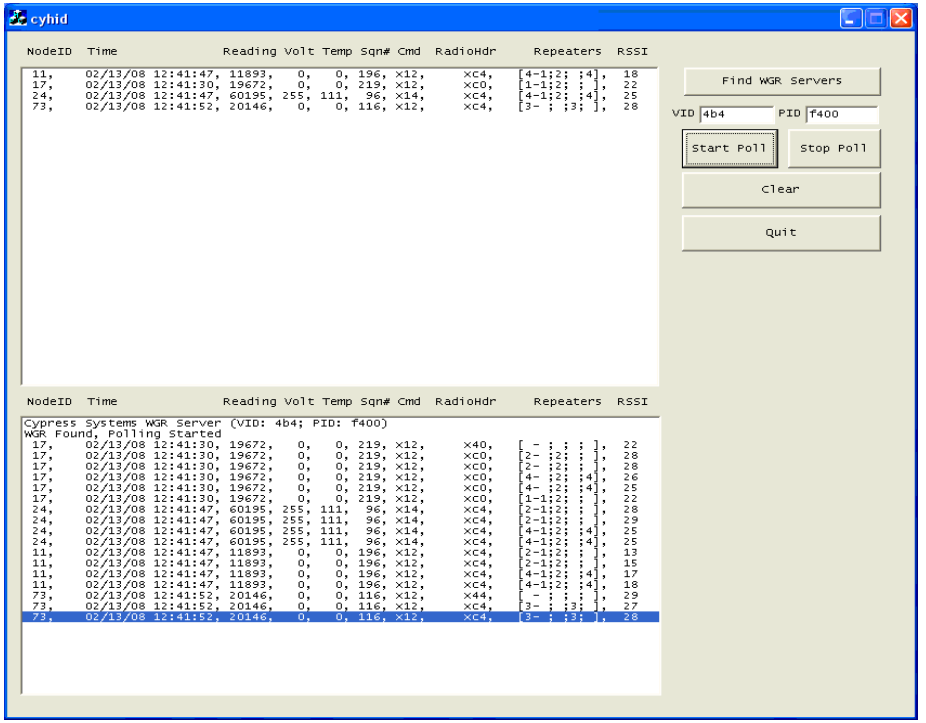
- Avoid solid metal obstacles in the line of transmission
- Don’t place repeaters or receivers inside metal cabinets

Wireless Survey Tool

Wireless Survey Tool

- The wireless survey tool is used to capture signal strength information on a laptop
- 2 components to the wireless survey tool
  - Diagnostic receiver (HW)
  - CYHid application (SW)
- Start with a WGR at the furthest location from the receiver and set to survey mode
  - Setting the WGR to survey mode is covered later
- Using the CYHid application, find the spot where RSSI drops below 10 – that is a good spot for a repeater
- Upon completion of the install, use the wireless survey tool at each repeater location to verify that the RSSI (WGR Signal Strength) is greater than 10

  Note: The application and receiver only records signal strength from the last “hop”

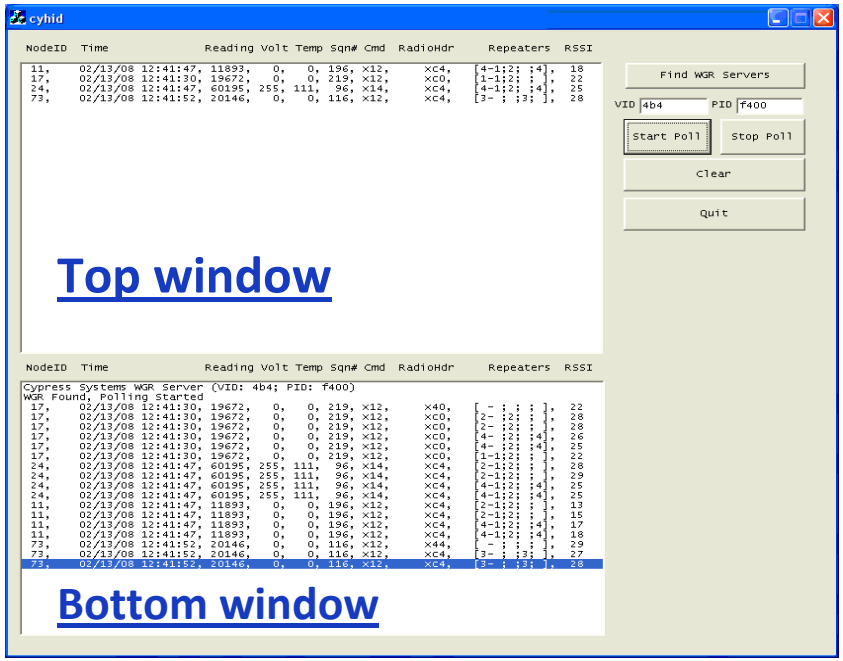


Setting up the Wireless Survey Tool

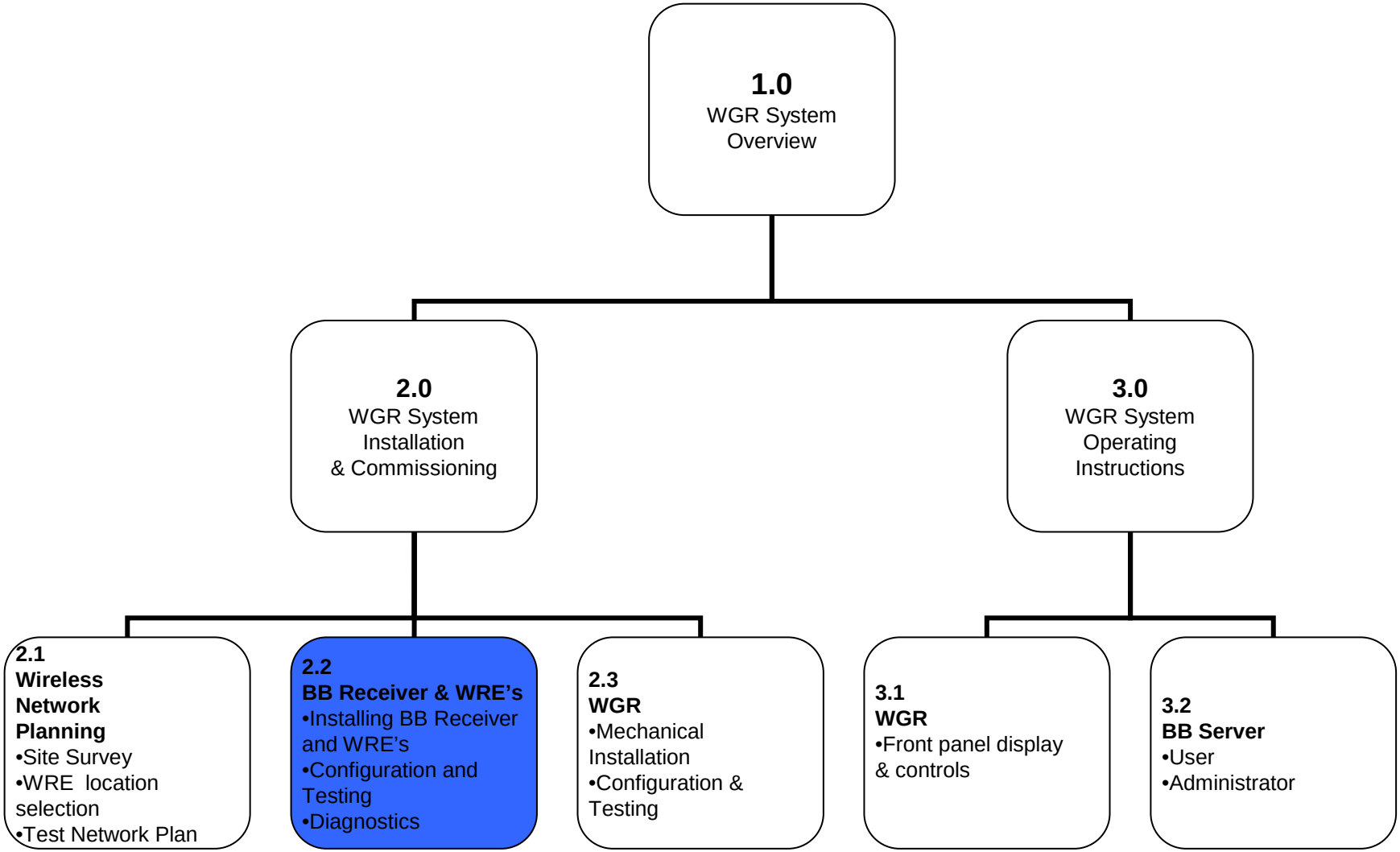
1. Connect the Diagnostic Receiver to your laptop via USB.
2. Launch the CYHid application
3. Click on “Start Poll” to start receiving

- The top window will show the maximum RSSI readings
- The bottom window will show readings as they are received

4. To stop, click on “Stop Poll”
5. To exit the application, click on “Close”



WGR System Training Modules



Installing the Wireless Network Infrastructure

- The wireless network infrastructure consists of Wireless Range Extenders (WREs) and the Blue Box Receiver (BBR)
- Site survey is needed to identify WGR locations and estimate the repeater and receiver locations
- After site survey is complete, temporarily install WREs and BBR (or multiple BBRs when applicable)
- Once wireless performance is verified, permanently install WREs and BBR

The Wireless Range Extender (WRE)

Wireless Range Extender (WRE) Overview

- WREs are used to extend the wireless range of a WGR

- WREs require 5 VDC
  - 120/240VAC adapter is included

- Multiple WREs in a system require different delays for each WRE (either 1, 2, 3, or 4 ms)

- Up to 4 WREs can be used to get a single WGR reading to the receiver
  - More than 4 WREs can be used in an install depending on layout

Verifying WRE Channel Set and Delay

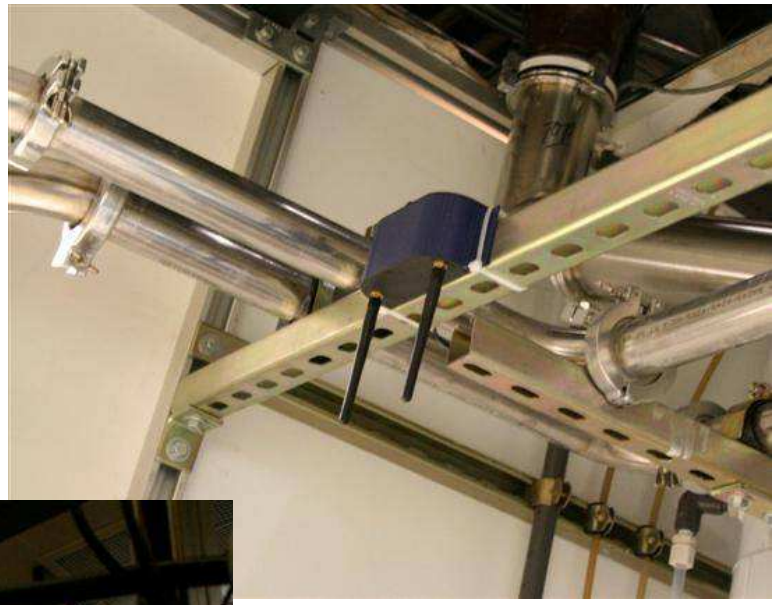
- WREs are pre-labeled with their channel set letter followed by the delay
  - The label is located on the bottom of the WRE
- A - 1 means channel set A with a delay of 1 ms
- Make sure the channel set of the repeaters matches the channel set of the BBR and WGRs

Installing WREs

- WREs should be installed with the fastest delays (1ms) farthest away from the receiver, and slowest delays (4ms) closest to the receiver
- WREs should be installed at eye level or above
- WREs should be securely attached so it can't be moved
  - Preferably use screws or cable ties, otherwise VHB tape may be used
- Cords should be cable tied if possible
- Make sure antennas are screwed in all the way and vertical

WRE Field Installations

Additional WRE Field Installations



The Blue Box Receiver (BBR)

Blue Box Receiver (BBR) Overview

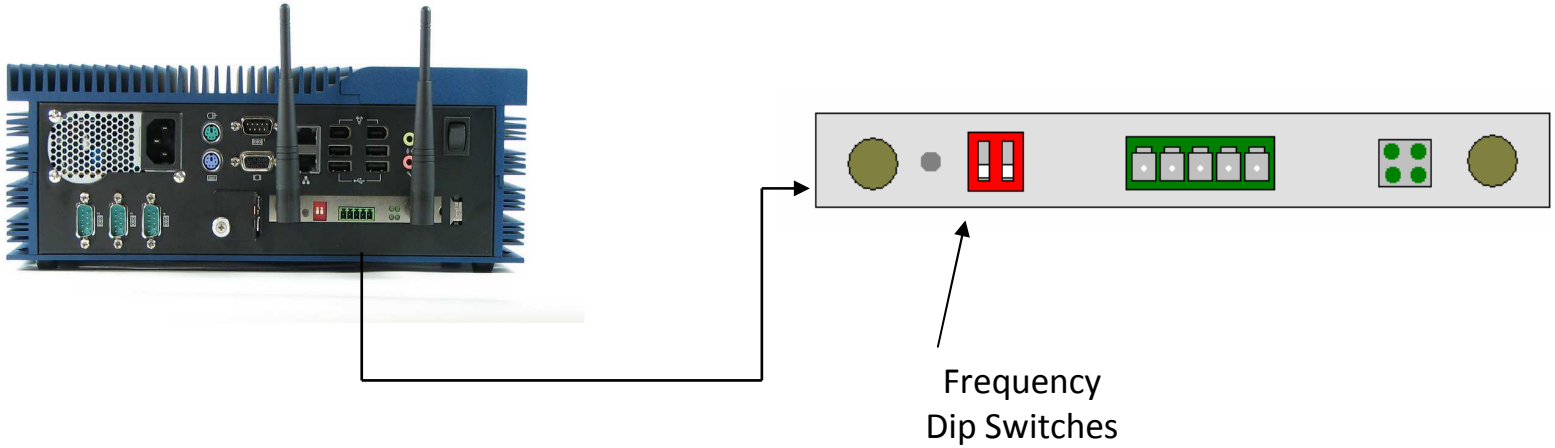
- Blue Box Receiver receives WGR readings and stores data in SQL database
- One receiver can handle 128 WGRs
- Multiple receivers may be installed at a single site if multiple wireless channels are used

