SRD991 Intelligent Positioner with FIELDBUS communication

Fieldbus Foundation

The intelligent positioner SRD991 is designed to operate pneumatic valve actuators and can be operated from control systems (e.g. Foxboro I/A Series System), controllers or PC-based configuration and operation tools such as PC20/IFDC. The positioner is available with different communication protocols. This includes versions with analog setpoint (4...20 mA) and superimposed HART- or FoxCom-protocol, digital with FoxCom-protocol, or fieldbus-communication according to PROFIBUS-PA and FOUNDATION Fieldbus H1 based on IEC 1158-2.

Features:

Auto-start with self-calibration, self diagnostics, status and diagnostic messages, communication FOUNDATION Fieldbus H1, configuration by means of local keys, PC or I/A Series system, low air consumption, low vibration effect in all directions, stroke 8 to 120 mm (0.3 to 4.7 in), angle range up to 95°, supply air pressure up to 6 bar (90 psig), single or double-acting, mechanical travel indicator, mounting on linear actuators directly or according to IEC534, Part 6 (NAMUR), mounting on rotary actuators according to VDI/VDE 3845, protection class IP 65, explosion protection: EEx ia IIC T4 according to CENELEC or “Intrinsic safety” according to FM and CSA, booster relay to minimize stroke time (optional), built-in independent inductive limit switches (optional), sensors for supply air pressure and output pressure (optional), additional in-/outputs (optional): 2 binary outputs (position alarms) or position feedback 4...20 mA, 1 alarm output or 2 binary inputs.

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1 GENERAL INFORMATION

This instruction manual contains operating information for the SRD991 Intelligent Positioner using the FIELDBUS FOUNDATION™ technology to interconnect with other devices.

Fieldbus is an all digital, serial two-way communication system, a Local Area Network (LAN) for instruments with built-in capability to distribute control application across the network. This two-wire connection is used for power supply and digital communication in parallel.

The fieldbus allows multiple variables from each device to be brought into the control system for archival, trend analysis, process optimization and report generation.

The SRD991 is a Link Master device with the capability to become a Link Active Scheduler (LAS). A LAS initiates scheduled communication, publishing data to all devices on the fieldbus. Scheduled data are typically used for regular, cyclic transfer of control loop data between devices.

A Fieldbus may have multiple Link Masters. If the current LAS fail, one of the remaining Link Masters will become the LAS and operation of the Fieldbus will continue.

Unscheduled communication is possible for all devices, after the LAS grants permission to a device.

A SRD991 consists of two Virtual Field Devices (VFD). One VFD is used for Network Management and System Management, the other for User Application. Network Management includes Virtual Communication Relationships (VCR), dynamic variables, statistics, and LAS schedules, if the device is a Link Master. System Management includes device tag and address information, and schedules for function block execution.

The device functions, which are determined by the arrangement and interconnection of blocks, are made visible to the fieldbus communication system through the User Application Virtual Field Device.

The SRD991 intelligent positioner has implemented

- one Resource Block,
- one Analog Output Block,
- one Transducer Block.

In addition the User Application VFD consists of the following objects:

- Link Objects, where links between Function Block inputs and outputs are defined (internal to the device and across the network);
- Trend Objects, to allow hosts or other devices access to local trending of function block parameters;
- Alert Objects, to allow reporting of alarms and events on the fieldbus;
- View Objects, where predefined block parameter sets are grouped to be used by human/machine interfaces.

The SRD991 Intelligent Positioner contains

- Up to 10 Link Objects,
- Up to 3 Floating Point Trend Objects,
- 1 Discrete Alert Object,
- 1 Update Event Alert Object,
- 4 View Objects for the Resource Block,
- 4 View Objects for the Analog Output Block,
- 7 View Objects for the Transducer Block (the fourth View Object is divided into 3 views).

It contains no Domain and Program Invocation Objects and no Action Object.

1.1 Device Address Assignment

Every fieldbus device must have an unique network address and physical device tag for the fieldbus to operate properly.

When a SRD991 Intelligent Positioner is shipped from the factory, it is programmed with a unique Physical Device Tag and a unique Device Identification and a default permanent address.

Table 1: system management identification data

Name	**Value**
Device Identification	3858842401SRD991$<yy/nnnnnn>
Physical Device Tag	SRD991$<yy/nnnnnn>
Node Address	29

<yy/nnnnnn> = Fabrication number (for example: 93/123456).

Because all of these three parameters are set, the SRD991 system management starts in state SM_OPERATIONAL. To become fully operational, it may be necessary to do further network communication configurations, depending on the host system or the actual network application.

If the station cannot use the assigned node address because this address is already used by another device, it is assigned one of the default addresses (0xF8..0xFF) and the state is set to INITIALIZED. In this state no other services are available except assigning a node address, clearing the physical device tag and identifying the device.

If only Device Identification is set, system management starts in state UNINITIALIZED. In this state no other services but identifying the device and configuring the device with a physical device tag are available.

1.2 Supported Services

The services listed in Table 1 are supported by the intelligent positioner SRD991 Fieldbus.

Table 2: Supported Fieldbus Services

Service	Type
Variable Access	Read Write Information Report
Event Management	Event Notification Event Notification with Type Acknowledge Event Notification Alter Event Condition Monitoring
Context Management	Initiate Abort Reject
OD-Management	Get OD
VFD Status	Status Unsolicited Status Identify

For a detailed description of system management services and procedures see Fieldbus specification FF-880.

1.3 Block Modes

Commissioning a SRD991 requires to modify some parameters in the Resource, Analog Output, and Transducer Block. A MODE parameter, which exists in every Block, determines the operating behaviour of each block. The MODE parameter has 4 components:

- Target mode – the mode(s) set by the operator; multiple target modes can be set. Only modes from those allowed by the permitted modes may be requested.
- Actual mode – the current mode of the block. The value may differ from the target mode based on operating conditions.
- Permitted mode – defines the modes which are allowed for a block.
- Normal mode – This is the mode for a block under normal operating conditions. The normal mode is set by the configurator, but can only be set to a permitted mode.

Some parameters are only allowed to change, if the Block Mode (target or actual mode) has a specific value. The requirements to change a parameter are listed in the description of all parameters later in this manual (chapter 3.10).

Foundation Fieldbus has defined the following target modes:

Table 3: Target Block Modes

Bit	Meaning	Priority
0 (LSB)	Remote-Output (ROUT)	0 - lowest
1	Remote-Cascade (RCAS)	1
2	Cascade (CAS)	2
3	Automatic (AUTO)	3
4	Manual (MAN)	4
5	Local Override (LO)	5
6	Initialization Manual (IMAN)	6
7 (MSB)	Out of Service (OOS)	7 - highest

The “automatic” modes are AUTO, CAS, and RCAS. The “manual” modes are IMAN,LO, MAN and ROUT. In OOS mode the normal algorithm is no longer executed and any outstanding alarms are cleared.

2 INITIAL SETUP

2.1 Procedure for installing device description files

The Fieldbus Foundation has specified a Device Description (DD) to achieve interoperability between devices from various manufacturers. The DD describes all the information available at the fieldbus interface. The DD is available in the standard fieldbus binary format and contains the following set of files for SRD991:

0401.FFO
0401.SYM.

Every fieldbus host application, which uses Device Description Services (DDS), is able to get information about a device description.

The file 040101.CFF is a common format file for use in configuring and maintaining devices and their function block applications. This is a human-readable document in plain text format.

The device description files need to be stored in the appropriate directories. It depends on the host system where the “device data” directory is. Sub-directories are organized in the following form:

ManufacturerID
|
DeviceType
|
DeviceRevDDRev.FFO
DeviceRevDDRev.SYM
DeviceRevDDRevCFFRev.CFF

ManufacturerID = 385884 (hexadecimal)
DeviceType = 2401 (hexadecimal) for SRD991
DeviceRev = 04
DDRev = 01
CFFRev = 01

After installing the SRD991 device description files the directory structure is as follows:

<DEVICE_DATA>
|
385884
|
2401
|
0401.FFO
0401.SYM
040101.CFF

Because the SRD991 complies with Interoperability Test Kit Version 4, please verify that the standard text dictionary file STANDARD.DCT has at least version 1.32. Older versions cannot read the resource block descriptions correctly.

You can download the device description from our website http://www.foxboro-eckardt.com or at the foundation fieldbus website http://www.fieldbus.org.

2.2 Commissioning

Before beginning the initial setup, the positioner should be correctly mounted and electrically ready for operation as described in MI EVE0105 A-(en). **The safety regulations must be observed, as described in MI EVE0105 D-(en) in Chap. 10!**

The positioner is preset by the manufacturer with default parameters, and instrument-specific data are permanently stored. The internal temperature sensor and the position sensor angle are calibrated.

During first commissioning an autostart must be performed. For the automatic determination of the operation range perform a SHORT AUTOSTART. For automatic determination of the operation range and the control parameter execute AUTOSTART.

Before initiating an AUTOSTART, at least the following parameters have to be set to their correct values:

Table 4: Preset Parameters for Autostart

Parameter Label	Parameter Name	Description
VALVE_ACT	Actuator Type	1 = single-acting 2 = double-acting
POSITION_LINEARIZATION	Position linearization	2 = linear actuator (sliding stem), left mounted 3 = rotary actuator,opening counterclockwise 6 = linear actuator (sliding stem), right mounted 7 = rotary actuator, opening clockwise

The manufacturer has set VALVE_ACT to its correct value, POSITION_LINEARIZATION is set to 2 by default.

Changing these values can be done by means of local keys as described in MI EVE0105 D-(en) or by using a configuration tool (for example PC20 or NI-FBUS-Configurator) and write the appropiate values to these parameters, which are located in the Transducer Block.

During the first commissioning the user-specific data must be entered. These are described in the chapter 4.10 later in this manual. If no entry is made, the default parameters are retained.

Note

The Resource Block Mode must be OUT OF SERVICE before executing AUTOSTART.

CAUTION

This function automatically opens and closes the valve. It will override the previous control parameters in case of performing an AUTOSTART!

Initiating an Autostart can be done by means of local keys as described in MI EVE0105 D-(en) or using a configuration tool and write to the parameter SELF_CAL_CMD in the Transducer Block. In case of SHORT AUTOSTART the value to be written is 2, in case of AUTOSTART the value to be written is 3.

