TM360A AUTOMOTIVE TEMP-SEEKER®

Precision Thermo-Psychrometer

Multi-Channel Air Conditioning Humidity and Temperature Drop Tester

OWNER'S MANUAL (English)

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OVERVIEW

Congratulations on your purchase of one of the best precision automotive AC diagnosis, testing and repair tools available! CPS Products TM360A TEMP-SEEKER® is a high resolution thermo-psychrometer adaptable to accommodate all your temperature, humidity, dry/wet bulb and dew point measurements. The instrument offers 4 separate temperature channels for high accuracy thermistor probes, and an auxiliary port to connect a state-of- the-art solid state RH/DB probe.

The TM360A memory functions continuously store MIN & MAX readings from all temperature input ports. Pressing SCAN key will toggle the display between all four temperature input ports in three second intervals, providing continuous monitoring of multiple probe points during critical system diagnosis. The unit has an illuminated, low power LCD making it easy to take readings both in poorly illuminated areas and in bright sunlight. It also has a provision to connect to an optional external power adapter to conserve battery life during extended monitoring situations.

Designed in a rugged blow-molded polyethylene case, the TM360A is engineered to provide laboratory accuracy in rough shop/field environments. A generous probe storage area is provided to keep all your job-specific probes neatly housed. Note: Probes can remain plugged in during storage, reducing life-shortening stress on both the connection ports and the probe connector ends.

FEATURES

- Four discrete temperature channels
- High accuracy silicon humidity transducer probe port
- Large, 4-digit, easy-to-read, backlit LCD (Liquid Crystal Display)
- Min/Max & memory functions
- Temperature differential between any two of the four temperature ports
- Direct relative humidity and wet bulb measurements
- Calibrated to NIST traceable standards
- Auto-off after ten minutes of non-use or continuous ON mode
- Operates thirty continuous hours on one 9V alkaline battery
- Integrated battery eliminator jack
- Rugged polyethylene blow-molded case
- Large probe storage area
- Probes can remain plugged in to reduce jack/probe wear
- Switchable °C/°F
- One year warranty

SPECIFICATIONS

Resolution	±0.1˚F or ˚C
Temperature Accuracy	±0.4˚F / ±0.2˚C from 14.0 to 158˚F / -10.0 to 70˚C; 0.6˚F / 0.3˚C elsewhere in the range
RH Range	0 to 100%RH
RH Accuracy (TMX3RH)	±1.8%RH from 10 to 90%RH; ± 3% elsewhere in the range
DB Accuracy (TMX3RH)	±1.2% of reading ± 1.0˚F from -40˚F to 200˚F (± 1.2% of reading ± 0.5˚C from -40˚C to 90˚C)
Power Source	9V alkaline battery or optional TMX3PS AC adapter for 100 to 240VAC (40 to 60 Hz)
Battery Life	30hrs. continuous use
Automatic Power Off	After 10 minutes of non-use or user selectable continuous ON mode
Backlight	15 seconds
Dimensions	12" X 10" X 3" (30.5cm x 25.4cm x 7.6cm)
Weight	3lb (1.4 kg) with probes
Warranty	1 year

