

MODEL GFC7000EU
CO₂ ANALYZER
(Addendum to GFC7000E Manual PN 04584)

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OVERVIEW

The model GFC7000EU is a close derivative of the Model GFC7000E CO Analyzer. The optical bench is longer (14 m), making the instrument more sensitive at low CO₂ levels. The instrument has a user selectable full scale range of 0-100 PPB to 0-100 PPM of CO₂.

The instrument does not come equipped with a sample flow rate sensor. Hence, disregard any reference to the flow sensor in the users manual.

Because the GFC7000EU is a close derivative of GFC7000E, the Model GFC7000E Instruction Manual continues to be valid as the reference manual covering the details of the instrument's components. Only the sections of the manual that are different between the GFC7000E and a GFC7000EU are listed in this addendum.

2. SPECIFICATIONS, AGENCY APPROVALS, AND WARRANTY

2.1 Specifications

Table: Model GFC7000EU Specifications

Ranges	User selectable to any full scale range from 0-100 ppb to 0-100 ppm
Measurement Units	ppb, ppm, µg/m ³ , mg/m ³ (user selectable)
Zero Noise	≤ 0.01 ppm RMS ⁽¹⁾
Span Noise	< 0.5% of reading RMS over 5 ppm ^{(1) (3)}
Lower Detectable Limit	0.02 ppm ⁽¹⁾
Zero Drift (24 hours)	< 10 ppb ⁽²⁾
Zero Drift (7 days)	< 20 ppb ⁽²⁾
Span Drift (24 hours)	< 0.5% of reading ^{(2) (4)}
Span Drift (7 days)	< 1% of reading ^{(2) (4)}
Linearity	Better than 1% of Range ⁽⁵⁾
Precision	0.5% reading ^{(1) (5)}
Lag Time	<10 sec ⁽¹⁾
Rise/Fall Time	<60 sec to 95% ⁽¹⁾
Sample Flow Rate	800 scc/min. ± 10%
Temperature Range	5 - 40°C operating

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Humidity Range	0-95% RH, Non-Condensing
Temp Coefficient	< 0.05 % of reading per °C (5 ppb/°C minimum) ⁽⁶⁾
Voltage Coefficient	< 0.05 % of reading per V
Dimensions (HxWxD)	7" x 17" x 23.5" (178 mm x 432 mm x 597 mm)
Weight	50 lb (22.7 kg)
AC Power	100V 50/60 Hz (3.25A), 115 V 60 Hz (3.0A), 220 – 240 V 50/60 Hz (2.5A)
Environmental Conditions	Installation Category (Over voltage Category) II Pollution Degree 2
Analog Outputs	Three (3) Outputs
Analog Output Ranges	100 mV, 1 V, 5 V, 10 V, 2-20 or 4-20 mA isolated current loop. All Ranges with 5% Under/Over Range
Analog Output Resolution	1 part in 4096 of selected full-scale voltage
Status Outputs	8 Status outputs from opto-isolators
Control Inputs	6 Control Inputs, 2 defined, 4 spare
I/O	One (1) RS-232; One (1) RS-485/RS-232/Ethernet Baud Rate : 300 - 115200
Certifications	CE: EN61010-1:90 + A1:92 + A2:95, EN61326 - Class A

⁽¹⁾ As defined by the USEPA

⁽²⁾ At constant temperature and voltage

⁽³⁾ Or 0.2 ppm, whichever is greater

⁽⁴⁾ Or 0.1 ppm, whichever is greater

⁽⁵⁾ Above 10 ppm range, otherwise 0.2 ppm for lower ranges

3.1.2. Pneumatic Connections

This section is similar to the one in the manual, with the following exception. The extra port labeled "From Purge" is the exhaust port for the for the purge gas. The gas needs to exhausted with a gas line not more than 10 meters long.

In addition, the GFC7000EU uses a different sample pressure sensor than the GFC7000E. The GFC7000EU pressure sensor is rated for oxygen service. The part number is listed in the appendix – spare parts.

