WMA-5

CO_2 Gas Analyzer

Operation Manual

Version 1.01

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3rd November 2016

PP Systems

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Welcome

Thank you very much for purchasing our **WMA-5 CO_2 Gas Analyzer**. We greatly appreciate your business and we look forward to working with you and your team for many years to come.

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For applications where failure of this equipment to function correctly would lead to consequential damage, the equipment must be checked for correct operation and calibration at intervals appropriate to the circumstances. The PP Systems' equipment warranty is limited to replacement of defective components, and does not cover injury to persons or property or other consequential damage.

This manual is provided to help you install and operate the equipment. Every effort has been made to ensure that the information it contains is accurate and complete. PP Systems does not accept any liability for losses or damages resulting from the use of this information.

It is the operator's responsibility to review this information prior to installation and operation of the equipment. Otherwise, damage may be caused which is not covered under our normal warranty policy.

User Registration

It is very important that ALL new customers register themselves with us to ensure that our user's list is kept up-to-date. If you are a PP Systems' user, please go to www.ppsystems.com and click on Customer Registration in the upper left hand corner.

Only **REGISTERED** users will be allowed access to the protected "Users" section of our web site. This section will contain important product information including hardware/software updates, application notes, newsletters, etc.

Thank you in advance for your cooperation.

Service & Warranty

PP Systems' equipment warranty is limited to replacement of defective components, and does not cover injury to persons or property or other consequential damage.

The equipment is covered under warranty for one complete year, parts and labor included. This, of course, is provided that the equipment is properly installed, operated and maintained in accordance with written instructions (i.e. Operator's Guide).

The warranty excludes all defects in equipment caused by incorrect installation, operation or maintenance, misuse, alteration, and/or accident.

If for some reason, a fault is covered under warranty, it is the responsibility of the customer to return the goods to PP Systems or an authorized agent for repair or replacement of the defective part(s).

Prior to returning equipment to PP Systems for service, you must first get in contact with our Service Manager (service@ppsystems.com) to request a case number for reference and tracking purposes.

Contact Information

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Unpacking and Storage of Your Equipment

Unpacking

It is extremely important that you check the contents of your equipment immediately upon receipt to ensure that your order is complete and that it has arrived safely. Please refer to packing list to show all items that are included with your order. **DO NOT DISCARD ANY OF THE PACKAGING MATERIAL UNTIL ALL OF THE ITEMS LISTED ARE ACCOUNTED FOR. WE RECOMMEND THAT YOU RETAIN THE ORIGINAL PACKING FOR FUTURE USE.** If you suspect that any of the items listed on the packing list are not included or damaged, you must contact PP Systems or your authorized distributor immediately.

Technical Specification

Analysis Method	Non-dispersive infrared, configured as an absolute absorptiometer with microprocessor control of linearization
CO_2 Measurement Ranges	0-1000 ppm (µmol mol^{-1}) 0-2000 ppm (µmol mol^{-1}) 0-5000 ppm (µmol mol^{-1}) 0-10000 ppm (µmol mol^{-1}) 0-20000 ppm (µmol mol^{-1}) 0-30000 ppm (µmol mol^{-1}) 0-50000 ppm (µmol mol^{-1}) 0-100000 ppm (µmol mol^{-1}) Readings are automatically corrected for temperature and pressure.
Accuracy	< 1% of span concentration over the calibrated range but limited by the accuracy of the calibration mixture.
Linearity	< 1% throughout the range
Stability	Auto-zero at regular intervals corrects for sample cell contamination, source and detector ageing and changes in electronics.
Warm-up Time	Approximately 15 minutes
Sampling Rate	10 Hz. Sample data is averaged and output every 1.0 seconds.
Sampling Pump	Integral, long life 12V air sampling pump
Gas Flow Rate	200-500 cc/min (280-340 cc/min is optimal). An internal, electronic flow sensor monitors flow rate.
Terminal Block	System power, analog, digital and current (4-20mA) outputs and sensor inputs are available from the 22 pin terminal block
Analog Output	0-2.5V (CO_2 range selectable) and 4-20mA
Digital Output	RS232 and USB
Air Filter & Water Trap	An external water trap and internal hydrophobic filter are used to protect analyzer from water.
Alarm	Visual and audible alarm/warnings. 2 relay contacts (Alarm1 and Alarm2)
CO_2 Control	High and low user set points
Data Storage (USB)	USB Flash Drive for data storage in multiple formats.
Display	2.7" electronic paper touch display with 264 x 176 pixel resolution
Power Requirements	12 VDC, 1.5A or 100-240 VAC, 50-60 Hz, 0.6A (AC Adapter included)
Power Consumption	Warm up: 12W (12V @ 1.0A) Normal operation: 6W (12V @ 0.5A)
Enclosure	High impact, IP65 enclosure
Gas Connections	Two barbed fittings (inlet and exhaust) for use with 1/8" (.125") ID tubing
Operating Temperature	0-50 ^{o}C, non-condensing. External filtration may be required in dirty environments.
Dimensions	213 cm L x 185 cm H 114 cm W (Enclosure only)
Weight	1.5 kg
Optional Accessories	- H_2O Sensor - Range: 0-Dewpoint (mb) - O_2 Sensor – Range: 0-100% - WIFi
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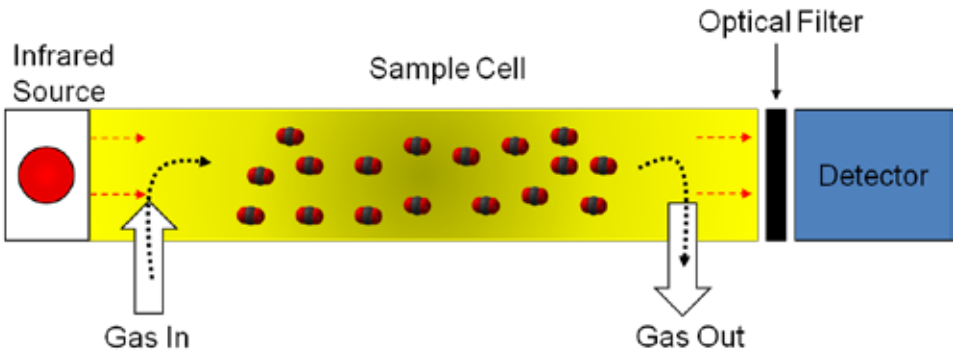
Summary of System Design

Overview and Theory

The WMA-5 is designed to function as a self-contained instrument for continuous measurement of CO_2 in air. Its open-path design allows for continuous, unattended air sampling, as the pump introduces fresh sample gas to the essential component, the IRGA (infrared gas analyzer).

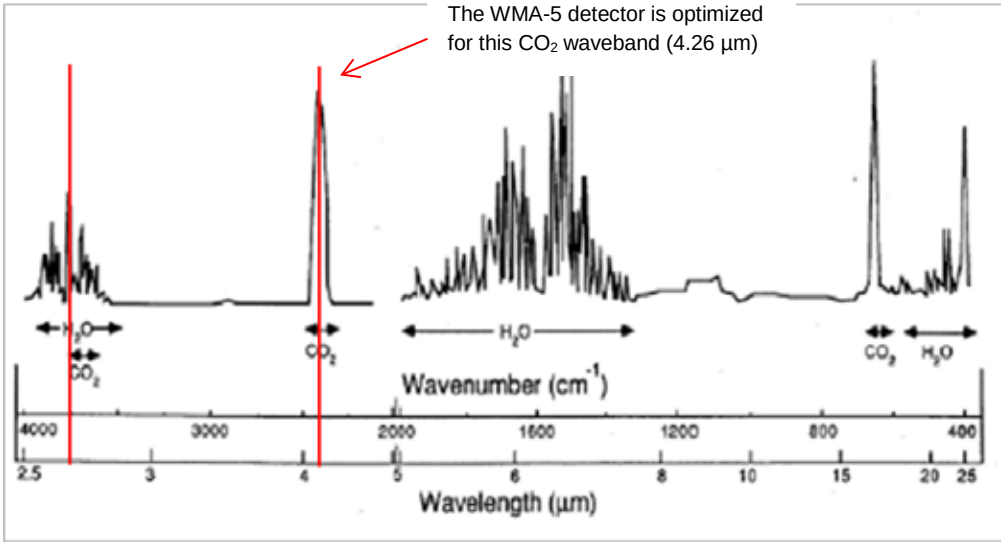
The IRGA forms the core of gas analysis systems that measure CO_2. Non-dispersive infra-red (NDIR) refers to the transmission of a broad-band infra-red wavelength from the IRGA source lamps. A single IRGA consists of four basic components:

- Infra-red source
- Sample cell of known path length and volume
- Optical interference filter
- Infra-red detector



The theory itself is quite simple – light from mid-infra-red wavelengths is produced by the source and pulsed through a gold plated cell. The interference filter narrows the bandwidth of the IR source received by the detector to the signature wavelength absorbed by the target gas molecule, e.g. CO_2. The CO_2 cell employs a unique optical filter. As the sample gas fills the cell, the target gas molecule absorbs IR energy at the particular wavelength, and the reduction in IR energy reaching the detector is measured. The *higher* the target gas concentration, the *lower* the infra-red signal received at the detector, as defined by the Lambert-Beer Law of Attenuation.

CO_2 molecules have a discrete absorption band at 4.26 µm that has very little overlap with any other molecule's absorption band, so that wavelength provides good sensitivity and selectivity. The WMA-5 electronics could be considered another major component, which processes raw analog-to-digital (A/D) information from the IRGA detector, accurately translating this information into gas concentrations.



The gas sample is of course a mixture of gas molecules, and this can present problems in terms of accurate detection of concentrations of a specific gas, such carbon dioxide. This effect, *foreign gas broadening* (FGB), must be corrected to ensure accurate measurement of gas concentrations. With FGB, the CO_2 gas in the IRGA cell is somewhat diluted by the increased air volume induced by water vapor. This effect is about 0.1 µmol mol^{-1} CO_2 mb^{-1} H_2O. The presence of water vapor also causes an increase in infra-red absorption, which is detected as an apparent increase in [CO_2]. This is of a similar magnitude, but opposite to the dilution effect, and the WMA-5 automatically corrects these FGB effects.

The WMA-5 IRGAs are quite stable owing to their construction, calibration and thermal environment, but various circumstances can cause apparent changes over time. Some changes may require recalibration, although one of the strengths of the WMA-5 is that recalibration is not a routine (annual) maintenance task as a result of our innovative “Auto-Zero” function. Our Auto-Zero function corrects for nearly all changes that result in calibration drifts. It minimizes effects on span (gas sensitivity), of sample cell contamination, lamp ageing, changes in detector sensitivity, amplifier gains and reference voltages. Measurements are ratioed to the Zero reading before IR absorbance is determined. From the relationship between absorbance and concentration determined in the factory for each instrument, and the current calibration factor, the sample concentration is determined.

Optional Sensors for use with WMA-5

O_2 Sensor

An optional electrochemical O_2 sensor can be used with the WMA-5 for measurement of oxygen in addition to CO_2.

- Range: 0-100%
- Response Time: ≤ 15 seconds at 23 ± 2 ^{o}C
- Linearity: ± 1.0% of full scale

The O_2 sensor is mounted into a manifold located inside the terminal block enclosure and is fitted in-line to sample the incoming gas stream. Recalibration should not be necessary and based on our experience with this sensor it should have a working life of approximately 4-5 years.

H_2O Sensor

An optional solid state H_2O sensor can be used with the WMA-5 for measurement of H_2O in addition to CO_2.

- Range: 0-Dewpoint (mb)
- Accuracy: < 2% RH

The humidity sensor is mounted into a manifold located inside the terminal block enclosure and is fitted in-line to sample the incoming gas stream. Readings are displayed and recorded in absolute vapor pressure (mb). Recalibration of this sensor is not necessary.

Mechanical Specifications & Mounting Instructions

The WMA-5 is very easy to mount. The rear of the enclosure has convenient markings showing where to place mounting screws. All dimensions are in centimeters (cm).

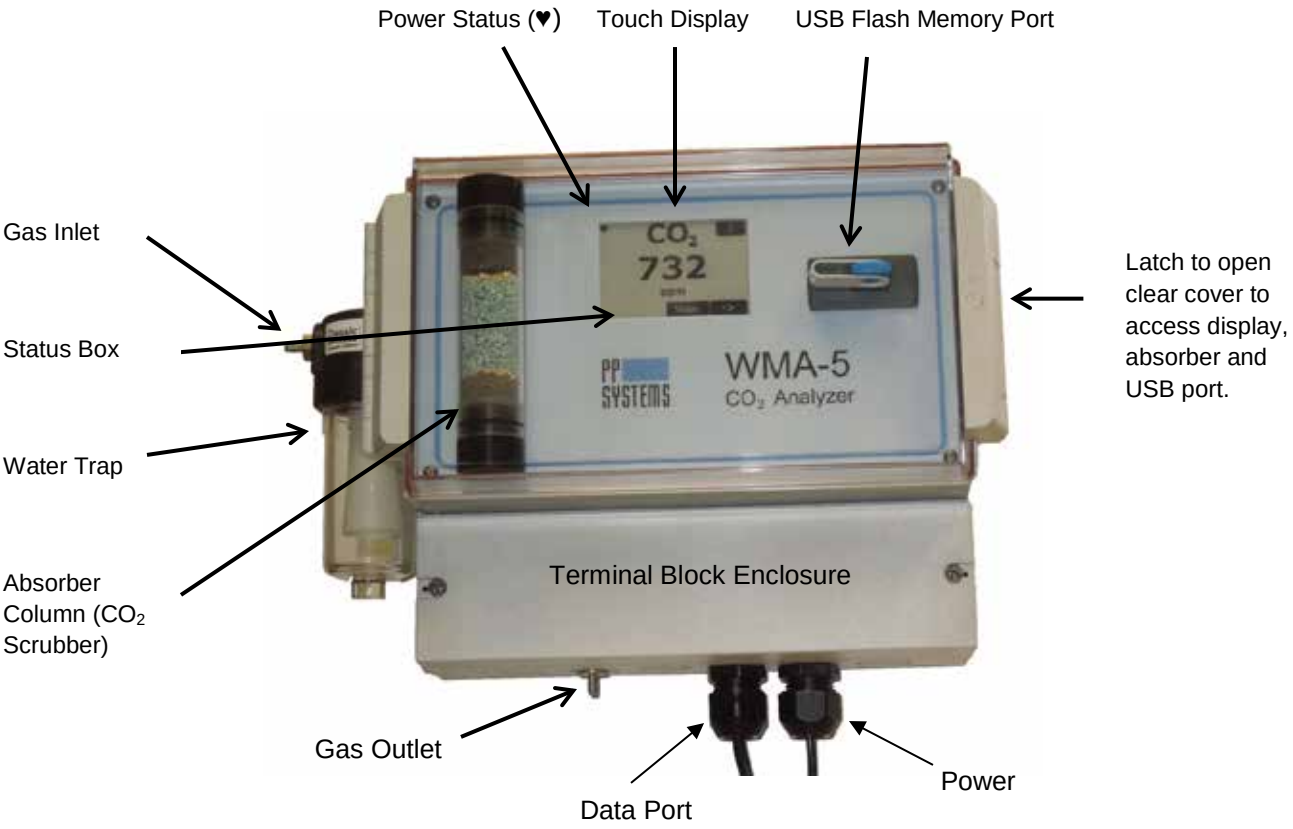
System Power

The WMA-5 is supplied with its own power supply to allow operation from local mains power. The specification of the power supply is as follows:

Input: 12 VDC, 1.5A or 100-240 VAC, 50-60 Hz, 0.6A (AC adapter included)

The WMA-5 can be powered by 12V if required via direct connection to the terminal block. It requires a 12V DC input at 1.5A. Connect the positive to +12V and the negative to GND. The terminal block is clearly marked for ease of connection.

Getting Familiar with the WMA-5



Touch Display

The WMA-5 features a 2.7" a-Si, active matrix TFT, Electronic Paper Display (EPD) touch panel. The panel has such high resolution (117 dpi) that it is able to easily display fine patterns. Due to its bi-stable nature, the EPD panel requires very little power to update and needs no power to maintain an image.

Features

- a-Si TFT active matrix Electronic Paper Display(EPD)
- Resolution: 264 x 176 pixel
- Ultra low power consumption
- Super Wide Viewing Angle - near 180°
- Extra thin & light
- SPI interface
- RoHS compliant

Status Box

All messages and warnings are displayed in the Status Box which is located in the bottom left hand corner of the display. A flashing ♥ (Heart) symbol in the upper left hand corner of the display indicates that the system is powered on.

Gas Ports

There are two gas ports (barb fittings) on the WMA-5. The gas inlet is located on the water trap and the gas outlet is located on the bottom of the WMA-5 enclosure. Each port is designed for use with 1/8" (.125) ID tubing. The sampling line should be fitted to the gas inlet port using 1/8" tubing. The gas outlet should be left open to atmosphere to allow the sample air to exhaust without restriction.

