



**TELEDYNE**  
ADVANCED POLLUTION INSTRUMENTATION  
A Teledyne Technologies Company

**ADDENDUM TO M300E/EM MANUAL P/N 04288**

***MODELS 320E and 320EU***  
***N<sub>2</sub>O ANALYZERS***

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# SAFETY MESSAGES

Your safety and the safety of others are very important. We have provided many important safety messages in 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 M320E/EU Analyzer. The definition of these symbols is described below:

	<b>GENERAL SAFETY HAZARD:</b> Refer to the instructions for details on the specific hazard.
	<b>CAUTION:</b> Hot Surface Warning.
	<b>CAUTION:</b> Electrical Shock Hazard.
	<b>TECHNICIAN SYMBOL:</b> All operations marked with this symbol are to be performed by qualified maintenance personnel only.

## CAUTION

The Model 320E/EU, N<sub>2</sub>O Analyzer with Auto-Reference, should only be used for the purpose and in the manner described in this manual. If you use the M320E/EU in a manner other than that for which it was intended, unpredictable behavior could ensue with possible hazardous consequences.

## NOTE

Technical Assistance regarding the use and maintenance of the M320E/EU or any other Teledyne Instruments product can be obtained by:

Contacting Teledyne Instruments' Customer Service Department at 800-324-5190

or

Via the internet at <http://www.teledyne-api.com/>

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## **USER NOTES:**

# 1. INTRODUCTION

The M320E and M320EU are Gas Filter Correlation (GFC) analyzers that are designed to measure, respectively, low level and trace level nitrous oxide (N<sub>2</sub>O). The primary difference between the models is their maximum operating range; 1000 ppm for the M320E and 200 ppm for the M320EU. The M320E and M320EU are designed to be used for monitoring background levels of N<sub>2</sub>O in the atmosphere, byproducts of combustion products and contamination of bottle gases.

This addendum is a supplement to the M300E/EM manual (P/N 04288) to allow a user to setup, operate, calibrate, troubleshoot and repair a M320E and M320EU nitrous oxide (N<sub>2</sub>O) analyzers. In almost all ways (electrical, electronic, mechanical, etc.) the M320E is identical to the M300EM and the M320EM is identical to the M300E. Therefore, most of the basic set up information, operating instructions as well as maintenance, troubleshooting and repair methods are the same for the M320E/EU and can be found in the M300E/EM manual (P/N 04288). A simple way to remember this relationship is:

**M320E = M300EM      M320EU = M300E**

When using the M300E/EM manual the user should substitute the words nitrous oxide for carbon monoxide and the chemical abbreviation N<sub>2</sub>O for CO:

**Carbon Monoxide → Nitrous Oxide      CO → N<sub>2</sub>O**

There are six major differences between the M320E/EU and their companion models:

- **Operating wavelength:** A different photo detector is used that closely matches the peak absorption wavelength of N<sub>2</sub>O.
- **Gas Filter Correlation Filter (GFC) wheel:** The GFC wheel is filled with N<sub>2</sub>O rather than CO to correlate properly with N<sub>2</sub>O.
- **Software:** Display text strings, variable names and variable values reflect the difference in gas name and physical characteristic. Wherever "CO" is displayed on the M300E/EM "N<sub>2</sub>O" will be displayed on the M320E/EU.
- **Calibration Methods:** There are no specialized USEPA calibration methods since these methods currently do not exist.
- **Calibration Gasses:** Since there are no readily available low cost N<sub>2</sub>O scrubbers and traditional zero air generators like the TAPI model 701 do not remove N<sub>2</sub>O, zero gas must be either N<sub>2</sub> or synthetic air - especially for the M320EU.
- **Calibration Valve Options:** Options 51B and 51C Are not available for the M320E or M320EU since there are no convenient and compact N<sub>2</sub>O scrubbers.

## 1.A. REFERENCE NUMBERING CONVENTION

Unless otherwise specified, chapter, section, figure and table reference numbers referred to within this text are relative to this document.

- EXAMPLE: "Table 2-B" refers to the table, within this document.
- Additionally, in the electronic version(s) of this manual references internal to this document will be active links to that section, figure or table.

References to chapters, sections, figures and tables in the original document will be labeled as such:

- EXAMPLE: "Figure 6-1 of the M300E/EM Operators Manual (P/N 04288)".

**NOTE**

The information contained in this addendum is relevant to M320E/EU analyzers running: **SOFTWARE REVISION L.8**. Some or all of the information may not be applicable to earlier or later revisions of software.

The software revision your analyzer is running is displayed in the upper left-hand corner of the display any time the instrument is in **SETUP** mode.

