Fieldpiece

Digital Manifold & Micron Gauge

OPERATOR'S MANUAL

Model SMAN360

Quick Start

1 Install six AA batteries into rear battery compartment. Batteries included in packaging.
2 Press the center blue button for 1 second to turn on your new manifold.
3 Connect hoses and pipe clamps to the manifold and the system.
4 See real-time pressure and temperature measurements all at once!

Certifications

N22675   C-Tick (N22675)

CE
RoHS Compliant

Test Equipment Depot
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Melrose, MA 02176
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▶ Visit us at www.TestEquipmentDepot.com

Description

Your SMAN360 is the top of the line two-valve Digital Manifold and Micron Gauge for HVACR professionals. See all your pressures and temperatures at the same time on the redesigned large display with bright blue backlight.

SMAN360 combines high precision, absolute pressure sensors, a superheat/subcooling calculator, true micron gauge for vacuum, and dual temperature measurements. Your SMAN360 calculates and displays target superheat and actual superheat to verify proper charge.

SMAN360 is designed to meet the demands of HVACR field service with a rugged rubber boot for durability, a strong metal hanger for easy storage and a form fitting, water resistant, padded nylon pouch. SMAN360 has a very intuitive user interface and long battery life.

Your SMAN comes pre-programmed with accurate P-T charts for 45 of the most common refrigerants in the field so you are always prepared for any job.

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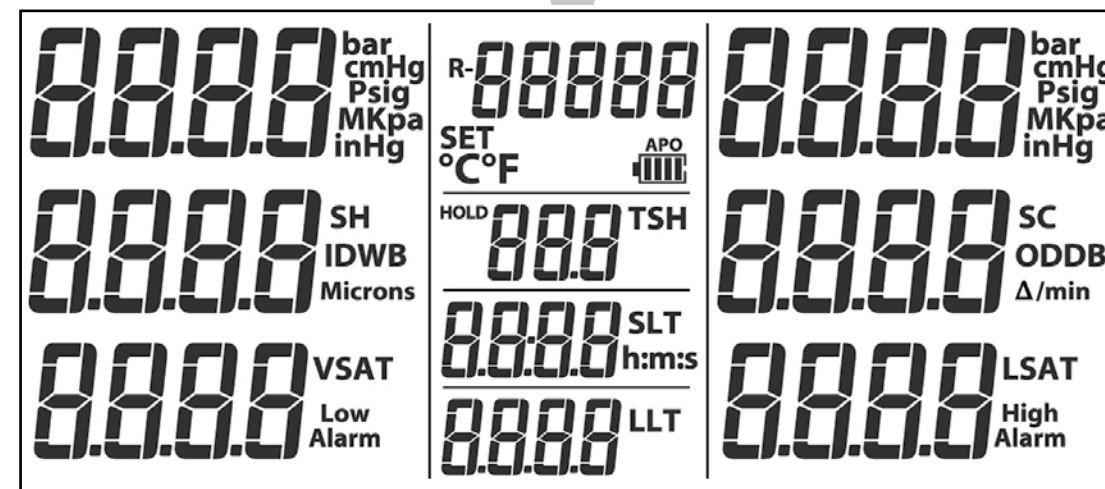
bar	Pressure (bar)
Psig	Pressure (pounds/in²)
MkPa	Pressure (kilopascals or Megapascals)
inHg	Negative Pressure (inches of mercury)
cmHg	Negative Pressure (cm of mercury)
SH	Superheat
SC	Subcooling
TSH	Target Superheat
SLT	Suction Line Temperature
LLT	Liquid Line Temperature
VSAT	Vapor Saturation Temperature
LSAT	Liquid Saturation Temperature

ODDB	Outdoor Dry Bulb
IDWB	Indoor Wet Bulb
HOLD	Static Target Superheat Calculation
h:m:s	Hours:Minutes or Minutes:Seconds
(battery)	Battery Life
APO	Auto Power Off Enabled
R-	Selected Refrigerant of System
Microns	Vacuum (Microns of Mercury)
Δ/min	Rate of change (Microns per Minute)
Set	Set Mode
High Alarm	High Alarm
Low Alarm	Low Alarm