High Level Installation Steps for the BBR

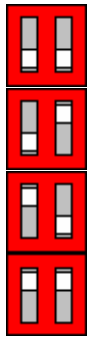
1. Set the receiver channel
2. Connect to the BBR for configuration
3. Add installed WGR nodes to database
4. Configure alarms (if needed)
5. Verify wireless signal strength
6. Mount BBR (if needed)

Next slides will show details of each step

Setting the Wireless Receiver Channel



Wireless Channel Set must match WGR configuration



-Channel Set A (2,74)
-Channel Set B (6,78)
-Channel Set C (24,50)
-Channel Set D (30,54)

Connecting to the BBR

Three ways to access the data on the BBR

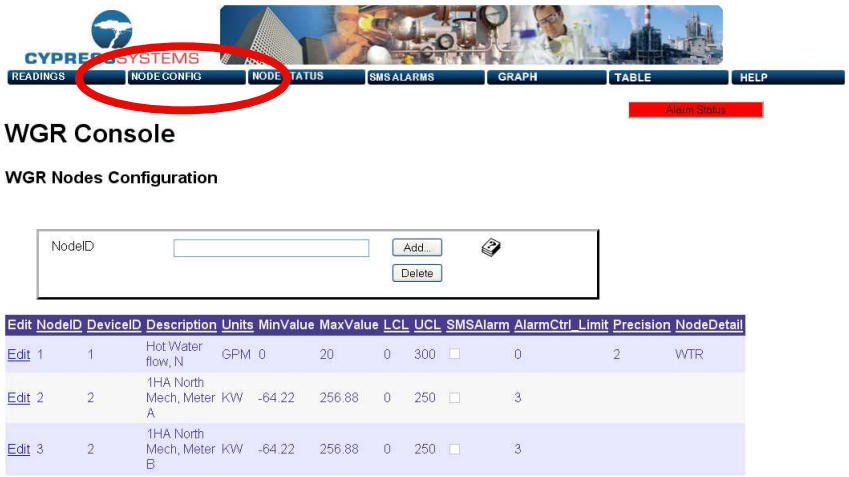
1. Access from LAN via intranet.
   - Any PC on the LAN can access the data via web browser.
   - In web browser, type in BBR machine name or IP address
     - For example, http://WGRServerNNN/ or http://192.168.1.190
   - BBR machine name is on label (bottom of BBR)
     - Name is typically “WGRServerNNN”, where NNN is a unique number

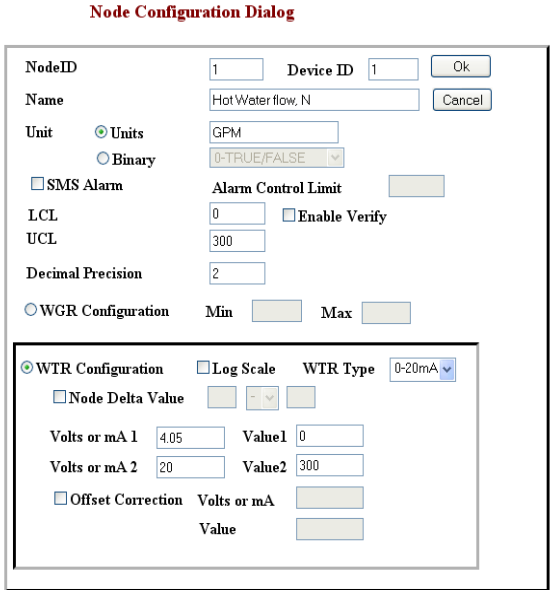
2. Access from ethernet locally connected to laptop.
   - Use if LAN cannot be accessed
   - Connect ethernet cable between BBR and laptop
   - Open web browser in laptop and enter BBR machine name or IP address

3. Local keyboard and monitor
   - Use as a stand alone workstation
   - Start web browser and enter BBR machine name or IP address

Adding Installed Nodes through WGR Console

- Click the “NodeConfig” button on the WGR Console. When prompted enter:
  - Username: admin
  - Password: wgradmin
- To add new node, enter nodeID in text box and click “Add”
- Enter node info into new dialog window, and click OK
  - See help file for explanation of Node Configuration parameters





Configuring SMS Alarms through WGR Console

- In web browser, go to WGR Console then click “SMS Alarms” button
- Add SMS/Email Alarm recipients
- Customize Site Name
  - Custom site name will appear to the left of “WGR Console” label
- Same username and password as the Node Config page

Site Name WGR Console

WGR Cell Phone SMS Alarms Configuration

COM Port Setting for SMS Modem. If using SMTP server for email notification, please specify SMTP server host and port#. Update UserID,Password and Domain only if credential is required to access the SMTP server.

	SiteName	Modem_Phonenum	MaxNodes	COMPort	SMTPServer	SMTPPort	UserID	Password	Domain
Edit	Site Name	32075	100	10					

Recipients SMS Phone Numbers for Alarm Nofication

Phone# Name Add

Email address

	Phone Number	Belongs to	Email
Edit Delete	15555555555	John	cysupport@cypress.com

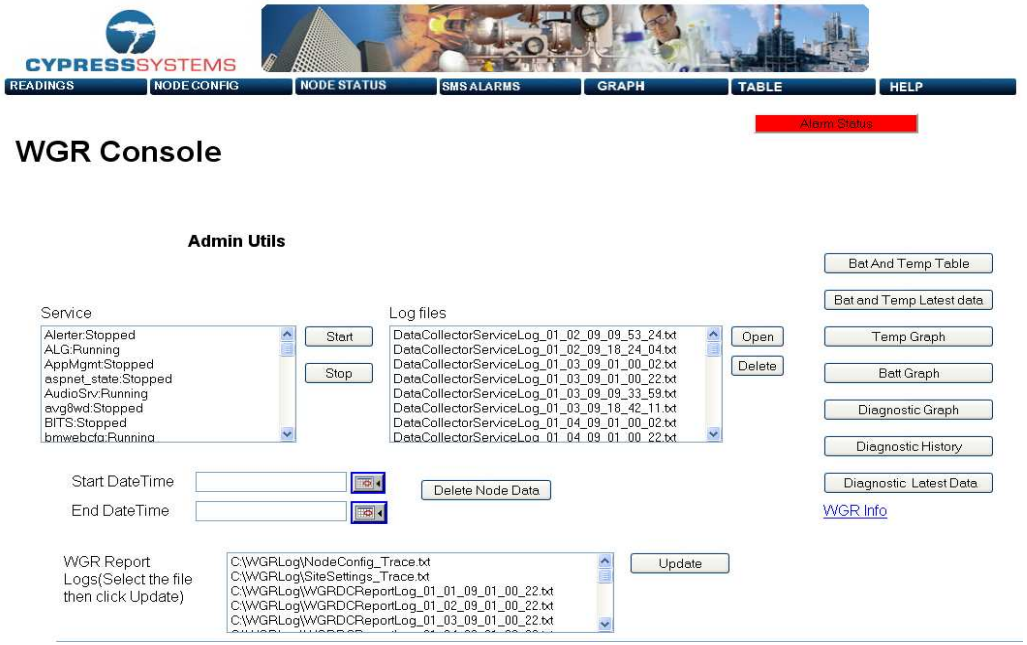
*Note: If the SMS Alarm checkbox is checked for a node, everyone in the alarm list will be notified via SMS text and/or email when the node goes into alarm state

Verify Wireless Strength through Web Console

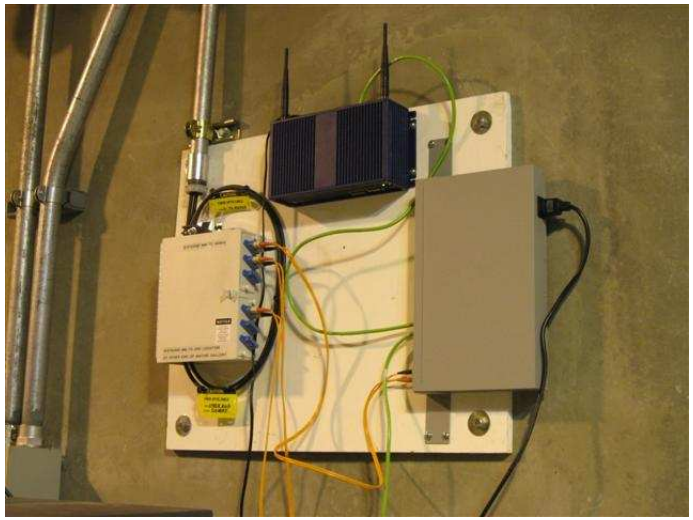
- Access admin page by typing http://WGRServerNNN/admin.aspx into web browser address bar. When prompted, enter
  - Username: master
  - Password: wgrmaster

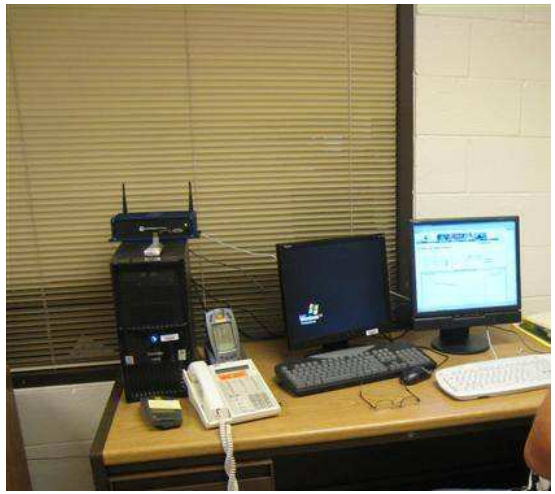
- Use Diagnostic History and Diagnostic Latest Data to see WGR data reception paths
  - This will show which repeaters were used to get data to receiver

- Verify all signal strengths (RSSI) are greater or equal to 10
  - If lower than 10, adjust WRE locations

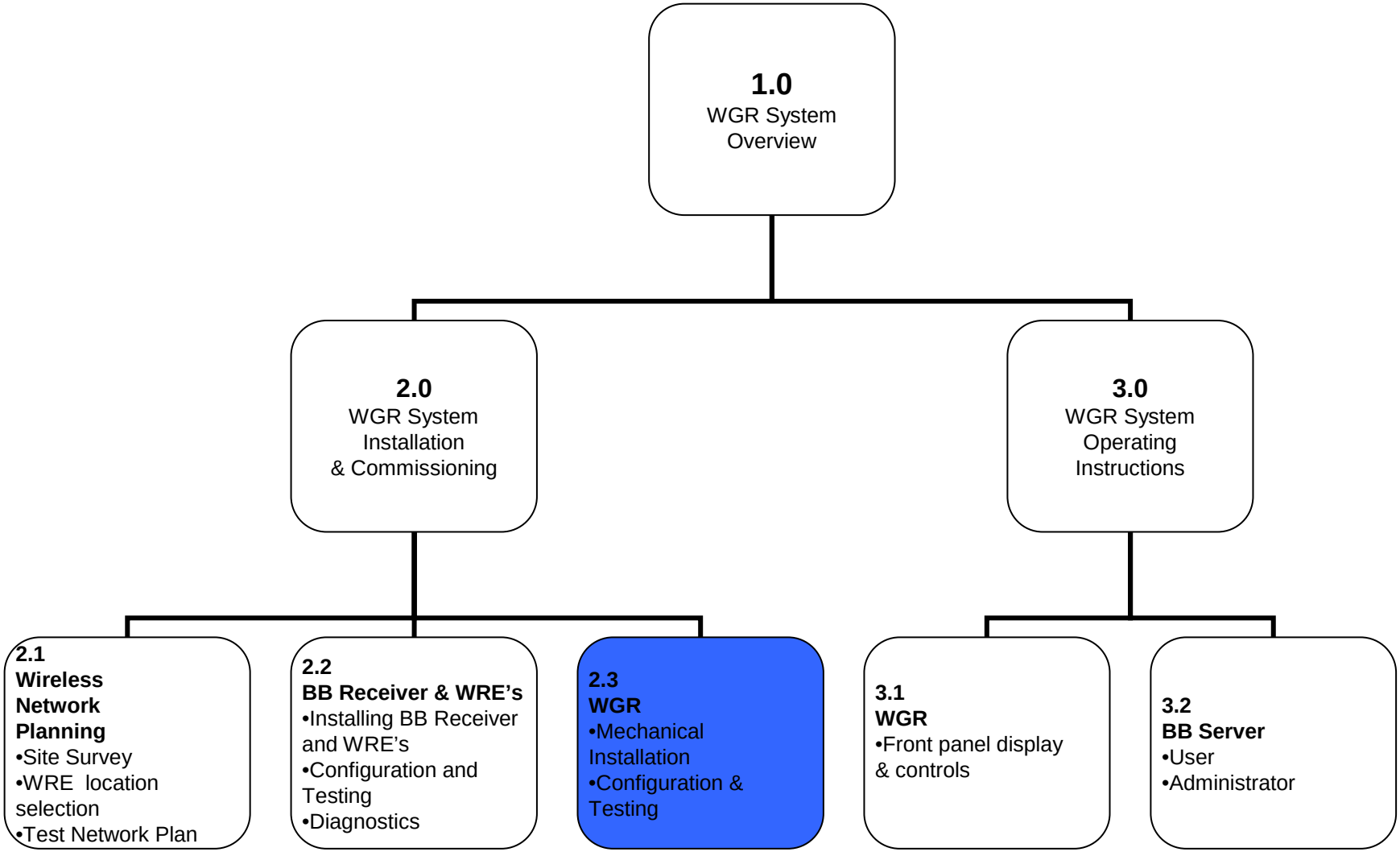


Mounting the BBR – Field Examples





WGR System Training Modules



WGR Installation overview

- This training module addresses:
  - Understanding the WGR
  - Understanding the Handheld Configuration Tool
  - Understanding the configuration activity
  - How to physically mount the WGR
  - How to configure a WGR to a specific gauge