SAFETY PRECAUTIONS

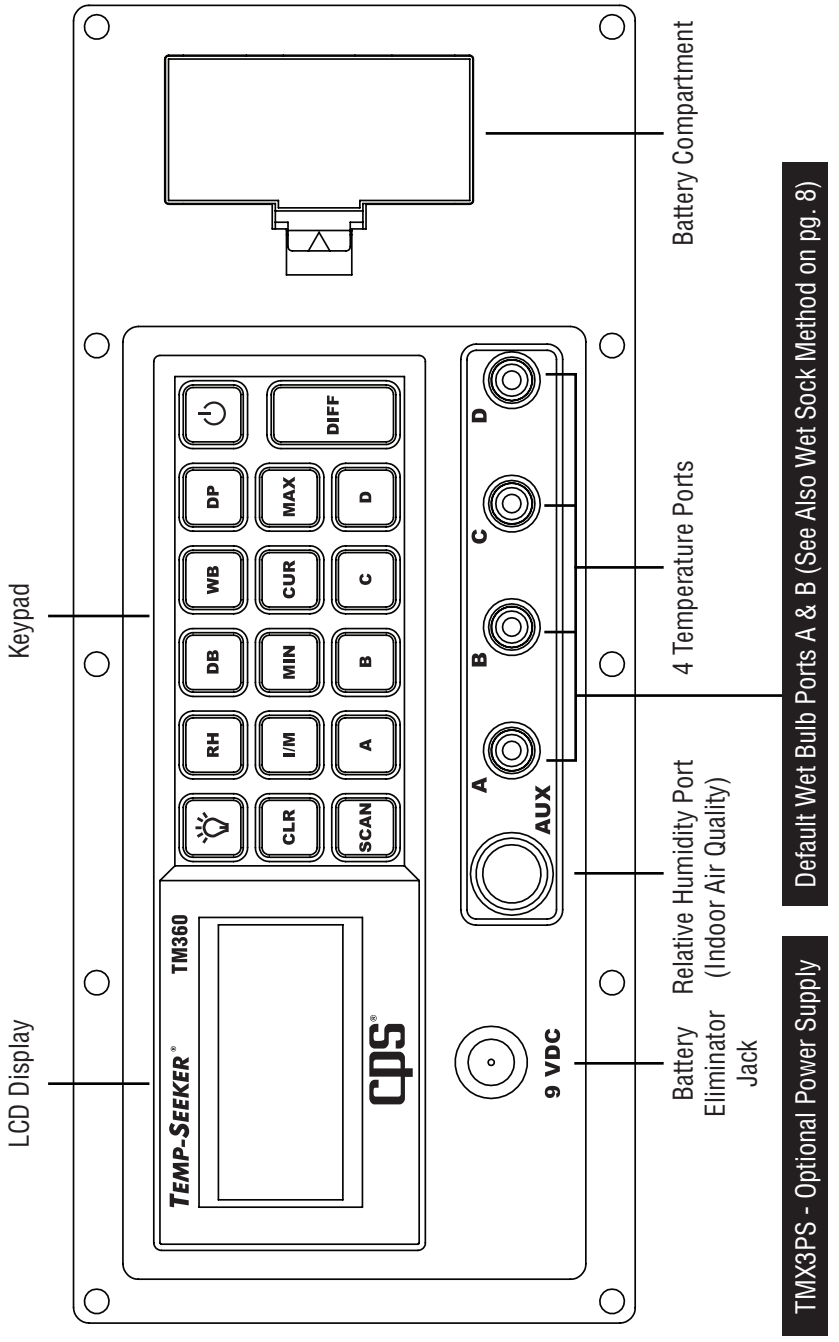
Only qualified service personnel should operate this unit. Some countries, states, etc…may require the user to be licensed. Please check with your local government agency.

Safety Note: Test conditions place the AC system and vehicle sub-systems (engine cooling system including both mechanical and electrical cooling fans, charging and fuel control systems) under severe operating conditions when the cabin and ambient air temperatures exceed 80°F (27°C). Any abnormalities should become quite evident, and safety must be held most important with regard to continuing tests. If any unsafe condition exists, that must be addressed first, before any further AC system testing is performed! Please refer to the Appendix at the back of this manual and use copies of these documents for vehicle testing purposes: "Diagnostic Testing & Repair Verification Worksheets" (DTRVWs) "Diagnostic Flow Charts" (DFCs)

Always wear gloves

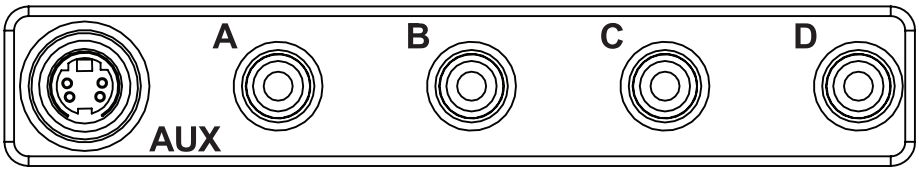
Always wear safety glasses

OPERATION


LCD Display
Keypad
Battery Compartment
4 Temperature Ports
Relative Humidity Port (Indoor Air Quality)
Battery Eliminator Jack
TEMP-SEEKER®
TM360
cps®
SCAN
CLR
RH
I/M
A
DB
MIN
B
WB
CUR
C
DP
MAX
D
DIFF
A
B
C
D
AUX
9 VDC
TMX3PS - Optional Power Supply
Default Wet Bulb Ports A & B (See Also Wet Sock Method on pg. 8)