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**USER NOTES:**



## 2. SPECIFICATIONS, APPROVALS AND WARRANTY

### 2.A. SPECIFICATIONS

**Table 2-A: M320E/EU Basic Unit Specifications**

Parameter	Model 320E	Model 320EU
Ranges	User selectable to any full scale range from 0-1 ppm to 0-1000 ppm	User selectable to any full scale range from 0-200 ppb to 0-200 ppm
Measurement Units	ppb, ppm, $\mu\text{g}/\text{m}^3$ , $\text{mg}/\text{m}^3$ (user selectable)	
Zero Noise <sup>1,2</sup>	$\leq 20$ ppb RMS	$\leq 5$ ppb RMS
Span Noise <sup>1,2,3</sup>	$< 0.5\%$ of reading RMS over 8 ppm	$< 0.5\%$ of reading RMS over 2 ppm
Lower Detectable Limit <sup>1,2</sup>	$< 40$ ppb	$< 10$ ppb
Zero Drift (24 hours) <sup>2</sup>	$< 100$ ppb	$< 25$ ppb
Zero Drift (7 days) <sup>2</sup>	$< 200$ ppb	$< 50$ ppb
Span Drift (24 hours) <sup>2,4</sup>	$< 0.5\%$ of reading	$< 0.5\%$ of reading
Span Drift (7 days) <sup>2,4</sup>	$< 1\%$ of reading	$< 1\%$ of reading
Linearity <sup>6</sup>	Better than 1% of Range	
Precision <sup>1,5</sup>	0.5% reading	
Lag Tim <sup>1</sup>	$< 10$ sec	
Rise/Fall Time <sup>1</sup>	$< 60$ sec to 95%	
Sample Flow Rate	800 $\text{cm}^3/\text{min}$ . $\pm 20\%$ (some instruments 1600 $\text{cm}^3/\text{min}$ . $\pm 20\%$ )	
Temperature Range	5 - 40°C operating	
Humidity Range	0-95% RH, Non-Condensing	
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, Four (4) with an optional O <sub>2</sub> or CO <sub>2</sub> sensor	
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 (current loop outputs available only on outputs 1 through 3)	
Analog Output Resolution	1 part in 4096 of selected full-scale voltage	
Status Outputs	Eight (8) Status outputs from opto-isolators	
Control Inputs	Six (6) Control Inputs, 2 defined, 4 spare	
Optional Alarm Outputs	Four (4) SPDT, 3A/250VAC Relays	
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	
<sup>1</sup> As defined by the USEPA	<sup>4</sup> Or 10 ppb, whichever is greater	
<sup>2</sup> At constant temperature and sample pressure	<sup>5</sup> Or LDL whichever is greater	
<sup>3</sup> Or 20 ppb, whichever is greater	<sup>6</sup> For values greater than twice the LDL	

## **2.B. EPA EQUIVALENCY DESIGNATION**

The US EPA does not currently have a reference method for the measurement of nitrous oxide so therefore neither the M320E nor the M320EU are designated as reference or equivalent methods. Please note that due to this section 10 of the model 300E/EM manual does not apply.

## **2.C. CE MARK COMPLIANCE**

See Section 2.4 of the M300E/EM manual (P/N 04288).

## **2.D. WARRANTY**

See Section 2.5 of the M300E/EM manual (P/N 04288).

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## **USER NOTES:**

### 3. GETTING STARTED

#### 3.A. UNPACKING THE M320E/EU

Unpack the M320E/EU as per the directions in Section 3.2 of the M300E/EM manual (P/N 04288), with the following difference(s):

- The *Final Test and Validation Data Sheet* are specific to the M320E or M320EU and have the following part numbers: 06453 for the M320E and 05989 for the M320EU

#### 3.B. INITIAL OPERATION OF THE M320E/EU

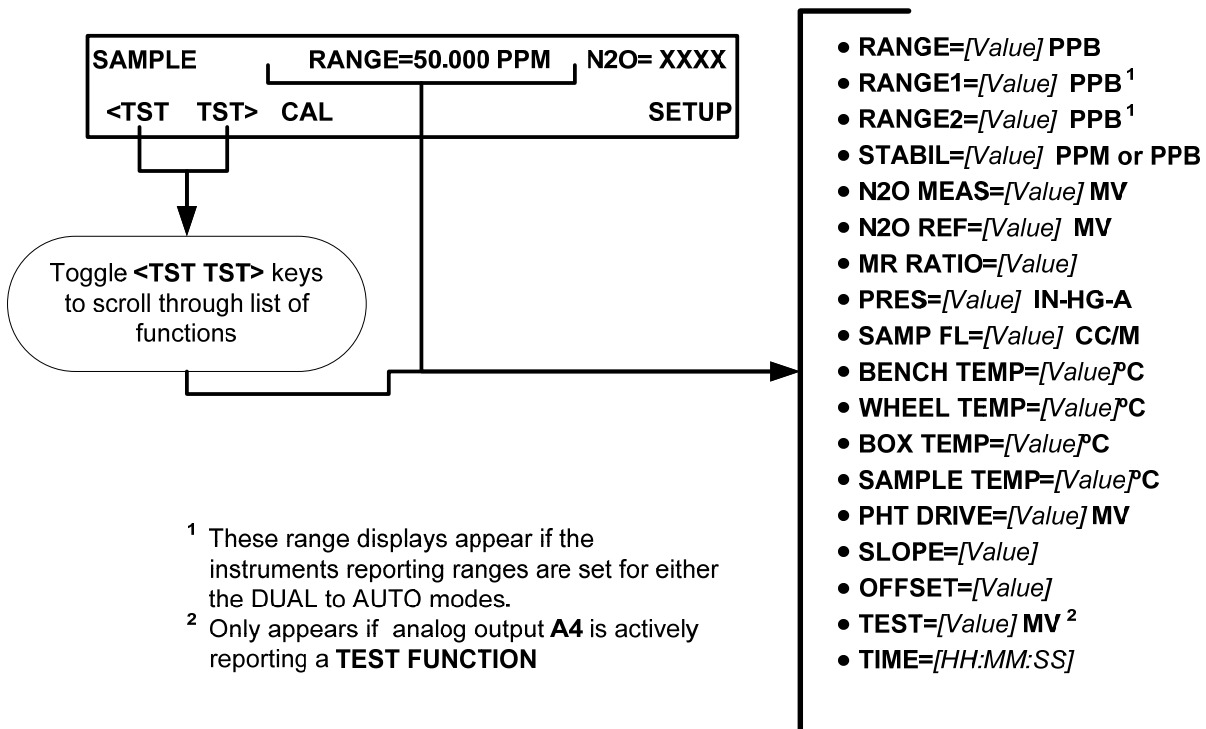
#### 3.C. STARTUP AND WARM UP OF THE M320E/EU

The process for starting and warming up the M320E/EU is identical to that described in Sections 3.5.1 and 3.5.2 of the M300E/EM Operators Manual (P/N 04288).

