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GA 500 GAS ANALYZER

Operations & Maintenance Manual

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WARNING

Read the OPERATION MANUAL before operating this equipment.

- **NOTE:** Algas-SDI reserves the right to use alternate manufacturers' components as vendor delivery applicability dictates. Vendors have supplied literature contained in the Operation Manual. Please check to be sure supplied data matches your configuration. Contact Algas-SDI if any questions exist.
- This equipment uses LPG-a flammable fuel, or NH₃-a toxic gas, (depending on the model), handled under pressure. Inherent hazards exist and a thorough understanding of the equipment is required to allow safe operation and maintenance.
- Allow only a **TRAINED** and **FULLY QUALIFIED PERSON** to service this equipment.
- Any time a component must be replaced, use the same type, model, etc. **DO NOT SUBSTITUTE!** The consequence from such actions are unpredictable and may lead to dire consequences. When components are replaced with components not approved for use in our FM/CSA listed equipment, the FM/CSA listing becomes void for that unit.

GA500-W INSTRUMENT SPECIFICATIONS - Wobbe Index Thermal Analyzer

Units:	Kcal/Nm ³ or Btu/scf
Standard Measuring Range:	7500 – 18800 Kcal/Nm ³ or 800 – 2000 Btu/scf
Accuracy:	± 1.5%
Repeatability:	± 0.3%
Linearity:	± 0.2%
Fuel Consumption:	85 liters/hr or 3 scfh (based on a fuel gas with a specific gravity of 0.6)
Gas Pressure:	2.5 kpa or 15" W.C. minimum 6.9 kpa or 27.7" W.C. maximum
Air Consumption:	4250 liters/hr or 152 scfh
Air Pressure:	517 kpa or 75 PSIG minimum 1034 kpa or 150 PSIG maximum
Electrical Requirements:	
	115 VAC/ 1ph / 50-60 hz @ 1 Amp
	Or
	230 VAC / 1ph / 50-60 hz @ 0.5 Amp
	Fuse: F1 - 1 Amp Slo-Blo
	Fuse: F2 - 1 Amp Slo-Blo
Electrical Area Classification:	General Purpose
Output:	4 – 20 mA 600 Ohms impedance isolated Alarm Output Relay 2 Amp 264 VAC
Dimensions:	635 mm W x 889 mm D x 2235 mm H
	Or
	25 in W x 35 in D x 88 in H
Weight:	113 kg or 250 lbs
Response:	Less than one second after deviation of gas sample at the instrument. 50% of deviation within 30 seconds and 90% in one minute. Full scale stability in less than 3 minutes.

GA500-W INSTRUMENT SPECIFICATIONS - Wobbe Index Thermal Analyzer

Transformer wired for: 115 VAC 230 VAC

Regulator & Flow Meter Settings

Regulators:	Setting:
1st stage Air regulator	60 psig
2nd stage Burner Air regulator	25 psig
1st stage Calibration Gas regulator	4" W.C.
1st stage Sample Gas regulator	4" W.C.
2nd stage Gas regulator	2" W.C.
Flow Meters:	Setting:
Thermal Analyzer - Measurement Air	100 scfh

Burner Air pressure switch set to open at: 20 PSIG on decreasing pressure.

OPERATOR DISPLAY SETUP

2408i Indicator Home level Settings

LEVEL	ITEM	ASDI DEFAULT SETTING
dSP.F - Home Display Front	PU - Process Value	Not Adjustable
dSP.F - Home Display Front	PU - Process Value	Not Adjustable

2408i Indicator Home Level Settings: Low Alarm Setpoint

LEVEL	ITEM	ASDI DEFAULT SETTING
AL - Alarm Setpoint ** NOTE	1FSL - Alarm Setpoint Low	7500
	Below Setpoint Alarm Relay is on.	

**** NOTE:** The GA500-W operator should determine if Low Wobbe Index Alarm is needed. Factory Default setting for Low Wobbe Index Alarm ("FSL") is set to "OFF" in the configuration menu under "AL" then "AL 1". The Low Wobbe Index Alarm value can only be adjusted when "AL" then "AL 1" is set to "FSL" in the configuration menu.

2408i Indicator Home Level Settings: Alarm Setpoint Range

LEVEL	ITEM	ASDI DEFAULT SETTING
SP L - Minimum Alarm Setpoint	1FSL - Alarm Setpoint Low	7,500***
SP H - Maximum Alarm Setpoint	1FSL - Alarm Setpoint High	18,500***

***** NOTE:** The end user may change this value as required. Maximum is Set by ",P", "VAL.H".

2408i Indicator Home Level Settings: Input Filtering

LEVEL	ITEM	ASDI DEFAULT SETTING
,P - Input Filtering	int.t - Input Filtering Time	5
	Stabilizes last digit on display	

GA500-W INSTRUMENT SPECIFICATIONS - Wobbe Index Thermal Analyzer

OPERATOR DISPLAY SETUP

To enter Configuration Setup:

ACCS → "CODE" → Select "1"
 GOTO → Select → "conF" → "CONF" → Select "2"

2408i Indicator Configuration Level Settings

LEVEL	ITEM	ASDI DEFAULT SETTING
InST - Instrument Configuration	unit - Units	None
	deCP - Decimal Places	None
	Acbu - Front Panel Ack/Reset Button	Disabled
,P - Sensor Input Configuration	,nPt - Input Type	mV - Linear Millivolts
	ImP - Input Impedance	AUTO - DETECT SENSOR BREAK
	InP.L - Electrical Input Low	
	InP.H - Electrical Input High	40.00
	VAL.L - Displayed Value Low	
	VAL.H - Displayed Value High SPAN - Value Changes with each calibration	
	tYPE - Type of Calibration	OFF
AL - Alarm Configuration	AL 1 - Alarm 1 Type	FSL - Full Scale, Low Alarm
	Ltch - Alarm 1 Latching	NO
	bLoc - Alarm 1 Blocking	NO
	AL 2 - Alarm 1 Type	OFF
	Ltch - Alarm 1 Latching	NO
	bLoc - Alarm 1 Blocking	NO
	AL 3 - Alarm 1 Type	OFF
	Ltch - Alarm 1 Latching	NO
	bLoc - Alarm 1 Blocking	NO
	AL 4 - Alarm 1 Type	OFF
	Ltch - Alarm 1 Latching	NO
	bLoc - Alarm 1 Blocking	NO
	Sbrt - Sensor break	EnAb
LA - Digital Input Config.	N/A - Skip over, use Factory Default	
Lb - Digital Input Config.	N/A - Skip over, use Factory Default	

GA500-W INSTRUMENT SPECIFICATIONS - Wobbe Index Thermal Analyzer

OPERATOR DISPLAY SETUP CONTINUED

2408i Indicator Configuration Level Settings

LEVEL	ITEM	ASDI DEFAULT SETTING
AA - Relay 1 Output Config.*	,d - Identity of Output	rELY - Relay
	Func - Function of Output	diG - Output Enabled
	SEnS - Sense of the Output	Inu - Inverted
	1FSL - Alarm 1, Full Scale - Low (NOTE)	YES
	AL 2 - Alarm 2	NO
	AL 3 - Alarm 3	NO
	AL 4 - Alarm 4	NO
	Sbr - Sensor Break	YES
	SPAn - Process Span Exceeds Limits	YES
	rmt.F - Remote Failure	NO
	iP1.F - Input 1 Fail	YES
	nw.AL - New Alarm	NO
HA - Communication Module	N/A - Skip over, use Factory Default	
JA - PDSIO MODULE	N/A - Skip over, use Factory Default	
1A - Output Module 1Config.**	,d - Identity of Module	dc.Re - DC Retransmission
	Func - Function	PU - Process value retransmission
	VAL.L - Retransmission Value Low	7,500
	VAL.H - Retransmission Value High (span)***	18,800
	Unit - Electrical Output units	mA - Milliamps
	Out.L - Min. Electrical Output	4.0
	Out.H - Max. electrical Output	20.0
2A - Module 2 Config.	N/A - Skip over, use Factory Default	
3A - Module 3 Config.	N/A - Skip over, use Factory Default	
CAL - Calibration	N/A - Skip over, use Factory Default	
PASS - Passwords	N/A - Skip over, use Factory Default	
EXIT - Leaving Configuration	YES - Select Yes to Exit	

NOTE: 1FSL changes to AL 1 when "AL" - "AL 1" is set to "Off", set value stays "YES".

GA500-WC INSTRUMENT SPECIFICATIONS - Wobbe Index Value / Specific Gravity Thermal Analyzer / Calorific Gravity

Calorific Value:	Units Kcal/Nm ³ or Btu/scf
Wobbe Index:	Units Kcal/Nm ³ or Btu/scf
Specific Gravity:	Unity
Wobbe Index Measuring Range:	7,500 – 23,500 Kcal/Nm ³ or 800 – 2500 Btu/scf
Calorific Value Measuring Range:	7,500 – 32,500 Kcal/Nm ³ or 800 – 3470 Btu/scf
Specific Gravity Measuring Range:	0.50 – 2.10
Accuracy:	+/- 1.5%
Repeatability:	+/- 0.3%
Linearity:	+/- 0.2%
Fuel Consumption:	55.0 liters/hr or 1.94 scfh on a fuel gas with a specific gravity of 1.43 57.7 liters/hr or 2.04 scfh on a fuel gas with a specific gravity of 1.30
Gas Pressure:	2.5 Kpa or 15" W.C. minimum 6.9 Kpa or 27.7" W.C. maximum
Air Consumption:	4250 liters/hr or 152 scfh
Air Pressure:	517 Kpa or 75 PSIG minimum 1034 Kpa or 150 PSIG maximum
Electrical Requirements:	115VAC / 1ph / 50-60hz @ 1 amp Or 230VAC / 1ph / 50-60hz @ 0.5 amp Fuse: F1 - 1 Amp Slo-Blo Fuse: F2 - 3/4 Amp Slo-Blo Fuse: F3 - 1/2 Amp Slo-Blo Fuse: F4 - 1 Amp Slo-Blo
Electrical Area Classification:	General Purpose
Output:	4 – 20 mA 900 Ohms impedance isolated
Dimensions:	635 mm W x 889 mm D x 2235 mm H Or 25in W x 35 in D x 88 in H
Weight:	113 kg or 250 lbs
Response:	Less than one second after deviation of gas sample at the instrument. 50% of deviation within 30 seconds and 90% in one minute. Full scale stability in less than 3 minutes.

GA500-WC INSTRUMENT SPECIFICATIONS - Wobbe Index Thermal Analyzer / Calorific Value / Specific Gravity

Transformer wired for: 115V 230V

SETTINGS:

Regulator	Setting
1 st stage Air regulator	60 PSIG
2 nd stage Burner Air regulator	25 PSIG
1 st stage Calibration gas regulator, Light Gas / Heavy Gas	6" / 12" W.C.
1 st stage Sample gas regulator, Light Gas / Heavy Gas	6" / 12" W.C.
2 nd stage Gas regulator	2" W.C.
Flow Meter	Setting
Measurement Air - Thermal Analyzer	100 scfh
Sample / Calibration Gas - Specific Gravity	50 cc/min
Instrument Air - Specific Gravity	200 cc/min

Recorder Output Factory Default Values	Setting
WI - Wobbe Index Low - 4.00 mA @	7,500 Kcal/Nm ³
WI - Wobbe Index High - 20.00 mA @	23,500 Kcal/Nm ³
CV - Calorific Value Low - 4.00 mA @	7,500 Kcal/Nm ³
CV - Calorific Value High - 20.00 mA @	32,500 Kcal/Nm ³
SG - Specific Gravity Low - 4.00 mA @	0.50
SG - Specific Gravity High - 20.00 mA @	2.10

Burner Air Pressure switch set to open at: 20 PSIG on decreasing pressure.

