

**KAHN**  
**MD10 DEWPOINTMETER**  
**INSTRUCTION MANUAL**

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## SOME DISTINGUISHING FEATURES OF THE KAHN MD10 DEWPOINTMETER

- RUGGED AND PORTABLE. DESIGNED FOR HARD FIELD USE.
- HEAVY DUTY CARRYING CASE.
- HIGH ACCURACY
- WIDE RANGE (-100°C TO +30°C).
- CALIBRATION TRACEABLE TO NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
- RAPID RESPONSE, 90% RESPONSE TO STEP CHANGES IN HUMIDITY
  - 75°C to +10°C <1 minute
  - +10°C to -75°C <30 minutes
- MICROPROCESSOR CONTROLLED:
  - AUTOMATIC, ELECTRONICALLY PROGRAMMED CALIBRATION OCCURS EACH TIME THE INSTRUMENT IS TURNED ON.
  - EXTREMELY LOW CURRENT CONSUMPTION.
  - USER SELECTABLE UNITS (°C, °F, PPMV and PPMW for air, nitrogen, hydrogen or natural gas).
  - IN-LINE TEMPERATURE DISPLAY (°C)
- VERY LOW SAMPLE FLOW REQUIREMENTS (0.5 SCFH IS AMPLE)
- RECORDER OUTPUT WITH ADJUSTABLE ZERO AND RANGE.
- DIGITAL LIQUID CRYSTAL AND ANALOG BAR DISPLAYS.
- OPERATES OFF RECHARGEABLE NI-CAD BATTERY OR LINE CURRENT.

### 1.0 DESCRIPTION

## 1.1 INSTRUMENT

The Kahn Instruments MD10 Dewpointmeter is a rugged, portable, solid state instrument for the rapid determination of the water content of gases. With the Kahn aluminum-oxide thin-film sensor, it is responsive to very small changes in water vapor pressure. With microprocessor control, it is capable of measuring over a very wide dewpoint range with an accuracy and speed of response unmatched by any other portable dewpoint meter.

The instrument is a self-contained unit with sensor and circuit built into a compact steel housing and protected by a padded carrying case. Internal rechargeable batteries make for complete portability, but the instrument can also be operated directly from line power. All instruments are fitted with a recorder output which can be used when operating on batteries or line supply. The System Purge feature is available to accelerate the response to very dry gases.

The MD10 features autocalibration; the instrument performs a self-test and calibration when turned on. There is no need for any additional equipment to perform this test.

The simplicity of the MD10 Dewpointmeter enables it to be used with very little instruction by non-technical staff, and its rugged construction insures a long life in industrial or laboratory environments.

## 1.2 SENSOR

The unique Kahn thin-film aluminum-oxide sensor is the foundation for this extraordinary instrument. It is designed for long term industrial or laboratory use. Of sturdy construction, the sensor has a large (greater than one square inch) cylindrical sensing surface to yield a strong and stable input signal. It is not harmed by contact with water. In fact it is even washable in solvents in the event of contamination by, for example, hydrocarbon condensates. No periodic regeneration is required.

Should it ever be necessary to replace a sensor, all MD10 sensors are interchangeable without need for adjustment or calibration. Moreover, the calibration of each sensor is traceable to the National Institute of Standards and Technology (formerly National Bureau of Standards) in Washington, D.C. You can be assured of the accuracy of your hygrometer.

## 2.0 RECEIPT INSPECTION

- 2.1 Unpack the instrument. Examine it for damage in transit, and verify that you have received:

The MD10 Dewpointmeter  
Padded Carrying Case with Shoulder Strap  
Snap-on Accessories Case  
Power Cord  
BNC Connector for Recorder Output  
6-Foot Length of PTFE (Teflon) Sample Tubing (MD10 with System Purge Option Only)  
Kahn Instruments Screwdriver

- 2.2 Verify that all special accessories you may have ordered, such as mounting brackets, valves, and filters, have been included and are undamaged.
- 2.3 Please report any problems to Kahn Instruments Sales immediately.