6.13.1.3 Relay alarm outputs

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There are 4 relay alarm outputs (AL1-AL4) on the rear panel. AL1 is for system okay, AL2 is for concentration limit 1 exceeded and AL3 is for concentration limit 2 exceeded. The relay alarm output AL1 is enabled all the time, whereas the AL2 and AL3 can be enabled/disabled by going into the diagnostics menu (with 929 password), then factory options, then turning conc. Alarm Relays ON or OFF. When the concentration alarm relays are enabled, concentration alarms status is no longer available through the “Status output” pins. So, either the alarm relays or the status bits could be used to monitor the concentration alarms but not both at the same time. The default factory setting is to enable the concentration alarm relays. The AL1 relay is energized when the system is okay and de-energized when the system has a fault. The AL2 and AL3 relays energize when the corresponding concentration limits are exceeded.

11.1.1. Interpreting WARNING Messages

The most common and/or serious instrument failures will result in a warning message being displayed on the front panel. The table below lists warning messages, along with their meaning and recommended corrective action.

It should be noted that if more than two or three warning messages occur at the same time, it is often an indication that some fundamental analyzer sub-system (power supply, Relay Board, Motherboard) has failed rather than indication of the of the specific failures referenced by the warnings. In this case, it is recommended that proper operation of power supplies, the Relay Board, and the A/D Board be confirmed before addressing the specific warning messages.

The analyzer will alert the user that a Warning Message is active by displaying the keypad label **MSG** on the Front Panel. In this case the Front panel display will look something like the following:

SAMPLE	RANGE=50.00 PPM	CO = 00.00
<TST TST>	CAL	MSG CLR SETUP

The analyzer will also alert the user via the Serial I/O COM port(s) and cause the FAULT LED on the Front panel to blink.

To View or Clear the various warning messages press:

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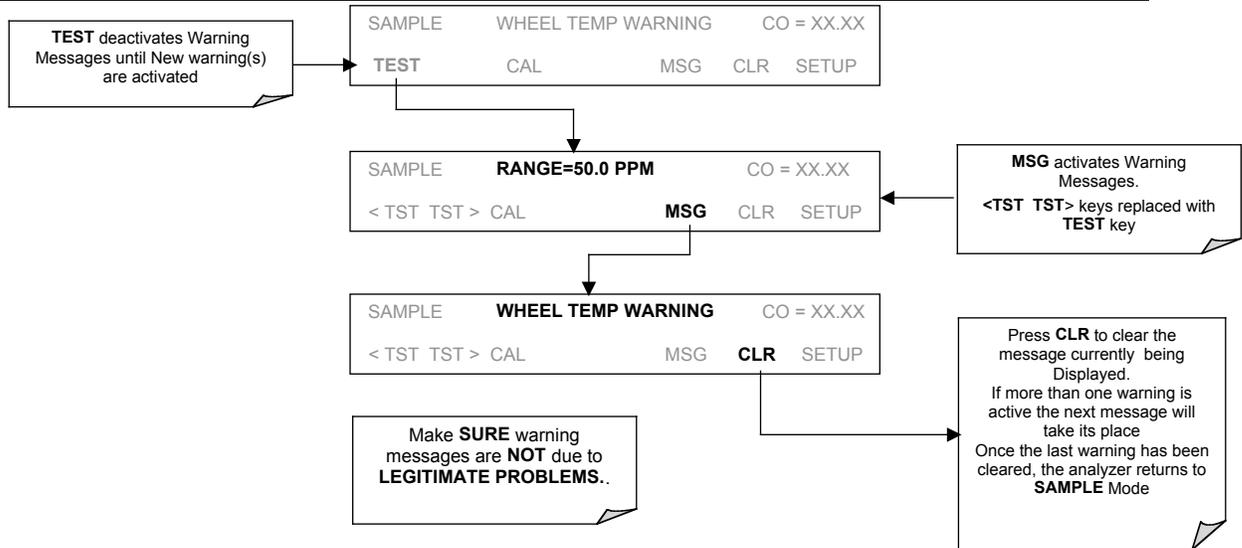


Figure: Viewing and Clearing Warning Messages

NOTE: A failure of the analyzer’s CPU or Mother Board can result in any or ALL of the following messages.