OPERATION

KEY	FUNCTION
⏻	Press to turn ON, press and hold for 3 sec. to turn OFF
A, B, C, D	Press to display probe measurement of that channel
RH,DB,WB,DP	Press to display relative humidity, dry bulb, wet bulb or dew point temperatures. Use TMX3RH accessory probe or wet-sock method
MIN,CUR,MAX	Press to display the lowest (MIN), current (CUR) or highest (MAX) value of the channel selected
CLR	Press to clear the MAX/MIN values of channel selected to current (NORM)value. Press and hold while turning instrument ON to enable or disable the Automatic Power Off feature
DIFF	Press this key followed by any two of the A, B, C or D keys to display the algebraic difference between the two selected channels
SCAN	Press to display the measurements of each temperature channel in 3 second intervals
I / M	Press to select Metric or Imperial units of measurement
💡	Press to turn on the LCD backlight for 15 seconds



The display defaults to Channel A when initially turned ON.

Channel AUX: Designated for use with the **TMX3RH** accessory probe to provide direct **RH**,**DB**,**WB** and **DP** measurements.

Channel A: General purpose temperature measurements and the default dry bulb channel for humidity measurements obtained using the Wet Sock method

Channel B: General purpose temperature measurements and the default wet bulb channel for humidity measurements obtained using the Wet-Sock method

Channel C: General purpose temperature measurements.

Channel D: General purpose temperature measurements.

OPERATION

Turning the instrument ON and Off: Press the ⏻ key to turn the instrument on; the LCD will initially display all characters, the software version used (CPS 110 or similar) and whether the automatic power off feature is enabled or not (APO ON or APO OFF). The instrument will then default to displaying the measurement read in channel A. To turn the unit off, press and hold the power key for approximately 3 to 5 seconds until the letters **BYE** appear on the LCD, then release the key and the unit will turn off.

Memory Function: The instrument will record and store the high and low values of all channels as long as the instrument remains **ON**. To view, press the **MAX**,**CUR**,**MIN** key until the desired reading is displayed. **MX** or **MN** characters will appear on the LCD to indicate which value is being displayed. At any time, the displayed units can be changed from Imperial to Metric by pushing the **I/M** key.

APO ON/OFF: This feature, when enabled, turns the TM360A off after 10 minutes if no key has been pressed. To toggle the feature **ON** or **OFF**, press and hold the **CLR** key and turn the instrument on. Hold the **CLR** key down until the APO ON or OFF message appears on the display, then release the CLR key. The selection is stored in the memory of the TM360A until it is changed by the user.

Temperature Differential: The instrument can display the temperature difference between any two of the four available temperature channels. This is done by pressing the **DIFF** key followed by the keys representing the two channels for which the temperature difference is desired. For instance, the sequence DIFF ➨ A ➨ C displays the algebraic difference between the temperature values at channel A and C.

Display Units: At any time the displayed units can be changed from Imperial to Metric by pushing the **I/M** key.

Scan Key: Press this key to display the measurements from temperature channels **A** through **D** in approximately 3 second intervals. The measurements displayed can either be the current (**CUR**), maximum (**MAX**) or minimum (**MIN**) readings of each channel depending on the selection of the MAX,CUR,MIN key. The (**CLR)** key can be used to clear the MIN and MAX values and replace them with the current reading.

Backlight: An efficient **EL** panel illuminates the LCD when the 💡 key is activated and remains on for 15 seconds.

Low Battery Indicator: The symbol **BAT** will appear on the LCD when 10% battery life remains.

OP/SP: The **OP** symbol appearing on the display means the selected temperature channel either has no probe connected or the probe is open. Verify that a probe is firmly connected to the channel's RCA connector. If a probe is connected, try rotating the connector; if the symbol persists on the display, the probe is defective. The **SP** symbol appearing on the display means the probe is shorted and must be replaced.

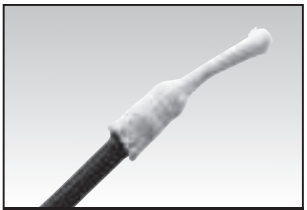
TMX3RH METHOD

The **TMX3RH** is a high accuracy silicon device for the measurement of relative humidity and dry bulb temperature. Both sensors are integrated in one small silicon chip, factory calibrated and conditioned to give accurate and fast response. The TM360A uses this accurate data to compute the wet bulb and the dew point temperatures using the latest software algorithms.

