



FORMALDEHYDE METER

USER'S MANUAL



FD08

Please read this manual carefully and thoroughly before using this product

TABLE OF CONTENTS

Introduction	2 – 6
Key Features	7
What's in the Package	8
Product Overview	8 – 9
Setup Instructions	9 – 10
Install Batteries	9 - 10
Operating Instructions	10 – 14
Specifications	14 - 15
Operating & Maintenance Tips	15- 18
Warranty Information	18
Return for Repair Policy	19

INTRODUCTION

Thank you for purchasing General Tools & Instruments' FD08 Formaldehyde Meter. Please read this user's manual carefully and thoroughly before using the product.

The FD08 is an easy-to-use handheld instrument for measuring levels of gaseous formaldehyde (HCHO) as part of a workplace indoor air quality (IAQ) maintenance program or to spot-check a residential environment.

Exposure to formaldehyde has a significant impact on human health. In 2011, the U.S. National Toxicology Program described formaldehyde as "known to be a human carcinogen." It can also be toxic and allergenic.

Formaldehyde—which is colorless and has a characteristic pungent, irritating odor—is ubiquitous. It is produced by the oxidation or combustion of methane and other carbon compounds and is therefore present in forest fires, automobile exhaust, and tobacco smoke. When produced in the atmosphere by the action of sunlight and oxygen on atmospheric methane and other hydrocarbons, formaldehyde becomes part of smog.

The primary exposure concern is for the workers in the industries producing or using formaldehyde. Including indirect employment, over 4 million people work in the formaldehyde industry across approximately 11,900 plants in the U.S. and Canada alone. For example, the textile industry uses formaldehyde-based resins as finishers to make fabrics crease-resistant. Formaldehyde-based materials are key to the manufacture of automobile transmissions, electrical systems, engine blocks, door panels, axles and brake shoes.

Occupational exposure to formaldehyde by inhalation is mainly from three types of sources: thermal or chemical decomposition of formaldehyde-based resins, formaldehyde emission from aqueous solutions (for example, embalming fluids), and combustion of a variety of organic compounds. Because formaldehyde resins are used in many construction materials it is one of the more common indoor air pollutants. At concentrations above 0.1 ppm in air, formaldehyde can irritate the eyes and mucous membranes, resulting in watery eyes. Formaldehyde inhaled at this concentration may cause headaches, a burning sensation in the throat and difficulty breathing, and can trigger or aggravate asthma symptoms.

When treated with phenol, urea, or melamine, formaldehyde produces polymer resins that are commonly used as permanent adhesives in plywood and carpeting, in nail

hardeners and nail polish, and as the wet-strength material added to sanitary paper products such as facial tissue, table napkins and roll towels. Production of formaldehyde resins accounts for more than half of formaldehyde consumption.

Other formaldehyde derivatives include methylene diphenyl diisocyanate, an important ingredient of polyurethane paints and foams. Formaldehyde has been found as a contaminant in several bath products, at levels from 54 to 610 ppm; it is thought to arise from the breakdown of preservatives in the products. Since 2006, formaldehyde (methylene glycol) is also used in hair smoothing treatments in order to straighten wavy/curly hair and make hair less prone to frizz in humid weather. OSHA Oregon has reported these treatments as unsafe for human health.

An aqueous solution of formaldehyde can be useful as a disinfectant as it kills most bacteria and fungi, including their spores. Formaldehyde solutions are applied topically in medicine to dry the skin, such as in the treatment of warts.

Urinary tract infections are often treated with a derivative of formaldehyde (methenamine), a method often chosen because it prevents overuse of antibiotics and the resultant development of bacterial resistance to them. Some topical creams, cosmetics and personal hygiene products contain derivatives of formaldehyde as the active ingredients that prevent the growth of potentially harmful bacteria.

A 1988 Canadian study of houses with urea-formaldehyde foam insulation found that formaldehyde levels as low as 0.046 ppm were positively correlated with eye and nasal irritation. A recent review of studies has shown a strong association between exposure to formaldehyde and the development of childhood asthma. Chronic exposure at higher

levels, starting at around 1.9 ppm, has been shown to result in significant damage to pulmonary function, resulting in reduced maximum mid-expiratory flow and forced vital capacity. There is also research that supports the theory that formaldehyde exposure contributes to reproductive problems in women.

RESIDENTIAL EXPOSURE

In the residential environment, formaldehyde exposure comes from a number of different routes; formaldehyde can off-gas from wood products, such as plywood or particle board, but it is produced by paints, varnishes, floor finishes, and cigarette smoke as well.