Understanding the WGR

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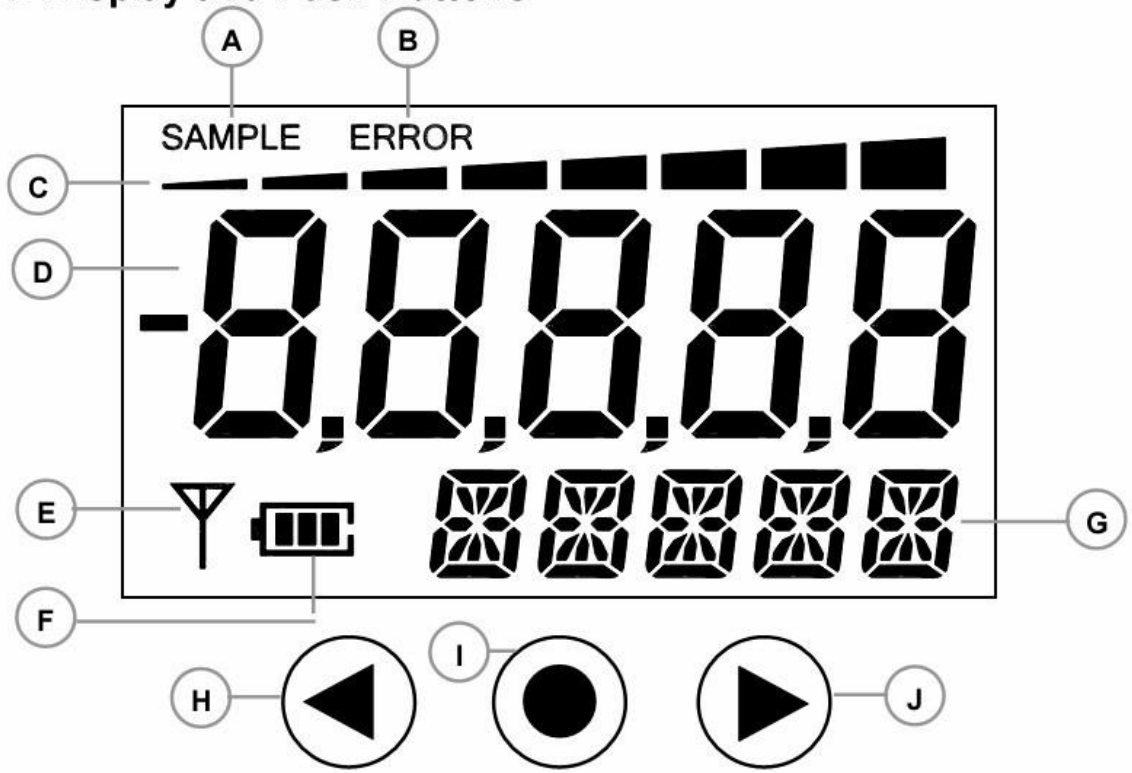
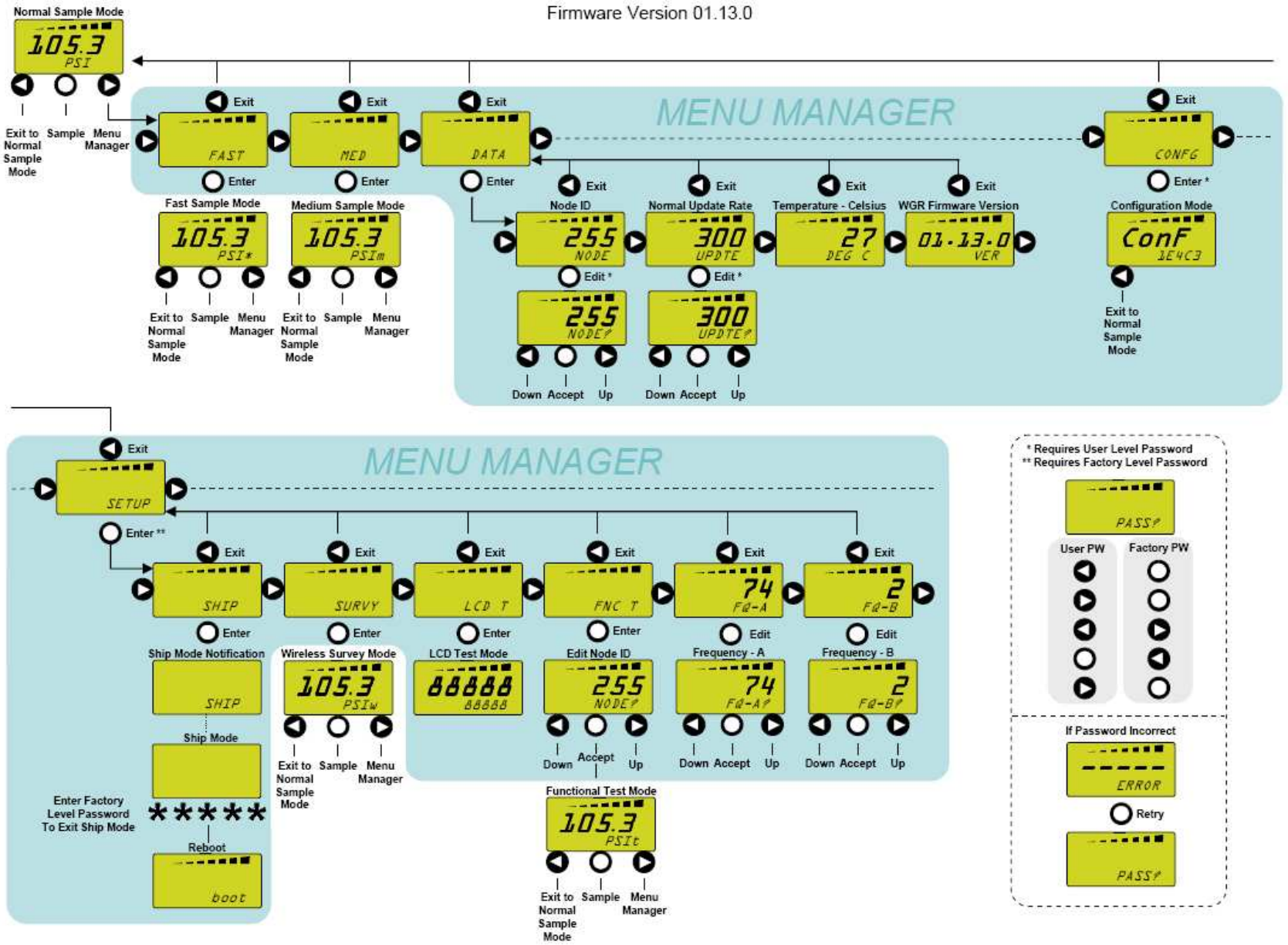
WGR LCD Display Details

LCD Display and Push Buttons

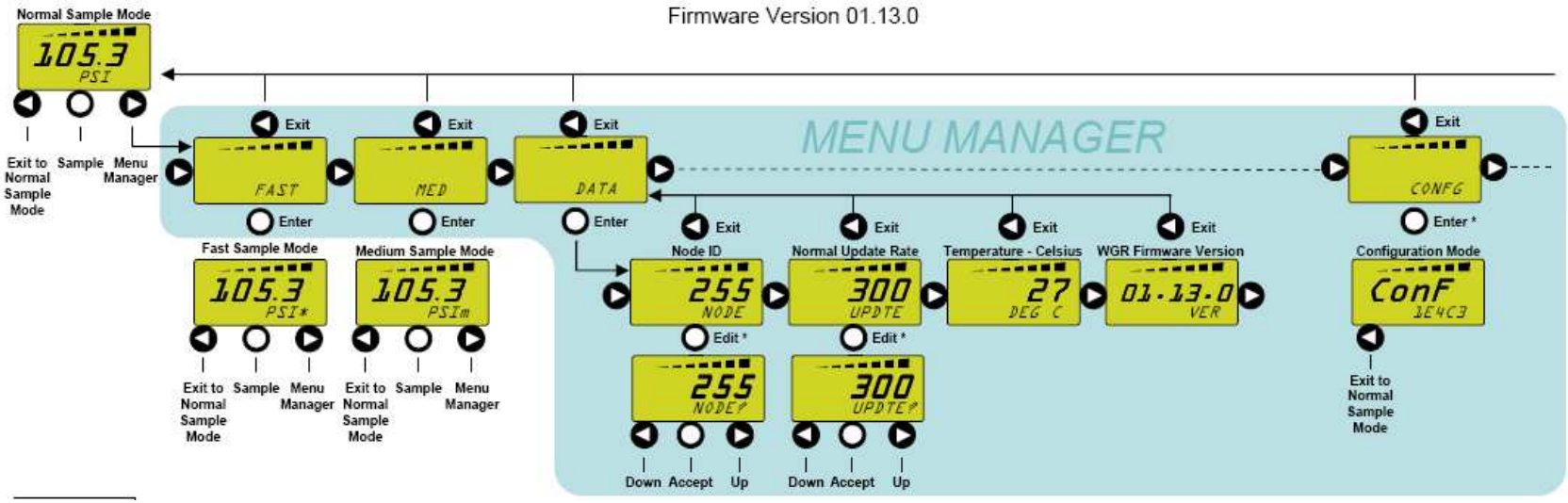


A.	**SAMPLE Icon**	Displayed when a new reading is being captured and converted
B.	**ERROR Icon:**	Displayed when an error condition is detected
C.	**Bar Graph**	Indicates percent of full-scale reading
D.	**Numeric Display**	Displays the converted reading value
E.	**Antenna Icon**	Displayed when wireless communication is successful
F.	**Battery Level**	Displays percentage of battery life remaining
G.	**Alpha-numeric Display**	Displays the reading units or diagnostic messages
H.	**Left Button**	Menu navigation and decrease values
I.	**Center Button**	Requests immediate updated reading and menu navigation
J.	**Right Button**	Menu navigation and increase values

WGR menu structure



WGR menu structure



Normal Sample Mode: Standard WGR operating mode. Time between samples is setup using the HH.

Fast Sample Mode: WGR will sample every 5 seconds for 5 minutes. It will automatically return to Normal Sample Mode. This mode is useful for short term diagnostics.

Medium Sample Mode: WGR will sample every 30 seconds for 8 hours. It will automatically return to Normal Sample Mode. This mode is useful for medium term diagnostics.

Node ID: The Node ID of the WGR. This can be viewed and edited.

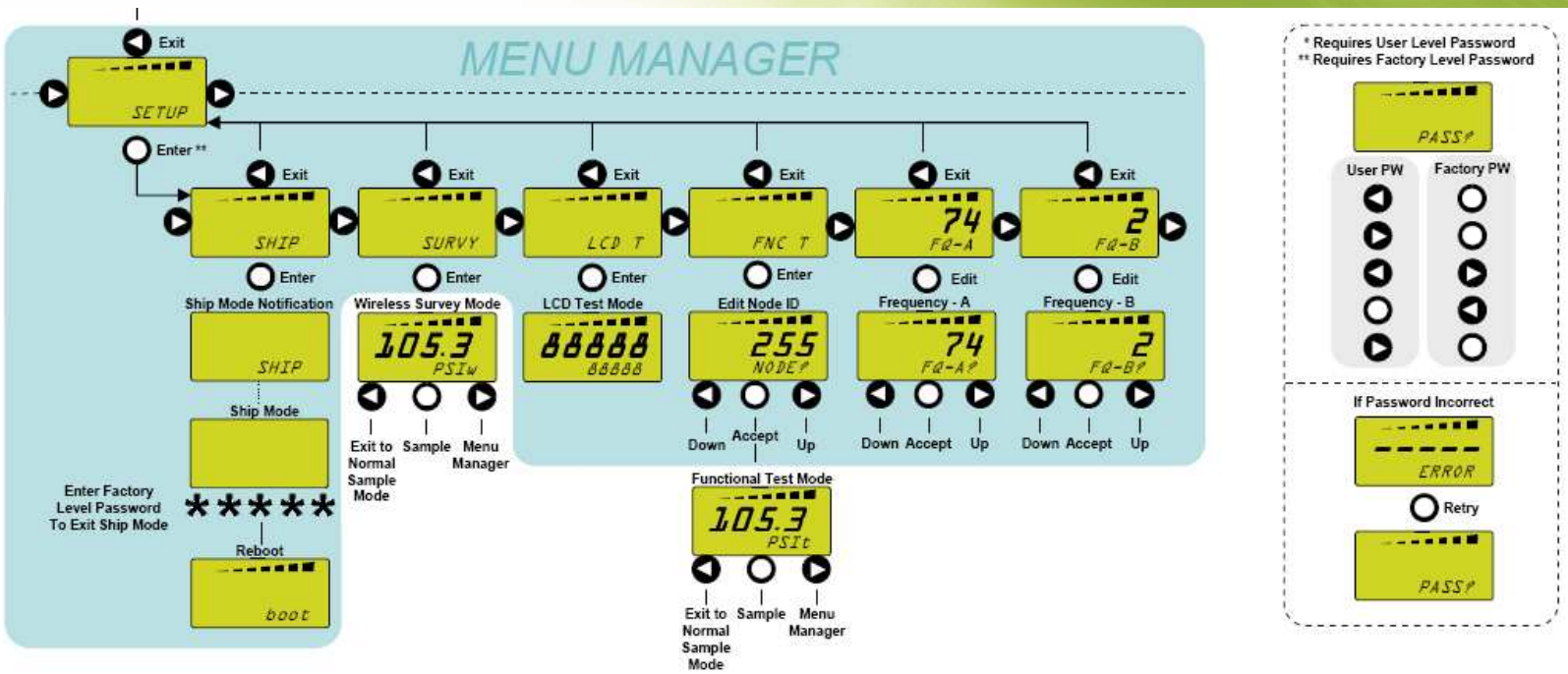
Normal Update Rate: The update rate for Normal Sample Mode. This can be viewed and edited.

Temperature – Celsius: Displays the current temperature reading at the WGR. Read-only.

WGR Firmware Version: Displays the WGR firmware version number. Read-only.

Configuration Mode: This mode is used to configure the WGR with a HH device.

WGR menu structure



Ship Mode: This mode effectively powers down the WGR. The WGR is in an ultra low power consumption state. This mode is used when storing or transporting WGRs.

Wireless Survey Mode: Mode used when performing wireless survey at a site. The WGR sends dummy samples without taking image to save battery power.

LCD Tests Mode: Mode used during manufacturing test.

Functional Test Mode: Mode used during manufacturing test.

Frequency – A: Frequency A can be viewed and edited.

Frequency – B: Frequency B can be viewed and edited.

Understanding the Handheld Configuration Tool

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Handheld (HH) Basics

1. **Touch Screen:** Main display. Use stylus to navigate on screen.

2. **Navigation Arrows:** Up, down, left, and right navigation keys. Used to navigate to different text entry fields in application. Also, Left Arrow used to type negative symbol "-" into text entry field.

3. **[Enter/On] Key:** Used to power on HH and accept changes/entries.

