Product Bulletin
56.1:6000-SGIM-1 and SGIM-2

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FlowScanner™ 6000 SGIM-1 and SGIM-2 Strain Gauge Interfaces

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The SGIM-1 and SGIM-2 Strain Gauge Interfaces for the FlowScanner™ 6000

The FlowScanner 6000 is a powerful valve diagnostic tool that helps you evaluate the condition of most Air Operated Valves and analyze operating forces from measured actuator pressure. In certain situations, you may want the added ability to measure forces more directly through strain gauge sensors attached to the valve stem. Adding a Strain Gauge Interface to your FlowScanner 6000 will give you that capability. The interface is well matched to the high resolution and range of the FlowScanner 6000 input channel — it will give you a low-noise signal that can measure and graph the range of loads on the stem from light friction up to full seating forces.

The SGIM-1 and SGIM-2 are designed for easy integration and use. They mount in the accessory pocket of the FlowScanner 6000 operating case and draw power from the FlowScanner 6000—no external power source is required. The SGIM-1 is a single-channel interface for QSS-type sensors only, and the SGIM-2 is a dual-channel interface for use with both QSS and c-clamp type sensors. The sensor cable can be integrated with other valve connections in a common cable and tubing tether. Because this single, short tether carries the control signal, the travel signal, four pressure lines, and the strain gauge signal, you'll only need to run one line from the FlowScanner 6000 to the valve assembly. The cable is well suited to the vast majority of AOVs. For AOV assemblies requiring more pressure or auxiliary signal lines, you can use a second bundle or individual lines.

For added convenience, you can leave the cable tether attached to the FlowScanner 6000 during normal use, and then simply coil it inside the top cover for transport and storage. The strain gauge sensor cable can also remain connected to the interface.

Figure 1. The FlowScanner 6000 housed in its convenient padded canvas operating bag, with the Interface module integrated into the accessory pocket (left). Shown with cables coiled and ready for transport (below).

The SGIM-1and SGIM-2 Interfaces Offer Unique Features

- Complete, compact integration —These Strain Gauge Interfaces are designed for easy integration and use with the FlowScanner™ 6000. Simply slip the interface module into the accessory pocket of the FlowScanner 6000's operating case, and you'll have a compact, highly portable field kit.

- Shared power system—Unlike generic interfaces that require external power sources, the integrated SGIMs draws power directly from the FlowScanner 6000—a truly battery powered solution. The SGIM-2 features reduced power consumption for extended battery life.

- Direct connection to Teledyne QSS stem sensors—With both the SGIM-1 and SGIM-2, you can use a standard connection with the popular Teledyne QSS sensors. An interface cable is provided with the module. The cable can be interchanged with the Teledyne system for MOVs, which allows for easy field replacement.

- Use with c-clamp sensors- The SGIM-2 has a second input for use with c-clamp sensors, with calibrates LEDs to simplify the required pre-tensioning of these sensors. An adapter cable is available to connect the c-clamp sensors to the SGIM-2.

- Low-noise, high accuracy circuitry—Thanks to the modular circuitry and the clean power provided by the FlowScanner 6000, strain signals from the interfaces are exceptionally clean and usually do not require filtering. You can be confident of the full rated accuracy of the strain gauge sensors: each interface is tested to confirm accuracy of at least 0.05% FS.

- Easy bridge balancing adjustment- The SGIM-1 has a push-to-turn balance pot to zero the output before testing. The SGIM-2 automatically balances and zeros the output on power up.

- Full software support—The FlowScanner 6.1 software fully supports the use of the SGIM-1 with QSS sensors. Using stem material properties, the software allows you to read forces directly, as well as graph and analyze for forces, such as friction and seat load for sliding stem valves and operating torque for rotary valves. The software also gives you automated calculation and retest capabilities.