## 3.0 OPERATION

The MD10 may be operated as a fully portable instrument powered by internal Ni-Cad batteries. Alternatively, it may be used in a bench-top arrangement powered either from the Ni-Cad batteries or from line power.

### 3.1 STANDARD MODELS

In normal use, simply connect the instrument to the gas to be tested by means of a valve and sampling tubing (**not provided**). Establish a slight flow through the instrument. While not critical, anywhere from 0.5 to 30 SCFH is normal.

Open the front flap, press the POWER switch, and wait for approximately eight seconds until the unit has gone through its self test sequence. During this time, the letters "CAL" will be displayed. As soon as the self test is complete, the instrument will display the dewpoint of the sampled gas.

NOTE: If the CAL TEST button was depressed while the power switch was in the OFF position, it may be necessary to push the power switch more than once to turn on the display.

### 3.2 THE SYSTEM PURGE OPTION FOR MEASURING LOW DEWPOINTS

A popular optional feature of the MD10 is the System Purge. The purpose of this option is to accelerate the speed of response to a dry gas. When not in use, the sensor is stored exposed to desiccant rather than to ambient atmospheric conditions. By reducing the number of water molecules which must be released from the surface of the sensor to bring it into equilibrium with a dry gas, response time is accelerated. An accurate reading will be obtained in 2-3 minutes.

3.2 (Continued)

On units so equipped, the System Purge plunger is located on the instrument back panel, above the gas inlet and outlet ports. The plunger is released by pressing the button on its top. This button must also be pressed while pushing the plunger back in; releasing the button then locks the plunger in place.

Connect the instrument to the gas to be tested as described in section 3.1. Allow the sample gas to flow briefly to flush any residual water vapor out of the sample lines, then release the System Purge plunger. The displayed dewpoint will increase rapidly, then level out at the true gas dewpoint.

When the instrument is not in use, leave the purge plunger in the IN position to keep the sensor exposed to the desiccant. This will speed sensor response on subsequent tests.

**4.0 SELECTING UNITS OF MEASUREMENT**

The MD10 is calibrated over the range -80 to +30 degrees Celsius dewpoint and displays over the range -100 to + 30 degrees Celsius. There are a number of display units available which are selectable by means of a ten position UNIT SELECTOR switch on the instrument back panel. The small screwdriver supplied with the instrument enables you to select the units as follows:

POSITION	UNIT	RANGE
0	Degrees Celsius	-100/+30
1	Degrees Fahrenheit	-148/+86
2	PPM(V)	0.1 to 1999
3	PPM(W) Air	0.1 to 1999
4	PPM(W) hydrogen	0.1 to 1999
5	PPM(W) nitrogen	0.1 to 1999
6	PPM(W) carbon dioxide	0.1 to 1999
7	PPM(W) natural gas	0.1 to 1999
8	Sensor temperature in degrees Celsius	
9	Sensor information (See Section 9.0)	

In addition to the digital display there is an analog bar display which always corresponds to degrees Celsius dewpoint.

## 5.0 RECHARGING BATTERIES

A flashing display (LO BAT) in the top left hand corner will indicate when battery power is low. In this case connect the instrument to line power. Leave it plugged in with the power switch in the OFF position to recharge the batteries.

