OPERATING INSTRUCTIONS

FOR

TAI MODEL 322

MULTI-CHANNEL

OXYGEN MONITORING SYSTEM

SERIAL NUMBER

CUSTOMER ORDER NUMBER

SALES ORDER NUMBER

TELEDYNE ANALYTICAL INSTRUMENTS
16830 CHESTNUT STREET
CITY OF INDUSTRY, CA 91749

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

IMPORTANT NOTICE

The instrument serves as a safety monitor. However, it is the responsibility of the user to establish whether or not the total system of instrument, environment, alarm components, and any other relevant devices actually will assure safety in his particular circumstances.

The safety checklist outlined here should be treated only as a guide. It is up to the user to establish practical safety precautions. It is vital that the operator understand and test the operation of the total system.

Safety Checklist

1. Verify that the instrument is powered correctly.
2. Verify that the instrument works (all functions).
3. Verify that alarm indications give the intended results.
4. Verify that unauthorized personnel cannot tamper with the instrument or its auxiliary equipment.
5. Institute routine test/calibration procedures.
6. Identify and handle any sampling or location problems.
7. User provides any necessary warning labels; verify that the labels are on the equipment.
8. Train all operators to understand all operations and functions of the analyzer and the system.
9. Identify and handle any environmental or other influences that could affect the operation of the instrument.

1. INTRODUCTION

The Teledyne Analytical Instruments' (TAI) Model 322 is a multichannel oxygen monitoring system for determining the concentration of oxygen at up to eight remote locations. Alarm and/or control functions can be provided continuously and simultaneously on all channels at any desired oxygen level.

The oxygen concentration is sampled by diffusion or pneumatically (using flow-thru adaption) and sensed by TAI's patented* Micro-fuel Cell. A small portion of the oxygen in the sample gas surrounding the cell is converted, through an electrochemical reaction, to an electrical current that is proportional to oxygen content of the sample gas.

The system is designed to provide indication (up to three levels) when the oxygen concentration rises above or below (optional) present levels.

2. DESCRIPTION

The system is comprised of a general purpose configuration system control unit and remote probe assemblies. The system control unit can be furnished to provide any number of oxygen alarm or control channels. The basic, single chassis system control unit which can accommodate up to eight channels, is comprised of a cage assembly, a control module and up to eight channel modules. The block diagram given in Figure 1 illustrates their functional relationships. Overall system accuracy is ± 2% of full scale. The diagram in Figure 2 illustrates a one channel Model 322 Analyzer.

2.1 Cage Assembly

The cage assembly provides structural support and electrical interconnection of the control and channel modules. These latter plug into sockets mounted on the cage assembly. Terminal strips at the rear of the cage assembly provide for external electrical connections.

* U.S. Patent Nos. 3,492,796 and 3,767,552

2.2 Channel Module

Each channel module is a complete, self-contained oxygen monitoring system. AC line power supplied to the module is converted to the various DC voltages required for its electronics.

The current from the Micro-fuel Cell is amplified by an amplifier operated as a current to voltage transducer. A second stage voltage amplifier is used to temperature compensate the signal from the Micro-fuel Cell (the cell has a +2.5%/°C temperature coefficient). Temperature compensation is accomplished over a temperature range of 0-50°C and to accuracy of ±5% of reading (worst case). A potentiometer between amplifiers is used for span adjustment which allows for the variation in output from cell to cell.

The oxygen level signal at the comparator switch is compared with reference signals derived from a stable temperature compensated voltage reference source and adjusted to the desired levels using the level "Set". When the oxygen level signal falls below or rises above (optional) the set reference level at any of the three comparators, that comparator output will swing negative causing its associated lamp to be illuminated, relay to be deactivated or activated (optional), and the associated common alarm bus to be driven to a negative voltage level.

The comparators associated with "Switch #1" and "Switch #2" can be set for manual or automatic reset (optional) and the relays can be set to be fail-safe or not fail-safe (optional). If operated fail-safe, the device operated by the relay would be activated if there was a loss of power. These settings are made during the manufacturing process and are determined by the application requirements. The failure alarm comparator is always supplied with manual reset, with its associated relay, either fail-safe or not fail-safe (optional) (sub-chassis, non-adjustable). When any comparator (with manual reset) switches from its normal state, it will remain in that state until the condition is cleared and either the reset button is depressed or the appropriate bypass switch is returned to the normal operating position.

Power for lamps and relays is provided from unregulated 28 volt D.C. supplies. An integrated circuit voltage regulator provides the positive and negative 15 volt supply for the amplifiers and comparators. The primary of the power transformer on each channel module is fused to provide over current protection. A green pilot lamp is provided to indicate when power is applied.

2.3 Control Module

The control module provides control of electrical power to the system and of any external alarm indicators connected with the system through common relays. It also provides a common meter (optional) for indicating the signal levels from the channel modules. Lights are provided to indicate the state of the system. The AC power switch controls power to the system module and to the AC power bus serving the channel modules. When the green light is on, power is applied to the system. Signals from any channel module deactivate or activate (optional) the corresponding relay in the control module. Thus, for example, switching signals from the "Switch #1" of any channel will deactivate the "Switch #1" relay in the control module. There are three such relays in the control module, one each for "Switch #1", "Switch #2" and Failure alarm. Each of these relays provide SPDT contacts rated at 5A/115VAC non inductive load for operation of external devices. An additional set of contacts from each of these relays are ganged in parallel to provide power to the External Audible Alarm terminals and to the internal alarm buzzer. Thus an audible alarm is actuated when any alarm state occurs. This audible alarm may be disconnected by switching the audible alarm control switch to "Bypassed". When this is done, the red light on the system module is illuminated as an indication that the audible alarms are not functional.