Detailed Information

Automated calculations and re-test capabilities

Automation is one of the hallmarks of the interfaces. To calculate scaling factors, you simply use the Sensitivity Worksheet to enter the stem diameter and the gauge factors marked in the QSS, and select the stem material from the list. Then, based on the material properties of the valve stem/shaft, the FlowScanner automatically scales electrical signals from voltage to accurate force displays. (Materials properties can also be entered directly from engineering documentation, if required by plant practices.) A snapshot of the completed worksheet can even be saved with the Valve TAG in the database. (When c-clamp sensors are used with the SGIM-2 they are normally used for proof of seat contact, and scaling to force is not used.)

Once gauge factors are calculated, they can be saved as devices in standard test setups. Each time a valve is retested, you can select the gauge from a list—the calibrated channels are selected automatically when you start to test a valve with the gauge mounted. The software eliminates the need to go through the calculation each time a valve is retested, saving field technicians valuable time.

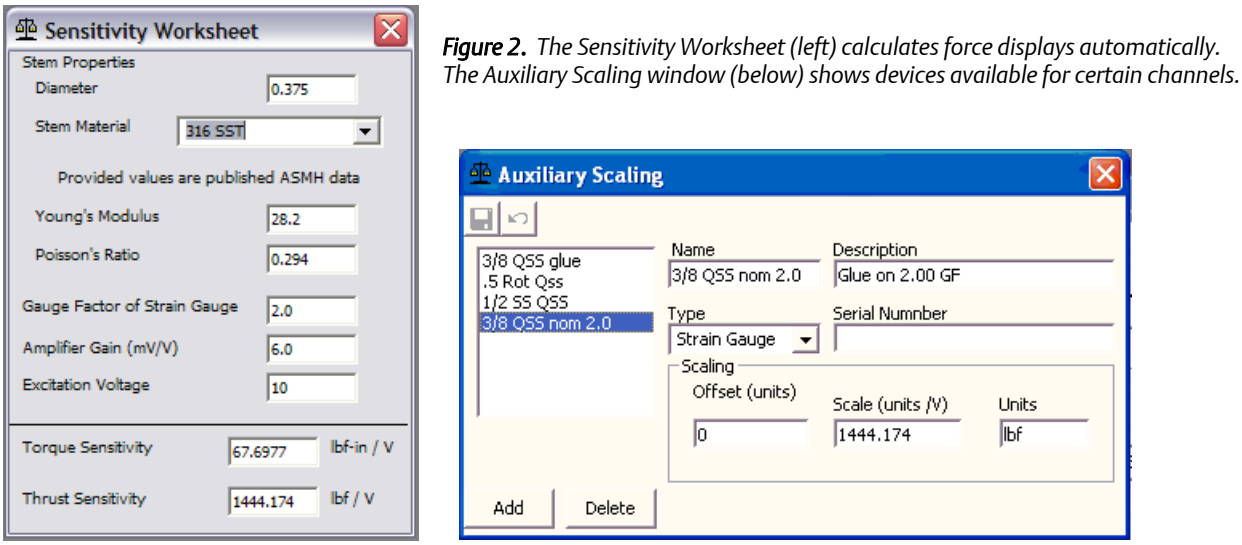

Figure 2. *The Sensitivity Worksheet (left) calculates force displays automatically. The Auxiliary Scaling window (below) shows devices available for certain channels.*

To achieve highly accurate results that are comparable with the analysis from traditional FlowScanner 6000 pressure recordings, the QSS stem sensor should be glued in place on the valve stem following the Teledyne Qualified procedures. Clamp-on sensors can also be used to verify seating contact.

***Figure 3**. The convenient, two-part field kit: the FlowScanner 6000 operating case and the tool-kit/laptop bag.*

Convenient, 'field-kit' solution for field operation

Because the Strain Gauge Interface integrates into the FlowScanner™ 6000 and draws power directly from it, there's no need to carry extra equipment into the field. You'll still only carry two items: the FlowScanner 6000 operating case and the tool-kit/laptop bag. This unique, highly portable, battery-operated solution is ideally suited for plant environments.