Controls
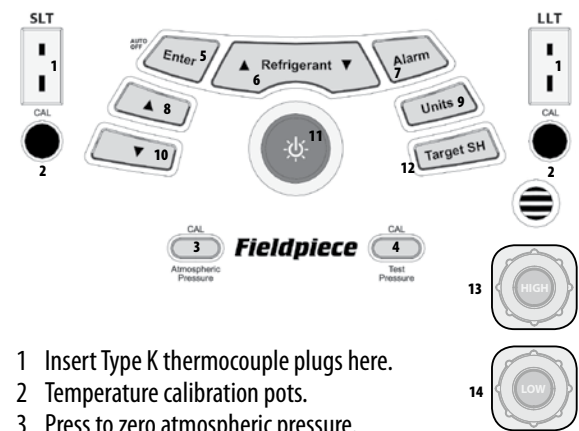
1 Insert Type K thermocouple plugs here.
2 Temperature calibration pots.
3 Press to zero atmospheric pressure.
4 Press to calibrate to refrigerant tank.
   (See Advanced Pressure Calibration section.)
5 Press to confirm selection.
6 Press/hold to cycle through refrigerants.
7 Press to turn on/off the Hi/Lo vacuum
   alarms and hold to change alarm settings.
8 Press to scroll up to adjust values.
9 Press to change units.
10 Press to scroll down to adjust values.
11 Hold 1 second to power on or off. Press to toggle backlight.
12 Press to enter Target Superheat set up mode.
13 Turn clockwise to close High side port.
14 Turn clockwise to close Low side port.

Functions

Superheat and Subcooling

Your SMAN360 can calculate and display both superheat and subcooling simultaneously.
1 Select the appropriate refrigerant using the REFRIGERANT button.
2 Connect EPA approved refrigerant hoses to low and high side on SMAN360. Plug Type K thermocouple pipe clamps to SLT and LLT.
3 Connect your SMAN360 to the system:
   Superheat: Hand tighten low side hose to suction line service port. Place the SLT pipe clamp thermocouple on the suction line between the evaporator and compressor, no closer than 6 inches to compressor.
   Subcooling: Hand tighten high side hose to liquid line service port. Attach the LLT pipe clamp thermocouple on the liquid line between the condenser and expansion valve (TXV), as close to the service port as possible.
4 After turning the system on or making any adjustments to the system wait 15 minutes before charging by superheat or subcooling to ensure the system is stabilized.
5 To add or remove refrigerant connect a refrigerant or recovery tank to the center port on SMAN360. Follow recommened charging or recovery practices from equipment manufacturer. Use the low side and high side valves on SMAN360 to charge or recover refrigerant as needed. Let system stabilize for 15 minutes.
Note: When superheat and/or subcooling cannot be calculated an "OL" or "-OL" will be displayed. Please check the following:
1 The correct refrigerant is selected on the SMAN.
2 The pipe thermocouples are plugged into SLT/LLT ports and are in good working condition.
3 The pipe thermocouples are attached in the appropriate location on the system. See step 3 above for details.

Target Superheat

Target Superheat is useful for charging fixed orifice air conditioning systems. Your SMAN will calculate the target superheat for you. Just manually input the IDWB (indoor wet bulb) and ODDB (outdoor dry bulb) temperatures into the SMAN.

Manually Input Temperatures
1 Press Target SH button to enter Target SH mode. IDWB will begin blinking indicating it is ready for an input.
2 Press UP or DOWN ARROW to toggle between IDWB or ODDB input. Hold ENTER to select which temperature you want to input, either IDWB or ODDB. The far left digit of IDWB or ODDB will begin blinking indicating manual input mode is ready.
3 Press the UP or DOWN ARROW to change values and press ENTER to lock in each digit.
4 Repeat steps 2 and 3 for the other temperature. The calculated target superheat will show in the center column of the display. A solid HOLD will display to the left of the TSH calculation indicating a static target superheat calculation.
Note: If the inputted temperature is out of the calculable range for IDWB or ODDB an "Err" will flash once and a double beep will sound. IDWB range (40°F to 125°F, 4.4°C to 51.7°C) and ODDB range (50°F to 140°F, 10°C to 60°C). Re-input a temperature within these ranges to calculate target superheat.