### 5.1 CHARGING

- 5.1.1 Charging is achieved through the use of the plug-in line cord and integral battery charging circuitry. A flashing LO BAT in the top left corner of the front panel display will indicate when battery power is low.
- 5.1.2 Normal charging is performed with the unit switched off. Connect the external power cord and plug into line power. At room temperature, a fully discharged battery will take between 10 and 12 hours to completely charge.
- 5.1.3 Disconnect the power cord when charging is complete. As a general rule, do not charge for more than 14 hours continuously. Overcharging may severely reduce the battery's operational lifetime.
- 5.1.4 Longest life and largest battery power capacity can be achieved through full charge-discharge cycles. It is therefore recommended that the unit be fully charged before use, and then used until indicating LO BAT.
- 5.1.5 Batteries will normally discharge slowly even when the unit is not in use. A six hour charge is recommended once for every 45-60 days of storage (at °C).
- 5.1.6 It is possible to operate the unit while charging the battery. Note that the additional current drain will slow down the charging process. A unit with a completely discharged battery may take several minutes of charging before being operational on line power.
- 5.1.7 The normal lifetime for rechargeable batteries is 70-100 charge-discharge cycles, or roughly 2 years storage.

### 5.2 REMOVAL AND INSTALLATION

- 5.2.1 Make sure the unit is turned off and no external power is applied.
- 5.2.2 Remove four top panel screws, two right side screws, and two lower left side screws, using a small slotted screwdriver.

- 5.2.3 Slide the instrument top cover forward approx 1 cm. Remove the cover by lifting gently, being careful not to disturb the wiring inside.
- 5.2.4 Undo the upper end ribbon cable connector from the top circuit board. This allows the cover to be set down to the left of the unit.
- 5.2.5 Disconnect the two battery power terminals.
- 5.2.6 Remove the two nuts securing the battery clamp. The battery may now be lifted out.
- 5.2.7 Installation is the reverse of removal. Be sure to connect the battery in the correct polarity, i.e. red-positive, green-negative.

### 5.3 REPLACEMENT

- 5.3.1 New battery packs may be ordered from Kahn Instruments' spare parts department. Order by description: Battery Pack for MD10 Dewpointmeter.

## 6.0 RECORDER OR DATA OUTPUT

The 0 - 1 VDC output may be used for a recorder or remote data logging. It is set to operate over the range -80 to +30 degrees C dewpoint. This output may be spread over any portion of the range with a maximum resolution of 40 mV per °C dewpoint. To set the output, adjust the zero and gain potentiometers on the back panel according to individual requirements.

## 7.0 SAMPLING SYSTEMS

### 7.1 SAMPLE SYSTEM REQUIREMENTS

- 7.1.1 A sample flow of 0.5 to 30 SCFH (0.25 to 15 liters per minute) is recommended but is not critical; higher flows will produce faster response times.
- 7.1.2 Keep the volume (length, diameter) of the sample line small to reduce response time. A 6mm or 1/4" tube size is normally adequate. Less internal surface area will reduce hygroscopic effects which result in long response times.
- 7.1.3 Hot sample gases may be cooled in a 5 to 10 foot (2 to 3 meter) length of metal sample tube, which may be coiled loosely. The cooled gas temperature should be checked prior to admitting gas to the sensor block.

Keep the gas temperature at the sensor below 40°C (104°F) and above the dewpoint temperature. High temperatures shorten sensor life; low temperatures result in condensation affecting accuracy.



7.1.4 Sampling tube and system materials are critical for low dewpoint work. As a general rule, adhere to the following recommendations:

Dewpoints no drier than -20°C  
Copper, PVC, Polyethylene

Dewpoints no drier than -50°C  
Copper, PTFE (Teflon), Nickel

Dewpoints drier than -50°C  
ONLY Stainless Steel or PTFE (Teflon)

7.1.5 At very low dewpoints, it is good practice to connect a length of at least 12 inches of any tubing to the GAS OUT port to prevent distortion of readings by water vapor diffusing into the sensor chamber against the sample flow.

## 7.2 CONTAMINANTS

Exposure to various mists, condensibles and dust will contaminate the probe as well as the entire sampling system. This is often observed as a slowing down of response time. If you wish to sample gases containing physical contaminants, be sure to install a non-hygroscopic filter, such as sintered stainless steel, porous Teflon or glass fiber, upstream where it will protect the entire sampling system.

