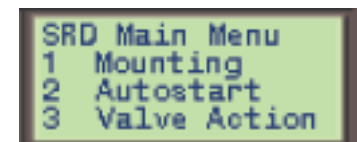
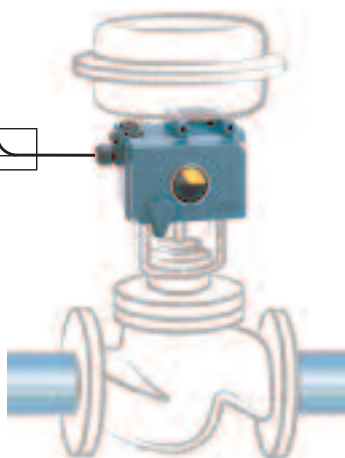


Valve Monitor Diagnostics for Positioners SRD960 / SRD991

Digital Control System (DCS)



Intelligent Valve Diagnostics for Predictive Maintenance

The valve diagnostic software is available as Device Type Manager (DTM) for integration into control systems based on the Field Device Tool (FDT) technology such as the Foxboro

I/A™ Series System.

It is designed to support methods for evaluation of the valve health, operation and configuration. The DTMs support the communication protocols HART, Profibus PA, FOUNDATION Fieldbus (FF) and FoxCom.

- Predictive Maintenance Capabilities
- Intelligent Alarm Management
- Self-surveillance in accordance with NE107
- Service Management
- Histograms for Valve Position- and Response History
- Data collected for up to 60 months
- Data stored inside positioner memory
- Determination of Stem Friction to detect leakage and stuck stem
- Histogram for Friction History
- Partial Stroke Test function for ESD applications

FDT/DTM-Technology

The FDT/DTM concept specifies a “frame application” with a uniform platform for software tools and provides the particular advantage of a simple, standardized and common implementation of field devices into any FDT compliant control system. It defines interfaces and mechanisms which provide a simple method of running a type of “printer driver” for field devices, the Device Type Manager (DTM).

DTM describes the field device specific software component. Valve Monitor is such a “driver” and supports the communication protocols HART, Profibus PA, FOUNDATION Fieldbus and FoxCom. FDT supplements the DDL-technology, and offers much more, i. e. a unified architecture for all devices in a plant. Benefit, the “driver” can be integrated into any FDT compliant control system.

Predictive Maintenance

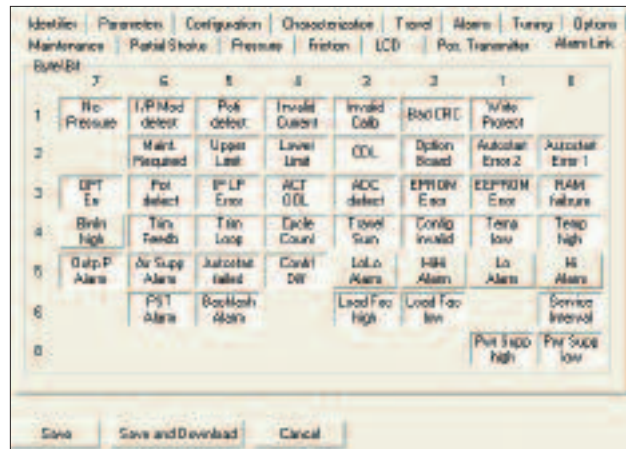
Valve Monitor is not only software to display the setpoint or measured values, but it also offers enhanced applications and methods to analyze data. The onboard memory automatically retrieves and stores all important valve data collected by the positioner during its’ operation. This feature enables the software to run on demand. As a result, it need not run

continuously on the control system, and can therefore reduce unnecessary traffic on the communication signal.