Simple pre-tensioning of c-clamp sensors

The SGIM-2 incorporates automatic offset for c-clamp sensors and indicating LEDs for adjusting the clamp tension. Simply connect the c-clamp to the interface, power on the FlowScanner, and tighten the c-clamp on the valve stem until one LED is illuminated and one is off. Slowly tighten until the second LED lights up; then back off until it just goes out. The pre-tension is then in the recommended range.

***Figure 4**. Simply adjust c-clamp pre-tension until both LEDs illuminate, and then loosen until one just goes out. No special software or complex procedures are needed.*

Enhanced Diagnostics Capability

Most of the time, you'll be able to adequately diagnose air-operated valves without attaching strain gauges. There are certain instances, however, when this practice can be beneficial. You can use the Strain Gauge Interface with your FlowScanner™ 6000 to:

- Determine whether a valve construction has been set up incorrectly, contacting the lower actuator stop instead of the valve seat.
- Obtain independent confirmation of seat load for regulatory compliance.
- Obtain a primary measurement for seat load or friction if the actuator area is unknown.
- Determine whether friction problems are caused by the actuator or the valve trim.
- Test open/close valves that have no controlled ramp capability.
- Evaluate rotary valves with complex linkages.

Using the Strain Gauge Interface in Special Circumstances

Determining whether a valve construction is contacting the valve seat

Although it's generally more accurate to determine force by actuator pressure than by strain gauge results, you can use a combination of both signals to get a more complete picture of a valve's condition.

Figure 5 shows a plot of a strain gauge analysis overlaid on the Net Pressure plot used for traditional FlowScanner™ 6000 force analysis. Plotting in reference to travel gives you consistent, easy-to-correlate results. The actuator pressure plot (red-blue) shows spikes on both ends where the travel stops are contacted. The stem strain plot only shows a spike on the closed position end, since stem strain is not affected by the upper actuator stop. This analysis gives you positive verification that the valve is closed and seating as indicated by the FlowScanner 6000.

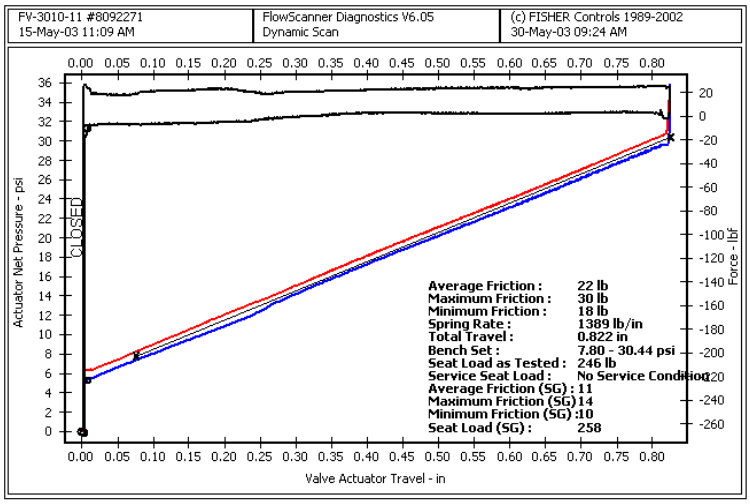

Figure 5. Strain gauge analysis overlaid on a net pressure plot. (Obtained using the SGIM-1 Strain Gauge Interface and the FlowScanner 6000 using a Teledyne QSS stem sensor.)

Measuring seat load

Because the FlowScanner 6000 uses conservative actuator effective area figures, the seat load analysis based on pressure tends to be up to 5% conservative. When measured by a strain gauge, the load tends to be slightly higher because the calculations do not try to be conservative. Typically the results of the two different analyses bracket the actual load obtained. Strain gauge sensors such as the Teledyne QSS claim about +/- 8% accuracy, so results will vary between the two methods.

Locating friction problems

The FlowScanner™ 6000 friction analysis based on pressure readings gives the total valve and actuator friction, while the stem strain sensor does not include any actuator friction. As a result, the strain gauge friction numbers tend to be lower, especially on an actuator that has seals on the actuator stem. Comparing the difference between the total assembly friction (pneumatic results) to the valve friction (stem sensor results) can help you locate where the friction is occurring.