Water Trap

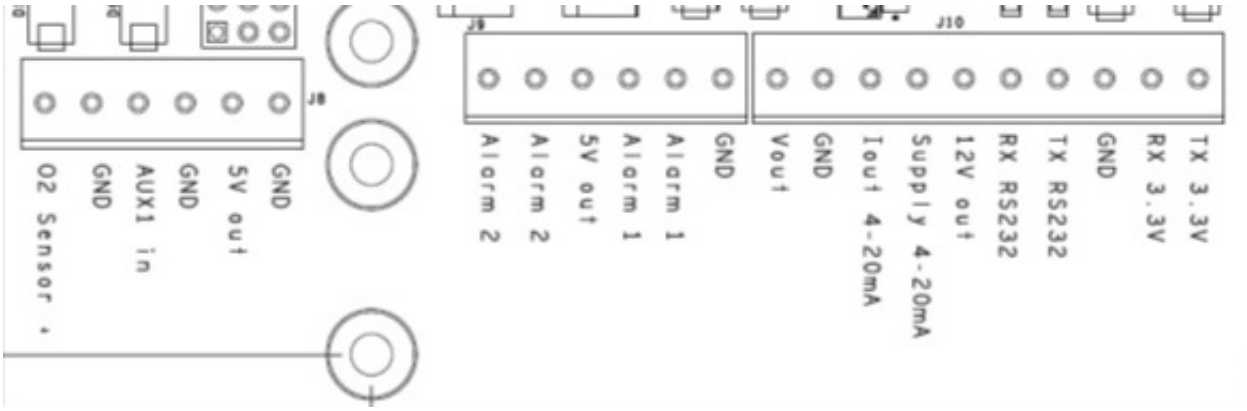
The water trap (also referred to as a "Float Valve Housing") is an essential filtration tool when gas is being drawn to the CO_2 analyzer preventing the carry-over of water from getting into the system.

How the Water Trap Works

As liquid is collected in the bowl the level starts to rise, gas becomes trapped in the open-end of the float and it too starts to rise. The entire float assembly then begins to move upwards and eventually closes the valve and shuts of the flow to the analyzer. This loss of flow is then detected by the WMA-5 mass flow controller ensuring flow is cut-off to the analyzer. An error message is also displayed in the Status Box.

Terminal Block

A terminal block is located inside the small rectangular enclosure below the main enclosure for simple and convenient connection to external devices (i.e. power, RS232, power, microprocessors, etc.). To access the terminal block, remove the two screws on either side of the enclosure to remove the cover.

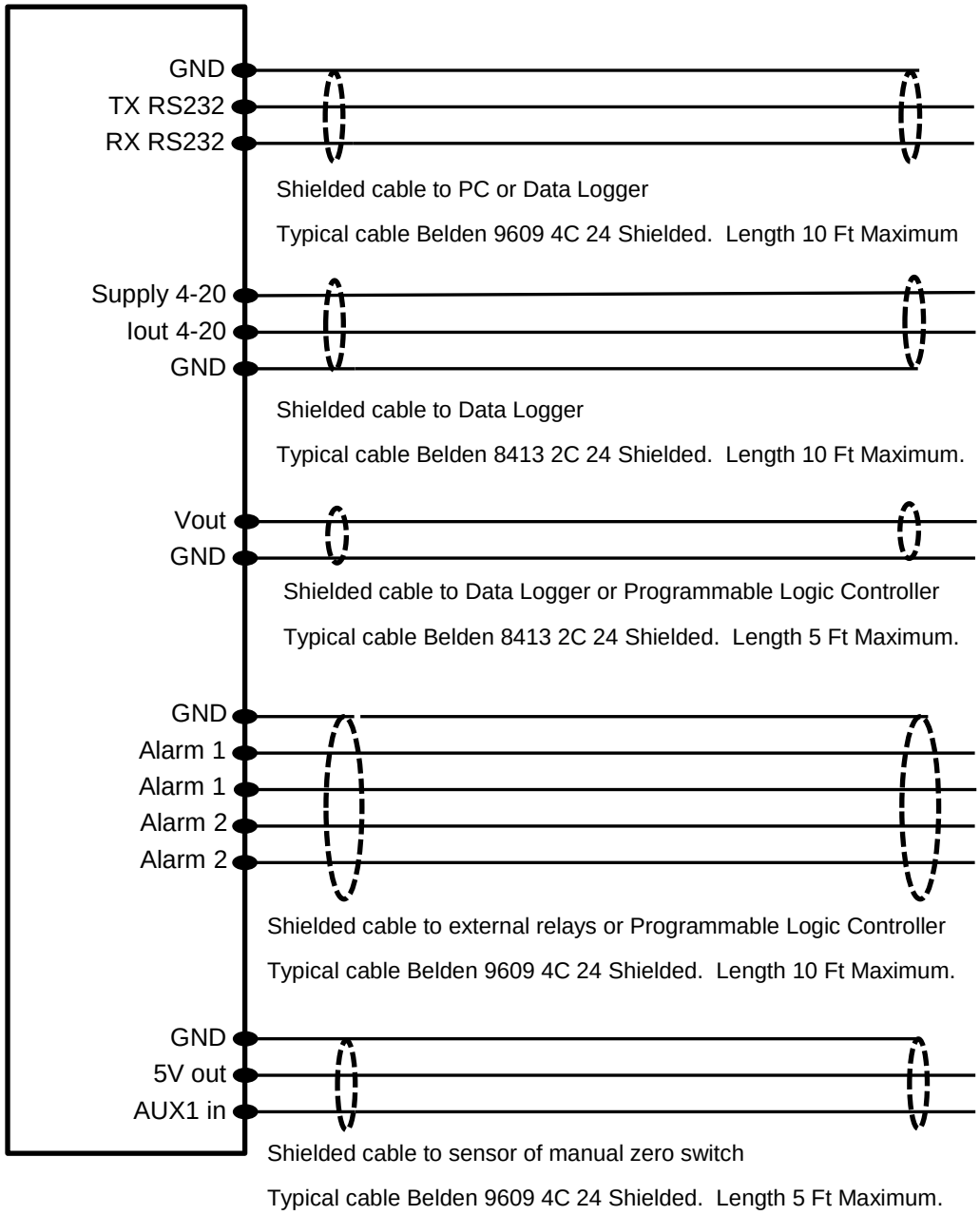


We recommend that the terminal block cover is always fitted and secured in place during operation.

Recommended Cable Interface

When connecting up to external devices via the WMA-5 terminal block we recommend the following cable type and lengths.

WMA-5 Terminal Block



USB Memory Stick Port

A USB Memory Stick Port is available on the front panel to allow users to save data directly to a USB flash drive (also commonly referred to as a “thumb drive” or “memory stick”). When a USB flash drive is inserted into the USB Memory Stick port, the LED indicator will first turn red in recognition of the flash drive and then it will flash green indicating that it is available to save data to it.

Flow Adjustment

The WMA-5 features an internal electronic flow sensor for measuring the flow. It is factory calibrated by the manufacturer and should remain within the accuracy tolerance for life. Flow rate is adjustable by changing the Pump Power percent in the Flow settings in the touch display.

Flow Range: 200-500 cc/min

We recommend a flow rate of 280-340 cc/min for optimal performance.

Important Note

If the WMA-5 is reading low CO_2, chances are that there is no flow through the analyzer. Check the water trap to make sure that it is not filled with water.

Absorber Column and CO_2 Scrubber

The absorber column contains a CO_2 scrubbing desiccant commonly referred to as Soda Lime. When air passes through this column, it removes all of the CO_2 from the air stream. The “Auto-Zero” facility built into the WMA-5 periodically switches the flow of gas from the analyzer through this column to check the analyzer zero. This routine ensures long term stability and accuracy of the CO_2 analyzer. It automatically corrects for such things as sample cell contamination, source aging, detector sensitivity and changes in electronics.

Soda Lime (CO_2 Scrubber)

Soda lime (Sodium Hydroxide) is used to remove CO_2 from air entering the WMA-5. Both self-indicting (white to violet) and non-indicating Soda Lime can be can be used with the WMA-5. Refer to Soda Lime on page 68 for maintenance and replacement information.

Data Port

The Data Port line can be connected to the COM port of a PC that is running a terminal emulation program (i.e. Hyperterminal). Measure data is continuously sent through this port.

Routine System Checks

The WMA-5 is designed to monitor CO_2 24/7 and should require minimal maintenance. The routine system checks are as follows:

Flashing Heart (♥) – Make sure that the heart symbol is flashing in the upper left hand corner.

Water Trap – Periodically inspect for water build-up and empty as required.

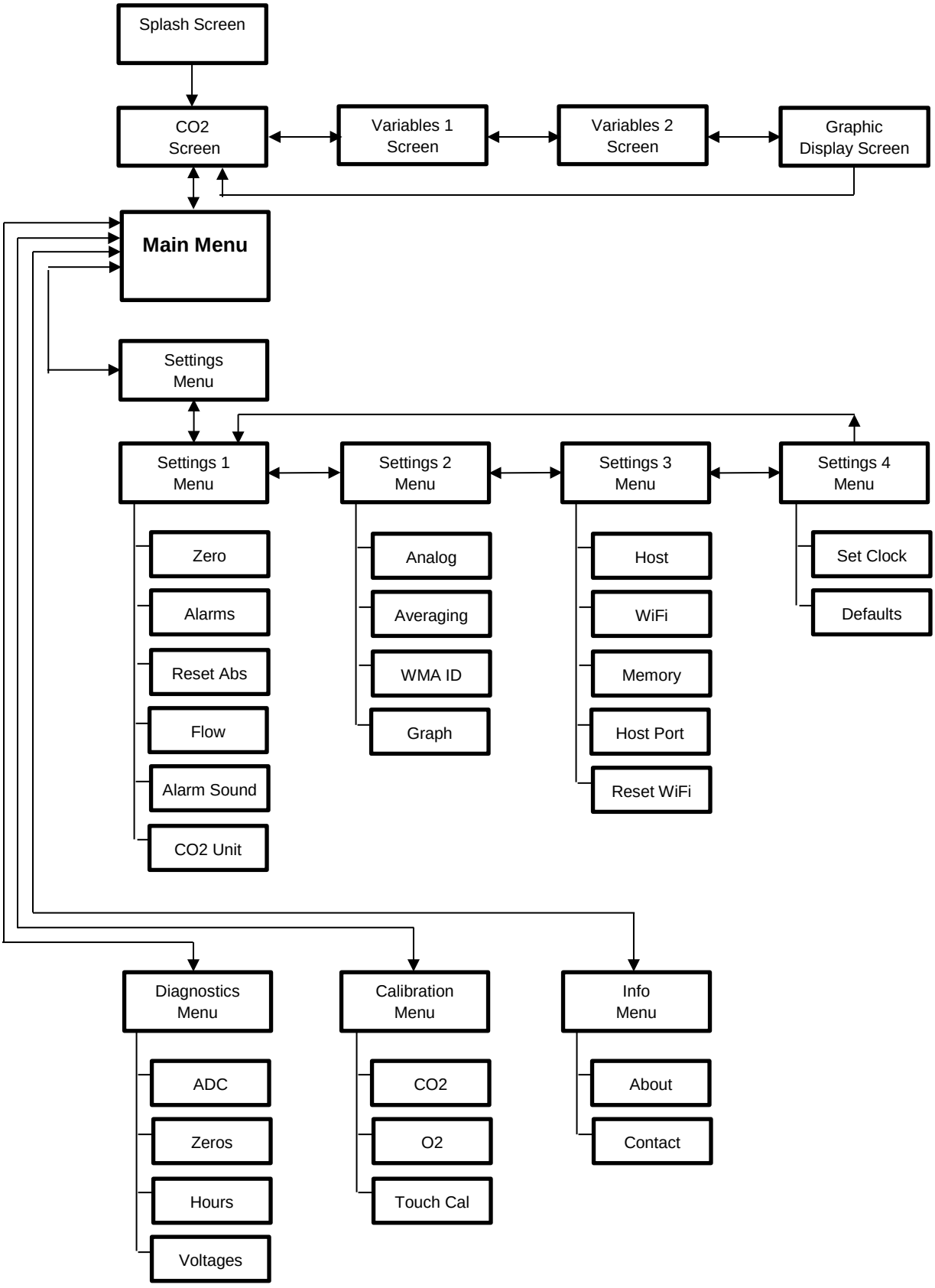
Status Box – Inspect periodically for error messages/warnings.

Absorber Column

- Make sure absorber column is seated properly in its manifold.
- Soda lime is fresh to ensure that the unit receives a good Zero to maintain calibration and stability. If you have any doubt about the freshness of the soda lime you should replace it.
- All "O" rings are lubricated with silicone grease to ensure good seal and to avoid problems associated with breaking or cracking.
- Inspect gray foam filters and replace if worn or reduced in size.

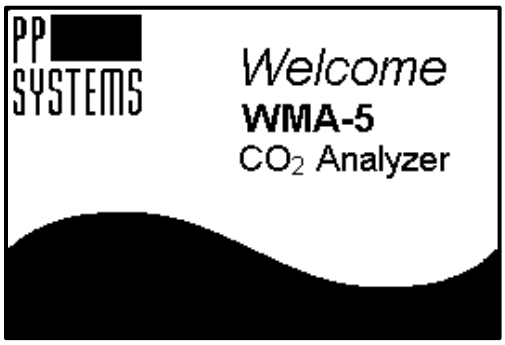
Touch Display Overview

The flowchart below describes an overview of the touch display for the WMA-5. When the instrument is first powered up, there is a brief period where the Splash screen is shown. After this time, the instrument goes into the warm-up period which is approximately 10-15 minutes and the Measure screen is displayed. During and after the warm-up period, the user has the ability to navigate through the menus as shown in the flowchart below. The following sections describe each screen and its functionality.


Splash Screen
CO2 Screen
Variables 1 Screen
Variables 2 Screen
Graphic Display Screen
Main Menu
Settings Menu
Settings 1 Menu
Settings 2 Menu
Settings 3 Menu
Settings 4 Menu
Zero
Alarms
Reset Abs
Flow
Alarm Sound
CO2 Unit
Analog
Averaging
WMA ID
Graph
Host
WiFi
Memory
Host Port
Reset WiFi
Set Clock
Defaults
Diagnostics Menu
Calibration Menu
Info Menu
ADC
Zeros
Hours
Voltages
CO2
O2
Touch Cal
About
Contact

Splash Screen

When the instrument is first powered up, the Splash screen is displayed momentarily, and then the Measure screen is displayed.

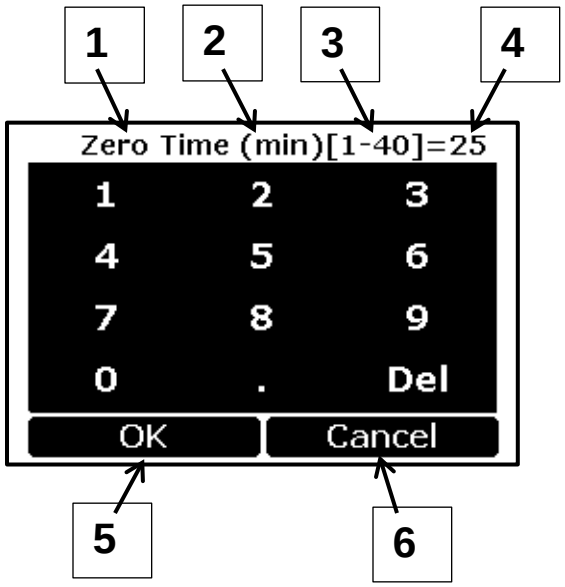


General Screen Info

New screens are displayed by the user selecting either the lower left or the lower right buttons. Generally speaking, the left button brings you back to the previous screen and the right button to the next available screen.

Data Entry Screen

The Data Entry Screen is used to enter new numerical values. The screen is displayed whenever a new value is required.



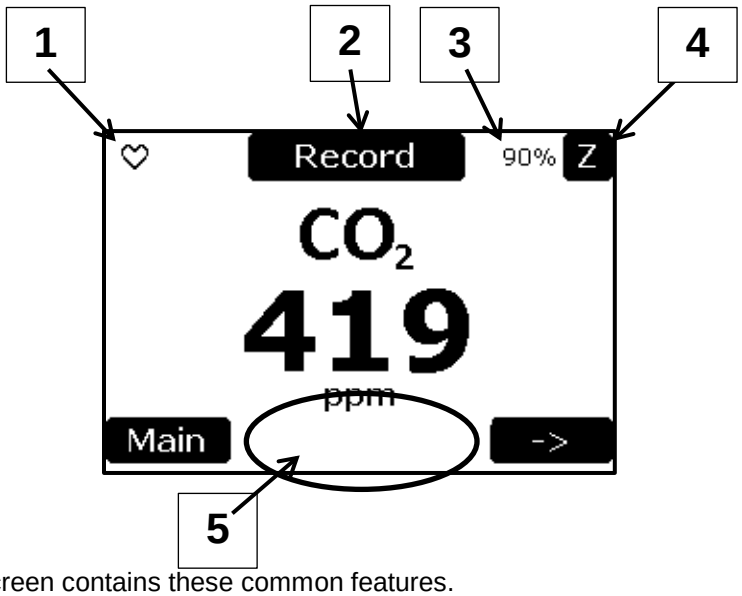
1. The name of the parameter.

2. The units associated with the parameter.
3. The acceptable range of values.
4. The value being entered.
5. The OK button selects the entered value. If the entered value is out of range, it is set to the minimum or maximum value. It then returns to the previous screen.
6. The Cancel button returns to previous screen without changing the initial value.

Measurement Mode

The Measurement Mode is comprised of four screens; Measure screen, Variables 1 screen, Variables 2 screen, and the Graphic Display screen. Each screen allows the user to view the WMA-5 data in various ways. The screens can be rotated through by the user using the left and right arrow buttons. The initial screen is the Measure screen which displays the value of CO_2 concentration in a large bold font. The Second screen is the Variables 1 screen which displays the values of six variables in real time; CO_2, H_2O, O_2, Temperature, Flow Rate, and Pressure. The Third screen is the Variables 2 screen which displays the values of four variables in real time; CO_2, H_2O, O_2, and Aux. The forth screen is the Graphic Display screen which displays CO_2, H_2O or O_2 concentration graphically over time.

Measure Screen Info



Each measurement screen contains these common features.