The U.S. Environmental Protection Agency (EPA) allows no more than 0.016 ppm formaldehyde in the air in new buildings constructed for that agency. An EPA study found that a new home measured 0.076 ppm when brand new and 0.045 ppm after 30 days. The agency recommends the use of “exterior-grade” pressed-wood products with phenol instead of urea resin to limit formaldehyde exposure, since pressed-wood products containing formaldehyde resins are often a significant source of formaldehyde in homes.

People who suffer allergic reactions to formaldehyde tend to display lesions on the skin in the areas that have had direct contact with the substance, such as the neck or thighs (often due to formaldehyde released from permanent-press clothing) or dermatitis on the face (typically from cosmetics). Formaldehyde has been banned in cosmetics in both Sweden and Japan.

The eyes are most sensitive to formaldehyde exposure: The lowest level at which many people can begin to smell formaldehyde is about 0.05 ppm and the highest level is 1 ppm. The maximum concentration value at the workplace is

0.3 ppm. In controlled chamber studies, individuals begin to sense eye irritation at about 0.5 ppm; 5 to 20% report eye irritation at 0.5 to 1 ppm; and greater certainty for sensory irritation occurred at 1 ppm and above. While some agencies have used a level as low as 0.1 ppm as a threshold for irritation, the expert panel found that a level of 0.3 ppm would protect against nearly all irritation. In fact, the expert panel found that a level of 1.0 ppm would avoid eye irritation—the most sensitive endpoint—in 75 to 95% of all people exposed.

Formaldehyde emits from a variety of construction materials, furnishings, and consumer products. The three products that emit the highest concentrations are medium-density fiberboard, hardwood plywood, and particle board.

Environmental factors such as temperature and relative humidity can elevate levels because formaldehyde has a high vapor pressure. Formaldehyde levels from building materials are the highest when a building first opens because materials have had less time to off-gas. Formaldehyde levels decrease over time as the sources suppress.

A Guide to Formaldehyde Exposure Levels

0.03 ppm	Average outdoor level
0.10 ppm	Recommend upper short-term exposure limit (STEL) limit for residences by ASHRAE, ANSI, EPA, and NIOSH
0.40 ppm	Recommended upper STEL for manufactured homes
0.50 ppm	OSHA's workplace limit

0.75 ppm	OSHA's 15-minute time-weighted average (TWA) limit
0.80 ppm	Level at which most people first detect odor
2.00 ppm	OSHA's STEL limit

KEY FEATURES

- Electrochemical sensor measures real-time formaldehyde gas concentration from 0 to 5 ppm with $\pm 5\%$ accuracy and 0.01 ppm resolution
- Also tracks, calculates and displays three cumulative formaldehyde gas metrics: 8-hour TWA (time-weighted average), 1-hour average, and 15-minute STEL (short-term exposure limit)
- One-button calibration to 0 ppm in fresh air
- User-adjustable high concentration audible alarm threshold
- Also measures relative humidity (RH) and temperature in °F or °C
- Manually offsettable long-term drift of temperature and RH accuracy
- Min/Max memory and data hold
- Large backlit dual-readout LCD
- 15-minute Auto Power Off (can be disabled)
- Low battery indication
- Tripod mount
- Powered by (4) “AAA” batteries (not included) or included 110VAC adaptor
- CE and RoHS approved
- 2 year limited warranty

WHAT'S IN THE PACKAGE

The FD08, a 110VAC adaptor and this user's manual come in a soft pouch inside a white box.

PRODUCT OVERVIEW

Fig. 1 shows all controls, indicators and physical structures of the FD08. Fig. 2 shows all possible indications on the LCD. Familiarize yourself with the locations and functions of the control buttons and the meanings of the display icons before moving on to the Setup Instructions and Operating Instructions.

1. Formaldehyde gas sensor inside vented ball housing

2. Dual-readout LCD

3. Control buttons

HOLD. Freezes both readouts.

Also used to increment individual digits of high concentration alarm.

MODE. Pressed and held, calibrates meter to 0 ppm in fresh air. Pressed briefly in high alarm adjustment mode, shifts one digit to left.

PWR. Pressed briefly with meter off, powers meter on.

Pressed briefly with meter on, arms/disarms high concentration alarm. **Pressed and held with meter on,** powers meter off.



Fig. 1. The controls, indicators and physical structures of the FD08

MAX/MIN. Selects value shown on upper readout. Options are: 1) highest or lowest (Max or Min) level detected since meter was powered on; 2) 8-hour TWA (time-weighted average); 3) 15-minute STEL (short-term exposure limit); 4) 1-hour average. **Pressed briefly** in high alarm adjustment mode, shifts one digit to right.