#### 3.D. FUNCTIONAL CHECK

The information found in Section 3.5.4 of the M300E/EM Operators Manual (P/N 04288) regarding performing an initial functional check of the analyzer is applicable to the M320E/EU with the following exception(s).

The Test functions available from the front panel of the M320E or M320EU are:



## 3.E. INITIAL CALIBRATION

### 3.E.1. CALIBRATION GASES

The information found in Section 3.4.1 of the M300E/EM Operators Manual (P/N 04288) is applicable to the M320E/EU with the following exceptions:

#### ZERO GAS

Zero gas is a gas that 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<sub>2</sub>O and water vapor. For the M320E/EU this gas **MUST** be synthetic air, ultra zero air or nitrogen (N<sub>2</sub>).

#### NOTE

**Zero air created by a Zero Air Generator like the T-API model 701 should not be used since the M701 does not scrub N<sub>2</sub>O. Likewise since there are no effective and convenient catalytic, absorptive or reactive scrubbers for N<sub>2</sub>O, T-API does not offer a zero scrubber cartridge.**

#### SPAN GAS

A gas 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<sub>2</sub>O measurements made with the M320E/EU analyzer, it is recommended that you use a span gas with a N<sub>2</sub>O concentration equal to 80% of the measurement range for your application.

EXAMPLE: If the application is to measure between 0 ppm and 500 ppb, an appropriate span gas concentration would be 400 ppb N<sub>2</sub>O in N<sub>2</sub>.

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<sub>2</sub>O gas of higher concentration in conjunction with a gas dilution calibrator such as a Teledyne Instruments Model 700E. This type of calibrator precisely mixes a high concentration gas from with zero gas (both supplied externally as either synthetic air or N<sub>2</sub>) 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<sub>2</sub>O gasses 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.E.2. PNEUMATIC CONNECTIONS TO M320E/EU BASIC CONFIGURATION:

The information found in Section 3.4 of the M300E/EM Operators Manual (P/N 04288) is applicable to the M320E/EU with the following changes:

- Synthetic air, ultra-zero air or N<sub>2</sub> should be used as the zero gas rather than a Zero Gas Generator like the T-API M701. The figures below document this difference.

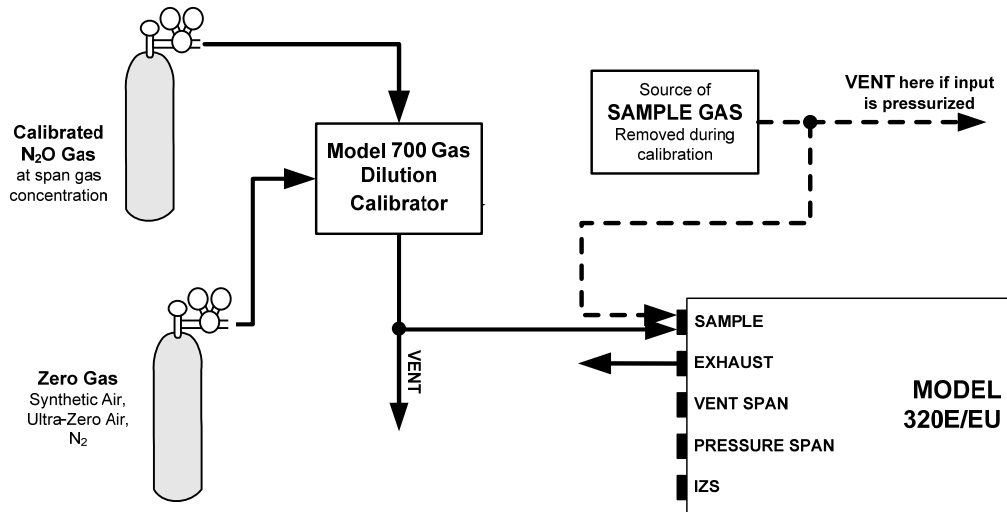


Figure 3-A: Pneumatic Connections—Basic Configuration—Using Gas Dilution Calibrator

