MFM300
Multi-Function Instrument
User Guide and Instrument Warranty

C E ☒ RoHS

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THIS UNIT IS CALIBRATED TO STANDARDS
TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

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POWER-UP THE MFM300

Press the **POWER** button until the display shows the Cooper logo, the remaining battery life and the installed firmware. Press the **LIGHT** button to illuminate the screen in low light conditions.

POWER-DOWN THE MFM300

Press the **POWER** button until the display goes blank.

DISPLAY MODES

Normal mode: Displays the measured values of all the probes currently connected.

Superheat mode: Displays superheat or sub-cooling values. Requires a temperature probe be installed in either **T1** or **T2** (or both) and optionally a pressure probe in **U1** or **U2** (or both). Press the **SH** button to enter **Superheat Mode**. Press the **SH** button again, or **CANCEL**, to return to **Normal Mode**. See the section on measuring system Superheat / Sub-cooling for further information.

Psychrometrics mode: Displays psychrometric values. Requires a relative humidity probe to be installed in either **U1** or **U2** (or both). Press the **PSYCH** button to enter the **Psychrometric Mode**. Press the **PSYCH** button again, or **CANCEL**, to return to **Normal Mode**.

The MFM300 will attempt to operate in the last mode it was in when powered off. If it can not, the **Normal Mode** is the default. If no probes are connected, the "No Probes" message will appear on the display.

DISPLAY MIN, MAX AND AVG VALUES

When in Normal Mode press:
    MIN button to display the lowest readings sensed by each probe.
    MAX button to display the highest readings sensed by each probe.
    AVG button to display the average readings sensed by each probe.
The active mode, **MIN, MAX** or **AVG,** will be indicated near the bottom of the display. Pressing the same button again, or **CANCEL,** turns off the selected mode. Disconnecting a probe will clear that probe's **MIN, MAX,** and **AVG** memory, but all probes still connected will continue to be updated. All **MIN, MAX** and **AVG** memory is lost when the MFM300 is powered down.

MEASURE TEMPERATURE

Install one, two, or three Cooper 10K thermistor probes into any of the three temperature jacks: **T1, T2** or **T3**. The MFM300 will sense the probe and display the temperature measurement with the appropriate label.

MEASURE TEMPERATURE DIFFERENCE (DELTA T)

With two probes connected, press the **DELTA** button until "Delta T" appears on the display. The absolute temperature difference appears to the right of the horizontal bars that point to the two temperature inputs being measured. Press the **DELTA** button again, or **CANCEL**, to turn off the "Delta T" display. If three temperature probes are connected, press the **DELTA** button again to display the next "Delta T". With three temperature probes connected, the "Delta T" sequence is as follows:

FIRST PRESS: T1 – T2;
SECOND PRESS: T1 – T3;
THIRD PRESS: T2 – T3;
FOURTH PRESS: DELTA T DISPLAY OFF.

MEASURE PRESSURE

Connect a Cooper Pressure Transducer to either **U1** or **U2** (or both). The MFM300 will sense the probe(s) and display the pressure measurement(s) with the appropriate **U1** or **U2** label. Before connecting the transducer(s) to the cooling system, zero the pressure reading(s) (refer to **Setup** section on zeroing the pressure probes and setting altitude).

NOTE: AT SEA LEVEL, THE PRESSURE READING SHOULD BE 0 PSI (0 KPA) WHEN NOT CONNECTED TO A COOLING SYSTEM. AT ELEVATIONS ABOVE SEA LEVEL THE DISPLAY WILL SHOW A NEGATIVE PRESSURE READING (-0.5 PSI / 1000 FEET ALTITUDE). CONNECT THE TRANSDUCER(S) TO THE COOLING SYSTEM ACCESS PORTS, USING BEST INDUSTRY PRACTICES, TO BEGIN MEASURING SYSTEM PRESSURE.

MEASURE SYSTEM SUPERHEAT / SUB-COOLING

Select the refrigerant: The selected refrigerant is displayed when in **Superheat / Sub-cooling Mode**, or when viewing pressure / temperature charts. To change the refrigerant, press the **REF** button. The "Up / Down Arrows" will appear beside the refrigerant name. Use the **UP / DOWN ARROW** buttons to scroll to the desired refrigerant and then press the **ENTER** or **REF** button. Press the **CANCEL** button to abandon changes.

Add and / or change refrigerants: The MFM300 stores P / T data from 15 popular refrigerants that reside in permanent memory. There is room in the memory for up to five more refrigerants. New refrigerant P / T data can be downloaded from the Cooper-Atkins website (www.cooper-atkins.com/mfm.asp) using the **MFM300 Toolbox** and the optional computer connection cable.

