



User Manual

Model 430

Compact Ozone Analyzer

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TRADEMARKS

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SAFETY MESSAGES

Important safety messages are provided throughout this manual for the purpose of avoiding personal injury or instrument damage. Please read these messages carefully. Each safety message is associated with a safety alert symbol, and are placed throughout this manual and inside the instrument. The symbols with messages are defined as follows:



WARNING: Electrical Shock Hazard



HAZARD: Strong oxidizer



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



CAUTION: Hot Surface Warning



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.



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



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 the 430 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).

Note

Technical Assistance regarding the use and maintenance of the 430 or any other Teledyne API product can be obtained by contacting Teledyne API's Technical Support Department:

Phone: 800-324-5190

Email: sda_techsupport@teledyne.com

or by accessing various service options on our website at
<http://www.teledyne-api.com/>.

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!

WARRANTY

WARRANTY POLICY (02024J)

Teledyne API (TAPI), a business unit of Teledyne Instruments, Inc., provides that:

Prior to shipment, TAPI equipment is thoroughly inspected and tested. Should equipment failure occur, TAPI assures its customers that prompt service and support will be available. (For the instrument-specific warranty period, please refer to the “Limited Warranty” section in the Terms and Conditions of Sale on our website at the following link: http://www.teledyne-api.com/terms_and_conditions.asp).

COVERAGE

After the warranty period and throughout the equipment lifetime, TAPI stands ready to provide on-site or in-plant service at reasonable rates similar to those of other manufacturers in the industry. All maintenance and the first level of field troubleshooting are to be performed by the customer.

NON-TAPI MANUFACTURED EQUIPMENT

Equipment provided but not manufactured by TAPI is warranted and will be repaired to the extent and according to the current terms and conditions of the respective equipment manufacturer’s warranty.

PRODUCT RETURN

All units or components returned to Teledyne API should be properly packed for handling and returned freight prepaid to the nearest designated Service Center. After the repair, the equipment will be returned, freight prepaid.

The complete Terms and Conditions of Sale can be reviewed at http://www.teledyne-api.com/terms_and_conditions.asp

CAUTION – Avoid Warranty Invalidation



Failure to comply with proper anti-Electro-Static Discharge (ESD) handling and packing instructions and Return Merchandise Authorization (RMA) procedures when returning parts for repair or calibration may void your warranty. For anti-ESD handling and packing instructions please refer to the manual, Fundamentals of ESD, PN 04786, in its “Packing Components for Return to Teledyne API’s Customer Service” section. The manual can be downloaded from our website at <http://www.teledyne-api.com>; RMA procedures can also be found on our website.

ABOUT THIS MANUAL

Note

We recommend that this manual be read in its entirety before any attempt is made to operate the instrument.

CONVENTIONS USED

In addition to the safety symbols as presented in the *Important Safety Information* page, this manual provides *special notices* related to the safety and effective use of the analyzer and other pertinent information.

Special Notices appear as follows:

ATTENTION

COULD DAMAGE INSTRUMENT AND VOID WARRANTY

This special notice provides information to avoid damage to your instrument and possibly invalidate the warranty.

IMPORTANT

IMPACT ON READINGS OR DATA

Could either affect accuracy of instrument readings or cause loss of data.

Note

Pertinent information associated with the proper care, operation or maintenance of the analyzer or its parts.

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1. INTRODUCTION, SPECIFICATIONS, APPROVALS

The Teledyne API Model 430 is a compact analyzer for measuring ozone.

1.1. OVERVIEW

The Model 430 is a compact, portable ozone analyzer that can be used for regulatory, research, or educational monitoring in routine, remote, and mobile air applications. Because of its low power consumption, it can be run from various DC power sources, such as batteries or solar panels, and can use car adapters.

1.2. SPECIFICATIONS

Table 1-1 below presents the Model 430 specifications.

Table 1-1: Model 430 Specifications

PARAMETER	SPECIFICATION	
Ranges	0-100 ppb (min), 0-20,000 ppb (max) (User-selectable)	
Measurement Units	ppb, ppm (User-selectable)	
Zero Noise	< 1 ppb (RMS)	
Span Noise	< 0.5% of reading (RMS) above 100 ppb	
Lower Detectable Limit	< 2 ppb	
Zero Drift	< 1 ppb/24 hours	
Span Drift	< 1% full-scale/24 hours	
Lag Time	< 20s	
Rise/Fall Time	< 15s to 95%	
Linearity	1% full-scale	
Precision	< 0.5 ppb or 0.5% of reading above 100 ppb	
Sample Flow Rate	0.8 L/min +/-10%	
Power	Rating	Power Consumption
	12V (DC) 110-240 V~ 50-60 Hz (AC) (With included power adapter)	9 W Typical, 30 W Max
Analog Output Ranges	0-5V	
Analog Output Resolution	16-Bit Resolution	

PARAMETER	SPECIFICATION
Standard I/O	1X RS-232 1X 0-5V analog output 5X 0-5V analog input 1X SD card slot (SD card not included)
Dimensions H x W x D	4.2" x 7.1" x 10.2" (107 x 180 x 259 mm)
Weight	5.2 lbs (2.4 kg)
Operating Temperature Range	5 - 40 °C
Humidity Range	0-95% RH non-condensing
Environmental Conditions ^{1, 2}	Installation Category (Over voltage Category) II Pollution Degree 2 Intended for Indoor Use Only ¹ Maximum Operating Altitude 2000 meters
¹ An external enclosure should be used in outdoor environments to prevent water and dust ingress ² A sample pre-filter is recommended for high dust/particulate environments	

1.3. EPA DESIGNATION

Teledyne API's Model 430 Compact Ozone Analyzer is officially designated as EPA Automated Equivalent Method EQOA-1015-229 for O₃ measurement as defined in 40 CFR Part 53. The official List of Designated Reference and Equivalent Methods is published in the U.S. Federal Register – <http://www3.epa.gov/ttn/amtic/criteria.html>.