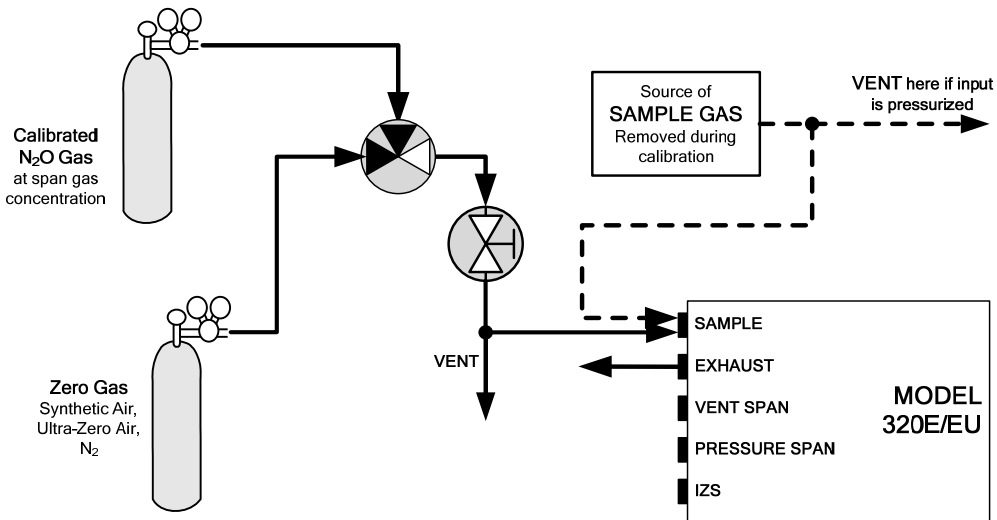


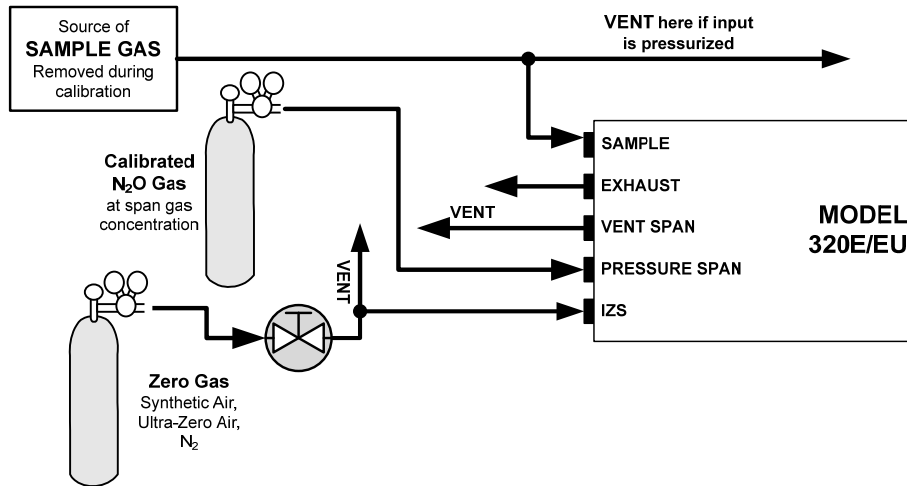
Figure 3-B: Pneumatic Connections—Basic Configuration—Using Bottled Span Gas

### 3.E.3. PNEUMATIC CONNECTIONS TO M320E/EU WITH INTERNAL VALVE OPTIONS INSTALLED

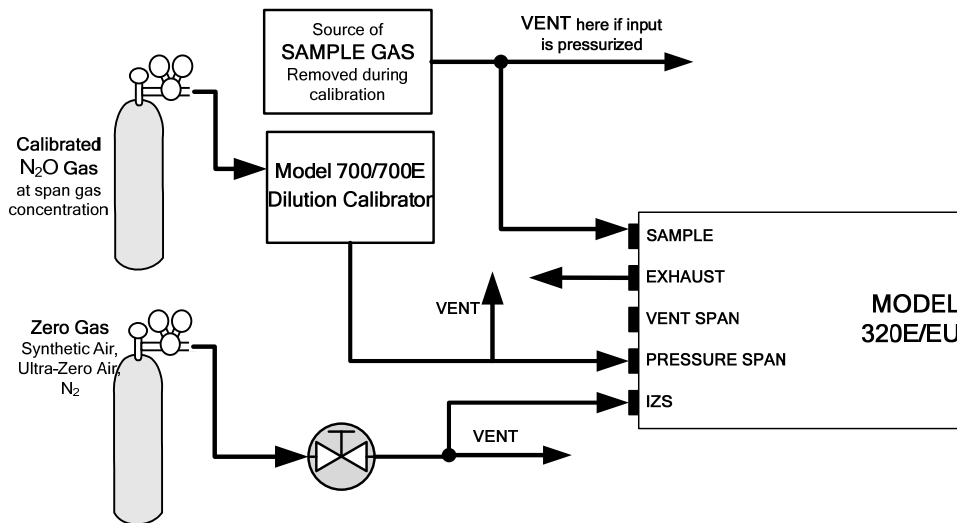
The following figures show the pneumatic set up for M320E/EU analyzers with one of the three available internal valve options installed. This differs from the M300E/EM in the following ways:

- Option 51B (IZS Valve without Shutoff Valve) and Option 51C (IZS with Shutoff Valve) are not available for the M320E or M320EU.
- An additional option is available; Option 50G (Z/S Valve with Common Shutoff Valve for Pressurized Zero and Span).

- See below. For more information on these options see Chapter 5.



**Figure 3-C: Pneumatic Connections – Option 50A: Z/S Valve with Shutoff Valve for Pressurized Span and Atmospheric Zero**