CALCULATE SUPERHEAT / SUB-COOLING

The MFM300 can be used as a Superheat / Sub-cooling calculator. Connect the temperature probes to the system and press the **SH** button. Select the refrigerant and press the **ENTER** button. Since there are no pressure transducers connected, system pressure will default to 25 PSI for superheat and 75 PSI for Sub-cooling. You may manually enter the actual pressure value from the manifold gauge into the MFM300 using the **UP / DOWN ARROW** buttons. Once the pressure is entered for Superheat, use the **SHIFT** button to move to Sub-cooling, where pressure is manually entered the same way. Remember that the values shown in this mode are not dynamic.

MEASURE DYNAMIC SYSTEM SUPERHEAT / SUB-COOLING

Measuring dynamic system Superheat or Sub-cooling requires both a temperature probe and a pressure transducer. The refrigerant type selected on the display must match the refrigerant type used in the system. Refer to the section **Select the Refrigerant.** For Superheat measurement, connect the temperature probe to **T1**, and the pressure transducer to **U1**. For Sub-cooling measurement, connect the temperature probe to **T2** and the pressure transducer to **U2**. To measure superheat, attach the temperature probe to the system suction line near the compressor. Attach the pressure transducer to the low side access port. Press the **SH** button.

MEASURE DYNAMIC SYSTEM SUPERHEAT / SUB-COOLING - Continued

The system superheat value is displayed along with the actual temperature and pressure readings. Sub-cooling is measured in the same way, except the temperature probe is attached to the liquid line, and the pressure transducer is attached to the high side access port.

NOTE: SUPERHEAT MEASUREMENTS USE T1 AND U1; SUB-COOLING MEASUREMENTS USE T2 AND U2.

MEASURE RELATIVE HUMIDITY AND DRY-BULB TEMPERATURE

Connect a Cooper relative humidity probe to either **U1** or **U2** (or both). The MFM300 will sense the probe and display the relative humidity and dry-bulb temperature measurements with the appropriate **U1** or **U2** label.

DISPLAY PSYCHROMETICS

Connect a Cooper relative humidity probe to either **U1** or **U2** (or both). Press the **PSYCH** button to display the psychometrics calculated from the current relative humidity and dry-bulb measurements. Press the **PSYCH** button again, or **CANCEL** to return to **Normal Mode**.

MEASURE AIRFLOW

Connect a Cooper anemometer to either **U1** or **U2** (or both). The MFM300 will display airflow in feet per minute (FPM) and temperature. To display airflow in cubic feet per minute (CFM), press the **ALT** button. To insure that the correct cubic feet per minute values are displayed, you must enter the shape and size of the duct opening where airflow is being measured. To do this, press the **MENU** button while viewing CFM. Use the on-screen directions to enter the duct shape and size and press the **ENTER** button when done.

AIR BALANCING

To perform basic Air Balancing, the MFM300 will calculate the average CFM and FPM using all entered readings. While viewing CFM, press the **AVG** button while measuring airflow. Each time the **AVG** button is pressed, new average values are calculated based upon the measurement being taken. The display will show the average CFM and FPM and the number of individual readings taken. To clear all average values, press the **MENU** button and then press the **AVG** button.

NAVIGATE THE MENU

Additional functions and settings are available through the MFM300 **MENU.** Press the **MENU** button to display the top-level menu and use the **UP / DOWN ARROW** buttons to select a menu option, then press the **ENTER** button.

MENU FUNCTIONS

Adjust contrast: Allows display contrast to be changed to suit lighting situation. Use the **UP / DOWN ARROW** buttons to set contrast and press the **ENTER** button to complete. Press the **CANCEL** button to abandon changes.

View GL100 Log: Manage up to five data logger downloads stored in MFM300 memory.

Pressure / temp chart(s): Select the desired refrigerant by pressing the **REF** button, then use the **UP / DOWN ARROW** buttons to scroll to the desired refrigerant and press the **ENTER** button

to save. Press the **CANCEL** button to abandon changes. While viewing pressure / temperature charts, use the **UP / DOWN ARROW** buttons to scroll through the chart.

Hide / show elapsed time: In **Normal Mode**, the elapsed time is shown in the lower-left corner of the display. The elapsed time may be turned off by selecting this menu item and Pressing the **ENTER** button. If disabled, the menu item will be shown as "Show Elapsed Time". If enabled, the menu item will be shown as "Hide Elapsed Time".

Disable / enable auto shut-off: When Auto Shut-off is enabled, the MFM300 will power-off in 15 minutes if no buttons have been pressed. To disable Auto Shut-off, use the **UP / DOWN ARROW** buttons to highlight this menu item and press the **ENTER** button. Auto Shut-off is the default setting when turning the MFM300 on.