4. **[FN] Key:** Used w/ [Enter/On] to turn off or perform a full reboot of the HH.
   - Force power down
     - Hold [FN] + [Enter/On] for 5 sec
   - Off/Hibernate state
     - Press [FN] then [Enter/On]

5. **[BKSP] Key:** Backspace key.

6. **Green LED:** Shows power and charge status

7. **Docking Station:** Docking station to charge HH and extra battery pack. Also used to connect HH to a PC.

Launching the HHControl application

1. Power on the Handheld using the [Enter/On] key.

2. Tap Start Icon with stylus to access the Cypress Systems HH configuration application, “HH Control”

3. Tap on “HH Control” with stylus to launch application.

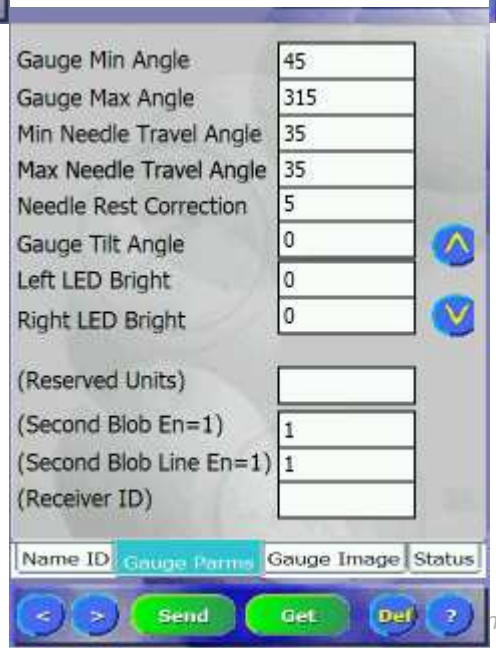
4 Menu Tabs of HH Control Application

Name ID

- Default page
- Used to select device for configuration

Gauge Params

- Used to set gauge specific parameters

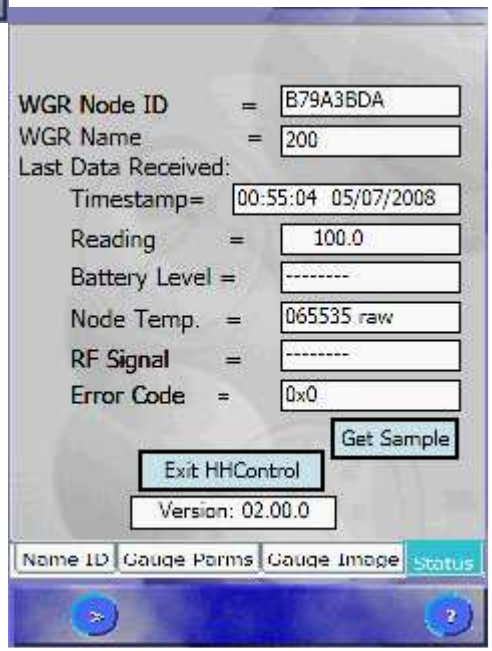


Gauge Image

- Displays gauge image and

Status

- Summary tab
- Used to verify proper configuration



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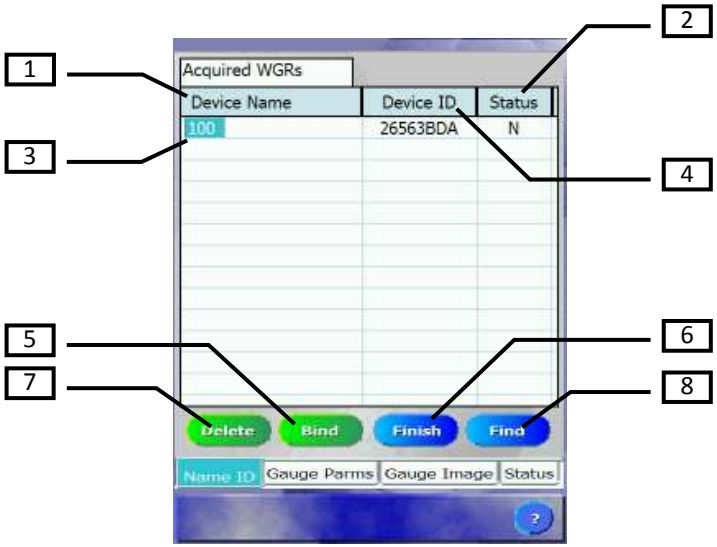
Tab Detail: Name ID



1. **Device Name:** Column contains the node numbers of the WGR that the handheld has or is wireless bound to

2. **Status:** Column shows connection status between WGR and HH
   - Blank → HH cannot detect WGR
   - "N" → HH detected the WGR but they are not connected
   - "Y" → HH and WGR are connected

3. **Device Name**: Select, enter or edit the name of a WGR here.
   - To select a WGR tap on the name with the stylus.
   - To enter or edit the name, first select WGR. Then click on the name once more with stylus. Entry field will switch to edit mode. Type name with keypad. To exit edit mode, press [Enter/On] key or tap anywhere else on screen with the stylus.

4. **Device ID**: Column lists unique radio ID of WGRs that are found. When connected to HH, WGR displays its radio ID on its LCD.

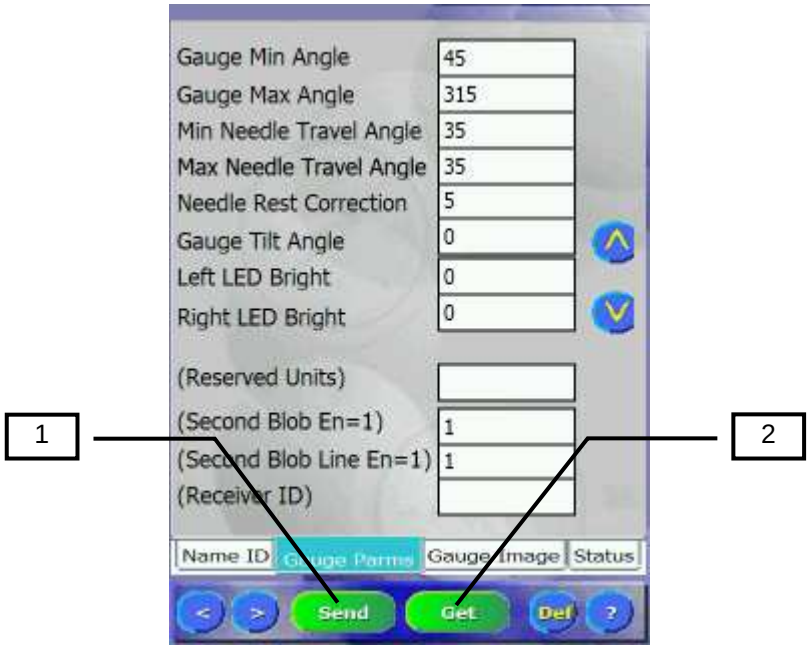
5. **Bind**: Tap to connect HH to selected WGR in Device Name column

6. **Finish**: Tap to terminate connection between HH and WGR. <u>WGR will not save config settings if connection is terminated any other way.</u>

7. **Delete**: Tap to delete highlighted WGR in Device Name column.

8. **Find**: Tap to have HH search for any WGRs in Discovery/Config mode within wireless range.
   - Detected WGRs will be labeled "<UNASSIGNED>" in the Device Name column and an "N" in the Status column.

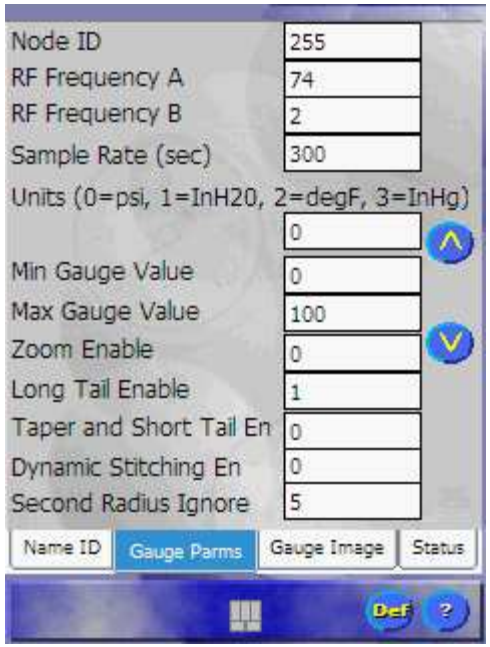
Tab Detail: Gauge Params Buttons



1. **Send:** This will send all current parameters from the HH to the WGR.

2. **Get:** This will request all parameters from the WGR and fill them in the HH.
   *Note: If HH is connected to older WGR, some parameters may not filled in.

Tab Detail: Gauge Parameters (1 of 3)



Node ID: Unique ID of the WGR.

RF Frequency A: Channel A used for wireless communication.

RF Frequency B: Channel B used for wireless communication.

Sample Rate (sec): Time in seconds between samples.

Units: Units of the gauge.

Min Gauge Value: Minimum value on the gauge

Max Gauge Value: Maximum value on the gauge

Zoom Enable: Camera will capture the image with a 2x zoom

Long Tail Enable: Specifies the pointer type.

- 1 = Long Tail Mode
- 0 = Short Tail Mode.

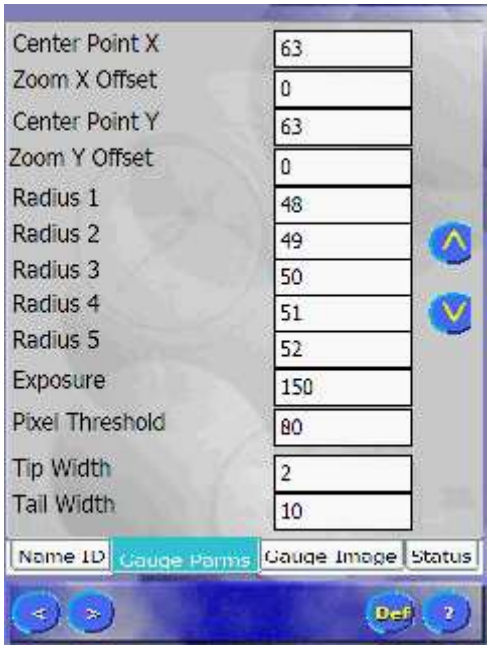
Taper and Short Tail En: If enabled, WGR will also process the taper of a short tail pointer to find the tip.

Dynamic Stitching En: Special mode used to find tip of a long tail pointer with a slight taper.

Second Radius Ignore: Specifies which Circles/Radius to ignore for angle calculation. All circles greater than this value will be ignored.

- Long Tail mode: 5
- Short Tail mode: Set based on circles that only overlap tip – usually 3.

Tab Detail: Gauge Parameters (2 of 3)



Center Point X: Center of pointer and concentric circles in X direction.

Zoom X Offset: Offset image in X direction.

Center Point Y: Center of pointer and concentric circles in Y direction.

Zoom Y Offset: Offset image in Y direction. Only valid when Zoom enabled.

Radius 1: Innermost circle radius.

Radius 2: Circle 2 radius.

Radius 3: Circle 3 radius.

Radius 4: Circle 4 radius.

Radius 5: Outermost circle radius.

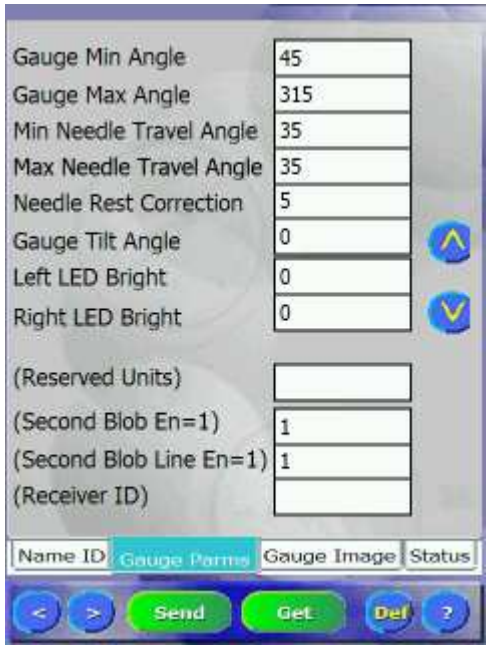
Exposure: Adjust brightness of image, 0-250. Larger number gives brighter image.

Pixel Threshold: Algorithm parameter used to define “dark” pixels. Decreasing Pixel Threshold increases number of pointer pixels detected.

Tip Width: The pointer tip width in pixels.

Tail Width: The pointer tail width in pixels.

Tab Detail: Gauge Parameters (3 of 3)



Gauge Min Angle: Angle of Min Gauge Value with respect to gauge bottom

Gauge Max Angle: Angle of Max Gauge Value with respect to gauge bottom

Min Needle Travel Angle: Angle at which gauge value will switch from Maximum to Minimum or vice versa. Angle is with respect to gauge bottom. Must be between Gauge Min and Max Angles. Different with WMRs.

Max Needle Travel Angle: Enter same angle as the Min Needle Travel Angle. Different with WMRs.

Needle Rest Correction: Offset angle from Gauge Min Angle where the value will always read Min Gauge Value. If needle is between the Gauge Min Angle and Gauge Min Angle + Needle Rest Correction, then value will read Minimum.

Gauge Tilt Angle: Angle between the WGR and Gauge Bottom.
Example: -30 = Gauge is 30 degrees counterclockwise.

Left LED Bright: WMR parameter. Adjust brightness of left half of image, 0-21

Right LED Bright: WMR parameter. Adjust brightness of right half of image, 0-21

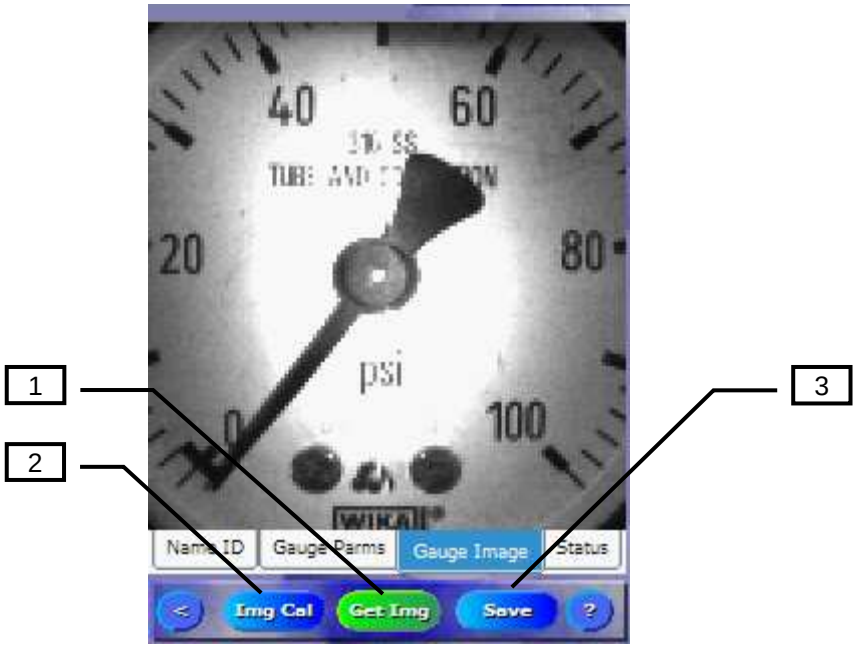
(Reserved Units): Unused.