Whenever either Switch #1 or Switch #2 in the control module is used for a control function rather than alarming (switch circuits are set for automatic reset) and the corresponding relay is deleted from the control module. This is done so that the External Audible Alarm does not become energized during the control switching process.

The meter on the control module provides measurement of the oxygen signal level and set point levels from any channel. Pressing the "Read Level" button on any channel module causes the meter to indicate the oxygen level from that channel. Moving either "Read-Bypass" switch on any channel module to the READ position causes the meter to indicate the set point level.

Fuses are provided in the control module for protection of the system. Power for the channel modules and the external audible alarm is fused at three amperes. Any equipment connected to the external audible alarm circuit should be independently fused at one ampere.

2.4 Remote Probe Assemblies

Each control unit allows for up to eight remote probe assemblies. These assemblies can be of standard configuration (see Probe Assembly Outline Drawing) or special design (see Section 7 when applicable) depending upon the application requirement. In either case the probes can be located almost any distance (up to 1,000 feet or more) from the system chassis.

Each probe assembly, when placed into service, will contain a Micro-fuel Cell, a temperature compensating thermistor and auxiliary sample handling equipment (if required). The Micro-fuel Cell is packaged in a gas barrier bag and should not be installed in the probe assembly until after installation of all other components of the system has been accomplished.

Temperature compensation is affected over the range 0-50°C and to an accuracy of ±5% of full scale. If other than diffusion sampling is to be enployed, it is assumed that the sample gas will be brought to ambient temperature. The cell and thermistor must always be kept at the same temperature, otherwise the resultant differential temperature of these two components can cause inaccuracies in excess of those specified.

If the ambient temperature at the probe assembly can drop below 0°C (32°F), auxiliary heating should be employed. Normally this condition is noted at the time of purchase and specially configured probes will have been provided. TAI can provide sampling probes to cope with most all sampling problems encountered in virtually any application. Refer to Section 7 of this manual if non-standard probes have been provided.

3. INSTALLATION

Each Model 322 control unit is normally shipped with the channel modules and control module installed.

3.1 System Module

The physical dimensions and mounting hole spacing are given on the outline drawing. The system module is designed to fit into a standard 19 inch width RETMA rack. It requires 7 inches panel height and 12-1/8 inch depth plus allowance for cabling behind the panel.

3.1.1 Location

The system module is designed for installation in a non-hazardous environment.

3.1.2 Power

Normally the Model 322 is designed for operation from 115V/50-60Hz single phase. Maximum power required is approximately 75 watts plus the power to be supplied any external devices through the Model 322. Ventilation must be provided to dissipate heat generated within the system module. Natural convection will be sufficient to cool one or two control units. However, if more than two are mounted in the same rack, forced ventilation will be required.

3.1.3 Electrical Connections

All customer connections are available at the barrier type terminal strips located at the rear of the system module. These are shown on the interconnection drawing. Primary power should not be applied to the unit while making or changing connections to any of the terminal strips. Relay contact connections are indicated as NC (normally closed), NO (normally open) and C (common). These designations refer to the deactivated state. All relay contacts are rated at 115VAC, 5 amperes non-inductive load. Probe assembly connections are indicated as RD (red), BK (black), WH (white), GN (green) and SH (shield). These designations refer to the color coding of the probe assembly lead wires. The terminals marked "Ext. Audible Alarm" provide 115VAC to activate external devices when any channel is in an alarm state. These external devices must be separately provided with over current protection to limit the current drawn from these terminals to less than one (1) ampere. The primary power terminals are designated H (hot), N (neutral), and GND (ground). Connections should be made in accordance with these designations.

3.2 Control Module

In the event that it is necessary to remove the control module, primary power to the system module must first be disconnected, and the six small screws around the periphery of the control module front panel removed. The two knurled, slotted jack screws may then be backed out to pull the module out until it is disengaged from its socket. It then may be slid out of the cage assembly.

Reinstallation of the control module simply requires that it be slid into the cage assembly, making sure that the circuit board lines up with the connector. The circuit board may be seated in the connector by tightening the jack screws. The six retaining screws may then be reinstalled and the primary power reconnected to the cage assembly.

3.3 Channel Modules

Channel modules may be removed first by turning the power off and unscrewing the top (retaining) screw, then unscrewing the bottom (jack) screw. As the jack screw is backed out it will pull the module from its socket. When the jack screw is free, the module may be slid out by pulling on the two screws. In the event that it is desired to remove a channel module without disturbing the common alarm circuits, the channel module power may be switched off before removal. Reinstallation of the channel module may be accomplished by sliding the module into the chassis until the top and bottom screws may be engaged, engaging them, tightening the bottom (jack) screw to reconnect the module and then tightening the top (retaining) screw. If the channel module power switch is off prior to installation, the common alarms will not be disturbed. If it is desired to power up the channel module without activating any of the common alarms, place Switch #1 and Switch #2 in the BYPASS position and depress the RESET switch while turning the POWER switch ON. The alarm switches may be returned to their normal position after completion of calibration for that channel.