1. There is a pulsing ♥ icon to confirm that the WMA-5 display is actively on.
2. The Record button saves data as a marked record in the USB memory stick, and also sends the record to the host and WiFi ports.

3. The percentage value in the top right corner is the estimated percentage of Auto-zero absorber column capacity remaining based on the number of zeros performed since the last time the counter was reset by the user (See Reset Zero Absorber on page xx).

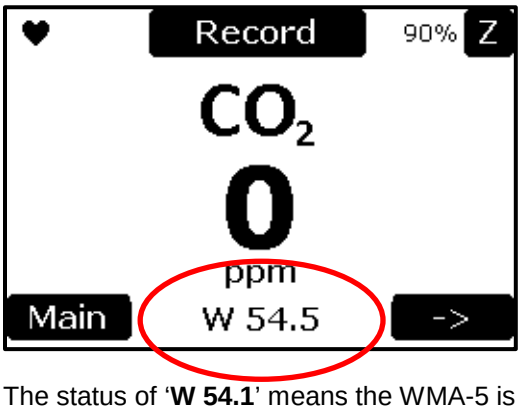
4. The 'Z' button is used to initiate a manual zero.
5. A status or error message can be displayed in the Status Area.

Measure Screen

The Measure screen is displayed after the Splash screen and when the WMA-5 is powered up. For the first 10-15 minutes, the WMA-5 goes into a warm-up period until it achieves its stable temperature of 55°C and an Auto-Zero is performed. During this time, messages are displayed in the Status Box area that indicates that the instrument is in the warm-up stage. At the completion of the warm-up period, the proper CO_2 value is displayed and the Status Box is blank.

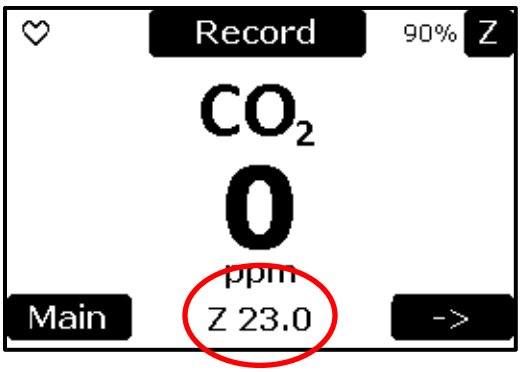
The Main and right arrow buttons are operational during and after the warm-up period.

Warming Up



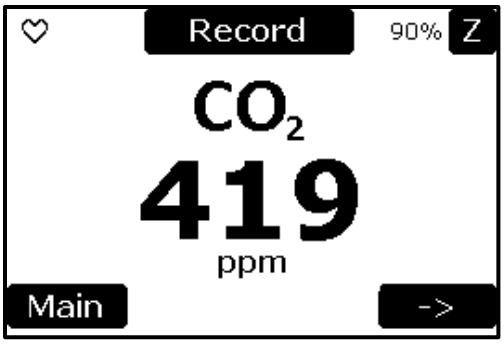
The status of '**W 54.1**' means the WMA-5 is warming and the CO_2 IRGA temperature is 54.1°C. During warm-up, the CO_2 value is displayed as 0.

Performing a Zero

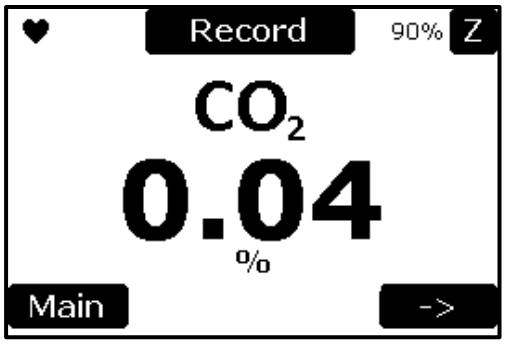


The status of '**Z 23**' means the WMA-5 is performing a zero. The number is how many seconds it will take to complete the sequence. A normal zero starts at 25 seconds. During a Zero, the CO_2 value is displayed as 0 as the readings are not valid during the Zero sequence.

At the completion of the warm-up and the first Zero, valid readings are displayed.



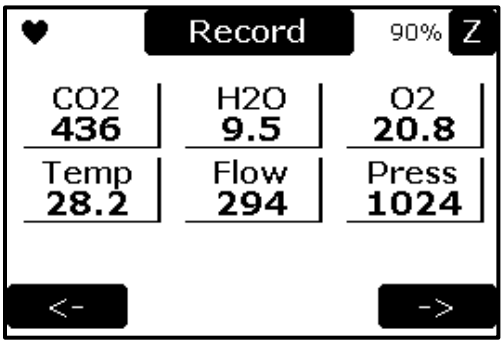
or



Measure Screen	
CO_2	CO_2 Concentration (ppm or %). You can display CO_2 in ppm or as a percentage. See CO_2 Units Settings on page 28.
Main Button	The Main Menu screen is displayed when this button is selected.
Right Arrow Button	Selects the next measurement screen (Variables 1 Screen).

Variables 1 Screen

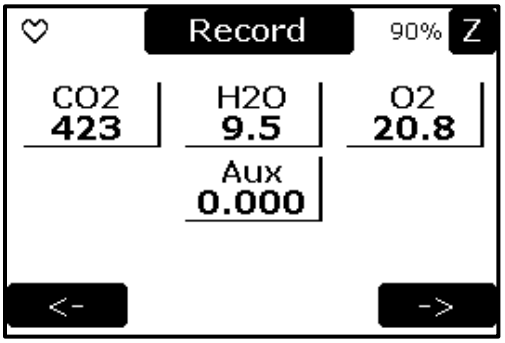
The Variable 1 screen displays the values of six variables in real time; CO_2, H_2O, O_2, Temperature, Flow Rate, and Pressure.



Variables 1 Screen	
CO_2	CO_2 concentration reading (ppm).
H_2O	H_2O reading (mb), only if optional humidity sensor is installed.
O_2	O_2 reading (%), only if optional O_2 sensor is installed.
Temp	Inlet air temperature (C), only if optional humidity sensor is installed.
Flow	Flow rate reading (cc/min).
Press	Absolute pressure in sample cell (mb).
Left Arrow Button	Displays the previous measurement screen, the Measure Screen.
Right Arrow Button	Displays the next measurement screen, the Variables 2 Screen.

Variables 2 Screen

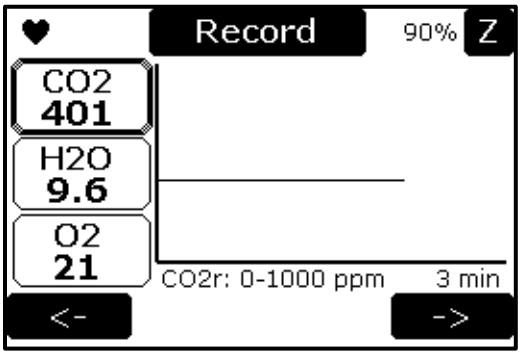
The Variable 2 screen displays the values of four variables in real time; CO_2, H_2O, O_2, and Aux.



Variables 2 Screen	
CO_2	CO_2 concentration reading (ppm).
H_2O	H_2O reading (mb), only if optional humidity sensor is installed.
O_2	O_2 reading (%), only if optional O_2 sensor is installed.
AUX	AUX1 input voltage (volts)
Left Arrow Button	Displays the previous measurement screen, the Variables 1 Screen.
Right Arrow Button	Displays the next measurement screen, the Graph Screen.

Graph Screen

The Graph screen shows a real-time display of the data.

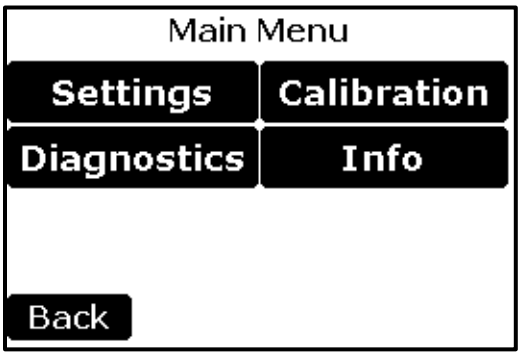


Graph Screen	
CO_2 Button	Selectable parameter to graph (0 – 100000 ppm)
H_2O Button	Selectable parameter to graph (0 - 30 mb)
O_2 Button	Selectable parameter to graph (0 – 100 %)
Y-axis	Range and units are located under the graph on left side
X-axis	X-axis time; fixed value of 3 minutes.

Left Arrow Button	Goes back the previous screen (Variables 2 Screen).
Right Arrow Button	Selects the next measurement screen (Measure Screen).

Main Menu

The Main Menu screen is displayed when the Main button is selected in the Measure screen. This menu is the top level menu for all settings and user functionality of the system.



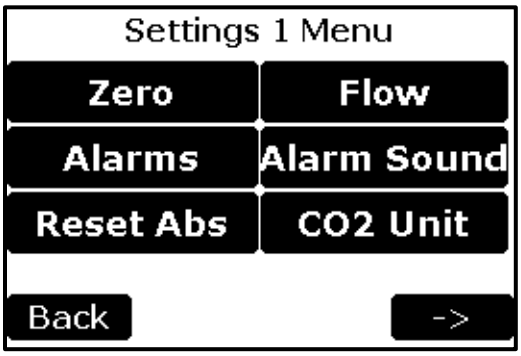
Main Menu	
Settings Button	Controls major settings of the WMA-5. There are four sub menus under Settings.
Diagnostics Button	Performs system diagnostics for troubleshooting purposes.
Calibration Button	Used to calibrate the CO_2 gas analyzer, O_2 Sensor, and the Touch Screen.
Info Button	To obtain version information and contact info
Back Button	Goes back to Measure screen

Settings

There are four settings menus; Settings 1-4. Generally, the settings have been grouped related to their frequency of change and common functionality.

Settings 1 Menu

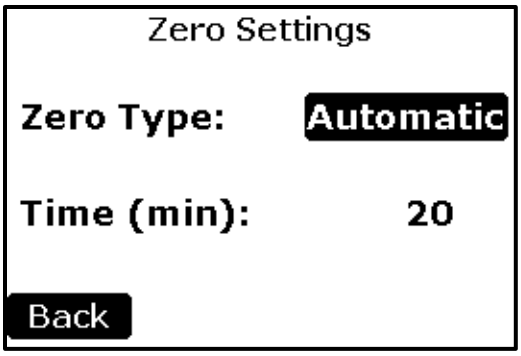
This menu contains the first tier and most common settings for the WMA-5 including the Zero, Alarms, Reset Abs (Reset Absorber Column), Flow, Alarm Sound, and CO_2 Units.



Settings 1 Menu	
Zero Button	Change/view the settings associated with the zero (zero type and time interval for performing zeros).
Alarms Button	To set the CO2 limits low and high which will cause an alarm
Reset Abs Button	To indicate that absorber material has been replaced and reset.
Flow Button	To set sample flow
Alarm Sound Button	To enable or disable the alarm sounds
CO2 Unit Button	To Select the units for Measure Screen Display (ppm or %)
Back Button	Returns to the Main Menu.
Right Arrow	Continues to the Settings 2 Menu screen.

Zero Settings

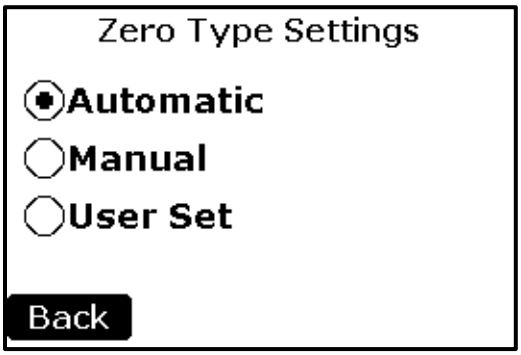
This function allows the user to change/view the zero parameters used by the WMA-5.



Zero Settings	
Zero Type Button	There are three types of zeros that can be performed; Automatic, Manual and User Set. **WE RECOMMEND AUTOMATIC.**
Time Button	Zero time is the interval between zeros in minutes. Time is always 20 minutes for Automatic. When Zero Type is set to User Set, the time can be selected and set.
Back Button	Returns to the Settings 1 Menu.

Zero Type Settings

Press the desired setting either directly on the radio button or on the text to the right of the radio button. Then select the Back button to return to the Zero Settings screen. The Zero Settings screen will return with the updated Zero Type value in the button box.



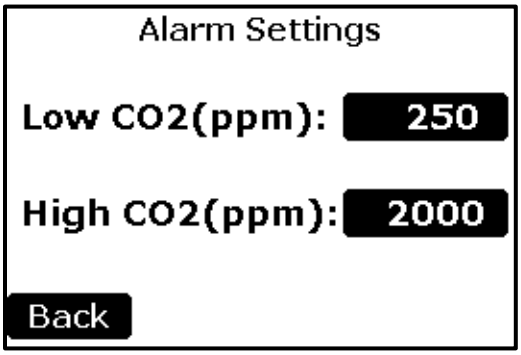
Zero Type Settings	
Automatic Button	This is the default and recommended Zero Type. The WMA-5 performs a zero more frequently initially after achieving the IRGA warm-up temperature (55 ^{o}C). At completion of warm-up it will perform an initial zero, then again after 3 minutes, then again after 6 more minutes, then after 12 minutes, then every 20 minutes thereafter. The Zero Time interval is fixed at 20 minutes.
Manual Button	A zero can be initiated at any time and regardless of the Zero Type Setting by pressing the Z button in the upper right hand corner of the display.
User Set Button	When selected, the WMA-5 performs a zero on start up, then again after 3 minutes, then again after 6 more minutes, then after 12 minutes, then finally after 20 minutes. It then performs zeros at the user-specified interval. It can be set from 1 to 40 minutes.
Back Button	Returns to the Zero Settings screen.

Important Notes

A Zero can be performed at any time either automatically or using the “Z" button in the Measure Screens. In this case, the timer resets back to zero and will perform another zero when the Zero Time interval has

Alarm Settings

This function allows the user to change/view the low (ALARM1) and high (ALARM2) alarm facilities that are built into the WMA-5. An alarm consists of an audio beep (if enabled in the Alarm Sound Setting screen), an information message in the Status Box in the Measurement Mode screens and a relay switch closure. There is a relay switch for each alarm: low (ALARM1) and high (ALARM2).



Alarm Settings	
Low CO2 (ppm) Button	To set the low CO_2 limit value at which an error is generated.
High CO2 (ppm) Button	To set the high CO_2 limit value at which an error is generated.
Back Button	Returns to the Settings 1 Menu.

Low CO_2 Alarm Setpoint

To change the Low CO_2 Setpoint, select the button to the right of the "Low CO_2 Setpoint (ppm):" text. The numerical keypad will appear allowing a new number to be inputted. See numerical keypad description under Zero Time section for details.

The WMA-5 is supplied with a factory default low alarm setting of 250 ppm. The reason for this is that a typical low CO_2 value is the result of one of the following scenarios:

- Low or no air flow.
- Absorber column exhausted (soda lime).
- Zero valve failure.

The low alarm (ALARM1) terminal relay switch handles the output when CO_2 is below the low settings.

High CO_2 Alarm Setpoint

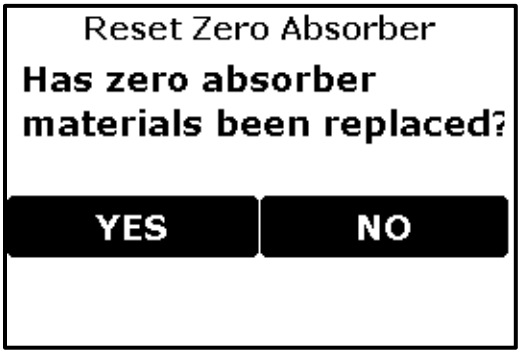
To change the High CO_2 Setpoint, select the button to the right of the "High CO_2 Setpoint (ppm):" text. The numerical keypad will appear allowing a new number to be inputted. See numerical keypad description under Zero Time section for details.

The default WMA-5 high alarm setpoint setting is 2000 ppm.

The high alarm (ALARM2) terminal relay switch handles the output when CO_2 exceeds the high settings.

Once the desired values are displayed, the Back button is selected to return to the Settings Menu.

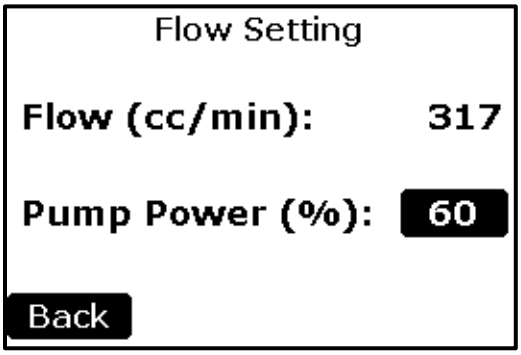
Reset Zero Absorber



Reset Zero Absorber	
Yes Button	Reset the Zero Absorber capacity gauge to 100%. This should be set every time the soda lime is changed in the Auto-Zero column to ensure reporting accuracy.
No Button	Returns to the Settings 1 Menu without resetting the Zero Absorber capacity gauge.

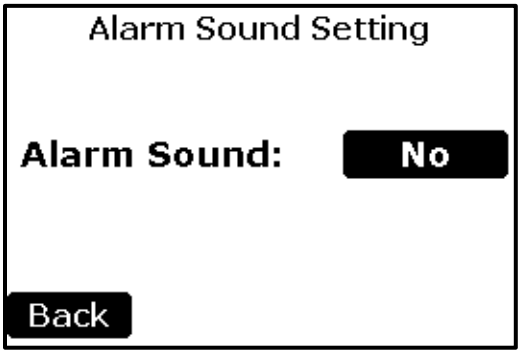
Flow Settings

This function allows the user to change/view the Flow rate of the WMA-5.