(Second Blob En=1): Always be set to 1.

(Second Blob Line En=1): Always be set to 1.

(Receiver ID): Unused.

Tab Detail: Gauge Image

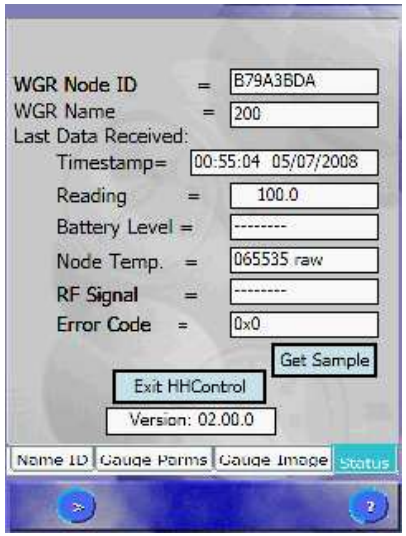


1. **Get Image:** Requests image from WGR and displays image on LCD.

2. **Image Calibration:** Initiates the step-by-step graphical pointer centering and circle calibration.

3. **Save:** Saves all gauge parameters to a text file

Tab Detail: Status



Reading: Reading results from "Get Sample" Request. Used to verify calibration of the WGR.

Error Code: Error code result from the last Get Sample performed.

Get Sample: Initiates a sample reading using current calibration parameters.

Exit HHControl: Closes Cypress Envirosystems HH configuration application.

Understanding the WGR configuration activity

CYPRESS
ENVIROSYSTEMS

Revision 1.0

Defining the gauge face

Related HH Variables

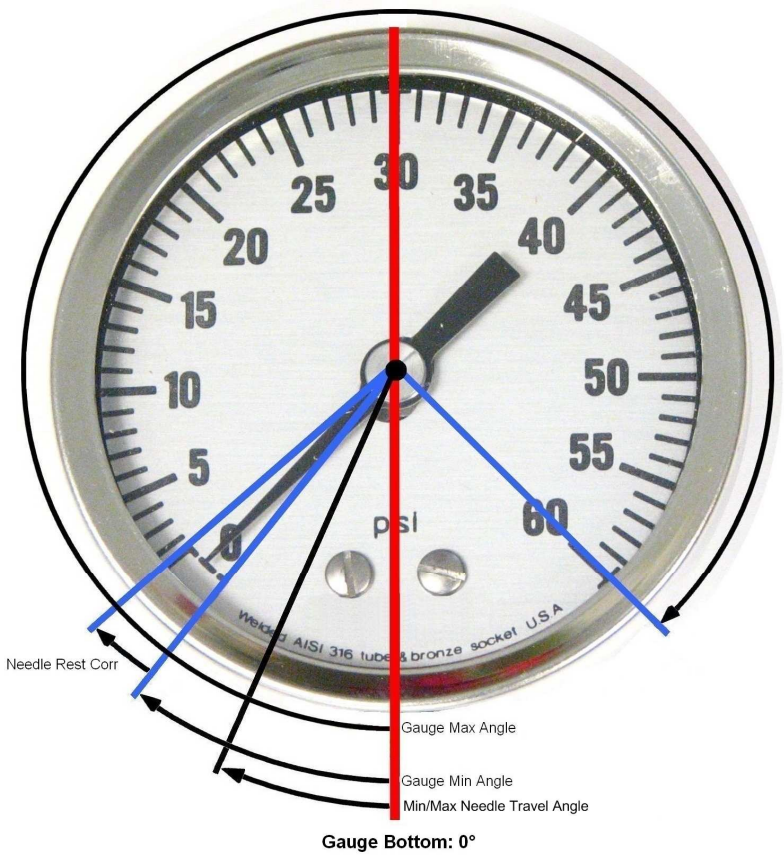
- **Gauge Min Angle**
- **Gauge Max Angle**
- **Min/Max Needle Travel Angle**
- **Needle Rest Correction**
- **Gauge Tilt Angle**

- 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.

- These gauge characteristics do not depend on how the WGR is rotationally mounted on a gauge.

- All angles are defined with respect to the gauge face.

- Reference the Red Line in the example diagrams. All angles start from 0° and turn clockwise to 359°.

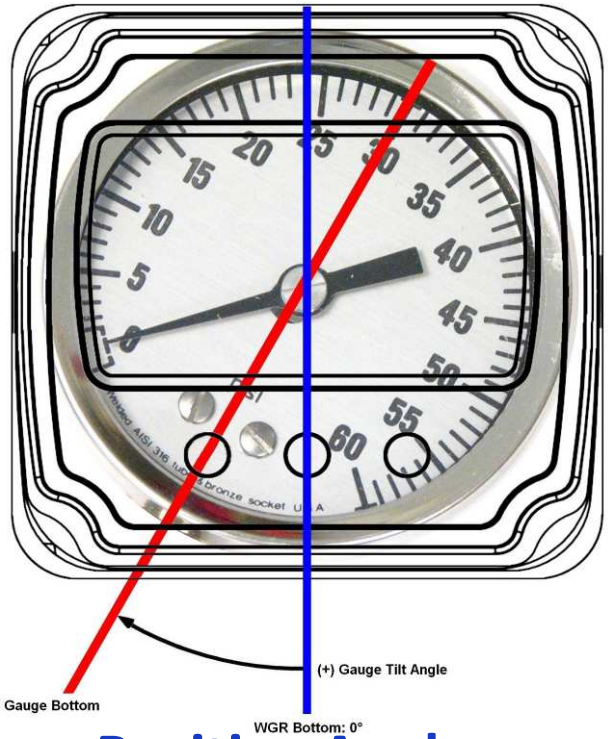


Defining the gauge face (continued)

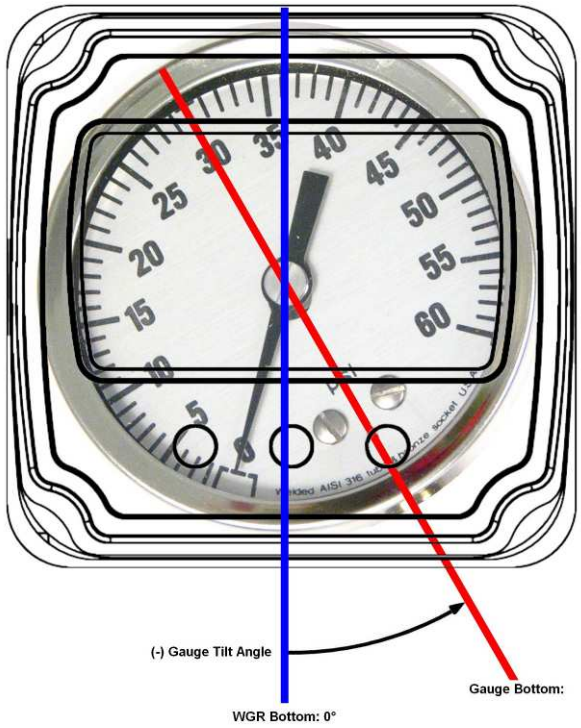
Gauge Tilt Angle:
Often a gauge is installed at an angle, which then requires an offset be added to the WGR.

The Gauge Tilt Angle is defined with respect to the WGR.

- Positive angles start from 0° and turn clockwise to 180°
- Negative angles start from 0° and turn counterclockwise to 180°



Positive Angles

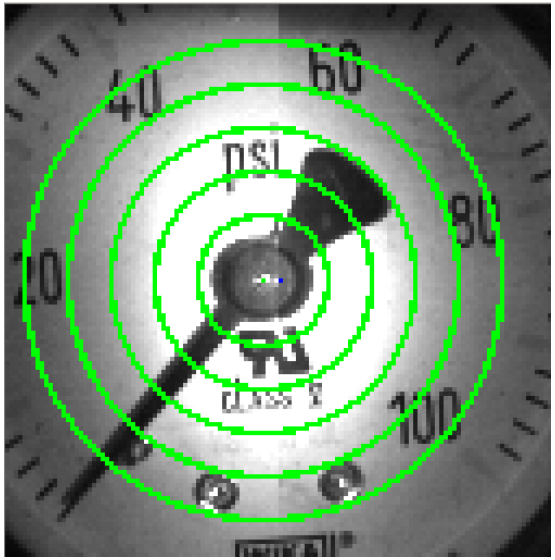


Negative Angles

Circle Calibration: Circles, Zoom, Zoom X Offset, Zoom Y Offset, Get Sample and Tip/Tail width

Related HH Variables:

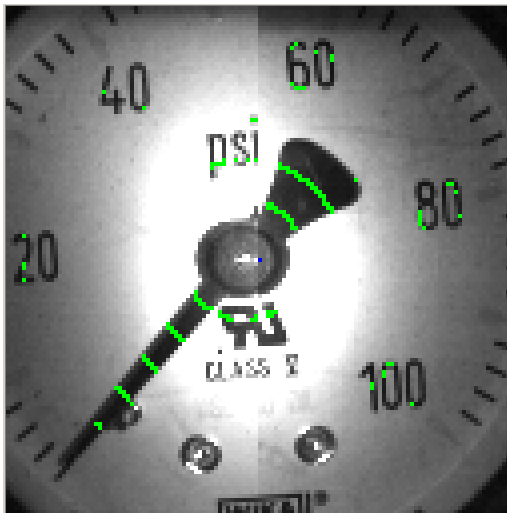
- **Center Point X**
- **Center Point Y**
- **Radius 1**
- **Radius 2**
- **Radius 3**
- **Radius 4**
- **Radius 5**
- **Zoom Enable**
- **Zoom X Offset**
- **Zoom Y Offset**
- **Tip Width**
- **Tail Width**
- **Circles**



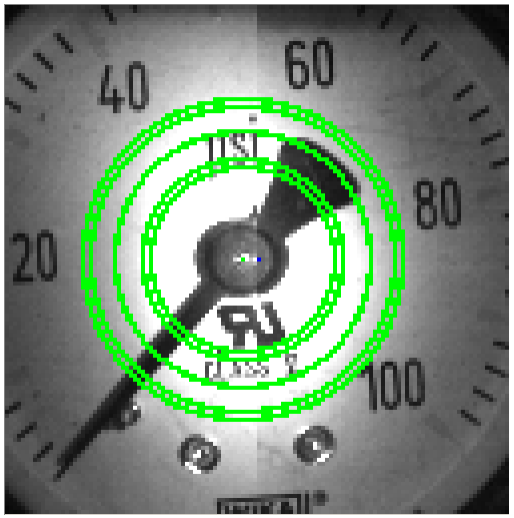
- The WGR looks for the pointer along user defined concentric circles. You must setup these circles to avoid as much background as possible while still overlapping the pointer.
- Writing, markings, graphics etc. that are dark enough may be picked up by the software as part of the pointer. This may create some uncertainty or error in the reading.
- Center Point X and Y and Radius 1-5 define the size and location of the circles.
- The example above shows concentric circles improperly setup. They overlap the PSI symbol, the numbers, the graphic in the center, and even the rivets at the bottom.

Circle Calibration: Circles, Zoom, Zoom X Offset, Zoom Y Offset, Get Sample and Tip/Tail width

The image to the upper right is the same as the prior, except the green pixels represent what the image processing algorithm considers the pointer. Notice all green pixels outside of the pointer. These could confuse the image processing algorithm and distort the reading.

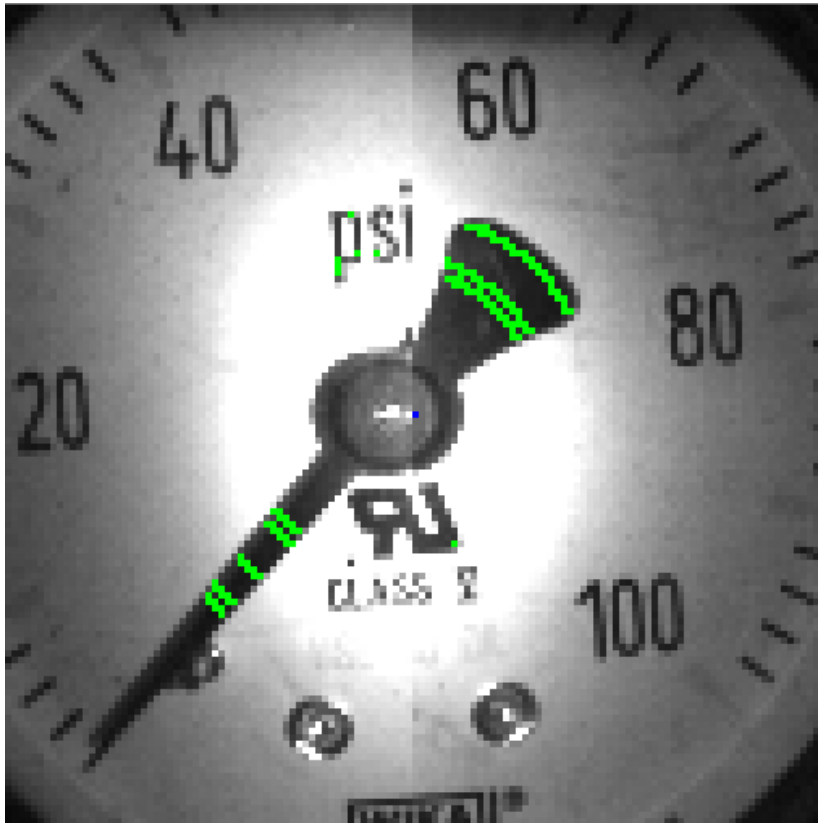


The image to the lower right is an example of concentric circles properly setup. The image processing algorithm will ignore the numbers, rivets and the large graphic in this example. However, portions of the PSI symbol and the top of the “100” marker are still overlapped.



