

# IMVS2

Smart Integrated Valve Monitoring Device (Product Brochure)



# Smart monitoring system for pneumatic and hydraulic actuators

Even a very short unscheduled downtime of an actuator in a manufacturing company in the chemical and/or oil/gas industry can lead to extremely high costs.

As a result, forward-looking production has become established in practice. Errors should be detected before they occur, reducing costs, avoiding failures, and ultimately the manufactured products.

This technical report presents a smart monitoring system for pneumatic and hydraulic drives.

The safety concept - the Safety Instrumented System (SIS) plays a key role in predictive production. Therefore, various safety requirements apply in every plant, especially in critical processes. Plant planners, operators, and equipment manufacturers are therefore striving to find a solution or solution. to find a uniform architecture that takes all important aspects into account to avoid the risk of plant failure as completely as possible. However, since errors can never be completely ruled out, the goal is to keep potential damage as small as possible.

## SIL analysis as basis

The Safety Integrity Level (SIL) serves as a method for identifying the potential risk to persons, systems, devices, and processes in the event of a malfunction. Operators of installations with safety-related

As part of a risk assessment and SIL analysis in accordance with IEC 61511/61508, the operators of installations with safety-relevant functions define the safety integrity level for the respective safety function. In accordance with this definition, the appropriate equipment is selected and merged into a system.

The default rates are then determined based on the calculated data (Figure 2). These characteristics are used to assess the level of safety integrity under the standards.

An actuated valve, consisting of actuator and valve, can guarantee the corresponding SIL capability for a certain time. However, this requires drive controls that can be used to generate advanced diagnostics.



Figure1: Control Panel Low Pressure

Security integrity level	Risk Reduction Factor	Risk Reduction Factor
SIL-4	100000-10000	$10^{-5}$ - $10^{-4}$
SIL-3	10000-1000	$10^{-4}$ - $10^{-3}$
SIL-2	1000-100	$10^{-3}$ - $10^{-2}$
SIL-1	100-10	$10^{-2}$ - $10^{-1}$

Figure2: SIL- failure rates

## Electric Drives

For some time now, Smart Actuators, (including all advantages such as preventive maintenance, partial stroke tests, time-stamped event logs, and Fieldbus connections, etc.), have been successfully implemented in electric actuators, so that the majority of new projects is equipped directly with electric rather than conventional actuators plus control.

SIL requirements are no longer a problem due to the integration of a SIL module into the control of the electric actuator. If an alarm is triggered in the ongoing process with a downstream safety function, it is immediately and primarily executed.

## Pneumatic and hydraulic drives

But what if the requirements include pressure control?

The safety function of the pneumatic actuator is usually to take the desired position of the actuator when the alarm is triggered to shut off or release a volume flow so that they are single-channel up to SIL2 or redundant configuration SIL3 or SIL4 with duplicated systems.

Pneumatic low-pressure actuators and in particular hydraulic high-pressure solutions, which are often used as central shut-off devices in main supplies, are usually used to control the functions of an above-mentioned control unit using positioners and limit switch boxes analog of an electric actuator - added to gain benefits from it.

According to statistics, critical applications, such as ESD applications, are usually only tested during general plant shutdowns and process shutdowns. This is because the system cannot be tested during operation, as it would disrupt the process and prevent the maximum production capacity from being reached. The ESD emergency mode switches the solenoid valve off the current, and the valve moves into its emergency position. However, this would mean a disruption of the process.