The internal diagnostic routines continuously evaluate the status of the valve and inform the operator of any irregularities by executing a status and/or diagnostic message. This self surveillance method follows the NAMUR Recommendation NE107. The total operating hours of the device can be dis-

The screenshot displays the Valve Monitor software interface. At the top, there are tabs for Overview, Process, Hardware, Calibration, and Position/Status. Below the tabs, there are sub-tabs for Service Mngt, Position History, Response History, and Friction. The main area shows the Status of Service Interval as 'Service Required' with a red warning icon. Below this, it indicates 'Actual Time in Operation: 873.8 Hours'. A 'Configured Limits' section contains two columns of data: 'Time Since Last Service: 780.7 Hours', 'Cycle Count: 2176 Cycles', and 'Travel Since: 558 Strokes' on the left; and 'Service Reminder after: 780 Hours', 'Cycle Count Limit: 1500 Cycles', and 'Full Strokes Limit: 550 Strokes' on the right. At the bottom right, there are 'Update' and 'Close' buttons.

* Option Board: Additional Electronic Board added to the main electronics to enhance the positioners basic functionality



played. Service Intervals can be timed, using the Service Management. Histograms display the Valve Position History or Valve Response History. The Stem Friction can be measured to identify possible problems caused by a reduced (or increased) friction on the stem packing. The measured values are then displayed in the Histogram.

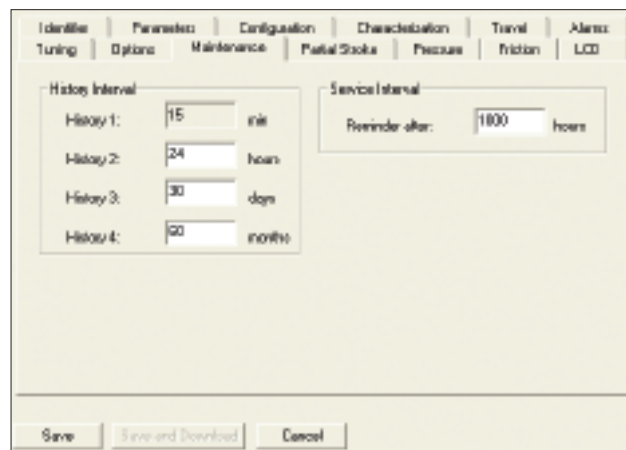
Alarm Link

The newly designed Alarm Link allows the operator to freely define and activate the alarm that he wants to display on his operating station, or on his Alarm channel of the Option Board*.

Maintenance Management

This feature allows configuration of the Service and History Intervals.

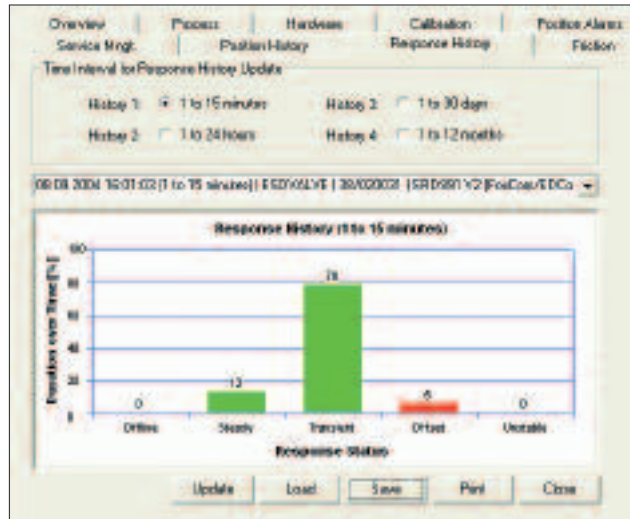
The Service Interval is used to automatically generate an alarm that a service to the device is required. The History Interval can be freely configured, defining the time window of the Histograms for the Response, Position, and Friction History, showing the last 15 minutes, 24 hours, 30 days or 60 months.



The indicated and illustrated data, such as the Valve Position History, and the Response History, can be ideally utilized for process optimization and predictive maintenance. This results in a more transparent and, at the same time, economic monitoring of the control process. Downtimes can be minimized, and service costs can therefore be reduced.