The computed **Wet Bulb** and **Dew Point** specifications
Wet Bulb Temperature Accuracy (1 Atmosphere): +/-1.5% or +/- 1.0˚F (+/-0.5˚C) from 32˚F to 120˚F (0˚C to 50˚C) and 20% to 80% RH.
Dew Point Temperature Accuracy (1 Atmosphere): +/-1.5% +/-1.0˚F(+/-0.5˚C) from 32˚F to 120˚F (0˚C to 50˚C) and 20% to 80% RH.

WET-SOCK METHOD

This method can be used to obtain relative humidity, dry/wet bulb and dew point measurements using two standard **TMX2G** temperature probes and channels A and B. There are two options for **Step 4**. Both options provide accurate readings and are merely a method of user preference.



TMX2G w/ 2" cotton sock

Step 1: Connect a **TMX2G** probe to **Channel A** and another to **Channel B**.

Step 2: Press the **RH** key and then the **MIN** key to display the minimum value of the RH.

Step 3: Slip a supplied **2" cotton sock*** over the end of the **TMX2G** probe connected to **Channel B** and wet it with distilled water.

Step 4 (Option 1): Grip both probes approximately **18"** from the ends in one hand. Proceed to swing the probes in a circular motion through the air until the display reading stabilizes. At that point you can stop swinging the probes.

Step 4 (Option 2): Place both probes in front of an air stream from air handler or register. For best results the air should flow at about 9 feet per second (3 m. second) over the wet sock ensuring that no radiant heat flows into the probe such as direct sunlight or heat from machinery. The correct measurement is obtained when the display stabilizes.

Step 5: Press the **CLR** key to erase the readings during the stabilization period and display the current values. Pressing the **RH**,**DB**,**WB** or **DP** keys will display the current value of the relative humidity, dry bulb, wet bulb, or dew point temperatures.

*** TMX3WB 2" cotton socks for RH measurement using wet sock method (6 pieces)**

PSYCHROMETRIC CHART

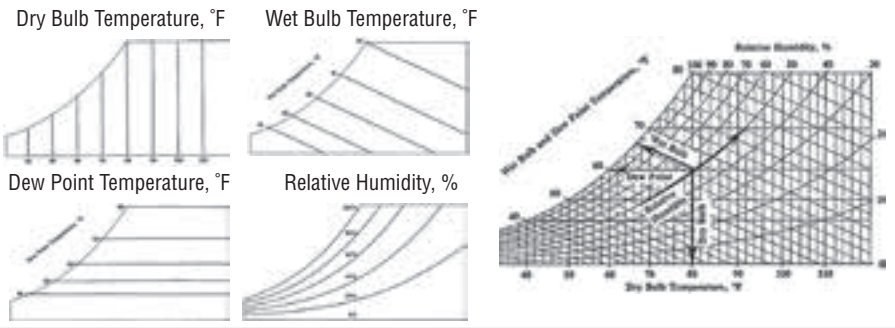
Psychrometry is the science which studies the properties of moist air. A psychrometric chart graphically illustrates the relationship between air temperature and relative humidity as well as other properties. **Air Temperature** is a measure of the heat content of air.

Three different temperature measurements are used in the psychrometric chart.

1. **Dry Bulb** temperature refers basically to the ambient air temperature not affected by the moisture in the air. The dry bulb scale is located at the base of the chart. Vertical lines indicate constant dry bulb temperatures.
2. **Wet Bulb** temperature reflects the cooling effect of evaporating water. The cooling effect of the evaporating water causes a lower temperature compared to the dry bulb air temperature. The wet bulb temperature scale is located along the curved upper left portion of the chart. The sloping lines indicate equal wet bulb temperatures.
3. **Dew Point** is the temperature at which water vapor starts to condense out of the air; the temperature at which air becomes completely saturated. Water will condense on a surface, such as a building wall or pitcher of ice water, that is at or below the dew point temperature of the air. Above this temperature the moisture will stay in the air. The dew point temperature scale is located along the same curved portion of the chart as the wet bulb temperature scale. However, horizontal lines indicate equal dew point temperatures. ***If the dew point temperature is close to the air temperature, the relative humidity is high, and if the dew point is well below the air temperature, the relative humidity is low***.

Relative Humidity is a measure of how much moisture is present compared to how much moisture the air could hold at that temperature expressed as a percentage. Lines representing conditions of equal relative humidities sweep from the lower left to the upper right of the psychrometric chart. The 100 percent relative humidity (saturation) line corresponds to the wet bulb and the dew point temperature scale line. The line for zero percent relative humidity falls along the dry bulb temperature scale line.