Changing Units

Your SMAN can display pressure and temperature measurements in English, Metric or combination of both units.
1 Press UNITS to enter unit selection screen.
2 Use ARROW to select your desired pressure units. Press ENTER.
3 Use ARROW to select your desired temperature units. Press ENTER to return to pressure units.
4 Press UNITS to return to normal SMAN display.

Pulling a Vacuum

Follow all manufacturers' evacuation procedures over those in this manual.
1 Connect your SMAN360 to your vacuum pump and the system, then power on your SMAN360.
2 Set up vacuum alarms. These will notify you when you've reached your desired vacuum and stabilization levels. See Set Vacuum Alarm instructions below.
3 Pull a vacuum on the system. SMAN360 will automatically sense the negative pressure and begin to display in inHgV. Once the vacuum levels are low enough, the display will automatically change to show vacuum in microns. Once in micron mode the inHgV readings will no longer display.
4 The rate at which the vacuum levels are changing will be displayed in microns per minute. The smaller the rate of change, the closer you are to stabilization.

Set Vacuum Alarms
1 Hold ALARM for 1 second to enter Alarm Set Mode. The first digit of LO alarm will blink.
2 Use ARROWS to change the blinking number. Press ENTER to lock in a digit and move to the next digit. Repeat for all LO alarm digits.
3 When LO alarm is complete, the first digit of HI alarm will blink. Use ARROWS to change the blinking number. Press ENTER to lock in a digit and move to the next digit. Repeat for all HI alarm digits.
4 When all digits of HI alarm are locked in you will automatically exit Alarm Set Mode and your target alarm values will be saved.
Note: Anytime while in Alarm Set Mode, you can press ALARM to toggle between alarm HI set and alarm LO set. Hold ALARM to exit Alarm Set Mode and save at any time.
Note: "Err" will show if you try to set the HI alarm lower than the LO alarm, or the LO alarm higher than the HI alarm.

Activate Vacuum Alarms

1 Press ALARM to activate low alarm. Default is 500 microns. Stopwatch will start. When low alarm target value is reached, SMAN360 will beep and the stopwatch will restart from zero. You can monitor how long the vacuum has been under your target.
2 Press ALARM again to deactivate low alarm and activate high alarm. Default is 1000 microns. When high alarm value is reached, SMAN360 will beep and the stopwatch will pause. You can see how long it took to reach your target value.
3 Press ALARM again to deactivate high alarm.

Additional Evacuation Tips to Reach a Deeper Vacuum:
1 Use shortest vacuum rated hoses with largest diameter available.
2 Remove schrader cores and core depressors. Core removal tools like the "MegaFlow Valve Core Removal Tool" can be purchased from Appion, Inc. to help with this process.
3 Inspect the rubber seals at both ends of your hoses for damage that may result in leakage.
4 Do not use hoses with low loss fittings when evacuating or pulling a vacuum on a system.
5 When the vacuum pump is isolated from the system, a slow rise in micron levels may signify moisture is still present in the system but should eventually stabilize. A continuous rise in microns levels to atmosphere may indicate a leak in the hoses, the vacuum pump connections or the system.

Auto Power Off (APO)

To conserve battery life, your SMAN will power down after 30 minutes of inactivity. APO is activated by default and APO displays above the battery icon. To deactivate, press and hold ENTER while powering on the SMAN. When deactivated, APO will no longer show above the battery icon.

What is Superheat and Subcooling? Why Do I Need to Measure It?