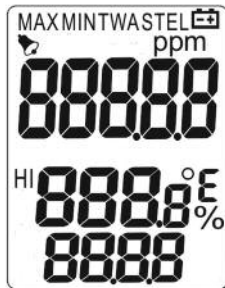
SET. Pressed and held, enters/exits high alarm adjustment mode.

UNIT. Selects °F or °C unit for ambient temperature reading.

BKLT. Pressed briefly, turns backlight on and off. Also used to decrement individual digits of high concentration alarm.

4. Battery compartment (on back)
5. Threaded tripod mounting screw hole (on bottom)
6. Jack for AC adaptor (on side)

Fig. 2. All possible display indications



SETUP INSTRUCTIONS

INSTALL BATTERIES

The FD08's battery compartment (Fig. 1, Callout 4) is located on the lower back of the meter.

Obtain four “AAA” batteries. **To install them:**

1. Open the battery compartment by using your thumb to slide its cover down and away from the meter.
2. Install the batteries in series in the compartment, observing the polarity markings inside.
3. Close the battery compartment by sliding the cover back up on its track until it snaps shut.

OPERATING INSTRUCTIONS

To power on the FD08, briefly press the **PWR** button. The LCD will illuminate and immediately begin scrolling “0s” across the five positions on the upper readout to indicate that it is warming up. During the warmup period, the meter will burn off any dust on the formaldehyde sensor inside the vented ball. If this is the first use of the meter or if it has not been powered on for a long time, the warmup period may last as long as several hours.

Normally, it takes 1 to 15 minutes for the scrolling to stop. Once it stops, the upper readout will begin counting down from **9999** through **8888** and **7777** all the way to **0000**. When the upper readout reaches **0000**, if no formaldehyde is present the upper readout will begin reading **0.00 ppm**, the lower readout will begin alternating displays of ambient temperature and RH, and the term **HCHO** (the chemical formula for formaldehyde) will appear below the lower readout.



If you want the meter to calculate and display cumulative formaldehyde levels over a period longer than 15 minutes (the meter's Auto Power Off triggering time), you must disable the APO function. **To power on the FD08 and simultaneously disable the APO function**, first press and hold the **HOLD** button, and then (without releasing **HOLD**) press and hold the **PWR** button. Doing this will cause a small **n** to briefly appear on the LCD before the meter powers up with both readouts visible. There is no permanent on-screen indication that the APO function has been disabled. So if you disable APO, realize that the batteries will discharge within an hour or two if you forget to manually power off the meter after a measurement session.

Once the meter has been powered on and both readouts have stabilized, the FD08 automatically begins operating in real-time measurement mode. In this mode you can:

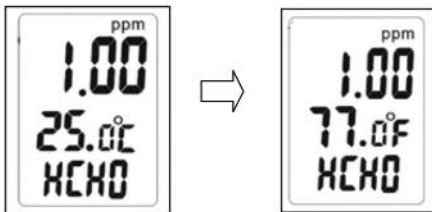
- 1) **Turn the LCD backlight on and off**, by briefly pressing the **BKLT** button. This feature comes in handy when making measurements above your head, below your knees, around a corner, or in the dark.
- 2) **Calibrate the meter to 0 ppm**. With the FD08 powered on in a room completely free of formaldehyde gas, enter calibration mode by pressing and holding the **MODE** button. This will produce the screen shown below, with temperature and RH values continuing to alternate on the lower readout. The "00000" string will continue to flash during the self-calibration procedure, which typically takes 15 seconds.



- 3) **Freeze both readouts** by briefly pressing the **HOLD** button. The term **Hold** will appear below the lower readout as a reminder that neither readout is now showing real-time values.



- 4) **Change the unit of the ambient temperature value shown on the lower readout** to/from °F and °C by pressing the **UNIT** button. The FD08 will “remember” the unit in use when the meter powers off and will resume using that unit when it is powered on again.

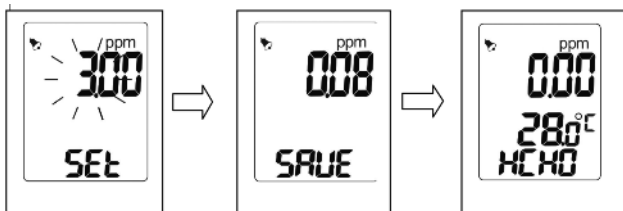


- 5) **Adjust the high concentration alarm threshold.** To enter threshold adjustment mode, press and hold the **SET** button. This will produce a display showing **0.08 ppm** (the default alarm threshold) on the upper readout, with the left “0” (the “ones” digit) flashing. To raise the threshold in increments of 1 ppm to a maximum of 5 ppm, press the **HOLD** button one or more times. To lower the threshold in increments of 1 ppm, press the **BKLT** button one or more times.