The versatility of the psychrometric chart lies in the fact that by knowing just two properties of moist air, the other properties can be determined.



AUTOMOTIVE OVERVIEW

The TM360A allows today's automotive technicians to assure both proper AC (Air Conditioning) operation, and to verify repairs made.

By performing **temperature drop tests with pressure checks**,proper pre/post-repair AC system performance is proven, further enhancing customer satisfaction, and virtually eliminating the possibility of repair comebacks.

Automotive AC system vent temperatures are **greatly** affected by the additional system load posed by high RH (relative humidity). An additional port provided on this unit allows accurate measurement of RH so that vehicle-specific OE temperature & pressure performance charts can be used to verify proper system performance.

The "Appendix" of this manual provides:

- **DIAGNOSTIC TESTING & REPAIR VERIFICATION WORKSHEETS** (DTRVWs) These worksheets will make your AC service & repair tasks easier, and will go a long way toward assuring maximum customer satisfaction when used as a supporting tool for review of both repairs needed, and repairs completed. They also support protecting your shop's interests through building very detailed and accurate vehicle repair history files.

- **DIAGNOSTIC FLOW CHARTS** (DFCs)
  CPS has designed this manual to allow you, a professional repair technician, to use the above mentioned DTRVWs along with various DFCs presented herein, to achieve the highest level of automotive AC repair success possible. Use of this manual together with your TM360A TEMP-SEEKER® and the OE Pressure & Temperature Performance Charts is the key to raising your AC repair capabilities to the highest levels possible.

AUTOMOTIVE AIR CONDITIONING TEMPERATURE DIAGNOSTICS

When using the diagnostic flow charts **(DFC)** follow these procedures:

- Ensure the vehicle is properly secured in “Park” and the “Parking Brake” is properly applied.
- If possible, have the vehicle exposed to sun-load.
- Open all vehicle doors.
- Ensure the engine is at operating temperature.
- The engine should be operated at idle speed.
- Set the blower speed to high.
- Operate the AC system for at least five minutes in the MAX AC mode before taking any measurements. (MAX Mode is typically: compressor on, air directed to the face vents, fresh/recirc door in the recirculating mode, not the fresh air mode, and blower on high. Some systems have a MAX mode, others don’t any must be set this way manually.)
- **Obtain the OEM’s (Original Equipment Manufacturer’s) spec charts for both temps and pressures, for the vehicle you are servicing!** These charts will show both specific duct temperatures and system pressures, based upon ambient temperature, and relative humidity levels. You will notice that today’s vehicles, will **NEVER** obtain duct temperatures possible on older vehicles of just a few decades past.

  For example, an OEM spec chart for a current R-134a system, with ambient temps between 96-105+°F and a humidity level above 40%, shows duct temperature in a properly functioning system ***will be no lower than 72°F.*** *Placing a temperature probe in a vent and condemning a system that is not reaching 38°F is* ***NOT*** *the proper way to test a system. Referring to the vehicle’s dedicated specification charts is a must, for proper AC system service.*
- Measure air temperature from the duct closest to the evaporator and compare your reading to the OEM temperature performance chart, noting ambient air temp and humidity level.
- Measure the temperature drop across the condenser from the condenser inlet pipe to the condenser outlet pipe, as close to the condenser as possible. Refer to the Condenser DFC-A (Diagnostic Flow Chart A) in the appendix and follow its recommendations.
- Measure the temperature drop between ambient air and the discharge duct closest to the evaporator and follow the recommendations of DFC-B, in the appendix.
- Measure the temperature drop between the evaporator inlet (downstream or after the refrigerant metering device) and outlet pipes and follow the recommendations of DFC-C, in the appendix.

TECHNICIAN OPERATING TIPS

Experience has shown that accurate temperature readings can be affected by several factors. Listed below are some of the conditions you may encounter when performing temperature drop tests.

The pressure that you apply to a temperature probe can affect the reading by as much as 20°F (-6°C). Try to be consistent when using touch probes, because if you apply light pressure on the first temp reading and heavy pressure on the second reading your results may not be accurate.

Air conditioning lines coated with dirt or paint need to be 16 scraped cleaned where the probe will make contact. Several manufactures use epoxy black paint on condensers and liquid lines that can affect your readings by as much as 30° F (-1°C).

Limited contact area can be a problem if the temperature probe tip is too large. Some vehicles use a very short evaporator outlet pipe between the evaporator case and the accumulator nut. In some cases only 3/16 of an inch is available for the probe to make contact. Taking readings on flange nuts will skew the actual temperature by over 20° F (-6°C).