Table: Warning Messages

Warning Message	Fault Condition	Possible Causes
BENCH TEMP WARNING	The optical bench temp is controlled at 48 ± 5 °C.	<ul style="list-style-type: none"> ▪ Bench Heater ▪ Bench Temperature Sensor ▪ Relay controlling the Bench Heater ▪ Entire Relay Board ▪ I²C Bus
BOX TEMP WARNING	Box Temp is < 5 °C or > 48 °C.	Box Temperature typically runs ~7°C warmer than ambient temperature. <ul style="list-style-type: none"> ▪ Poor/blocked ventilation to the analyzer. ▪ Stopped Exhaust-Fan ▪ Ambient Temperature outside of specified range
CANNOT DYN SPAN	Dynamic Span operation failed	<ul style="list-style-type: none"> ▪ Measured concentration value is too high or low. ▪ Concentration Slope value to high or too low
CANNOT DYN ZERO	Dynamic Zero operation failed	<ul style="list-style-type: none"> ▪ Measured concentration value is too high. ▪ Concentration Offset value to high
CONFIG INITIALIZED	Configuration and Calibration data reset to original Factory state.	<ul style="list-style-type: none"> ▪ Failed Disk on Chip ▪ User erased data
DATA INITIALIZED	Data Storage in iDAS was erased	<ul style="list-style-type: none"> ▪ Failed Disk on Chip ▪ User cleared data

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Warning Message	Fault Condition	Possible Causes
FRONT PANEL WARN	The CPU is unable to Communicate with the Front Panel Display /Keyboard	<i>WARNING</i> only appears on Serial I/O COM Port(s) Front Panel Display will be frozen, blank or will not respond. <ul style="list-style-type: none"> Failed Keyboard I²C Bus failure Loose Connector/Wiring
PHOTO TEMP WARNING	PHT DRIVE is >4750 mVDC or <250 MVDC	<ul style="list-style-type: none"> Failed IR Photo-Detector Failed Sync/Demod Board IR Photo-Detector improperly attached to the Sample Chamber BENCH TEMP too high.
REAR BOARD NOT DET	Mother Board not detected on power up.	<i>WARNING</i> only appears on Serial I/O COM Port(s) Front Panel Display will be frozen, blank or will not respond. <ul style="list-style-type: none"> Massive Failure of Mother Board
RELAY BOARD WARN	The CPU cannot communicate with the Relay Board.	<ul style="list-style-type: none"> I²C Bus failure Failed Relay Board Loose connectors/wiring
PURGE PRESS WARN	Purge Pressure outside of warning limits specified by PURGE_PRESS_SET variable	<ul style="list-style-type: none"> Loss of purge flow Failed purge pressure sensor Purge pressure regulator not set properly
SAMPLE PRES WARN	Sample Pressure is <15 in-Hg or > 35 in-Hg Normally 29.92 in-Hg at sea level decreasing at 1 in-Hg per 1000 ft of altitude (with no flow – pump disconnected).	<p>If Sample Pressure is < 15 in-HG:</p> <ul style="list-style-type: none"> Blocked Particulate Filter Blocked Sample Inlet/Gas Line Failed Pressure Sensor/circuitry <p>If Sample Pressure is > 35 in-HG:</p> <ul style="list-style-type: none"> Blocked Vent line on pressurized Sample/Zero/Span gas supply Bad Pressure Sensor/circuitry Failed Permapure dryer
SAMPLE TEMP WARN	Sample temperature is < 10°C or > 100°C.	<ul style="list-style-type: none"> Ambient Temperature outside of specified range Failed Bench Heater Failed Bench Temperature Sensor Relay controlling the Bench Heater Failed Relay Board I²C Bus
SOURCE WARNING	Occurs when CO Ref is <1250 mVDC or >4950 mVDC. Either of these conditions will result in an invalid M/R ratio.	<ul style="list-style-type: none"> GFC Wheel stopped Failed Sync/Demod Board <p>If Status LED's on the Sync/Demod Board ARE flashing the cause is most likely a failed:</p> <ul style="list-style-type: none"> IR Source Relay Board I²C Bus IR Photo-Detector
SYNC WARNING	Phase Lock Loop (PLL) has lost lock	<ul style="list-style-type: none"> GFC Wheel stopped GFC Wheel rotation very slow/dragging

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Warning Message	Fault Condition	Possible Causes
	on wheel rotation.	<ul style="list-style-type: none"> ▪ Failed Sync/Demod Board If Status LED's on the Sync/Demod Board ARE flashing the cause is most likely an a problem with the analyzer's main power: <ul style="list-style-type: none"> ▪ Intermittent loss of the power supply too short to cause a SYSTEM RESET warning; ▪ Frequency problem with the AC Mains.
SYSTEM RESET	The computer has rebooted.	This message occurs at power on. If it is confirmed that power has not been interrupted: <ul style="list-style-type: none"> ▪ Failed +5 VDC power, ▪ Fatal Error caused software to restart ▪ Loose connector/wiring
WHEEL TEMP WARNING	The filter wheel temperature is controlled at 68 ± 5 °C	<ul style="list-style-type: none"> ▪ Blocked Cooling Vents below GFC Assembly ▪ Analyzer's Top Cover removed ▪ Wheel Heater ▪ Wheel Temperature Sensor ▪ Relay controlling the Wheel Heater ▪ Entire Relay Board ▪ I²C Bus