**Figure 3-D: Pneumatic Connections – Option 50B: Z/S without Shutoff Valve**

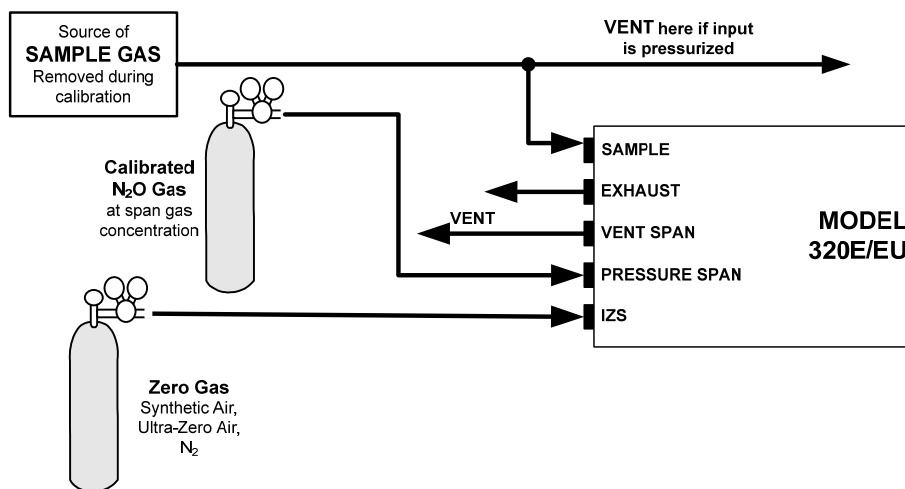


Figure 3-E: Pneumatic Connections – Option 50G: Z/S Valve with Common Shutoff Valve for Pressurized Zero and Span

### 3.E.4. PNEUMATIC CONNECTIONS TO M320E/EU 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 Instruments M700 or M700E. This type of calibrator precisely mixes span gas and zero air to produce any concentration level 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.

For example, Figure 3-A and Figure 3-D depict the pneumatic set up in this sort of application of a M320E/EU N<sub>2</sub>O Analyzers with zero/span valve option 50B installed.

# USER NOTES:



## **4. FREQUENTLY ASKED QUESTIONS & GLOSSARY**

The information found in Chapter 4 of the M300E/EM Operators Manual (P/N 04288) is applicable to the M320E/EU.

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**USER NOTES:**

## USER NOTES:

## 5. OPTIONAL HARDWARE AND SOFTWARE

In general the same options are available for the M320E and M320EU as are available for the M300E and M300EM with the following exception:

- Valve options 51B and 51C are not available for the 320E/EU while an additional option, 50G, is available for the M320E/EU. Please see the following section for details.

### 5.A. CALIBRATION VALVE OPTIONS FOR THE M320E/EU

There are only three calibration valve options for the M320E and M320EU because a catalytic zero scrubber is not available. M300E/EM Operators Manual (P/N 04288) with the following exception(s).

- Option 51B (IZS Valve without Shutoff Valve) and Option 51 (IZS with Shutoff Valve) are not available for the M320E or M320EU.
- An additional option is available; Option 50G (Z/S Valve with Common Shutoff Valve for Pressurized Zero and Span).

**Table 5-A: M320E/EU Available Valve Options**

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

For descriptions of options 50A and 50B and their use please see Chapter 5 of the M300E/EM Operators Manual (P/N 04288) but noting that wherever a zero air generator like the T-API 701 is shown synthetic air, ultra-zero air, or N<sub>2</sub> should be substituted. For a description of option 50G please see Section 5.A.1.

For assistance with ordering these options, please contact the Sales department of Teledyne – Advanced Pollution Instruments at:

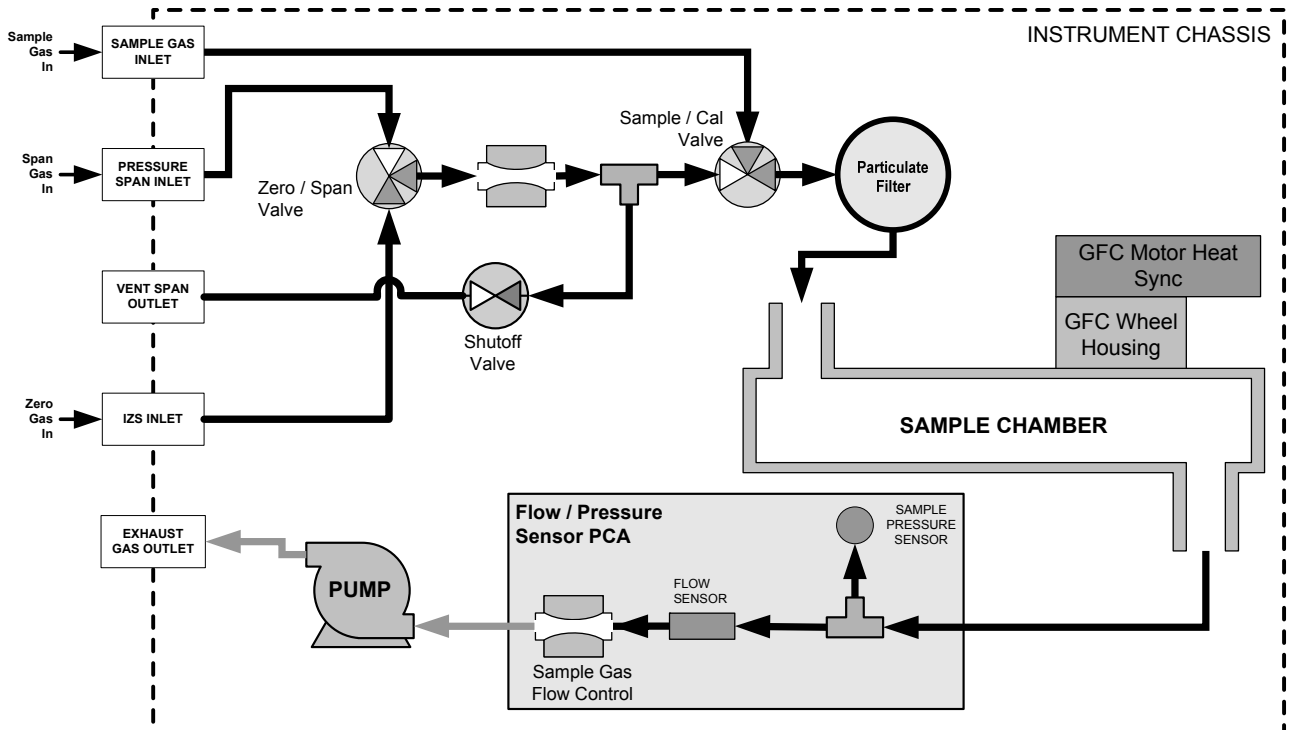
**TOLL-FREE:** 800-324-5190  
**FAX:** 858-657-9816  
**TEL:** 858-657-9800  
**E-MAIL:** [api-sales@teledyne.com](mailto:api-sales@teledyne.com)  
**WEB SITE:** [www.teledyne-api.com](http://www.teledyne-api.com)