# Integration in control systems

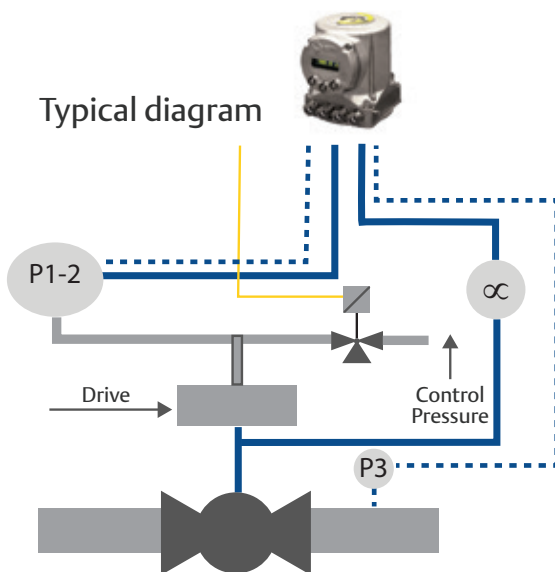
What possibilities exist for integrating the actuator into a control system?

For this purpose, a device that is used to ensure the SIL level, without disturbing the production process during test verification, is recommended: an intelligent, integrated, manufacturer-independent monitoring system for pneumatic and hydraulic actuators (Smart Integrated Valve Monitoring Device IMVS), which is an intelligent partial lifting device particularly suitable for preventive diagnostics in valve solutions using compressed air or mineral oil as a working medium.

The sensor-integrated, electromechanical Smart Integrated Valve Monitoring Device is operated on the single or double-acting actuator pneumatic or hydraulic type, mounted analogously to a limit switch box, and controlled by a separate single or redundant solenoid valve. Diagnostic, operational, and safety functions are thus guaranteed.

The solenoid valves used are explicitly tested for each partial stroke test, as they are switched voltage-free at the same time at the start of the test

However, it is also possible to test the functionality of the solenoid valves separately without a partial stroke test.



∞: Measurement of the valve position  
 P1, P2: Pressure measurement drive  
 P3: Process pressure measurement (optional)

Figure3: Simplified function diagram of the IMVS

During the partial or full stroke test, the integrated IMVS controls the solenoid valve, which is used to control the actuator as a combination of valve and actuator.

This ensures that the actual dynamics of the automated valve are detected and that the solenoid valve is fundamentally checked in parallel. The partial stroke describes a movement at an angle of 10 to 15 degrees (with a 90°-fitting) to avoid possible effects on the process (the PST angle is settable in the device menu).

It is thus clear that the device represents far more than a modified electro-pneumatic five-point controller, which typically detects the current position of the drive via a potentiometer and compares it with position control (target and actual values).

The IMVS mounted on the actuator (Figure 4) can be used for reference operation during the entire service life of the device and thus detect real-time deviations directly or report potential errors (predictive maintenance).

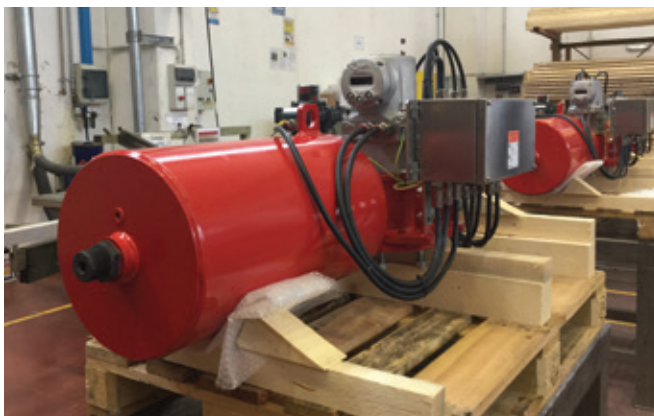


Figure4: IMVS mounted on a Scotch-Yoke drive



Figure5: The IMVS is not only suitable for partial stroke tests

## Smart monitoring system

The IMVS is a sensor-integrated electromechanical device that provides diagnostic, operating, and safety functions via a single or double-acting quarter turn, linear, (independent of manufacturer) which is mounted on top of the housing like a limit switch box and is driven by an external single or redundant solenoid valve to enable a partial stroke test, hydraulic or pneumatic solution.