Any gas which attacks aluminum or aluminum oxide cannot be measured. Avoid using this type of sensor where ammonia or chlorine exist in more than trace quantities.

## 7.3 READINGS AT OTHER PRESSURES

7.3.1 When measuring dewpoints of gases at atmospheric pressure or below, use a small sample pump located downstream to draw a sample through the instrument.

7.3.2 The MD10 with System Purge option is most commonly used to measure dewpoints at low pressures and should only be used at pressures below 15 psig. The MD10 without System Purge option may be utilized up to 5,000 psig.

## 8.0 CALIBRATION TEST

The automatic electronically programmed calibration occurs each time the instrument is turned on. Additionally, when the CAL.TEST switch located on the front panel is pressed, the following information will appear on the LCD display:

LO BAT	Battery level low indicator. See Section 5.
PAS	System OK indication
FAI	System not OK indication. Check with Kahn Instruments for help.
CAL	Auto calibration: EPROM being downloaded to RAM on start-up, all circuits being checked, and sensor output examined.
OR	Sensor reading is over range of the MD10. If exposure of the sensor to a dry air does not correct this then contact Kahn Instruments for help.
UR	Sensor is reading under range. If exposure to wetter air does not correct this then contact Kahn Instruments for help.

## 9.0 CALIBRATION AND TRACEABILITY

The MD10 is supplied fully calibrated over the range -80 to +30 degrees C dewpoint. Calibrations are traceable to the NIST. The Calibration Certificate supplied with the instrument specifies the calibration gas dewpoints used and states the calibration accuracy over the range.

The Calibration EPROM stores information on the month and year of calibration, sensor number, batch number, and other software reference information. To obtain this information select position 9 on the UNITS SELECTOR (see Section 4.0). Successive depression of the CAL. TEST button on the front panel will display this information along with a reference on the bar display:

1 bar	Month and Year
2 bars	Sensor Number
3 bars	Batch Number
4 bars	Software reference data

## 10.0 WARRANTY

All hygrometers and sensors are warranted for construction and calibration for one year, excluding damage or misuse.

## 11.0 SPECIFICATIONS

Dimensions (inches):

Without carrying case: 8.5 W x 3.5 H x 10.5 D

With carrying case: 10 W x 5 H x 11.5 D

Weight (Pounds):

Instrument: MD10SB (Standard Unit) 11.5

MD10PP 14 (System Purge Unit) 14

Carrying Case: 1.5

Materials of construction:

Instrument case: Steel.

Finish: Cadmium plated, passivated, matte black stove enamel.

Sensor:

Kahn Thin-Film Aluminum-Oxide, very high capacitance type. Mounted in stainless steel. Integral EPROM linearizer.

Sampling system:

MD10SB: Stainless Steel sensor housing.

MD10PP: Dual Chambered Gas/Desiccant.

Accuracy:

$\pm 3^{\circ}\text{C}$

Calibration:

Three point calibration by systems traceable to the National Institute of Standards and Technology. Ten point calibration available.

Response Time:

Reads 90% of step changes in seconds.

Outputs:

0-1 volt, linear output. Adjustable zero and range.

Display:

LCD digital and analog bar display.

Customer selectable units:

Dewpoint in  $^{\circ}\text{C}$  or  $^{\circ}\text{F}$ ,

ppm(V),

ppm(W) for Air, Hydrogen, Nitrogen, Carbon Dioxide and Natural Gas.

Temperature readout,  $^{\circ}\text{C}$

## 11.0 SPECIFICATIONS (Continued)

Sample gas conditions: (Not critical for accuracy)

Inlet pressure: 0 - 5000 psig (standard models)

0 - 15 psig (models with System Purge option)

Flow rate: 0.5 - 30 scfh (0.25 - 15.0 liters/minute)

Temperatures:

Storage : -50° to +70°C

Operating : -10° to +40°C Temperature must always be higher than measured dewpoint to avoid condensation.

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