	Display Configuration	PLC Current Output milliamps	BRIDGE OUTPUT mV DC Output
WI - ZERO - Water Bath			
SG - AIR			
SG - Calibration Gas			
WI - Calibration Gas			
CV - Calibration Gas			
WI - Sample Gas			
SG - Sample Gas			
CV - Sample Gas			

Bridge Excitation Voltage:

5.00 VDC

	GA500 Gas Analyzer Spare Parts and Accessories	Recommended Spares	Quantity	Model		
				GA500-W 363-203-02	GA500-W 363-203-03	GA500-WC 2404-2001-01
				A.S.D.I. P/N:		
DESCRIPTION						
	EQUIPMENT DRAWING			D363-603	D363-603	2404-6001
	PIPING DIAGRAM			D363-806	2404-8003	2404-8002
	ELECTRICAL DRAWING					2404-7001
	PRESS SNUBBER #25B 1/4" NPT BRASS		2	30499		
	GAU 0-100 PSI BKMT LIQ DUAL SCALE		1	30637		
	SPARK IGNITER, SELF GROUNDING		1	34120		
	GAU 0-60 PSI BKMT LIQ DUAL SCALE		1	35337		
	F1 - FUSE SLO-BLO 1 AMP 250V	*	1	F1 - 52514		
	FUSE FNM 1 AMP 250V	*	1	F2 - 50059		F4 - 50059
	MOV 250V 72 JOULES 4500AMPS		1	50544		
	MANUAL FOR GA500W & GA500-WC		2	52667		
	XFMR PRI 120V/240V SEC 24VAC 75 VA		1	52907		
	GA500-W PROCESS INDICATOR/ALARM		1	53134		
	DIVERTER, DRAFT		1	363-505-03		
	BURNER BAFFLE, GA500		3	363-511-01		
	VALVE SLND 1/4"NPT 24VAC / 6.1W		1	8053-101		
	RPR KIT 1/4" SLND VALVE, 24VAC / 6.1W	*		40377		
	REGULATOR, 1/4"NPT, 35-100 PSIG		1	8122-111		
	GAU PRESSURE 0-4" W.C.		1	8144-102		
	ELECTRONIC IGNITER 117VAC / 24VAC		1	8146-103		
	REGULATOR, 1/4"NPT, 0-60 PSI		1	8151-106		
	REGULATOR, 1/4"NPT, 0-2 PSI		3	8151-112		
	PRV R400S 1/2" 1-3.5 W.C. BRN SPR		1	8159-104		
	PRV R500S 3/4" 4-12"W.C VIO SPR		1	8159-105		
	ELEMENT, FILTER, 1 X 2-1/2		2	8161-202		
	SWITCH, PRESSURE, 0-50 PSI		1	8169-106		
	TC DIFFERENTIAL 'K' TYPE		1	8174-105		
	ARRESTOR/SNUBBER 1/4"NPT BRASS		1			33558
	F2 - FUSE SLO-BLO 3/4 AMP 250V	*	1			F2 - 50279
	F3 - FUSE SLO-BLO 1/2 AMP 250V	*	1			F3 - 50034
	PLC 4-SLOT BASE 110V / 220V		1			52400
	DL205 DL250 CPU Module Programmed		1			52464-1
	D2-250 PLC CPU BATTERY		1			52442
	POWER SUPPLY 24VDC @ 1 AMP		1			52444
	4 CH IN, 2 CH OUT ANALOG CURR. CARD		1			52461
	2 CH OUTPUT ANALOG CURRENT CARD		1			52462
	CPU PROGRAMMED PLC CARD		1			52464-1
	OPERATOR DISPLAY INTERFACE		1			52465
	COMPLETE PLC ASSY		1			52466-1
	MILLIVOLT SIGNAL ISOLATOR		1			51951
	THERMOCOUPLE SIGNAL ISOLATER		1			51953
	POWER SUPPLY 5VDC @ 1.5 AMPS		1			51952

Spare Parts Used prior to SN: 02130016

Notes	GA500 Gas Analyzer Spare Parts and Accessories	Recommended Spares	Quantity	Model				
				GA500-W 363-203-01	GA500-W 363-203-02	GA500-WC 2404-2001-01	GA500-W 363-203-03	
				A.S.D.I. P/N:				
	DESCRIPTION							
1	GA500-W PROCESS INDICATOR/ALARM		1	8180-105F				
2	XFMR PRI 115V/230V SEC 24VAC		1	9013-109 (Replaced by PN: 52907)				
3	CIRCUIT BREAKER, 10 Amp		1	9051-101A (Replaced by PN: 52514 Fuse)				
4	POWER SUPPLY 24VDC		1			50288		
5	REGULATOR, 1/4"NPT, 0.5-10 PSI		2	8151-125 (Replaced by PN: 8151-112)				
6	BRIDGE ISOLATOR, SN: 04130023		1			51801-1		
7	THERMOCOUPLE ISOLATOR, SN: 04130023		1			51802-1		
8	DL205 DL250 CPU Module, SN: 04130023		1			52464		
9	COMPLETE PLC ASSY, SN: 04130023		1			52466		
10	MINIATURE POT-TRIMMER SCREWDRIVER		1			51331		
11	POWER SUPPLY 24VDC		1			52449		

Notes:

1. PN: 8180-105F is still available for replacement, ASDI PN: 53134 can be used as substitute.
Part number 53134 is equipped with a relay and 4-20 mA retransmission.
2. Replacing the transformer with ASDI PN: 52907 requires new mounting holes and slight wiring change.
3. Circuit breaker is not in stock and requires ordering. Circuit Breaker can be replaced by a fuse, will require re-wiring and installing a fuse holder.
4. Replacing Power Supply PN 50288 with ASDI PN: 52449 requires new mounting holes.
New Power Supply operates on 85 - 265 VAC, no jumper required.
When installing ASDI PN: 50288, copy the jumper configuration of the previous power supply.
5. The Replacement Regulator ASDI PN: 8151-112 is rated for 0-2 PSI. This range improves the resolution when setting the pressure.
6. A) Units built prior to SN: 04130024 use PN: 51801-1 for the bridge isolator, PN: 52464 CPU Module, PN: 52466 PLC Assembly.
Units with SN: 04130024 and above use PN: 51951 for the bridge isolator, PN: 52464-1 CPU Module, PN: 52466-1 PLC Assembly.
B) Units built prior to SN: 04130024 the Reference Air flow rate was 150ML.
Units with SN: 04130024 and above have a Reference Air flow rate of 200ML.
Units with SN: 04130024 and above have a Specific Gravity range of 0.50 to 2.10.
Units with SN: 04130024 and above have a CPU program file name of GA500P06.prj.
7. Units built prior to SN: 04130024 use thermocouple isolator PN: 51802-1.

Warranty Registration

To Register your new equipment: Visit Algas-SDI's web site at: algas-sdi.com, then click on the "Tech Support" button. Select online Registration or print out the Acrobat Warranty Registration.

OR

Fill out the Warranty Registration information on the last page of this manual. Then make a photocopy and mail to the address shown at the bottom.

Warranty and Copyrights

WARRANTY

Algas-SDI International, LLC (ASDI) warrants that the equipment is free of defects in materials and workmanship under normal use and service. ASDI agrees to repair or replace, at our option, without charge f.o.b. factory, any part which has proven defective to the satisfaction of Algas-SDI International, LLC within one (1) year from the date of the original installation or within 18 months from the date of shipment, whichever is earlier. Equipment, which in the opinion of ASDI, has been damaged by improper installation or operation, or has been abused or tampered with in any way, will not be accepted for return under warranty.

Algas-SDI International, LLC will not accept back charges for work performed by others upon or in conjunction with ASDI equipment, unless prior authorization is given by means of an Algas-SDI International, LLC purchase order. Algas-SDI International, LLC will not be liable by reason of shutdown, non-operation or increased expense of operation of other equipment, or any other loss or damage of any nature, whether direct or consequential, arising from any cause whatsoever.

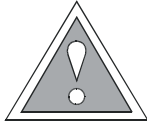
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Symbols and Conventions

Special symbols are used to denote hazardous or important information. You should familiarize yourself with their meaning and take special notice of the indicated information. Please read the following explanations thoroughly.



GENERAL WARNING OR CAUTION

Indicates hazards or unsafe practices, which can result in damage to the equipment or cause personal injury. Use care and follow the instructions given.



FLAMMABLE GAS HAZARD

Indicates a potential hazard, which can result in severe personal injury or death. Use extreme care and follow the instructions given.



ELECTRICAL DISCONNECT REQUIRED

Indicates a potentially dangerous situation, which can result in severe personal injury or death or damage to equipment. Use great care and follow the instruction given.

ASDI CONTACT NUMBERS

If you have questions, need help with your equipment, or want information on other products, contact Algas-SDI at:

Telephone: 206.789.5410

Facsimile: 206.789.5414

E-mail: sales@algas-sdi.com

Internet: <http://www.algas-sdi.com>

TABLE of CONTENTS

1. Introduction

Description	1-1
Universal Model	1-1
Description of Operation	1-3

2. Installation

General	2-5
<i>Figure 1A - GA500-W - Gas Analyzer Equipment Drawing</i>	2-7
<i>Figure 1B - GA500-W - Gas Analyzer Equipment Drawing</i>	2-8
<i>Figure 2 - GA500-W - Control Panel Detail</i>	2-9
<i>Figure 3A - GA500-WC - Gas Analyzer Equipment Drawing</i>	2-10
<i>Figure 3B - GA500 Equipment Equipment Drawing</i>	2-11
<i>Figure 4 - GA500-WC - Control Panel Detail</i>	2-12

3. Operation

Initial Start-Up	3-13
<i>Figure 5 - GA500-WC - Control Panel Detail</i>	3-15
Start-Up	3-16
Normal Start-Up	3-17
Shut Down Procedure	3-18
GA500-WC Operator Panel	3-18
General Description	3-18
Operator Panel Menu Levels	3-18

4. Calibration

GA500-WC Field Calibration Instructions	4-21
Initial Setup Values	4-21
WI-Wobbe Index Setup & Testing	4-22
Wobbe Index Zero	4-22
Wobbe Index Span	4-22
Wobbe Index Recorder Output	4-23
SG-Specific Gravity Setup & Testing	4-25
Specific Gravity Zero	4-25
Specific Gravity Correction	4-25
Specific Gravity Span	4-26
Specific Gravity Recorder Output	4-27
CV-Calorific Value Setup & Testing	4-28
Calorific Value Recorder Output	4-28
Record Final Setpoint Values for Your Records	4-30
GA500-W Field Calibration Instructions	4-30
Initial Setup Values	4-30
Wobbe Index Setup & Testing	4-30
Wobbe Index Zero	4-30
Wobbe Index Span	4-31
Wobbe Index Recorder Output	4-31

5. Maintenance

Maintenance	5-35
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6. Troubleshooting

Troubleshooting	6-37
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Appendix A: Component Information

Warranty Registration - Refer to the nameplate on the unit to fill out the product registration. Then Photo copy and mail to address shown. Or register on line by visiting Algas-SDI web site under "Tech Support".

Revisions

January 23, 2006, Updated GA500-W configuration sheet, changed GA500-WC Power Supply and updated Component Information.

Introduction

1

DESCRIPTION

The Algas-SDI GA500 is a fuel gas analyzing device which burns a sample of fuel gas, under highly controlled conditions and produces an electronic output to provide information, in the form of an indicator or recorder, concerning the combustion characteristics of the fuel gas. The output can also be used in a controlling instrument, which in turn can control a device used to add air or an inert gas to the fuel gas for purposes of stabilizing the gas. The GA500-W version of this analyzer is designed to detect changes in the heating index of the fuel gas being analyzed; and provides a function referred to as "Wobbe Index". The GA500-WC version of this analyzer is designed to detect changes in both the heating index and specific gravity of the fuel gas being analyzed; and provides the function referred to as "Wobbe Index", "Calorific Value", and "Specific Gravity".

The instrument receives a fuel gas sample and uses compressed air to provide the required flame geometry in a precision burner. A larger volume of compressed air, under highly controlled conditions, passes through a measurement chamber where the amount of heat added by the burner is measured in an accurate and precise thermally isolated atmosphere.