To adjust the alarm threshold in increments of less than 1 ppm, use the **MODE** and **MAX/MIN** buttons to move the flashing digit left and right, respectively. Then use the **HOLD** and **BKLT** buttons to set the “tenths” and

“hundredths” digits of the ppm threshold to any value between 0 and 9. Used together, the **HOLD**, **BKLT**, **MODE** and **MAX/MIN** buttons allow you to set the alarm threshold to any value between 0 and 5 ppm with 0.01 ppm resolution.

Once you have adjusted the high alarm threshold to its desired value, press and hold the **SET** button to save the setting and return to real-time measurement mode.



6) Arm and disarm the high concentration alarm.

- To arm the alarm, briefly press (but do not hold) the **PWR** button until the 🐼 icon appears in the upper left corner of the LCD.
- To disarm the alarm, briefly press the **PWR** button until the 🐼 icon disappears.
- To cancel the alarm when it sounds, briefly press the **PWR** button.

7) Display maximum and minimum formaldehyde, temperature and RH session values, as well as cumulative formaldehyde exposure levels. A

measurement session is the period of time during which you measure the formaldehyde level, temperature and RH at multiple locations. The session begins when you power on the FD08; it typically ends 15 minutes after you finish making measurements with the activation of the APO function. You can extend a measurement session beyond

15 minutes by pressing any front-panel button (in effect, resetting the clock to zero) or by disabling the APO function and powering the FD08 through the optional AC adaptor (see page 11 to learn how to do this).

The value of being able to quickly determine where the level of formaldehyde is highest and lowest in an area or facility should be obvious.

The sequence of five screen shots below illustrates the order in which the two session values and three cumulative formaldehyde exposure metrics are displayed by pressing the **MAX/MIN** button.



To clear the **MAX** and **MIN** session values without powering off the meter, press and hold the **HOLD** button for at least 2 seconds. This will flash the text **CLr** on the lower readout, switch the meter to real-time measurement mode, and reset the Max and Min memories to the values being measured at that moment.

SPECIFICATIONS

Formaldehyde Range / Resolution: 0 to 5 ppm / 0.01 ppm

Formaldehyde Accuracy: $\pm(5\% + 0.03 \text{ ppm})^*$

Formaldehyde Sensor Type/Warmup Time: Electrochemical / 1 to 15 minutes, typical

Temperature Range: 0° to 122°F (0° to 50°C)

Temperature Accuracy/Resolution: $\pm 1.8^\circ\text{F}$ (1°C) / 0.1°

RH Range: 10 to 90%RH

RH Accuracy / Resolution: $\pm 5\%$ of reading / 0.1%RH
Display Type / Size: Dual readout LCD / 2 in. (51mm) diagonal
Auto Power Off Trigger: 15 minutes of front-panel inactivity
(can be disabled)
Operating Temperature: 32° to 122°F (0° to 50°C) @
0 to 95%RH, non-condensing
Dimensions: 8.3 x 2.4 x 1.0 in. (210 x 60 x 25mm)
Weight: 7.2 oz. (204g), including batteries
Power Source: (4) “AAA” batteries (not included) or included
110VAC adaptor
* Meets U.S. National Institute for Occupational Safety and
Health's (NIOSH's) acceptance criterion within $\pm 25\%$ of true
value at 95% confidence level

OPERATING & MAINTENANCE TIPS

When the low battery indicator appears in the upper right corner of the LCD, install fresh batteries immediately, following the instructions on pages 9 and 10 of this manual. Be aware that measurements remain valid even though the batteries have grown weak.

The electrochemical formaldehyde sensor is as power-hungry as it is accurate and sensitive. General recommends using the included 110VAC adaptor if you plan to routinely conduct measurement sessions lasting more than 15 minutes. The AC adaptor can also provide a worry-free way to keep the FD08 powered long enough to calculate and display the three cumulative formaldehyde exposure metrics.