3.4 Probe Assemblies

The remote probe assemblies are designed to be flush mounted against a wall or bulkhead (see outline drawing for dimensional information). Although the Micro-fuel Cell is position insensitive, it is recommended that the probe assemblies be mounted in either a horizontal or vertical position with the sensing surface pointing sideways or downward. These positions will minimize the effects of particulate matter or water that might deposit itself on the end of the sensing surface of the probe assembly if mounted in an upright vertical position.

No obstructions should be in the area immediately around the probe assembly as the Micro-fuel Cell depends strictly on diffusion to sample the atmosphere. Flow-thru adaptors may be used when positive pressure sample gas is being analyzed. The cell is flow insensitive; however, it is recommended that flow rate of 0.1 to 10 liters/min. be employed. Flow rates must be controlled externally. The probe assemblies should be installed so that personnel can gain access to the cell assembly when replacement is required.

3.4.1 Micro-fuel Cell

A Micro-fuel Cell is furnished for each remote probe assembly. The cell is supplied in a controlled atmosphere package. The following installation procedure should be followed for each probe assembly.

1) Remove cell from its package, care should be taken not to puncture or abrate the thin membrane covering the perforated gold sensing surface.

2) Remove the shorting clip.

3) Unscrew the probe cap and remove it from the probe body.

4) Place the cell, contact end facing upwards, in the exposed probe cavity and replace the cap.

4. OPERATION

4.1 Start-up

After the system has been installed, re-check all wiring to be sure that it is correct. Check that all power switches are in the OFF position and apply primary power to the system. Check that the audible alarm switch is in the "Bypass" mode and then move the system module power switch to "ON". The green pilot light and the red bypass light should both turn on. For each channel module in turn, turn the power switch on while pressing the alarm reset button. All the lights on the channel module should be illuminated and the channel module relays in the switched or controlling state while the reset button is pressed.

Upon release of the reset button the blue cell failure light will extinguish and its relay will reset (energize). The switch circuits will likewise reset if the analog oxygen signal is outside the set point limits of the switch circuit in question. The alarm (or control) levels can be checked by moving the appropriate toggle switch to its "READ" position. The level can then be read on the control module meter (or the meter of the channel module under test if that option is present).

The unspanned (uncalibrated) output can be read by pressing the READ LEVEL pushbutton; if the individual channel readout meter option has been supplied, the analog signal is continuously being readout on each channel module meter (unless one of the switch level "READ" toggles is momentarily activated, in which case, that alarm level is displayed).

4.2 Initial Calibration

The entire calibration procedure is accomplished at the control unit; no personnel are required in the remote site areas. One channel at a time can be calibrated.

4.2.1 Preliminary

1) Move the audible bypass switch to the BYPASSED position. Place (and hold switch if spring loaded) all READ-BYPASS switches in the BYPASS position. NOTE: This disables all the alarms.

2) Turn system and individual module power switches to "ON" position.

3) Make certain that all probe assemblies are exposed to atmospheric air or flow instrument air over the cell assembly (other calibration gases may be used, however, TAI recommends atmospheric air because of its inherent accuracy and convenience).

4) Lift and lock into place the protector bars on each module.

4.2.2 Calibration

The following procedure should be followed for each module in turn:

1) Press the READ LEVEL pushbutton and simultaneously adjust the SPAN adjustment until the readout meter indicates a level that is outside the set point limits of the manual reset switches. (No READ LEVEL pushbutton is present or required when individual channel meters are furnished.) This condition can be verified by placing the READ-BYPASS switch in the neutral or straight-up position and momentarily pressing the RESET pushbutton; the switch indicator lights should remain extinguished.

NOTE: The above step must be accomplished prior to adjusting the level of the manual reset switches. Manual reset switch levels cannot be read accurately when they are in their "latched-in" mode. This limitation does not apply to automatic reset switch circuits.

2) Set the alarm (and or control) levels by simultaneously, and in turn, holding the READ-BYPASS toggle switch in the READ position and adjusting the respective SET adjustment until the desired level is noted on the readout meter. Replace toggle switch in BYPASS position after calibration.

3) Press READ LEVEL pushbutton and simultaneously adjust the SPAN adjustment until the readout meter reads 20.9% oxygen. If multiple range system, use 0 to 25% range.

4.2.3 Operational Mode

After each channel has been calibrated:

1) Place all probe assemblies in their operational mode (i.e., so that each cell is monitoring the oxygen sample it is intended to monitor).

2) IMPORTANT! Move all READ-BYPASS toggle switches to their neutral position to enable the alarms.

3) Press the RESET pushbutton on each channel module. All switch lights should be extinguished (assuming that their levels were set out of the normal operating level). Switching circuits furnished for control with Automatic Reset will activate and deactivate in a cyclic fashion over time. Frequency will depend upon the servo time constants involved.

4) Move the audible bypass switch to the ACTIVE position.

4.3 Routine Operation

During routine operation, the system will require no attention unless an alarm state occurs. In the event of an alarm indication, the audible alarm may be silenced in one of two ways:

1) Move the AUDIBLE ALARM switch on the control module to BYPASS. This will immediately silence the audible alarm and but will also prevent an audible indication from occurring should another channel go into an alarm state.

2) Move the READ-BYPASS switch associated with the visual alarm indication to BYPASS. After a brief time delay (4-5 sec.), the audible alarm will silence, then move the switch back to the READ position. In this case, only the specific alarm channel will be affected, and in the occurrence of an additional alarm in the same channel, or any alarm in any channel, the audible alarm will again activate.