1.4. APPROVALS AND CERTIFICATIONS

The Teledyne API Model 430 was designed, tested and certified for Safety and Electromagnetic Compatibility (EMC). This section presents the compliance statements for those requirements and directives. For additional certifications, please contact Technical Support by telephone at 1-800-324-5190 or by email at sda_techsupport@teledyne.com.

1.4.1. SAFETY

IEC/EN 61010-1:2010 (3rd Edition), safety requirements for electrical equipment for the measurement, control and laboratory use.

CE: 2006/95/EC, Low-Voltage Directive

1.4.2. EMC

IEC/EN 61326-1, Class A Emissions/Industrial Immunity
 EN55011 (CISPR 11), Group 1, Class A Emissions
 FCC 47 CFR Part 15B, Class A Emissions
 CE: 2004/108/EC, Electromagnetic Compatibility Directive

1.5. INSTRUMENT LAYOUT

1.5.1. FRONT PANEL

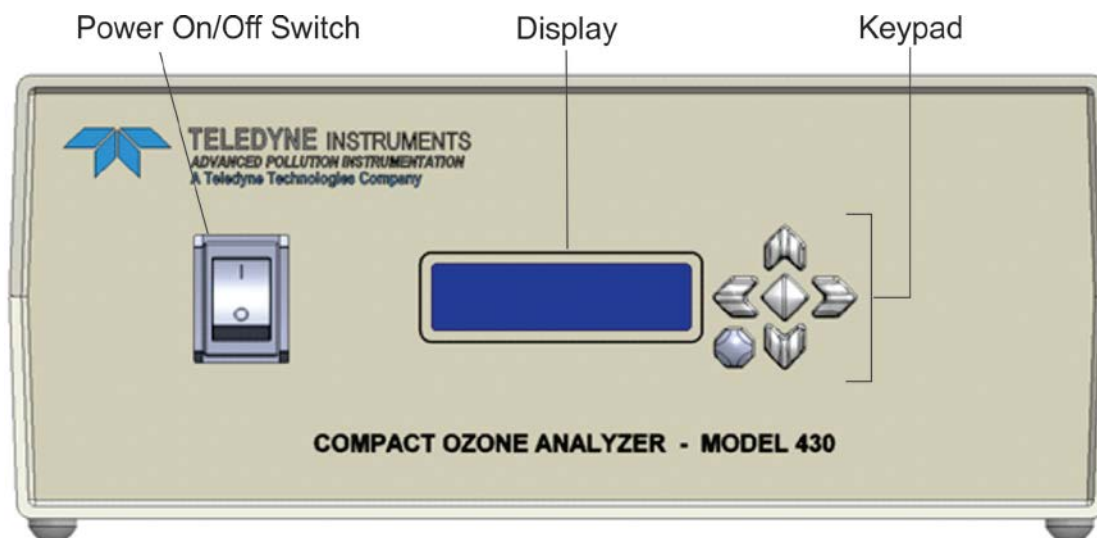


Figure 1-1. Model 430 Front Panel

1.5.2. REAR PANEL

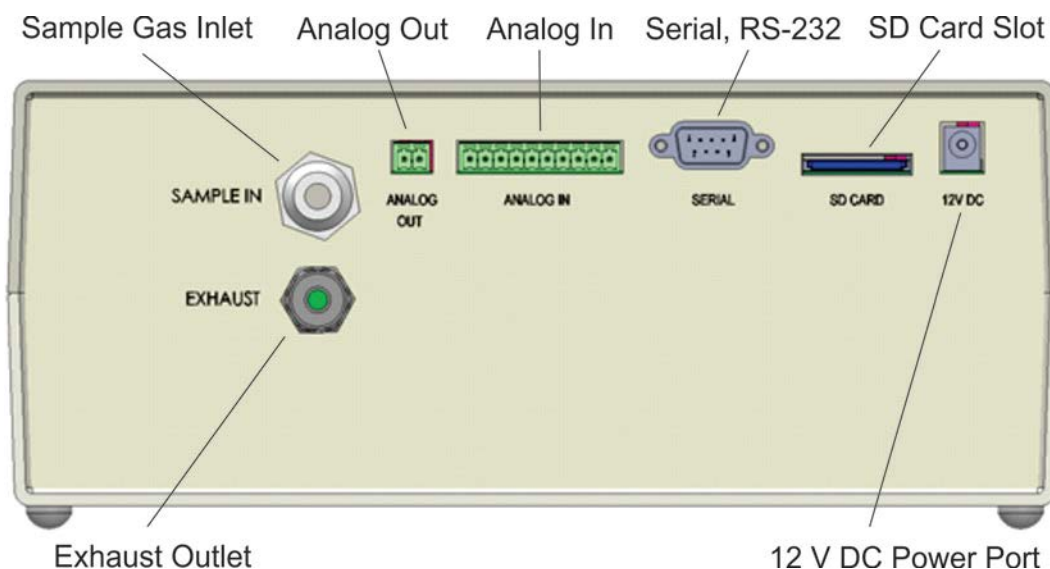


Figure 1-2. Model 430 Rear Panel

1.6. OPTIONAL RECHARGEABLE EXTERNAL BATTERY

The external battery option, rated for 14 hours of continuous use, is available for remote operation. This option includes a charger and requires a full charge before first use.