A change in heating value of the gas will change the amount of heat added to the measurement chamber. Likewise, a change in specific gravity will cause flow rate changes in the burner gas mixing system providing the sample to the burner, also changing the amount of heat added to the measurement chamber. Since the flow rate change (due to a change in specific gravity) is a square root function, the interaction of changes in heating value and changes in specific gravity results in a Wobbe Index output.

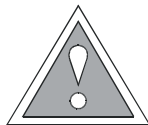
UNIVERSAL MODEL

Since all applications, other than laboratory analyses, are only interested in values of Calorific Value (CV) or Wobbe Index (WI) at a given specific set point; the Algas-SDI GA500-W is the standard unit for these applications. This unit provides a signal from the analyzer to one or more electronic displays, which may be calibrated, to a specific value required by the process. The displays will then indicate any deviation from the desired CV - (Calorific Value) or WI - (Wobbe Index).

NOTE:

All discussions in this manual refer to the Universal Model

CAUTION



Natural gas, propane, butane, and various other hydrocarbons are combustible gases, transmitted under pressure, which, when mixed with the proper amount of air, or released free into the atmosphere, can be ignited from a source of ignition. Natural gas is lighter than air but the others are heavier than air. In any case, adequate ventilation is necessary in enclosed areas where equipment and distribution lines are installed, to prevent accumulation of gas from a possible leak in the system. It is most important that any system of piping, vessels or equipment handling fuel gas be carefully checked for leaks and repaired when necessary. Fuel gas contains an odorant in order to make its presence detectable. The presence of this odor indicates a leak that should be repaired at once. It is most important that you read the following instruction book carefully before attempting to operate your equipment.

WARNING



All electrical equipment and controls furnished with this system are enclosed in standard industrial enclosures appropriate for the environment in which the equipment is intended to be installed. The equipment as furnished is intended for indoor operation in a dry environment. As necessary wiring and terminal strips are enclosed in approved enclosures. For the safety of the operator and the equipment, do not operate this equipment with terminal strips and wiring exposed. When making changes to, or removal of wiring, necessitating removing covers from junction boxes and other components of the equipment, make certain all power is disconnected first. In the event it is necessary (for calibration and troubleshooting procedures) to open covers on electrical enclosures with power on, trained personnel should accomplish this only. The equipment furnished includes enclosures, which are not to be exposed to moisture. Water impinging on open terminal strips which have power applied to them can cause a potential hazard for the operator from electric shock and destroy control equipment. Algas-SDI International will not honor its warranty on equipment which is destroyed by failure on the part of the operator or other personnel to take precautions to keep electrical equipment dry and further, will not be held responsible for injury to personnel due to negligence or any other action or cause beyond its control.

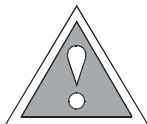
DESCRIPTION OF OPERATION

Please refer to the piping and wiring diagram located at the beginning of the manual (D363-806) when reading the following description. The operation of the Thermal Analyzer on the GA500-W and GA500-WC are identical.

1. 115 volt AC or 230 volt AC electric power enters the unit at terminal "L1" & "N" and powers the digital display and electronic network directly, since each has its own supply and also provides power to the primary side of a transformer with a 24 volt AC secondary, which powers the safety and ignition system. If a different service voltage required, refer to electrical drawing and reconfigure transformer to the desired voltage. On some older units (prior to S/N: 03130018), the 24 VDC power supply needs to be configured to the new desired voltage selection. Units built after S/N: 03130018 are equipped with a 24 VDC power supply, PLC or meter that operates on 115 VAC or 230 VAC.
2. The gas to be analyzed enters the gas inlet through a 100 mesh strainer and proceeds to a solenoid valve where flow is stopped until the safety system is energized.
3. Air enters the air inlet of the system passing through two air filters, piped in tandem, through a 100 mesh strainer to a tee connection where air is divided into measurement air and burner air.
4. Burner air proceeds through a burner air pressure regulator with a pressure gauge on the downstream side and then enters the gas-air venturi mixer and at the same time establishes air to an air pressure switch.
5. With the proper burner air pressure registering on the pressure switch, electric power is provided to the gas solenoid valve and the automatic ignition system.
6. The automatic ignition system begins sparking to ignite a flame at the burner.
7. With the gas solenoid activated, gas proceeds through the gas pressure regulator to the venturi mixer and also registers on the gas pressure gauge.
8. As gas is delivered to the burner head, ignition takes place and the automatic ignition system discontinues sparking.
9. Measurement air passes through a primary regulator, which reduces the air pressure to an acceptable level for the secondary measurement air regulator. This regulator is used to regulate the measurement air flow as registered on the meter.
10. Air passing through the Air flow measurement meter passes over a thermocouple measuring the temperature of the incoming air and then proceeds to the measurement chamber. The measurement chamber contains a second thermocouple measuring the temperature of the products of combustion in the measurement chamber.
11. The outputs of the thermocouples enter the electronic network, which provides an output, which translates into Wobbe Index Units.
12. Wobbe Index is indicated in the Wobbe Index Digital Display and this signal also provides output to a remote recorder. The display and/or recorder can be calibrated to display and/or record Wobbe Index.

13. A Calibration Gas with a known heating value and specific gravity must be supplied by the purchaser and connected to the unit to use as calibrating gas. High-pressure cylinders of gas are available at some gas utilities and at most industrial gas supply companies.
14. On the GA500-WC model a specific gravity sensor is included. The specific gravity is measured by comparing Instrument Air with the Sample Gas being measured. The specific gravity sensor uses a bridge circuit to measure the difference between the 2 gases. The signal is the processed and in the PLC. A 3-way valve allows for the use of air to calibrate the sensor. The Specific gravity and a calculated Calorific Value are displayed on the Operator Interface Panel. Three 4-20mA outputs are provided for Wobbe Index, Calorific Value, and Specific Gravity. The ranges for the outputs are user definable.
15. The GA500-W models feature an Alarm Relay that can be configured by the customer as desired. Factory default for this relay is set to not used. The GA500-WC does not have an Alarm Relay. If alarm is required the recorder output can be used with another device provided by the customer.

GENERAL



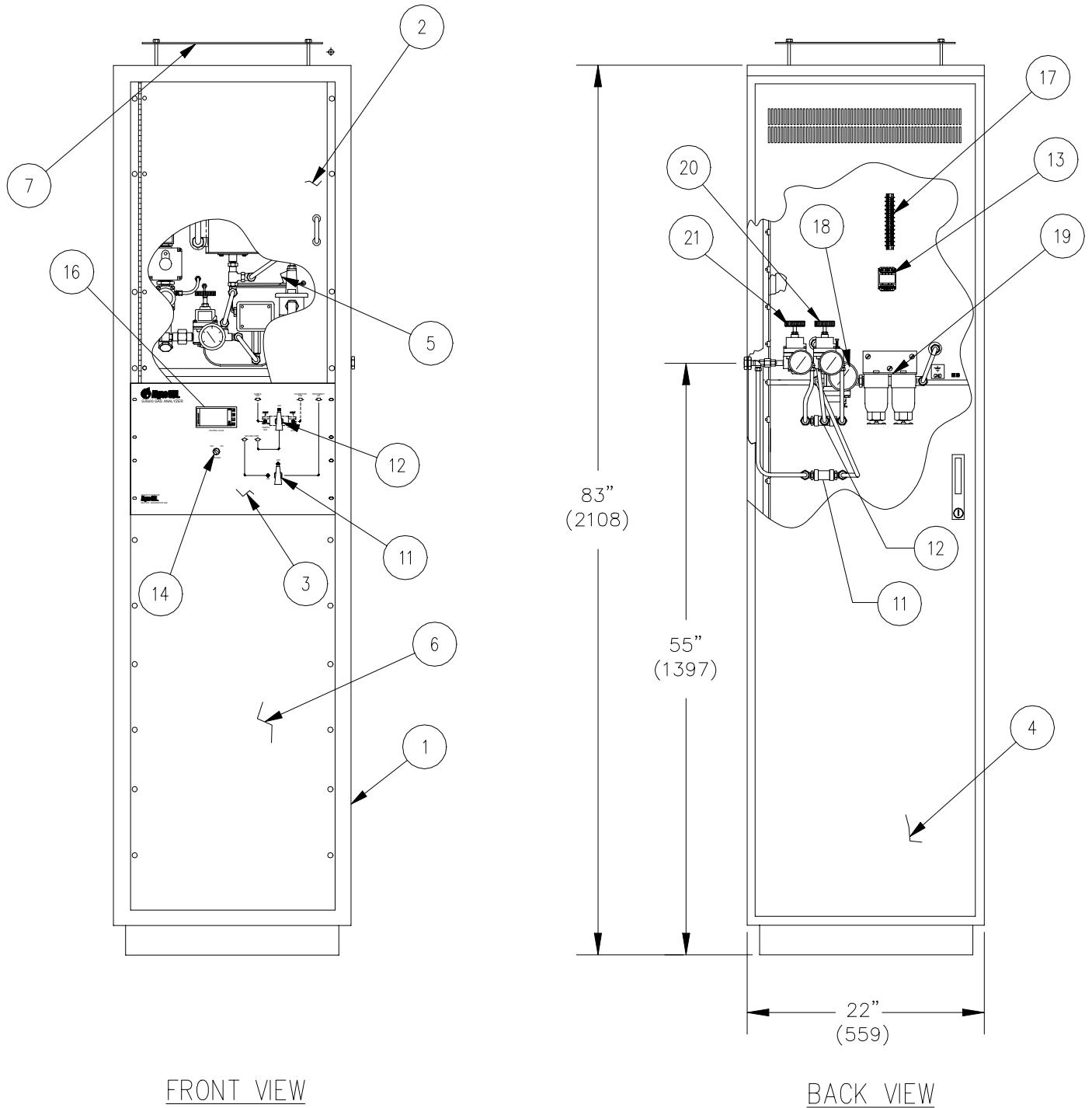
1. Place cabinet in a location where access is available to both the front and rear of the cabinet since it is necessary to perform some calibration procedures through the rear door of the cabinet. The unit must not be installed in rooms where the ceiling is lower than 9 feet unless all construction in the ceiling and above is fireproof. Ambient Temperature should be maintained at $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($77^{\circ}\text{F} \pm 5.4^{\circ}\text{F}$). Analyzer should be shielded from drafts.
2. If the unit is supplied with casters for mobility, it will be necessary to provide some kind of detent in the floor, or some method of blocking to keep the unit from moving after service connections are made. If service connections are made with flexible tubing, the unit may be installed with the back against the wall provided there is sufficient room to roll the cabinet forward for access through the rear door. In any case, provisions must be made to prevent movement of the cabinet from breaking service connections.
3. Connect electrical service by cutting a hole for conduit (or for a grommet for portable units) at the most convenient location on either side, top or the back. If the unit is to be mounted permanently in position, it is suggested that the electrical service be brought down through the top panel. In such a case, the access must be near the rear of the cabinet, well away from the flue gas outlet, which is under the draft diverter panel, **Figure 1A - Item #7**, GA500-W.
4. Connecting gas, air and vent line: If the unit is to be installed permanently, these connections should be made with copper or stainless steel tubing. If the unit is installed on casters, it is suggested that rigid piping terminate at the wall or ceiling, near the unit, with the final connections from the permanent piping to the unit being made by the use of nylon or teflon instrument tubing, or equal.
5. Instrument air enters is Connected to Item #8 found on the side of the cabinet on **Figure 1B & 3B** and must be supplied at a pressure not less than 75 PSIG or more than 150 PSIG (75 PSIG recommended).
6. The Calibration Gas from the Calibration gas cylinder regulation station is connected to Item #9 found on the side of the cabinet on **Figure 1B & 3B**. When procuring the Calibration Gas cylinder it is necessary to have the cylinder equipped with a regulator which will provide gas pressure at 15 inches Water Column.
7. The Sample Gas to be analyzed is Connected Item #10 found on the side of the cabinet on **Figure 1B & 3B**. The Sample Gas needs to be equipped with a regulator, which will provide gas pressure at 15 inches Water Column.
8. On the GA500-WC models an additional connection at Item #23 found on the side of the cabinet on **Figure 3B**, is required to vent the gas from the specific gravity sensor to a safe location.

