

Manual Addendum

***Models GFC 7002T and
GFC 7002TU N₂O
Analyzers***
(Addendum to GFC 7000T manual)

Use and Disclosure of Data

Information contained herein is classified as EAR99 under the U.S. Export Administration Regulations. Export, reexport or diversion contrary to U.S. law is prohibited.

SAFETY MESSAGES

Important safety messages are provided throughout this manual. Please read these messages carefully.

A safety message alerts you to potential hazards that could hurt you or others. Each safety message is associated with a safety alert symbol. These symbols are found in the manual and inside the instrument. The definition of these symbols is described below:



WARNING: Electrical Shock Hazard



HAZARD: Strong oxidizer



GENERAL WARNING/CAUTION: Read the accompanying message for specific information.



CAUTION: Hot Surface Warning



Technician Symbol: All operations marked with this symbol are to be performed by qualified maintenance personnel only.



DO NOT TOUCH: Touching some parts of the instrument without protection or proper tools could result in damage to the part(s) and/or the instrument.



Electrical Ground: This symbol inside the instrument marks the central safety grounding point for the instrument.



CAUTION - General Safety Hazard

This instrument should only be used for the purpose and in the manner described in this manual. If you use this instrument in a manner other than that for which it was intended, unpredictable behavior could ensue with possible hazardous consequences.

NEVER use any gas analyzer to sample combustible gas(es).

CONSIGNES DE SÉCURITÉ

Des consignes de sécurité importantes sont fournies tout au long du présent manuel dans le but d'éviter des blessures corporelles ou d'endommager les instruments. Veuillez lire attentivement ces consignes. Chaque consigne de sécurité est représentée par un pictogramme d'alerte de sécurité; ces pictogrammes se retrouvent dans ce manuel et à l'intérieur des instruments. Les symboles correspondent aux consignes suivantes:



AVERTISSEMENT : Risque de choc électrique



DANGER : Oxydant puissant



AVERTISSEMENT GÉNÉRAL / MISE EN GARDE : Lire la consigne complémentaire pour des renseignements spécifiques



MISE EN GARDE : Surface chaude



Ne pas toucher : Toucher à certaines parties de l'instrument sans protection ou sans les outils appropriés pourrait entraîner des dommages aux pièces ou à l'instrument.



Pictogramme « technicien » : Toutes les opérations portant ce symbole doivent être effectuées uniquement par du personnel de maintenance qualifié.



Mise à la terre : Ce symbole à l'intérieur de l'instrument détermine le point central de la mise à la terre sécuritaire de l'instrument.

MISE EN GARDE



Cet instrument doit être utilisé aux fins décrites et de la manière décrite dans ce manuel. Si vous utilisez cet instrument d'une autre manière que celle pour laquelle il a été prévu, l'instrument pourrait se comporter de façon imprévisible et entraîner des conséquences dangereuses.

NE JAMAIS utiliser un analyseur de gaz pour échantillonner des gaz combustibles!

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1. INTRODUCTION

The GFC 7002T and GFC 7002TU are Gas Filter Correlation (GFC) analyzers that are designed to measure low level and trace level nitrous oxide (N₂O), respectively. The primary difference between the models is their maximum operating range; 1000 ppm for the GFC 7002T and 200 ppm for the GFC 7002TU. The GFC 7002T and GFC 7002TU are designed to be used for monitoring background levels of N₂O in the atmosphere, byproducts of combustion products and contamination of bottled gases.

This addendum is a supplement to the GFC 7000T manual to facilitate setup, operation, calibration, troubleshooting and repair of GFC 7002T and GFC 7002TU nitrous oxide (N₂O) analyzers. Most of the basic set up information, operating instructions as well as maintenance, troubleshooting and repair methods are the same for the GFC 7002T/GFC 7002TU and can be found in the GFC 7000T manual.

When using the GFC 7000T manual, it is necessary to substitute the words *nitrous oxide* for *carbon monoxide* and the chemical abbreviation N₂O for CO:

Carbon Monoxide → Nitrous Oxide CO → N₂O

There are six major differences between the GFC 7002T/GFC 7002TU and their counterpart models, GFC 7000T / GFC 7000TU:

- **Operating wavelength:** A different photo detector is used that closely matches the peak absorption wavelength of N₂O.
- **Gas Filter Correlation Filter (GFC) wheel:** The GFC wheel is filled with N₂O rather than CO to correlate properly with N₂O.
- **Software:** Display text strings, variable names and variable values reflect the difference in gas name and physical characteristic. Wherever "CO" is displayed on the GFC 7000T/U "N₂O" will be displayed on the GFC 7002T/GFC 7002TU.
- **Calibration Methods:** There are no specialized USEPA calibration methods since these methods currently do not exist.
- **Calibration Gases:** Since there are no readily available low cost N₂O scrubbers and traditional zero air generators which do not remove N₂O, zero gas must be either N₂ or synthetic air - especially for the GFC 7002TU.
- **Calibration Valve Options:** Due to there being no N₂O scrubbers or traditional zero air generators for either the GFC 7002T or the GFC 7002TU, Options 51B and 51C for the GFC 7000T are not available for the GFC 7002T or GFC 7002TU.

NOTE

The information contained in this addendum is relevant to GFC 7002T/GFC 7002TU analyzers, some of which may not be applicable to the current version of software.

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2. SPECIFICATIONS, APPROVALS AND WARRANTY

This section provides the specifications for the GFC 7002T and the GFC 7002TU analyzers, and references approvals and warranty.

2.1. SPECIFICATIONS

Specifications differ between the GFC 7002T and the GFC 7002TU analyzers for Ranges, Noise, Lower Detectable Limit and Drift.