Testing open/close valves

When testing AOVs that operate from a switched pressure signal instead of controlled pressure, the strain gauge method can simplify testing because you don't need to use a temporary I/P converter to obtain accurate pressure measurements. The strain signal and travel can simply be recorded while the valve is switched open/closed, and the results plotted for analysis. Results can even be obtained when it is not feasible to tap into the actuator pressures. The valve stroking speed, however, does affect the friction readings (Figure 6).

In Figure 6, the controlled ramp test (red) shows lower friction than the stepped stroke test (blue). As long as the same method is used in repeat testing, the changes in condition can still be adequately trended.

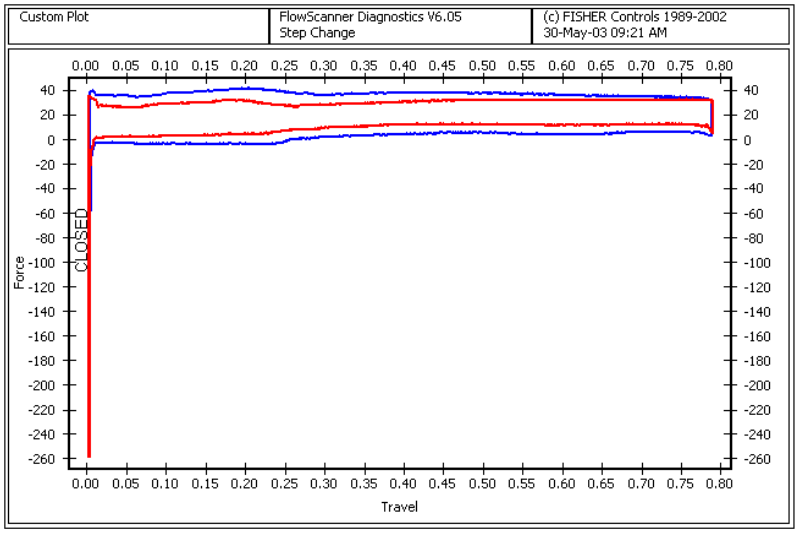

Figure 6. Overlay of a stepped open/close stroke compared to a controlled ramp stroke.

Evaluating rotary valves

Some rotary valves have a complex linkage between the actuator and valve that reduces the accuracy of determining torque values from actuator pressure. The QSS stem sensor can be applied directly to the shaft of a rotary valve, which delivers a direct readout of torque that eliminates linkage errors. As with sliding stem valves, the strain reading accuracy is not affected by rapidly changing pressures, so even valves with uncontrolled stroke speed can be analyzed.

Figure 7 shows a plot of torque vs. travel for a rotary valve with a QSS sensor mounted on the shaft. The plot shows the increasing torque needed to overcome a seating restriction due to foreign material in the valve throat. While the plot clearly shows that about 50 in-lb torque is needed to overcome the seating resistance, you cannot quickly determine how close this may be to the maximum torque available from the actuator. In other words, you don't know how much worse the friction can get before the valve fails to close.