NOTE

The sample gas line must be as short as possible, a minimum size, and operated at the reduced pressure, to minimize the time delay in delivering the sample to the analyzer.

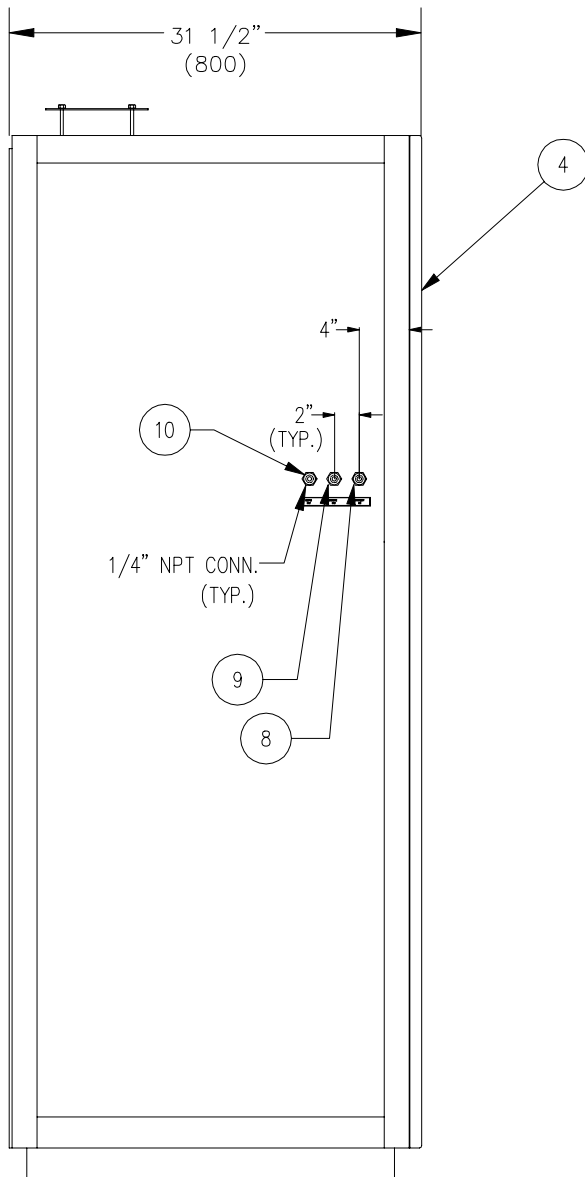
9. A regulator must be installed **AT THE GAS LINE SAMPLE CONNECTION** to minimize the amount of gas in the line. Use of a ¼" tube is suggested for the sample line.

Figure 1A – GA500-W – Gas Analyzer Equipment Drawing



Installation

Figure 1B – GA500-W – Gas Analyzer Equipment Drawing

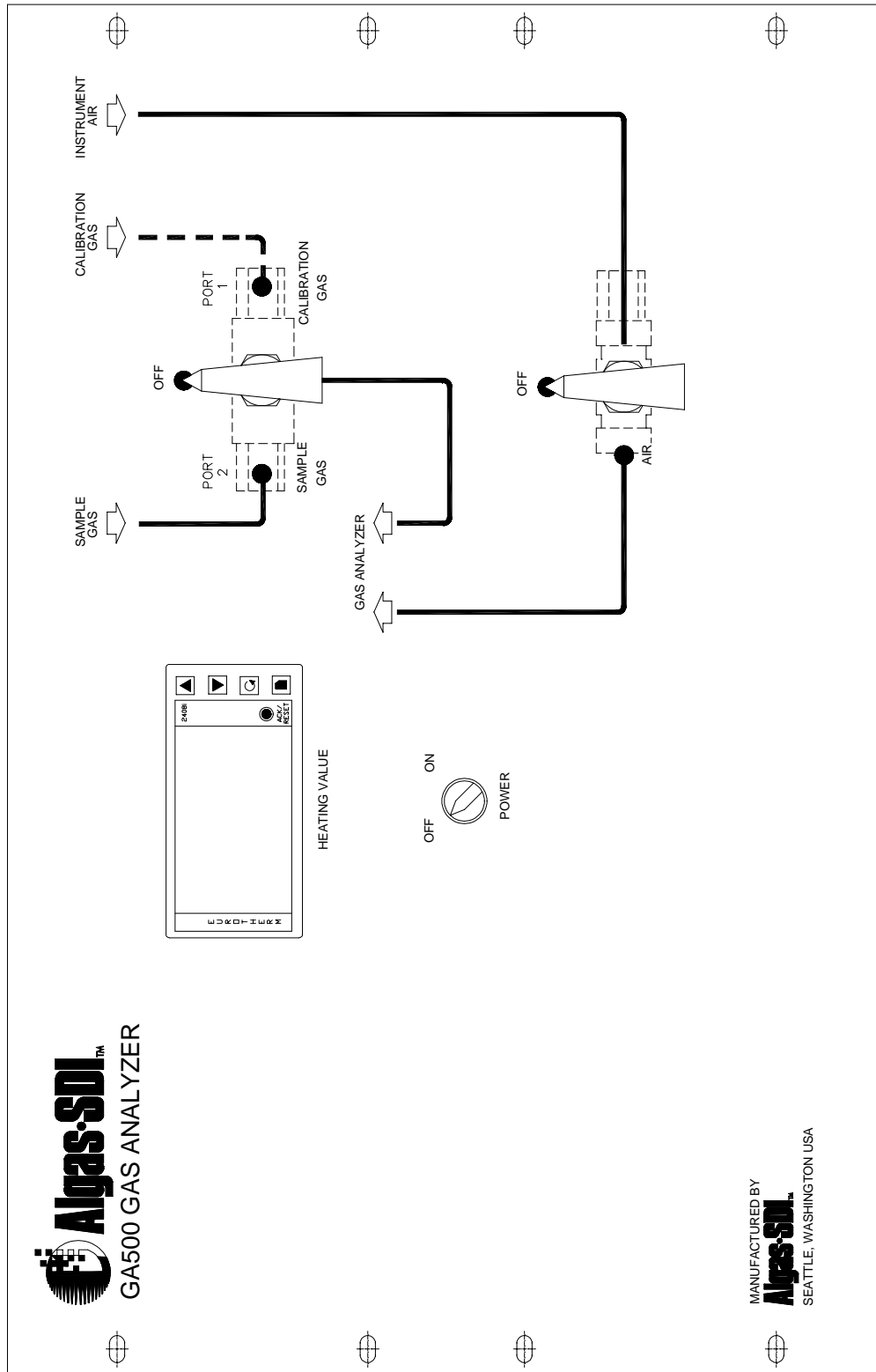


LIST OF COMPONENTS

1. GA500W-RR CABINET
2. GA500W-RR ANALYZER ACCESS DOOR
3. GA500W-RR SWITCH, VALVE, DISPLAY PANEL
4. REAR DOOR
5. GA500W-RR BURNER ASSEMBLY
6. LOWER FRONT PANEL
7. DRAFT DIVERTER PANEL
8. INSTRUMENT AIR INLET
9. CALIBRATION GAS INLET
10. SAMPLE GAS INLET
11. AIR VALVE
12. GAS VALVE
13. TRANSFORMER, 230 OR 115V PRIMARY, 24V SECONDARY
14. ANALYZER POWER SWITCH
15. NOT USED
16. DISPLAY W/SIGNAL PROCESSOR
17. TERMINAL STRIP
18. PRIMARY AIR REGULATOR & PRESSURE GAUGE
19. AIR FILTER
20. SAMPLE GAS REGULATOR
21. REFERENCE GAS REGULATOR

RIGHT SIDE VIEW

Figure 2 – GA500-W Control Panel Detail



Installation

Figure 3A – GA500-WC – Gas Analyzer Equipment Drawing

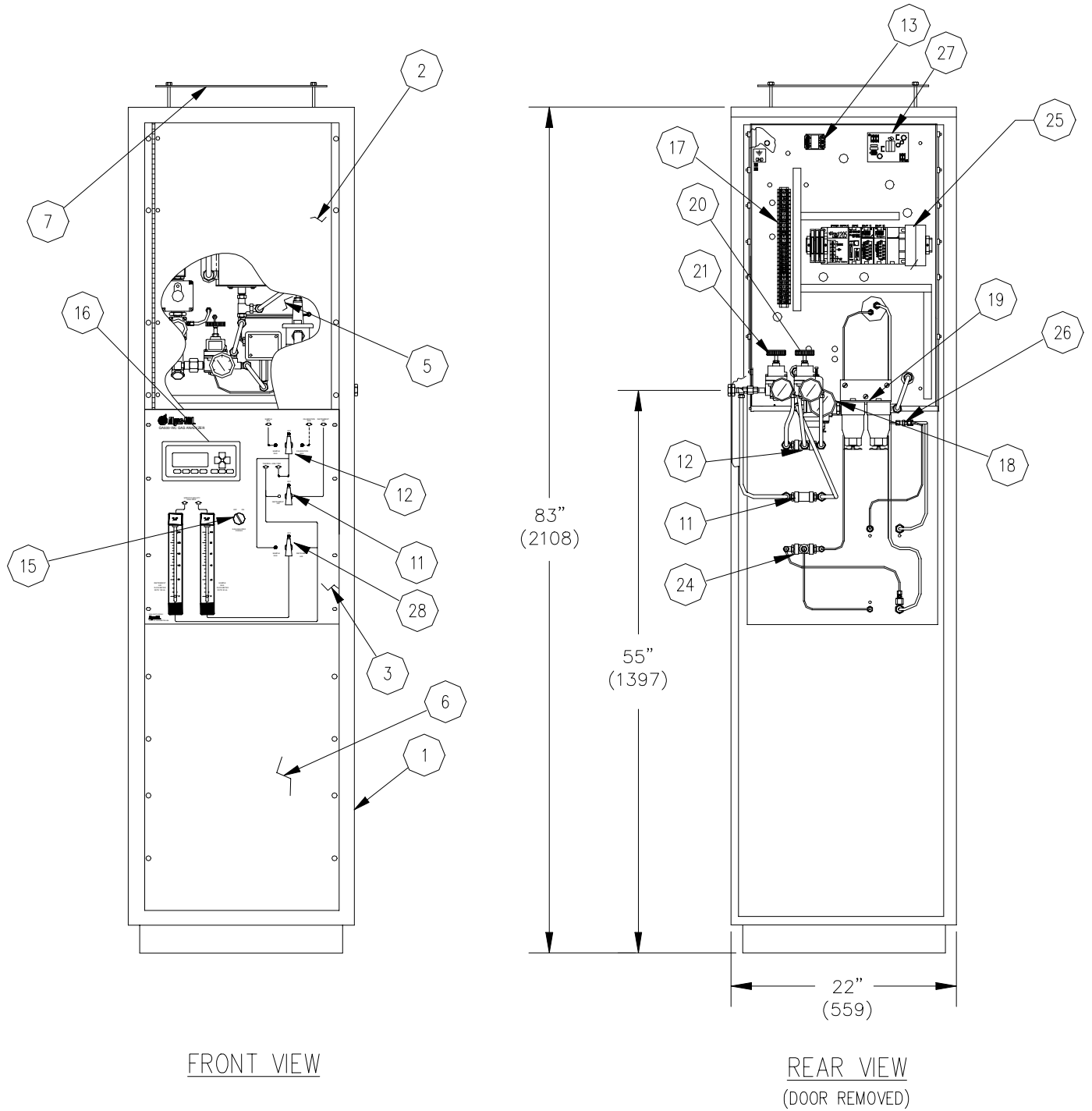
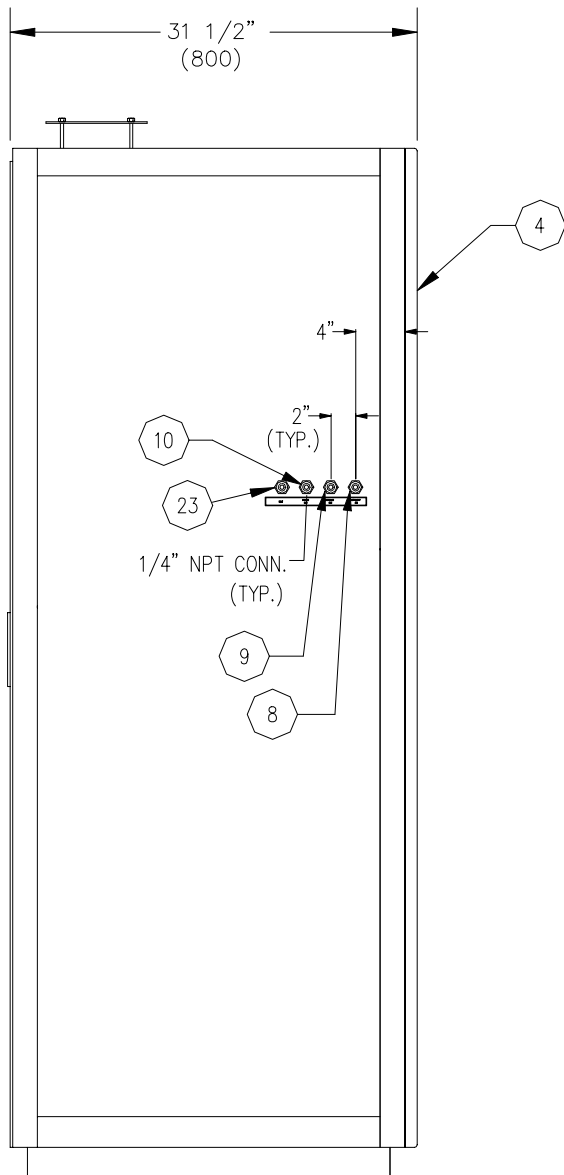