Superheat is the difference between the actual temperature of the refrigerant (gas) as it leaves the evaporator and the boiling point of the refrigerant. After boiling, the refrigerant continues to heat up. The number of degrees it "heats up" after boiling is called the superheat. Under worst case conditions (low load for fixed orifice systems), the refrigerant in the evaporator boils off near the end of the evaporator coil. To make sure liquid doesn't enter the compressor under the worst case condition (low load), the refrigerator or A/C manufacturers publish charts indicating what the superheat should be at a given indoor wet bulb measurement and outdoor air temperature.

Measuring superheat is your best indication on a fixed orifice system of the proper refrigerant charge and operating conditions. If everything else is working properly and the actual superheat is too high, add refrigerant. If it's too low, evacuate refrigerant.

Subcooling is the difference between the boiling point of the refrigerant in the condenser and the actual temperature of the refrigerant

as it leaves the condenser. The degrees that the refrigerant "cools down" below the boiling point is the subcooling. Under worst case scenario (low load for TXV) the subcooling will continue to rise. If the subcooling rises too high, liquid may be backed into the compressor causing damage and catastrophic failure. See www.fieldpiece.com for more technical articles.

- Location of Subcooling Test
- Location of Superheat Test
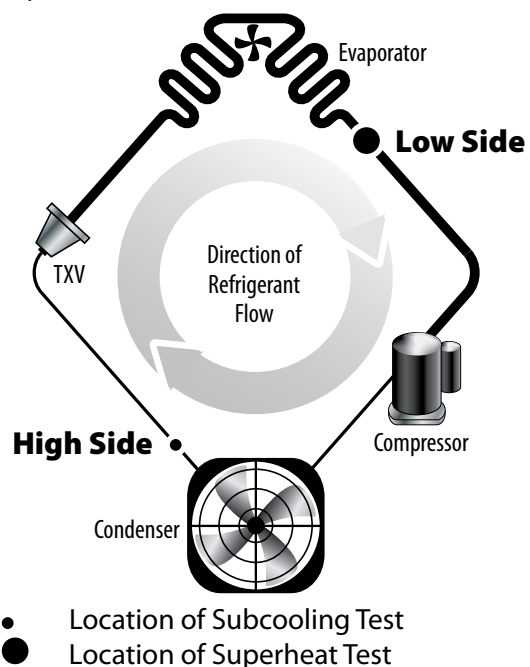
Specifications

Display size: 5 inches (diagonal)
Backlight: Blue (On for 3 minute unless turned off manually)
Mini-USB Port: For updating to latest version of firmware.
Battery: 6 x AA (Battery life below based on alkaline type)
Battery life: 350 hours (without backlight and vacuum)
Low battery indication: ▭ is displayed when the battery voltage drops below the operating level
Auto Shut off: 30 minutes of inactivity when APO is activated
Operating environment: 32°F to 122°F (0°C to 50°C) at <75% relative humidity
Storage temperature: -4°F to 140°F (-20°C to 60°C), 0 to 80% RH (with battery removed)
Temperature coefficient: 0.1 x (specified accuracy) per °C (0°C to 18°C, 28°C to 50°C), per 0.6°F (32°F to 64°F, 82°F to 122°F)
Over range: "OL" or "-OL" is displayed
Weight: 3.04 lbs (1.38 kg)

Pressure

Connector Type: Standard 1/4" NPT male flare fitting
Range: 29"HgV to 580 Psig (English), 74 cmHgV to 0 to 4000KPa (Metric)
Resolution: 0.1 psi/inHg; 1 kPa/cmHg
Accuracy: 29"HgV to 0"HgV: ±0.2"HgV
74 cmHgV to 0 cmHgV: ±1 cmHgV
0 to 200 Psig: ±1 Psi; 0 to 1378 KPa: ±7 KPa; 0 to 1.378MPa: ±0.007MPa; 0 to 13.78 bar ±0.07 bar
200 to 580 Psig: ±(0.3% of reading+1 Psig); 1378 to 4000KPa: ±(0.3% of reading+7 Kpa); 1.378 to 4.000MPa: ±(0.3% of reading+0.007MPa); 13.78 to 40.00bar: ±(0.3% of reading +0.07bar)
Maximum overload pressure: 800 psig
Units: Psig, kPa, MPa, bar, inHg, and cmHg