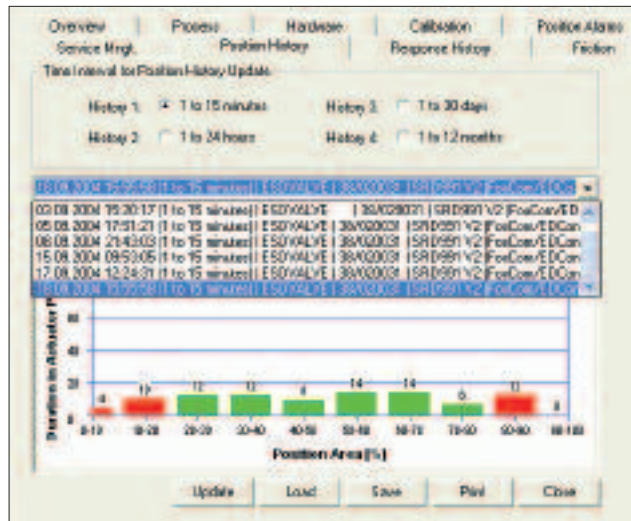
Tools for Predictive Maintenance

The positioner database can be analyzed at a later time by loading the data to a Control System (or to a PC) while the valve is still active in the process. Unnecessary down times are minimized, because the valve can be inspected while it's still in operation. The data can be visualized in different freely definable time intervals. This allows for the observation of the last 15 minutes, 24 hours, 30 days and up to 60 months. Color coding shows the operator if this is a critical (red) or non-critical (green) situation.



Response History

Shows the control behavior of the valve over time and identifies the state of the valve: offline, steady, transient, offset or unstable.



Position History

Shows the valve position over time and identifies if the valve is operating within or outside the specified range.

Alarm Management

The SRD offers the most enhanced self surveillance and diagnostic monitoring capabilities available on the market.

Unified self-surveillance (NE107)

Self-surveillance and diagnostic monitoring following the Namur Recommendation NE107. This recommendation defines unified status messages for field devices, providing the user with information about the status of the field instrument. The available information indicates clearly what device-alarm was activated, from where the alarm initiated, possible reason for the alarm, and what corrective actions need to be initiated to restore it to a normal operating state.

In the following illustration, an example display is shown. All alarms are generated in the positioner and can be uploaded at any time. The columns show the displayed status messages, e.g. control difference, air supply pressure alarm, high friction alarm, current or his-

torical message, a full text description explaining the possible reason for the status message, and the recommended actions for maintenance.

Status	General	Maintenance	Category	Description	Action
Position High Alarm	(I) INFO	(I) INFO	Position	Position above High Alarm Setpoint.	Monitor situation or correct cause.
Position High Alarm	(M) INFO	(I) INFO	Position	Position above High Alarm Setpoint.	Monitor situation or correct cause.
Control Error Code	(X) Maintenance Required	(X) Maintenance Required	Mechanics	Difference between applied analog or digital setpoint and the corresponding valve position. The values exceed the allowed limit in comparison with a specified time limit. The default value is 10% valve hysteresis.	Check to ensure that there is adequate supply pressure. Verify tuning parameters. Check maintenance of actuator and valve. Refer to troubleshooting manual of M-Drive 8000.3.
No Autostat Start	(X) Maintenance Required	(X) Maintenance Required	Calibration	The Autostat was done or Autostat was finished and complete successfully.	Check proper mounting of positioner and adequate supply pressure. Check source flag for other potential causes. Perform Autostat Calibration procedure.
Air Supply Pressure Alarm	(X) Maintenance Required	(X) Maintenance Required	Process	The Air Supply Pressure falls below the configured Limit Limit.	Check to ensure that there is adequate supply pressure.
Pressure Failure	(X) Failure	(X) Failure	Process	The main indicator is critical state for the operation of the device. The supply pressure has fallen and caused a remaining control failure.	Check the filter and/or check the supply pressure and check the control behavior.
Actuator Lock	(X) Failure	(X) Failure	Mechanics	The alarm indicates a critical state for the operation of the device. The valve position is not within permissible range of nominal setpoint that more determined during the start and up. The reported state of the valve is outside the allowed range (valve position: -1.25% to +1.25%).	Check mechanical connection between the positioner and the actuator / valve. Perform Diagnostic Calibration. This call also be made if some on the plug or seal. Check if they are still in tact.