Figure 3B – GA500 – Gas Analyzer Equipment Drawing



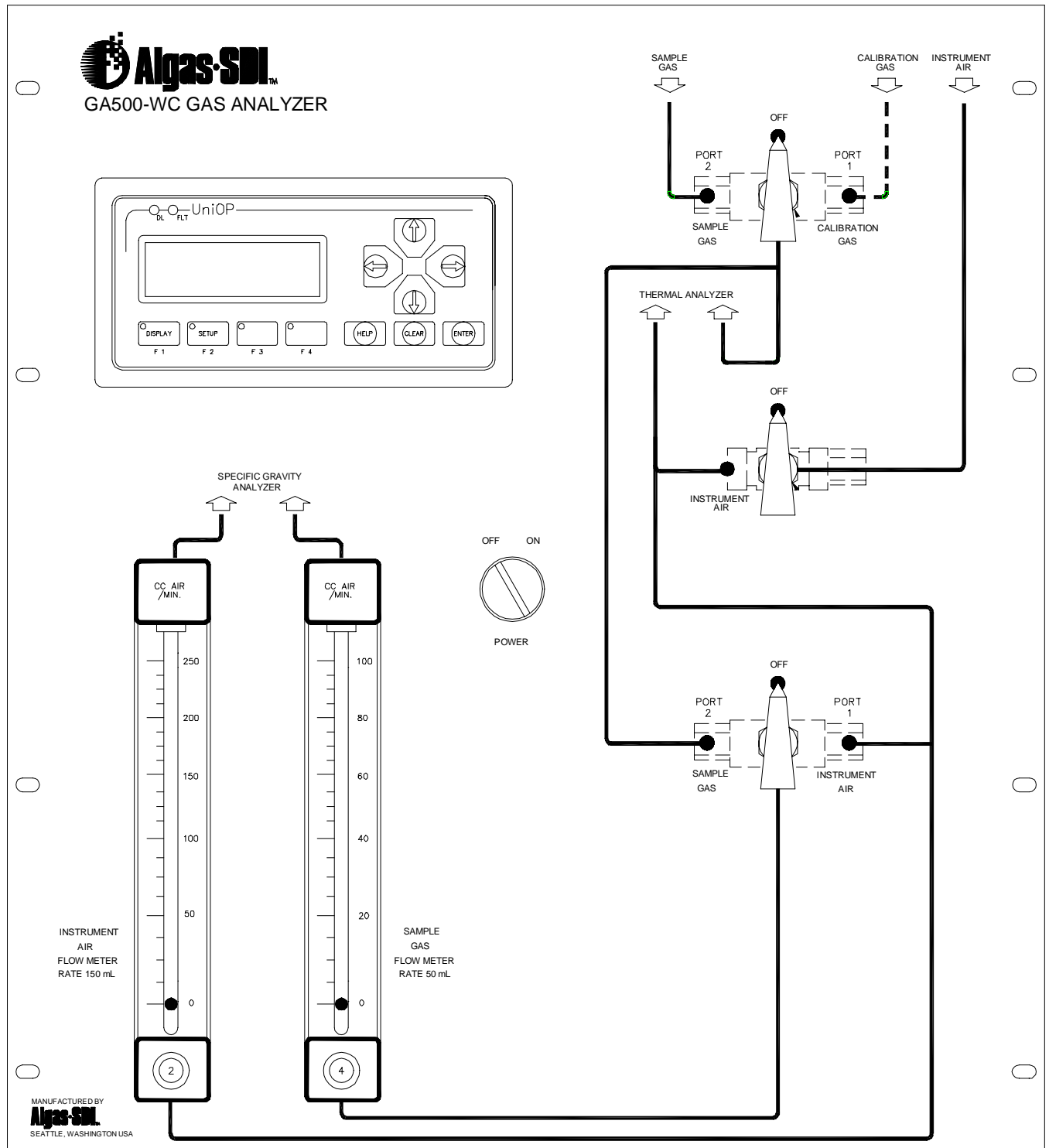
RIGHT SIDE VIEW

LIST OF COMPONENTS

1. GA500WC CABINET
2. GA500WC ANALYZER ACCESS DOOR
3. GA500WC SWITCH, VALVE, DISPLAY PANEL
4. S.G. ANALYZER FLOW METERS
5. GA500W BURNER ASSEMBLY
6. LOWER FRONT PANEL
7. DRAFT DIVERTER PANEL
8. INSTRUMENT AIR INLET
9. CALIBRATION GAS INLET
10. SAMPLE GAS INLET
11. AIR VALVE
12. GAS VALVE
13. TRANSFORMER, 230 OR 115V PRIMARY, 24V SECONDARY
14. (NOT USED)
15. POWER SWITCH
16. INTERFACE PANEL
17. TERMINAL STRIP
18. PRIMARY AIR REGULATOR & PRESSURE GAUGE
19. AIR FILTER
20. SAMPLE GAS REGULATOR
21. REFERENCE GAS REGULATOR
22. (NOT USED)
23. ATMOSPHERIC VENT
(VENT TO SAFE LOCATION)
24. SPECIFIC GRAVITY (S.G.) ANALYZER VALVE
25. PLC PANEL
26. SPECIFIC GRAVITY (S.G.) ANALYZER
27. POWER SUPPLY
28. SPECIFIC GRAVITY (S.G.) ANALYZER VALVE

Installation

Figure 4 – GA500-WC Control Panel Detail



INITIAL START-UP

Item numbers referenced in the following description, refer to **Figure 5**. The burner chamber is identical on the GA500-W & GA500-WC, with the one exception, on the GA500-WC. The GA500-WC has an extra connection before the gas pressure regulator Item #13 for the Specific Gravity measurement. Before start-up, check the following items:

1. Check to see that air, gas and electric power supplies are within acceptable limits. Air should be 75 PSIG and should be dry instrument quality air. Gas pressure to the unit should be 15 inches water column. If pressure is higher, an external gas regulator must be used to lower the pressure.
2. Electrical power is 115 volts AC, plus or minus 10% or 230 volts AC plus or minus 10%. This means that voltage could drop as low as 104 (207) volts or go as high as 126 (253) volts without affecting the operation.

NOTE:

Circuit Breaker/Power ON: On some older units (prior to S/N: 03130018), the main power switch is a combination power switch and circuit breaker which will move toward the center if the breaker is tripped by short circuiting or overloading. In this event, the circuit breaker may be reset by placing in the "OFF" position and then back in the "ON" position. Newer versions will use a fuse in place of the breaker and an "ON" / "OFF" selector switch operator in place of the breaker.

Starting the Gas Analyzer, "ON" / "OFF": On some older units (prior to S/N: 03130018) to start the Gas Analyzer, switch in the "ON" position by depressing the switch. Depressing it a second time will place the switch back in the "OFF" position. Newer versions will have an "ON" / "OFF" selector switch operator.

3. Make certain that gas and air lines are connected to the proper places. The gas line must enter through strainer Item #17 to solenoid valve Item #15. The air line is on the opposite side connecting to air strainer Item #16, which delivers air to regulator Item #10, and also to primary air measurement regulator Item #11.
4. Valves are provided on both air supply line and gas supply line. The gas supply line valves is a 3-way valves marked as "SAMPLE GAS" / "OFF" / "CALIBRATION GAS". The gas valve is arranged to supply a gas sample from a cylinder of standard calibration gas for calibration purposes or from the plant gas supply (SAMPLE GAS) which is to be analyzed. The air line supply valve is a 2-way valve marked as "INSTRUMENT AIR" / "OFF".

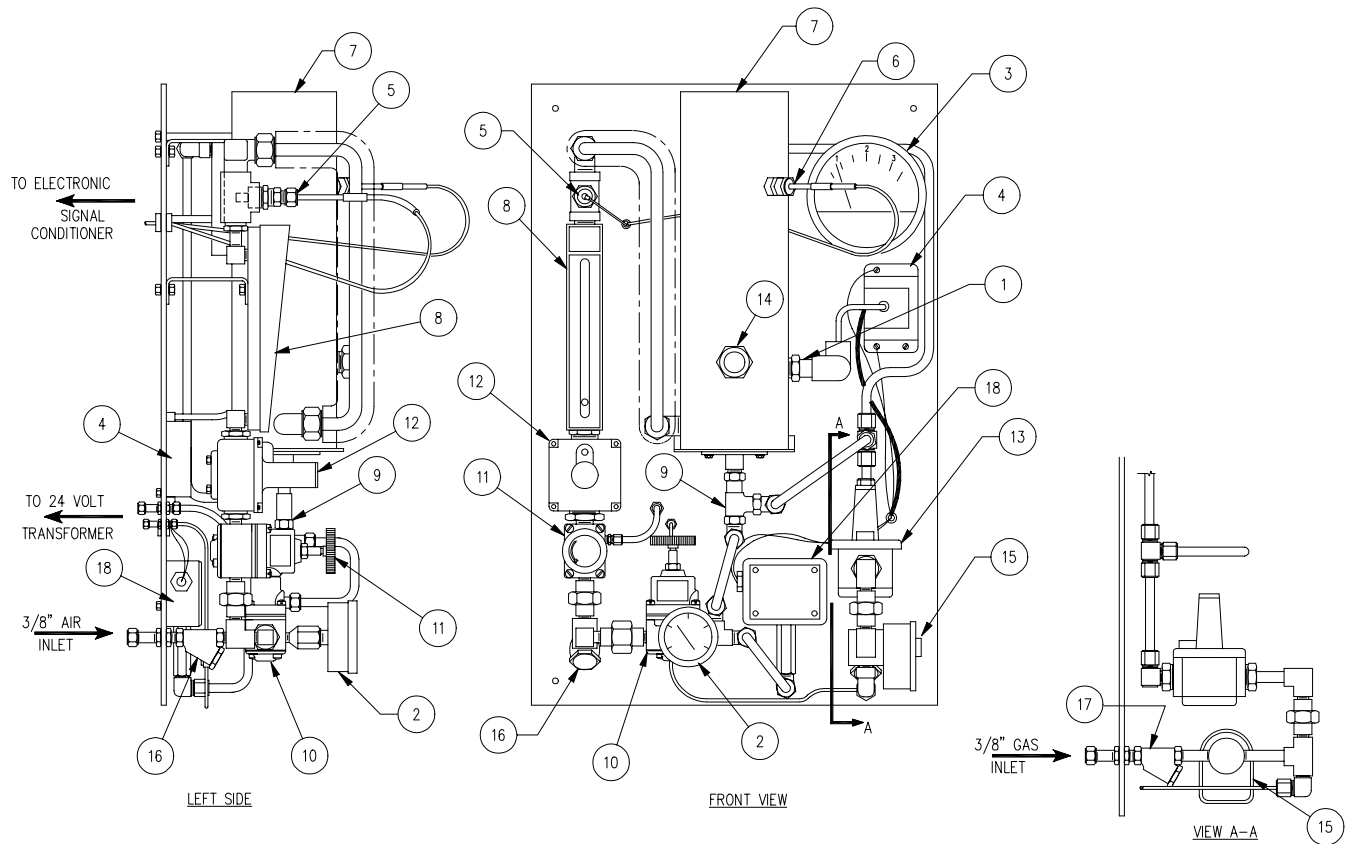
5. It is necessary that a bottle of standard calibration gas be supplied for calibration purposes. The GA500-W requires a chemically pure methane. The GA500-WC requires a gas blend for calibration that has identical Wobbe Index and Specific gravity to the desired mix.
6. Check to see that the air filters have clean elements, properly in place, and that the polycarbonate bowls are clean and dry. Note: Some filters may be furnished with metal bowls. Opening the drain cock at the bottom of the polycarbonate bowls can drain any moisture that has been collected.