Gaining access to the outlet side of both orifice tubes and thermal expansion valves can be difficult on some applications. Some General Motors and Ford light truck applications place the outlet tip of the orifice tube just inside the evaporator case. You may gain access to the pipe by cutting a small section of the evaporator case away with a hot knife or vibratory cutting tool. After completing the repair job, seal the area with HVAC Permagum or insulation tape and reinstall the section of the case that was cut away using plastic welding, if possible.

SAMPLE PERFORMANCE CHARTS

Temperature/Humidity Pressure Chart

Temperature	Humidity	Low Pressure	High Pressure
55-65°F (13-18°C)	0-100%	151-220 kPa (22-32 psi)	537-937 kPa (78-136 psi)
66-75°F (19-24°C)	Below 40%	151-248 kPa (22-36 psi)	689-1109 kPa (100-161 psi)
	Above 40%	151-282 kPa (22-41 psi)	757-1178 kPa (110-171 psi)
76-85°F (25-29°C)	Below 35%	186-289 kPa (27-42 psi)	978-1322 kPa (142-192 psi)
	35-50%	206-303 kPa (30-44 psi)	1019-1336 kPa (148-194 psi)
	Above 50%	213-323 kPa (31-47 psi)	1040-1378 kPa (151-200 psi)
86-95°F (30-35°C)	Below 30%	234-337 kPa (34-49 psi)	1212-1577 kPa (176-229 psi)
	30-50%	248-351 kPa (36-51 psi)	1233-1598 kPa (179-232 psi)
	Above 50%	261-372 kPa (38-54 psi)	1260-1619 kPa (183-235 psi)
96-105°F (36-41°C)	Below 20%	289-385 kPa (42-56 psi)	1488-1853 kPa (216-269 psi)
	20-40%	296-399 kPa (43-58 psi)	1488-1853 kPa (216-269 psi)
	Above 40%	310-413 kPa (45-60 psi)	1508-1853 kPa (219-269 psi)
106-115°F (42-46°C)	Below 20%	344-434 kPa (50-63 psi)	1770-2080 kPa (257-302 psi)

Ambient Temp vs. Discharge Temp

Ambient Temp	Humidity	Front Center	Left Rear
55-65°F (13-18°C)	0-100%	41°F (5°C)	41°F (7°C)
66-75°F (19-24°C)	Below 40%	46°F (8°C)	46°F (10°C)
	Above 40%	50°F (10°C)	50°F (12°C)
76-85°F (25-29°C)	Below 35%	52°F (11°C)	52°F (13°C)
	35-50%	54°F (12°C)	54°F (14°C)
	Above 50%	57°F (14°C)	57°F (16°C)
86-95°F (30-35°C)	Below 30%	59°F (15°C)	59°F (18°C)
	30-50%	63°F (17°C)	63°F (19°C)
	Above 50%	66°F (19°C)	66°F (21°C)
96-105°F (36-41°C)	Below 20%	66°F (19°C)	66°F (21°C)
	20-40%	70°F (21°C)	70°F (23°C)
	Above 40%	72°F (22°C)	72°F (24°C)
106-115°F (42-46°C)	Below 20%	73°F (23°C)	73°F (25°C)
	Above 20%	75°F (24°C)	75°F (27°C)
116-120°F (47-49°C)	Below 30%	81°F (27°C)	81°F (28°C)

STANDARD OT & TXV SYSTEM TEST

Refer to figure D-1, Below

- Hook up TMX3C Clamp-on probe or TMX2S Velcro Strap-On temp probes as follows: Channel A to inlet and channel B to outlet of evaporator*/condenser (*use optional TMX2FP Flex Surface Probe on evaporator inlet for vehicles like GM S-10 and Ford Trucks where orifice tubes are mounted at the evaporator inlet).
- Hook up either TMX2A Moving Air probe or TMX2GA General Purpose Air probe from channel C to monitor ambient temperature 1-2' in front of the condenser.
- Hook up a second air probe from channel D to check vent air temperature in the vent closest to the evaporator
- Hook a RH (Relative Humidity) probe to the AUX port. Vent temperatures will increase significantly as humidity levels rise, so this will allow you to follow the OEM specifications for minimum vent temps based upon ambient air temp and RH level.