**5.A.1. ZERO/SPAN WITH COMMON SHUTOFF VALVES (OPTION 50G)**

Option 50G is operationally and pneumatically similar to Option 50B (see M300E/EM manual), except that both the zero and span gasses are applied to the analyzer under pressure. This option is designed to be used with bottled zero and span gasses. 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-B: Zero/Span/Shutoff Valve Operating States for Option 50G**

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



**Figure 5-A: Internal Pneumatic Flow OPT 50G – Zero/Span with common Shutoff Valves**

## 6. BASIC OPERATION

### 6.A. TEST FUNCTIONS

The information found in Section 6.2 of the M300E/EM Operators Manual (P/N 04288) is applicable to the M320E/EU with the following exception(s):

- The following table supersedes Table 6-2 of the M300E/EM Operators Manual (P/N 04288).

**Table 6-A: Test Functions Defined**

Parameter	Display Title	Units	Meaning
RANGE -- RANGE1 RANGE2	<b>RANGE</b>	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"> <li><b>THIS IS NOT</b> the Physical Range of the instrument. See Section 6.6.1 of the M300E/EM Operators Manual (P/N 04288) for more information.</li> </ul> If <b>DUAL</b> or <b>AUTO</b> Range modes have been selected, two <b>RANGE</b> functions will appear, one for each range.
Stability	<b>STABIL</b>	PPB, PPM UGM, MGM	Standard deviation of N <sub>2</sub> O concentration readings. Data points are recorded every ten seconds using the last 25 data points.
N <sub>2</sub> O Measure	<b>MEAS</b>	MV	The demodulated, peak IR detector output during the measure portion of the CFG Wheel cycle.
N <sub>2</sub> O Reference	<b>REF</b>	MV	The demodulated, peak IR detector output during the reference portion of the CFG wheel cycle.
Measurement / Reference Ratio	<b>MR Ratio</b>	–	The result of <b>N2O MEAS</b> divided by <b>N2O REF</b> based on readings taken during the normal sample measurement portion of the <b>A-REF</b> cycle. This ratio is the primary value used to compute N <sub>2</sub> O concentration. The value displayed is not linearized.
Sample Pressure	<b>PRES</b>	In-Hg-A	The absolute pressure of the Sample gas as measured by a pressure sensor located inside the sample chamber.
Sample Flow	<b>SAMPLE FL</b>	cm <sup>3</sup> /min	Sample mass flow rate as measured by the flow rate sensor in the sample gas stream,
Sample Temperature	<b>SAMP TEMP</b>	°C	The temperature of the gas inside the sample chamber.
Bench Temperature	<b>BENCH TEMP</b>	°C	Optical bench temperature.
Wheel Temperature	<b>WHEEL TEMP</b>	°C	GFC wheel temperature.
Box Temperature	<b>BOX TEMP</b>	°C	The temperature inside the analyzer chassis.
Photo-detector Temp. Control Voltage	<b>PHT DRIVE</b>	mV	The drive voltage being supplied to the thermoelectric coolers of the IR photo-detector by the sync/demod Board.
Slope	<b>SLOPE</b>	–	The sensitivity of the instrument as calculated during the last calibration activity. The <b>SLOPE</b> parameter is used to set the span calibration point of the analyzer.
Offset	<b>OFFSET</b>	–	The overall offset of the instrument as calculated during the last calibration activity. The <b>OFFSET</b> parameter is used to set the zero point of the analyzer response.
Test Channel Output	<b>TEST</b>	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	<b>TIME</b>	–	The current time. This is used to create a time stamp on iDAS readings, and by the <b>AUTOCAL</b> 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  $\text{mg}/\text{m}^3$  and  $\text{ug}/\text{m}^3$  use  $0^\circ\text{C}$ , 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:

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

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

### 6.A.1. SELECTING A TEST CHANNEL FUNCTION FOR OUTPUT A4

This section supplements Section 7.4.6 of the M300E/EM Operators Manual (P/N 04288)

The Test Functions available to be reported on analog output **A4** are:

**Table 6-B: Test Channels Functions Available on the M320E/EU'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 <sup>3</sup> /min	1000 cm <sup>3</sup> /min
SAMPLE TEMP	The temperature of gas in the optical bench's sample chamber	0 C°	70 C°
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 M320E/EU'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.

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## USER NOTES:

# USER NOTES:



## **7. ADVANCED FEATURES**

The information found in Chapter 7 of the M300E/EM Operators Manual (P/N 04288) is applicable to the M320E and M320EU we recommend that you read this section before continuing.

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### **USER NOTES:**

# USER NOTES:

## 8. REMOTE OPERATION

The information found in Chapter 8 of the M300E/EM Operators Manual (P/N 04288) is applicable to the M320E and M320EU we recommend that you read this section before continuing.