You can monitor the state of the procedure by watching the LED on the device or look at the value of the parameter STAT_AUTOINIT in the Transducer Block. Flashing of LED is described in MI EVE0105 D-(en), the parameter STAT_AUTOINIT can have the following values:

0x10 to 0x11	finding end positions
0x20 to 0x2F	calculating I/P-converter parameters
0x30 to 0x3F	calculating control paramters (Autostart only)
0x40 to 0x42	measuring travel time (Autostart only)
0x01	Autostart error

When the value of the parameter STAT_AUTOINIT is set to ZERO the Autostart is completed.

Note

The Autostart procedure may take several minutes.

After performing a SHORT AUTOSTART, or if the AUTOSTART procedure is aborted prematurely after determining the operating range, the control parameters must be determined and entered manually.

The Autostart function will change the values of the following parameters:

ACT_STROKE_TIME_INC, ACT_STROKE_TIME_DEC,
ADC_GAIN, MOTOR_PAR, SPRING_ACT,
POWER_UP_ACT, STAT_AUTOINIT,
SERVO_GAIN, SERVO_RATE, SERVO_RESET,
SERVO_GAIN2, SERVO_RATE2, SERVO_RESET2.

2.3 Test Settings

You should check that the calculated control parameters fulfill your requirements by following the instructions below:

- Verify that the value of the Analog Output Block parameter CHANNEL is 1. Writing to this parameter is only allowed if Analog Output Block target mode is in Block mode OUT OF SERVICE.
- Set Analog Output Block Parameter SP_RATE_UP and SP_RATE_DOWN to zero, if the setpoint should be used immediately with no delay.
- Switch Resource Block Mode parameter into AUTO.
- Switch Analog Output Block Mode into AUTO.
- Switch Transducer Block Mode into AUTO.
- Set the parameter Setpoint (SP) to the desired values.

If the step response is not as expected during observation, the control parameters can be manually adapted. Please refer to the Control Parameters section 4.2 for details.

3 DATA STRUCTURES

The intelligent positioner SRD991 has an internal database with data accessable via Parameter Numbers, Parameter Names or Device Description-Items.The data belong to the user application Virtual Field Device. They are according to Foundation Fieldbus Standard Function Blocks (Resource and Analog Output Block) with additional manufacturer specific extensions and Foundation Fieldbus Transducer Block called Standard Advanced Positioner Valve Basic Device Access with additional manufacturer specific extensions. It is called the Object Dictionary Directory Object.

Table 5: Object Dictionary Directory Object

Index	Relative Index	Parameter Label	Parameter Name
000	-	-	Object Dictionary Object Description
001..255	-	-	Data types and data structures defined by Foundation Fieldbus
256	-	-	Application Process Directory Header
Resource Block			
Standard Parameter			
257	1	BLK_DATA	Resource Block Object
258	2	ST_REV	Static Revision
259	3	TAG_DESC	Tag Description
260	4	STRATEGY	Strategy
261	5	ALERT_KEY	Alert Key
262	6	MODE_BLK	Resource Block Modes
263	7	BLOCK_ERR	Block Error
264	8	RS_STATE	Resource State
265	9	TEST_RW	Read/Write Test Structure
266	10	DD_RESOURCE	Device Description Resource
267	11	MANUFAC_ID	Manufacturer Identification Number
268	12	DEV_TYPE	Device Type
269	13	DEV_REV	Device Revision
270	14	DD_REV	Device Description Revision
271	15	GRANT_DENY	Grant/Deny Permission
272	16	HARD_TYPES	Hardware Type
273	17	RESTART	Restart
274	18	FEATURES	Features
275	19	FEATURES_SEL	Selected Features
276	20	CYCLE_TYPE	Cycle Types
277	21	CYCLE_SEL	Selected Cycle Type
278	22	MIN_CYCLE_T	Minimum Cycle Time
279	23	MEMORY_SIZE	Memory Size
280	24	NV_CYCLE_T	Minimum Non-volatile Cycle Time
281	25	FREE_SPACE	Free Space
282	26	FREE_TIME	Free Time
283	27	SHED_RCAS	Shedding RCAS Timeout
284	28	SHED_ROUT	Shedding ROUT Timeout
285	29	FAULT_STATE	Fault State
286	30	SET_FSTATE	Set Fault State
287	31	CLR_FSTATE	Clear Fault State
288	32	MAX_NOTIFY	Maximum Notify Messages
289	33	LIM_NOTIFY	Maximum Alert Messages

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Index	Relative Index	Parameter Label	Parameter Name
290	34	CONFIRM_TIME	Confirmation Time
291	35	WRITE_LOCK	Write Lock
292	36	UPDATE_EVT	Update Event
293	37	BLOCK_ALM	Block Alarm
294	38	ALARM_SUM	Alarm Summary
295	39	ACK_OPTION	Alarm Acknowledge Option
296	40	WRITE_PRI	Write Priority
297	41	WRITE_ALM	Write Lock Alarm
298	42	ITK_VER	ITK Version
Manufacturer Specific Resource Block Parameter			
299	43	SOFTWARE_REVISION	Software Revision
300	44	HARDWARE_REVISION	Hardware Revision
301	45	DIAGNOSIS	Diagnosis
302	46	MESSAGE_1	Message 1
303	47	MESSAGE_2	Message 2
304	48	MESSAGE_3	Message 3
305	49	MESSAGE_4	Message 4
306	50	MESSAGE_5	Message 5
307	51	DEVICE_OPTIONS	Device Options
308	52	MODELCODE	Modelcode
309	53	DEVOCE_SER_NUM	Device Serial Number
310	54	LOCAL_OP_ENA_	Local Operation Enable
311..319	-	Unused/reserved	-
Analog Output Block			
Standard Parameter			
320	1	BLK_DATA	Analog Output Block Object
321	2	ST_REV	Static Revision
322	3	TAG_DESC	Tag Description
323	4	STRATEGY	Strategy
324	5	ALERT_KEY	Alert Key
325	6	MODE_BLK	Resource Block Modes
326	7	BLOCK_ERR	Block Error
327	8	PV	Process Variable
328	9	SP	Analog Setpoint
329	10	OUT	Primary Output Value
330	11	SIMULATE	Simulate
331	12	PV_SCALE	Process Variable Scaling
332	13	XD_SCALE	READBACK/OUT Scaling
333	14	GRANT_DENY	Grant/Deny Permission
334	15	IO_OPTS	I/O Options
335	16	STATUS_OPTS	Status Options
336	17	READBACK	Readback
337	18	CAS_IN	Cascaded Input
338	19	SP_RATE_DN	Setpoint Rate Down
339	20	SP_RATE_UP	Setpoint Rate Up
340	21	SP_HI_LIM	Setpoint High Limit
341	22	SP_LO_LIM	Setpoint Low Limit
342	23	CHANNEL	Channel Number
343	24	FSTATE_TIME	Fault State Time
344	25	FSTATE_VAL	Fault State Value
345	26	BKCAL_OUT	Back Calculation Out

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Index	Relative Index	Parameter Label	Parameter Name
346	27	RCAS_IN	Remote Cascaded Input
347	28	SHED_OPT	Shedding Options
348	29	RCAS_OUT	Remote Cascaded Output
349	30	UPDATE_EVT	Update Event
350	31	BLOCK_ALM	Block Alarm
Manufacturer Specific Analog Output Block Parameter			
351	32	POS_VALVE_HI_ALARM	Valve Position High Alarm Value
352	33	POS_VALVE_HIHI_ALARM	Valve Position High High Alarm Value
353	34	POS_VALVE_LO_ALARM	Valve Position Low Alarm Value
354	35	POS_VALVE_LOLO_ALARM	Valve Position Low Low Alarm Value
356	36	POWER_UP_ACTION	Power-up Action
357	37	BININ_CONFIG	Binary Input Configuration
358	38	BININ_STAT	Binary Input Status
359	39	SENSOR1_VALUE	Pressure Sensor 1 Value
360	40	SENSOR2_VALUE	Pressure Sensor 2 Value
361	41	SENSOR1_UNITS	Sensor 1 Engineering Units
362	42	SENSOR2_UNITS	Sensor 2 Engineering Units
363	43	INST_MODE	Instrument Mode
364	44	CONTROL_DIFFERENCE	Control Difference
365	45	INPUT_CURRENT	Input Current Consumption
366..369	-	Unused/reserved	-
Transducer Block (Standard Advanced Positioner Valve Basic Access)			
Standard Parameter			
370	1	BLK_DATA	Transducer Block Object
371	2	ST_REV	Static Revision
372	3	TAG_DESC	Tag description
373	4	STRATEGY	Strategy
374	5	ALERT_KEY	Alert Key
375	6	MODE_BLK	Resource Block Modes
376	7	BLOCK_ERR	Block Error
377	8	UPDATE_EVT	Update Event
378	9	BLOCK_ALM	Block Alarm
379	10	TRANSDUCER_DIRECTORY	Transducer Directory
380	11	TRANSDUCER_TYPE	Transducer Type
381	12	XD_ERROR	Transducer Error
382	13	COLLECTION_DIRECTORY	Collection Directory
383	14	FINAL_VALUE	Final Value
384	15	FINAL_VALUE_RANGE	Final Value Range
385	16	FINAL_VALUE_CUTOFF_HI	Final Value Cutoff High
386	17	FINAL_VALUE_CUTOFF_LO	Final Value Cutoff Low
387	18	FINAL_POSITION_VALUE	Final Position Value
388	19	SERVO_GAIN	Servo Gain
389	20	SERVO_RESET	Servo Reset
390	21	SERVO_RATE	Servo Rate
391	22	ACT_FAIL_ACTION	Actuator Failure Action
392	23	ACT_MAN_ID	Actuator Manufacturer Identification Number
393	24	ACT_MODEL_NUM	Actuator Model Number
394	25	ACT_SN	Actuator Serial Number
395	26	VALVE_MAN_ID	Valve Manufacturer Identification Number
396	27	VALVE_MODEL_NUM	Valve Model Number