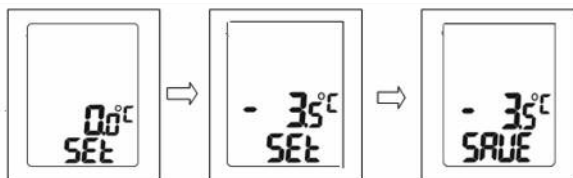
Remove the batteries if you don't expect to use the FD08 for an extended period of time (months or years).

The meter uses a capacitive RH sensor and a thermistor temperature sensor whose accuracy may drift over time. If you

notice that the temperature and/or RH readings on the lower readout are consistently high or low, compared to a known reference, write down the magnitude(s) of the difference, including whether it is positive or negative. This number (for temperature or RH) or these numbers (for both parameters), represent the extent of the FD08's temperature and/or RH drift.

Following is a procedure that you can perform to offset either or both types of drift and thereby restore the FD08's specified accuracy.

- 1) With the meter powered off, press and hold the **MODE** and **BKLT** buttons with fingers of your left hand while pressing and holding the **MAX/MIN** and **PWR** buttons with fingers of your right hand.
- 2) When the LCD shows **0.0C** and **SET**, release all four buttons.
- 3) If you prefer to work in °F, press the **UNIT** button briefly to change **0.0C** to **0.0F**.
- 4) If your temperature drift is negative, you want to add value to **0.0** to compensate. If your temperature drift is positive, you want to subtract value. To add value to the **0.0** term, press the **HOLD** button once for each 0.1° of compensation you need. To subtract value, press the **BKLT** button once for each 0.1°C of compensation. You can press and hold the **HOLD** or **BKLT** button to add or decrease a large value. The maximum amount of temperature drift you can compensate for is $\pm 9.9^{\circ}$ (C or F).
- 5) If you only need to compensate for temperature drift, press and hold the **SET** button to save the offset value you entered. After the bottom line of the LCD shows **SAVE** for 2 seconds, the meter will automatically power off with your temperature offset in place.



- 6) If you also need to offset RH, do not press and hold the **SET** button yet. Instead, press the **SET** button briefly. This will change the display to **0.0%**.
- 7) If your RH drift is negative, you want to add value to **0.0** to compensate. If your RH drift is positive, you want to subtract value. To add value to the **0.0** term, press the **HOLD** button once for each 0.1% of compensation you need. To subtract value, press the **BKLT** button once for each 0.1% of compensation. The maximum amount of RH drift you can compensate for is $\pm 9.9\%$ RH.
- 8) When you are satisfied with the temperature and/or RH offset values you have entered, press and hold the **SET** button to save the settings. After the bottom line of the LCD shows **SAVE** for 2 seconds, the meter will automatically power off with the offsets in place.

Abrupt temperature changes will cause condensation and possible vapor penetration. Clean the LCD after the vapor evaporates. Blow off loose particles with compressed air. Gently brush remaining debris away with a lens hair brush.

Never use a solvent or an abrasive cleaner on the FD08. To clean the housing, use a soft, damp cloth.

Do not drop or disassemble the meter or immerse it in water.

There are two error messages you may encounter when using the FD08:

Er1: Typically indicates damage to the formaldehyde sensor, ambient temperature sensor or RH sensor.

Er2: Typically displayed for 1 second on the lower readout when the meter tries to measure a temperature or RH value outside the specified measurement range. It may also be produced by clearing the Max/Min memory.

WARRANTY INFORMATION

This product from General Tools & Instruments (General) is warranted to the original purchaser to be free from defects in material and workmanship for a period of two years. Subject to certain restrictions, General will repair or replace this instrument if, after examination, the company determines it to be defective in material or workmanship.

This warranty does not apply to damages that General determines to be from an attempted repair by non-authorized personnel or misuse, alterations, normal wear and tear, or accidental damage. The defective unit must be returned to General Tools & Instruments or to a General-authorized service center, freight prepaid and insured.

Acceptance of the exclusive repair and replacement remedies described herein is a condition of the contract for purchase of this product. In no event shall General be liable for any incidental, special, consequential or punitive damages, or for any cost, attorneys' fees, expenses, or losses alleged to be a consequence of damage due to failure of, or defect in any product including, but not limited to, any claims for loss of profits.

RETURN FOR REPAIR POLICY

Every effort has been made to provide you with a reliable product of superior quality. However, in the event your instrument requires repair, please contact our Customer Service to obtain an RGA (Return Goods Authorization) number before forwarding the unit via prepaid freight to the attention of our Service Center at this address:

General Tools & Instruments
80 White Street
New York, NY 10013
212-431-6100

Remember to include a copy of your proof of purchase, your return address, and your phone number and/or e-mail address.



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