2. GETTING STARTED

This section addresses the procedures for unpacking, inspecting, setting up the instrument, and conducting an initial calibration check.

2.1. UNPACKING AND INSPECTING THE INSTRUMENT

ATTENTION

----- COULD DAMAGE INSTRUMENT AND VOID WARRANTY

Printed Circuit Assemblies (PCAs) are sensitive to electro-static discharges (ESD) too small to be felt by the human nervous system. Failure to use ESD protection when working with electronic assemblies will void the instrument warranty. For information on preventing ESD damage, refer to the manual, Fundamentals of ESD, PN 04786, which can be downloaded from our website at <http://www.teledyne-api.com> under Help Center > Product Manuals in the Special Manuals section.



CAUTION!

Do not operate this instrument until you've removed dust plugs from SAMPLE and EXHAUST ports on the rear panel.

Note

Teledyne API recommends that you store shipping containers/materials for future use if/when the instrument should be returned to the factory for repair and/or calibration service. See Warranty section in this manual and shipping procedures on our Website at <http://www.teledyne-api.com> under Customer Support > Return Authorization.

Verify that there is no apparent external shipping damage. If damage has occurred, please advise the shipper first, then Teledyne API.

For your Quality records the Final Test and Validation Data Sheet (P/N 08315) was included in your shipment as important quality assurance and calibration documentation.

2.2. PNEUMATIC CONNECTIONS

SAMPLE IN	Connect ¼" OD tubing (PTFE recommended) to the SAMPLE IN fitting.
EXHAUST	Connect ¼" OD tubing (PTFE recommended) to the EXHAUST fitting; ensure maximum 10 m length and the exhaust gases are properly ventilated.

2.2.1. INTERNAL PUMP

The instrument is equipped with an internal pump rated at 10,000 hours and requires no additional connections; refer to Section 4.1 for the maintenance schedule and Section 6 for the part number.

2.3. ELECTRICAL CONNECTIONS

Note

To maintain compliance with EMC standards, it is required that the cable length be no greater than 3 meters for all I/O connections, which include Power, Analog In, Analog Out, RS-232, and RS-485.

The Model 430 rear panel (Figure 1-2) has connectors for power, for serial communications, and for data collection and reporting.

2.3.1. POWER

Connect the power cord provided with the instrument to the 12 V DC power port. (If using the external battery option, insert the battery connector into the power port). The polarity of the power port is center positive as shown below:



Figure 2-1. Power Port Polarity

CAUTION!



Ensure that the power source complies with the power rating for this instrument.

Always maintain easy accessibility for quickly disconnecting power if needed.

2.3.2. ANALOG OUT

Connect a strip chart recorder or data-logger to the ANALOG OUT channels port. Configure the Analog Outputs via the Data menu (refer to Figure 3-2).

Table 2-1. Analog Output Pin Assignments

ANALOG OUT



(For orientation only;
not numbered on rear
panel).

PIN	ANALOG OUTPUT	STANDARD VOLTAGE OUTPUT
1	VOUT	0-5V
2	GND	

2.3.3. ANALOG IN

Connect other instrumentation to the ANALOG IN connector to receive and log external voltage signals. The input voltage range for each analog input is 0-5 V DC and input impedance is nominally 20 k Ω in parallel with 0.1 μ F. Configure the Analog Inputs via the View menu (refer to Figure 3-2).

Table 2-2. Analog In Pin Assignments

ANALOG IN



(For orientation only; not
numbered on rear panel)

PIN	DESCRIPTION
1	GND
2	VIN 1
3	GND
4	VIN 2
5	GND
6	VIN 3
7	GND
8	VIN 4
9	GND
10	VIN 5

2.3.4. SERIAL COMMUNICATIONS

Connect a DB9 connector to the SERIAL port for RS-232 communications. See Section 3.3, Data Collection, for data output to the serial output. Additionally, data stored in internal memory may be accessed through the serial port (Section 3.3.1).

Configure the settings for RS-232 communication as follows:

Baud	19200
Data bits	8
Parity	none
Stop bits	1
Flow control	none

2.3.4.1. COMMAND FORMAT AND SUMMARY

For serial communications protocol, the Model 430 follows the generic command format, **[cmd]: [val]** where [cmd] is the command letter and [val] is the numerical value if needed. Refer to Table 2-3 for the command summary.

Table 2-3. Serial Protocol Command Summary

Cmd	Description	Parameters
?:	List (these) commands.	n/a
A:[val]	Contrast	Integer, 0...50
B:[val]	Zero Offset (mV)	Float, -20.0...20.0
C:[val]	Span concentration in PPB	Float, 10.0...1.000.0
D:[val/val/val]	Set date: month, day, year	MM/DD/YY (with /s, pad with 0s)
E:	Perform analog electrical step test	n/a
F:[val]	Box Car Filter Length	Integer, 1...30
G:	Get NV Log Data	n/a
K:[val]	Keypad Backlight	Integer, 0...100
L:[val]	LCD Backlight	Integer, 0...100
M:[val]	Span Slope	Float, 0.5...2.0
R:[val]	Serial output rate (in seconds)	Integer, 10...999
S:	Perform Span calibration	n/a
T:[val:val:val]	Set time: hour, minutes, seconds (military/24 hour clock format)	HH:MM:SS (with :s, pad with 0s)
V:	Show current slope, offset, etc. operating values	n/a
W:	Show current warning and error codes	n/a
X:	Clear NV Log Data	n/a
Y:	Restore default EE values	n/a
Z:	Perform Zero calibration	n/a

3. OPERATION

This section provides instructions for operating the Model 430, including a description of the display and control/navigation panel, the menu structure, and communication and data collection.