Microns for Vacuum

Connector Type: Standard 1/4" NPT male flare fitting
Range: 0 to 9999 microns of mercury
Resolution: 1 micron (0 to 2000 microns), 250 microns (2001 to 5000 microns), 500 microns (5001 to 8000 microns), 1000 microns (8001 to 9999 microns)
Accuracy: ±(5% of reading + 5 microns), 50 to 1000 microns
Maximum Overload pressure: 580 psig
Units: Microns of mercury

Temperature

Sensor type: Type K thermocouple
Range: -95°F to 999.9°F (-70°C to 537.0°C)
Resolution: 0.1°F/°C
Accuracy: ±(1.0°F) -95°F to 199.9°F; ±(0.5°C) -70°C to 93°C ±(2.0°F) 200°F to 999.9°F; ±(1.0°C) 93°C to 537.0°C
Note: All accuracies are after a field calibration.

Refrigerants

The P-T charts of the following 45 refrigerants come pre-programmed into your SMAN. In your SMAN the refrigerants are listed in order of most commonly used. Here, they are listed in numerical order.
R11, R113, R114, R12, R123, R1234YF, R124, R125, R13, R134A, R22, R23, R32, R401A(MP39), R401B, R402A, R402B, R404A, R406A, R407A, R407C, R407F, R408A, R409A, R410A, R414B (Hotshot), R416A, R417A, R417C (HOT SHOT 2), R420A, R421A, R421B, R422A, R422B(NU22B), R422C(Oneshot), R422D, R424A, R427A, R434A(RS-45), R438A(M099), R500, R502, R503, R507A, R508B (Suva95)

Using Different Refrigerants

You can use your manifold with different refrigerants. Be sure to purge your manifold and hoses before connecting to a system with a different refrigerant.

Maintenance

Clean the exterior with a dry cloth. Do not use liquid.

Battery Replacement

The battery must be replaced when the battery life indicator ▭ is empty. SMAN will display "lo batt" and power off. Remove rear battery cover and replace with 6 AA batteries.

Cleaning the Sensors

Over time, the vacuum sensor of the SMAN360 may become contaminated with dirt, oil, and other contaminents introduced from pulling vacuums.

1. **Never** use an object such as a cotton swab to clean the sensor, you may cause damage to the sensor.
2. Open all knobs/valves, and cap all the ports except for the center port.
3. Drop enough Isopropyl (rubbing) alcohol (>70%) into the uncapped port using an eye dropper or funnel so that it can flush out contaminents.
4. Cap central port and gently shake your SMAN upside down to clean sensor.
5. Turn right side up. Open a port to pour out the rubbing alcohol and open all ports to allow sensors to dry out; usually an hour or so.

Calibration

Temperature

To calibrate your SMAN temperature thermocouples, adjust the pot on the front of the meter labeled SLT Cal or LLT Cal. The best way to calibrate is to match to a known temperature. Ice water is very close to 32°F and is readily available. Accuracies of one degree or better are easily obtained.

1. Stabilize a large cup of ice water by stirring. Pure, distilled water will be the most accurate.
2. Immerse the temp probe in ice water from SLT and adjust the SLT Cal pot with a flathead screwdriver and let it stabilize, keep stirring.
3. Repeat Step 3 for temp probe in LLT.

Pressure Zeroing

To calibrate your SMAN360 pressure sensors to atmospheric pressure, ensure that your SMAN360 is disconnected from any pressure source and at equilibrium with the ambient pressure.
1. Press the CAL Atmospheric Pressure button and your SMAN360 will set the zero point of pressure to the ambient pressure.