WARNING: Leaving a READ-BYPASS switch in the BYPASS position will disable that alarm.

In either case, once the audible alarm has been silenced the oxygen level may be determined by pressing the READ LEVEL switch on the channel indicating an alarm and reading the level on the common meter on the control module. Where individual channel meters are furnished these levels are available continuously and simultaneously. When the level has diminished to less.....

than the alarm level, the alarm may be reset (if manual reset), by either returning the READ-BYPASS switch to its normal operating position if it has been actuated, or by pressing the RESET button.

In the event of a cell failure indication, the audible alarm can be silenced only by placing the AUDIBLE ALARM switch in the BYPASS position, or by turning the affected channel module OFF.

5. ROUTINE CALIBRATION

System calibration should occur at regular intervals in the absence of alarms. The required period of routine calibrations depends in part on the nature of the environment to which the cells are exposed. In general it is recommended that system calibration occur at 2-4 week intervals. Longer intervals should be used as experience indicates that such is warranted.

Routine calibration procedure is the same as initial calibration (see Section 4.2) except 4.2.2 paragraph 2 can generally be eliminated, unless it is desired to change the alarm (and or control) levels.

6. MAINTENANCE

6.1 Micro-fuel Cells

When the Micro-fuel Cell nears the end of its useful life, its output current will become erratic, and shortly thereafter, the current output will drop off sharply to zero. The cell failure alarm circuit will be activated in this instance (the cell failure alarm level is factory set normally at 0.5% oxygen).

The life expectancy of Micro-fuel Cells is given on the warranty card packaged with each cell. These intervals are given for cells left continuously in air (21%) and at 25°C (77°F).

To offset the possibility of not having replacement cells available when they are needed, it is recommended that a set of spare cells (one per channel) be ordered approximately 3 to 6 months after placing the system into operation and 3 to 6 months after each subsequent replacement thereafter. Do not attempt to stockpile spare cells. TAI suggests that all cells in the system be replaced at the same time when the first needs replacement, providing, of course, the cell that failed did so within acceptable limits of the warranty period. This recommendation also assumes that all cells are being exposed to nearly the same level of oxygen throughout their life.

Customer having warranty claims must return the cell in question to the factory for evaluation. If it is determined that failure is due to faulty workmanship or material, the cell will be replaced at no cost to the customer. If a cell was working satisfactorily, but ceases to function before the warranty period expires, the customer will receive credit, on a pro-rated basis, toward the purchase of a new cell.

6.2 Electronics

Lamps on the system and channel module may be replaced from the front by unscrewing the cylindrical, colored plastic covers, except for the power indicator lamp which pulls off.

7. SPECIFICATION DATA

7.1 TAI Sales Order Number:

7.2 System Model Number: 322

7.3 System Serial Number:

7.4 Micro-fuel Cell Class:

7.5 Type Code Designations:

7.5.1. Channel Module(s)

7.5.2. Control Module

TABLE I

MODEL 322 CHANNEL AND CONTROL MODULE TYPE CODES

Channel Module

Switching Options

1 - Switch #1
2 - Switch #2
M - Manual Reset
A - Automatic Reset
H - High Level Switch (indicate lamp assembly color)
L - Low Level Switch (indicate lamp assembly color)
S - Fail Safe Relay Operation
N - Not Fail Safe Relay Operation
F - Failure Alarm, ML options, S or N option

Other Options

M - Meter
A - Analog Output, only if other than one volt full scale (specify, maximum two volts)
R - Multiple Range (specify ranges, maximum of three)
V - Only if other than 110V 50/60 Hz (specify power required)

EXAMPLE: 1AH(RD)S,2ML(RD)N,FS,MA(100MV) R(0-5,0-25)

If S or N is omitted, no relay is supplied

Control Module

1 - Switch #1
2 - Switch #2
F - Failure Alarm
S - Fail Safe Relay Operation
N - Not Fail Safe Relay Operation
M - Meter
V - Only if other than 110V 50/60 Hz, (specify power required)

EXAMPLE: 1S,2N,FS,MV(220V,50Hz)

Lamp assembly colors:	Red (RD) -	Alarm
	Yellow (YL) -	Caution
	Green (GR) -	Control