3.1. DISPLAY AND NAVIGATION

At power on, a splash screen appears in the display, followed by measurement readings, which will stabilize after a short warming period.

Figure 3-1 illustrates how to enter and move through the menu system and how to select menu items, cancel, or exit a menu.

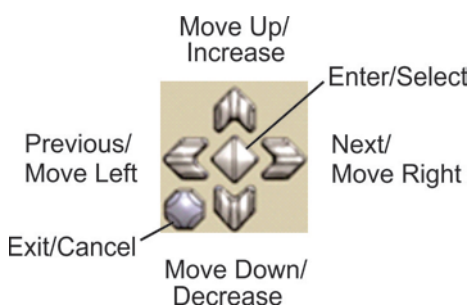


Figure 3-1. Model 430 Control Buttons

3.2. MENU

The menu system (Figure 3-2) consists of four main menus: View, Calibration, Configuration, and Data.

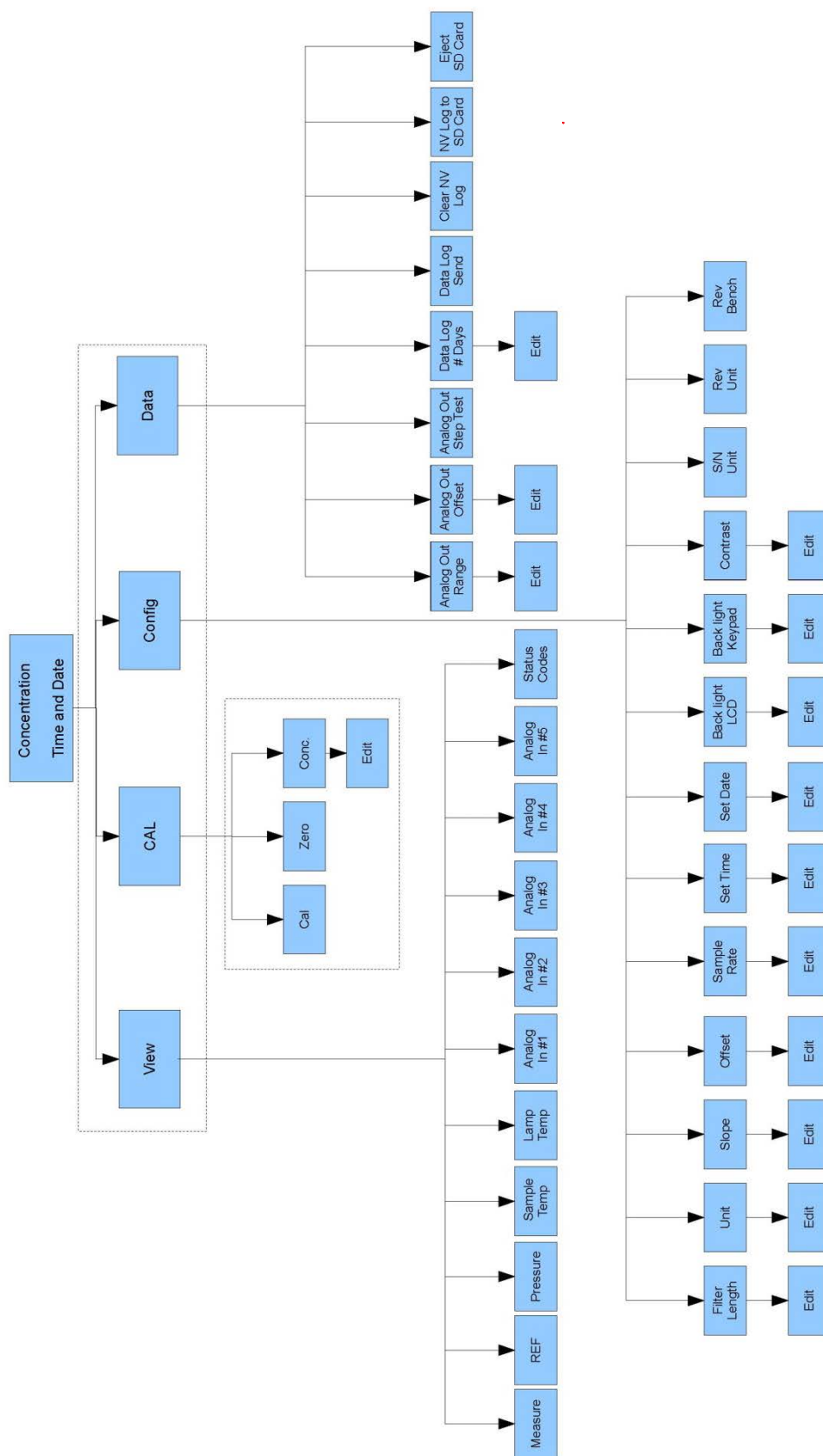


Figure 3-2. Model 430 Menu Map

3.2.1. VIEW

The View menu displays performance parameters of the bench module. The values are updated in real-time as they continuously scroll. The View menu also displays Analog Inputs from up to five external sensors.

Table 3-1. View Menu Description

Parameter	Meaning	Units	Normal Range*
MEASURE	UV detector reading, measure cycle	mV	250 – 1230
REF	UV detector reading, reference cycle	mV	250 – 1230
PRESSURE	Sample pressure	psia	9.0 – 14.9
SAMPLE TEMP	Sample temperature	°C	5.0 – 50.0
LAMP TEMP	UV lamp temperature	°C	50.0 – 52.0
Analog In #1 thru Analog In #5	Analog input readings from up to five external sensors.	V	0.0 – 5.0
*After initial 20 minute warm-up period.			