Setup: Press the **MENU** button, highlight the "Setup" option and press the **ENTER** button. Setup Items include set altitude, set units of measure, temperature calibration, and zero-out pressure transducers. Use the **UP / DOWN ARROW** buttons and press **ENTER** to select the highlighted option. To return to the main menu, press **CANCEL** at any time.

- **Set altitude:** Use the **UP / DOWN ARROW** buttons to enter the current altitude in 500-foot increments.
- **Units of measure:** Select either English or Metric units of measure.
- **Temperature calibration:** Place a temperature probe connected to **T1** into an environment with a known temperature and adjust the reading to calibrate and match.
- **Zero-out probe P1, Zero-out probe P2:** When a pressure transducer is attached to **U1** or **U2**, select this option before connecting to the system if the transducer reading is not "0 PSI" after setting the altitude.

USING THE MFM300 WITH A GL DATA LOGGER

Connect the Data Logger Reader to **U1** using the GL300 data logger cable.

NOTE: THE GL300 DATA LOGGER CABLE IS NOT SUPPORTED ON U2.

Attach the GL100 Data Logger Tag to the reader. The MFM300 detects the Data Logger and displays the GL100 Data Log Menu. If the Data Logger has been previously programmed for a mission, the mission description is displayed. Below the mission description are the menu options. Use the **UP / DOWN ARROW** buttons to scroll to the desired menu option and press the **ENTER** button.

Check settings: Select this menu option to view the current mission status.
The status screen displays the following data:
- Mission description or "Name"
- Sampling status: Active or stopped
- Sample interval: Time between samples
- Mission start time and date
- Action when Data Logger is full: Stop or rollover
- Record count
Press any key to return to the GL100 Data Log Menu.

Program a mission: Enter up to 20 alphanumeric characters to describe the pending mission. The symbol in the lower-left corner of the display indicates whether letters or numbers are entered. "ABC" indicates upper case letters, "abc" indicates lower case letters and "1 2 3" indicates numbers.

Switch between letters and numbers by pressing the **SHIFT** button. When entering letters, press the letter button repeatedly until the desired character is displayed. After 2 seconds the cursor will advance to the next position. Press the **UP ARROW** button to move the cursor to the right, or press the **DOWN ARROW** button to move the cursor to the left. Use the **SPACE (ALT)** button to insert a space in the description. When the mission description is complete, press the **ENTER** button.

Sampling interval: Use the number buttons to enter the desired sampling interval (the time between samples). The minimum interval is 1 minute, the maximum is 255 minutes. Press the **ENTER** button when done.

When full instructions: Select the action to take when the data logger has reached the end of its storage memory. Select "Roll-over" (continue to take readings) or "stop". Use the **UP / DOWN ARROW** buttons to scroll. Press the **ENTER** button when done.

Set clock: Use the number buttons and the **UP / DOWN ARROW** buttons to set the current date and time. Press the **ENTER** button when done.

Delay start: The Data Logger will begin recording at the end of the delay time. Use the **NUMBER** buttons to enter the **Delay Start** in minutes up to 255 minutes.

Confirm: Press the **ENTER** button to complete the mission programming, or press the **CANCEL** button to abandon. Once finished, remove the Data Logger from the cable and place it where temperatures are to be measured.

Download data: Select this "menu" option to store the Data Logger contents in the MFM300, and view at a later time.

View data: Select this "menu" option to view the records contained in the Data Logger. The data is displayed in two ways: as a graph of the temperature data points, and as discrete data at the bottom of the display. Use the **UP / DOWN ARROW** buttons to move the cursor (the short vertical line near the bottom of the display). As the cursor moves, the temperature, date and time data pointed to by the cursor is displayed below the cursor line.

NOTE: WHEN VIEWING TEMPERATURE DATA ON THE MFM300, UP TO 16 PAGES, OR
        SCREEN VIEWS, MAY BE SHOWN. PRESS THE MAX BUTTON TO VIEW THE NEXT
        PAGE. PRESS THE MIN BUTTON TO VIEW THE PREVIOUS PAGE. PRESS THE CANCEL
        BUTTON WHEN DONE AND DISCONNECT THE DATA LOGGER FROM THE DATA LOG
        READER.

CAPTURE OR STORE SNAPSHOTS

The MFM300 can capture and store data that is currently being measured and displayed. Select the **"**Capture Snapshots" option in the main menu and press the **ENTER** button. Select the "Take Snapshots" option and press the **ENTER** button to display the snapshot set up screen. The description, date and time are entered here using the **UP / DOWN ARROW** buttons. Once set up is complete, a flashing camera icon appears on the screen.

Take a snapshot: Press the **ENTER** button, and then press the **ENTER** button again to save. Use the Buttons to enter an identifying tag for future reference. Up to 50 snapshots can be stored in the MFM300. To stop using the snapshot feature, return to the main menu, select "Capture Snapshots" and select "Stop Snapshots".