Figure D-1

VARIABLE DISPLACEMENT COMPRESSORS

The compressor control valve may mask a refrigerant undercharge when checking max heat load in the service bay. The recommended practice is to assure that the compressor is commanded to a 100% duty cycle during testing. Various methods are available to perform this function.

ACCESSORY PROBES / ACCESSORIES

Models	
TM360	Includes: TMX2A (1) TMX2G (1) TMX2S (1)
TM360A	Includes: TMX3C (1) TMX2GA (1) TMX2FP (1)
TM360C	Includes: TMX2A (1) TMX3C (1) TMX2S (1)

Accessories	
TMX3PS	Optional A/C power supply (100-240V)
TMX3WB	6pk of 2" cotton socks for use with the Wet Sock Method (pg.8)

TMX2A Moving Air Probe	
All probes have 15ft / 4.5m leads	
Probe Type	Air
Common Uses	Ducting / Registers / Air movement across condensers / Ambient Air
Response Time	6 seconds
Range	-40˚F to 221˚F /-40C TO +105˚C

TMX3C Clamp-On-Probe	
All probes have 15ft / 4.5m leads	
Probe Type	Surface
Common Uses	Surface temperatures of copper piping from 3/16" (5mm) to 1 1/8" (29mm)
Response Time	12 seconds
Range	-40˚F to 221˚F /-40C TO +105˚C

TMX2FP Flexible Surface Probe	
All probes have 15ft / 4.5m leads	
Probe Type	Surface
Common Uses	Hard to reach areas
Response Time	10 seconds
Range	-40˚F to 221˚F /-40C TO +105˚C

ACCESSORY PROBES / ACCESSORIES

TMX2G General Purpose Probe	
All probes have 15ft / 4.5m leads	
Probe Type	Surface / Air / Liquids
Common Uses	Copper pipe / Ambient Air / RH wet-sock method
Response Time	6 seconds
Range	-40˚F to 257˚F / -40˚C TO +125˚C

TMX2GA General Purpose Air Probe	
All probes have 15ft / 4.5m leads	
Probe Type	Air / Surface / Liquids
Common Uses	Ambient air / Ducting / Registers / Air movement across condensers
Response Time	12 seconds
Range	-40˚F to 257˚F / -40˚C TO +125˚C

TMX2P Puncture Probe	
All probes have 15ft / 4.5m leads	
Probe Type	Surface / Liquids (shaft only)
Common Uses	Internal temperatures of frozen materials / Air ducts
Probe Shaft Length	6 in
Response Time	6 seconds
Range	-40˚F to 257˚F / -40˚C TO +125˚C

TMX2S Velcro Strap Pipe Probe	
All probes have 15ft / 4.5m leads	
Probe Type	Surface
Common Uses	Surface temperatures of copper piping
Response Time	15 seconds
Range	-40˚F to 257˚F / -40˚C TO +125˚C

ACCESSORY PROBES / ACCESSORIES

TMX3RH RH/DB/WB/DP Probe (TM360)	
All probes have 15ft / 4.5m leads	

Probe Type	Specialty RH probe
Common Uses	Measuring indoor air quality, setting/troubleshooting humidity devices
Response Time	10 seconds in moving air, 20 seconds in still air
Temperature Range	-40˚F to 194˚F / -40˚C TO +90˚C
Temperature Accuracy	±1.0˚F from -40˚F to 200˚F or ±1.2 % of reading ±1.2˚C from -40˚C to 90˚C or ±0.5% of reading
RH Range	0 to 100% RH
RH Accuracy	±1.8%RH from 10 to 90%RH; ± 3% elsewhere in the range
Wet bulb Accuracy	±1.4˚F from 32˚F to 120˚F / ±0.7˚C from 0˚C to 50˚C
Dew Point Accuracy	±1.4˚F from 32˚F to 120˚F / ±0.7˚C from 0˚C to 50˚C

CONDENSER FLOW CHART A

Measure condenser inlet and outlet temperature within 4" of condenser of the condenser. Temperature drop (difference) should be between 20°F and 50°F (-6°C and 10°C) in a properly performing system.