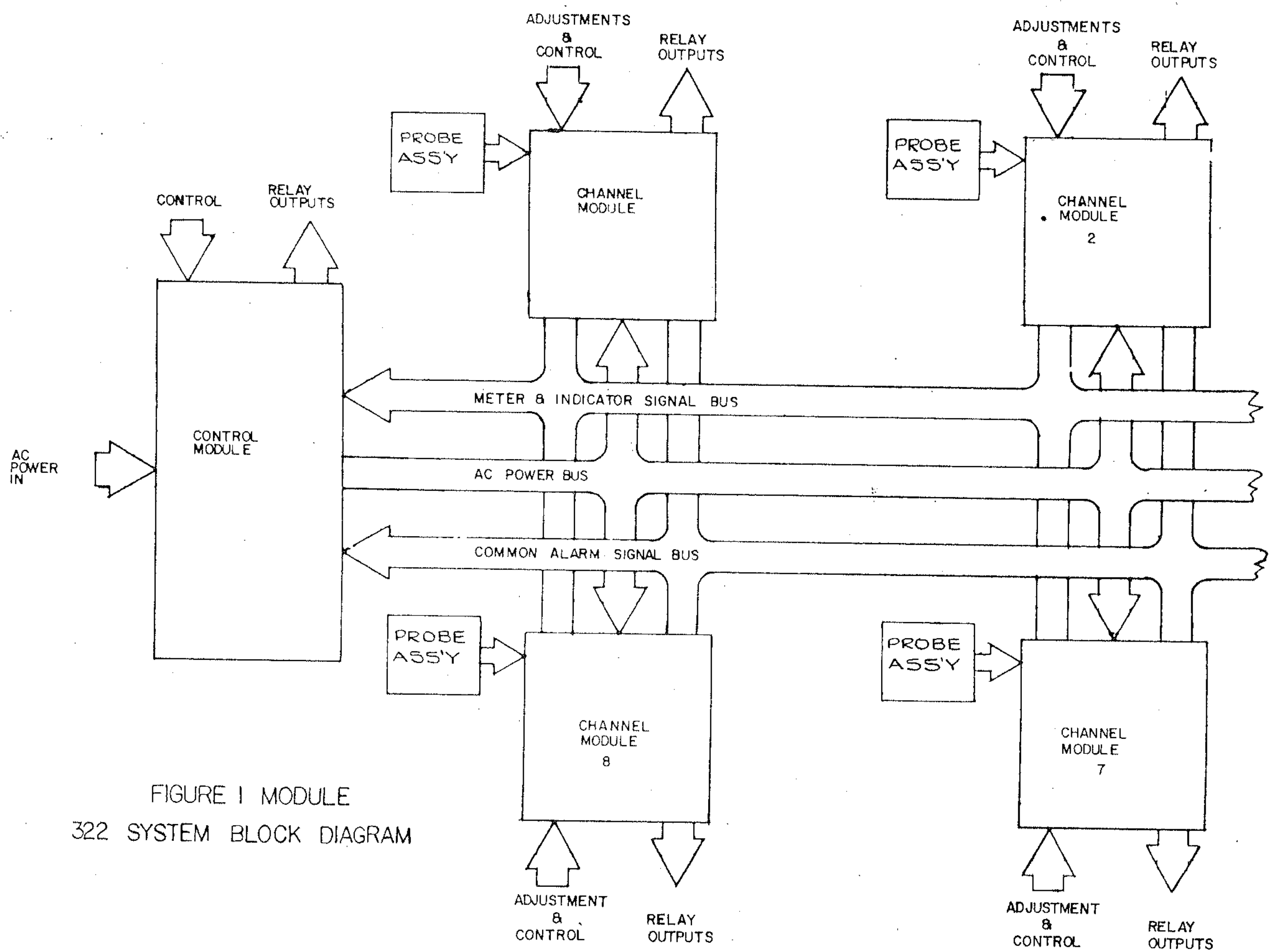


FIGURE I MODULE
322 SYSTEM BLOCK DIAGRAM

ADDENDUM A - SAFETY SYSTEMS

Guidelines for Safety Inspection (Equipment Criteria) -- This checklist is intended to help TAI personnel evaluate a safety system. It is not necessarily complete or appropriate, and its use does not imply any warranty that the system will be safe if all its recommendations are met. It is included in this manual as a guide to the user to help him optimize his equipment and operation to maximum safety.

1. Sample:

Position of sample points:

- Are there enough to get a valid measurement of the conditions?
- Do they know the distribution of gases in their system?

Nature of Sample:

- Have TAI approved?
- Is it actually what they told TAI what it was?

Compatibility with Sensors:

- Are there acid or corrosive gases present?
- Are there sulfur bearing compounds? ($H2S$, Mercaptans, etc.)
- If in doubt, check with the factory.

Compatibility with Other Components:

- e.g., Probes, wires, sample tubes, filter materials.
- Are there any toxic/corrosive/condensing components? If so, does the sample system handle them?

Upset Conditions:

- What is likely or unlikely to happen?
- Are the sample conditions going to be different?

2. Sample System

Operation:

- Does it under all possible process conditions?
- Does it really need one?
- Does the customer have realistic ideas of what it can do?
- Are the materials right?

Failure:

- What happens?
- Does it fail safe?
- How does anyone know that it failed?
- What happens in a power failure?

Testing:

- Has the customer tested it under all possible conditions?
- What about extremes of weather?

Maintenance Procedure:

- Does it correspond with TAI recommendations?
- Does it make sense to you?
- Is it in writing?
- If not, when are they going to put it in writing?

Maintenance Program:

- Does it correspond with TAI recommendations?
- Does it make sense to you?
- Is it in writing?
- If not, when are they going to put it in writing?

Spares:

- Do they have TAI recommended spare parts?
- Is the TAI recommendation adequate?
- Are they happy with their stock?

3. Electrical

Power Failure:

- What happens?
- Does the system fail safe?
- Does it come back up working?
- Do the operators know what it does when power fails?

Component failure:

- Is it understood that Teledyne Analytical does not guarantee that the equipment will not fail, only that TAI will fix it if it does?
- For a safety system, if the equipment fails, is there a plan to handle it.

Alarm Operation:

- Alarms set right?
- Alarm latching?
- Alarm disabling?
- Description of alarm operation correct?
- Everyone understands that?

Sensor Failure Indication:

- Do they appreciate what the instrument will indicate if the sensor fails?
- How do they detect it if it fails?

Area Classification:

- Is it correct?

The following areas are included in the "Sample System" section, however, they also need to be addressed when evaluating the "Electrical" safety system.