Table 2-1. GFC 7002T/GFC 7002TU Basic Unit Specifications

Parameter	Model GFC 7002T	Model GFC 7002TU
Ranges	Min:	0-1 ppm Full scale
	Max:	0-1000 ppm Full scale (selectable, dual ranges and auto ranging supported)
Measurement Units	ppb, ppm, $\mu\text{g}/\text{m}^3$, mg/m^3 (selectable)	
Zero Noise ^{1,2}	< 0.02 ppm (RMS)	< 5 ppb (RMS)
Span Noise ^{1, 2, 3}	< 0.5% of reading RMS over 8 ppm	< 0.5% of reading RMS over 2 ppm
Lower Detectable Limit ^{1,2}	< 0.04 ppm	< 10 ppb
Zero Drift (24 hours) ²	< 0.1 ppm	< 25 ppb
Span Drift (24 hours) ^{2, 4}	< 0.5% of reading	< 0.5% of reading
Lag Time ¹	<10 sec	
Rise/Fall Time ¹	<60 sec to 95%	
Linearity ⁶	1% of full scale	
Precision ^{1, 5}	0.5% reading	
Sample Flow Rate	800 cm^3/min . \pm 10%	
Voltage Coefficient	< 0.05 % of reading per V	
Power Requirements	100V-120V, 220V-240V, 50/60 Hz	
Analog Output Ranges	10V, 5V, 1V, 0.1V (selectable)	
Recorder Offset	\pm 10%	
Analog Output Resolution	1 part in 4096 of selected full-scale voltage	
Included I/O	1 Ethernet: 10/100Base-T 2 RS-232 (300 – 115,200 baud) 2 USB device ports 8 opto-isolated digital status outputs 6 opto-isolated digital control inputs 4 analog outputs	
Optional I/O	1 USB com port 1 RS485 8 analog inputs (0-10V, 12-bit) 4 digital alarm outputs Multidrop RS232 3 4-20mA current outputs	

Parameter	Model GFC 7002T	Model GFC 7002TU
Temperature Range	5 - 40°C operating	
Humidity Range	0-95% RH, Non-Condensing	
Dimensions (HxWxD)	7" x 17" x 23.5" (178 mm x 432 mm x 597 mm)	
Weight	50 lb (22.7 kg)	
Environmental Conditions	Installation Category (Over voltage Category) II Pollution Degree 2	
Certifications	CE: IEC 61010-1:2001 North American: cNEMKO (Canada): CAN/CSA-C22.2 No. 61010-1-04 NEMKO-CCL (US): UL No. 61010-1 (2 nd Edition)	
¹ As defined by the USEPA	⁴ Or 10 ppb, whichever is greater	
² At constant temperature and sample pressure	⁵ Or LDL whichever is greater	
³ Or 20 ppb, whichever is greater	⁶ For values greater than twice the LDL	

2.2. EPA EQUIVALENCY DESIGNATION

There is no US EPA reference method for the measurement of nitrous oxide; therefore, neither the GFC 7002T nor the GFC 7002TU are designated as reference or equivalent methods. Hence, the EPA Protocol Calibration section of the Model GFC 7000T/U Operation Manual does not apply.

2.3. CE MARK COMPLIANCE

See the CE Mark Compliance section of the GFC 7000T manual.

2.4. WARRANTY

See the Warranty page of the GFC 7000T manual.

3. GETTING STARTED

3.1. UNPACKING THE GFC 7002T/GFC 7002TU

Follow the unpacking directions in the Getting Started section of the GFC 7000T manual; note that the *Final Test and Validation Data Sheet* for the GFC 7002T or the GFC 7002TU are unique.