Less than 20°F (-6°C)

CHECK CONDENSER FOR AIR FLOW

- ☐ Bent fins
- ☐ Debris on condenser or between radiator and condenser
- ☐ Inspect for external airflow restrictions (big screens, bras, etc.,)

No Debris | Clean & Retest

- ☐ Check fan clutch
- ☐ Check electronic cooling fan for proper operation
- ☐ Check condenser fan (if equipped) for proper operation
- ☐ Check fan shroud for damage
- ☐ Inspect gaskets between radiator and condenser
- ☐ Inspect air dams for damage
- ☐ Inspect coolant condition/ level

No Problems | Repair & Retest

TEST FOR

- ☐ Internal contamination
- ☐ Refrigeration overcharge condition
- ☐ Incorrect or inferior condenser installed
- ☐ Condenser installed upside down

Between 20°F and 50°F (-6°C and 10°C)

Refer to Chart B

More than 50°F (10°C)

- **Check for low refrigerant charge**
- **Test refrigerant for contamination (non-condensable gases - air)**
- **Test condenser for internal restrictions**

- **Refer to condenser identification and repair procedures**

AIR EFFICIENCY FLOW CHART B

Measure ambient air temperature 16-18" in front of the condenser. Measure air temperature of the AC duct closest to the evaporator using the vent probe. The temperature difference between ambient and duct air should be approximately 30°F (-1°C) in a properly performing system.

Less than 30°F (-1°C)

CHECK FOR OUTSIDE HEAT ENTERING CABIN

- ☐ Blend air door not closing
- ☐ Heater valve not closing
- ☐ Fresh air door not closing

CHECK EVAPORATOR CONDITION

- ☐ Evaporator fins dirty or restricted
- ☐ Evaporator interior coated with scale
- ☐ Air bypassing evaporator (missing gaskets)
- ☐ Inadequate airflow across evaporator (i.e., clogged cabin air filter or rodent infestation can also damage compressor slugging failure)

CHECK REFRIGERANT AND OIL CHARGE SERVICE

- ☐ Was system evacuated?
- ☐ Was system cleaned?
- ☐ Was the compressor oil level checked?
- ☐ Refer to diagnostic chart C

Repair & Retest as Necessary

Greater than 30°F (-1°C)

- ☐ System performing to specifications
- ☐ Check temperature balance at condenser (see Chart A)

EVAPORATOR FLOW CHART C

Measure the evaporator inlet and outlet temperatures as close to the evaporator core as possible. The ideal temperature difference between the inlet and outlet is 0°F (-18°C). The acceptable temperature range for the outlet tube is from 5°F (-15°C) colder to 5°F (-15°C) warmer than the inlet tube. Readings within this range indicate there is adequate refrigerant flowing in the system to transfer heat properly and carry the refrigerant oil out of the evaporator, to the compressor.

Outlet Tube < 5°F (15°C) Colder than inlet tube

CHECK SYSTEM FOR

- ☐ Overcharge condition
- ☐ Leaking o-ring seals at the orifice tube
- ☐ Correct OT (orifice tube) for the application (too large)
- ☐ TXV (Thermal Expansion Valve) stuck open

Outlet Tube > 5°F (15°C) Warmer than inlet tube

CHECK SYSTEM FOR

- ☐ Undercharge condition
- ☐ Excessive oil in system
- ☐ Inspect orifice tube for restrictions (dirty screen)
- ☐ Correct OT (orifice tube) for the application (too small)
- ☐ TXV (Thermal Expansion Valve) clogged

Notes:

- Many systems (both OT (Orifice Tube) and TXV (thermal expansion valve)) do not allow adequate access to the evaporator tubes for proper temperature drop testing. As noted on page 11, (Technician Operating Tips), you may be able to gain access by cutting a small section of the evaporator case away with a hot knife or vibratory cutting tool. After completing the repair, reinstall the removed case piece and seal with HVAC Permagum or insulation tape.
- Variable Orifice Tubes (VOTs) are available for most applications that originally had a fixed orifice tube. VOTs have been found to increase system performance, lowering duct temperatures as much as 5-12 degrees F, at idle. VOTs are highly recommended, especially in older vehicles converted from R-12 to R-134a.
- An evaporator high-side outlet tube temp warmer than the low-side inlet tube by 10°F (-12°C), or more indicates a restriction to refrigerant flow, or a very low refrigerant charge. Check the high-side of the system for failures using Condenser Flow Chart A.

WARRANTY

CPS Products, Inc. guarantees that all products are free of manufacturing and material defects to the original owner for one year from the date of purchase. If the equipment should fail during the guarantee period it will be repaired or replaced (at our option) at no charge. This guarantee does not apply to equipment that has been altered, misused or solely in need of field service maintenance. All repaired equipment will carry an independent 90-day warranty. This repair policy does not include equipment that is determined to be beyond economical repair.

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