+ Operation
+ Failure
+ Testing
+ Maintenance Procedure
+ Maintenance Program
+ Spares

Failure Analysis:

- Personnel hazard
- Equipment hazard
- How does anyone know it failed?

TAI Documentation:

- Is the manual correct?
- Is there any ambiguity in it?
- Does it address any safety issues?
- Does it provide realistic calibration procedures?
- Does it describe the alarm functions correctly?

Labeling:

- Are there labels warning of hazards?
- Are ther labels warning of hazardous actions? For example:
  - "Do not disable alarms"
  - "Authorized personnel only"
  - "Do not operate system if any lights are lit"
- Is there an instruction sheet posted that tells you what to do under unusual or emergency circumstances?

Redundancy:

- Do they have redundant measurements?
- Redundant units on separate power supplies
- Any common failure mode?
- If no redundancy, what do they do if something fails?
- If no redundancy, why not?

Safety consultant:

- Has the customer had an expert in safety in their field analyze the system?
- Does the system meet his recommendations?
- Has anyone audited the system?

Customer personnel:

- Are they trained on the equipment?
- Can they maintain it?
- Do they understand it?
- Do they understand the whole system?
- Whose responsibility is the system?
- Who is responsible for the TAI equipment?

4. Operating Procedures for Whole System

Maintenance:

- Does the maintenace program correspond with TAI recommendations?
- Is it being done?
- What is the state of the TAI equipment?
- What is the state of the plant generally?

Testing:

- Has the system been tested under all conditions?
- Does it do what the customer wants?
- Has he put that in writing?

Operation:

- What are their operating procedures?
- Do they correspond with TAI recomendations?

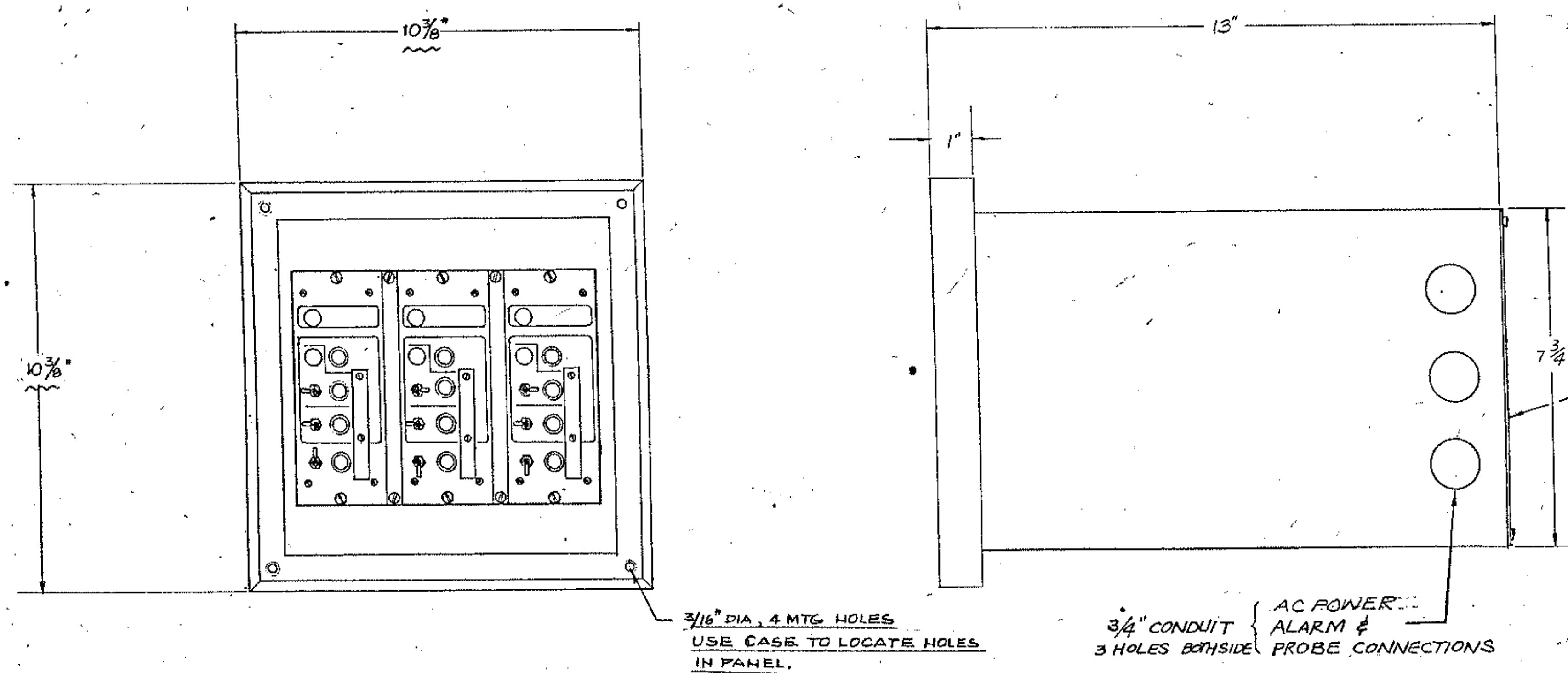
Security procedures:

- Is the equipment protected from unauthorized personnel tampering with controls etc.?
- Is the equipment exposed to anything that might degrade it?

Personnel:

- Are they trained? who by?
- Do they understand what we mean by our terminology, particularly our alarm terminology?
- Is the write up in manual correct?
- Do the operators have written procedures?
- Do they understand what can bypass, invalidate, or damage the alarm system provided?