The latest software packages, HART7 or Modbus connections, and Bluetooth™ connectivity are available for this purpose (Figure 5).

The IMVS is not part of the SIL loop - the ESD action works independently and the ESD configuration determine the SIL level and the emergency capability.

During the partial stroke test, two integrated half-conductor relays ensure potential-free switching and thus a very long minimum service life (from 10<sup>7</sup> at 300 cycles per minute).

The exploded view (Figure 6) clearly shows that position (1) and pressure sensors (2) are already integrated. A deliberate separation (3) between sensors and EEPROM represents the functions of the network card (4), logic card (5) and the following field bus (6), and the display cards.

Thanks to the integrated non-contact position and pressure sensors, repeatability and the reliability of the process.

In addition, the IMVS tests itself by comparing all signals in and out of the logic card.

The IMVS works directly with the available medium as well as with pneumatic low pressure (Figure 1) or up pressure up to 200 barg. Hydraulic high pressures up to 400 barg (Figure 7) can also be processed without problems. Another advantage is the use of manufacturer-independent solenoid valves without fluid in the device.



Figure7: Hydraulic High Pressure Control Panel

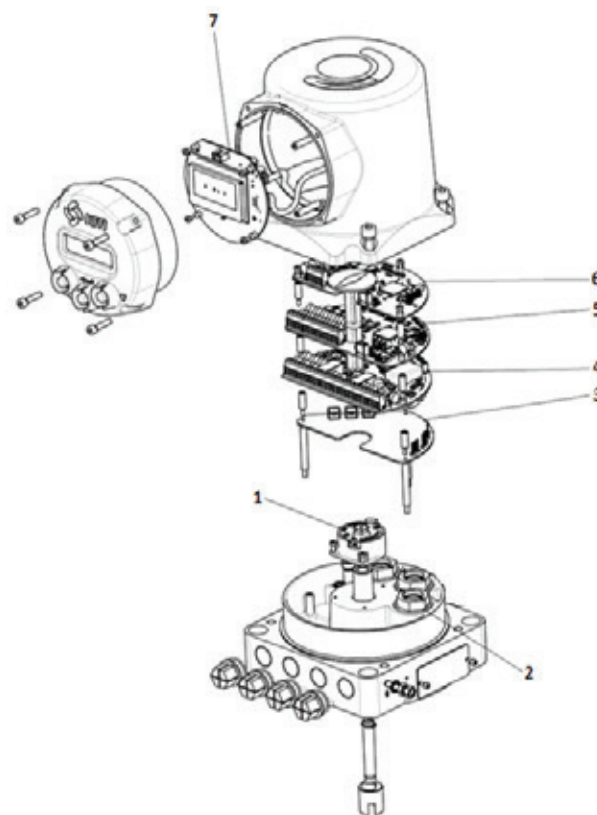


Figure6: Explosive presentation IMVS

The IMVS can be used with the configurations “One out of One” (1oo1), “One out of Two” (1oo2), and “Two out of Two” (2oo2) in the security system. Thus, a wide range of Emergency Shut Down (ESD) or High-Integrity Pressure Protection System (HIPPS) applications can be successfully implemented.

With the help of the HART 7 protocol, the IMVS can be easily integrated directly into the (process) control level, which significantly simplifies the perfect exchange of the field level with the entire automation pyramid. Further compatibility with DeltaV, Honeywell, and Yokogawa offers the advantage of being able to use numerous certified documents and modules.

The extended temperature ranges from -40°C to +75°C with an OLED screen, the full coverage of explosion-proof certification for worldwide installations, the free software for easy calibration and data download, wide-range voltage input (19.2 - 57.6 VDC), easy retrofitting to all existing altar fittings, configuration via Bluetooth, HART and/or Modbus Protocols as well as especially the numerous diagnoses with constant real-time relays are further advantages.

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## THE HIGH-PERFORMANCE VALVE MOTION