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Index	Relative Index	Parameter Label	Parameter Name
397	28	VALVE_SN	Valve Serial Number
398	29	VALVE_TYPE	Valve Type
399	30	XD_CAL_LOC	Device Calibration Location
400	31	XD_CAL_DATE	Device Calibration Date
401	32	XD_CAL_WHO	Device Calibration Person
Manufacturer Specific Transducer Block Parameter			
402	33	FX_CMD	Factory Command
403	34	FX_RSP	Factory Response
404	35	VALVE_ACT	Actuator Type
405	36	SPRING_ACT	Actuator Spring Effect
406	37	CONTROL_ALGORITHM	Control Algorithm
407	38	POSITION_LINEARIZATION	Position Linearization
408	39	TRAVEL_POS_UNITS	Travel Position Units
409	40	CYCLE_COUNT	Cycle Counter
410	41	CYCLE_COUNT_LIMIT	Cycle Count Limit
411	42	TRAVEL_SUM_LIMIT	Travel Sum Limit
412	43	TRAVEL_SUM_DEADBAND	Travel Sum Deadband
413	44	TRAVEL_SPAN	Travel Span
414	45	TRAVEL_POS	Travel Position
415	46	TRAVEL_SUM	Travel Sum
416	47	SERVO_GAIN2	Servo Gain 2
417	48	SERVO_RESET2	Servo Reset 2
418	49	SERVO_RATE2	Servo Rate 2
419	50	ANALOG_OUTPUT	Analog Output Value
420	51	ELECTRONICS_TEMP	Electronics Temperature
421	52	ELECTRONICS_TEMP_UNITS	Electronics Temperature Units
422	53	CONTROL_DIFF_LIMIT	Control Difference Limit
423	54	CONTROL_DIFF_TIME	Control Difference Time
424	55	CONTROL_GAP	Control Gap
425	56	CUTOFF_HYSTERESIS	Cutoff Hysteresis
426	57	ALARM_HYSTERESIS	Alarm Hysteresis
427	58	ELECTRONICS_TEMP_LL	Electronics Temperature Lower Limit
428	59	ELECTRONICS_TEMP_UL	Electronics Temperature Upper Limit
429	60	LOW_PRESSURE_LIMIT	Air Supply Pressure Lower Limit
430	61	BINOUT1_CONFIG	Binary Output 1 Configuration
431	62	BINOUT2_CONFIG	Binary Output 2 Configuration
432	63	POS_ENDPOINT_LOW	Lower Position Endpoint
433	64	POS_ENDPOINT_HIGH	Upper Position Endpoint
434	65	MOTOR_PAR	I/P-Motor Parameter
435	66	ADC_GAIN	A/D-Converter Gain
436	67	ACT_STROKE_TIME_DEC	Decreasing Actuator Stroke Time
437	68	ACT_STROKE_TIME_InC	Increasing Actuator Stroke Time
438	69	SELF_CALIB_CMD	Self-Calibration Command
439	70	STAT_AUTOINIT	Status Auto Initialization
440	71	LIN_TYPE	Linearization Type
441	72	TRAV_INC_LIM	Travel Rate Increasing Limit Time
442	73	TRAV_DEC_LIM	Travel Rate Decreasing Limit Time
443..449	-	Unsued/reserved	-
Link Objects			
Standard Parameter			
450..459	-	FB_LINK01..FB_LINK10	Function Block Link Objects 1 to 10

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Index	Relative Index	Parameter Label	Parameter Name
Alert Objects			
Standard Parameter			
460	-	ALERT_DSC01	Discrete Alert Object
461	-	ALERT_EVT01	Update Event Alert Object
462..469	-	Unused/reserved	-
Trend Objects			
Standard Parameter			
470	-	TREND_FLT01	Float Trend Object 1
471	-	TREND_FLT02	Float Trend Object 2
472	-	TREND_FLT03	Float Trend Object 3
473..499	-	Unused/reserved	
View Objects			
Standard Parameter			
500	-	VIEW_1	Resource Block View 1
501	-	VIEW_2	Resource Block View 2
502	-	VIEW_3	Resource Block View 3
503	-	VIEW_4	Resource Block View 4
504..509	-	Unused/reserved	-
510	-	VIEW_1	Analog Output Block View 1
511	-	VIEW_2	Analog Output Block View 2
512	-	VIEW_3	Analog Output Block View 3
513	-	VIEW_4	Analog Output Block View 4
514..519	-	Unused/reserved	-
5020	-	VIEW_1	Transducer Block View 1
521	-	VIEW_2	Transducer Block View 2
522	-	VIEW_3	Transducer Block View 3
523	-	VIEW_4	First Transducer Block View 4
524	-	VIEW_4	Second Transducer Block View 4
525	-	VIEW_4	Third Transducer Block View 4
526	-	Unused/reserved	-

3.1 Parameter Description

Table Legend:

Store: S: Static. The parameter must be stored non-volatile in EEPROM. Changing of the parameter increases the static revision counter.
N: Non-volatile parameter stored in EEPROM. Changing of the parameter does not increase the static revision counter.
D: Dynamic. The parameter is dynamic and is calculated or changed by the block. It is stored only in RAM.

Access: ro Read only
rw Read- and writable

Table 6: Parameter Description

Parameter Name	Description	Store / Access	Range	Default
Resource Block				
ACK_OPTION	Selection of alarms which will be automatically acknowledged	S / rw	Set Bit 0: writes have been disabled 7: Block alarm	0
ALARM_SUM	Current alert status	SD / rw	Data structure: - current alarms - unacknowledged - unreported - disabled Set Bit 0: writes have been disabled 7: Block alarm	0,0,0,0
ALERT_KEY	Identification number of the plant. This information may be used in the host system for sorting alarms etc.	S / rw	1 to 255	0
BLK_DATA	Resource Block Object	S / rw	See chapter 3.4	See chapter 3.4
BLOCK_ALM	Block alarm for all configuration, hardware, connection failure or system problems	D / rw	Data structure: - unacknowledged - update state - time stamp - subcode - value	0,0,0,0,0

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Parameter Name	Description	S/A	Range	Default
BLOCK_ERR	Block error(s)	D / ro	Set Bit 0: Other (LSB) 1: Block Configu-ration Error 2: Link Configuration Error 3: Simulate active 4: Local Override 5: Device Fault State set 6: Device needs maintenance soon 7: Input failure / process variable has BAD status 8: Output failure 9: Memory failure 10: Lost static data 11: Lost NV data 12: Readback check failed 13: Device needs maintenance now 14: Power-up 15: Out-of-service	0
CLR_FSTATE	Clear the device fault state if field condition has cleared	D / rw	1 = Off 2 = Set	0
CONFIRM_TIME	Maximum time the resource will wait for confirmation of receipt of a report before trying again	S / rw	Unit: 1/32 msec.	640000 (20 sec.)
CYCLE_TYPE	Block execution methods available	S / ro	Set Bit 0: Scheduled (LSB) 1: completion of block execution 2: manufacturer specific	Scheduled and completion of block execution
CYCLE_SEL	Select block execution method	S / rw	See CYCLE_TYPE	See CYCLE_TYPE
DD_RESOURCE	Device Description Resource	S / ro	Up to 32 characters	Spaces
DD_REV	Device Description Revision	S / ro	0 to 255	1
DEV_TYPE	Device Type, manufacturer´s model number	S / ro	0 to 65535	0x2401

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Parameter Name	Description	S/A	Range	Default
DEV_REV	Device Revision	S / ro	0 to 255	4
DEVICE_ OPTIONS	Configuration of additional boards, connectable to the main board	S / rw	Set Bit 0: external position return 1: internal pressure sensors 2: external binary inputs 3: external binary outputs 4: external sensors	By manufacturing
DEVICE_SER_ NUM	Device Serial Number	S / ro	Up to 16 characters Format: xx/yyyyyy	By manufacturing
DIAGNOSIS	Provides diagnostic information of the device	D / ro	See chapter 3.5	0,0,0,0,0,0
FAULT_STATE	Condition set by loss of communication to an output block	N / ro	1 = Clear 2 = Set	0
FEATURES	Supported resource block options	S / ro	Set Bit 0: unicode strings (LSB) 1: reports supported 2: fault state supp. 3: soft write lock supported 4: hard write lock supported 5: output readback supported 6: direct write supp. 7: change of BYPASS in an automatic mode	Reports, fault state, soft write lock and output readback supported
FEATURES_SEL	Selected resource block options	S / rw	See FEATURES	See FEATURES
FREE_SPACE	Percent of memory available for further configuration	S / ro	0 to 100 % 0 = preconfigured device	0
FREE_TIME	Percent of processing time to process additional blocks	S / ro	0 to 100 %	0
GRANT_DENY	Options for controlling access of host systems and local control panels	D / rw	See chapter 3.6	0

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Parameter Name	Description	S/A	Range	Default
HARD_TYPES	Type of hardware available as channel numbers	S / ro	Set Bit 0: Scalar Input (LSB) 1: Scalar Output 2: Discrete Input 3: Discrete Output	Discrete Output
HARDWARE_ REVISION	Hardware revision of the device	S / ro	Up to 16 characters format: xx.yyy	By manufacturing (such as 03.000)
ITK_VER	Major revision number of the interoperability testcase	S / ro	Set by FF	4
LIM_NOTIFY	Maximum number of unconfirmed alert notify messages	S / ro	0 to 255	8
LOCAL_OP_ENA	Local enable (lock/unlock local keys)	N / rw	1 = local keys enabled 2 = local keys disabled	Enabled
MANUFAC_ID	Manufacturer Identification number	S / ro	Controlled by FF	0x385884
MAX_NOTIFY	Maximum number of unconfirmed notify messages	S / ro	0 to 255	8
MEMORY_SIZE	Available configuration memory in the empty resource	S / ro	in unit KBytes	0
MESSAGE_1	User-defined message	S / rw	up to 32 characters	Spaces
MESSAGE_2	User-defined message	S / rw	up to 32 characters	Spaces
MESSAGE_3	User-defined message	S / rw	up to 32 characters	Spaces
MESSAGE_4	User-defined message	S / rw	up to 32 characters	Spaces
MESSAGE_5	User-defined message	S / rw	up to 32 characters	Spaces
MIN_CYCLE_T	Shortest cycle interval of which the resource is capable	S / ro	unit: 1 / 32 ms	8000 (250 msec.)
MODELCODE	Modelcode of the device	S / rw	See SRD991 Product specifications	By manufacturing (such as BQNS..)
MODE_BLK	Actual, target, permitted and normal modes of the block	SN / rw	See chapter 1.3	OOS,OOS, OOS | MAN | AUTO, AUTO