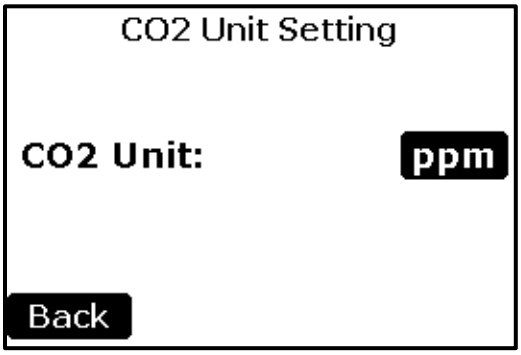
Flow Settings	
Flow (cc/min)	The measured flow rate
Pump Power (%) Button	The Pump Power setting (0-100%)
Back Button	Returns to the Settings 1 Menu.

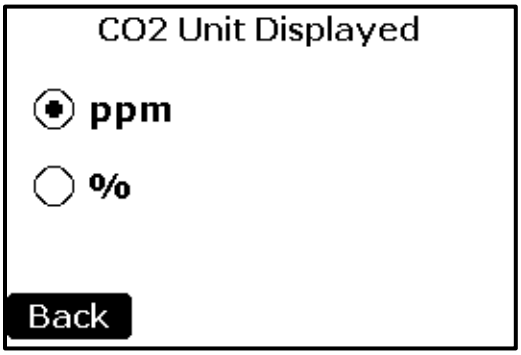
Alarm Sound Settings



Zero Settings	
Alarm Sound Button	To Select Yes or No (enable or disable the Alarm Sound)
Back Button	Returns to the Settings 1 Menu.

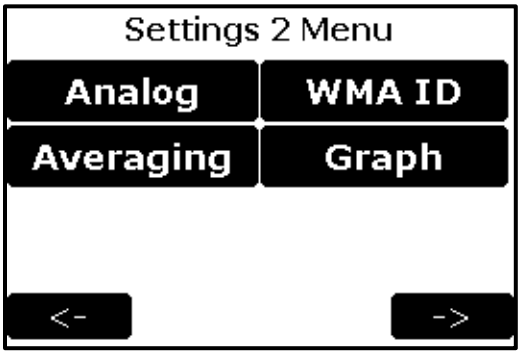
CO_2 Units Settings





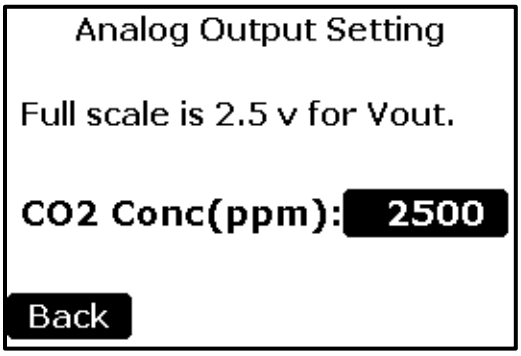
CO_2 Units Settings	
PPM Button	Sets the units for CO_2 in the Measure Screen Display to ppm.
% Button	Sets the units for CO2 in the Measure Screen Display to %.
Back Button	Returns to the Settings 1 Menu.

Settings 2 Menu



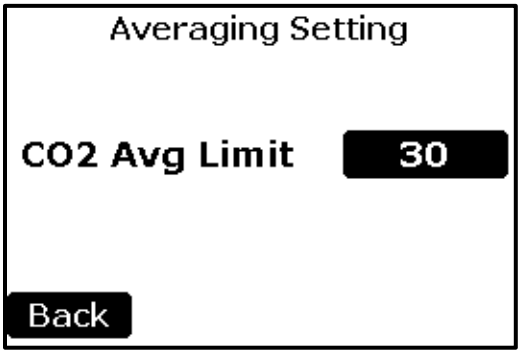
Settings 2 Menu	
Analog Button	To set the CO_2 concentration corresponding to the full scale analog output value.
Averaging Button	Sets the CO_2 averaging value range
WMA ID Button	To select an ID number of the WMA-5
Graph Button	To set the CO2 Y-axis range for the graph.
Back Button	Returns to the Settings 1 Menu screen.
Right Arrow Button	Continues to the Settings 3 Menu screen.

Analog Settings



Analog Settings	
CO2 Conc (ppm) Button	To set the CO_2 concentration corresponding to the full scale analog output value.
Back Button	Returns to the Settings 2 Menu.

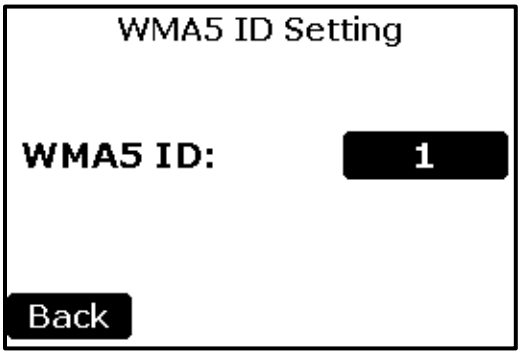
Averaging Settings



Averaging Settings	
CO2 Avg Limit Button	To select the CO_2 limit in which the CO_2 is being averaged.
Back Button	Returns to the Settings 2 Menu.

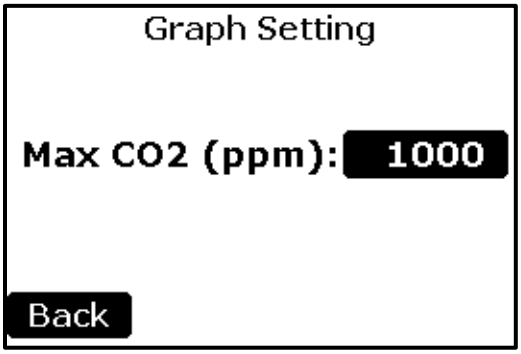
Running Average: An exponential running average filter can be applied to smooth out small fluctuations while remaining sensitive to larger differences by using an Average Limit value. Whenever a new reading differs from the current running average by more than the CO_2 Avg Limit value, a new running average begins. Thus, when the CO_2 concentration is changing rapidly, averaging is suspended and the instrument can track changes at the basic instrument data rate of 1 second. When the CO_2 Avg Limit is set to 0, no running average is performed. The running average filter response time is 3.5 seconds to reach 66% of a new value, and 16 seconds to reach 99%. In other words, if Avg Limit is set above 100 ppm and the inlet sample gas concentration instantaneously changed by 100 ppm, it would take 4 seconds for the CO_2 reading to change by 66 ppm; then after 16 seconds, the measured value would change by 99 ppm.

WMA ID Settings

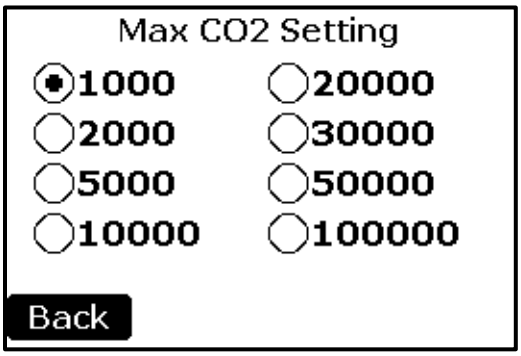


WMA ID Settings	
WMA ID Button	To Select device ID Range 0-9 (the Default is 1)
Back Button	Returns to the Settings 2 Menu.

Graph Setting

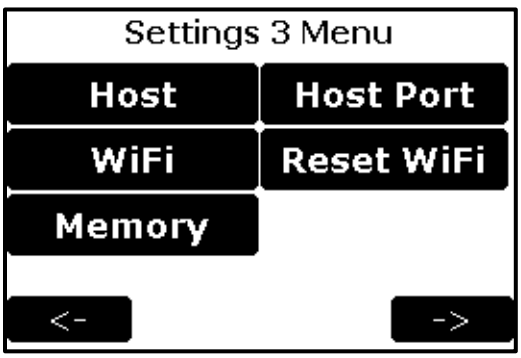


Graph Settings	
Max CO2 (ppm) Buttons	To select the CO2 Y-axis range for the Graph Screen
Back Button	Returns to the Settings 2 Menu.



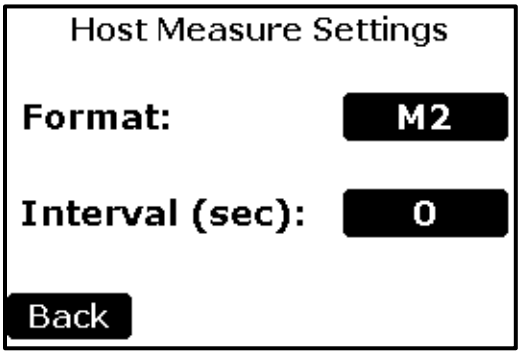
Max CO2 Settings	
Radio Buttons	Selects the CO2 Y-axis range for the Graph Screen
Back Button	Returns to the Graph Settings screen.

Settings 3 Menu



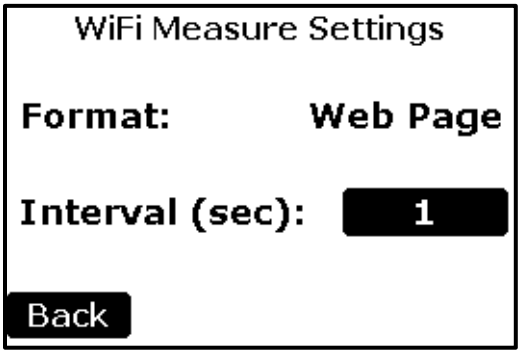
Settings 3 Menu	
Host Button	Configures the data format and time interval that the measure data will sent to a computer via a terminal emulation program (*i.e.* Hyperterminal).
WiFi Button	Configures the data format and time interval that the measure data will sent to the internet.
Memory Button	Configures the data format and time interval that the measure data will sent to a USB memory stick
Host Port Button	To select which Port to connect Host.
Reset WiFi Button	To reset Wi-Fi to Factory Settings (if installed)
Back Button	Returns to the Settings 2 Menu screen.
Right Arrow Button	Continues to the Settings 4 Menu screen.

Host Settings



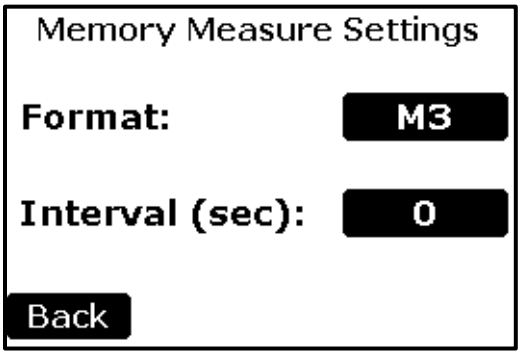
Host Measure Settings	
Format Button	Determines the measure data format. All data formats are available (M1-M6). The default is M2. See the Measure Format Settings table for a detailed description of each format is below.
Interval (sec) Button	Determines the time interval in seconds in which the measure data will be sent. A value of 0 stops sending data. The maximum value is 3600 seconds (1 hour). Default is 0.
Back Button	Returns to the Settings3 Menu.

WiFi Settings



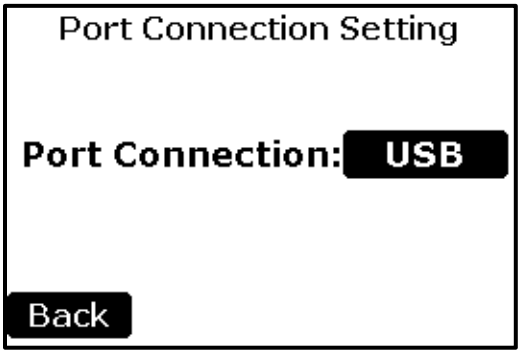
WiFi Measure Settings	
Interval (sec) Button	Determines the time interval in seconds in which the measure data will be sent. A value of 0 means no data sent. The maximum value is 3600 seconds (1 hour). Default is 1 second.
Back Button	Returns to the Settings3 Menu.

Memory Settings



Memory Measure Settings	
Format Button	Determines the measure data format. All data formats are available (M1-M6). The default is M3. See the Measure Format Settings table for a detailed description of each format is below.
Interval (sec) Button	Determines the time interval in seconds in which the measure data will be sent. A value of 0 means no data sent. The maximum value is 3600 seconds (1 hour). Default is 0.
Back Button	Returns to the Settings3 Menu.

Host Port Settings



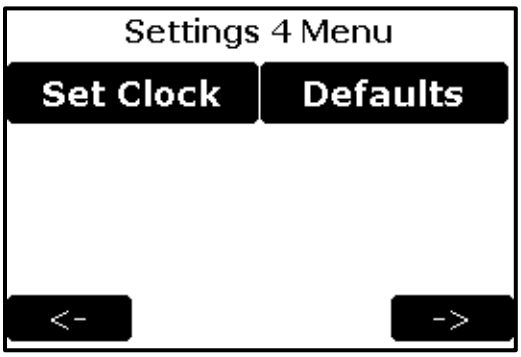
Host Port Settings	
Port Connection Button	To select which Port to connect Host. · USB · Wi-Fi
Back Button	Returns to the Settings 3 Menu.

Reset WiFi Settings



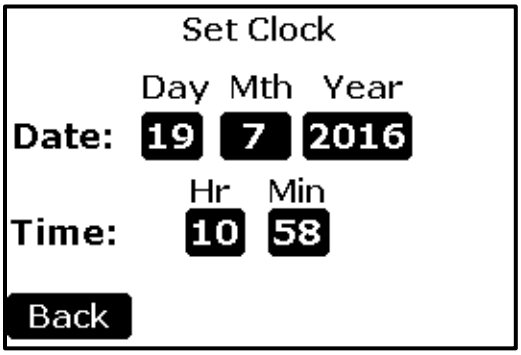
Reset WiFi Settings	
Yes Button	Reset Wi-Fi to original Factory Settings then returns to Settings 3 Menu
No Button	Returns to the Settings 3 Menu without resetting Wi-Fi

Settings 4 Menu



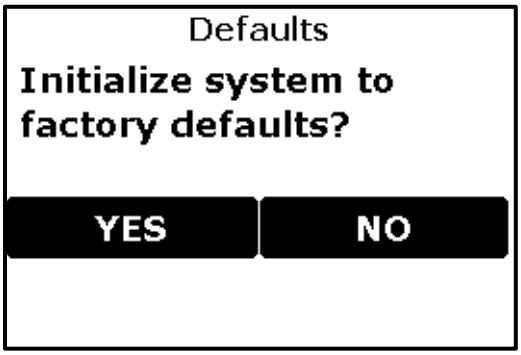
Settings 4 Menu	
Set Clock Button	To set the time and date of the WMA-5
Defaults Button	To reset all parameters to factory defaults This function allows the user to initialize the WMA-5 to its factory default values. This feature may be needed to correct an erroneous calibration, or to simply undo undesirable configuration changes.
Back Button	Returns to the Settings 3 Menu screen.
Right Arrow Button	Continues to the Settings 1 Menu screen.

Set Clock Settings



Set Clock Settings	
Day Button	To set the day (1 – 31)
Mth Button	To set the month (1 -12)
Year Button	To set the year (20XX)
Hr Button	To set the hour (0 – 23) (24 hour format)
Min Button	To set the minutes (0 – 59)
Back Button	Returns to the Settings 4 Menu.

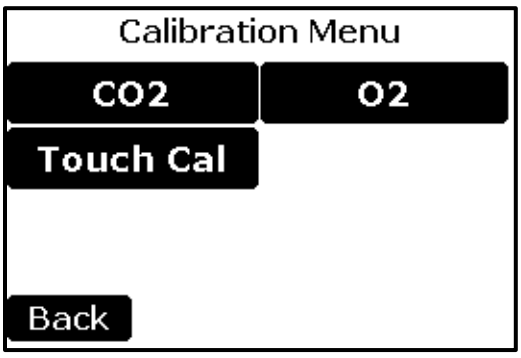
Default Settings



Default Settings	
Yes Button	Resets WMA-5 to original factory settings then returns to Settings 4 Menu. This function allows the user to initialize the WMA-5 to its factory default values. This feature may be needed to correct an erroneous calibration, or to simply undo undesirable configuration changes.
No Button	Returns to the Settings 4 Menu with no changes.

Calibration

This WMA-5 allows calibration of the CO_2 IRGA, the O_2O Sensor, and the Touch Screen.



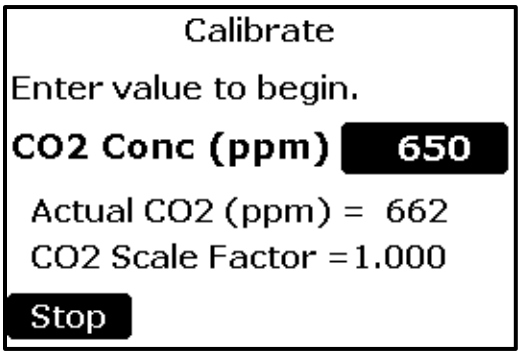
Calibration Menu	
CO2 Button	To perform CO_2 calibration.
O2 Button	To perform O_2 calibration.
Touch Cal Button	To perform Touch Screen calibration
Back Button	Returns to the Main Menu.

CO_2 Calibration

This menu allows the user to recalibrate the CO2 gas analyzer.

Before calibrating, confirm that:

- The absorber column is properly seated in its manifold
- The soda lime is fresh in the Zero Column.
- The WMA-5 has been on for at least 30 minutes.
- The Gas Out port is unobstructed.



Calibration	
CO2 Conc (ppm) Button	CO_2 concentration (ppm) of the calibration reference gas. Entering a value will begin the calibration process
Actual CO2	The current CO2 Reading based on the Scale Factor
CO2 Scale Factor	The current Scale Factor being used
Stop Button	Returns to the Calibration Menu.