3.2.2. CAL (CALIBRATION)

The Model 430 is calibrated at the factory to NIST traceable standards. A calibration certificate for your instrument is shipped with the instrument. Teledyne API also recommends that the Model 430 be re-calibrated once a year. Teledyne API can provide NIST traceable calibration services at our factory or on-site. Please contact our Technical Support department for details on these services.

Refer to Figure 3-1 for control buttons called out in the following instructions:

To access the Calibration menu from the top-level menu, highlight CAL and press the Enter button.

- To recalibrate, highlight **CAL** and press the Enter button.
- To run a zero calibration, highlight **Zero** and press the Enter button.
- To change the calibration concentration, highlight **Conc** and press Enter, then use the directional keys to change the value, and press Enter to confirm. (Or press Cancel to abort the change).

3.2.3. CONFIG (CONFIGURE)

Scroll to the configuration parameters, press Enter to edit.

Table 3-2. Config Menu Description

Menu Item	Description
Filter Length	Moving average filter for measured concentration (default 10 samples).
Unit	Change units between PPB and PPM.
Slope	Manually edit the calibration slope.
Offset	Manually edit the calibration offset.
Sample Rate	Change the frequency of data reporting from the serial output.
Set Time	Adjust the time of day.
Set Date	Adjust the date.
Backlight LCD	Adjust the brightness of the liquid-crystal display.
Backlight keypad	Adjust the lighting behind the control buttons.
Contrast	Adjust the contrast of the liquid-crystal display.
S/N Unit	Press to display the instrument's serial number.
Rev Unit	Press to display the instrument revision.
Rev Bench	Press to display the bench revision.

3.2.4. DATA

The Data menu allows configuration of the Analog Output and operation of the internal data log and the SD Card. Note that the menus use “NV” (non-volatile) to refer to data in the internal memory as distinguished from data on an SD card).

Table 3-3. Data Menu Description

Menu Item	Description
Analog Out	Analog Out Range and Analog Out Offset are used to configure the analog output for 0-5 V, which correlates to the 0-to-maximum concentration range, by adjusting the voltage values through their respective Edit menus. The voltage output signal is automatically scaled according to the settings. Analog Out Step Test ramps the analog output signal from 0 to 5 V at 1.25 V increments to test the analog output. The analog output signal can be verified by measuring the voltage with a multimeter.
Data Log	Data Log Send sends the data stored on the internal memory through the serial output. Data Log # Days>Edit sets the number of days' worth of data that will be sent under the Data Log Send command.
Clear NV Log	Clear NV Log clears the data from the non-volatile internal memory log. (Does not impact any data on an SD card).
SD Card	NV Log to SD Card sends the data stored on the non-volatile (NV) internal memory to the SD card.  DO NOT REMOVE THE SD CARD OR POWER OFF THE INSTRUMENT WITHOUT FIRST RUNNING A SOFTWARE EJECT VIA THE DATA>EJECT SD CARD MENU. Improper ejection of the SD card may result in corruption or loss of data. Eject SD Card performs a software eject, which is required <i>prior</i> to removing the SD card or powering off the instrument.

3.3. DATA COLLECTION

Sample measurements begin upon power-up, and are constantly outputted through the serial connection while the instrument is running. Data output can be recorded through the serial port using programs such as Hyperterminal, and will appear as one line in a comma-delimited format.

Data line Example:

12/18/15,15:19:16,150.60,1057.75,1056.88,14.56,29.82,51.87,1.2,1.0,2.3,3.5,4.9,00,00

DATE, TIME, CONCENTRATION, MEASURE, REF, PRESSURE, SAMPLE TEMP, LAMP TEMP, ANALOG 1, ANALOG 2, ANALOG 3, ANALOG 4, ANALOG 5, OZONE BENCH ERROR BYTE (E1), INSTRUMENT ERROR BYTE (E2)

See Table 3-1 for description of parameters and units.

3.3.1. INTERNAL STORAGE

Data is automatically collected in the internal memory of the instrument, which is capable of storing 10,000 lines of data (see data line example in Section 3.3). Stored data may be sent through the serial port using the **Data Log Send** command in the Data menu on the instrument front panel, and can also be transferred to an SD card (see Section 3.3.2). The number of days of data being sent can be set with the **Serial Data # Days** command in the Data menu.

When the memory is filled, the oldest data entry is overwritten with the newest data entry.

3.3.2. SD CARD

When inserted, an SD card begins automatically collecting/storing data simultaneously with the internal memory storage (Section 3.3.1). An SD card can also have data that was stored in the internal memory prior to the card's insertion transferred to it via the **NV Log to SD Card** command in the Data menu.

Additional points:

- Format of data and rate of record apply to all data collection.
- A new file is created daily at midnight.
- SD cards are not provided with the instrument.
- The Model 430 is compatible with SD and SDHC memory cards. The following brands are recommended:
 - SanDisk (SDHC Class 4 or faster)
 - Kingston (SDHC Class 4 or faster).

Note

Prior to 1st use, SD cards must be formatted to FAT32.

IMPORTANT

AVOID CORRUPTING DATA

To avoid the risk of corrupting data, do not remove the SD card or power off the instrument until first performing a software eject through the front panel menu, **Data>Eject SD Card**.

4. MAINTENANCE AND SERVICE

4.1. MAINTENANCE SCHEDULE

Table 4-1. Maintenance Schedule

MAINTENANCE ITEM	ACTION	FREQUENCY	DATE	DATE	DATE	DATE	DATE
Pump	Replace	Recommended at 10,000 hours or when the flow is less than 0.7 lpm.					
Filter	Replace	every 6 months *					
Measurement Bench:							
UV Lamp	Adjust	As needed, when REF value is out of range (800-1150 mV).					
	Replace	As needed, when REF can no longer be adjusted within range.					
Bench Module Valve	Replace	Every 2 years.					
*Some environments may require greater frequency; recommend checking monthly until determined.							