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Parameter Name	Description	S/A	Range	Default
NV_CYCLE_T	Minimum time interval for writing copies of non-volatile parameters to non-volatile memory	S / ro	0 to 0xFFFFFFFF 0 = it will never be automatically copied	115200 (60 min.)
RESTART	Allows a manual restart	D / rw	1 = Run 2 = Restart resource 3 = Restart with defaults 4 = Restart processor 5 = Reset historical status	0
RS_STATE	Resource State	D / ro	0 = Undefined 1 = Start / Restart 2 = Initalization 3 = On-line linking 4 = On-line 5 = Standby 6 = Failure	0
SET_FSTATE	Initiate Fault State condition manually	D / rw	1 = Off 2 = Set	0
SHED_RCAS	Time duration at which to give up on computer writes to function block RCAS locations	S / rw	unit 1 / 32 msec.	64000 (2 sec.)
SHED_ROUT	Time duration at which to give up on computer writes to function block ROUT locations	S / rw	unit 1 / 32 msec.	64000 (2 sec.)
SOFTWARE_ REVISION	Software revision of the device	S / ro	up to 16 characters format: xx.yyy	By manufacturing (such as 08.050)
ST_REV	Static Revision	S / ro	1 to 65535	0
STRATEGY	Can be used to identify grouping of blocks	S / rw	0 to 65535	0
TAG_DESC	User description of the intended application of the block	S / rw	up to 32 characters	Spaces
TEST_RW	Read/write Test parameter, used only for conformance testing	D / rw	See Fieldbus Specification FF809	0
UPDATE_EVT	Generated by any change to the static data	D / ro	Data structure: - unacknowledged - update state - time stamp - static revision - relative index	0,0,0,0,0

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Parameter Name	Description	S/A	Range	Default
WRITE_ALM	Alert generated if WRITE_LOCK is cleared	D / rw	Data structure: - unacknowledged - update state - time stamp - subcode - value	0,0,0,0,0
WRITE_LOCK	If set, no writes from anywhere are allowed, except to clear WRITE_LOCK	S / rw	1 = unlocked 2 = locked	1
WRITE_PRI	Priority of the alarm generated by clearing the WRITE_LOCK	S / rw	0 to 15	0
Analog Output Block				
ALERT_KEY	Identification number of the plant. This information may be used in the host system for sorting alarms etc.	S / rw	1 to 255	0
BININ_CONFIG	Configuration data for external binary input option board	S / rw	Set Bit 0: when binary input channel 1 is set, position will change to 0 %, 1: when binary input channel 2 is set, position will change to 100 % 2: when binary input channel 1 is set, binary_input_set-Status will be set in DIAGNOSIS 3: when binary input channel 2 is set, binary_input_set-Status will be set in DIAGNOSIS	0x0F
BININ_STAT	Actual Binary Input Status	D / ro	Set Bit 0: Status of Switch 1 1: Status of Switch 2 7: Setpoint forced by Switch1 or 2	0
BKCAL_OUT	Value and status required by an upper blocks BKCAL_IN	D / ro	Data structure: status, value	0, 0.0

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Parameter Name	Description	S/A	Range	Default
BLK_DATA	Analog Output Block Object	S / rw	See chapter 3.4	See chapter 3.4
BLOCK_ALM	Block alarm for all configuration, hardware, connection failure or system problems	D / rw	Data structure: - unacknowledged - update state - time stamp - subcode - value	0,0,0,0,0
BLOCK_ERR	Block error(s)	D / ro	See description in Resource Block	0
CAS_IN	Remote setpoint value from another FF-block or a DCS block through a defined link	N / rw	Data structure: status, value	0, 0.0
CHANNEL	Number of logical hardware channel connected to AO-Block	S / rw	1	0
CONTROL_ DIFFERENCE	control difference	D / ro	unit: percent	0.0
FSTATE_TIME	Time in seconds from detection of remote setpoint fault to output action if condition still exists	S / rw	Positive	0.0
FSTATE_VAL	Preset analog setpoint value to use when fault occurs	S / rw	Limited to PV_SCALE ± 10 %	0.0
GRANT_DENY	Options for controlling access of host systems and local control panels	D / rw	See chapter 3.6	0
INPUT_ CURRENT	current consumption of the device	D / ro	unit: mA	typically 10.6
INST_MODE	reflects the internal software state of the positioner	N / rw	0 = OFFLINE 1 = ONLINE 2 = FAULT STATE 3 = DIAGNOSIS 4 = CALIBRATE 5 = INIT	Depends on the value of POWER_UP_ ACTION and whether an Autostart has been executed
IO_OPTS	Options to alter input and output block processing by user	S / rw	See chapter 3.7	0
MODE_BLK	Actual, target, permitted and normal modes of the block	SN / rw	See chapter 1.3	OOS,OOS, OOS | MAN | AUTO | CAS | RCAS, AUTO

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Parameter Name	Description	S/A	Range	Default
OUT	Primary analog output value (result of executing AO-Block)	N / rw	Data structure: status, value	0, 0.0
POS_VALVE_ HI_ALARM	defines Valve position when first upper Alarm Status in DIAGNOSIS will be set	S / rw	±INF	110.0
POS_VALVE_ HIHI_ALARM	defines Valve position when main upper-Alarm Status in DIAGNOSIS will be set	S / rw	±INF	110.0
POS_VALVE_ LO_ALARM	defines Valve position when first lower Alarm Status in DIAGNOSIS will be set	S / rw	±INF	-10.0
POS_VALVE_ LOLO_ALARM	defines Valve position when main lower-Alarm Status in DIAGNOSIS will be set	S / rw	±INF	-10.0
POWER_UP_ ACTION	Defines the state of the internal instrument mode after Power-Up	S / rw	1 = ONLINE 2 = FAULT STATE	ONLINE
PV	Process Value, calculated from the READBACK value	D / ro	Data structure: status, value	0, 0.0
PV_SCALE	Scaling of PV and parameters with the same scaling as PV	S / rw	Data structure: - EU at 100 % - EU at 0 % - units index - decimal point	 100.0 0.0 1342 (percent) 1
RCAS_IN	Target setpoint and status provided by a supervisory host	N / rw	Data structure: status, value	0, 0.0
RCAS_OUT	Block setpoint and status after ramping—provided to a supervisory host	D / ro	Data structure: status, value	0, 0.0
READBACK	Indicates readback of actuator position	D / ro	Data structure: status, value	0, 0.0
SENSOR1_ UNITS	Sensor1 units	S / rw	1141 = psi 1137 = bar 1133 = kPa	Bar
SENSOR1_ VALUE	Value and status for optional supply pressure sensor	D / ro	data structure: status, value	0, 0.0

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Parameter Name	Description	S/A	Range	Default
SENSOR2_ UNITS	Sensor2 units	S / rw	1141 = psi 1137 = bar 1133 = kPa	Bar
SENSOR2_ VALUE	Value and status for optional output pressure sensor	D / ro	data structure: status, value	0, 0.0
SHED_OPT	Defines action to be taken on remote control device timeout	S / rw	See chapter 3.9	0
SIMULATE	Allows the transducer input/output to the block manually supplied	D / rw	Data structure: - simulate status - simulate value - transducer status - transducer value - simulate enable / disable	 0 0.0 0 0.0 simulate disable
SP	Analog setpoint	N / rw	Data structure: status, value; value limited to PV_SCALE ± 10 %	0, 0.0
SP_HI_LIM	Setpoint high limit (the highest setpoint operator entry that can be used by the block)	S / rw	Limited to PV_SCALE ± 10 %	100.0
SP_LO_LIM	Setpoint low limit (the lowest setpoint operator entry that can be used by the block)	S / rw	Limited to PV_SCALE ± 10 %	0.0
SP_RATE_DN	Ramp rate for downward setpoint changes in PV units per second	S / rw	+INF 0 = use setpoint immediately	+INF
SP_RATE_UP	Ramp rate for upward setpoint changes in PV units per second	S / rw	+INF 0 = use setpoint immediately	+INF
ST_REV	Static Revision	S / ro	1 to 65535	0
STATUS_OPTS	Options for block processing of status by user	S / rw	See chapter 3.8	0
STRATEGY	Can be used to identify grouping of blocks	S / rw	0 to 65535	0
TAG_DESC	User description of the intended application of the block	S / rw	Up to 32 characters	Spaces

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Parameter Name	Description	S/A	Range	Default
UPDATE_EVT	Generated by any change to the static data	D / ro	Data structure: - unacknowledged - update state - time stamp - static revision - relative index	0,0,0,0,0
XD_SCALE	Scaling READBACK/OUT for a specified channel	S / rw	Data structure: - EU at 100 % - EU at 0 % - units index - decimal point	 100.0 0.0 1342 (percent) 1
Transducer Block (Standard Advanced Positioner Valve Basic Device Access)				
ACT_FAIL_ ACTION	Specifies the action the actuator takes in case of failure	S / rw	0 = undefined 1 = Self-closing 2 = Self-opening 3 = Hold last value 4 = Maximum value 5 = Minimum value 255 = indeterminate	255
ACT_MAN_ID	Actuator manufacturer identification number	N / rw	Defined by FF	0x385884
ACT_MODEL_ NUM	Actuator model number	N / rw	Up to 32 characters	NULL
ACT_SN	Actuator serial number	N / rw	Up to 32 characters	0
ACT_STROKE_ TIME_DEC	Measured fastest time of the actuator/valve combination for a whole decreasing stroke in seconds	S / ro	-	0
ACT_STROKE_ TIME_INC	Measured fastest time of the actuator/valve combination for a whole increasing stroke in seconds	S / ro	-	0
ADC_GAIN	actual gain code for position input	S / rw	-	0
ALARM_ HYSTERESIS	Hysteresis for the parameters: final value range and position limits in percent	S / rw	Positive	1.0
ALERT_KEY	Identification number of the plant. This information may be used in the host system for sorting alarms etc.	S / rw	1 to 255	0