Connecting Calibration Gas to the WMA-5

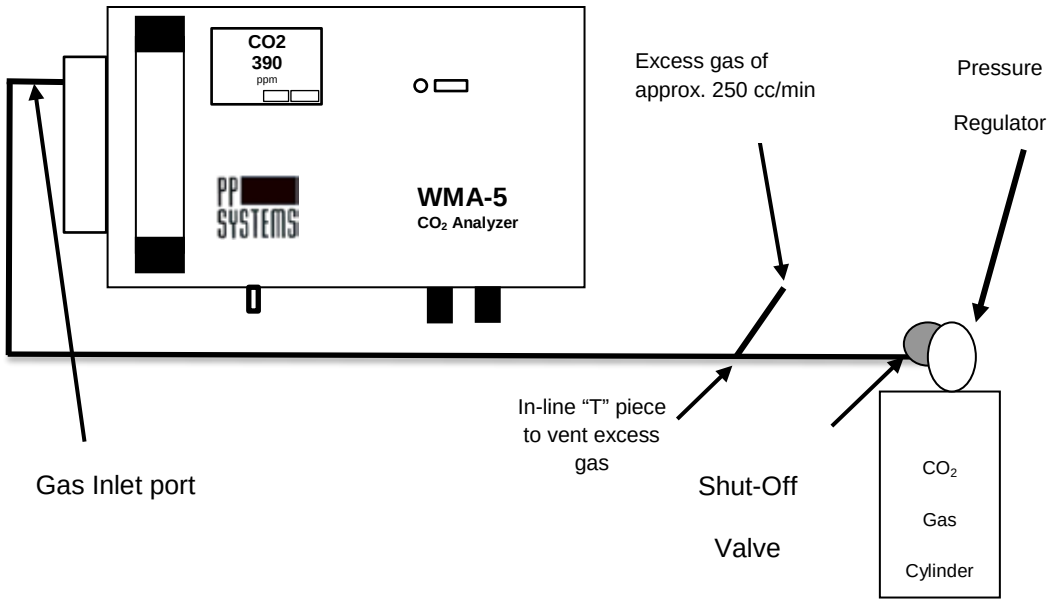
During calibration, the signal from the CO_2 detector is referenced against a gas of known CO_2 concentration. The WMA-5 calibration procedure uses two reference points:

1. Zero CO_2 (generated from air that has been scrubbed through soda lime).
2. Span Gas (a user-defined CO_2 concentration, normally a very accurate (+/- 1% accuracy), certified cylinder of CO_2 composition).

It is therefore vital that both of these references are accurate. For greater accuracy, cylinder mixtures should be accurate to +/- 1% and traceable to NIST standards. The zero gas will only be accurate if the soda lime in the absorber column is fresh.

Assuming that a calibration gas mixture is used to calibrate the WMA-5, follow these instructions:

1. To avoid excess pressure in the sample cell and possible damage to the analyzer, you must connect the sample line with a “T” piece between the calibration gas mixture and the gas inlet port on the WMA-5 as follows:

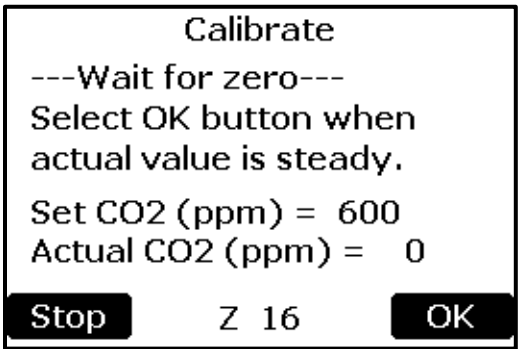


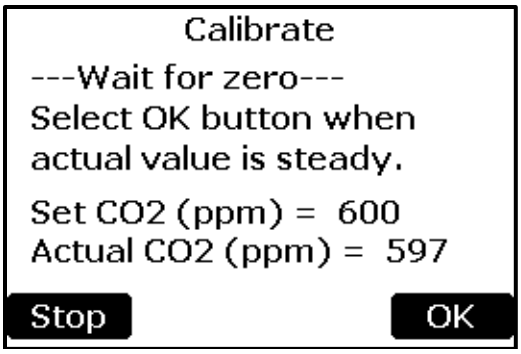
2. The pressure regulator should be set to a very low pressure and there should be a slight flow excess gas venting from the open "T" Piece (approx. 250 ml/min).

3. Select the button to the right of the "CO_2 Conc (ppm):" text. The numerical keypad will appear allowing a new number to be inputted. See numerical keypad description under Zero Time section for details.

4. Enter the CO_2 concentration of the calibration gas that you are using. This value must match the certified CO_2 concentration of the calibration cylinder and be similar or higher than the anticipated measurement range of the instrument (*i.e.* it is best to calibrate the instrument with a reference gas containing 350 - 450 ppm CO_2 when measuring around 350 ppm CO_2).

5. The WMA-5 will then perform a zero. At completion of successful zero, a similar message to the following will be displayed.

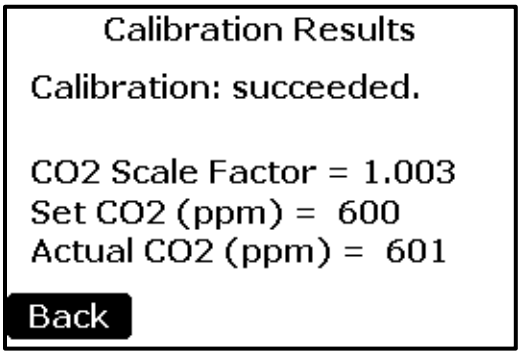




Calibration	
Set CO2	The CO_2 concentration value entered at the beginning of the Calibration Process.
Actual CO2	The current CO_2 reading
Stop Button	Returns to the Calibration Menu with no changes.
OK Button	Calculates new Scale Factor and goes to next screen

Note, the Actual value may not be the value you entered in step 4 above. When the Actual CO2 value has stabilized (i.e., not changing by more than 1 ppm after 30 seconds), press the OK button. To cancel without performing a Calibration, press Stop.

If the process is successful, the screen below will be displayed and the new calibration constant will be stored in non-volatile memory. If the process is unsuccessful, the message “Calibration: failed.” will be displayed and no changes made.

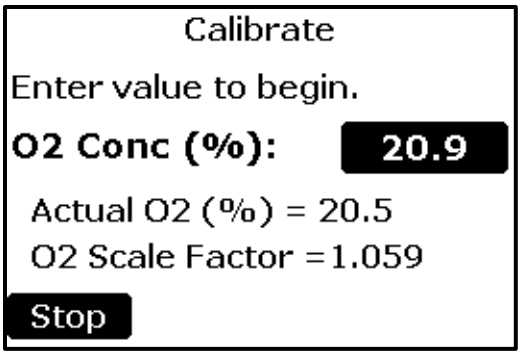


The Back button returns the user back to the Main Menu.

O_2 Calibration

This function allows the user to recalibrate the internal O_2 Sensor used with the WMA-5.
Before calibrating, confirm that:

- The WMA-5 has been on for at least 30 minutes.
- The Gas Out port is unobstructed.



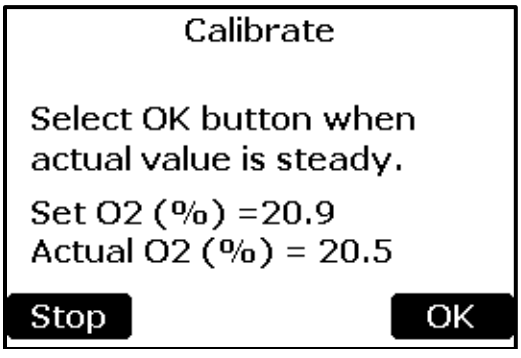
Calibration	
O_2 Conc Button	O_2 concentration (%) of the calibration reference gas. Entering a value will begin the Calibration Process
Actual O_2	The current O_2 reading based on the Scale Factor
O_2 Scale Factor	The current Scale Factor being used
Stop Button	Returns to the Calibration Menu.

Connecting Reference Gas the WMA-5

During calibration, the O_2 Sensor readings are referenced against air of known O_2 concentration.

Follow these instructions to calibrate the WMA-5 O_2 Sensor:

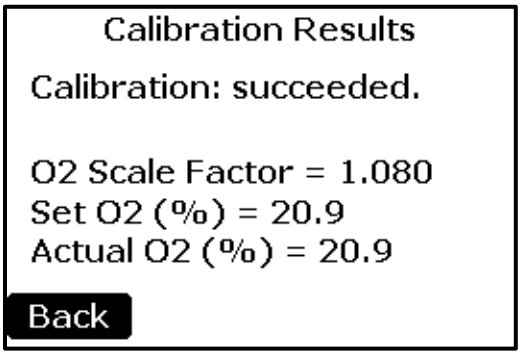
1. Connect the reference (sample) gas to the **GAS IN** port on the WMA-5
2. Select the button to the right of the "O_2 Conc (%):" text.
3. Enter the O_2 concentration of the reference gas.



Note, the Actual value may not be the value you entered in step 4 above. When the Actual O_2 value has stabilized, press the OK button. To cancel without performing a Calibration, press Stop.

Calibration	
Set O_2	The O_2 concentration Value entered at the beginning of the Calibration Process.
Actual O_2	The current O_2 Reading
Stop Button	Returns to the Calibration Menu with no changes.
OK Button	Calculates new Scale Factor and goes to next screen

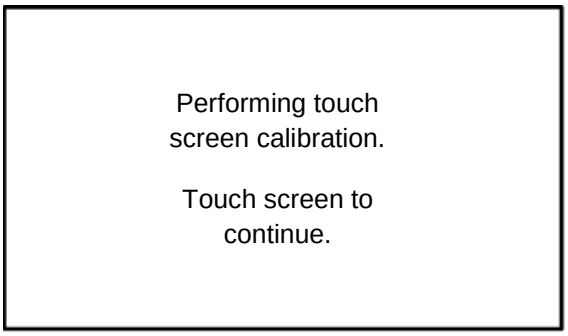
If the process is successful, the screen below will be displayed and the new calibration constant will be stored in non-volatile memory. If the process is unsuccessful, the message “Calibration: failed.” will be displayed and no changes made.



The Back button returns the user back to the Main Menu.

Touch Calibration

This function allows the user to calibrate the touch screen display. Follow the on-screen prompts to complete the process.

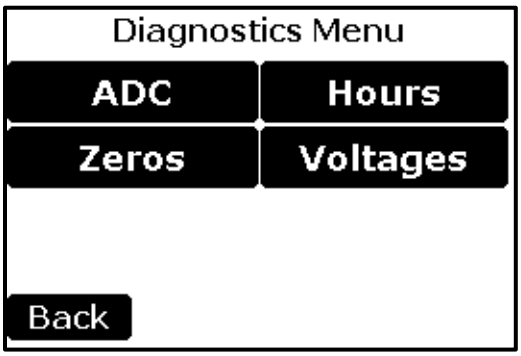


NOTE: This function can also be initiated by holding a finger on the screen while powering up the WMA-5. If your touch screen is not reacting to your touch:

1. Turn the instrument off.
2. Place your finger anywhere on the touch display and turn system power on and wait for the next screen to appear.
3. Proceed as directed with the touch screen calibration.

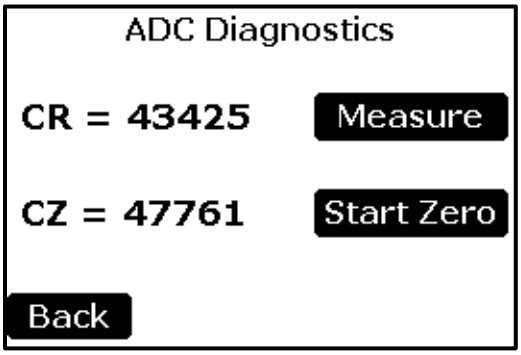
Diagnostics

This menu monitors and reports key system diagnostics associated with WMA-5 hardware. It is generally used for troubleshooting and diagnosing potential problems associated with the instrument.



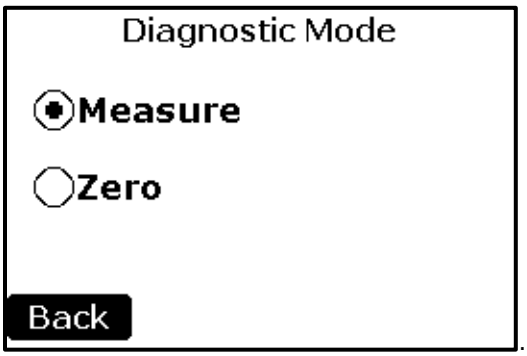
Diagnostic Menu	
ADC Button	To read the CO_2 IRGA ADC values
Zero Button	To retrieve the last 7 zero ADC values
Hours Button	To Display the WMA-5 Hours
Voltages Button	To Display the various measured voltages
Back Button	Returns to the Main Menu.

ADC Diagnostics



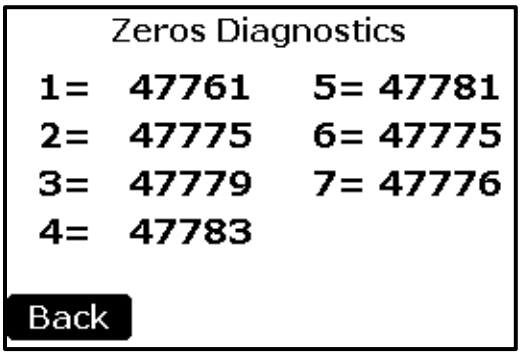
ADC Diagnostics	
CR	This is the reading from the 16 bit A/D converter for the CO_2 detector.
Mode Button	To Modify the Diagnostic Modes setting. The Button displays the current mode
CZ	This is the reading from the last zero.
Start Zero Button	Initiates a zero.
Back Button	Returns the display back to the Diagnostic Menu.

Diagnostic Mode



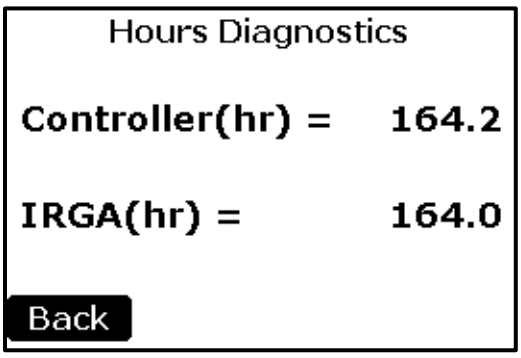
Diagnostics Mode	
Measure Button	Puts the WMA-5 into “Measure” Mode. In “Measure” mode, the CR value should read approximately 35000-45000 for CO_2 concentration around 400 ppm.
Zero Button	Puts the WMA-5 into “Zero” mode. In “Zero” mode, the A/D value for CR should read approximately 40000-50000 **if fresh soda lime is present in the absorber column**. The CR value in “Zero” mode should always be greater than the CR value in “Measure” mode.
Back Button	Returns the display back to the Diagnostics display.

Zeros Diagnostics



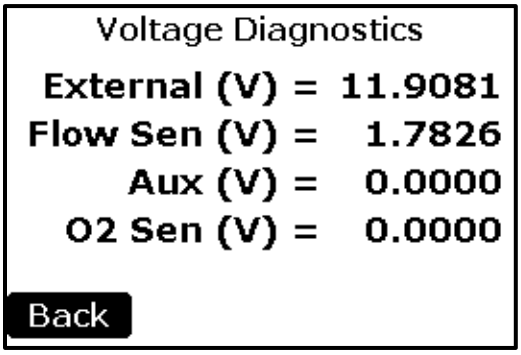
Zeros Diagnostics	
# =	The zero ADC value of the last seven zeros
Back Button	Returns the display back to the Diagnostic Menu.

Hours Diagnostics



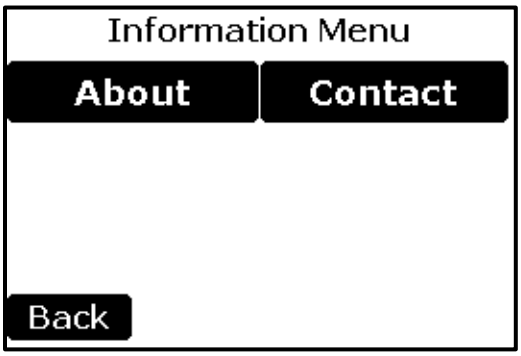
Hours Diagnostics	
Controller (hr)	The number of Hours the WMA-5 has been Powered
IRGA (hr)	The number of Hours the CO2 IRGA has been Powered
Back Button	Returns the display back to the Diagnostic Menu.

Voltage Diagnostics



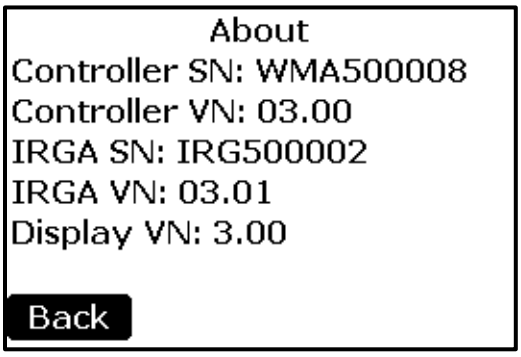
Voltage Diagnostics	
External (V)	The measured voltage powering the WMA-5
Flow Sen (V)	The voltage measured from the Flow sensor
Aux (V)	The voltage applied to the Aux input (range 0 - 1.000)
O2 Sen (V)	The voltage measured from the O2 sensor
Back Button	Returns the display back to the Diagnostic Menu.

Information Menu



Information Menu	
About Button	Provides information about serial numbers and the firmware versions
Contact Button	Information to contact PP Systems
Back Button	Returns to the Main Menu.