ISSUE NO.	APP.
1-8-	
~ WAS 9¼" 2. 5-23-80	
REVISED 3.) 10-2-81	

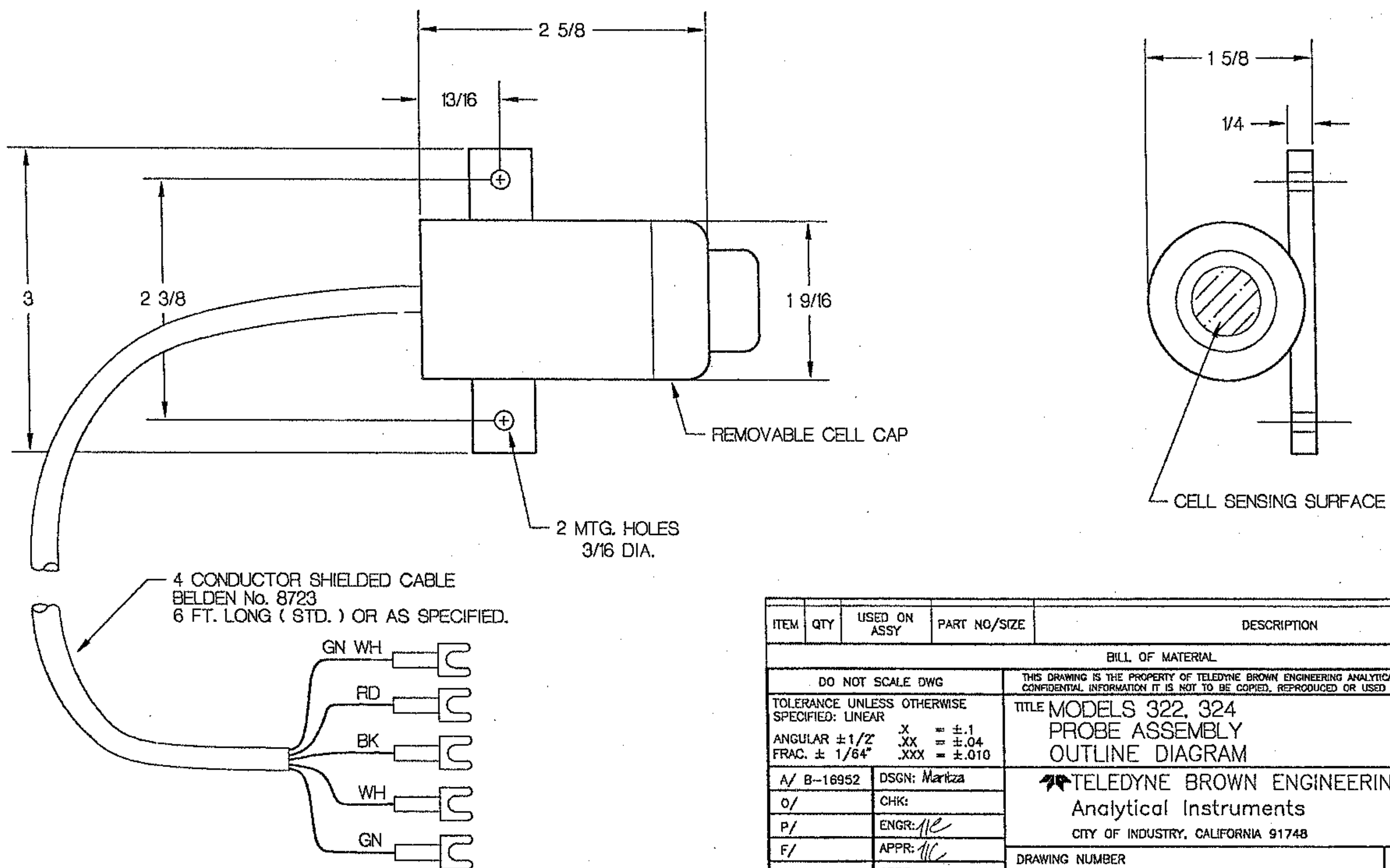


NOTE: 1. RECOMMENDED PANEL CUTOUT 7⅞" x 7⅞".
2. NUMBER OF CHAN. MODULES MAY VARY PER CUSTOMER APPLICATION.

TOLERANCE UNLESS OTHERWISE SPECIFIED	FRACT. ± 1/64	DEC. ± .005	ANGULAR ± 1/2°
TELEDYNE ANALYTICAL INSTRUMENTS, SAN GABRIEL, CALIFORNIA		SCALE FULL	DATE 8-3-77
MDL. 134, 322 X OUTLINE DIAGRAM		MAT'L	
		FINISH	
		DR.	ENGR / APP
		C-17447	

BISHOP GRAPHICS/ACCUPRESS

ISSUE NO	DATE	REVISION/ECO NUMBER	APP
2	11-15-89	CABLE WAS 4 CONDUCTOR	J.Cruz
3	1-18-94	ECO# 94-016	JC



ITEM	QTY	USED ON ASSY	PART NO/SIZE	DESCRIPTION	ZONE

BILL OF MATERIAL

DO NOT SCALE DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED: LINEAR
ANGULAR ±1/2° .X = ±.1
FRAC. ± 1/64" .XX = ±.04
.XXX = ±.010