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Parameter Name	Description	S/A	Range	Default
ANALOG_ OUTPUT	Value of the analog output signal displayed in mA	S / ro	Positive	0.0
BINOUT1_ CONFIG	Defines the behaviour of optional binary output channel 1	S / rw	Set Bit 0: switch to active state in case of first position high alarm status 1: switch to active state in case of main position high alarm status 2: switch to active state in case of first position low alarm status 3: switch to active state in case of main position low alarm status 7: inverted alarm	0x08
BINOUT2_ CONFIG	Defines the behaviour of optional binary output channel 2	S / rw	Set Bit 0: switch to active state in case of first position high alarm status 1: switch to active state in case of main position high alarm status 2: switch to active state in case of first position low alarm status 3: switch to active state in case of main position low alarm status 7: inverted alarm	0x04
BLK_DATA	Transducer Block Object	S / rw	See chapter 3.4	See chapter 3.4
BLOCK_ALM	Block alarm for all configuration, hardware, connection failure or system problems	D / rw	Data structure: - unacknowledged - update state - time stamp - subcode - value	0,0,0,0,0
BLOCK_ERR	Block error(s)	D / ro	See description in Resource Block	0

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Parameter Name	Description	S/A	Range	Default
COLLECTION_ DIRECTORY	Directory that specifies the number, starting indexes and DD-Item-Ids of the data collections in each transducer within a transducer block	S / ro	1st element: number of data collections 2nd element: index of 1st data collection 3rd element: index of 3rd data collection...	1, 13
CONTROL_ ALGORITHM	Control algorithm used internally to position the valve	S / rw	000 = PID 254 = no control	PID
CONTROL_DIFF_ LIMIT	If the control difference exceeds this limit for a time greater then the time specified in the CONTROL_DIFF_TIME parameter, the CONTROL DIFF LIMIT status will be set in the DIAGNOSIS parameter	S / rw	0 to 100 %	5
CONTROL DIFF TIME	This is the relevant time in Seconds for the control difference limit	S / rw	Positive	60
CONTROL_GAP	Range in percent where a change of the setpoint doesn't make any sense caused by stiction of a valve	S / rw	Positive	0.1
CUTOFF_ HYSTERESIS	Hysteresis for the seal close span of a valve in percent	S / rw	Positive	0.005
CYCLE_COUNT	cycle counter which counts changes in movement (up/down or right/left)	S / rw	0 to 0xFFFFFFFF	By manufacturing
CYCLE_COUNT_ LIMIT	Limit for cycle counter. When the cycle count value exceeds the limit value the CYCLE_COUNT_LIMIT status bit will be set in the DIAGNOSIS parameter.	S / rw	0 to 0xFFFFFFFF	90000000
ELECTRONICS_ TEMP	Internal temperature of the device in engineering units specified in electronics temperature units parameter	S / ro	-40 to + 80 °Celsius	

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Parameter Name	Description	S/A	Range	Default
ELECTRONICS_ TEMP_LL	Lower limit of the internal temperature. When the electronics temperature is falling below this limit, the TEMP TOO LOW status bit will be set in the DIAGNOSIS parameter	S / ro	-40 °Celsius	-40
ELECTRONICS_ TEMP_UL	Upper limit of the internal temperature. When the electronics temperature is raising above this limit, the TEMP TOO HIGH status bit will be set in the DIAGNOSIS parameter	S / ro	+80 °Celsius	80
ELECTRONICS_ TEMP_UNITS	Specifies engineering unit for electronics temperature parameter	S / rw	1001 = °Celsius 1002 = °Fahrenheit	°Celsius
FINAL_POSITION _VALUE	Actual valve position and status	N / ro	FINAL_VALUE_ RANGE	0, 0.0
FINAL_VALUE	Requested valve position and status written by Analog Output Function Block	N / ro	Limited to values in parameter FINAL_ VALUE_RANGE	0.0
FINAL_VALUE_ CUTOFF_HI	If FINAL_VALUE is more positive than this value, the valve is forced to its maximum high value (fully opened)	S / rw	FINAL_VALUE_ RANGE, +INF	+INF
FINAL_VALUE_ CUTOFF_LO	If FINAL_VALUE is more negative than this value, the valve is forced to its minimum low value (fully closed)	S / rw	FINAL_VALUE_ RANGE, -INF	-INF
FINAL_VALUE_ RANGE	Scaling of FINAL_VALUE and parameters with the same scaling as FINAL_VALUE	N / ro	Data structure: - EU at 100 % - EU at 0 % - units index - decimal point	 100.0 0.0 1342 (percent) 1
FX_CMD	Parameter for passing a factory diagnostic command to Transducer	D / rw		
FX_RSP	Parameter for the response to factory diagnostic command from Transducer	D / ro		

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Parameter Name	Description	S/A	Range	Default
LIN_TYPE	Setpoint characterization	S / rw	0 = Linear 1 = Equal percentage 1:50 2 = Quick open 3 = Customer spec.	linear
LOW_PRESSURE_LIMIT	Lower limit of the sensor 1 parameter. When the pressure is falling below this limit, the PRESS TOO LOW status will be set in the DIAGNOSIS paramter	S / rw	-	-0.5 bar
MODE_BLK	Actual, target, permitted and normal modes of the block	SN / rw	See chapter 1.3	OOS,OOS, OOS | MAN | AUTO, AUTO
MOTOR_PAR	IP-Motor specific value calculated while autostart is running	S / rw	-	0
POS_ENDPOINT_HIGH	Upper endpoint for the valve position in degree	S / rw	-	45.0
POS_ENDPOINT_LOW	Lower endpoint for the valve position in degree	S / rw	-	-45.0
POSITION_LINEARIZATION	Position Linearization	S / rw	2 = stroke, left mounted 3 = rotary, opening counterclockwise 6 = stroke, right mounted 7 = rotary, opening clockwise	Stroke, left mounted
SELF_CALIB_CMD	Parameter to initiate an Autostart or reset cycle/travel counter	S / rw	0 = no reaction/initial value 2 = Autostart 3 = Short Autostart 7 = Reset travel and cycle counter	0
SERVO_GAIN	PID gain value for valve opening direction (linear coefficient)	S / rw	Positive	2.0
SERVO_GAIN2	PID gain value for valve closing direction (linear coefficient)	S / rw	Positive	15.0
SERVO_RATE	PID rate value for valve opening direction (differential coefficient)	S / rw	Positive	0.0

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Parameter Name	Description	S/A	Range	Default
SERVO_RATE2	PID rate value for valve closing direction (differential coefficient)	S / rw	Positive	0.0
SERVO_RESET	PID reset value for valve opening direction (integral coefficient)	S / rw	Positive	2.7
SERVO_RESET2	PID reset value for valve closing direction (integral coefficient)	S / rw	Positive	7.5
SPRING_ACT	Spring effect	S / rw	0 = no spring 1 = spring closes valve 2 = spring opens valve	Spring closes valve
ST_REV	Static Revision	S / ro	1 to 65535	0
STAT_AUTOINIT	actual status while (short) autostart is running	S / ro	0x00 = no error 0x01 = Autostart error 0x10..0x11 = find end positions 0x20..0x2F = calculate I/P-converter parameter 0x30..0x3F = calculate control parameter (Autostart only) 0x40..0x42 = measure travel time (Autostart only)	0
STRATEGY	Can be used to identify grouping of blocks	S / rw	0 to 65535	0
TAG_DESC	User description of the intended application of the block	S / rw	Up to 32 characters	Spaces
TRANSDUCER_ DIRECTORY	Directory that specifies the number and starting indexes of the transducers in the ransducer block	S / ro	1st element: number of tranducers 2nd element: index of 1st tranducer 3rd element: index of 2nd transducer...	1, 10
TRANSDUCER_ TYPE	Identifies the transducer that follows	S / ro	Defined by FF	106 = Standard Advanced Positioner Valve

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Parameter Name	Description	S/A	Range	Default
TRAV_DEC_LIM	Configurable T63 percent time limit for decreasing full span travel	S / rw	-	0.4
TRAV_INC_LIM	Configurable T63 percent time limit for increasing full span travel	S / rw	-	0.4
TRAVEL_POS	Actual travel position in engineering units specified in travel position units parameter	S / ro	-	0.0
TRAVEL_POS_ UNITS	Specifies engineering unit for travel position, travel span, and travel position limits parameter	S / rw	1005 = degree 1013 = mm 1019 = inch	Degree
TRAVEL_SPAN	Travel span of the valve in engineering units specified in travel position units parameter	S / rw	Positive	90.0
TRAVEL_SUM	Actual summarized travel value in full strokes	S / rw	Positive	By manufacturing
TRAVEL_SUM_ DEADBAND	Configurable deadband for the summarized travel value	S / rw	0 to 100 %	1.0
TRAVEL_SUM_ LIMIT	Limit value for summarized travel (in full strokes). When the travel sum parameter value exceeds the limit value the TRAVEL_SUM_LIMIT status bit will be set in the DIAGNOSIS parameter	S / rw	0 to 0xFFFFFFFF	90000000
UPDATE_EVT	Generated by any change to the static data	D / ro	Data structure: - unacknowledged - update state - time stamp - static revision - relative index	0,0,0,0,0
VALVE_ACT	Actuator Type	S / rw	1 = single-acting 2 = double-acting	Single-acting
VALVE_MAN_ID	Valve manufacturer identification number	N / rw	Defined by FF	0x385884
VALVE_MODEL_ NUM	Valve model number	N / rw	Up to 32 characters	NULL
VALVE_SN	Valve serial number	N / rw	Up to 32 characters	0

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Parameter Name	Description	S/A	Range	Default
VALVE_TYPE	Valve type	N / rw	000 = Undefined 001 = Linear 002 = Rotary 255 = Other	0
XD_CAL_DATE	Date of last positioner calibration	S / rw	Data structure: - ms (0...59 999) - min (0...59) - h (0...23, including SU in highest bit (0 = standard time 1 = summer time)) - day of month (1...31, including day of week in upper 3 bits (1...7)) - months (1...12) - years (0..99)	By manufacturing
XD_CAL_LOC	Location of last positioner calibration	S / rw	up to 32 characters	By manufacturing
XD_CAL_WHO	Name of the person responsible for last positioner calibration	S / rw	up to 32 characters	By manufacturing
XD_ERROR	Block Alarm Subcode	D / ro	16 = unspecified error 17 = general error 18 = calibration error 19 = configuration error 20 = electronics error 21 = mechanical error 22 = I/O failure 23 = data integrity error 24 = software error 25 = algorithm error	0
Link Objects				
FB_LINK01... FB_LINK10	Link Objects to define links between function block application and between interface devices and field devices	N / rw		