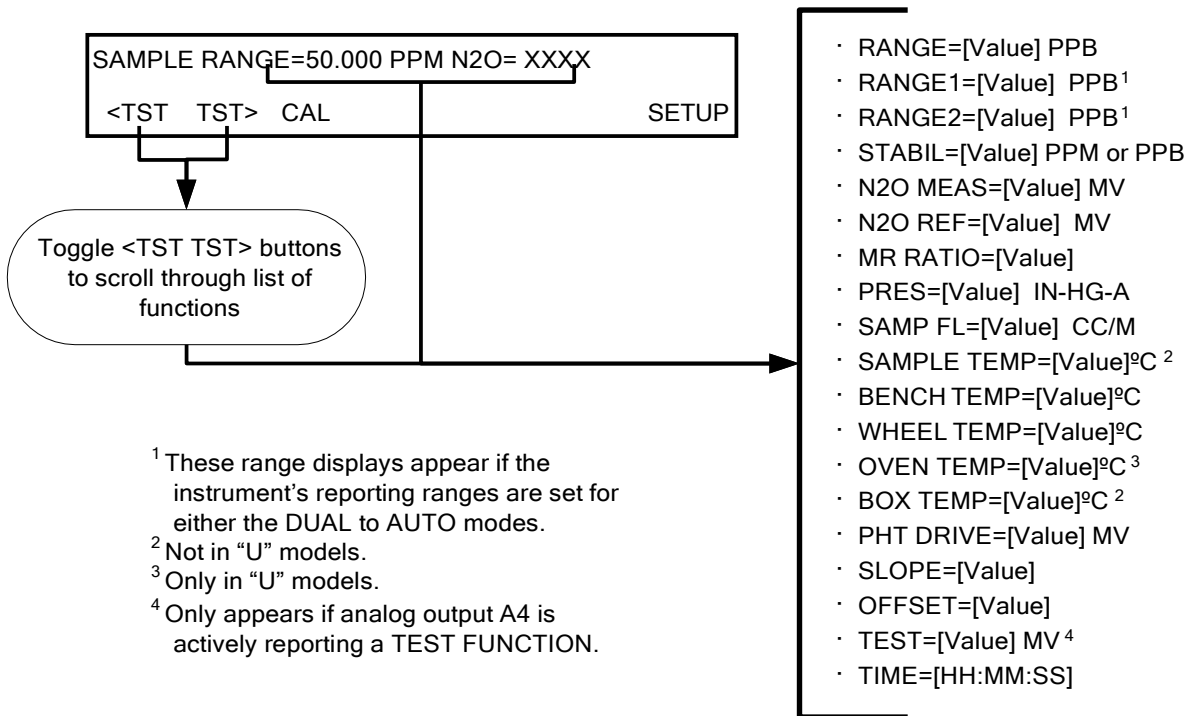
3.2. INITIAL OPERATION OF THE GFC 7002T/GFC 7002TU

The analyzer should be started and allowed to warm up; a functional check followed by calibration should be performed. The process for starting and warming up the GFC 7002T/GFC 7002TU is identical to that described in the Initial Operation section of the GFC 7000T/U Operators Manual (P/N 06864).

3.3. FUNCTIONAL CHECK

The functional check information also in the Initial Operation section of the GFC 7000T Operators Manual is applicable to the GFC 7002T/GFC 7002TU with the following exception(s).

The Test functions available from the front panel of the GFC 7002T or GFC 7002TU are:



3.4. INITIAL CALIBRATION

3.4.1. CALIBRATION GASES

The information found in the Calibration Gases section of the GFC 7000T Operators Manual is applicable to the GFC 7002T/GFC 7002TU with the following exceptions:

ZERO GAS

Zero gas is similar in chemical composition to the atmosphere that is to be measured but scrubbed of all components that might affect the analyzers readings, in this case N_2O and water vapor. For the GFC 7002T/GFC 7002TU this gas **MUST** be synthetic air, ultra zero air or nitrogen (N_2).

NOTE

Zero air created by a Zero Air Generator like the T-API Model T701 should not be used since the T701 does not scrub N_2O . Likewise since there are no effective and convenient catalytic, absorptive or reactive scrubbers for N_2O , T-API does not offer a zero scrubber cartridge.

SPAN GAS

Span gas is specifically mixed to match the chemical composition of the type of gas being measured at near full scale of the desired measurement range. In this case, N_2O measurements made with the GFC 7002T/GFC 7002TU analyzer, it is recommended that you use a span gas with a N_2O concentration equal to 80% of the measurement range for your application.

EXAMPLE: If the application is to measure between 0 ppm and 500 ppm, an appropriate span gas concentration would be 400 ppm N_2O in N_2 .

Some applications require a multipoint calibration procedure where span gases of different concentrations are applied to the analyzer under test. We recommend using a bottle of calibrated N_2O gas of higher concentration in conjunction with a gas dilution calibrator such as a Teledyne Instruments Model T700. This type of calibrator precisely mixes a high concentration gas from with zero gas (both supplied externally as either synthetic air or N_2) to accurately produce span gas of the correct concentration. Linearity profiles can be automated with this model and run unattended over night.

Currently there are no Standard Reference Material (SRM) N_2O gases available off-the-shelf from NIST (National Institute of Standards and Technology) therefore it is essential that span gas be purchased from a reputable supplier and that the gas be traceable to a reputable national standards laboratory.