NOTE:

Terminology change: On some older units (prior to S/N: 03130018), Reference Gas and Calibration Gas have been used to describe the same function in the manual and on the labeling on the unit. Units built after S/N: 03130018 will use Calibration Gas only to describe the Calibration Gas processes.

Terminology change: On some older units (prior to S/N: 03130018), Instrument Air and Reference Air have been used to describe the same function in the manual and on the labeling on the unit. Units built after S/N: 03130018 will use Instrument Air only.

Figure 5 – GA500 Equipment for Burner Chamber, Regulators Drawing



- | | |
|--|---|
| 1. Flame rod | 10. Burner air pressure regulator |
| 2. Burner air pressure gauge | 11. Primary air measurement regulator |
| 3. Gas pressure gauge | 12. Secondary air measurement regulator |
| 4. Automatic ignition system | 13. Gas pressure regulator |
| 5. Cold junction thermocouple | 14. Sight glass |
| 6. Hot junction thermocouple | 15. Gas solenoid valve |
| 7. Measurement chamber and burner housing assembly | 16. Air strainer |
| 8. Air flow measurement meter | 17. Gas strainer |
| 9. Venturi mixer | 18. Air pressure switch |

START-UP

After checking all of the above items, start the unit as follows:

1. Establish electric power to the analyzer. The digital display will show a meaningless value since the measurement chamber is below the minimum Wobbe Index.
2. Operate gas supply valve to introduce calibration gas to the unit. No gas will flow beyond solenoid valve Item #15 since air pressure switch Item #18 is not activated (Open) until air is present.
3. Open air inlet valve establishing air to the analyzer. Burner air pressure gauge Item #2 should read approximately 25 PSIG. If setting is not 25 PSIG, adjust burner air pressure regulator Item #10 to show 25 PSIG on pressure gauge Item #2.

The low air pressure switch is set at approximately 20 PSIG so with 25 PSIG shown on gauge Item #2, solenoid valve Item #15 and automatic ignition system Item #4, are now energized and gas will be drawn into the unit.

4. The burner will be ignited by ignition rod Item #1. Note: The ignition rod and the flame rod are a single combination rod.
5. When flame rod Item #1 senses the burner has been ignited, sparking ceases. The flame is visible through site glass Item #14. If flame rod Item #1 senses a loss of flame, sparking again commences until flame is reestablished.
6. Gas pressure on gas pressure gauge Item #3 should read 2" W.C. If it does not read correctly, adjust gas pressure regulator Item #13 to show 2" W.C. on gauge Item #3.
7. Air flow rate on gauge Item #8 should be 100 SCFH. If the reading on flow gauge Item #8 is incorrect, adjust primary air measurement regulator Item #11 to produce the proper flow rate. Do not adjust Secondary regulator Item #12 unless proper control cannot be established by Primary regulator Item #11. Primary regulator Item #11 reduces air pressure to approximately 1 PSIG to the inlet of secondary regulator Item #12.
8. Observe Wobbe Index digital display. As the measurement chamber warms up, the display will begin showing an increasing number. After approximately 30 minutes warm-up time, the display will stabilize with only the unit digit (last digit on the right) changing to a point higher or lower. It is normal for the unit digit to change slightly during operation.
9. If the unit is also connected to a recorder, the recorder will show when stabilization has been achieved.
10. At this point, the digital display should show the Wobbe Index of the calibration gas. Using the usual natural gas, this will be a value of approximately 1360 Btu/scf or 12,758 Kcal/Nm³, or use the Wobbe Index of the calibration gas. If the display is off set the span using the following equation. $((\text{desired display}) \times (\text{current span})) / (\text{current display}) = (\text{new span})$.
11. After the unit has been calibrated, switch the gas valve from Calibration Gas to Sample Gas to introduce the plant gas to be analyzed into the system.

12. If the analyzer is being used to control a blender and a deviation from the calibration point occurs (when analyzing the plant gas) the blender will be adjusted to provide the proper amount of air (or other gas) into the gas stream to bring it back to a proper Wobbe Index.
13. Note that if a momentary failure of gas occurs, the flame rod will automatically re-ignite the burner when gas is restored.
14. A short term loss of air, causing pressure to drop below the setting of the air pressure switch Item #18, will shut off the gas supply and the ignition system as well. When air is reestablished, above the setting of the air pressure switch, gas will automatically be reestablished by the activation of gas solenoid valve Item #15 and the ignition system Item #4 will automatically ignite the burner.
15. Since turning off the air will deactivate the unit, the gas supply valves can be left in the "ON" position, for short term shut down. Then by simply reestablishing air and electric power, the system is again operative.
16. It is advisable to calibrate the unit at least once each day while it is being used.

NORMAL START-UP

1. Observe air filter for proper operation.
2. Establish electric power.
3. Turn "ON" gas valve.

NOTE:

Gas can be left on at all times if desired as described under initial start-up and calibration.

4. Establish air supply.
5. Check gauges for proper readings:
Gas pressure should be 2" W.C.
Burner Air pressure 25 PSIG
Measurement Air flow rate approximately 100 SCFH (or flow rate established during calibration)
On GA500-WC models set the Instrument Air flow meter to 200 cc/min and Sample Gas flow meter to 50 cc/min.
6. After display and/or recorder shows stability, check calibration and adjust as necessary.

SHUT DOWN PROCEDURE

1. Turn off air supply. This will shut down entire system but leave display and electronic signal conditioning network active.
2. If system is going to be shut down for a long period of time, also discontinue electric power and close manual valve/s on the gas supply.

GA500-WC Operator Panel

General Description

This document will outline the operator screens and procedures for modifying the configuration of the GA500-WC gas analyzer manufactured by Algas-SDI International.

The GA500-WC operator panel displays three different gas quality characteristics. The gas characteristics are as follows; Wobbe Index (units of Btu/scf and Kcal/Nm³), Calorific Value (units of Btu/scf and Kcal/Nm³) and Specific Gravity (unity).

The operator can also calibrate the gas analyzer through the panel and scale the ranges for the three independent analog outputs. The three analog outputs provide a signal for the following perimeters; Wobbe Index, Calorific Value and Specific Gravity.

OPERATOR PANEL MENU LEVELS



F 1



or



Parameter scroll arrows.



F 2



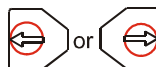
or



Parameter scroll arrows.



Parameter modifications.



or



Shift cursor right or shift cursor left.



Increment Value / Up.

OR



Decrement Value / Down.



Save parameter modification.

or



Reverts to previous entry.

Display, F1



F 1

To view the displays for Wobbe Index, Calorific Value and Specific Gravity press the Display button (F1).

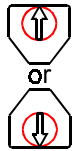
The operator can scroll through the following data items using the up or down arrow keys.

DATA DISPLAY

**WI - (WOBBE INDEX) #### BTU / SCF
 ##### Kcal / Nm³**

**CV - (CALORIFIC VALUE) #### BTU / SCF
 ##### Kcal / Nm³**

SG - (SPECIFIC GRAVITY) #.#



Setup, F2



F 2

To view or change calibration of the gas analyzer press the Setup button (F2).

The operator can scroll through the following data items using the up and down arrow keys.

DATA SETUP

**WI INPUT
ZERO ###**

**WI INPUT
SPAN #####**

**SG CORRECTION
####**

**WI OUTPUT
LOW #####Kcal/Nm³**

**WI OUTPUT
HIGH #####Kcal/Nm³**

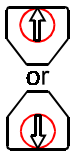
**CV OUTPUT
LOW #####Kcal/Nm³**

**CV OUTPUT
HIGH #####Kcal/Nm³**

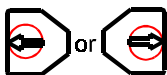
**SG OUTPUT
LOW #.#**

**SG OUTPUT
HIGH #.#**

To convert from Btu/scf to Kcal/Nm³
use the following equation;
[## (Btu/scf) x 9.381 = ## (Kcal/Nm³)]



Screen Brightness



The right arrow key brightens the display and the left arrow key dims the display.

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GA500-WC FIELD CALIBRATION INSTRUCTIONS

Run vent line to safe area.

Connect Air and Gas to there appropriate inlet ports to set regulators.

Maximum Inlet Pressures: Air: 150 PSIG, Calibration Gas & Sample Gas: 20" W.C.

Turn on power.

Turn on fuel with gas selected and let burner ignite, check for proper flame.

Initial Setup Values

Pressure & Flow Settings

Regulators:

Setting:

- 1st stage Air regulator: 60 PSIG
- 2nd stage Burner Air regulator: 25 PSIG
- 1st stage Calibration Gas regulator: 6" W.C. Light Gas / 12" W.C. Heavy Gas
- 1st stage Sample Gas regulator: 6" W.C. Light Gas / 12" W.C. Heavy Gas
- 2nd stage Gas regulator: 2" W.C.

Flow Meters:

Setting

- Thermal Analyzer - Measurement Air: 100 scfh
- Specific Gravity - Sample / Calibration Gas: *50 mL/min

*NOTE: Flow needs to be adjusted when there are dramatic variations in gas quality.

- Specific Gravity - Instrument Air: 200 mL/min
- Burner Air Pressure Switch drops out at: 20 PSIG

Recorder Output factory default values for reference

- WI - Wobbe Index Low - 4.00mA @ 7500 Kcal/Nm³
- WI - Wobbe Index High - 20.00mA @ 23,500 Kcal/Nm³
- CV - Calorific Value Low - 4.00mA @ 7,500 Kcal/Nm³
- CV - Calorific Value High - 20.00mA @ 32,500 Kcal/Nm³

- SG - Specific Gravity Low - 4.00mA @ 0.50 SG
- SG - Specific Gravity High - 20.00mA @ 2.10 SG

WI - WOBBE INDEX SETUP & TESTING

Wobbe Index Zero

Reference Operator Display functions in Chapter 3 as needed.

Wobbe Index Zero should be performed when the thermocouple is changed or if the thermocouple is suspected as being defective. Otherwise under normal conditions this procedure is not required. Before starting record Wobbe Index Zero Value in case you need to return to this value again. Push the "SETUP" BUTTON, scroll to WI Zero and record value below.