About



About	
About	Provides important information related to the instrument hardware including serial number of the WMA-5 console.
Back Button	Returns to the Information Menu.

Contact



Contact	
Contact	Contact information for PP Systems.
Back Button	Returns to the Information Menu.

Connecting WMA-5 to External Devices

The WMA-5 has many features and options for communicating with external devices including analog, digital, and if the WiFi option is installed, wireless.

Analog Voltage Output

One analog voltage output is available for the current CO2 reading. The full scale output is 2.5V and the CO2 concentration corresponding to full scale can be user set in the Main > Settings > Analog Output screen. 0 Volts always corresponds to 0 ppm CO2. The analog voltage output is located on the terminal block at the pins labeled Vout (positive) and GND (negative).

4-20 mA Analog Current Output

One analog current output is available for the CO2 reading. The full scale output is 20 mA and the CO2 concentration corresponding to full scale can be user set in the Main > Settings > Analog Output screen. 4 mA always corresponds to 0 ppm CO2. The user must supply a fixed loop voltage of 12 to 30 VDC to the terminal labeled Supply 4-20 mA. This supply voltage can come from an external voltage source, or from the 12V out terminal if an external source is not desired (using a small jumper wire). An external voltage source should be grounded to the WMA-5 ground at one of the GND terminals. The current output is then produced between the terminal labeled Iout 4-20mA (positive) and the terminal labeled GND (negative). A shunt resistor, often 250 Ohm, is normally used at a data logger to convert the current output into a voltage. With a 12V supply voltage, the 4-20 mA can operate with a combined loop resistance (shunt resistance plus cable resistance) of approximately 500 Ohm or less. With a 30V supply voltage, the combined loop resistance can be 1200 Ohm or less.

Alarm Relay Outputs

There are two normally open relay contacts that are activated (closed) when the Low CO2 Alarm (Alarm 1) or High CO2 Alarm (Alarm 2) condition occurs. The Alarm limits are set in Main > Settings > Alarms. The relays are rated for 30 VDC 1A or 125 VAC 0.3 A. One of the 5V out or 12V out terminals could be jumpered to one side of these relays to get a 0 to 5V or 12V output signal to trigger an external device such as a computer, solenoid value or, warning light.

USB Memory Stick

The USB Type A jack on the front panel is designed specifically for a USB Flash Memory Stick. Any memory stick can be used, however the low profile memory stick provided with the WMA-5 will also allow the enclosure cover to be closed with the memory stick installed.

It is recommend to format the memory stick to a 512 sector with 32 bit FAT for best performance.

Data collection begins when a Memory Stick is inserted into the USB port on the WMA-5. Data collection ends when the Memory Stick is removed from the USB port. The data format used is what has been defined for the Measure Memory Format in the Memory Measure Settings screen. The time interval used is what has been defined for the Memory Measure Interval in the Memory Measure Settings screen.

When the memory stick is inserted the first time, a directory called “WMA5“ is created. A filename is created within the directory using the following format:

YYMMDDWI.txt

Where,
YY is the last 2 digits of the clock year.
MM is the 2 digit month.
DD is the 2 digit day.
W is the WMA Id (0-9).
I is the increment of the file if there is more than one file created for a day.

Each time the memory stick is removed and then reinserted or the instrument is powered off then on, a new file is created and the increment 'I' is increased.

Refer to the Error Messages for the WMA-5 table below for disk errors.

Digital Connection Methods

There are three ways to connect to the WMA-5 for viewing digital data: the USB port, the RS232 port and the WiFi Option (if installed).

USB

A USB cable is factory installed in the WMA-5 that allows the WMA-5 to be connected to any USB host device such as a PC, laptop or tablet. USB communication is appropriate when the connecting device is within 2 meters of the WMA-5. This cable is connected inside the WMA-4 into the terminal block. If the cable is removed for any reason, then reconnect the three wires as follows:

USB cable wire color	WMA-5 Terminal block label
Black	GND
Yellow	RX 3.3V
Orange	TX 3.3V

The COM port settings for the USB module to communicate with the WMA-4 controller are: 19200 baud, 8 bit, 1 stop, no parity. By default the WMA-5 is set to utilize the USB port for serial communication. If needed, the selection of the USB port can be changed or reset in Main > Miscellaneous > More > Port.

RS232

For longer distance direct communication, a standard RS232 output is available which allows communication with a computer or data logger up to approximately 60 meters away. The physical connection is to the terminals labeled GND, TX RS232, and RX RS232. The port settings are 19200 baud, 8 bit, 1 stop, no parity, and no hardware or software flow control. The RS232 port is selected as active in Main > Settings > Host Port > RS232. The USB cable must be left unconnected to a PC (or disconnected from the WMA-5 completely) when using the RS232 interface.

Terminal Block Label	Data Direction	Standard PC 9 pin D connector pin
RX RS232	WMA-5 to External host	Pin 2
TX RS232	External Host to WMA-5	Pin 3
GND	-	Pin 5

Wireless

When the WiFi option is installed in the WMA-5, there are two additional connection methods available: First, a direct wireless connection (up to 15m) between any wireless device (phone, tablet, laptop) and the WMA-5 can be made without any additional hardware or routers. Second, the WMA-5 can be connected to the customer's wireless router which joins the WMA-5 into the customer's Local Area Network (LAN). Once the WMA-5 is connected to a LAN, any computer or device on that LAN can access it, and potentially additional connections to any device on the Internet at large can be made if the user's LAN firewall and security protocols permit.

Digital Communication Protocols and Software

Once a connection is made to the WMA-5 as described in the previous section, communication software is needed to read, display and record data. This section describes three software programs and protocols for utilizing WMA-5 data: WMA-5 Command Set for direct communication using WMA-5 ASCII character strings, GAS Software for a Windows based graphical user interface with graphing and logging, and Web Pages which are available only with the WiFi Option.

WMA-5 Command Set

When a computer is connected to the WMA-5 using either the USB cable or the RS232 port, a communication protocol and command set comprised of ASCII characters and strings allows receipt of WMA-5 data and setting of WMA-5 parameters. A terminal emulation program (*i.e.* Hyperterminal, TeraTerm or PuTTY) is generally used for this, but other custom user software can be made to observe and interact with the WMA-5 through these commands also.

Measured data is continuously output by the WMA-5 through the currently active port (USB or RS232). The time interval can be modified using the Host Measure Interval setting (default is every 1 second). The data format is dependent on the Host Measure Format setting selected. See Host Measure Settings section to modify these parameters.

Sending a command

To initiate a command, the Host (*i.e.* Hyperterminal) sends an ASCII string in CSV format to the WMA-5. The command can be sent with or without a CRC-8. If a CRC-8 is sent, a 'C' follows the CRC-8 value.

For example,
Host sends command without CRC-8: S,1,25<CR>
Host sends command with CRC-8: S,1,25,080C<CR>

The CRC calculation includes everything but the CRC itself and the 'C' character. In the example above, the CRC was calculated from the string "S,1,25,".

The command sent is processed by the WMA-5 after the command string terminator <CR> is received.

The command is successful if the string is under 90 characters. If a CRC-8 is present, the CRC-8 also needs to be correct for the string to be successful.

On successfully receiving the command string, WMA-5 sends an acknowledgement by sending to the Host a '+' followed by a <CR>.

On a failure, a '-' is sent back to the Host with a <CR>.

A failure can be caused by a string longer than 90 characters or an incorrect CRC.

Receiving a response

Depending on the value of the CRC parameter (See Get/Set Parameter Values Table below), a CRC will/will not be appended to the command received from the WMA-5. If the CRC parameter value is '0' (CRC Off), no CRCs will be appended to any of the commands received from the WMA-5. If the CRC parameter value is '1' (CRC On), CRCs will be appended (including the 'C') to all commands received from the WMA-5. See Get/Set Parameter Values Table for more details on turning off/on the CRC.

For example,
With CRC=0 (CRC Off):
Received from WMA-5: G,1,25<CR>

With CRC=1 (CRC On):
Received from WMA-5: G,1,25,043C<CR>

The following table describes the WMA-5 Command Set that can be used from the Host (*i.e.* Hyperterminal) to communicate with the WMA-5. Note, the examples shown below are with CRC=0 (CRC Off). There are two types of commands; Auto and Standard. Auto commands are commands that the WMA-5 will send out without being prompted by the user. For example, the 'W' (Warm Up) command is only sent by the WMA-5 when it is warming up. Standard commands are commands that are sent by the user. <CR> represents a carriage return (ASCII 13).

WMA-5 Command Set Table

WMA-5 Command Set		
Command	Type	Description
*	Auto	Indicates that the device has been powered up.
Axy	Standard	This command is the diagnostic toggle for the alarm relay. x='1' for ALARM1 x='2' for ALARM2 y='0' for Alarm Off y='1' for Alarm On Example: Sent from Host: A11<CR> Received from WMA-5: +<CR> A11 In this example, ALARM1 would be set to on. <CR> represents a carriage return (ASCII 13).
C,d,a,c	Standard	This command calibrates the WMA-5. d = device 1 = CO_2 Irga 2 = O_2 sensor a = Action 0 = Calibrate 1 = Reset to 1.0 2 = read Current Factor c = Calibration Value Returned String: C,d,a,c,f,e<CR> f = New Calibration Factor e = Status Code / Error Code

		0 = Success 10 = Bad Format 11 = Device parameter incorrect 12 = Action parameter incorrect 13 = Calibration value (CO_2) out of range 14 = Calibration factor (CO_2) out of range 15 = Calibration failed 16 = Calibration value (O_2) out of range 17 = Calibration factor (O_2) out of range Example: 1. Calibrate to CO_2 to 2000ppm Example: Sent from Host: C,1,0,2000<CR> Received from WMA-5: +<CR> C,1,0,2000,1.091,0<CR> In the example, the CO_2 reading is 2000 and the calibration factor is 1.091.
E,xxx	Auto	This command transmits any errors. See Error Messages for the WMA-5 Table below for more details. Example, Received from WMA-5: +<CR> E,11<CR> In this example, 11 is the Low Alarm error.
Fx	Standard	This command sets the Zero Valve. x='0' Off x='1' On Example: Sent from Host: F1<CR> Received from WMA-5: +<CR> F1 In this example, Zero Valve would be set to on.
G,x	Standard	This command gets a parameter stored in EEPROM (non-volatile memory). The value x is the number associated with a particular parameter (See Get/Set Parameter Values Table below). When Gx is sent from the Host, the value associated with that particular parameter is returned. Example: Sent from Host: G,1<CR> (Get Zero Type) Received from WMA-5: +<CR> G,1,1.000<CR> In this example, the value of Zero Type is 1 (Automatic).
Mx	Standard	This command performs a "one shot" output. Each time the 'Mx' is called one set of data is displayed in the format that was selected previously (i.e., M1, M2, etc.). The value of x determines where the data will be sent:

		H=Host M=Memory Stick W=Wireless A=All three Example: Sent from Host: MH<CR> Received from WMA-5: +<CR> M3,1,0003,17,12,15,27,1095,0.0,20.41,327,0.0000,55.0, 1002.9,0x0000<CR> In this example, the data is sent to the Host only. The Host Measure Format setting had been set to 3. See Get/Set Parameter Values Table below for more details.
N	Standard	This command returns five system voltage measurements in volts. External Voltage, System Voltage, Flow Sensor Voltage, AUX1 Voltage and O_2 Sensor Voltage are sent in order in CSV format. Example: Sent from Host: N<CR> Received from WMA-5: +<CR> N,12.1324, 6.6143, 0.4765, 0.0000, 0.0000<CR> In this example, External Voltage=12.1324, System Voltage=6.6143, Flow Sensor Voltage=0.4765, AUX1 Voltage=0.0000 and O_2 Sensor Voltage=0.0000.
S,x,v	Standard	This command sets a parameter in EEPROM (non-volatile memory). The value of x is the number associated with a particular setting and v is the desired value of the particular setting. The value of v is saved in the EEProm. A 'G' command is returned to confirm the change requested. See Get/Set Parameter Values Table below. Example: Sent from Host: S,1,1<CR> Received from WMA-5: +<CR> G,1,1.00<CR> In this example, Zero Type is set to 1 (Automatic).
T	Standard	This command gets and sets the time in the 24 hour format. The command can be implemented in three different ways. 1. Get values: The 'T' command is used to get the complete set of day/time values. Example: Sent from Host: T<CR> Received from WMA-5: +<CR> T,04,42,15,05,01,15<CR> In this example, seconds=04, minutes=42, hour=15, day=05, month=01 and year=(20)15. 2. A Full Set: The 'T' command can also be used to set the complete set of day/time values.

		Example: Current time: T,04,42,15,05,01,15<CR> Sent from Host: T,04,42,10,05,02,15<CR> Received from WMA-5: +<CR> T,04,42,10,05,02,15<CR> In this example, hour is changed from 15 to 10 and month is changed from 1 to 2. If any one of the attributes is different from the current the value, it will be updated. 3. A Partial Set: The 'T' command can be used to set particular attributes of the day/time values using 1-6, where 1=seconds, 2=minutes, 3=hour, 4=day, 5=month and 6=last 2 digits of year. Example: Current time: T,4,42,10,05,02,15<CR> Sent from Host: T,3,11<CR> Received from WMA-5: +<CR> T,4,42,11,05,02,15<CR> In this example, the hour was changed from 10 to 11. All other values stayed the same.
V	Standard	This command returns the serial numbers and software versions of the WMA-5 controller, the IRGA and the Display. Example: Sent from Host: V<CR> Received from WMA-5: +<CR> V,WMA500007,01.02,IRGA00001,01.02<CR> Where, in this example, WMA-5 serial number= WMA500007 WMA-5 version number=01.02 IRGA serial number=IRGA00001 IRGA version number=01.02
W	Auto	During warm up of the WMA-5, the W command is transmitted every second until the operating temperature is reached. (No "M" strings are sent during this time) Example: Received from WMA-5: W,55.0<CR> Where in this example, 55.0 is the IRGA temperature (°C).
X	Standard	This command retrieves last seven zeros performed. Example: Sent from Host: X<CR> Received from WMA-5: +<CR> X, 44200, 44223, 49971, 49972, 49976, 49981, 49973<CR> The last seven zeros are displayed.
Z Z,xxx	Auto & Standard	This command initiates a zero. During a zero operation, the WMA-5 transmits every 1 seconds the Z command until the end of the zero operation. (No "M" strings are sent

		during this time). This command can be initiated by the user or by the WMA-5 itself. Example: Sent from Host: Z<CR> Received from WMA-5: +<CR> Z, 025<CR> Z, 024<CR> … A zero has been initiated by the user. In this example, xxx is 025 then 024 which counts down of the number of cycles remaining.

Get/Set Parameter Values Table

Get/Set Parameter Values				
Number (X)	Parameter Name	Description	Valid Values	Default Value
1	Zero Type	See Zero Settings section. The values are: 1=Automatic, 2=User Set, 3=Manual	1-3	1 (Automatic)
2	Zero Time (min)	See Zero Settings section.	1-40	20
3	Average Limit (ppm)	See Averaging Settings section.	0-100	30
4	Alarm Low (ppm)	See Alarm Settings section.	0-1000	250
5	Alarm High (ppm)	See Alarm Settings section.	100-20000	2000
6	Alarm Sound	See Alarm Sound section.	0=Off; 1=On	0 (Off)
7	CO_2 Concentration (ppm)	See Analog Output Settings section.	100-100000	2000
8	WMA ID	See WMA ID section.	0-9	1
9	Pump Power (%)	Percentage of the pump power (i.e., air flow).	0-100	60%
10	Host Measure Format	See Host Measure Settings section.	1-6	3 (Full format)
11	Host Measure Interval (seconds)	See Host Measure Settings section. Use ‘0’ for manual mode to stop broadcast.	0-3600	1 second
12	Memory Measure Format	See Memory Format Settings section.	1-6	3 (Full format)
13	Memory Measure Interval (seconds)	See Memory Measure Settings section.	0-3600	1 second
14	WIFI Measure Format	See WIFI Measure Settings section	1-6	2 (No header format)
15	WIFI Measure Interval (seconds)	See WIFI Measure Settings section.	0-3600	0 seconds (Manual)
16	Not Used			
17	CRC	Determines whether a CRC-8 will be appended to each command received from the WMA-5. This works for the Host only.	0=Off; 1=On	0 (Off)
18	Web Monitor	Adds counter and terminator to strings sent to the WiFi Port to use for web pages	0=Off; 1=On	1 (On)

19	Host Serial Port	Selects the Host serial port. '0' USB (TTL serial 3.3v) '1' RS232 (compliant RS232 voltage levels)	0=USB 1=RS232	0 USB

GAS (Gas Analysis Software)

PP Systems Windows® based GAS (Gas Analysis Software) software is available for displaying and logging data from the WMA-5. No programming or command-line knowledge is required to utilize the GAS software. Connection between the WMA-5 and computer is via the USB interface. GAS will run on Windows XP and above.

The GAS software is included on the flash drive that comes with each new instrument (Part No. xxxxx), under the "PC Utilities\GAS_v[x]" directory, where [x] is the version number. GAS is also available for download directly from our website (for registered users only). To install GAS, double click on "setup.exe". A number of standard installation windows will be shown to guide you through the installation process. Once GAS is installed, the following icon will appear on the desktop:



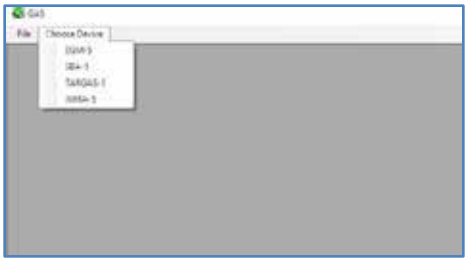
GAS

Double click this icon to start GAS.