Circle Calibration: Circles, Zoom, Zoom X Offset, Zoom Y Offset, Get Sample and Tip/Tail width

The image below is the same as the one prior, except the green pixels represent what the image processing algorithm considers the pointer. Note, the majority of the green pixels are concentrated only on the pointer.



Circle Calibration: Circles, Zoom, Zoom X Offset, Zoom Y Offset, Get Sample and Tip/Tail width

Zoom: Always enable Zoom, unless the circles can't be set up zoomed in. To enable zoom, set **Zoom Enable** to 1 and than calibrate the circles.

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 pointer by adjusting the Center Point X variable, we can move the pointer 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 Y Offset: Zoom Y Offset can be set the same way as the X Offset except that it can only be used when Zoom mode is enabled.

Circle Calibration: Circles, Zoom, Zoom X Offset, Zoom Y Offset, Get Sample and Tip/Tail width

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 pointer locations. The Red pixels represent the final pointer 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.

Tip/Tail Width: It is possible that the WGR will confuse a group of green pixels overlapping background objects as the pointer, which will cause incorrect readings. To check for and avoid these issues you can perform the following checks:

- 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:
  - Adjust the circle locations to avoid the background.
  - Adjust the Pixel Threshold if the background is not as dark as the pointer.
  - Increase the **Tip Width i**f the erroneous group of green pixels is slightly smaller than the width of the green pixels over the tip of the pointer.

- Perform a Get Sample. If you notice off centered red pixels are within a wide tail, then increase the **Tail Width**. This will tell the WGR that the group of green pixels that should be considered the pointer is wider. The WGR will treat all of the green pixels along the tail as a single group and center the red pixel.

Pixel Threshold

Related HH variables: Pixel Threshold

- To isolate the background from the pointer you can adjust what the image processing algorithm considers a dark pixel.
- Adjust the **Pixel Threshold** variable so that the pointer is found and the background isn't.
- Decreasing the Pixel Threshold will increase the number of pixels picked up.
- Increasing the Pixel Threshold will decrease the number of pixels picked up.
- The top image 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
- The bottom image is an example of when the Pixel Threshold needs to be decreased. Notice the entire needle is not being picked up.

Pixel Threshold (continued)

To ensure a robust setup perform the following steps:

1. Set the Pixel Threshold. Perform a Get Sample and make sure only the pointer 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.

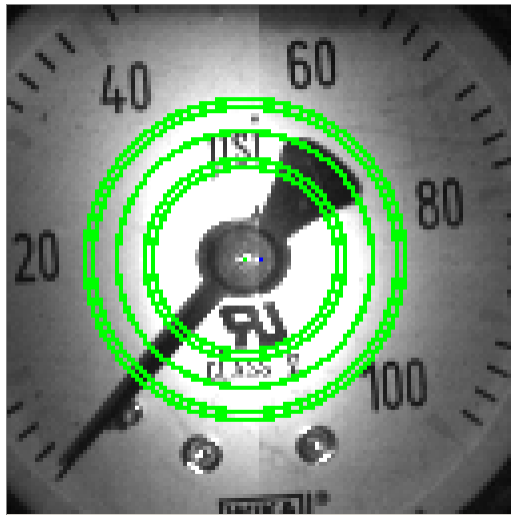
4. Increase the Pixel Threshold by 40 and perform a Get Sample. Make sure too many extra pixels were not dropped.

5. If steps 2 and 4 passed, your original setting is robust. If step 2 failed you must increase your Pixel Threshold value. If step 4 failed you must decrease your Pixel Threshold value.

Short Tail Discussion

Related HH variables:

- **Long Tail Enable**
- **Taper and Short Tail En**
- **Second Radius Ignore**



In general there are two types of needles; **Short Tail** and **Long Tail**

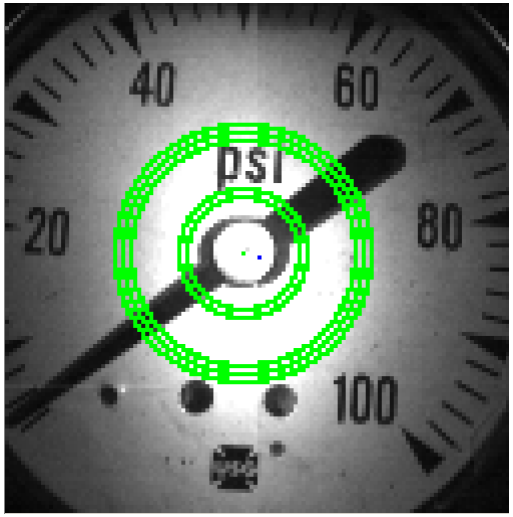
• **Short Tail:** These are pointers where at least one of the concentric circles can be position beyond the end of the tail without overlapping background objects. For this case, set **Long Tail Enable** to 0.

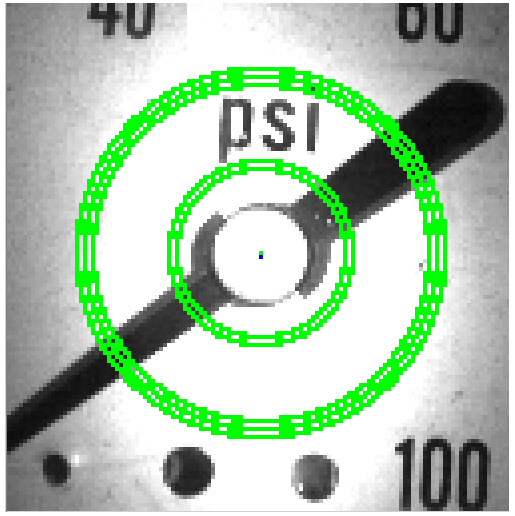
• In the image to the right, the two outermost circles only overlap the tip of the pointer not the tail. Set **Second Radius Ignore** to 3, meaning ignore circle number 4 and 5.

Long Tail – Short Tail Selection

- **Long Tail:**
  Pointers that have no room to place the circles beyond the end of the tail.
  Set **Long Tail Enable =** 1.

- For pointers with taper:
  - Position the circles such that they take advantage of large difference in the tip and tail width.
  - Set the **Second Radius Ignore** variable to 5.
  - Enable the **Zoom** variable
  - Enable the **Dynamic Stitching** variable.



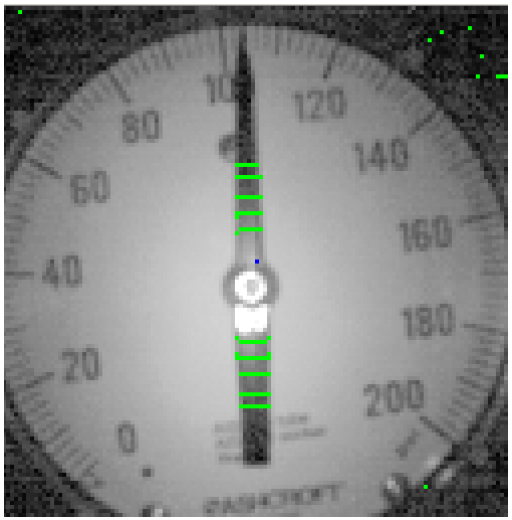


Dynamic Stitching

Dynamic stitching should only be used for the Long Tail method and when the pointer tail is tapered slightly or reversed.

- To enable, set to 1

- To optimize exposure, perform at least 2 “Get Image”, so each half can be viewed.



Mounting the WGR

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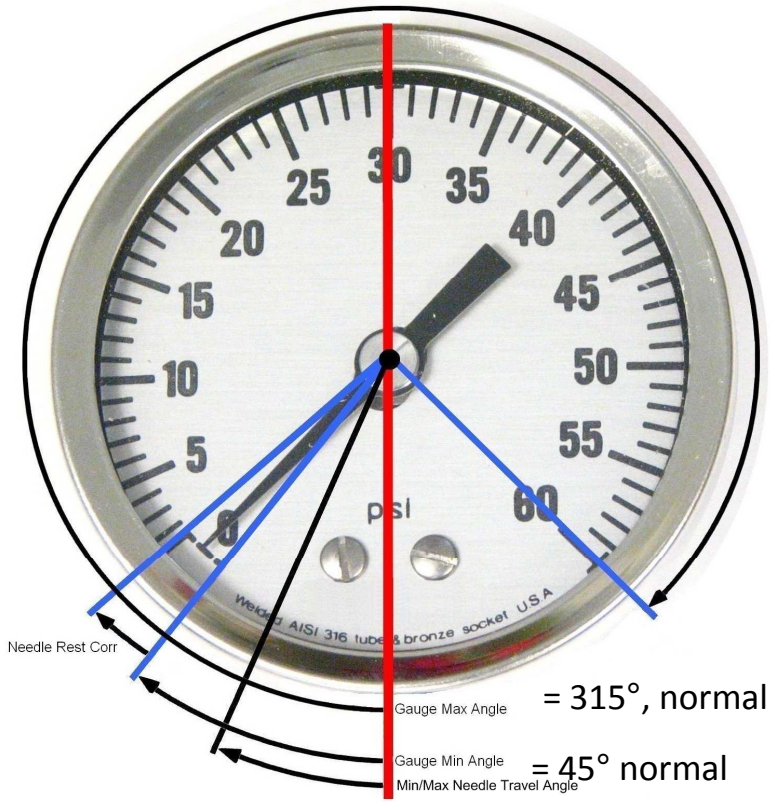
Revision 1.0

Preparation for Mounting WGR to Gauge

- Clean the gauge lens with an IPA wipe.
- Observe the gauge pointer to see if it is static or dynamic, record if dynamic.
- Verify gauge minimum value is at 45° and maximum value is at 315°, which is normal.



Preparation for Mounting WGR to Gauge (con't)

- Record specific parameters that will be used during the HH configuration activity:.
  1. Current reading
  2. Units.
  3. Minimum value
  4. Maximum value

- Mask the background, if necessary. Sometimes writing or graphics on the gauge face may corrupt the image processing routine that is defining the pointer position. For gauges with removable lens covers, remove the gauge cover and use non-gloss white tape to mask the background. Note: This training will not address how to mask the gauge

Attaching the WGR to Gauge

Process

1. Verify that the WGR adapter is the correct size.
2. Install rubber shims on gauge rim
3. Place WGR on gauge and tighten hose clamp.

Attachment Details

1. Verify correct adapter
   - Put WGR adapter over gauge to make sure it's not too big or too small

   OR

   - Measure outer diameter (OD) of gauge face and check WGR adapter table

2. Install rubber shims on gauge
   - Add 1-3 shims to the gauge so the adapter is snug

     Note: The shims will compress as the hose clamp is tightened

WGR Adapter Table

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]

Attachment Details (con't)

3. Place WGR on gauge and tighten hose clamp.

- Step 1: Position WGR at gauge face with bottom lip just engaged
- Step 2: Rotate/Insert the WGR until it is fully engaged on the gauge rim
- Step 3: Feel with your fingers that the insertion depth is uniform and visually check that the WGR display is square to how it will be viewed.
- Step 4: Tighten hose clamp to 160 in-oz (11.5 cm-kg) torque

How to configure a WGR to a specific gauge

How to configure a WGR to a specific gauge

This is broken into a 5 step process:

Note: For training, only a "Long Tail" gauge will be configured.

- Establish a wireless connection between the HH and the WGR
- Initial configuration
- Circles and Camera configuration
- Final adjustments to achieve "Best Configuration"
- Finishing the configuration activity

Establish a wireless connection between the HH and the WGR

1. Make sure the WGR is out of Ship Mode:

2. Transition the WGR into Configuration Mode:

3. Power on the HH. Press and hold the **[Enter/On]** key for one second. When the Green LED flashes, release the [Enter/On] key.

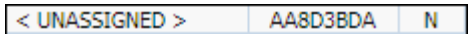
4. Launch the HH application: Select the Windows Start Icon on the top left of the Touch Screen,

Select the HH Control application from the Start menu

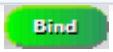
5. Bind to WGR: Select the Name ID Tab

, press the Find Button

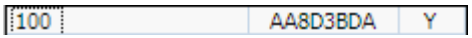
. Wait for the HH to search for all WGR's in the vicinity that are in Configuration mode.

6. The HH will list all WGR's and their Device ID's. Select the WGR you want to configure based on the Device ID 

7. Assign a Device Name (if not already assigned) by tapping on the name twice until it is in text entry mode

. Enter a name, which is the Node number being configured, and press Bind 

. The Status column should convert to "Y" from "N"



Initial configuration

1. Default all parameters in the HH by reading them in from the WGR. To read in the defaults, select the Gauge Parameters tab

press the Get button

.

2. Set all known parameters. From the Gauge Parameters tab

, highlight the field with your stylus and fill in

with the correct value from the keypad

. The following variables should be set at this time:

▪ Node ID ▪ RF Frequency A ▪ RF Frequency B ▪ Sample Rate ▪ Units ▪ Min Gauge Value ▪ Max Gauge Value ▪ Zoom Enable ▪ Long Tail Enable	▪ Taper and Short Tail En ▪ Dynamic Stitching ▪ Second Radius Ignore ▪ Exposure ▪ Gauge Min Angle ▪ Gauge Max Angle ▪ Min/Max Needle Travel Angle ▪ Needle Rest Correction ▪ Gauge Tilt Angle

Note: Prior to mounting the WGR, determine if you will use the Long Tail or Short Tail method. Refer to the Long Tail – Short Tail Selection and the Dynamic Stitching section as necessary.

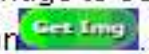
3. Send all parameters to the WGR. From the Gauge parameters tab

, press the Send button

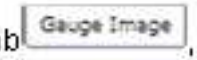
.

Circles and Camera configuration

1. Perform a Get Image to see the gauge face being configured. Select the Gauge Image tab

, press the Get Image button 

.