Record Wobbe Index – Zero: _____

Before removing the thermocouples, place a circular mark using a black permanent marking pen on the thermocouple as close to the nut as possible for re-installation. Loosen the nut that holds the hot and cold junction thermocouples in place. Remove thermocouples and place in a container of water. Allow temperature to stabilize. If the Operator Display does not display 0, push the "Setup" button to enter setup mode. Scroll to Wobbe Index Zero, adjust to a new value using the arrow keys. If the display value is very high, may also indicate that the thermocouple needs to be replaced. The Wobbe Index Zero Range can be set between 0 and 999. Push the "Display" button, if the display does not read zero select another value. These steps may be repeated until the Operator Display Reads Zero. If the display should read "****", the Wobbe Index Zero value is set to high, decrement as necessary. Record new Wobbe Index Zero Setpoint for future reference:

Record New Wobbe Index – Zero: _____

Install thermocouples into there original locations at the Cold Junction and Hot Junction positions. Using the mark that you made to position the thermocouple to there original location. For reference the Cold Junction thermocouple is insert all the way in, then pull out the thermocouple about a 1/2" inch. This should center the Cold Junction thermocouple in the tube. The Hot Junction thermocouple is centered in the burner chamber. If you can not determine the center you may have to remove the top and visually center the thermocouple.

Wobbe Index Span

Wobbe Index Span should be performed at least once a month to ensure the accuracy of the unit. It is recommended that the Calibration Gas should have the same Wobbe Index & Specific Gravity characteristic as the gas that will be tested. Turn "SAMPLE GAS"/"OFF"/"CALIBRATION GAS" valve to CALIBRATION GAS position. Turn the "INSTRUMENT AIR"/"OFF" valve to INSTRUMENT AIR position. The Specific Gravity Analyzer valve "SAMPLE GAS"/"OFF"/"INSTRUMENT AIR" is not required for the Thermal Analyzer.

Verify that the Burner Air Pressure Regulator is set to 25 PSIG and Gas Pressure Regulator is set to 2" W.C. Also verify the Air Flow Measurement Meter has a flow rate of 100 SCFH. If the Air Flow Measurement is not 100 SCFH, adjust the Primary Air Regulator such that the Air Flow Meter reads 100 SCFH. The Secondary Air Regulator under normal conditions does not require adjusting. If

the Secondary Air Regulator should require adjusting, it is typically set at mid range. Allow unit to run a minimum of 120 minutes making sure reading is stable. For purposes of explaining the procedure we will use a Wobbe Index of 12,758 and a current display of 8500. Before starting record current Wobbe Index Span Value in case you need to return to this value again and for calculating the new span value. Push the "SETUP" BUTTON", scroll to WI Span and record value below. If the Wobbe Index Span is "0", using the arrow keys to enter 25,000. The Wobbe Index Span Range can be set between 0 and 99999.

Record Wobbe Index - span: _____ Kcal/Nm³

Use the following equation to provide the proper Wobbe Index Span number to insert:

$$\text{Desired display} \times \text{Current Span} / \text{Current display} = \text{New Span Setting}$$

Desired display is the Wobbe Index value of the calibration gas.

Current span is the Wobbe Index Span reading on the display as recorded above from setup mode.

Current display is the Wobbe Index reading on the display in normal mode.

$$\text{Example: Desired display} \times \text{Current Span} / \text{Current display} = \text{New Span Setting}$$

$$12,758 \quad \times \quad 25,000 \quad / \quad 8,500 \quad = \quad 37,523$$

Push the "SETUP" BUTTON, scroll to WI span and enter 37,523 as a new span for this example. Exit the setup mode, your Wobbe Index should now read 12,758.

Wobbe Index Recorder Output

The Wobbe Index Recorder Output is an analog signal that can be scaled. The end user may change the Factory Default range on for the Wobbe Index Recorder Output as desired. Setting the Wobbe Index Low Output to the highest value possible could increase resolution and setting the Wobbe Index High Output the lowest value possible.

NOTE:

Before using the analog outputs (4-20 mA), be sure to read the manual of all the units that will be connected. In some cases an analog signal isolator is required to properly connect dissimilar instruments together. Also, if there is no instrument connected to the Recorder Output a load resistor is required to measure the Recorder Output. Use a 500 - 900 ohm resistor in series with the measuring device.

Calculating Recorder Output resolution using the factory default values.

$$\text{Wobbe Index High} - \text{Wobbe Index Low} = \text{Wobbe Index Difference}$$

$$23,500 \quad - \quad 7,500 \quad = \quad 16,000 \text{ Kcal/Nm}^3$$

milliamp Out High - milliamp Out Low = milliamp Output Difference

$$20.00 - 4.00 = 16.00 \text{ mA}$$

milliamp Output Difference / Wobbe Index Difference = mA/Kcal/Nm³ Resolution

$$16.00 / 16,000 = 0.001 \text{ mA/Kcal/Nm}^3$$

Operator Display - Wobbe Index Low = Wobbe Index Delta

$$12,758 - 7,500 = 5,258 \text{ Kcal/Nm}^3$$

Wobbe Index Delta x mA/Kcal/Nm³ Resolution + milliamp Out Low = Recorder Output

$$5,258 \times 0.001 \text{ mA/Kcal/Nm}^3 + 4.00 \text{ mA} = 9.26 \text{ mA}$$

The calculated Recorder Output values is 9.26 milliamps for the Operator Display value of 12,758 Kcal/Nm³. The Resolution would be 0.001 mA/Kcal/Nm³.

Enter Display Setup Values by pushing the "Setup" button on the Operator Panel. Reference Operator Display functions in Chapter 3 as needed. The Wobbe Index Recorder output Range can be set between 0 and 99999.

WI - Wobbe Index Low - Factory Default Value, 4.00mA @ 7500 Kcal/Nm³

WI - Wobbe Index High - Factory Default Value, 20.00mA @ 23,500 Kcal/Nm³

NOTE: If Wobbe Index drops below 7,500 Kcal/Nm³ the PLC current output will remain at 4.00 mA until the measurement increases above 7,500 Kcal/Nm³ setpoint.

If Wobbe Index increases above 23,500 Kcal/Nm³ the PLC current output will remain at 20.00 mA until the measurement decreases below 23,500 Kcal/Nm³ setpoint.

SG - SPECIFIC GRAVITY SETUP & TESTING

Specific Gravity Zero

Reference Operator Display functions in Chapter 3 as needed.

Specific Gravity Zero should be performed annually to ensure the accuracy of the unit.

Otherwise under normal operating conditions this procedure is not required.

Turn the "INSTRUMENT AIR"/"OFF" valve to INSTRUMENT AIR position.

Turn the Specific Gravity Analyzer "SAMPLE GAS"/"OFF"/"INSTRUMENT AIR" valve to INSTRUMENT AIR position, allow unit to stabilize.

Continuously monitor and maintain Instrument Air at 200 mL and Sample Gas set to Instrument AIR at 50 mL.

Verify and set Specific Gravity Bridge Excitation voltage to 5.00 VDC at the Bridge Input Isolation card.

The Specific Gravity Zero potentiometer is located very close the Specific Gravity terminal board.

Using a multimeter set to millivolts, adjust Specific Gravity Zero potentiometer such that the bridge output is 0mV, +/- 1mV at Terminal Pins 1 & 2.

Allow unit to run for 120 minutes making sure reading is stable, re-adjust bridge output to Zero.

After the Specific Gravity is Zeroed, a dab of silicone is placed on the zeroing potentiometer for shipping.

Specific Gravity Correction

Reference Operator Display functions in Chapter 3 as needed.

Specific Gravity Correction should be used as needed to ensure the accuracy of the unit.

Otherwise under normal operating conditions this procedure is not required.

Turn the "INSTRUMENT AIR"/"OFF" valve to INSTRUMENT AIR position.

Turn the Specific Gravity Analyzer "SAMPLE GAS"/"OFF"/"INSTRUMENT AIR" valve to INSTRUMENT AIR position, allow unit to stabilize.

Continuously monitor and maintain Instrument Air at 200 mL and Sample Gas set to Instrument AIR at 50 mL. If the display not show a specific gravity value of 1.00. Adjust the Specific Gravity Correction by entering the setup menu and scroll down to the Specific Gravity Correction menu. Adjust the Specific Gravity Correction up or down +/-1000 until the display shows 1.00.

The Specific Gravity Correction is used to shift the entire calibration curve up or down.

Specific Gravity Span

Specific Gravity Span should be performed annually to ensure the accuracy of the unit. The Specific Gravity Span uses Specific Gravity Correction feature to shift the entire calibration curve up or down.

Otherwise under normal operating conditions this procedure is not required.

It is recommended that the Calibration Gas should have the same

Wobbe Index & Specific Gravity characteristic as the gas that will be tested.

Turn "SAMPLE GAS"/"OFF"/"CALIBRATION GAS" valve to CALIBRATION GAS.

Turn the "INSTRUMENT AIR"/"OFF" valve to INSTRUMENT AIR. Turn the Specific Gravity Analyzer valve to "SAMPLE GAS"/"OFF"/"INSTRUMENT AIR" valve to SAMPLE GAS POSITION, allow unit to stabilize. Continuously monitor and maintain Instrument Air flow meter rate at 200 mL & Sample Gas flow rate at 50 mL. For purposes of explaining the procedure we will use a Gas with a Specific Gravity of 1.35.

Test Gas: CP Propane / Air with a Specific Gravity of: 1.35

Once the display is stabilized, adjust the Specific Gravity Correction value up or down such that the Operator Display will read the SG - Specific Gravity of the Calibration Gas being sampled, 1.35 from our example. Do this change with the Specific Gravity Correction, in some cases when the Specific Gravity is being referenced with Instrument Air the display will not read 1.00. The display does not read a value of 1.00 because the whole calibration curve was shifted up or down.

Specific Gravity Recorder Output

The Specific Gravity Recorder Output is an analog signal scaled by the PLC Controller based on the Specific Gravity measurements. The end user may change the Factory Default range on for the Specific Gravity Recorder Output as desired. Resolution can be increased by setting the Specific Gravity Low Output to the highest value possible and setting the Specific Gravity High Output the lowest value possible.

NOTE:

Before using the analog outputs (4-20 mA), be sure to read the manual of all the units that will be connected. In some cases an analog signal isolator is required to properly connect dissimilar instruments together. Also, if there is no instrument connected to the Recorder Output a load resistor is required to measure the Recorder Output. Use a 500 - 900 ohm resistor in series with the measuring device.

Calculating Recorder Output resolution using the factory default values.

$$\text{Specific Gravity High} - \text{Specific Gravity Low} = \text{Specific Gravity Difference}$$

$$2.10 - 0.50 = 1.60$$

$$\text{milliamp Out High} - \text{milliamp Out Low} = \text{milliamp Output Difference}$$

$$20.00 - 4.00 = 16.00 \text{ mA}$$

$$\text{milliamp Output Difference} / \text{Specific Gravity Difference} = \text{mA} / \text{Kcal/Nm}^3 \text{ Resolution}$$

$$16.00 / 1.60 = 10.00 \text{ mA} / \text{SG}$$

$$\text{Operator Display} - \text{Specific Gravity Low} = \text{Specific Gravity Delta}$$

$$1.35 - 0.50 = 0.85$$

$$\text{Specific Gravity Delta} \times \text{mA} / \text{SG Resolution} + \text{milliamp Out Low} = \text{Recorder Output}$$

$$0.85 \times 10.00 + 4.00 = 12.50 \text{ mA}$$

The calculated Recorder Output values is 12.50 milliamps for the Operator Display value of 1.35. The Resolution would be 10.00 mA / SG.

Enter Display Setup Values by pushing the "Setup" button on the Operator Panel.

Reference Operator Display functions in Chapter 3 as needed. The Specific Gravity Recorder output Range can be set between 0 and 99999.

SG - Specific Gravity Low - Factory Default Value, 4.00mA @ 0.50

SG - Specific Gravity High - Factory Default Value, 20.00mA @ 2.10

NOTE: If Specific Gravity drops below 0.50 the PLC current output will remain at 4.00 mA until the measurement increases above 0.50 setpoint.

If Specific Gravity increases above 2.10 the PLC current output will remain at 20.00 mA until the measurement decreases below 2.10 setpoint.

CV - Calorific Value SETUP & TESTING

The Calorific Value requires no calibration since it is a calculated value based on the Wobbe Index and Specific Gravity measurements. However, it does have a Recorder Output Range that can be scaled.

Calorific Value Recorder Output

Reference Operator Display functions in Chapter 3 as needed.