4.2. SERVICE AND TROUBLESHOOTING

The Model 430 requires little service other than being wiped down occasionally and following the maintenance schedule as presented in Section 4.1. However, in the rare instance that any fault may occur, the instrument will display messages that describe the cause of the fault. A fault can be either a Warning or an Error.

4.2.1. WARNINGS AND ERRORS

A Warning alerts the user to a non-critical fault while allowing operation to continue; an Error is a critical fault that prevents operation of the instrument until the cause has been resolved.

When a **Warning** occurs, the user is alerted by a front panel message describing the fault; the warning message may be dismissed by pressing X; however, if the fault persists or is not resolved, an asterisk (*) in the upper right corner of the display will continuously flash to indicate that the fault is still active. Pressing X again shows the warnings that are active or have previously occurred and resolved but not cleared. To clear a fault message, resolve the problem and then press X again; the message disappears and the asterisk stops flashing (unless there are other pending faults).

When an **Error** occurs, the instrument can no longer be operated, nor can the front panel message be dismissed until the issue is resolved. Resolve the issue, then clear the Error message by pressing X.

The Error message will also display a series of hexadecimal codes that indicate the occurring Error(s) or Warning(s). These hexadecimal codes must be converted to binary numbers (Table 4-2) that can be looked up in tables listing the front panel messages with their definitions or descriptions and conditions (Table 4-3, Table 4-4, or Table 4-5).

Note

The hexadecimal codes must be converted to binary code, using Table 4-2, in order to look up the Error or Warning definitions in Table 4-3, Table 4-4, or Table 4-5.

To decipher the error and warning codes, follow these steps (example follows):

1. Convert the error/warning code from hexadecimal to an 8-digit binary number (refer to Table 4-2).
2. Note which digit positions (bits) of the 8-digit binary number have a value of 1 (each bit is assigned a position number by its place from right to left, 0 - 7).
3. Look up the bit position number in the applicable table (Table 4-3 for an S:xx code, Table 4-4 for an E1:xx code, or Table 4-5 for an E2:xx code). The “E/W” column in Tables 4-4 and 4-5 indicates whether it is an Error (E) or a Warning (W).
 - If the value of a bit is 1, then that particular error or warning is active.
 - If the value of a bit is 0, then that particular error or warning is not active.

For example, for an error code of **E1:50**:

Convert **50** from hexadecimal to binary (Table 4-2), which yields 01010000.

Count the bit positions 0 through 7 from right to left, which shows the value one (1) at bit positions **4** and **6**.

Go to Table 4-4 (for **E1:xx** codes), and look up Bit 4 and Bit 6 for the active faults: Bit 4 = Lamp Low Warning; Bit 6 = Pressure Warning).

Active warning codes can also be viewed in the View>Status Codes menu.

Table 4-2. Hexadecimal-to-Binary Conversion

HEX	BINARY	HEX	BINARY	HEX	BINARY	HEX	BINARY	HEX	BINARY	HEX	BINARY	HEX	BINARY	HEX	BINARY
00	00000000	20	00100000	40	01000000	60	01100000	80	10000000	A0	10100000	C0	11000000	E0	11100000
01	00000001	21	00100001	41	01000001	61	01100001	81	10000001	A1	10100001	C1	11000001	E1	11100001
02	00000010	22	00100010	42	01000010	62	01100010	82	10000010	A2	10100010	C2	11000010	E2	11100010
03	00000011	23	00100011	43	01000011	63	01100011	83	10000011	A3	10100011	C3	11000011	E3	11100011
04	00000100	24	00100100	44	01000100	64	01100100	84	10000100	A4	10100100	C4	11000100	E4	11100100
05	00000101	25	00100101	45	01000101	65	01100101	85	10000101	A5	10100101	C5	11000101	E5	11100101
06	00000110	26	00100110	46	01000110	66	01100110	86	10000110	A6	10100110	C6	11000110	E6	11100110
07	00000111	27	00100111	47	01000111	67	01100111	87	10000111	A7	10100111	C7	11000111	E7	11100111
08	00001000	28	00101000	48	01001000	68	01101000	88	10001000	A8	10101000	C8	11001000	E8	11101000
09	00001001	29	00101001	49	01001001	69	01101001	89	10001001	A9	10101001	C9	11001001	E9	11101001
0A	00001010	2A	00101010	4A	01001010	6A	01101010	8A	10001010	AA	10101010	CA	11001010	EA	11101010
0B	00001011	2B	00101011	4B	01001011	6B	01101011	8B	10001011	AB	10101011	CB	11001011	EB	11101011
0C	00001100	2C	00101100	4C	01001100	6C	01101100	8C	10001100	AC	10101100	CC	11001100	EC	11101100
0D	00001101	2D	00101101	4D	01001101	6D	01101101	8D	10001101	AD	10101101	CD	11001101	ED	11101101
0E	00001110	2E	00101110	4E	01001110	6E	01101110	8E	10001110	AE	10101110	CE	11001110	EE	11101110
0F	00001111	2F	00101111	4F	01001111	6F	01101111	8F	10001111	AF	10101111	CF	11001111	EF	11101111
10	00010000	30	00110000	50	01010000	70	01110000	90	10010000	B0	10110000	D0	11010000	F0	11110000
11	00010001	31	00110001	51	01010001	71	01110001	91	10010001	B1	10110001	D1	11010001	F1	11110001
12	00010010	32	00110010	52	01010010	72	01110010	92	10010010	B2	10110010	D2	11010010	F2	11110010
13	00010011	33	00110011	53	01010011	73	01110011	93	10010011	B3	10110011	D3	11010011	F3	11110011
14	00010100	34	00110100	54	01010100	74	01110100	94	10010100	B4	10110100	D4	11010100	F4	11110100
15	00010101	35	00110101	55	01010101	75	01110101	95	10010101	B5	10110101	D5	11010101	F5	11110101
16	00010110	36	00110110	56	01010110	76	01110110	96	10010110	B6	10110110	D6	11010110	F6	11110110
17	00010111	37	00110111	57	01010111	77	01110111	97	10010111	B7	10110111	D7	11010111	F7	11110111
18	00011000	38	00111000	58	01011000	78	01111000	98	10011000	B8	10111000	D8	11011000	F8	11111000
19	00011001	39	00111001	59	01011001	79	01111001	99	10011001	B9	10111001	D9	11011001	F9	11111001
1A	00011010	3A	00111010	5A	01011010	7A	01111010	9A	10011010	BA	10111010	DA	11011010	FA	11111010
1B	00011011	3B	00111011	5B	01011011	7B	01111011	9B	10011011	BB	10111011	DB	11011011	FB	11111011
1C	00011100	3C	00111100	5C	01011100	7C	01111100	9C	10011100	BC	10111100	DC	11011100	FC	11111100
1D	00011101	3D	00111101	5D	01011101	7D	01111101	9D	10011101	BD	10111101	DD	11011101	FD	11111101
1E	00011110	3E	00111110	5E	01011110	7E	01111110	9E	10011110	BE	10111110	DE	11011110	FE	11111110
1F	00011111	3F	00111111	5F	01011111	7F	01111111	9F	10011111	BF	10111111	DF	11011111	FF	11111111