2. Configure the Circles and the pointer Center. Select the Gauge Image tab 

, press the Image Calibration button

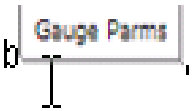
. This will initiate the Graphical Center/Circle calibration process:

   - The first step is to set the Center X and Y location

. Using the stylus, tap on the center on the needle in the gauge image:
   - Once the center is set, the HH will ask for the first or smallest circle Radius1

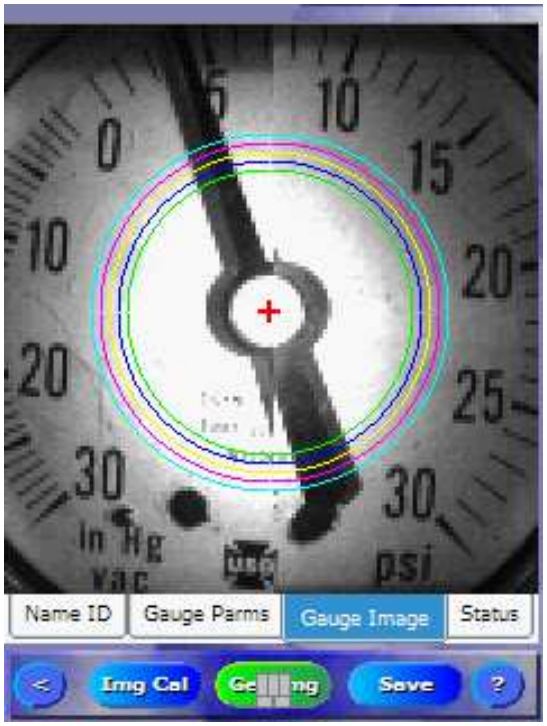
. Tap on the image where you want Radius 1 to go. Next, tap on the gauge image with your stylus to set the location of Radius 2, 3, 4, and 5.
   - When complete the HH will display all the circles.

Circles and Camera configuration, continued

3. If Zoom is enabled, set the Zoom X and Y Offset to [63 – Center Point X/Y], and set Center Point X and Y to 63. See the Circle Calibration section. Send parameters and perform a Get Image.
4. Set Circle radius's for best location on the Gauge Parameters tab : Radius 1, 2, 3, 4, and 5 on the
5. If you notice glare on the needle, or the contrast difference between the needle and the background is not big enough, adjust the Exposure.
6. Send all parameters to the WGR. From the Gauge parameters tab 

, press the Send button

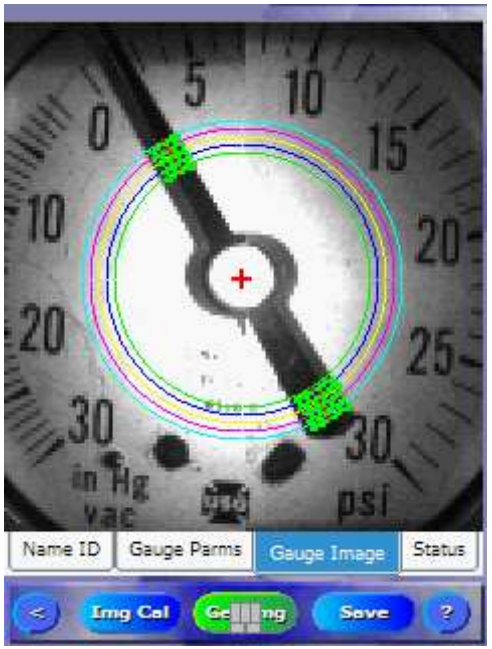
.



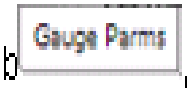
Final adjustments to achieve “Best Configuration”

1. Perform a Get Image to see the updated image from changes in the last section.
2. Perform a Get Sample TWICE to view the results. Any time the circle or camera settings have been updated, Get Sample must be performed two times for it to return accurate results. From the Status tab [Status], press the Get Sample Button [Get Sample]. Wait for the results to return.
3. When the status window

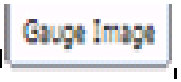
disappears, switch to the Gauge Image tab [Gauge Image]. You will see the Green and Red pixels superimposed on the image.
4. Adjust the Pixel Threshold as described in the Pixel Threshold section.
5. Adjust the Tip and Tail Width as described in the Circle Calibration section.
6. Finally check the WGR Reading [Reading = +38 psi] from the Status tab [Status] after you do a Get Sample. You can adjust the Gauge Tilt Angle to calibrate the reading to the actual gauge reading seen in the image.



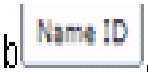
Finishing the configuration activity

1. Review all variables in the Gauge Image tab. Make sure all settings are correct and they make sense.
2. Send all variables. From the Gauge parameters tab 

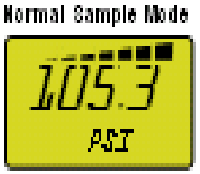
, press the Send button

.
3. Save the variables. From the Gauge Image tab 

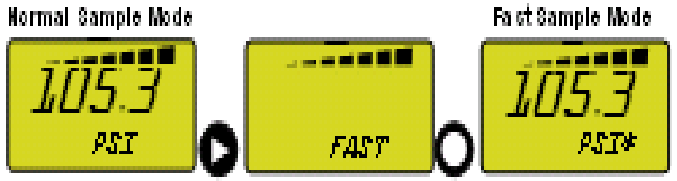
, press the Save Button

.
4. End the configuration mode on the WGR. Note this step will save the variables on the WGR. From the Name ID tab 

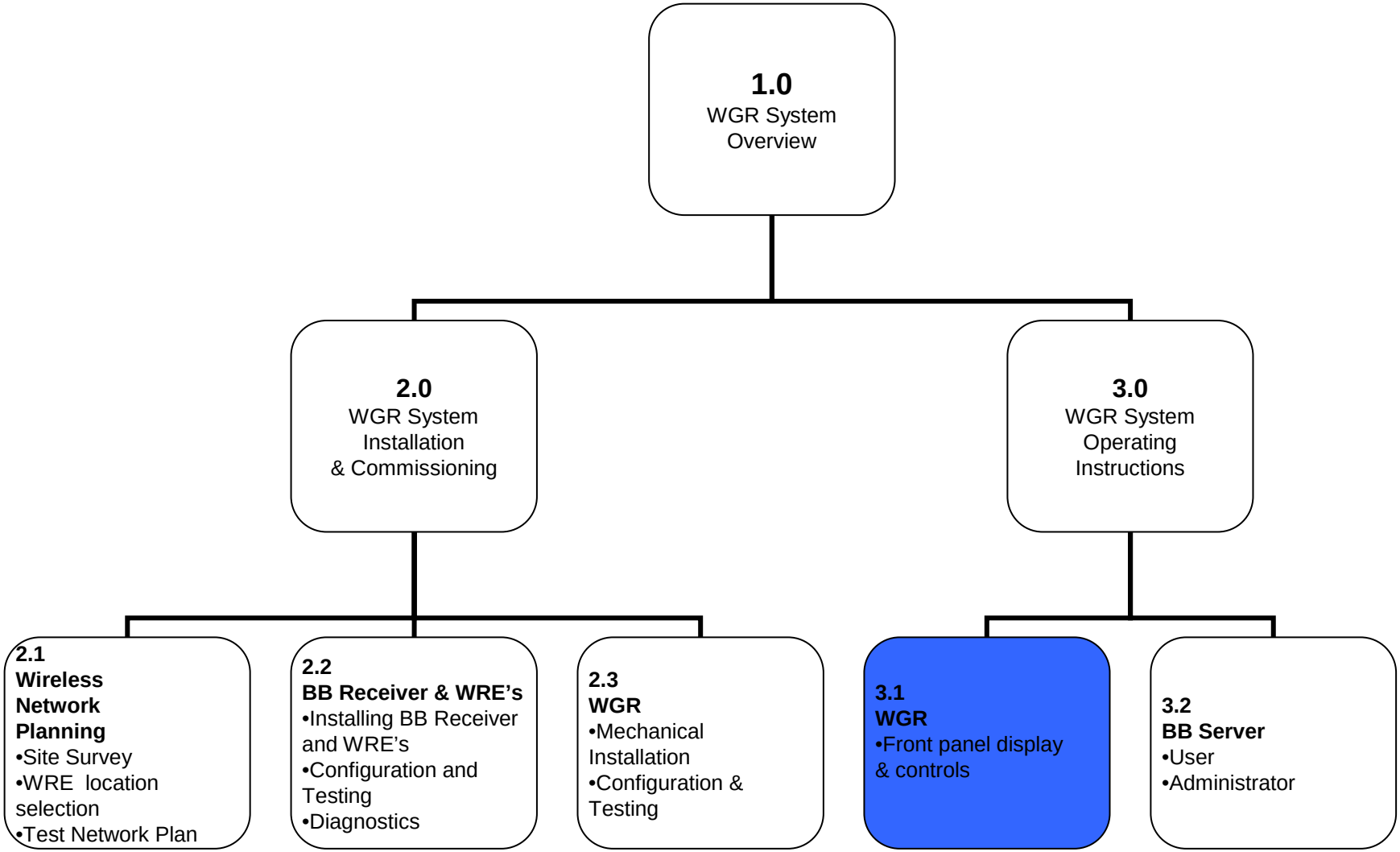
, press the Finish Button

. Make sure the WGR exits Configuration Mode and enters Normal Sample Mode 

.
5. Transition the WGR into Fast Sample Mode to collect a high number of readings. The data can be examined on the central serve to ensure the installation was successful. From Normal Sample Mode perform the following steps:



WGR System Training Modules

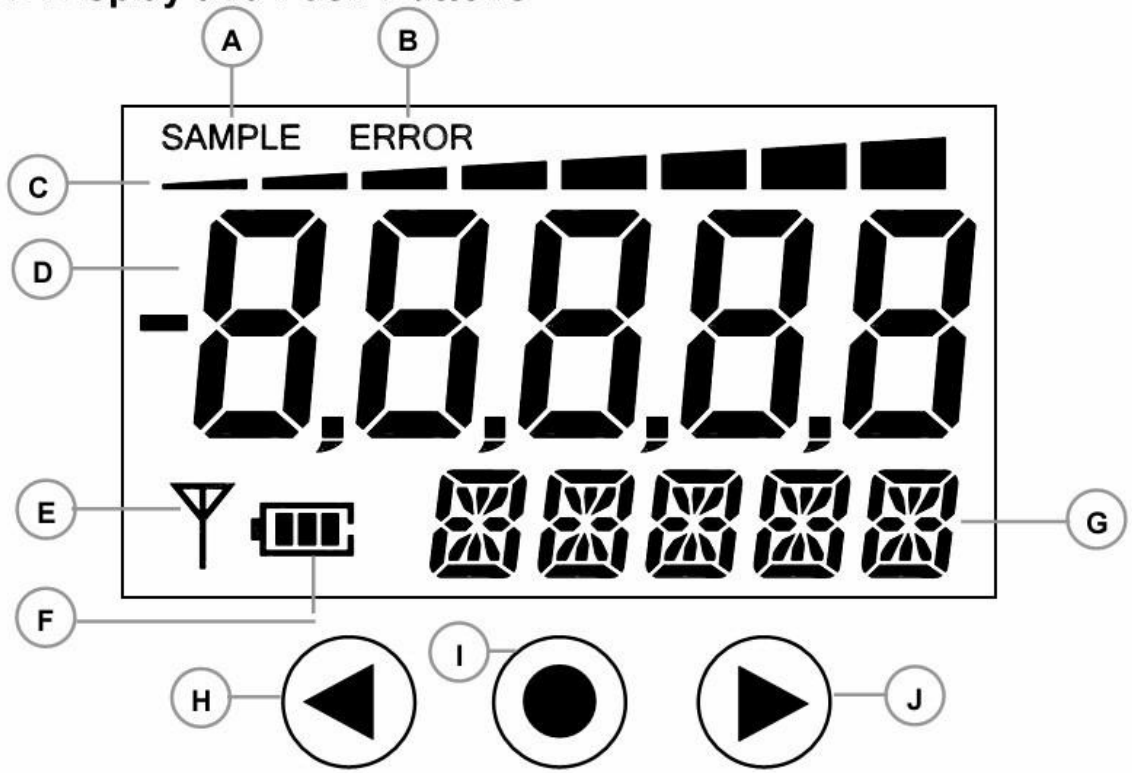


Wireless Gauge Reader Overview

- The WGR is placed over existing analog gauges
- It reads the pointer angle and displays the latest reading on the LCD
- It also wirelessly transmits the reading to the Blue Box Server
- The WGR is battery operated
- Sample rates can be configured based on customer application. Typically, sample rates are 10-15 minutes.