Status indicators are distinguished by messages and color-coding similar to traffic signals:

- Failure
- Maintenance Required
- OK
- INFO
- Out of Specification

Green indicates that no status messages are present; grey that a status message is present but no maintenance is required; yellow that maintenance is required but continued operation is still possible; red indicates a device failure that requires immediate service.

Audit Trail

The Audit Trail is designed to record all events realized by a positioner, listed by date and time. This event monitoring can be used to put a positioner under a special surveillance if there are uncertainties regarding its' operation.

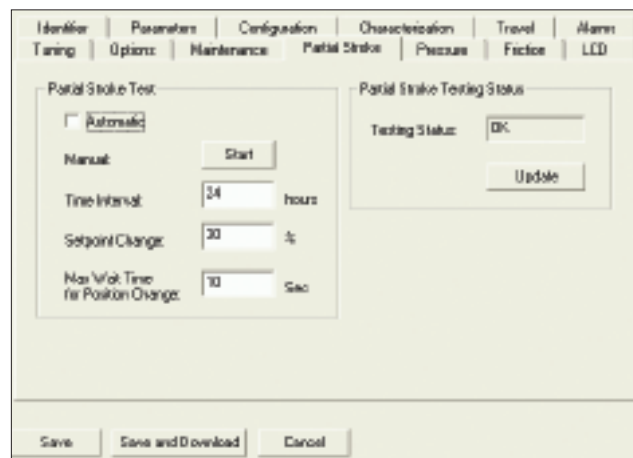
Date/Time	Parameter(Key)	Parameter(Description)	Access	New Value
11.07.2005 14:50:17	Function Event:	Test Output	Started	
11.07.2005 14:50:18	SETPNT	Setpoint	read	100.06334686
11.07.2005 14:50:37	Function Event:	Set Analog (4-20mA / Pulse)	Output	Done
11.07.2005 14:53:19	STAT1	Primary Status	read	c8
11.07.2005 14:53:20	DIAG_ER	Diagnostic Error	read	0
11.07.2005 14:53:49	STAT1	Primary Status	read	c8
11.07.2005 14:53:49	STAT2	Secondary Status	read	2
11.07.2005 14:53:50	ADSTAT	Additional Status	read	(d900000) Position above High Alarm Setpoint. Notification for a fully shut valve. Difference between applied digital or analog setpoint and actuator/valve-position exceeds allowed limit.
11.07.2005 14:54:31	STAT1	Primary Status	read	c8
11.07.2005 14:54:32	ADSTAT	Additional Status	read	(d900000) Position above High Alarm Setpoint. Notification for a fully shut valve. Difference between applied digital or analog setpoint and actuator/valve-position exceeds allowed limit.
11.07.2005 14:55:08	VLVDIAG	Valve Diagnosis Status	read	1,0,1,1,0,1

Concept of the Partial Stroke Test (PST) Solution

Final control elements in Emergency Shut Down (ESD) applications, such as ON-OFF, Blow Down, and Venting Valves remain in one position over a long period of time without any mechanical movement.

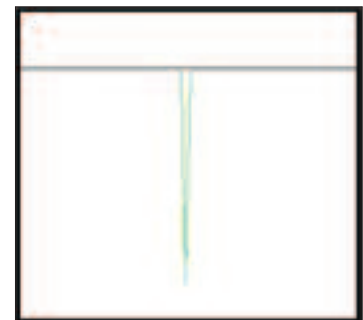
These valves can show a tendency to bind; and, as a result, might not operate on demand. This can have a severe impact to the functionality of a Safety System, and, potentially damaging results to the operating personnel, plant equipment, and environment.

The Partial Stroke Test (PST) offers operators a tool to identify the trouble-proof function of such ESD valves. The test can be easily executed via the operation and diagnostic tool - Valve Monitor.