The Calorific Value Recorder Output is an analog signal calculated by the PLC Controller using Wobbe Index and Specific Gravity measurements. The end user may change the Factory Default range on for the Calorific Value Recorder Output as desired. Resolution can be increased by setting the Calorific Value Low Output to the highest value possible and setting the Calorific Value High Output the lowest value possible.

NOTE:

Before using the analog outputs (4-20 mA), be sure to read the manual of all the units that will be connected. In some cases an analog signal isolator is required to properly connect dissimilar instruments together. Also, if there is no instrument connected to the Recorder Output a load resistor is required to measure the Recorder Output. Use a 500 - 900 ohm resistor in series with the measuring device.

Calculating Recorder Output resolution using the factory default values.

Calorific Value High - Calorific Value Low = Calorific Value Difference

32,500 - 7,500 = 25,000 Kcal/Nm³

milliamp Out High - milliamp Out Low = milliamp Output Difference

20.00 - 4.00 = 16.00

milliamp Output Difference / Calorific Value Difference = mA / Kcal/Nm³
Resolution

16.00 / 25,000 = 0.000640 mA/Kcal/Nm³

Operator Display - Calorific Value Low = Calorific Value Delta

16,308 - 7,500 = 8,808 Kcal/Nm³

Calorific Value Delta x mA/Kcal/Nm³ Resolution + milliamp Out Low = Recorder Output

$$8,808 \quad \times \quad 0.000640 \quad + \quad 4.00 = 9.64 \text{ mA}$$

The calculated Recorder Output values is 9.64 milliamps for the Operator Display value of 16,308 Kcal/Nm³. The Resolution would be 0.000640 mA/Kcal/Nm³.

Enter Display Setup Values by pushing the "Setup" button on the Operator Panel.

Reference Operator Display functions in Chapter 3 as needed.

The Calorific Value Recorder output Range can be set between 0 and 99999.

CV - Calorific Value Low - Factory Default Value, 4.00mA @ 7,500 Kcal/Nm³

CV - Calorific Value High - Factory Default Value, 20.00mA @ 32,500 Kcal/Nm³

NOTE: If Calorific Value drops below 7,500 Kcal/Nm³ the PLC current output will remain at 4.00 mA until the measurement increases above 7,500 Kcal/Nm³ setpoint.

If Calorific Value increases above 32,500 Kcal/Nm³ the PLC current output will remain at 20.00 mA until the measurement decreases below 32,500 Kcal/Nm³ setpoint.

Record Final Setpoints for Your Records

For your Records Record the setpoint ranges you have selected.

- WI INPUT ZERO _____
- WI INPUT SPAN _____
- SG CORRECTION _____
- WI OUTPUT LOW _____
- WI OUTPUT HIGH _____
- CV OUTPUT LOW _____
- CV OUTPUT HIGH _____
- SG OUTPUT LOW _____
- SG OUTPUT HIGH _____

GA500-W FIELD CALIBRATION INSTRUCTIONS

Run vent line to safe area.

Connect air and gas to there appropriate inlet ports to set regulators.

Maximum Inlet Pressures: Air: 150 PSIG, Calibration & Sample Gas: 20" W.C.

Turn on power.

Turn on fuel with gas selected and let burner ignite, check for proper flame.

Initial Setup Values

Pressure & Flow Settings

Regulators:	Setting:
-------------	----------

- | | |
|--|---------|
| • 1st stage air regulator: | 60 PSIG |
| • 2nd stage burner air regulator: | 25 PSIG |
| • 1st stage Calibration Gas regulator: | 4" W.C. |
| • 1st stage Sample Gas regulator: | 4" W.C. |
| • 2nd stage gas regulator: | 2" W.C. |

Flow Meters:	Setting
--------------	---------

- | | |
|---------------------------------------|----------|
| • Thermal Analyzer - Measurement Air: | 100 SCFH |
|---------------------------------------|----------|

Initial Recorder Output factory default values for reference

- | | |
|-------------------------------------|-----------------------------|
| • WI - Wobbe Index Low - 4.00mA @ | 7,500 Kcal/Nm ³ |
| • WI - Wobbe Index High - 20.00mA @ | 18,800 Kcal/Nm ³ |

WOBBE INDEX SETUP & TESTING

Wobbe Index Zero

Set the minimum Wobbe Index Low Display value by selecting **"P"**-Sensor Input Configuration, then select **"VAL.L"**-Span, display value Low, enter "0". Wobbe Index Zero should be performed when the thermocouple is changed or if the thermocouple is suspected as being defective. Otherwise under normal conditions this procedure is not required.

Before removing the thermocouples, place a circular mark using a black permanent-marking pen on the thermocouple as close to the nut as possible for re-installation. Loosen the nut that holds the hot and cold thermocouples in place. Remove thermocouples and place in a container of water. Allow temperature to stabilize. The display should read +/-5 Kcal/Nm³. If the display value is very high it may indicate that the thermocouple needs to be replaced.

Install thermocouples into there original locations at the Cold Junction and Hot Junction positions. Using the mark that you made to position the thermocouple

to there original location. For reference the Cold Junction thermocouple is insert all the way in, then pull out the thermocouple about a 1/2" inch. This should center the Cold Junction thermocouple in the tube. The Hot Junction thermocouple is centered in the burner chamber. If you can not determine the center you may have to remove the top and visually center the thermocouple.

Wobbe Index Span

Wobbe Index Span should be performed at least once a month to ensure the accuracy of the unit. It is recommended that the Calibration Gas should have the same Wobbe Index characteristic as the gas that will be tested. Turn "SAMPLE GAS"/"OFF"/"CALIBRATION GAS" valve to CALIBRATION GAS. Turn the "INSTRUMENT AIR"/"OFF" valve to INSTRUMENT AIR. Verify that the Burner Air Pressure Regulator is set to 25 PSIG and Gas Pressure Regulator is set to 2" W.C. Also verify the Air Flow Measurement Meter has a flow rate of 100 SCFH. If the Air Flow Measurement is not 100 SCFH, adjust the Primary Air Regulator such that the Air Flow Meter reads 100 SCFH. The Secondary Air Regulator under normal conditions does not require adjusting. If the Secondary Air Regulator should require adjusting, it is typically set at mid range. Allow unit to run for 120 minutes making sure reading is stable. For purposes of explaining the procedure we will use a Wobbe Index of 11,947 and a current display of 8500. Before starting, record current Wobbe Index Span Value in case you need to return to this value again and for calculating the new span value. Select ",P"-Sensor Input Configuration, then select "VAL.H"-Span, display value high, and record value below. If the Wobbe Index Span is "0", using the arrow keys to enter 25,000. The Wobbe Index Span Range can be set between 0 and 99999.

Record Wobbe Index - span: _____ Kcal/Nm³

Use the following equation to provide the proper Wobbe Index Span number to insert:

Desired display x Current Span / Current display = New Span Setting

Desired display is the Wobbe Index value of the calibration gas.

Current span is the Wobbe Index Span reading on the display as recorded above from setup mode.

Current display is the Wobbe Index reading on the display in normal mode.

Example: Desired display x Current Span / Current display = New Span Setting

$$12,758 \quad \times \quad 25,000 \quad / \quad 8,500 \quad = \quad 37,524$$

Select ",P"-Sensor Input Configuration, then select "VAL.H"-Span, display value high and enter 37,524 as a new span for this example. Exit the setup mode, your Wobbe Index should now read 12,758.

Wobbe Index Recorder Output

The Wobbe Index Recorder Output (Retransmission) is an analog signal scaled by the Operator Display based on the Wobbe Index measurements. The end user may change the Factory Default range on for the Wobbe Index Recorder Output as desired. Setting the Wobbe Index Low Output to the highest value possible can increase resolution and setting the Wobbe Index High Output the lowest value possible.

NOTE:

Before using the analog outputs (4-20 mA), be sure to read the manual of all the units that will be connected. In some cases an analog signal isolator is required to properly connect dissimilar instruments together. Also, if there is no instrument connected to the Recorder Output a load resistor is required to measure the Recorder Output. Use a 500 - 900 ohm resistor in series with the measuring device.

Calculating Recorder Output resolution using the factory default values.

$$\begin{array}{rcl} \text{Wobbe Index High} & - & \text{Wobbe Index Low} = \text{Wobbe Index Difference} \\ 18,800 & - & 7,500 = 11,300 \text{ Kcal/Nm}^3 \end{array}$$

$$\begin{array}{rcl} \text{milliamp Out High} & - & \text{milliamp Out Low} = \text{milliamp Output Difference} \\ 20.00 & - & 4.00 = 16.00 \end{array}$$

$$\begin{array}{rcl} \text{milliamp Output Difference} / \text{Wobbe Index Difference} & = & \text{mA/Kcal/Nm}^3 \text{ Resolution} \\ 16.00 & / & 11,300 = 0.001416 \text{ mA/Kcal/Nm}^3 \end{array}$$

$$\begin{array}{rcl} \text{Operator Display} - \text{Wobbe Index Low} & = & \text{Wobbe Index Delta} \\ 12,758 & - & 7,500 = 5,258 \text{ Kcal/Nm}^3 \end{array}$$

Wobbe Index Delta x mA/Kcal/Nm³ Resolution + milliamp Out Low = Recorder Output

$$5,258 \times 0.001416 \text{ mA/Kcal/Nm}^3 + 4.00 \text{ mA} = 11.45 \text{ mA}$$

The calculated Recorder Output values is 11.45 milliamps for the Operator Display value of 12,758 Kcal/Nm³. The Resolution would be 0.001416 mA/Kcal/Nm³.

To change or reset to the default values, select **"1A"**-Output Module 1 Configuration, then select **"VAL.L"**-Retransmission Low or **"VAL.H"**-Retransmission High and enter the desired values. The Wobbe Index Recorder output Range can be set between 0 and 99999.

WI - Wobbe Index Low - Factory Default Value, 4.00mA @ 7,500 Kcal/Nm³

WI - Wobbe Index High - Factory Default Value, 20.00mA @ 18,800 Kcal/Nm³

NOTE: If Wobbe Index drops below 7,500 Kcal/Nm³ the Recorder Retransmission current output will remain at 4.00 mA until the measurement increases above 7,500 Kcal/Nm³ setpoint.

If Wobbe Index increases above 18,800 Kcal/Nm³ the Recorder Retransmission current output will remain at 20.00 mA until the measurement decreases below 18,800 Kcal/Nm³ setpoint.

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Virtually no maintenance is required on the unit except for checking air filters and strainer and gas strainer, periodically. Internal parts of gas solenoid valve and all four regulators should be replaced as required. If the unit is used often, these items should be checked and replaced, if necessary, at least once a year. Under any circumstances, all components should be completely serviced, with a repair kit, at least once every 5 years.

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TroubleShooting

6

SYMPTOM	POSSIBLE CAUSE	CORRECTION NOTE NUMBER
Incorrect Burner Air Pressure	1. Air supply malfunction	1
	2. Filters or strainer plugged	2
	3. Regulator adjustment	3
	4. Defective regulator	4
	5. Defective gauge	5
Incorrect Measurement Air Flow	1-4 above	1-4
	6. Defective flow meter	6
Incorrect Gas Pressure	7. Gas supply pressure failure	1
	8. Strainer plugged	2
	9. Regulators adjustment	3
	10. Defective regulator	4
	11. Defective gauge	5
Incorrect Reading on Wobbe Index Display	Items 1-11 above	1-6
	If 1-11 are correct and condition still exist, one or more of the following:	
	A. Cold junction thermocouple	7
	B. Hot junction thermocouple	7
	C. Electronic network	8
D. Display	9	

CORRECTION NOTES (see 'correction note number' in chart):

- | | |
|--|-------------------------------|
| 1. Correct supply | 5. Replace gauge |
| 2. Replace filter elements and/or clean strainer | 6. Replace flow meter |
| 3. Adjust regulator | 7. Replace thermocouple |
| 4. Replace regulator | 8. Replace electronic network |
| | 9. Replace display |

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APPENDIX A

***GA500-W & GA500-WC
Common Component Information***

APPENDIX A

***GA500-W
Component Information***

APPENDIX A

***GA500-WC
Component Information***

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