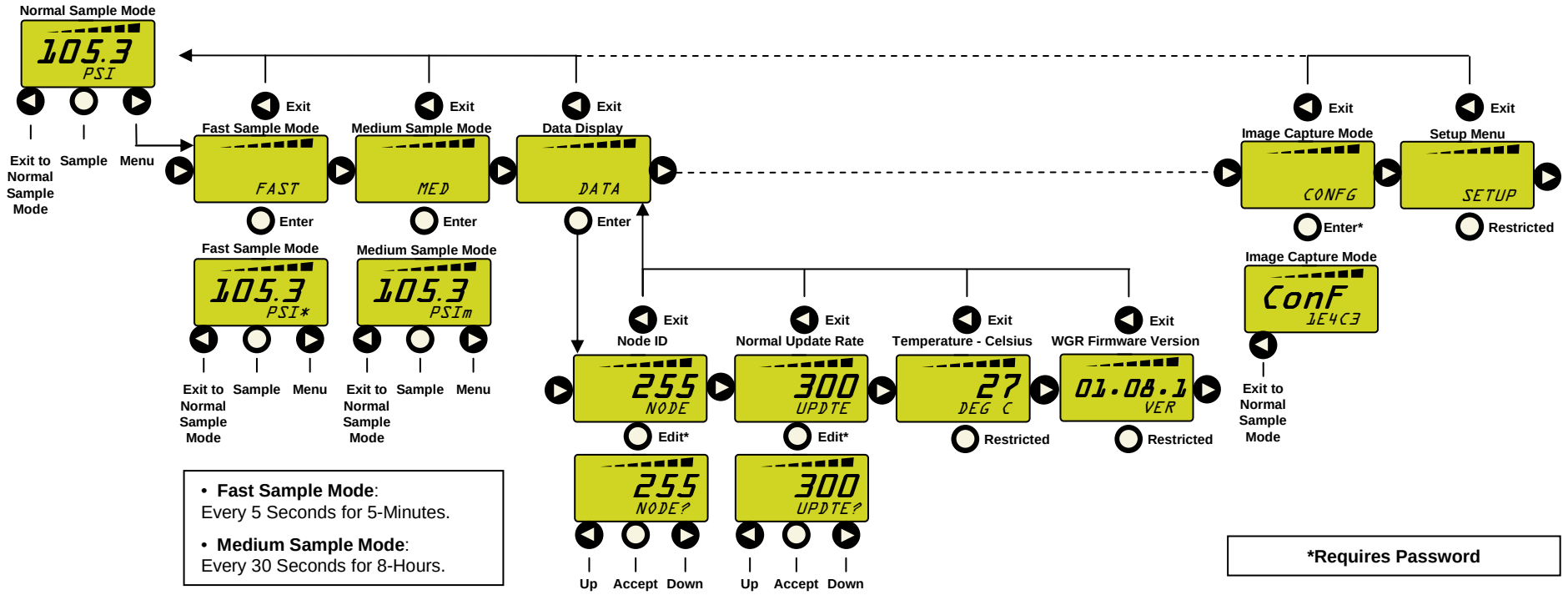
WGR LCD Display Details

LCD Display and Push Buttons

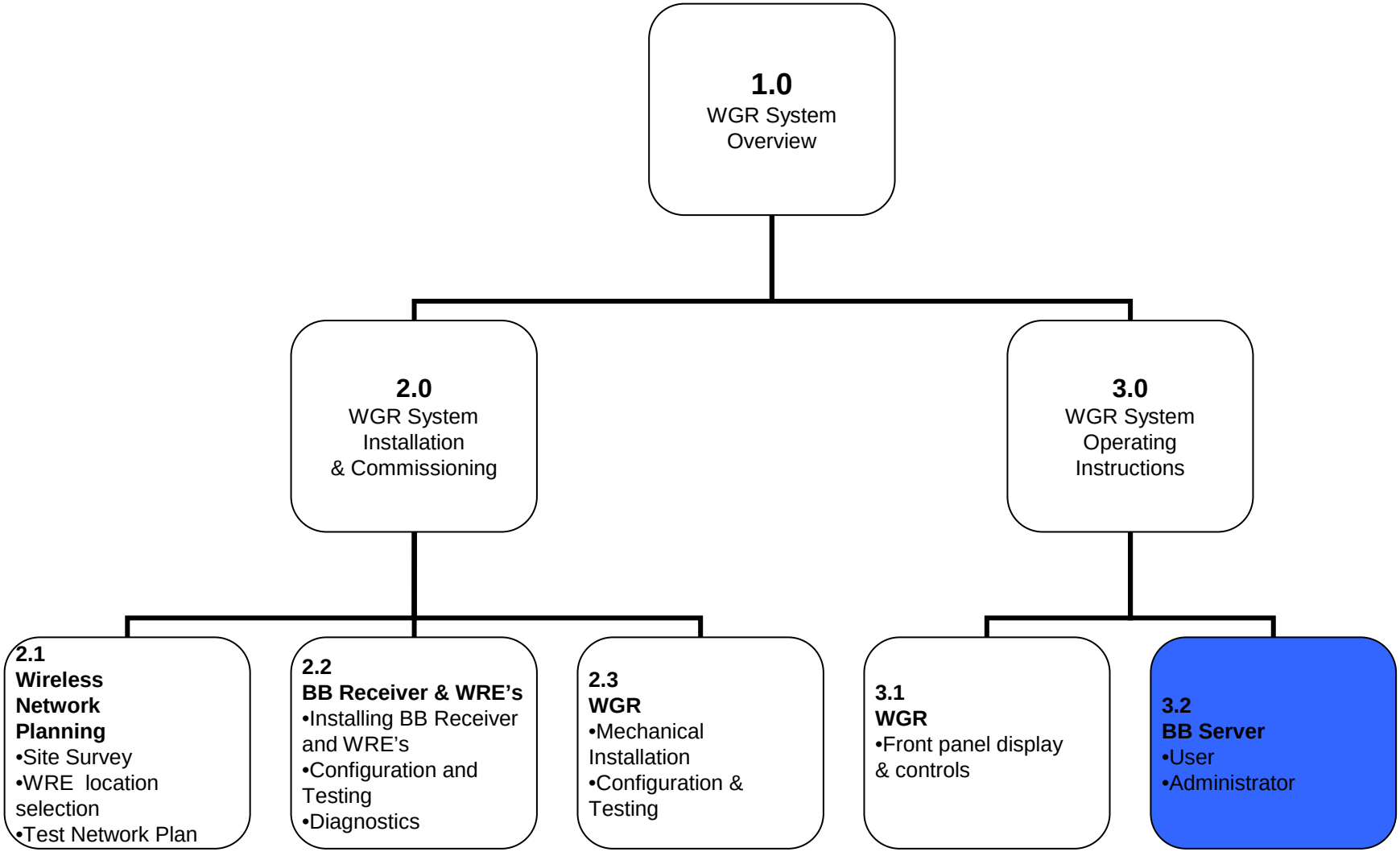


A.	**SAMPLE Icon**	Displayed when a new reading is being captured and converted
B.	**ERROR Icon:**	Displayed when an error condition is detected
C.	**Bar Graph**	Indicates percent of full-scale reading
D.	**Numeric Display**	Displays the converted reading value
E.	**Antenna Icon**	Displayed when wireless communication is successful
F.	**Battery Level**	Displays percentage of battery life remaining
G.	**Alpha-numeric Display**	Displays the reading units or diagnostic messages
H.	**Left Button**	Menu navigation and decrease values
I.	**Center Button**	Requests immediate updated reading and menu navigation
J.	**Right Button**	Menu navigation and increase values

WGR Menu details:



WGR System Training Modules



WGR Console Overview

- The WGR Console is a set of web pages that live on the BBR that allow the user to see the WGR data

- As long as the BBR is connected to the LAN, the WGR Console can be accessed from any PC on the LAN

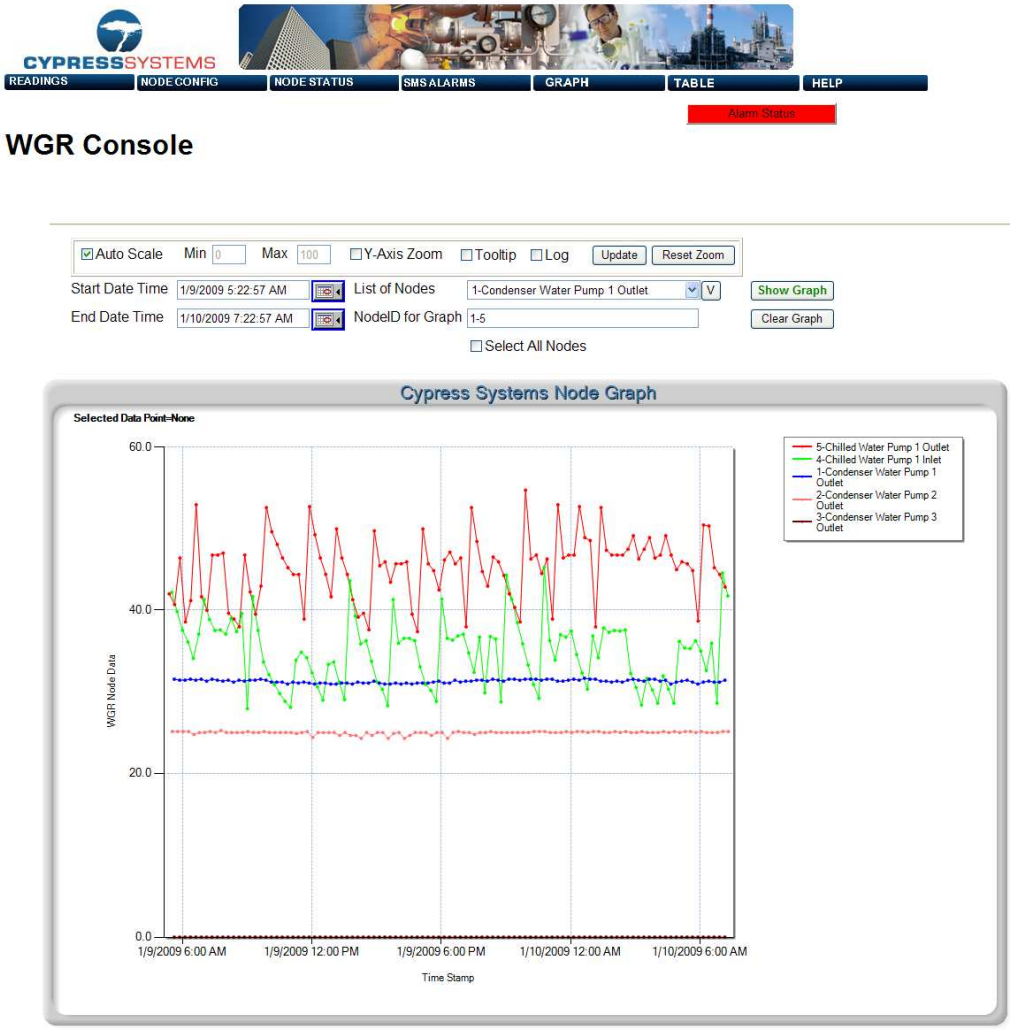
WGR Console - Readings Page

Timestamp	NodeID	Description	Reading	Units	LCL	UCL	Status
01/10/2009 07:09:06	1	Condenser Water Pump 1 Outlet	31.4	PSI	20	60	OK
01/10/2009 07:03:39	2	Condenser Water Pump 2 Outlet	25.1	PSI	20	60	OK
01/10/2009 07:08:52	3	Condenser Water Pump 3 Outlet	0.0	PSI	15	60	Lower Ctl Limit
01/10/2009 07:02:16	4	Chilled Water Pump 1 Inlet	44.5	PSI	0	40	Upper Ctl Limit
01/10/2009 07:09:41	5	Chilled Water Pump 1 Outlet	42.8	PSI	0	60	OK
01/10/2009 07:05:55	6	Chilled Water Pump 2 Inlet	48.0	PSI	-15	40	Upper Ctl Limit
01/10/2009 07:14:25	7	Chilled Water Pump 2 Outlet	27.4	PSI	20	60	OK
01/10/2009 07:12:53	8	Chilled Water Pump 3 Inlet	28.7	PSI	-15	40	OK
01/10/2009 07:07:32	9	Chilled Water Pump Out 3 Outleet	53.9	PSI	20	60	OK
01/10/2009 07:03:12	10	PCW Pump Out	75.7	PSI	0	100	OK
01/10/2009 07:02:34	11	Process Vacuum	-22.0	PSI	-17	-30	OK
01/10/2009 07:15:05	12	CDA Cooling Water Pump	57.0	PSI	50	100	OK

- **Timestamp:** Timestamp of last reading
- **NodeID:** Node identification number
- **Description:** Description of what gauge is being monitored
- **Reading:** The reading of the gauge
- **Units:** The units of the reading
- **LCL:** Lower Control Limit
- **UCL:** Upper Control Limit
- **Status:** Color coded status of reading
  - OK: Reading is within limits
  - Lower Ctl Limit: Reading is below LCL
  - Upper Ctl Limit: Reading is above UCL
  - Error: Could not determine pointer angle

If any limit is exceeded, then the “Alarm Status” button will turn RED

WGR Console – Graph Page



To graph:

- Select/Enter “Start Date Time”: MM/DD/YYYY HH:MM A/PM

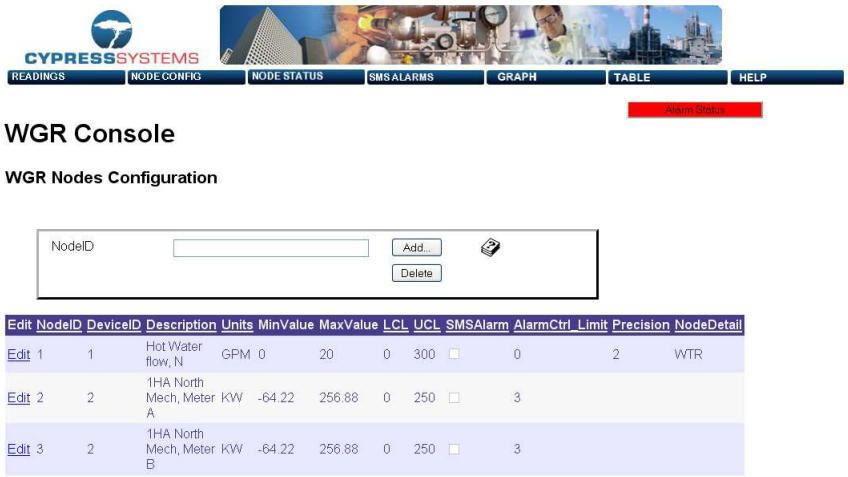
2. Select/Enter “End Date Time”: MM/DD/YYYY HH:MM A/PM

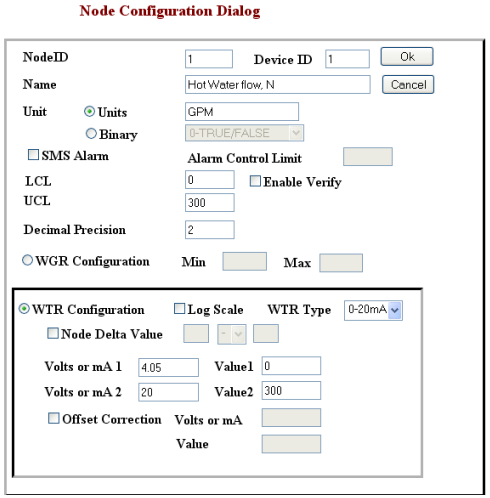
3. Select NodeID’s to graph:

    a. Select “List of Nodes” drop down list
    b. From dropdown list, select/highlight NodeID to be graphed.
    c. Select V to add the NodeID to the “NodeID for Graph” box/List.
    d. Repeat for additional NodeID’s.

4. Select **Show Graph** button.

WGR Console - Node Config





- Node Config page requires Admin username and password for access:
  - Username: admin
  - Password: wgradmin

- Edit node names, alarm limits, and SMS/Email alarm triggering

- Simply click edit next to the desired node, and the node info will load into a separate window

WGR Console - Additional web pages:

- Node Status
  - Displays the battery status of each node
- SMS Alarms
  - Used to define recipients of SMS alarm system
  - This page is password protected: See your System admin
- Alarm Status
  - Get a history of nodes in alarm state
  - Reset SMS/Email Alarms
- Table
  - Presents a table listing of the data stored in the database, which can be exported to .pdf or Excel. User can select which nodes and define the start/end time to list.
- Help
  - Brings up a help guide on the web pages.