The screenshot shows a software interface for configuring a Partial Stroke Test (PST). The interface is divided into several sections:

- Partial Stroke Test:** Includes a radio button for **Automatic** (selected) and a **Manual** section with a **Start** button.
- Time Interval:** A text input field set to **24** hours.
- Setpoint Change:** A text input field set to **30** %.
- Max/Min Time for Position Change:** A text input field set to **30** Sec.
- Partial Stroke Testing Status:** A section with a **Testing Status** dropdown menu set to **OK** and an **Update** button.
- Buttons:** **Save**, **Save and Download**, and **Cancel** buttons are located at the bottom.



In the **Manual mode** the test can be activated at any time, via a **Start** button (see above) and in the **Automatic mode**, the PST may be programmed to occur at any pre-determined interval. In both cases the valve can be stroked within a stroke-ratio of up to 30 %. The maximum wait time allows taking into account that each valve has a different dynamic behavior e.g. caused by the process media or the valve itself. If the valve has performed the test without any problems, the status for the partial stroke test will go to "OK". In case the valve does not move, and could be stuck, the operator will be informed by an alarm indicating an "Error".

In addition to this, the device continuously monitors the health of the control valve, such as the stem friction, and supply output pressure.

Features of Partial Stroke Test

Activation of Test	Manual
	Automatic
Configuration	Test Interval [Hours]
	Setpoint Change [%]
	Maximum Wait Time [Seconds]
Testing Status	<ul style="list-style-type: none"> • Not Done • Running • Restricted • OK
Testing Alarms and Diagnostic	Error (Stuck Valve or Failed Test)
	Service Required (Service Mgmt.)
Alarm Text on Positioner LCD	“Maintenance”
	(Stuck Valve or Failed Test)
Additional Diagnostics	Stem Friction
	Supply- and Output-Pressure
	Device Temperature
	Hours in Operation
	Valve Position History
	Valve Response History

Stem Friction

The Stem Friction status is an indispensable feature for today’s predictive maintenance capabilities of any control valve. This feature allows predicting possible leakages, or stuck valves; and, in turn, prevents dangerous spills, injuries to personnel, damage to plant equipment, and the environment. This also saves expensive downtime of the valve.



Internal pressure sensors (optional) measure the output- pressure for each set- point change. In Milliseconds, the Microprocessor of the positioner calculates the friction of the stem against the packing. The actual friction value is then displayed as Measured and Average Values, with additional drag-pointers for the Maximum and Minimum Values.

Friction Alarms can be configured to inform the operator if the Friction values have exceeded or gone below certain threshold limits.

Setting a Friction Reference allows the operator to set a fingerprint showing the initial Average Friction in connection with the Reference Time.

This value will then be highlighted as a vertical line in the Histogram for the Friction History.

Stem Friction History

The Histogram for the Friction History is an easy tool to show the operator the actual condition of the stem packing over time. The vertical line shows the Reference value defined by the operator after the valve has “broken in”. From that moment everything is done automatically by the positioner. If there is Less friction, the histograms will shift to the left,

if there is More friction, the histograms will shift to the right.

If Friction Alarms are set, the positioner will automatically execute a Diagnosis Alarm once the values of the configured thresholds are reached.

A comparison can be done between two different historians from 1 to 30 days and 1 to 60 months.



Invensys
Foxboro, MA 02035-2099
1-508-549-2424
1-888 -FOXBORO
Fax: 1-508-549-4999

www.foxboro.com/instrumentation

Invensys, Foxboro, FoxCom, d/p Cell, and FlowExpert are trademarks of Invensys plc or its subsidiaries and affiliated companies. All other marks may be trademarks of their respective owners.



How to order

The CD-Rom for the Valve Monitor Software-package can be ordered under the ID.-No.: EW 556 932 049. This package includes PACTware™, Communication-DTMs and the SRD-DTM.

For more information

Please contact us by email:
valve.monitor@ips.invensys.com