### 8.A.1. HESSEN PROTOCOL

The information found in Section 8.5 of the M300E/EM Operators Manual (P/N 04288) is applicable to the M320E/EU with the following exception(s):

- There is only one default gas type programmed into the M320E/EU. The following table replaces the gas type and gas ID from Section 8.5.6 of the M300E/EM Operators Manual (P/N 04288).

**Table 8-A: M320E/EU Hessen GAS ID List**

GAS DEFAULT	HESSEN GAS ID
N2O	320

- The list of Hessen status flags for the M320E/EU is the same as that of the M300E/EM. Please see Table 8-8 of the M300E/EM Operators Manual (P/N 04288) the specific assignments.

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## USER NOTES:

# USER NOTES:

## 9. CALIBRATION PROCEDURES

Calibration of the M320E/EU should be performed according to the procedures described in Chapters 9 of the M300E/EM Manual - P/N 04288 with the following notes and exceptions:

- Delivering span and zero gases for the higher resolution the M320E/EU can be difficult. Attention must be paid to the quality of the gasses, 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 though 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, stainless steel or brass only.
- Zero-air source which must be synthetic air, ultra-zero air or nitrogen (N<sub>2</sub>). A zero air generator like a T-API M701 should not be used.
- Span gas source (defined in Section 9.1.2.2 of the M300E/EM Operators Manual; but use N<sub>2</sub>O 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 Chapter 11 of this manual for troubleshooting tips.

### MANUAL CALIBRATION

The information found in Section 9.2 of the M300E/EM Operators Manual (P/N 04288) is applicable to the M320E/EU with the following exception(s).

- **STEP3 – ZERO/SPAN CALIBRATION**
  - Set the display to show the **N2OSTB** test rather than the **CO STB** function mentioned in the M300E/EM operator's manual).

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## USER NOTES:

**USER NOTES:**

## **10. EPA PROTOCOL CALIBRATION**

The information found in Chapter 10 of the M300E/EM Operators Manual (P/N 04288) does not apply to the M320E/EU because there are no USEPA reference methods for the measurement of N<sub>2</sub>O.

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**USER NOTES:**

**USER NOTES:**



## **11. THEORY OF OPERATION**

The information found in Chapter 11 of the M300E/EM Operators Manual (P/N 04288) is applicable to the M320E and M320EU (we recommend that you read this section before continuing) with the following exception:

The wavelength of operation is 4.58 $\mu$ m versus 4.7 $\mu$ m for the M300E/EM.

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### **USER NOTES:**

# USER NOTES:

## **12. MAINTENANCE SCHEDULE**

The information found in Chapter 12 of the M300E/EM Operators Manual (P/N 04288) is applicable to the M320E/EU with the following exception(s):

- Since a catalytic zero scrubber is not available for the M320E or M320EU there is no replacement schedule for the scrubber material.
- The Test record below should be used in place of the one included with the M300E/EM manual.

**Table 12-A: M320E/EU Test Function Record**

FUNCTION	OPERATING MODE*	DATE RECORDED					
STABILITY	ZERO CAL						
N2O MEAS	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						

## **13. TROUBLESHOOTING & REPAIR**

The information found in Chapter 13 of the M300E/EM Operators Manual (P/N 04288) is applicable to the M320E and M320EU. It is recommended that you read this section before continuing.

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### **USER NOTES:**

**USER NOTES:**

## **APPENDIX A - Version Specific Software Documentation**

Refer to Appendix A in your Technical Manual, M300E/EM, PN 04288 Rev. C for the menu trees.

**USER NOTES:**



## APPENDIX B - M320E/EU SPARE PARTS &amp; EXPENDABLES

## 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: Recommended Spare Parts Stocking Levels for the M320E/EU

PART NO.	DESCRIPTION	UNITS				
		1	2-5	6-10	11-20	21-30
001760400	Assy, Flow Control, 800ccm	*	*	1	2	3
003291500	Wheel Thermistor Assembly (885-071600)	1	1	1	2	2
009550500	IR Source Assembly	1	1	2	2	3
040010000	Assembly, Fan	1	1	2	2	3
040030100	Flow/Pressure Assy	*	*	1	2	3
041350000	PCA, Relay Board	*	1	1	2	2
041710000	CPU	*	*	1	1	1
042410200	Pump Universal 100-240, 50-60 Hz	*	*	*	2	2
042580000	Keyboard	*	*	*	1	1
050320000	PCA, Wheel Position Sensor	*	1	1	2	2
052830200	Assy, Motor, E Series (MR7)	*	*	1	1	2
055010000	Assy, Motor Wheel Heater w/Thermostat, 200W	*	*	1	2	2
058021100	PCA, Motherboard	*	*	*	1	2
DS0000025	Display Assy	*	*	*	1	1
PS0000011	Power Supply, +5/±15V	*	*	1	2	2
PS0000025	Power Supply, +12V	*	*	1	2	2
KIT000185	Gas Filter Wheel	*	*	*	1	1
RL0000015	Relay	1	1	2	2	2
	For M320E					
KIT000277	Kit, Sync Demodulator Board and Detector (036110600)	*	*	1	2	2
037250100	Band Bench Heater	*	1	1	2	2
	For M320EU					
KIT000278	Kit, Sync Demodulator Board and Detector (036110700)	*	*	1	2	2
037250000	Band Bench Heater	*	1	1	2	2
	With ZS Option					
042690000	Valve Assy, 2-Way, On/Off	*	*	1	1	2
042680000	Valve Assy, 3-Way	*	*	1	1	2