3.4.2. INTERNAL PNEUMATIC FLOW

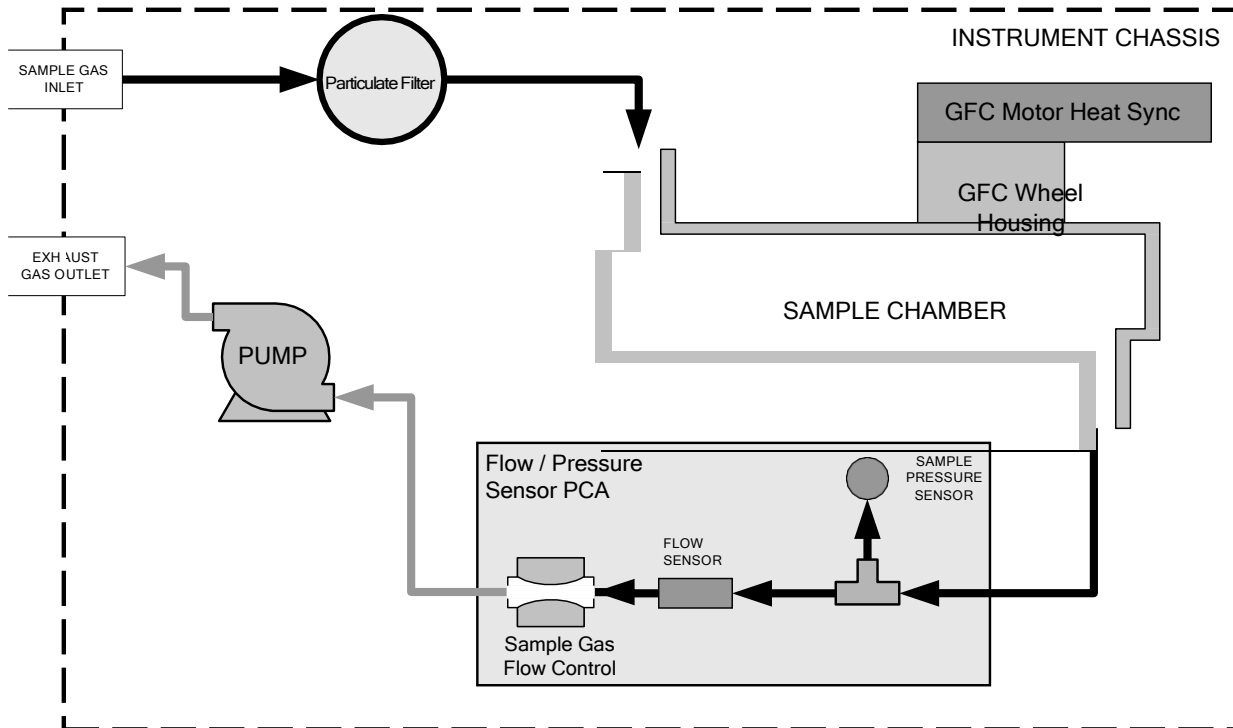


Figure 3-1. GFC 7002T Pneumatic Flow

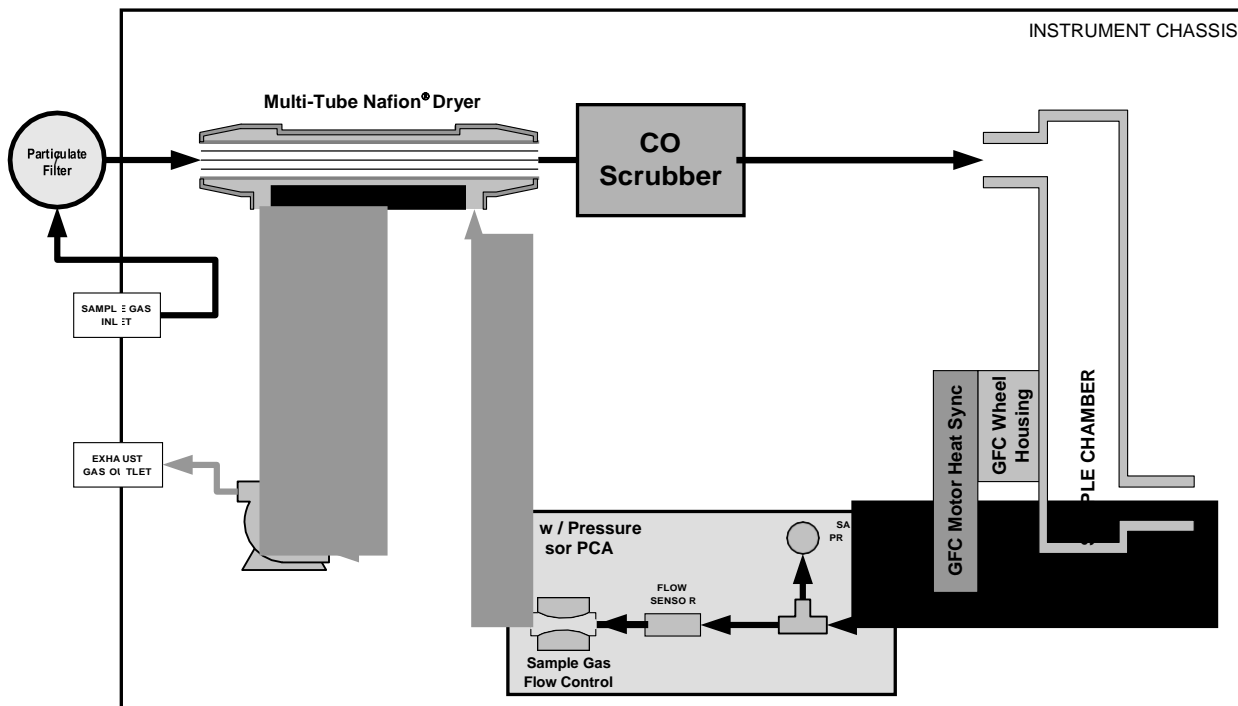


Figure 3-2. GFC 7002TU Pneumatic Flow

3.4.3. PNEUMATIC CONNECTIONS TO GFC 7002T/GFC 7002TU BASIC CONFIGURATION:

The information found in the Pneumatic Connections section of the GFC 7000T Operators Manual is applicable to the GFC 7002T/GFC 7002TU with the following changes:

- Synthetic air, ultra-zero air or N₂ should be used as the zero gas rather than a Zero Gas Generator like the TAPI Model 701. The following figures document this difference.

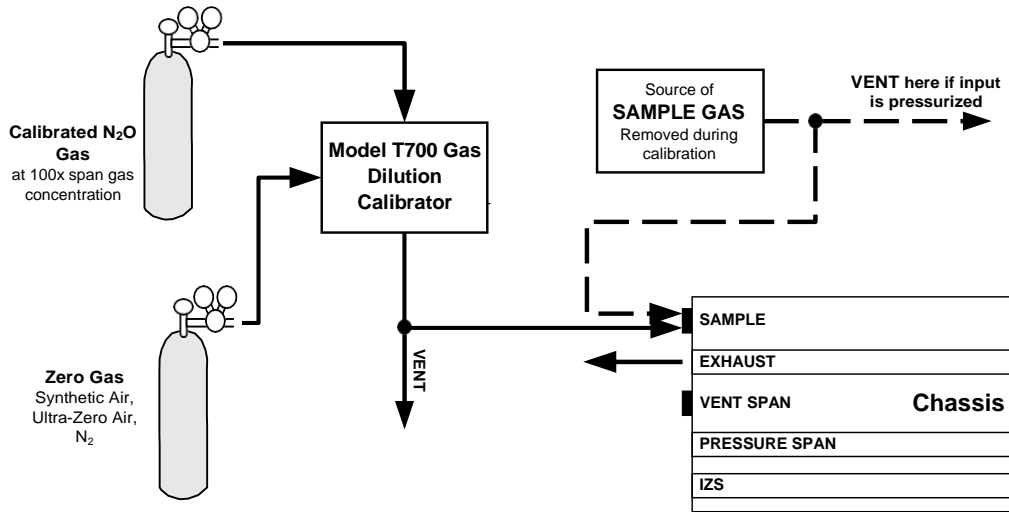


Figure 3-3. Pneumatic Connections, Basic Configuration Using Gas Dilution Calibrator