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Parameter Name	Description	S/A	Range	Default
Alert Objects				
ALERT_DSC01	Discrete Event notification object	N / rw		
ALERT_EVT01	Update Event notification object	N / rw		
Trend Objects				
TREND_FLT01... TREND_FLT03	Float Trend Object	N / rw		
View Objects				
Resource Block				
VIEW_1	Resource Block View 1 (access to the dynamic operating parameters with a single read)	D / ro	7 parameters: ST_REV, MODE_BLK, BLOCK_ERR, RS_STATE, FREE_TIME, FAULT_STATE, ALARM_SUM	-
VIEW_2	Resource Block View 2 (access to the static operating parameters with a single read)	D / ro	11 parameters: ST_REV, GRANT_DENY, FEATURES_SEL, CYCLE_SEL, NV_CYCLE_T, FREE_SPACE, SHED_RCAS, SHED_ROUT, LIM_NOTIFY, CONFIRM_TIME, WRITE_LOCK	-
VIEW_3	Resource Block View 3 (access to all dynamic operating parameters)	D / ro	See VIEW_1	-
VIEW_4	Resource Block View 4 (access to static paramters not included in VIEW_2)	D / ro	15 parameters: ST_REV, STRATEGY, ALERT_KEY, MANUFAC_ID, DEV_TYPE, DEV_REV, DD_REV, HARD_TYPES, FEATURES, CYCLE_TYPE, MIN_CYCLE_T, MEMORY_SIZE, MAX_NOTIFY, ACK_OPTION, WRITE_PRI	-

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Parameter Name	Description	S/A	Range	Default
Analog Output Block				
VIEW_1	Analog Output Block VIEW 1 (access to the dynamic operating parameters with a single read)	D / ro	8 parameters: ST_REV, MODE_BLK, BLOCK_ERR, PV, SP, OUT, READBACK, CAS_IN	-
VIEW_2	Analog Output Block VIEW 2 access to the static operating parameters with a single read)	D / ro	6 parameters: ST_REV, PV_SCALE, XD_SCALE, GRANT_DENY, SP_HI_LIM, SP_LO_LIM	-
VIEW_3	Analog Output Block VIEW 3 (access to all dynamic operating parameters)	D / ro	11 parameters: ST_REV, MODE_BLK, BLOCK_ERR, PV, SP, OUT, READBACK, CAS_IN, BKCAL_OUT, RCAS_IN, RCAS_OUT	-
VIEW_4	Analog Output Block VIEW 4 (access to static paramters not included in VIEW_2)	D / ro	11 parameters: ST_REV, STRATEGY, ALERT_KEY, IO_OPTS, STATUS_OPTS, SP_RATE_DN, SP_RATE_UP, CHANNEL, FSTATE_TIME, FSTATE_VAL, SHED_OPT	-
Transducer Block				
VIEW_1	Transducer Block VIEW 1 (access to the dynamic operating parameters with a single read)	D / ro	7 parameters: ST_REV, MODE_BLK, BLOCK_ERR, TRANSDUCER_ TYPE, XD_ERROR, FINAL_VALUE, FINAL_POSITION_ VALUE	-

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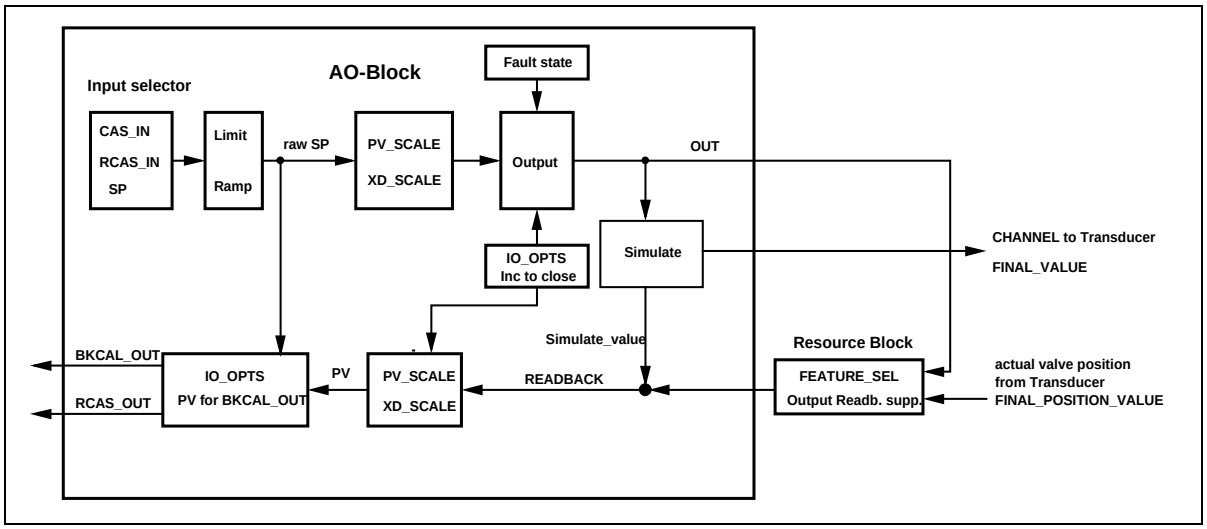
Parameter Name	Description	S/A	Range	Default
VIEW_2	Transducer Block VIEW 2 access to the static operating parameters with a single read)	D / ro	3 parameters: ST_REV, TRANSDUCER_ TYPE, FINAL_VALUE_ RANGE	-
VIEW_3	Transducer Block VIEW 3 (access to all dynamic operating parameters)	D / ro	See VIEW_1	-
VIEW_4	First Transducer Block VIEW 4 (access to static paramters not included in VIEW_2)	D / ro	13 parameters: ST_REV, STRATEGY, ALERT_KEY, TRANSDUCER_ TYPE, FINAL_VALUE_ CUTOFF_HI, FINAL_VALUE_ CUTOFF_LO, SERVO_GAIN, SERVO_RESET, SERVO_RATE, ACT_FAIL_ACTION , ACT_MAN_ID, ACT_MODEL_NUM, ACT_SN	-
VIEW_4	Second Transducer Block VIEW 4 (access to static paramters not included in VIEW_2)	D / ro	4 parameters: VALVE_MAN_ID, VALVE_MODEL_ NUM, VALVE_SN, VALVE_TYPE	-
VIEW_4	Third Transducer Block VIEW 4 (access to static paramters not included in VIEW_2)	D / ro	3 parameters: XD_CAL_LOC, XD_CAL_DATE, XD_CAL_WHO	-

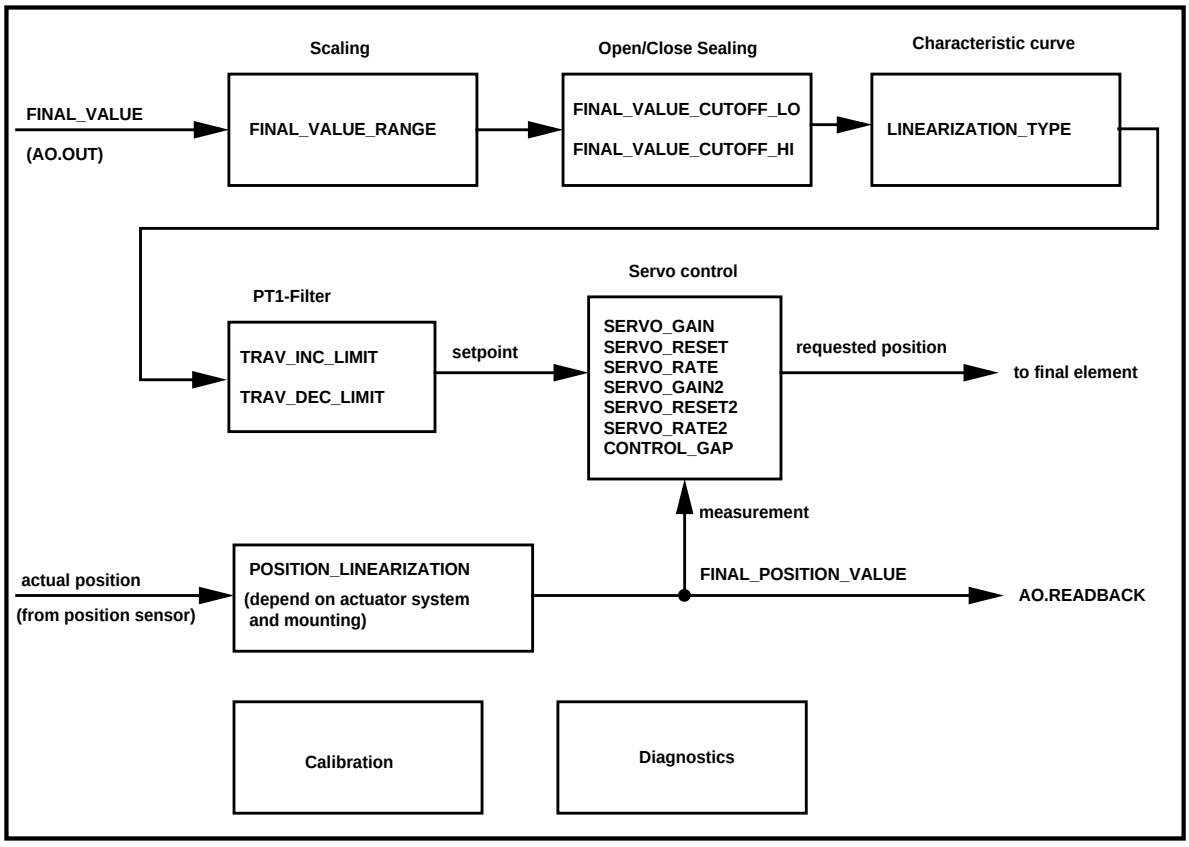
3.2 AO Function block diagram

The Analog Output function is an enhanced implementation of an AO function block as defined by Foundation Fieldbus in specification FF891-2 (Function Block Application Part 2). All available parameters including the enhanced (manufacturer specific) parameters are described in section 3.1 above.