USER NOTES:



CUSTOMER: \_\_\_\_\_ PHONE: \_\_\_\_\_

CONTACT NAME: \_\_\_\_\_ FAX NO. \_\_\_\_\_

SITE ADDRESS: \_\_\_\_\_

MODEL TYPE: \_\_\_\_\_ SERIAL NO.: \_\_\_\_\_ FIRMWARE REVISION: \_\_\_\_\_

Are there any failure messages? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(Continue on back if necessary)

PLEASE COMPLETE THE FOLLOWING TABLE:

PARAMETER	DISPLAYED AS	OBSERVED VALUE	UNITS	NOMINAL RANGE	
				M320E	M320EU
Range	<b>RANGE</b>		PPM, MGM PPB, UGM	1 – 1000 PPM	1 – 200 PPM
Stability	<b>N2O STB</b>		PPB, PPM	<1.0 PPM with N2	<200 PPB with N2
N2O Measure	<b>N2O MEAS</b>		mV	3600 – 4800 MV with N2	
N2O Reference	<b>N2O REF</b>		mV	3000 – 4000MV with N2	
Measure/Reference Ratio	<b>MR RATIO</b>		–	1.2 – 1.5 with N2	
Pressure	<b>PRES</b>		In-Hg-A	Ambient +0"/-2"	
Sample Flow	<b>SAMP FL</b>		cm3/min	800 ± 20%	
Bench Temp	<b>BENCH TEMP</b>		°C	48 ± 2	
Wheel Temp	<b>WHEEL TEMP</b>		°C	56 ± 2	
Oven Temp	<b>OVEN TEMP</b>		°C	46 ± 1	
Photo Drive	<b>PHT DRIVE</b>		mV	250 mV – 4750 mV	
Slope of N2O Measurement	<b>N2O SLOPE</b>		–	1.0 ± .3	
Offset of N2O Measurement	<b>N2O OFFSET</b>		PPM	0 ± 0.3	
Dark Cal Reference Signal	<b>REF DARK OFFSET</b>		mV	125 ± 50 mV	
Dark Cal Measure Signal	<b>MEAS DARK OFFSET</b>		mV	125 ± 50 mV	
Electric Test			PPM	40 ± 2 PPM	

**TELEDYNE INSTRUMENTS CUSTOMER SERVICE**

EMAIL: [api-customerservice@teledyne.com](mailto:api-customerservice@teledyne.com)

PHONE: (858) 657-9800

TOLL FREE: (800) 324-5190

FAX: (858) 657-9816

Have you performed a leak check and flow check? \_\_\_\_\_

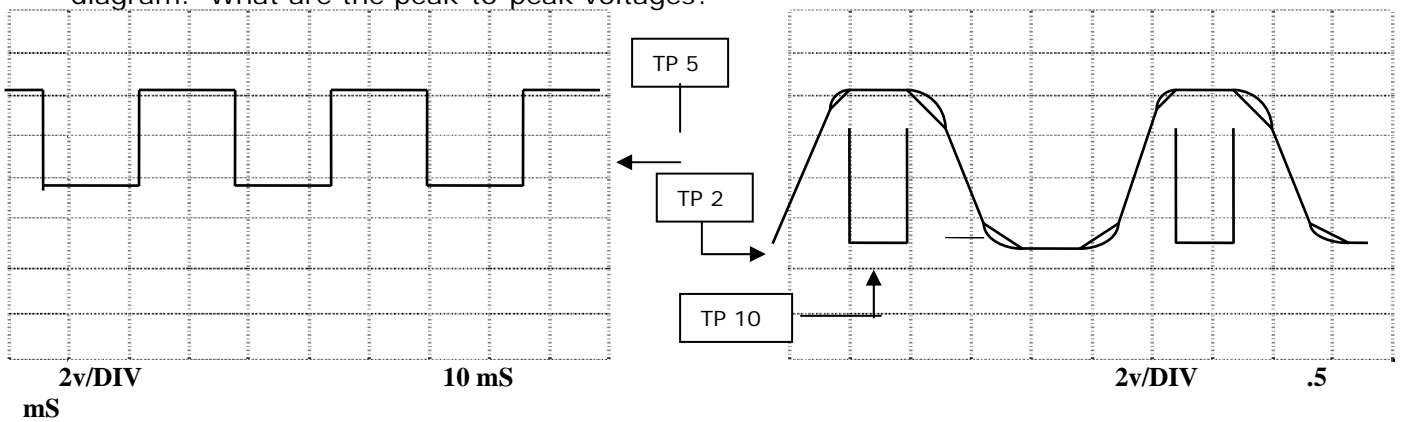
What are the failure symptoms? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

What test have you done trying to solve the problem? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Please check these signals and verify the correctness. Look for the signals annotated on the diagram. What are the peak-to-peak voltages?



If possible, please include a portion of a strip chart pertaining to the problem. Circle pertinent data.

THANK YOU FOR PROVIDING THIS INFORMATION. YOUR ASSISTANCE ENABLES TELEDYNE API TO RESPOND FASTER TO THE PROBLEM THAT YOU ARE ENCOUNTERING.

**OTHER NOTES:** \_\_\_\_\_

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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**TELEDYNE INSTRUMENTS CUSTOMER SERVICE**

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## **APPENDIX D - M320E/320EU ELECTRONIC SCHEMATICS**

Refer to Appendix D in your Technical Manual, M300E/EM, PN 04288 Rev. C for the list of electronic schematics.

## USER NOTES