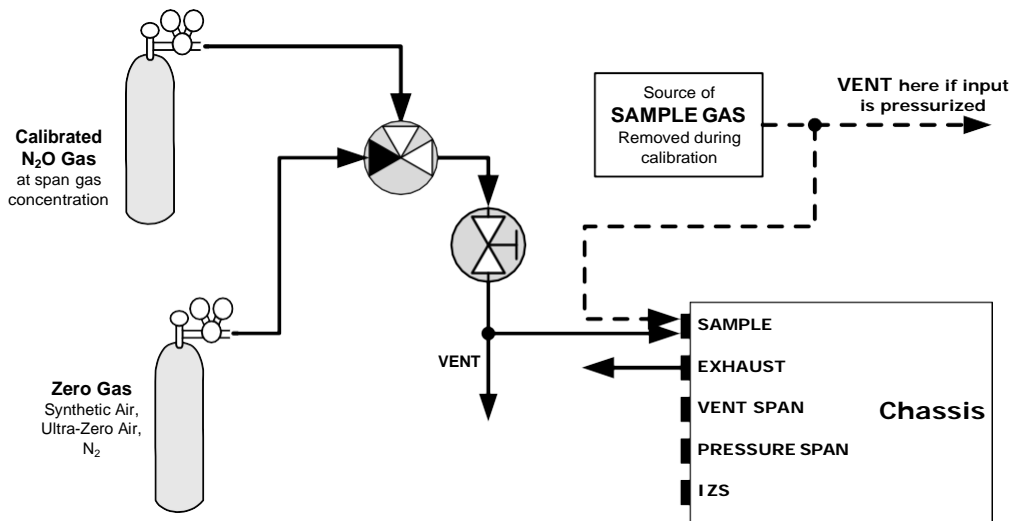


Figure 3-4. Pneumatic Connections, Basic Configuration Using Bottled Span Gas

3.4.4. PNEUMATIC CONNECTIONS TO GFC 7002T/GFC 7002TU WITH INTERNAL VALVE OPTIONS INSTALLED

- The following figures show the pneumatic set up for GFC 7002T/GFC 7002TU analyzers with one of the three available internal valve options installed. For more information on these options see Section 5 of this addendum.

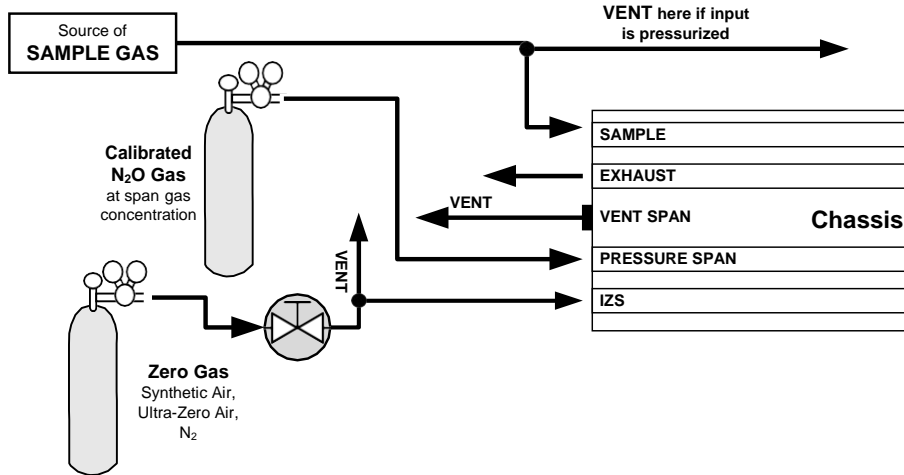


Figure 3-5. Pneumatics: Option Z/S Valve with Shutoff Valve for Pressurized Span and Atmospheric Zero