Table 4-3. Ozone Bench Status Byte (FW rev 1.06, not logged, displayed as S:xx during errors)

Bit	Definition	Front Panel Message
0	Data stale bit, no new data, 1 = stale	
1	Global error bit, 1 = error pending	
2	Startup mode bit, 1 = sensor in startup mode	STARTUP
3	Reading Invalid (Lamp Low Err) (Negative Reading < -10ppb) (	DATA INVALID
4	A/D locked	BENCH ADC ERROR
5	N/A	
6	Pressure < 9 psia or > 14.9 psia	PRESSURE ERROR
7	N/A	

Table 4-4. Ozone Bench Error Byte (FW rev 1.06, logged, displayed as E1:xx during errors)

Bit	Description	E/W	Conditions	Front Panel Message
0	EEPROM Initialized	W	EEPROM Initialized	BENCH HW ERROR
1	Lamp Temp Warning	W	50 < Lamp Temp < 62 (deg C)	LAMP TMP WARNING
2	Lamp Temp Error	E	-20 < Lamp Temp < 120 (degC) (Heater Off)	LAMP ERROR
3	Sample Temp Warning	W	0 < Sample Temp < 55 (deg C)	SAMPLE TMP WARN
4	Lamp Low Warning	W	Reference_mv < 375	LAMP LOW WARNING
5	Lamp Low Error	E	Reference_mv < 250	LAMP ERROR
6	Pressure Warning	W	9 < Pressure < 14.9 (psia)	PRESSURE ERROR
7	Lamp Stability	E	IIR threshold exceeded	LAMP ERROR

Table 4-5. Instrument Error Byte (FW rev 1.12, logged, displayed as E2:xx during errors)

Bit	Description	E/W	Conditions	Front Panel Message
0	Bench Comm Error	E	Bench is not responding	BENCH COM ERROR
1	n/a	-	Not implemented	
2	DAC Warning	W	DAC is unresponsive	DAC WARNING
3	RTC Error	E	RTC is malfunctioning	RTC ERROR
4	EEPROM Warning	W	EEPROM was initialized	EEPROM WARNING
5	AFE Warning	W	A-to-D system on motherboard is unresponsive	AFE WARNING
6	Pump Warning	W	Pressure drop after starting pump is too small	PUMP WARNING
7	n/a	-		

4.3. TECHNICAL ASSISTANCE

Contact Teledyne API Technical Support for any assistance:

Phone: +1 858-657-9800, Toll-free: 800-324-5190

Email: sda_techsupport@teledyne.com

5. PRINCIPLES OF OPERATION

Refer to Figure 5-1 for pneumatics and Figure 5-2 for electronics.

The Model 430 ozone analyzer measures ozone using UV absorption to calculate the concentration of ozone flowing through the sample path. The Model 430 uses a mercury lamp constructed to emit UV light at 254nm wavelength. This light shines down a hollow quartz tube that is alternately filled with sample gas, then filled with gas scrubbed to remove ozone in order to achieve a stable and accurate measurement. The flow is driven by a small sample pump inside the instrument and is controlled using a precision flow orifice.

Between the sample gas and the scrubbed gas, the intensity of the light is measured and compared as a ratio I/I_0 , using the Beer-Lambert equation. This ratio forms the basis for the calculation of the ozone concentration. (The Beer-Lambert equation factors the temperature, the pressure, and other parameters that also influence the density, thereby providing the true concentration of ozone.)