APPENDIX B – GFC7000EU Spare Parts List

NOTE

Use of replacement parts other than those supplied by API may result in non-compliance with European standard EN 61010-1.

Table B-1: GFC7000EU Individual Spare Parts List

Part Number	Description
000941000	CD, Orifice, 13 mil
003291500	Assy, Thermistor, Bench Wheel, M300E
006110200	Assembly, Motor Wheel Heater, 50W 120V
009550500	Source Assembly (with Adapter)
009600400	M300E 47 mm Filter Expendables Kit - KNF Pump Model

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	#N05ATI
009690000	Filter, TFE, 47 mm 5 um, Qty 100
009690100	Filter, TFE, 47 mm 5 um, Qty 25
009820200	Assy, Motor, Synchronous, 115V/60HZ, "E"
010790000	Input Mirror
010800000	Output Mirror
016290000	Window, Sample Filter, 47 mm
016910000	Akit, Catalyst, CO/CO2 Converter (1 OZ)
019340000	Sample Thermistor M400 (S/N >099) or M401 (S/N>0573)
024710000	Tubing: 6', 1/8"CLR
024720000	Tubing: 6', 1/8" BLK
024750000	Tubing: 6', 1/4" TYGON
033520000	Objective Mirror, M300E+B17
033560000	Field Mirror, 32 Pass, M300E
035950100	Disk-On-Chip with Software
036110400	Sync Demodulator Board
036310000	4-20 mA Output PCA
037250000	Assembly, Heater, Optical Bench
039750000	Keyboard
040010000	ASSY, Fan Rear Panel, E Series
040030300	PCA, Press Sensors w/SW49
035280000	CO ₂ Scrubber Assembly
040690200	Mother Board, relay alarm outputs
040880000	Wheel Position Sensor Assembly
041350000	Relay Board
041710000	CPU
045840000	Operators Manual for M360E
043940000	Ethernet Interface PCA
046730000	Internal Multi-Drop PCA
FL0000001	Sintered Filter (002-024900)
HW0000090	Spring, Flow Control
HW0000036	TFE Thread Tape (48 FT)
HW0000101	Shockmount, Pump
SW0000034	Replacement, Optical Switch , M300E
OP0000009	Window, Sapphire

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OR0000001	O-Ring, Flow Control
OR0000058	O-Ring, Sample Filter, 47 mm, 2-228V
OR0000034	O-Ring, Input/Output Mirror/Detector
OR0000039	O-Ring, Window
OR0000041	O-Ring, Field and Objective Mirror
043590100	Pump, 115V 50/60 Hz
PU0000022	Pump Rebuild Kit, KNF Model #N05ATI
PS0000025	Power Supply, +12V
PS0000011	Power Supply, +5/+ - 15V
042680000	Solenoid, Stainless Steel, 3-Way, 12V
042690000	Solenoid, Stainless Steel, 2-Way, 12V
039060000	Assy, Pressure Transducer, M360U/GFC7000

Table B-2: GFC7000E Expendables List

Part Number	Description	Qty
009600400	M300E Expendables Kit Includes:	
	This kit contains the following items	
009690100	Akit, TFE Fltr. Elements, 47mm, 5um (25)	1
FL0000001	Sintered Filter (002-024900)	1
HW0000020	Spring, Flow Control	1
OR0000001	O-Ring, Flow Control	2
PU0000022	Pump Rebuild Kit, KNF Model #NO5ATI	1
Note01-23	Service Note, How to rebuild KNF pump	

Table B-3: GFC70000E Spares Kit for 1 Unit

Part Number	Description	Qty
040360100	M300E Spares Kit for 1 unit:	
	This kit contains the following items	
009550500	Assy, Source, GFC7000E S/N >65	1
040010000	Assy, Fan Rear Panel, E series	1
RL0000015	Relay, DPDT, Gordos Preferred	1