Note: While first commissioning or after performing a “Restart with Defaults” (see chapter 4.9) please verify that the parameter CHANNEL is set to 1. Otherwise there is no valid link to the Transducer.

3.3 Transducer block diagram



The Transducer is a Standard Advanced Positioner Valve Basic Access Block with additional manufacturer specific extensions.

The transducer input is the FINAL_VALUE parameter, which is fed by the Analog Output Parameter OUT. The value can be modified using scaling, sealing, characterization and filtering functions. This modified value is the working setpoint for the servo control section.

The actual position is measured using the position sensor input and modified depending on the selected actuator system and mounting type (POSITION_LINEARIZATION parameter). The resulting value is stored in the parameter FINAL_POSITION_VALUE and transferred to the Analog Output parameter READBACK. FINAL_POSITION_VALUE is the actual value for the servo control section.

The servo control function uses a standard PID control algorithm with one set of GAIN, RESET and RATE parameters for valve opening direction and another set (GAIN2, RESET2, RATE2) for valve closing direction. Output of the servo control unit is the current to the final element, which is the I/P-converter module.

Parameter CONTROL_GAP defines the sensitivity of the positioner so that no corrective action is taken if the control difference is less than the defined limit (i.e. defining a deadband where a change of the setpoint doesn't make any sense caused by stiction of a valve).

3.4 BLK_DATA Parameter

The Block data structure consists of the attributes of a block. The default values are shown in the table below:

Table 7: BLK_DATA structure

Element Name	Values for Resource Block	Values for AO-Block	Values for Transducer Block
Block Tag	SRD991_RES$<fab#>	SRD991_AO$<fab#>	SRD991_TD$<fab#>
DD Character ID	0x80020AF5	0x800201F7	0x80020536
DD Item ID	0x80020AF0	0x800201F0	0x80020530
DD Revision	1	1	1
Profile	0x133	0x102	0x10D
Profile Revision	0x101	0x101	0x101
Execution Time	0	8000 [1/32 ms]	0
Period of Execution	0	32000 [1/32 ms]	0
Number of Parameters	53	45	73
Next FB to Execute	0	0	0
Starting index of Views	500	510	520
Number of VIEW_3	1	1	1
Number of VIEW_4	1	1	3

3.5 DIAGNOSIS

The SRD991 has several built-in functions to monitor the behavior of the positioner/actuator/ valve system.

- The Resource Block parameter DIAGNOSIS holds actual and historical information about system and process errors.

- Analog Output Block parameters CONTROL_DIFF_LIMIT and CONTROL_DIFF_TIME are configuration parameters, which hold information about when AO Block alarm *Device need maintenance now* will be generated if a control difference between requested transducer final value and actual valve position exceeds the allowed limit for the user-specified time.

- Transducer Block parameters CYCLE_CNT and TRAVEL_SUM count the changes in actuator movement and the number of full stroke movements. Transducer Block parameters CYCLE_CNT_LIMIT and TRAVEL_SUM_LIMIT and TRAVEL_SUM_DEADBAND hold the user-specified limit values, when AO Block alarm *Device need maintenance now* will be generated, if the actual value of CYCLE_CNT or TRAVEL_SUM exceed the configured limit.

- Transducer Block parameter LOW_PRESSURE_LIMIT allows the user to specify a lower limit for supply air, if optional pressure sensors are available. When the pressure is falling below this limit the Resource Block alarm *Device need maintenance now will be generated.*

3.5.1 DIAGNOSIS parameter

The actual and historical status can be read in the DIAGNOSIS parameter, which contains six entries of data type bit enumerated.

Entry 1 contains system errors. The individual bits of the status byte are defined below. When the specified condition exists, the status bit will be set to one, otherwise the status bit will be reset to zero. Table 8 describes system errors.

Entry 2 contains additional system errors. The individual bits of the status byte are defined below. When the specified condition exists, the status bit will be set to one, otherwise the status bit will be zero. Table 9 describes additional system errors.

Entry 3 contains process errors. The individual bits of the status byte are defined below. When the specified condition exists, the status bit will be set to one, otherwise the status bit will be zero. Table 10 describes process errors.

Entries 4, 5 and 6 contain historical errors. The meaning of the individual bits of the status bytes is the same as described above.

When the specified condition arises, the corresponding historical status bit will be set to one. Bits, which are set, can be cleared, if the specified condition is no longer active. The only function, which allows clearing of a historical status, is performing a RESET HISTORICAL STATUS command - writing value 5 to parameter RESTART of the Resource Block).

Table 8: Diagnosis system errors

Bit	Value	Explanation	Recommended Action
7	128	Option board was not configured or failed.	Check configuration, activate option by writing the desired value to Resource block parameter DEVICE_OPTIONS or replace failed option board.
6	64	Connection of potentiometer to electronics board failed.	Replace failed item or positioner.
5	32	Connection of I/P-converter to electronics board failed.	Replace failed item or positioner.
4	16	Position is not within permissible range (-5%...105%)	Check mechanics of actuator and valve. Perform Short Autostart.
3	8	A/D-converter function not controllable.	Replace failed item or positioner.
2	4	Error writing into positioner ROM	Replace failed item or positioner.
1	2	Error writing into positioner EEPROM	Replace failed item or positioner.
0	1	Error writing into positioner RAM	Replace failed item or positioner.

Table 9: Diagnosis additional system errors

Bit	Value	Explanation	Recommended Action
7	128	Binary Input Channel 1 or 2 is set	Monitor situation or correct cause; check cable joint
6	64	Feedback unit requires calibration	Perform angle calibration.
5	32	Reserved	None
4	16	Cycle Count Limit has exceeded limit configured (limit value in TD parameter CYCLE_CNT_LIMIT)	Check valve performance and conduct maintenance if necassary.
3	8	Travel Sum Limit has exceeded limit configured (limit value in TD parameter TRAVEL_SUM_LIMIT)	Check valve performance and conduct maintenance if necassary.
2	4	Configuration not valid	Correct configuration, perform Restore Factory Settings, re-run Autostart procedure.
1	2	Device temperature too low (limit value in TD parameter ELECTRONICS_TEMP_LL)	Operation outside temperature limit may damage positioner components and violate electrical safety certification requirements. Stop operating positioner.
0	1	Device temperature too high (limit value in TD parameter ELECTRONICS_TEMP_UL)	

Table 10: Diagnosis process errors

Bit	Value	Explanation	Recommended Action
7	128	Output pressure error (plausibility check)	Check mechanics of actuator. Check pneumatics in positioner and replace item or positioner if necessary.
6	64	The supply pressure has fallen below the configured lower limit (value in TD parameter LOW_PRESSURE_LIMIT)	Check to ensure that there is adequate supply pressure.
5	32	No Autostart was done or Autostart was run and did not complete successfully.	Ensure proper mounting of positioner and adequate supply pressure. Rerun Autostart Calibration procedure. Refer to troubleshooting section of MI EVE 0105-D.
4	16	Difference between requested setpoint and actual position exceeds allowed limit for a user specified time (values in AO parameters CONTR_DIFF_LIMIT and CONTR_DIFF_TIME)	Check to ensure that there is adequate supply pressure. Verify tuning parameters. Refer to troubleshooting section of MI EVE 0105-D.
3	8	Position below main low alarm setpoint (lower than the value in AO parameter POS_VALVE_LOLO_ALARM)	Monitor situation or correct cause.
2	4	Position above main high alarm setpoint (higher than the value in Analog Output parameter POS_VALVE_HIHI_ALARM)	Monitor situation or correct cause.
1	2	Position below warning low alarm setpoint (lower than the value in AO parameter POS_VALVE_LO_ALARM)	Monitor situation or correct cause.
0	1	Position above warning high alarm setpoint (higher than the value in AO parameter POS_VALVE_HI_ALARM)	Monitor situation or correct cause.

If more than one error is detected, values will accumulate. For example if position is below warning and main alarm level, process errors will be set to 10, which means bit 3 and bit 1 are set.

3.6 GRANT_DENY Parameter

The Grant/Deny parameter is used to allow the operator grant and deny access permissions to sets of function block parameters by other devices.

Table 11: GRANT_DENY structure

Element Number	Element Name	Description
1	Grant	Set Bit 0: **Program** - A higher level device may change the target mode, setpoint (if the block mode is MAN or AUTO), or output (if block mode is MAN) of the block 1: **Tune** - A higher level device may change the tuning parameters of the block 2: **Alarm** - A higher level device may change the tuning parameters of the block 3: **Local** - A local operator´s panel or hand-held device may change the target mode , setpoint (if the block mode is MAN or AUTO), or output (if block mode is MAN) of the block
2	Deny	Set Bit 0: **Program Denied** - The Program permission item has been turned off 1: **Tune Denied** - The Tune permission item has been turned off 2: **Alarm Denied** - The Alarm permission item has been turned off 3: **Local Denied** - The Local permission item has been turned off

3.7 IO_OPTS Parameter

The following AO Block options can be configured in the bitstring Parameter IO_OPTS:

Table 12: IO_OPTS Parameter

Bit	Meaning
0 (LSB)	reserved for DI and DO Blocks (Invert)
1	SP-PV Track in MAN
2	Reserved
3	SP-PV Track in LO
4	SP Track retained target
5	Increase to close
6	Fault State to value
7	Use Fault State value on restart
8	Target to MAN if Fault State activated
9	Use PV for BKCAL_OUT
10	Reserved for AI Block (Low cutoff)
11	Reserved
12	Reserved
13	Reserved
14	Reserved
15	Reserved

Table legend:

SP-PV Track in MAN target	Permits the setpoint to track the process variable when the mode of the block is MAN
SP-PV Track in LO	Permits the setpoint to track the process variable when the actual mode of the block is LO (Local Override)
SP Track retained target	Permits the setpoint to track the RCAS or CAS parameter based on the retained target when the actual mode of the block is LO or MAN.
Increase to close	Indicates whether the output value should be inverted before it is communicated to the I/O channel
Fault State to value	The output action to take when fault occurs (0=freeze, 1 = go to preset value)

3.8 STATUS_OPTS Parameter

Foundation Fieldbus defines several Status options for all blocks. For an Analog Output Block only one could be chosen in the bitstring STATUS_OPTS:

Bit 4: Propagate Fault Backward (i.e.if the status from the actuator is Bad, Device failure or Fault State Active or Local Override is active, propagate this as Bad, Device Failure or Good Cascade, Fault State Active or Local Override to BKCAL_OUT respectively without generating an alarm. The user may determine whether alarming (sending of an alert) will be done by the block or propagated upstream for alarming).