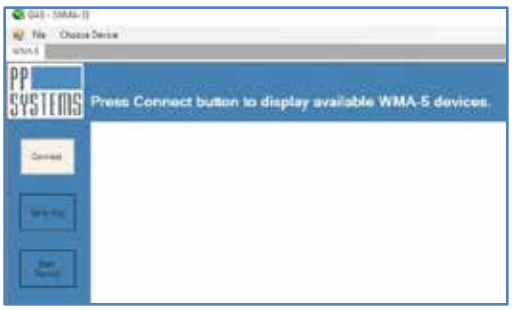


GAS

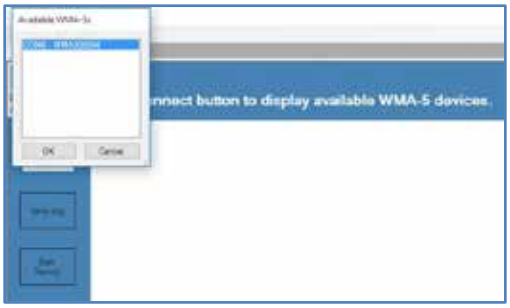
Click Choose Device and choose WMA-5.



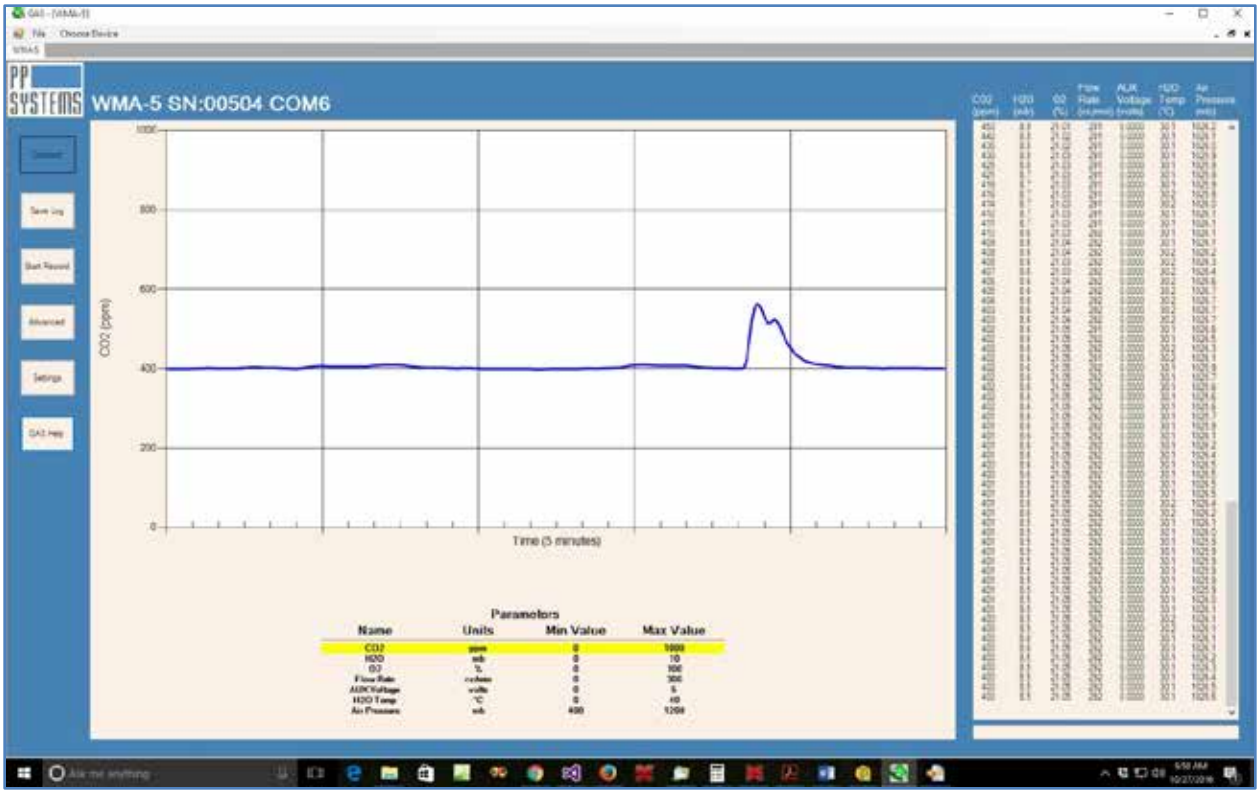
A new WMA-5 tab window will appear. Next, click the Connect button.



In the top left corner, a box will appear listing all available WMA-5 devices. Select one and click OK.



After clicking OK, the main measurement screen will be displayed.



Note: In the top left area, the device name (e.g., TARGAS-1, EGM-5, SBA-5 or WMA-5), serial number, and COM port are all displayed. Data is displayed both graphically and numerically. GAS gives the ability to log past data activity in a current session (Save Log) or record data (Start Record) for a time segment. Clicking the Advanced button will show a command-line window for sending commands directly to and from the WMA-5. The Settings button allows the user to modify the parameters' minimum and maximum values. Data is saved in comma-delimited .txt files. A graphical representation of each parameter can be seen by clicking the parameter name in the table below the graph. The highlighted parameter will be displayed on the graph.

For more detailed information on the functionality of GAS, refer to "Gas Help" under the Help menu in the software.

Communication Summary

The following table summarizes the communication methods and protocols described in the preceding sections. In addition, other capabilities exist within the WiFi option that may be useful to some users attempting to write custom code on a wireless connection – please contact PP Systems for more information.

Connection to WMA-5	Typical Distance	Receiving Device	Software	Result
USB	0-2 meter	Any USB host device (PC, laptop, iPad)	Any terminal emulation program such as HyperTerminal, TeraTerm, PuTTY	Data strings displayed in real time, Able to change WMA-5 settings with simple command strings
		Any Windows XP and above computer with a USB host port	PP Systems GAS (Gas Analysis Software)	Graphical display of data, and data logging
		Any USB host device	Custom user code	Custom interface to user equipment or data loggers
RS232	0-60 meter	Any device with a serial port	Any terminal emulation program such as HyperTerminal, TeraTerm, PuTTY	Data strings displayed in real time, Able to change WMA-5 settings with simple command strings
		Any Windows XP and above computer with a serial port	PP Systems GAS (Gas Analysis Software)	Graphical display of data, and data logging
		Any serial device	Custom user code	Custom interface to user equipment or data loggers
Wireless (WiFi) – Soft Access Point (no router required)	0-15 meter	Any wireless device with a browser (PC, iPad, iPhone, Android)	Any browser (Internet Explorer, Firefox, Chrome, Safari)	View WMA-5 web pages with live data and trend. Able to change wireless settings, but not WMA-5 settings.
Wireless (WiFi) – Client Mode (WMA-5 connected to LAN via existing router)	LAN extent	Any device on the LAN with a browser (PC, iPad, iPhone, Android)		
Wireless (WiFi) – Client Mode (WMA-5 connected to LAN via existing router, AND the router firewall is configured to allow external access)	Worldwide	Any device in the world with a browser		

Notes:

- USB and RS232 can not be used simultaneously.
- Highlighted blocks are the expected use methods for most customers.

Wireless Network Settings

The WMA-5 Wi-Fi embedded device server contains two network interfaces. The Software enabled Access Point interface (SoftAP) is also called ap0, and the wireless local area network interface (WLAN) is called wlan0.

A maximum of four clients can be connected to the SoftAP interface if the WLAN interface is disabled. If the WLAN interface is enabled a maximum of three clients may be connected.

The wireless network settings show the status of the Software-enabled Access Point (SoftAP) or WLAN interface/link and let you configure the settings on the device. Interface settings are related to the configuration of the IP and related protocols. Link settings are related to the physical link connection, which carries the IP traffic.

Note: *All network settings require a reboot to take effect. Wait a minimum of 20 seconds after rebooting the unit before attempting to make any subsequent connections. (Reboot the WiFi hardware from Wireless Settings > Device > Reboot menu item, or just power cycle the WMA-5.)*

Connecting To WMA-5 Via Direct Wireless Connection

Here are the steps to make a wireless connection to the WMA-5 using the Soft Access Point (Soft AP) mode that is the easiest and simplest WiFi connection for the WMA-5. The WMA-5 acts as an access point for a wireless device, and no other equipment is required. This is also the default connection method enabled after a factory reset, and users must use this connection mode to change the settings for other modes.

1. By default the SoftAP mode is enabled with a default SSID of 'WMA5'.
2. Use the Wi-Fi Connection Manager of your connecting device (phone, tablet, laptop, etc) to scan for available wireless networks, and above SSID should be presented as a choice. Select the SSID and follow the device connection manager instructions to continue to connect. (Note: if more than one WMA-5 is powered on within the wireless range of one another, and each WMA-5 defaults to the SSID of 'WMA5', it will be difficult to determine which WMA-5 is connected to the wireless device. When more than one WMA-5 is to be used, it is recommended to power on only one WMA-5 at a time at first, then change the SSID as described in step 8 below to a unique name that eliminates the duplicate SSIDs.)
3. The default security for WMA5 Wi-Fi SoftAP is WPA2 and the passphrase is 'PPSYSTEMS'. These defaults can be changed through the configuration web manager after the initial connection has been established.
4. When prompted enter the passphrase to complete the Wi-Fi connection authentication process. With a Wi-Fi client set to the above parameters, your device can connect directly to the WMA-5 Wi-Fi Soft AP.
5. Open a standard browser (E.g. Internet Explorer®, Firefox®, Chrome™, Safari® etc.) and in the address field of the browser enter '192.168.0.1' as the IP address. Some browsers interpret that address as a search term rather than a LAN IP address, so enter 'http://192.168.0.1' in the address bar, if necessary.
6. When prompted, enter the username of 'admin' and password 'PASSWORD' to access the WMA-5 Web pages. At this point, the WMA-5 Splash Screen will be displayed in the browser window. Click the **Main** button to advance to the 3 data screens of WMA-5 data continually updated with live data.
7. If it is desired to change any of the wireless network settings, go to web management page **Main > Settings > Yes**
8. Select **Network > ap0 > Link** to get to the **Status/Configuration** page for the SSID, Security Suite Type and Security and passphrase. Modification to any of these parameters requires first pressing the **Configuration** button, then a reset/power cycle of the module in order to take effect.

It is recommended that you record any changes you make.

SSID: _____

Security Suite: _____

Encryption: _____

Passphrase: _____

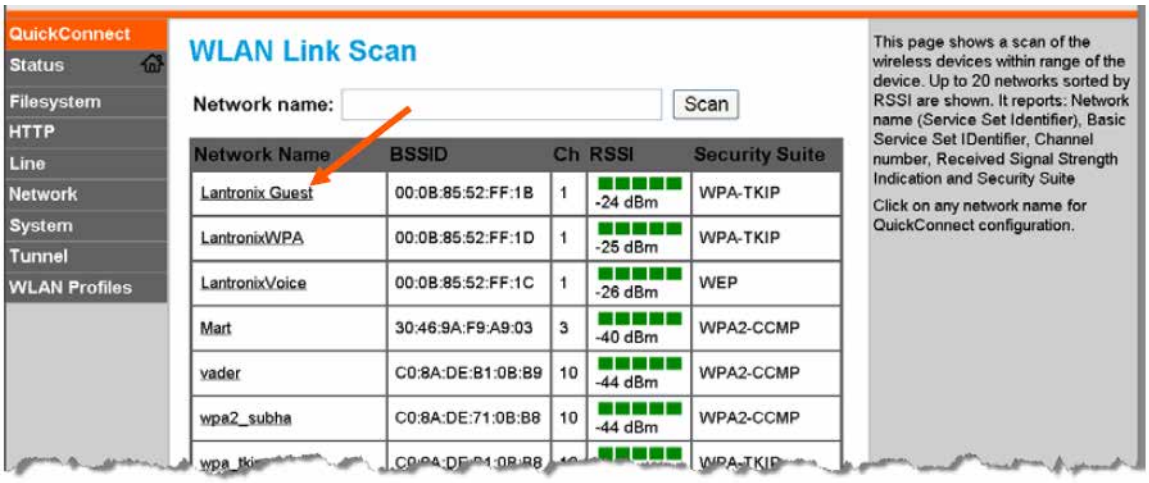
Connecting to WMA-5 via a Local Area Network

Here are the steps to make a wireless connection to the WMA-5 using the Client Mode method in which the WMA-5 is connected to a user's existing Local Area Network via a user's existing wireless access point or wireless router. Once the WMA-5 is joined to the LAN, any computer or wireless device that is also joined to the LAN can view the WMA-5 web pages.

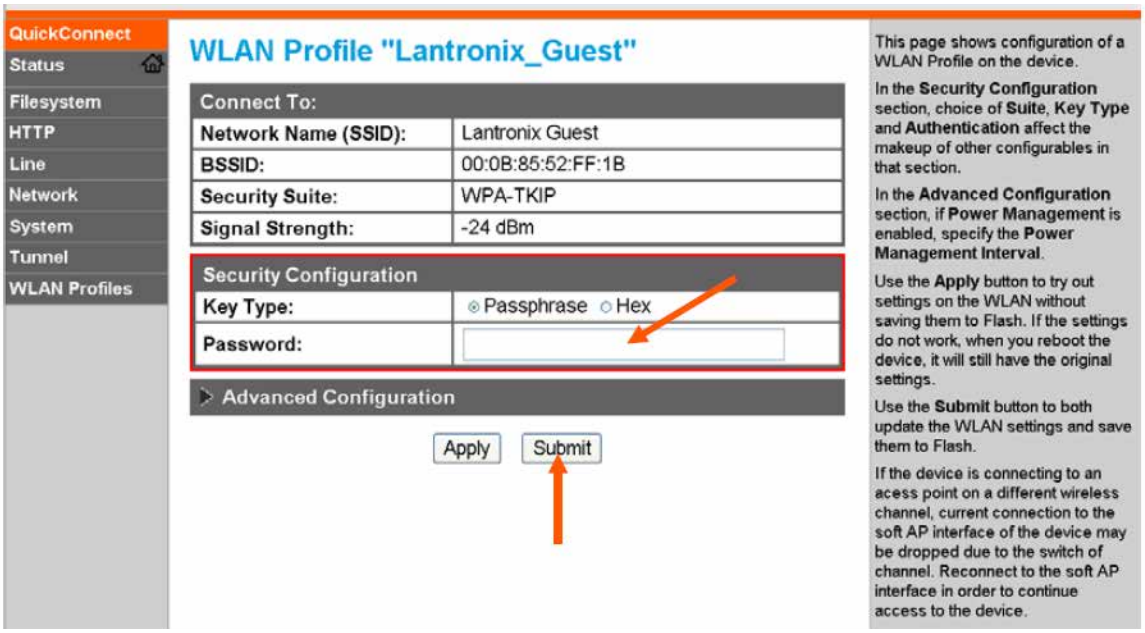
1. First, connect to the WMA-5 using the SoftAP method described above from any wireless device. Then navigate to the Wireless Network Settings (**Main > Settings > Yes**).
2. **WLAN QuickConnect:** QuickConnect offers the ability to configure the STA (WLAN Client) interface on WMA-5 WiFi to establish connection to an active Access Point. QuickConnect learns most of the connection properties from the available Access Points and prompts the user only for the security parameters and saves the settings under a corresponding new/existing WLAN profile for future autonomous operation of the WLAN Client interface.



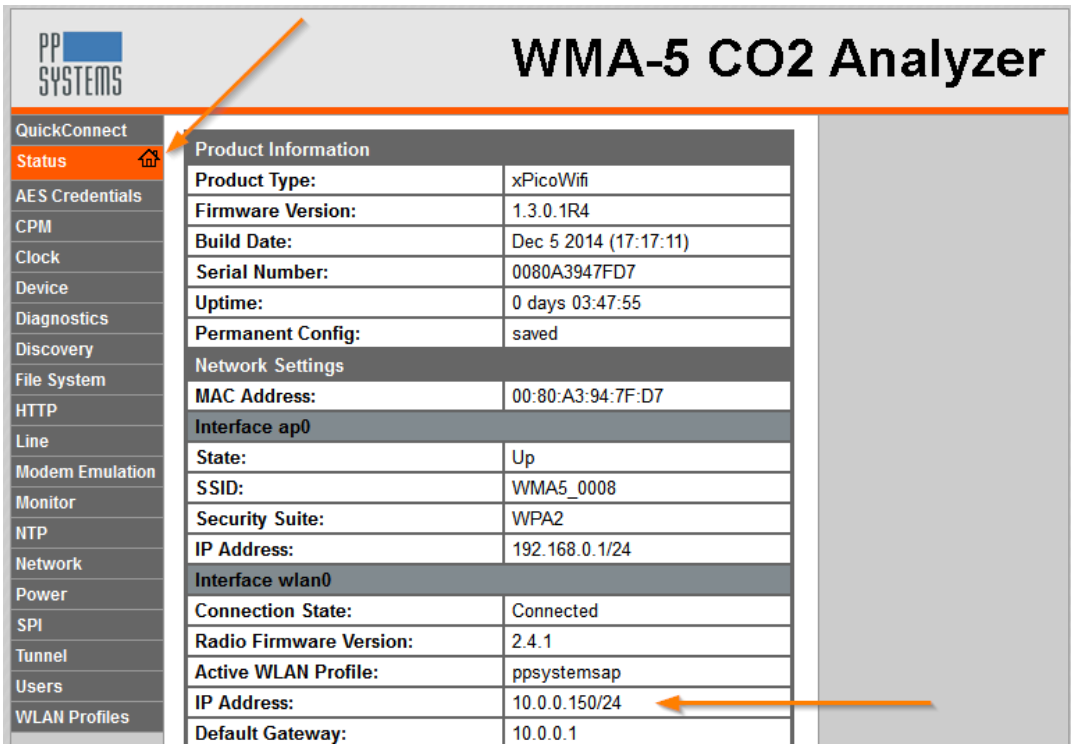
3. Upon selection of the QuickConnect option, the WMA-5 Wi-Fi scans and displays up to 20 wireless devices in order of strongest signal strength at the top. Click on a network name to view the connection to that desired Access Point.