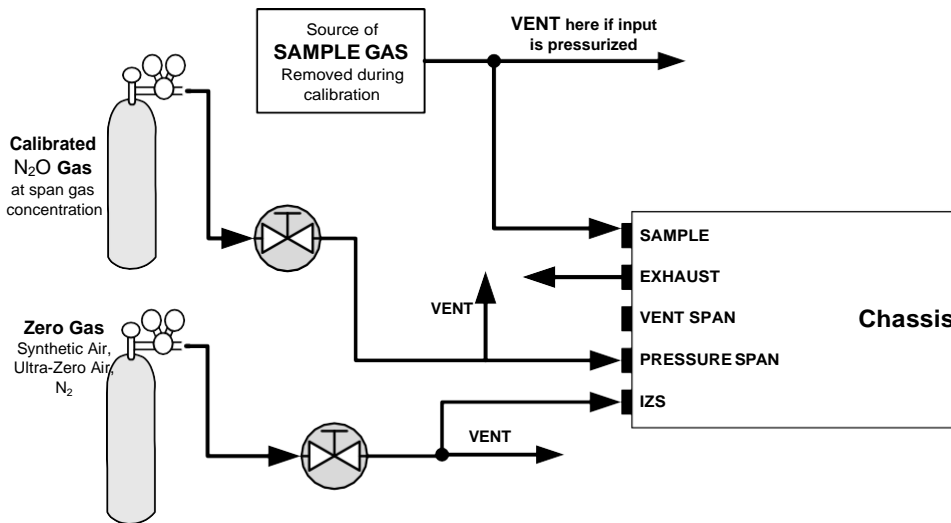


Figure 3-6. Pneumatics: Option Z/S without Shutoff Valve

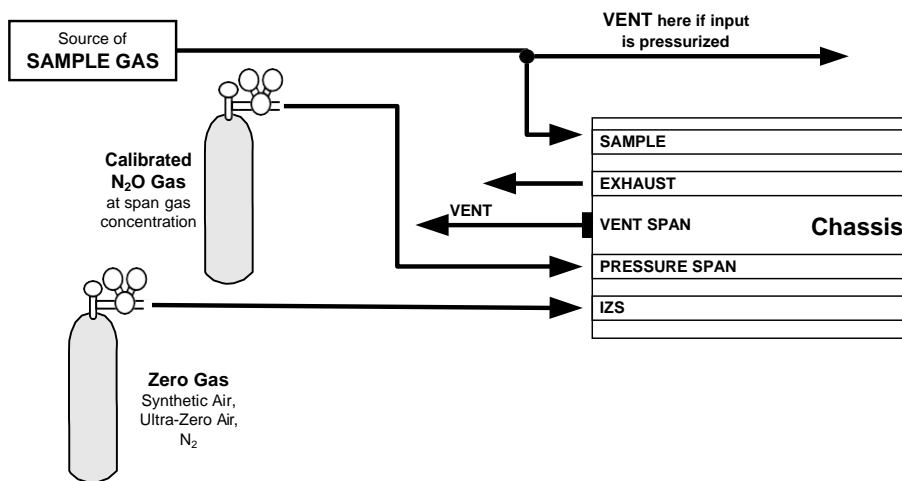


Figure 3-7. Pneumatics: Option Z/S Valve with Common Shutoff Valve for Pressurized Zero and Span

3.4.5. PNEUMATIC CONNECTIONS TO GFC 7002T/GFC 7002TU IN MULTIPOINT CALIBRATION APPLICATIONS

Some applications require multipoint calibration checks where Span gas of several different concentrations is needed. We recommend using high-concentration, certified, calibration gas supplied to the analyzer through a gas dilution calibrator such as a Teledyne API T700. This type of calibrator precisely mixes span gas and zero air to produce max concentration levels between 0 ppm and the concentration of the certified gas. This means that both the source of zero air and span gas must be connected to the calibrator whose output is then connected to the span inlet on the rear panel of the instrument.

4. FREQUENTLY ASKED QUESTIONS & GLOSSARY

The information found in the Frequently Asked Questions section of the GFC 7000T/U Operators Manual is applicable to the GFC 7002T/GFC 7002TU.

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5. OPTIONAL HARDWARE AND SOFTWARE

Not all options are available for the GFC 7002T and GFC 7002TU as are available for the GFC 7000.

5.1. CALIBRATION VALVE OPTIONS FOR THE GFC 7002T/GFC 7002TU

There three valve options available for the GFC 7002T and GFC 7002TU analyzers

Table 5-1. GFC 7002T/GFC 7002TU Available Valve Options

OPTION NO.	DESCRIPTION
VALVES AND IZS	
50A	Ambient Zero/Ambient Span Valves
50B	Zero / Span Valve with shut-off valve (Ambient Zero/ Pressurized Span)
50G	Zero / Span Valves with Shut-off Valve (Pressurized Zero/Pressurized Span)

For descriptions of options 50A and 50B and their use please see the Calibration Valves Options section of the GFC 7000T Operators Manual but noting that wherever a zero air generator like the TAPI 701 is shown, synthetic air, ultra-zero air, or N₂ should be substituted. For a description of option 50G please see Section 5.1.1 of this addendum.

5.1.1. ZERO/SPAN WITH COMMON SHUTOFF VALVES (OPTION 50G)

Option 50G is operationally and pneumatically similar to Option 50B (see GFC 7000T manual), except that both the zero and span gases are applied to the analyzer under pressure. This option is designed to be used with bottled zero and span gases. A shutoff valve is used to stop flow from the bottles during sample mode and a common vent is used to bring the pressure of the calibration gas down to local ambient pressure.

Table 5-2. Zero/Span/Shutoff Valve Operating States for Option 50G

MODE	VALVE	CONDITION
SAMPLE (Normal State)	Sample/Cal	Open to SAMPLE inlet
	Zero/Span	Open to internal ZERO AIR inlet
	Shutoff Valve	Closed
ZERO CAL	Sample/Cal	Open to ZERO/SPAN valve
	Zero/Span	Open to ZERO AIR inlet
	Shutoff Valve	Open to ZERO/SPAN valve
SPAN CAL	Sample/Cal	Open to ZERO/SPAN valve
	Zero/Span	Open to SPAN inlet
	Shutoff Valve	Open to ZERO/SPAN valve

