



## V-Cone Troubleshooting Guide

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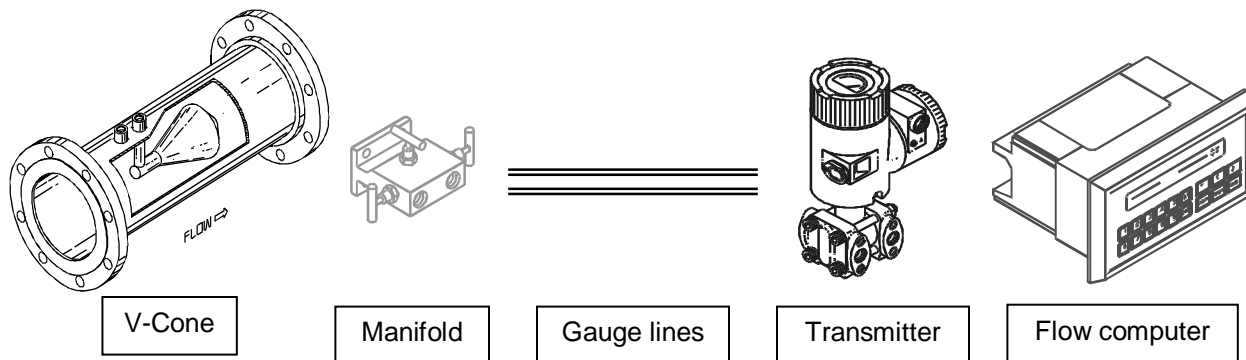
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## Troubleshooting a V-Cone System On-Site

This guide is intended to help you troubleshoot a V-Cone system. Keep several points in mind as you proceed:

1. Most V-Cones are calibrated devices. The meter has already had flow through it. If a cone is missing or a leak exists inside the meter, this would be discovered during the calibration.
2. A flow measurement requires a system. Do not assume a problem exists with the primary element just because it is called a *V-Cone* system. Most problems occur in the DP transmitter or the flow computer.
3. This guide assumes a simple system of meter, manifold, DP transmitter, and flow computer. Systems can be much more complex with pressure and temperature transmitters, as well as full scale digital control systems. Do not limit your evaluation to just these suggestions.
4. If you discover a problem / solution not listed in this guide, please let Stephen Ifft at McCrometer know at 1-909-765-5344 or [siff@mccrometer.com](mailto:siff@mccrometer.com).

This guide separates the flow measurement system into areas. These areas are labeled in the diagram below:



During troubleshooting, make a preliminary assessment of the symptoms of the problem and consult the following chart.

SYMPTOM	AREA	POSSIBLE PROBLEM / SOLUTION
No signal (0 mA)	Transmitter	No power to transmitter.
	Transmitter	Transmitter not wired correctly. Perform continuity check on wiring.
Negative signal ( $< 0$ mA)	Transmitter	Transmitter wires are reversed.
Low signal ( $< 4$ mA)	V-Cone	V-Cone installed backwards, with gauge lines attached as marked. In this case, the high pressure tap would be sensing a lower pressure than the low pressure tap. This negative DP would force the signal below 4 mA.
	Gauge lines	Gauge lines are reversed. Transmitter sees more pressure on low side than high side. Check "H" and "L" marks on V-Cone and transmitter.
	Transmitter	Transmitter is malfunctioning. Some transmitters will send a specified mA signal when a malfunction occurs. This can be set to low values, such as 3.8 mA, or high values, such as 20.1 mA.
Zero signal (4 mA)	V-Cone	Meter has been damaged. Remove meter and visually inspect.
	V-Cone	No flow in pipeline. Check other system locations to verify flow through the meter. The meter could be under pressure but still have no flow.
	Manifold	Manifold / gauge lines closed or blocked. Ensure valves and lines are open. If fluid is safe, open vent valves on transmitter to verify pressure in the gauge lines.
	Transmitter	Transmitter is check mode. Some transmitters allow for system checks by forcing the signal to 4 or 20 mA. Vent low side of transmitter to ensure the signal responds to pressure changes.
Wrong signal – high or low	V-Cone	Process conditions do not match actual conditions. Contact McCrometer or your sales representative to recalculate using the correct process conditions.
	V-Cone	Wrong meter. Verify serial numbers on meters to ensure correct specifications. Sometimes two meters are interchanged. Remember each V-Cone has a unique flow coefficient.
	Gauge lines	Foreign material trapped in gauge lines. Dirt and sediment can settle into the gauge lines. If the fluid is safe, vent the gauge lines and inspect for spurts of solids, gasses, or liquids (whichever should <u>not</u> be there). If the fluid is not safe, open the center manifold valve for several minutes under high DP. Close the valve and compare the signal level to before. In a horizontal, liquid application, install the meter with the taps on the sides of the pipe (3 or 9 o'clock) For a horizontal, gas application, install at top or sides of the pipe (12, 3, or 9 o'clock).
	Flow computer	Flow calculations are in error. Use loop calibrator and apply 4, 12, and 20 mA to computer / system. Each of these points should correlate with the V-Cone sizing information.
	Flow computer	mA signal is read incorrectly. Apply a known current to the loop and read the raw signal in the computer. Most computers allow the user to see the mA signal directly.