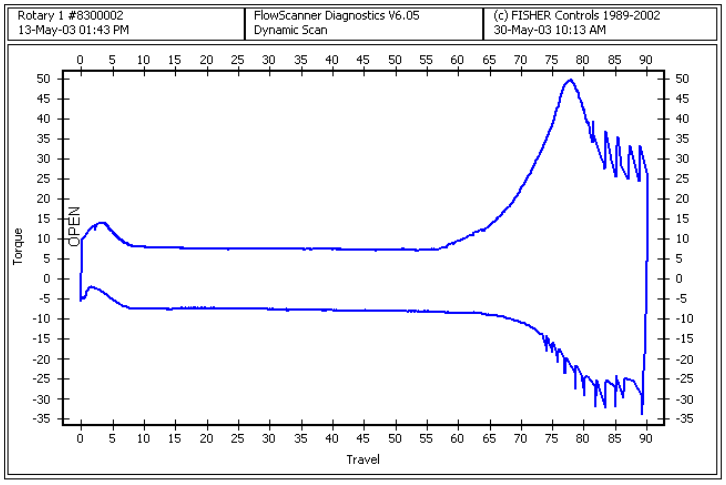

***Figure 7**. Plot of torque vs. travel for a rotary valve with QSS sensor.*

A combination of the strain plot and the traditional actuator pressure plot, shown in Figure 8, provides a more complete picture. It shows you that at the point of maximum resistance, there is less than one psi of additional pressure available to overcome any additional resistance that may develop. You can also see that simply increasing the supply pressure a few psi would give enough additional reserve force to assure operation.

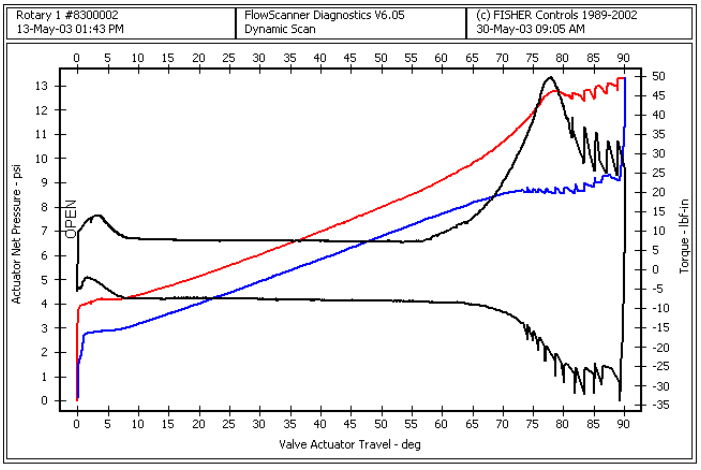

***Figure 8**. Strain and actuator pressure plots.*

Recommendation

The use of the SGIM-1 or SGIM-2 Strain Gauge Interface and strain gauge sensors on AOVs do provide enhanced diagnostics capability in many cases. Whenever feasible, however, they should be used along with the traditional FlowScanner™ 6000 pneumatic analysis to obtain a complete picture of the valve condition.

Specifications

Power
Powered by the FlowScanner™ 6000 12Vdc accessory output

Operating Temperature Limits
Operating temperature: -40 to 155º F (-40 to 70º C)
Operating humidity checks: 95% non-condensing

Input
Standard QSS 4-pin Lemo connector for 4-wire full bridge strain gauge devices such as the Teledyne QSS
Input range -- SGIM-1: +/- 3 mV/V; SGIM-2: +/- 3.5 mV/V

Output
Direct connection to FlowScanner 6000 Auxiliary channel H
Output range – SGIM-1+/- 5 VDC; SGIM-2 +/- 10VDC

Sensitivity
SGIM-1: Nominal 0.6 mV/v/V; SGIM-2 Nominal 0.35 mV/v/V

Effective Gain
SGIM-1: Nominal 6.0; SGIM-2 Nominal 3.5 (for FlowScanner software worksheet calculation)

Controls
SGIM-1: Push-to-turn balance pot to zero output (SGIM-2 automatic zero)

Housing
Plastic case sized to fit accessory pocket of FlowScanner 6000 operating case

Included Accessories
QSS connection cable

Optional Accessories
c-clamp connection cable

Accuracy
+/- 0.05% FS

Ordering Information

To order the FlowScanner 6000 SGIM-1 or SGIM-2, contact your local Emerson representative, or call Emerson Instruments Valve Services in Columbia, SC, at 803-736-3101.

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As the largest supplier in North America, Emerson's Instrument & Valve Services can help you avoid unplanned costs and unscheduled maintenance through our comprehensive startup, diagnostic, repair, and maintenance services. We are one of the offerings of Emerson Process Management's Asset Optimization Division that combines world-class services with innovative technologies to improve the availability and performance of production assets. Our knowledge of factory design, engineering, and specifications enables us to resolve problems quickly, maximizing your uptime. Put us to work today, and you'll discover that we're your best choice as a services partner.
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