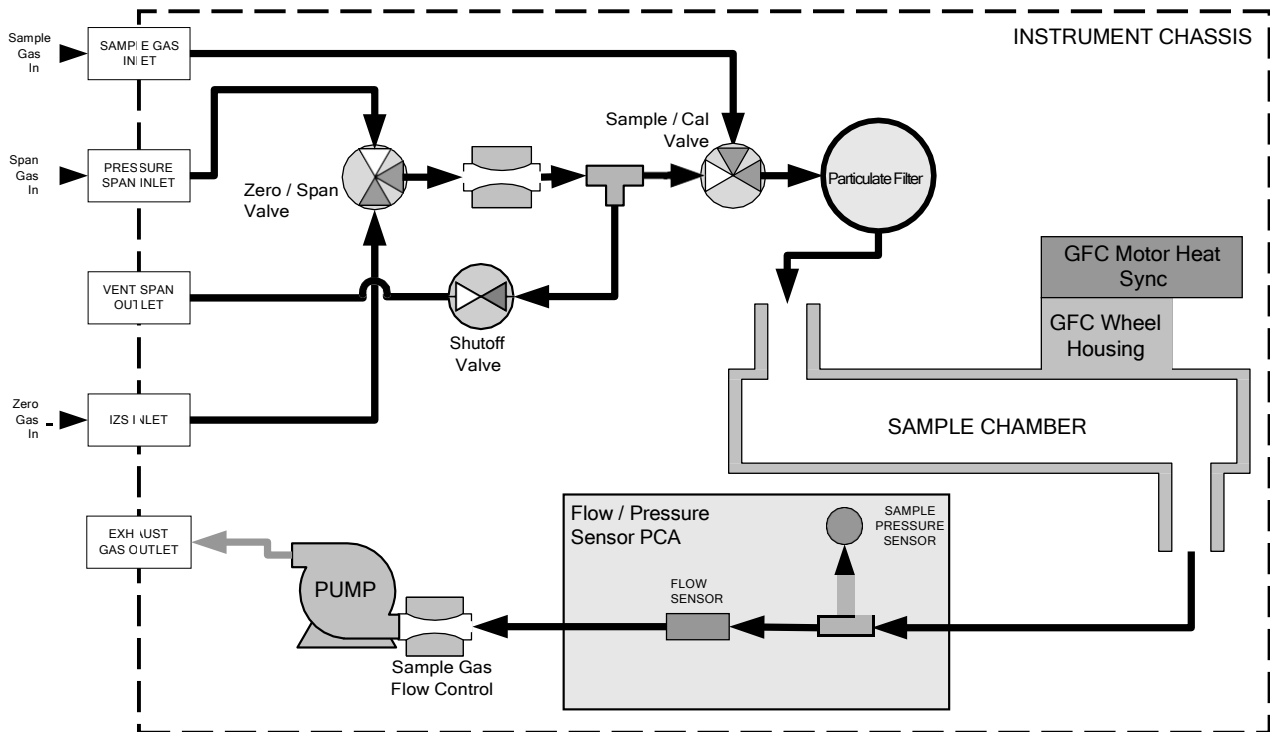


Figure 5-1. Internal Pneumatic Flow, Option Zero/Span with Common Shutoff Valves

6. BASIC OPERATION

6.1. TEST FUNCTIONS

The information found in the Test Functions section of the GFC 7000T Operators Manual is applicable to the GFC 7002T/GFC 7002TU with the following exception(s):

- The following table supersedes Test Functions Defined table of the GFC 7000T Operators Manual

Table 6-1. Test Functions Defined

Parameter	Display Title	Units	Meaning
RANGE -- RANGE1 RANGE2	RANGE	PPB, PPM UGM, MGM	The full-scale limit at which the output range of the analyzer's Analog Outputs is currently set. <ul style="list-style-type: none"> THIS IS NOT the Physical Range of the instrument. See Section 6.6.1 of the GFC 7000T Operators Manual for more information. If DUAL or AUTO Range modes have been selected, two RANGE functions will appear, one for each range.
Stability	STABIL	PPB, PPM UGM, MGM	Standard deviation of N ₂ O concentration readings. Data points are recorded every ten seconds using the last 25 data points.
N ₂ O Measure	MEAS	MV	The demodulated, peak IR detector output during the measure portion of the GFC Wheel cycle.
N ₂ O Reference	REF	MV	The demodulated, peak IR detector output during the reference portion of the GFC wheel cycle.
Measurement / Reference Ratio	MR Ratio	–	The result of N2O MEAS divided by N2O REF based on readings taken during the normal sample measurement portion of the A-REF cycle. This ratio is the primary value used to compute N ₂ O concentration. The value displayed is not linearized.
Sample Pressure	PRES	In-Hg-A	The absolute pressure of the Sample gas as measured by a pressure sensor located inside the sample chamber.
Sample Flow	SAMPLE FL	cm ³ /min	Sample mass flow rate as measured by the flow rate sensor in the sample gas stream,
Bench Temperature	BENCH TEMP	°C	Optical bench temperature.
Wheel Temperature	WHEEL TEMP	°C	GFC wheel temperature.
Box Temperature	BOX TEMP	°C	The temperature inside the analyzer chassis.
Photo-detector Temp. Control Voltage	PHT DRIVE	mV	The drive voltage being supplied to the thermoelectric coolers of the IR photo-detector by the sync/demod Board.
Slope	SLOPE	–	The sensitivity of the instrument as calculated during the last calibration activity. The SLOPE parameter is used to set the span calibration point of the analyzer.
Offset	OFFSET	–	The overall offset of the instrument as calculated during the last calibration activity. The OFFSET parameter is used to set the zero point of the analyzer response.
Test Channel Output	TEST	mV	The raw voltage being output on the analyzer's A4 analog output. Only appears when the test channel is assigned a function.
Current Time	TIME	–	The current time. This is used to create a time stamp on DAS readings, and by the AUTOCAL feature to trigger calibration events.

NOTE

Upper span limit setting for the individual range modes are shared. Resetting the span limit in one mode also resets the span limit for the corresponding range in the other modes as follows:

NOTE

Concentrations displayed in mg/m³ and ug/m³ use 0°C , 760 mmHg for Standard Temperature and Pressure (STP). Consult your local regulations for the STP used by your agency.

NOTE

Once the units of measurement have been changed, the unit **MUST** be recalibrated, as the “expected span values” previously in effect will no longer be valid. Simply entering new expected span values without running the entire calibration routine is not sufficient.