Advanced Pressure Calibration

Your SMAN360 has the ability to perform a linear adjustment of the pressure sensors based on refrigerant type, temperature, and pressure.
Calibration setup: For best results, first perform both the Temperature and Pressure Zeroing procedures. See Calibration section for details. This will ensure pressure readings are zeroed and thermocouple is properly calibrated to the SLT port of the SMAN. Calibration to LLT port is not necessary for this calibration. The refrigerant cylinder should be stored in a stable ambient environment for at least 24 hours before calibration.
1. Plug in a Type K thermocouple into SLT. (A bead type thermocouple, like the ATB1, is recommended.)
2. Connect the SMAN360 to a refrigerant cylinder of a known, single refrigerant using an EPA approved service hose. Be sure to open both HIGH and LOW side valves on your manifold and cap the unused ports. (If caps are not available you can connect both ends of a refrigerant hose to the two unused caps. Note: Some refrigerant will remain in the hoses which will need to be recovered.)
3. Press the REFRIGERANT button to match the refrigerant of the cylinder you are using.
4. Attach bead-type thermocouple to the side of the cylinder using tape. It is recommended to attach in the middle of the cylinder. Important: Let the temperature of the thermocouple stabilize to the refrigerant temperature for 1 to 2 minutes or until stable.
5. Open the refrigerant cylinder. The pressure inside cylinder should now be displayed on both HIGH and LOW side pressure sensors.
6. Press the CAL Test Pressure button. If successful, "Good" will display for 3 seconds. If failed, "Err" will display for same time.

Your SMAN checks with its built-in P-T charts to compare the temperature of the refrigerant in the tank to the vapor saturation temperature based on the refrigerant you selected. If the measured pressures on your SMAN are within ±3psi of the P-T chart pressure corresponding to the vapor saturation temperature, the SMAN will adjust the pressure sensor linearity to match the P-T chart.
Possible causes of failed "Err" pressure calibration:
1. Refrigerant tank was not stored in stable ambient conditions for at least 24 hours.
2. Thermocouple attached to refrigerant tank was not properly calibrated to SLT port of SMAN.
3. Thermocouple was plugged into wrong port LLT instead of SLT.
4. Incorrect refrigerant was selected on the SMAN.

Firmware Updates

Your SMAN360 firmware can be updated in the field to ensure you always have the most up-to-date features for your manifold. Just go to www.fieldpiece.com to periodically check for the latest firmware version. If a newer version is available, follow the download link and installation instructions on the website. Connect your SMAN360 to the PC via a mini-USB to USB cable (not included) to install the update on your SMAN.

To check your current firmware version, power off your SMAN360. Press and hold the blue power button for about 6 seconds. The SMAN360 firmware version will show in the top right corner of the display (X.XX).

⚠ **WARNINGS**
DO NOT APPLY MORE THAN 800 PSI TO ANY PORT ON THE MANIFOLD. FOLLOW ALL EQUIPMENT MANUFACTURER'S TESTING PROCEDURES ABOVE THOSE IN THIS MANUAL IN REGARDS TO PROPERLY SERVICING THEIR EQUIPMENT.

Limited Warranty

This meter is warranted against defects in material or workmanship for one year from date of purchase from an authorized Fieldpiece dealer. Fieldpiece will replace or repair the defective unit, at its option, subject to verification of the defect.

This warranty does not apply to defects resulting from abuse, neglect, accident, unauthorized repair, alteration, or unreasonable use of the instrument.

Any implied warranties arising from the sale of a Fieldpiece product, including but not limited to implied warranties of merchantability and fitness for a particular purpose, are limited to the above. Fieldpiece shall not be liable for loss of use of the instrument or other incidental or consequential damages, expenses, or economic loss, or for any claim of such damage, expenses, or economic loss.

State laws vary. The above limitations or exclusions may not apply to you.

Obtaining Service

Email Fieldpiece warranty department at fpwarranty@fieldpiece.com for current fixed price repair service. Send check or money order made out to Fieldpiece Instruments for the amount quoted. If your meter is under warranty there will be no cost for the repair/replacement. Send your meter, freight prepaid, to Fieldpiece Instruments. Send proof of date and location of purchase for in-warranty service. The meter will be repaired or replaced, at the option of Fieldpiece, and returned via least cost transportation.

For international customers, warranty for products purchased outside of the U.S. should be handled through local distributors. Visit our website to find your local distributor.

Fieldpiece
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