Signal too high	V-Cone	V-Cone is installed backwards. Look for a flow direction arrow on the meter body, near the pressure taps. If no arrow is visible and the meter is large than 2 inches, the flow direction can be determined by the location of the pressure taps. The pressure taps will be closer to the upstream side. On meters less than 2 inches, the gauge lines will need to be removed. Look at the base of both pressure taps. One tap will be smooth at the base, the other will be mostly weld material. The smooth tap is on the upstream side. With a meter measuring backward flow, the DP signal will be approximately 30% too high.
	V-Cone	Flow is going in opposite direction as expected. The assumption of flow direction is sometimes wrong. Verify with other system readings. With a meter measuring backward flow, the DP signal will be approximately 30% too high.
	V-Cone	Partially full pipe (liquids only). A partially full pipe will cause the meter to read too high. This can happen even in pressurized systems. <ul style="list-style-type: none"> <li>• On horizontal pipes: If the fluid is safe, open a pressure tap on the top of the pipe. Air release will indicate partially full pipe.</li> <li>• On vertical pipes: Up flow will guarantee a full pipe. Down flow is difficult to diagnose if the pipe is full.</li> </ul>
	V-Cone	Foreign object lodged in meter. This will increase the restriction of the meter and raise the DP. Remove the meter and visually inspect.
	Gauge lines	Leak on low pressure gauge line. Perform a leak check from the meter to the transmitter.
	Transmitter	Leak on low pressure vent valve. Perform a leak check on valve.
	Transmitter	Zero point has shifted positively. This will cause errors more pronounced at the low end of the transmitter range. Verify by closing the manifold side valves and opening the center valve. The reading should go to zero (4 mA). Recalibrate if necessary.
	Transmitter	DP span is set too low. Use pressure calibrator or handheld communicator to verify span point.
	Transmitter / flow computer	Both the transmitter and flow computer are set to take the square root of the signal. The signal will be correct at 20 mA. The positive error will increase dramatically as the signal decreases from 20 mA. Use a loop calibrator to check 12 mA point.
Flow computer	4 mA set to minimum flow. Our calculations assume that 4 mA will be equal to zero flow. Sometimes 4 mA is set to equal the minimum flow on the sizing page. This error will be zero at maximum flow and increase as the flow decreases. The amount of error will depend on the zero offset.	

Signal too low	Manifold	Manifold is cross-vented. The center valve must be closed. To test, close the two side valves and watch the transmitter signal. If the signal goes to zero (4 ma), the center valve is not closed completely.
	Gauge lines	Leak on high pressure gauge line. Perform a leak check from the meter to the transmitter.
	Transmitter	Leak on high pressure vent valve. Perform a leak check on valve.
	Transmitter	Zero point has shifted negatively. This will cause errors more pronounced at the low end of the transmitter range. Verify by closing the manifold side valves and opening the center valve. The reading should go to zero (4 mA). Recalibrate if necessary.
	Transmitter	DP span is set too high. Use pressure calibrator or handheld communicator to verify span point.
	Transmitter / flow computer	Neither the transmitter nor flow computer is set to take the square root of the signal. The signal will be correct at 20 mA. The negative error will increase dramatically as the signal decreases from 20 mA. Use a loop calibrator to check 12 mA point.
Unsteady signal	V-Cone	Partially full pipe occurring (liquids only). Periods with a partially full pipe will cause erratic readings. See above for details.
	Transmitter	Power supply not supplying enough power to create signal. Check power specifications for transmitter.
Slow response time	Transmitter	Dampening.
Sudden change in readings	V-Cone	Foreign object lodged in meter. This will increase the restriction of the meter and raise the DP. Remove the meter and visually inspect.
	Gauge lines	Leaks have started.

## Recommended Equipment for Troubleshooting a V-Cone Installation On-Site:

1. 4 to 20 mA loop simulator – highly recommended
2. Digital multimeter: with VDC, I, and  $\Omega$  measurements
3. Pressure calibrator
4. Handheld Communicator for smart instruments
5. Hand tools: Screwdriver(+), Screwdriver (-), 12 inch crescent wrench, 4 inch crescent wrench

Some suggestions for equipment manufacturers and their products follow. A wide range of products is available. We do not necessarily endorse these products or companies. Please choose a product that fits your needs and resources.

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740 Series Documenting Process Calibrators

718 Pressure Calibrator

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715 Volt/mA Calibrator

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713 30G/100G Pressure Calibrator

712 RTD Calibrator

787 Process Meter (combination digital multimeter and loop calibrator)

705 Loop Calibrator