The following equations give approximate conversions between volume/volume units and weight/volume units:

$$\text{N}_2\text{O ppb} \times 2.052 = \text{N}_2\text{O ug/m}^3$$

$$\text{N}_2\text{O ppm} \times 2.052 = \text{N}_2\text{O mg/m}^3$$

6.1.1. SELECTING A TEST CHANNEL FUNCTION FOR OUTPUT A4

This section supplements the corresponding section of the GFC 7000T/U Operators Manual The Test Functions available to be reported on analog output **A4** are:

Table 6-2. Test Channels Functions Available on the GFC 7002T/GFC 7002TU's Analog Output

TEST CHANNEL	DESCRIPTION	ZERO	FULL SCALE
NONE	TEST CHANNEL IS TURNED OFF		
N2O MEAS	The raw output of the optical bench's IR detector during the measure phase of the m/r cycle	0 mV	5000 mV
N2O REF	The raw output of the optical bench's IR detector during the reference phase of the m/r cycle	0 mV	5000 mV
SAMPLE PRESSURE	The pressure of gas in the optical bench's sample chamber	0" Hg	40" Hg-In-A
SAMPLE FLOW	The gas flow rate through the optical bench's sample chamber	0 cm ³ /min	1000 cm ³ /min
BENCH TEMP	The temperature of optical bench's itself	0 C°	70 C°
WHEEL TEMP	The temperature of GFC wheel	0 C°	70 C°
BOX TEMP	The temperature of the circulating air inside the convection oven section of the GFC 7002T/GFC 7002TU's interior.	0 C°	70 C°
PHT DRIVE	The drive voltage being supplied to the thermoelectric coolers of the IR photo-detector by the sync/demod Board.	0 mV	5000 mV

Once a function is selected, the instrument not only begins to output a signal on the analog output, but also adds **TEST** to the list of Test Functions viewable via the Front Panel Display.

7. ADVANCED FEATURES

The information found in the Advanced Features section of the GFC 7000T/U Operators Manual is applicable to the GFC 7002T and GFC 7002TU we recommend that you read that section before continuing.

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8. REMOTE OPERATION

The information found in the Remote Operation section of the GFC 7000T Operators Manual is applicable to the GFC 7002T and GFC 7002TU we recommend that you read that section before continuing.

8.1.1. HESSEN PROTOCOL

The information found in the Hessen Protocol Gas ID section of the GFC 7000T Operators Manual is applicable to the GFC 7002T/GFC 7002TU with the following exception(s):

- There is only one default gas type programmed into the GFC 7002T/GFC 7002TU: the Hessen Gas ID for N₂O is 320.

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9. CALIBRATION PROCEDURES

Calibration of the GFC 7002T/GFC 7002TU should be performed according to the procedures described in the Calibration section of the GFC 7000T manual with the following notes and exceptions:

- Delivering span and zero gases for the higher resolution the GFC 7002T/GFC 7002TU can be difficult. Attention must be paid to the quality of the gases, the level of contaminants in the gases as well as the history and conditioning of the gas delivery components.
- The analyzer must be continually operating with an adequate flow of sample gas, for 2 hours prior to performing a calibration (12 hours is recommended for the initial calibration).
 - DO NOT calibrate the analyzer if it has been turned off or if no sample gas has been flow through it within the last 2 hours.
- After this stabilization period is complete and just prior to performing the initial calibration, force the instrument to perform an auto-reference measurement.

REQUIRED EQUIPMENT, SUPPLIES AND EXPENDABLES

- Gas lines to and from the analyzer should be PTFE or FEP Teflon, glass, or stainless steel only.
- Zero-air source which must be synthetic air, ultra-zero air or nitrogen (N₂). A zero air generator like a T-API M701 should not be used.
- Span gas source (defined in the Calibration section's Span Gas subsection of the GFC 7000T/U Operators Manual; but use N₂O instead of CO).
- A recording device such as a strip-chart recorder and/or data logger (optional). Data recording device should be capable of bi-polar operation so that negative readings can be recorded.
- For electronic documentation, the internal data acquisition system can be used.

NOTE

If any problems occur while performing the following calibration procedures, refer to Troubleshooting and Service section the GFC 7000T/U manual for troubleshooting tips.

MANUAL CALIBRATION

The information found in the Manual Calibration section of the GFC 7000T Operators Manual is applicable to the GFC 7002T/GFC 7002TU with the following exception:

- Set the display to show the **N2OSTB** test rather than the **CO STB** test function mentioned in the GFC 7000T/U operator's manual.

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10. EPA PROTOCOL CALIBRATION

The information found in the EPA Protocol Calibration section of the GFC 7000T Operators Manual does not apply to the GFC 7002T/GFC 7002TU as there are no USEPA reference methods for the measurement of N₂O.

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11. PRINCIPLES OF OPERATION

The information found in the Principles of Operation section of the GFC 7000T Operators Manual is applicable to the GFC 7002T and GFC 7002TU (we recommend that you read this section before continuing) with the following exception:

The wavelength of operation is 4.58 μ m versus 4.7 μ m for the GFC 7000T/U.

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12. MAINTENANCE SCHEDULE

The information found in the Maintenance section of the GFC 7000T Operators Manual is applicable to the GFC 7002T/GFC 7002TU with the following exception(s):

- Since a catalytic zero scrubber is not available for the GFC 7002T or GFC 7002TU there is no replacement schedule for the scrubber material.
- The Test record below should be used in place of the one included with the GFC 7000T manual.

Table 12-1. GFC 7002T/GFC 7002TU Test Function Record

FUNCTION	OPERATING MODE	DATE RECORDED					
STABILITY	ZERO CAL						
N2O MEAS	ZERO CAL						
N2O REF	ZERO CAL						
MR RATIO	ZERO CAL						
	SPAN CAL						
PRES	SAMPLE						
PHT DRIVE	SAMPLE AFTER WARM-UP						
SLOPE	SPAN CAL						
OFFSET	ZERO CAL						
BOX TEMP	SAMPLE						

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13. TROUBLESHOOTING & SERVICE

The information found in the Troubleshooting and Service section of the GFC 7000T Operators Manual is applicable to the GFC 7002T and GFC 7002TU. It is recommended that you read that section before continuing.

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