4. When the selected Access Point profile displays, enter the password and click **Submit** to directly connect to the Access Point and to add the profile and configuration details to the WLAN profiles.



5. Once added, the Quick Connect profile is connected and is accessible and configurable through WLAN Profiles.
6. Then, once the WMA-5 is successfully connected a LAN, view the **Status** page under the **Interface wlan0** section to see the particular IP address that was assigned to the WMA-5. In the example below, the LAN IP address 10.0.0.150 was assigned to the WMA-5 (and the softAP **Interface ap0** address is still available for direct connection at 192.168.0.1). The LAN-assigned IP address can be changed from time-to-time by the LAN router, but the ap0 address will always be 192.168.0.1.



7. Now, any computer on the LAN can open a standard browser (E.g. Internet Explorer®, Firefox®, Chrome™, Safari® etc.) and in the address field of the browser enter IP address assigned to the WMA-5, such as '10.0.0.150' for the example shown. Some browsers interpret that address as a search term rather than a LAN IP address, so enter 'http://10.0.0.150' in the address bar, if necessary. Then, follow the steps 6, 7 and 8 from the SoftAP section above to enter the user name and password and navigate through the WMA-5 web pages.

Measure Format Settings Table

This table describes the six different Measure Formats. Note: In the examples, there CRC parameter is turned off and there are no CRCs concatenated to the end of a message. <CR> represents a carriage return (ASCII 13).

Measure Format Setting	
Setting	**Description**
M1	M1 is the legacy data format used in the WMA-4 (previous model to the WMA-5). Note: this format is NOT comma delimited. An example is: M1100012801131900968115025000000000000000000000099700<CR> The format is as follows: M1: Determines what data format is being displayed. In this case, M1 is WMA-4 format. (position 0,1) WMA ID: 0-9. (Identifier for WMA-5 when multiple units are used). (position 2) Record #: 1-9999. (position 3-6) Day: 1-31. (position 7,8) Month: 1-12 (January - December). (position 9,10) Hour: 1-24 (based on 24 hour clock). (position 11,12) Minutes: 0-59. (position 13,14) CO2 Ref: CO_2 reading in parts per million (ppm = µmol m^2 s^{-1}). (position 15-19) mb Ref: H_2O reading in millibars (mb). (position 20-22) AnT: Temperature (°C) of the gas sample. (position 23-26) Input 1: millivolts (mV) signal from sensor connected to AUX1. (position 27-30) Input 2: millivolts (mV) signal from sensor connected to AUX2. (position 31-34) Input 3: not used. Value is 0000. (position 35-38) Input 4: not used. Value is 0000. (position 39-42) Input 5: not used. Value is 0000. (position 43-46) ATMP: Atmospheric pressure in millibars (mb). (position 47-50) ECode: Displays error code message. See Error Messages for the WMA-5 table below for details. (position 51,52)
M2	M2 is the No Header format contains everything but the header and is comma delimited. An example is: M2, 1094, 0.0, 20.41, 327, 0.0000, 55.0, 1004.2,0x0000<CR> The format is as follows: M2: Determines what data format is being displayed. In this case M2 is No Header format. CO_2 (ppm): CO_2 reading in parts per million (ppm = µmol m^2 s^{-1}) H_20 (mb): H_2O reading O_2(%): O_2 reading Flow Rate (cc/min): Rate of flow. Aux Voltage (volts): AUX1. H_20 Sensor Temperature (°C): Temperature of the gas sample. Air Pressure (mb): Atmospheric pressure System Error (hex): Displays error code message. See Error Messages for the WMA-5 table below for details.
M3	M3 is the full format that has the complete data set and is comma delimited.

	An example is: M3,1,0003,17,12,15,27,1095,0.0,20.41,327,0.0000,55.0, 1002.9,0x0000<CR> The format is as follows: M3: Determines what data format is being displayed. In this case M3 is Full format. WMA-id: 0-9 (Identifier for WMA-5 when multiple units are used). Record #: 1-9999 Day: 1-31 Month: 1-12 (January - December). Hour: 1-24 (based on 24 hour clock). Minute: 0-59 CO_2 (ppm): CO_2 reading in parts per million (ppm = µmol m^2 s^{-1}) H_20 (mb): H_2O reading O_2(%): O_2 reading Flow Rate (cc/min): Rate of flow. Aux Voltage (volts): AUX1 H_20 Sensor Temperature (°C): Temperature of the gas sample. Air Pressure (mb): Atmospheric pressure System Error (hex): Displays error code message. See Error Messages for the WMA-5 table below for details.
M4	M4 is the short format is an abbreviated version of the data and is comma delimited. An example is: M4,1096,327,55.0,1002.9,0x0000<CR> The format is as follows: M4: Determines what data format is being displayed. In this case M4 is Short format. CO_2 (ppm): CO_2 reading in parts per million (ppm = µmol m^2 s^{-1}) Flow Rate (cc/min): Rate of flow. H_20 Sensor Temperature (C): Temperature of the IRGA. Air Pressure (mb): Atmospheric pressure System Error (hex): Displays error code message. See Error Messages for the WMA-5 table below for details.
M5	M5 is the fast format (every 0.1 seconds), is a minimized version of the data and is comma delimited. An example is: M5,1094.07,0x0000<CR> The format is as follows: M5: Determines what data format is being displayed. In this case M5 is Fast format which is 0.1 seconds. CO_2 (ppm): CO_2 reading in parts per million (ppm = µmol m^2 s^{-1}) System Error (hex): Displays error code message. See Error Messages for the WMA-5 table below for details.
M6	M6 is the raw format contains raw data (A/D values) from the IRGA. It is comma delimited. An example is: M6, 44572, 50675, 17603, 17600, 37340, 50292,0x0040<CR> Where <CR> represents a carriage return (ASCII 13) The format is as follows: M6: Determines what data format is being displayed. In this case M6 is Raw

	format. CO_2: Relates to the CO_2 reading. Air Pressure: Relates to the atmospheric pressure reading. Temperature Sensor1: Relates to temperature sensor 1. Temperature Sensor2: Relates to temperature sensor 2. Lamp: Relates to lamp current. Last Zero CO_2: Reports last zero value. Displays IRGA error code message as a hexadecimal number.

Error Messages for the WMA-5 Table

Error and status messages are displayed in the Status Box during operation.
The following table highlights the most common messages that you may see from time to time:

Error Messages		
Error Code	**Status Box Message**	**Description**
10	Low Zero Error	Zero read to low (<2500).
11	Low Alarm Error	CO_2 less than 250 ppm (default).
12	High Alarm Error	CO_2 greater than 2000 ppm (default).
13	Under Temp Error	Analyzer temperature < 50 ^{o}C.
14	Over Temp Error	Analyzer temperature > 60 ^{o}C.
15	Low Flow Error	The flow is less than 50.
16	IRGA EEProm Write Fail	IRGA unable to perform a write. If error persists, call PP Systems technical support.
17	IRGA EEProm CRC Fail	IRGA read/write EEProm CRC incorrect. If error persists, call PP Systems technical support.
18	IRGA Out of Range	IRGA setting error. Value is out of range. If error persists, call PP Systems technical support.
30	Unknown Command	Host only. First character is not recognized as a command. Example is just sending a <CR>.
31	Invalid Format	Host only. First character is a recognized command but the next character is invalid. Example: S1,1<CR>.
32	Invalid Parameter	Host only. Command is correct but parameter is not. Example: S,20,5. The value of 20 is an invalid parameter.
33	Low Range Limit	Host Only. Value entered is below the valid range of values for that parameter.
34	High Range Limit	Host Only. Value entered is above the valid range of values for that parameter.
50	Disk ND	Disk related error. No disk has been detected.
51	Disk CF	Disk related error. Command failed – Filename or directory name not found.
52	Disk BC	Disk related error. Bad command – Command not recognized.
53	Disk DF	Disk related error. Disk full – No free space on disk.
54	Disk FI	Disk related error. Invalid – Attempt to open a directory for reading or writing. Attempt to change currently selected directory to a file.
55	Disk RO	Disk related error. Read only – Attempt to open a read only file for writing.
56	Disk FO	Disk related error. File open – A file is currently open for writing and must be closed before this command can be executed.
57	Disk NE	Disk related error. Directory not empty – Attempt to delete a directory which is not empty.
58	Disk FN	Disk related error. Filename invalid – Firmware invalid or contains disallowed characters.
60	Disk NU	Disk related message. No upgrade – Firmware upgrade file not found on disk. This message is seen each time a disk is inserted into the

		drive.
61	Disk DD	Disk related message. Disk detected - This message is seen each time a disk is inserted into the drive.
62	Disk DR	Disk related message. Disk removed - This message is seen each time a disk is removed from the drive.

Maintenance

The WMA-5 requires minimal maintenance and access to internal components should not be required with the exception of the internal hydrophobic filter which does require periodic replacement (See Hydrophobic Filter on page 70). To access internal IRGA components, remove the 4 screws in each corner of the main front panel and gently pull off.



Absorber Column and CO_2 Scrubber



Periodically inspect the condition of the following items:

Soda Lime

- The soda lime should last for 2-3 months from the time it is replaced. PP Systems used to supply a “green to brown” indicating soda lime but this type is no longer available and has since been replaced by the “white to violet” indicating soda lime. For most applications running at low CO2 concentrations (i.e. less than 2000 ppm) the indicator is not very strong and you may not see any obvious change in color. So the rule of thumb should be to pay attention to the CO_2 absorber reset (see Reset Zero Absorber on page 27) function or simply change out the soda lime once every month if you have any questions about its freshness.

Soda Lime cannot be regenerated and should be discarded after exhaustion.

- Type: Sofnolime, 1.0-2.5 mm, self-indicating (white to violet), 1 kg
- Manufacturer: Molecular Products. (www.molecularproducts.com)
- For the latest Material Safety Data Sheet, please visit www.molecularproducts.com and request the latest MSDS or contact PP Systems.

For the latest MSDS on alternative types of soda lime, please contact the manufacturer directly or contact PP Systems

Take caution to wash your hands completely after handling soda lime.

Gray Foam Filters

- The gray foam filters used inside the absorber column (top and bottom) will wear over time and should be inspected regularly and replaced when torn or reduced in size. The foam must be of an open celled type, such as packing foam. The foam filters at the bottom of each column will likely require more frequent changes versus the upper foam filters.

Absorber Filters

- Each absorber end cap contains a white plastic filter disk. Generally these do not need to be replaced but should be checked periodically. However, they must be present to prevent any of the column contents being drawn with the gas stream causing damage to the instrument.

End Cap "O" Rings

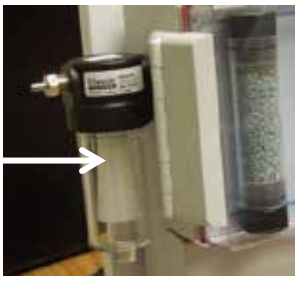
- Each end cap has two "O" rings, one that seals inside the plastic column and another that seals at the manifold. All "O" Rings on the absorber column should periodically (every couple of weeks) receive a slight smear of silicone grease to aid ease of fitting, improve the seal and extend the life of the "O" rings and to keep them from cracking or breaking. Once sealed, end fittings should be checked to ensure that the O-rings are seated correctly in their groove and that they are not trapped or pinched resulting in system leaks.

Re-Order Information	
Part Number	**Description**
10164-1	WMA-5 Absorber Column (Complete)
20041-2	Absorber Column (clear plastic only)
41508-1	Gray Filter Foam
30013-1	O-ring 4.47 x 1.78
30013-17	O-ring 17.6 x 2.4
STD007W	Sofnolime (white to violet), 1 kg

Water Trap

The water trap (also referred to as a “Float Valve Housing”) is an essential filtration tool when gas is being drawn to the CO_2 analyzer preventing the carry-over of water from getting into the system.

Grip glass section with your hand and turn counter-clockwise to empty water as required



Periodically inspect the water trap for water and empty as required. To empty, turn the glass counter-clockwise to remove from the black section at the top and empty. Inspect the “O” ring on the glass piece periodically and make sure it has a slight smear of silicone grease to aid ease of fitting, improve the seal and extend the life of the “O” ring and to keep it from cracking or breaking.

Hydrophobic Filter

An internal hydrophobic filter (Part No. 10045-1) is located inside the smaller terminal block enclosure. It is secured in place by the black viton tubing.



This should be replaced periodically based on environmental conditions. If sampling in dry environments, we recommend replacing the filter once every 3 months. If sampling in high humidity environments we recommend that you change it more frequently (once per month). To change, gently pull one end of the filter assembly from the gas tubing and then repeat on the other side. Connect new filter assembly to the tubing and reassemble.

Sampling Pump

The sampling pump used in the WMA-5 is a vibrating diaphragm type pump. It operates from 12 VAC that is generated onboard from the WMA-5 12V DC power supply. It is capable of delivering flow rates up to 500 cc/min flow. History has shown that this style pump is extremely rugged and durable and should last for many years. If replacement is necessary, please contact PP Systems.

Infrared Source

The infrared source should last for many years and not require replacement. The obvious sign of failure is that it is not flashing when the system is powered. It is preferable to return the instrument to PP Systems for full factory recalibration after changing a failed source lamp. However, if that is not possible, a few checks can be made to insure that the analyzer is working properly after changing a source lamp in the field. Please contact PP Systems for more information.

Appendix 1. WiFi Compliance

The Wireless device used in the WMA-5 is a product from Lantronix and is their xPico® Wi-Fi® Embedded Device Server

(According to ISO/IEC Guide and EN 45014)

Manufacturer's Name & Address:

Lantronix, Inc.
167 Technology Drive, Irvine, CA 92618 USA

Declares that the following product:

Product Name Models:

xPico® Wi-Fi® Embedded Device Server, xPico Wi-Fi SMT Embedded Device Server Conforms to the following standards or other normative documents:

Table C-1 Country Certifications

Country	Specification for xPico Wi-Fi Model	Specification for xPico Wi-Fi SMT Model
USA FC	◆ FCC Part 15, Subpart B, Class B ◆ ICES-003:2012 Issue 5, Class B ◆ ANSI C63.4-2009	◆ FCC Part 15, Subpart B, Class B ◆ ICES-003:2012 Issue 5, Class B ◆ ANSI C63.4-2009
USA	◆ FCC Part 15, Subpart C (Section 15.247) ◆ ANSI C63.10-2009 ◆ FCC Part 2 (Section 2.1091) ◆ FCC OET Bulletin 65, Supplement C (01-01) ◆ IEEE C95.1	◆ FCC Part 15, Subpart C (Section 15.247) ◆ ANSI C63.10-2009 ◆ FCC Part 2 (Section 2.1091) ◆ FCC OET Bulletin 65, Supplement C (01-01) ◆ IEEE C95.1
Canada	◆ Canada RSS-210 Issue 8 (2010-12) ◆ Canada RSS-Gen Issue 3 (2010-12) ◆ ANSI C63.10-2009 ◆ RSS-102 Issue 4 (2010-12)	◆ Canada RSS-210 Issue 8 (2010-12) ◆ Canada RSS-Gen Issue 3 (2010-12) ◆ ANSI C63.10-2009 ◆ RSS-102 Issue 4 (2010-12)
EU	◆ EN 300 328 V1.8.1 (2012-06) ◆ EN 301 489-1 V1.9.2 (2011-09) ◆ EN 301 489-17 V2.2.1 (2012-09) ◆ EN 55022:2010+AC:2011, Class B ◆ EN62311:2008	◆ EN 300 328 V1.8.1 (2012-06) ◆ EN 301 489-1 V1.9.2 (2011-09) ◆ EN 301 489-17 V2.2.1 (2012-09) ◆ EN 55022:2010+AC:2011, Class B ◆ EN62311:2008
Australia, New Zealand N11206	◆ AS/NZS 4268: 2012	◆ AS/NZS 4268: 2012
Japan	◆ ARIB STD-T66, MIC notice 88 Appendix 43 ◆ RCR STD-33, MIC notice 88 Appendix 44	◆ ARIB STD-T66, MIC notice 88 Appendix 43 ◆ RCR STD-33, MIC notice 88 Appendix 44

Table C-2 Country Transmitter Ids

Country	Specification for xPico Wi-Fi Model	Specification for xPico Wi-Fi SMT with U.FL Model	Specification for xPico Wi-Fi SMT with Antenna Model
USA FCC ID	R68XPICOW	R68XPICOW	R68XPICOW
Canada IC ID	3867A-XPICOW	3867A-XPICOW	3867A-XPICOW
Japan ID	201-135275	201-135275	201-135275

Table C-3 Safety

Country	Specification for xPico Wi-Fi Model	Specification for xPico Wi-Fi Model with Antenna
World Wide CE 0560	CB EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 In accordance with the council directive 2006/95/EC	CB EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 In accordance with the council directive 2006/95/EC
US, Canada	UL 60950-1 (2nd Edition)	UL 60950-1 (2nd Edition)

Hereby, Lantronix, declares that this xPico Wi-Fi and xPico Wi-Fi SMT embedded device server is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/ EC.

Federal Communication Commission Interference Statement

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 of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into 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.

***FCC Caution**: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.*

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

Radiation Exposure Statement

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