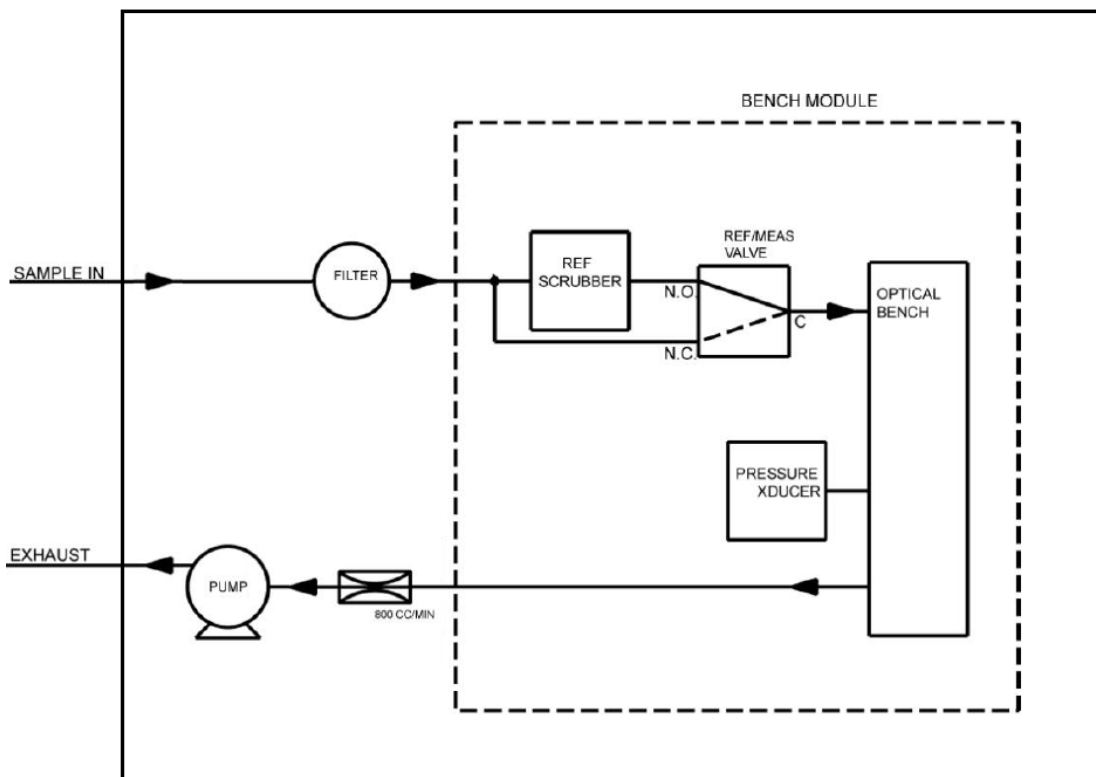


Figure 5-1. Model 430 Pneumatic Diagram

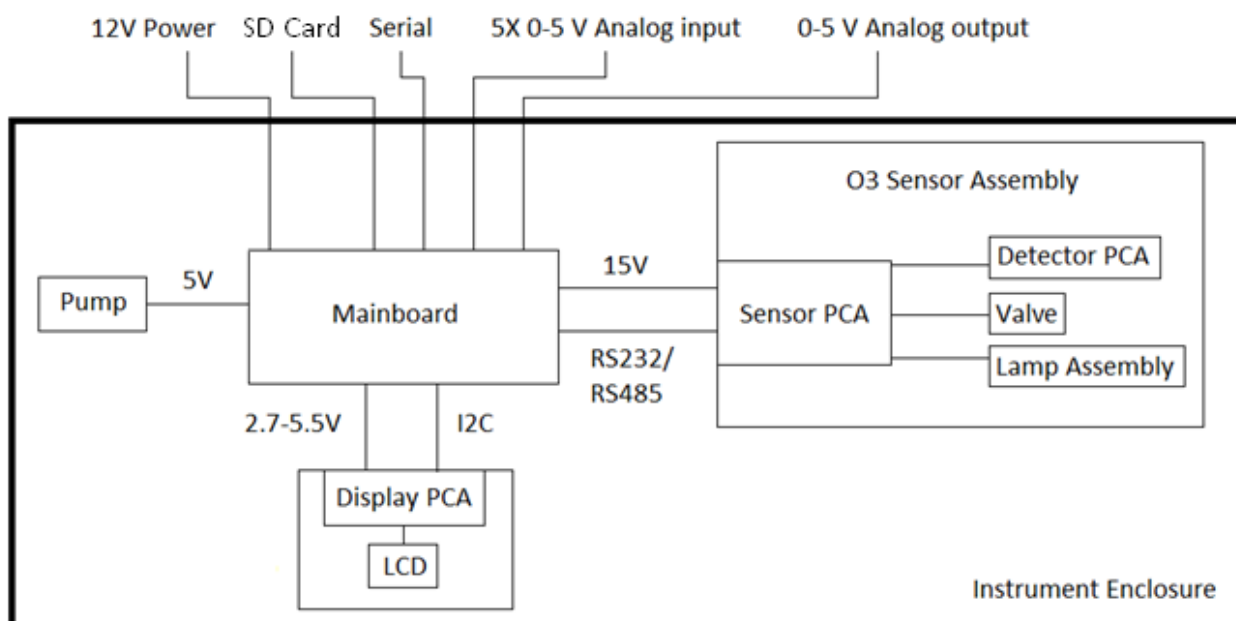


Figure 5-2. Model 430 Electronic Diagram

6. SPARE PARTS LIST

Note

Due to the dynamic nature of part numbers, please consult with
Technical Support before ordering spare parts. Call or email:

Phone: 800-324-5190

Email: sda_techsupport@teledyne.com

or access various service options on our website at
<http://www.teledyne-api.com/>.

Part	Part Number
Pump	083470000
Lamp	065660000
Filter	FL0000033
Valve	VA0000054