View stored snapshots: Select the capture snapshots option in the main menu and press the **ENTER** button. Highlight "View Snapshots" and press the **ENTER** button to display stored snapshots. Use the **UP / DOWN ARROW** buttons to scroll through the stored snapshots. To stop reviewing snapshots, press **CANCEL.**

Delete snapshots: Select the "Capture Snapshots" option in the main menu and press the **ENTER** button. Highlight "Delete all Snapshots" and press the **ENTER** button. Confirm that all snapshots should be deleted and press the **ENTER** button again.

MFM300 SPECIFICATIONS

Ambient Temperature Operating Conditions	32° to 122°F (0° to 50°C)
Ambient Humidity Operating Conditions	10% to 90% RH Non-Condensing
Power Source	4 "Double A" (AA) Alkaline Batteries
Battery Life	100 hours Minimum
Temperature Probes	
Temperature Measurement Range	-58° to 302°F (-50° to 150°C)
Temperature Accuracy	±0.3F° (±0.2C°) or ±0.5% of Reading (whichever is greater)
Temperature Display Resolution	0.1 Degree
Relative Humidity (RH) Probe	
Relative Humidity Measurement Range	0% to 99% RH
Relative Humidity Accuracy	±2% RH 20 to 80% RH, 3% < 20% and > 80%
Relative Humidity Display Resolution	1% RH
Dry-Bulb Temperature Measurement Range	-40° to 185°F (-40° to 85°C)
Dry-Bulb Accuracy	±0.3% Reading
Dry-Bulb Display Resolution	0.1 Degree
Pressure Transducers	
0 - 500 PSI Accuracy	±1% Full-Scale
0 - 1000 PSI Accuracy	±1% Full-Scale
Anemometer	
Temperature Range	32° to 150°F (0° to 65°C) 90% RH non-condensing
Temperature Accuracy	±2F° (±1C°)
Velocity Range	100 - 6,000 FPM (0.5 - 30.48 MPS)
Velocity Display Resolution	1 FPM (.01 MPS)
Velocity Accuracy	3% RDG + .5% Full Scale at 77°F (25°C) Up to 256 point averaging for airflow
Data Logger	
Data Logger Temperature Range	-40° to 185°F (-40° to 85°C)
Temperature Accuracy	±2F° (±1C°)
Record Capacity	2048
Sampling Intervals	1 minute to 255 minutes

MFM300 TOOLBOX

To update the MFM300 firmware, download new refrigerant data, download snapshot or data log information: connect the MFM300 to a PC that has the **MFM300 Toolbox** application installed. To install the **MFM300 Toolbox** application, go to the Cooper-Atkins website (www. cooper-atkins.com/downloads.asp), and click on **MFM300 Toolbox**. The **MFM300 Toolbox** contains the latest firmware and refrigerants available for the MFM300 as well as various data logging / management utilities (Contact Cooper-Atkins Corporation for more information).

MFM300 WARRANTY / OBTAINING SERVICE

The MFM300 Instrument is warranted against defects in material or workmanship for five (5) years from date of purchase. Cooper-Atkins Corporation will replace or repair the defective instrument, at their option, subject to verification of defect. All MFM300 probes and accessories are warranted against defects in material or workmanship for one (1) year from date of purchase. Cooper-Atkins Corporation has the option to replace or repair the defective accessory, subject to verification of defect. These warranties exclude all incidental and consequential damages. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the foregoing limitation may not apply. Except for the warranty set forth above, Cooper-Atkins Corporation, by this disclaimer, gives notice that any statements or representations made by it will not create a warranty that this product is fit for any particular purpose. Such statements, representations or descriptions are informational only, and are not made or given as a warranty of this product in any way. In addition, Cooper-Atkins Corporation does not warrant expressly, or by implication, that the electronic instrument will meet or comply with the requirements of any safety code or regulation of any country, or any municipality, State, Federal or other jurisdiction. Furthermore, Cooper-Atkins Corporation shall not be responsible for any loss or damage to customer, directly or indirectly, and whether arising in contract or tort.

MFM300 INSTRUMENT SERVICE INFORMATION

If your MFM300 requires service, send the instrument freight prepaid to Cooper-Atkins Corporation. For warranty service, also send proof of date and location of purchase. The instrument will be repaired or replaced, at the option of Cooper-Atkins Corporation, and returned via least cost transportation.

For non-warranty service, send instrument freight prepaid to Cooper-Atkins. An estimate to repair the instrument will be provided before repairs are initiated. The instrument will be returned via least cost transportation. There is a 90-day warranty on repaired MFM300 instruments.

PRODUCT REGISTRY

Please register your **Cooper-Atkins** product today. It is the only way to notify you of future software / product up-grades. There is no fee to register. Go to: **www.cooper-atkins.com/ registry.asp**, and complete the on-line form.