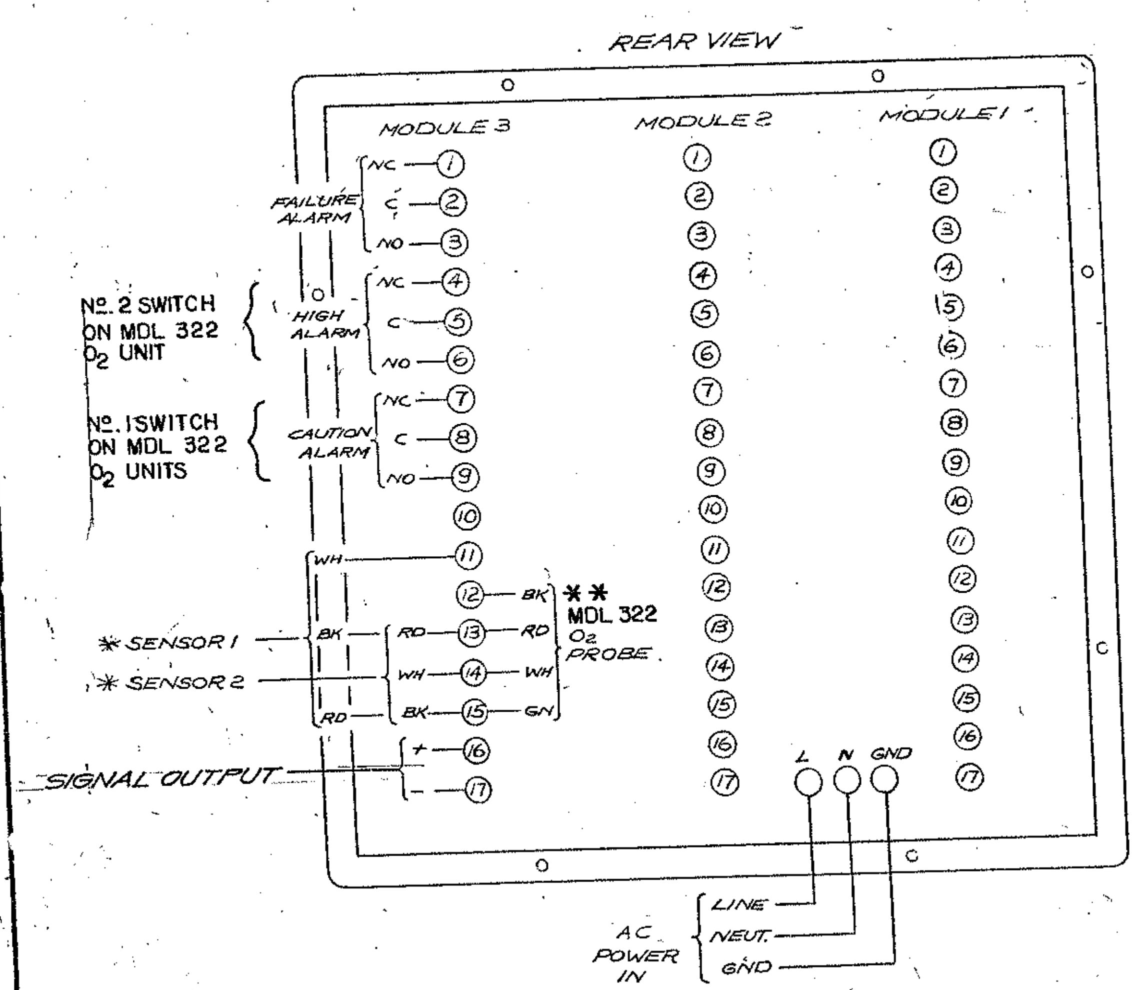
TITLE MODELS 322, 324
PROBE ASSEMBLY
OUTLINE DIAGRAM

A/ B-16952	DSGN: Maritza
O/	CHK:
P/	ENGR: JC
F/	APPR: JC
N/	APPR:
S.O.	APPR:

TELEDYNE BROWN ENGINEERING
Analytical Instruments
CITY OF INDUSTRY, CALIFORNIA 91748

CAD ID B-16484
SCALE 1:1
DRAWING NUMBER B- 16484
CHG A
DATE 1-12-94
SHEET 1

LOCATION : PC1 C:\MARITZA\ECO



ISSUE NO.	APP.
1. 9-22-77	
2. REVISED 10-2-81	
3. REV NOTES 5-12-86	

NOTES:

* MDL 122 COMB. UNITS ONLY
FOR INSTRUMENTS WITH SINGLE SENSOR USE "SENSOR 1" CONNECTIONS ONLY. IGNORE MDL 322 O_2 PROBE CONNECTIONS.

** MDL 322 O_2 UNIT ONLY
FOR INSTRUMENTS WITH OXYGEN MODULES ONLY. IGNORE MDL 122 COMB. SENSOR CONNECTIONS.

INTERCONNECTION OF MODULE 3 TYPICAL OF MODULE 1&2.-

TOLERANCE UNLESS OTHERWISE SPECIFIED | FRACT. ± 1/64 | DEC. ± .005 | ANGULAR ± 1/2°

TELEDYNE ANALYTICAL INSTRUMENTS
SAN GABRIEL, CALIFORNIA

SCALE | DATE 9-22-77
MATL
FINISH
DR KW | ENGR | APP

MDL 134 COMBUST. OR OXYGEN ANALYZER, UNIVERSAL INTERCONNECTION DIAG.

B-17497