3.9 SHED_OPT Parameter

This parameter may be used to configure the desired behavior when shedding. It determines the actual shed mode when the setpoint or output is not updated within a time-out limit in the remote-cascade mode or remote-output mode (remote-out is not available for an AO-Block).

The shed option is has the following enumerations:

Table 13: Shed_opt parameter

Value	Meaning
0	Un-defined, invalid
1	Normal shed, normal return
2	Normal shed, no return
3	Shed to AUTO, normal return
4	Shed to AUTO, no return
5	Shed to MAN, normal return
6	Shed to MAN, no return
7	Shed to retained target, normal return
8	Shed to retained target, no return (change target to retained target)

3.10 Write Checks

Foundation Fieldbus has defined some restrictions for changing values of writable Block Parameters.

Besides the valid ranges for several parameters, the required Block Mode allowing to change the value of a parameter is specified. The valid range is described in the Parameters table above (see chapter 3.1). The lowest priority target mode required to modify parameters is listed in the table below.

Table 14: Block Mode write checklist

Index	Parameter Name	Required Block Mode to modify parameter
328	SP	AO-Block target mode: AUTO
329	OUT	AO-Block target mode: MAN
331	PV_SCALE	AO-Block target mode: MAN
332	XD_SCALE	AO-Block target mode: MAN
334	IO_OPTS	AO-Block target mode: OOS
335	STATUS_OPTS	AO-Block target mode: OOS
342	CHANNEL	AO-Block target mode: OOS
385	FINAL_VALUE_CUTOFF_HI	Transducer Block target mode: OOS
386	FINAL_VALUE_CUTOFF_LO	Transducer Block target mode: OOS
388	SERVO_GAIN	Transducer Block target mode: OOS
389	SERVO_RESET	Transducer Block target mode: OOS
390	SERVO_RATE	Transducer Block target mode: OOS
391	ACT_FAIL_ACTION	Transducer Block target mode: OOS
399	XD_CAL_LOC	Transducer Block target mode: OOS
400	XD_CAL_DATE	Transducer Block target mode: OOS
401	XD_CAL_WHO	Transducer Block target mode: OOS
438	SELF_CALIB_CMD	Resource Block target mode: OOS

4 COMMON TASKS

4.1 Setting Input Characterization

What kind of ACTUATOR ACTION do you want to use?

Direct-acting -> Do not set Bit 5 (Increase to close) of Analog Output Parameter IO_OPTS (default).

Reverse-acting -> Set Bit 5 (Increase to close) of Analog Output Parameter IO_OPTS.

Choose CHARACTERIZATION**:**

Select **Linear**, **Equal Percentage (1:50**), **Quick Open (50:1**), or **Custom** in the Transducer Block parameter LIN_TYPE.

Note: Entering a custom curve can be done with the configuration tool PC20 only. Please follow the instructions in the Master Instruction MI020-495.This tool allows you to enter a curve consisting of up to 22 points (X-Y pairs).

4.2 Setting Control Parameters

In case of non-satisfactoring results of the Autostart function you can change control parameters in the Analog Output and Transducer Block. Prior to change some of these values, please check the following:

- Is increasing / decreasing travel rate within expected range? Check ACT_STROKE_TIME_DEC and ACT_STROKE_TIME_INC parameter of Transducer Block. If it is out of range, check mechanics of actuator and valve.

- Is there sufficient supply pressure? Read SENSOR1_VALUE of Analog Output Block, if internal pressure sensors are available.

When there is no error in mechanics you can try to change the control behaviour by changing the values of the following parameters:

Analog Output Parameter

SP_RATE_UP	ramp rate for upward setpoint changes in PV units per second (0 = use setpoint immediately with no ramp delay).
SP_RATE_DOWN	ramp rate for upward setpoint changes in PV units per second (0 = use setpoint immediately with no ramp delay).

Transducer Parameter

SERVO_GAIN	Enter the desired proportional gain value for valve opening direction.
SERVO_RESET	Enter the desired integral value for valve opening direction.
SERVO_RATE	Enter the desired differential value for valve opening direction.
SERVO_GAIN2	Enter the desired proportional gain value for valve closing direction.
SERVO_RESET2	Enter the desired integral value for valve closing direction.

SERVO_RATE2	Enter the desired differnetial value for valve closing direction.
CONTROL_GAP	Control gap defines the sensitivity of the positioner so that no corrective action is taken if the control difference is less than the defined limit.
TRAV_INC_LIM	Choose a value in seconds for a desired minimum T63 percent time limit for increasing full span travel (0 = no delay).
TRAV_DEC_LIM	Choose a value in seconds for a desired minimum T63 percent time limit for decreasing full span travel (0 = no delay).

Testing the new control settings is described in chapter 2.3.

4.3 Setting Travel Limits

The SRD991 provides the following parameters in the Transducer block to set travel limits:

- FINAL_VALUE_RANGE — There are two data elements in this data structure to enter travel limits in percent of total stroke. The value in EU AT 100% determines the upper travel stop and the value in EU AT 0% determines the lower travel stop.
- FINAL_VALUE_CUTOFF_HI — If FINAL_VALUE is more positive than this value, the valve is forced to is set maximum high value (fully opened)
- FINAL_VALUE_CUTOFF_LO — If FINAL_VALUE is more negative than this value, the valve is forced to is set minimum low value (fully closed)
- CUTOFF_HYSTERESIS — Enter the amount of hysteresis in percent of travel required above the cutoff low value and below the cutoff high value respectively, before the valve can reopen or reclose again. For example: 2% cutoff low with 0.5% cutoff hysteresis allows the valve to reopen at 2.5%.

As well it is possible to limit the value of the setpoint parameter SP using the Analog Output Block parameter SP_HI_LIM and SP_LO_LIM.

4.4 Diagnostic Options

The SRD991 has several built-in diagnostic capabilities to inform the user about current and historical error conditions. They are summarized in 6 diagnostic Bytes and mapped to BLOCK_ERR status in Resource Block, Analog Output Block or Transducer Block and Alarm Sub-codes in Transducer Block parameter XD_ERROR. When XD_ERROR is set, the Transducer Block BLOCK_ERR status will be set to OTHER. The diagnostic status information is available by reading the Resource Block parameter DIAGNOSIS. A description of all status bits can be found in chapter 3.5.

BLOCK_ERR is a bitstring parameter defined by FF. Error conditions will be reflected (0=inactive, 1=active) in the bitstring as follows:

Table 15: BLOCK_ERR codes

Bit	Meaning
0 (LSB)	Other
1	Block Configuration Error
2	Link Configuration Error
3	Simulate Active
4	Local Override
5	Device Fault State Set
6	Device Needs Maintenance Soon
7	Input Failure / process variable has BAD status
8	Output Failure
9	Memory Failure
10	Lost Static Data
11	Lost Non-volatile Data
12	Readback Check Failed
13	Device Needs Maintenance Now
14	Power-up
15	Out-of-Service

XD_ERROR is an unsigned8 enumerated parameter with the following list of valid values:

Table 16: XD_ERROR codes

Value	Meaning
16	Unspecified Error
17	General Error
18	Calibration Error
19	Configuration Error
20	Electronics Error
21	Mechanical Failure
22	I/O Failure
23	Data Integrity Error
24	Software Error
25	Algorithm Error

The diagnostic status information is available by reading the Resource Block parameter DIAGNOSIS. A description of all status bits can be found in chapter 3.5.

The mapping to BLOCK_ERR and XD_ERROR status is described in the table on next page.

Table 17: BLOCK_ERROR mapping list

Diagnosis Status	BLOCK_ERR	XD_ERROR (Transducer)
Option board was not configured or failed.	Other in Resource Block	-
Connection of potentiometer to electronics board failed.	-	Electronics Error
Connection of I/P-converter to electronics board failed.	-	Electronics Error
Position is not within permissible range (-5%...105%)	-	Mechanical Error
A/D-converter function error	-	Electronics Error
Error writing into positioner ROM	Memory Error in Resource Block	-
Error writing into positioner EEPROM	Memory Error in Resouorce Block	-
Error writing into positioner RAM	Memory Error in Resource Block	-
Binary Input Channel 1 or 2 is set	Other in AO-Block	-
Feedback unit requires calibration	Readback check failed in Resource Block	Calibration Error
Cycle Count Limit has exceeded limit configured	Device needs maintenance now in AO-Block	-
Travel Sum Limit has exceeded limit configured	Device needs maintenance now in AO-Block	-
Configuration not valid	-	Configuration Error
Device temperature too low	Device needs maintenance now in Resource Block	Electronics Error
Device temperature too high	Device needs maintenance now in Resource Block	Electronics Error
Output pressure error	Device needs maintenance now in Resource Block	Mechanical Error
The supply pressure has fallen below the configured lower limit	Device needs maintenance now in Resource Block	Mechanical Error
No Autostart was done or Autostart was run and did not complete successfully.	Device needs maintenance now in Resource Block	Calibration Error
Difference between requested setpoint and actual position exceeds allowed limit for a user specified time.	Other in AO-Block	-
Position below main low alarm setpoint.	Other in AO-Block	-
Position above main high alarm setpoint.	Other in AO-Block	-
Position below warning low alarm setpoint.	Other in AO-Block	-
Position above warning high alarm setpoint.	Other in AO-Block	-

If the actual value of cycle counter or travel sum has reached 95 percent of the configured cycle count limit or travel sum limit the AO-Block BLOCK_ERR parameter will be set to ”Device needs maintenance soon”.

4.5 Configure Binary Input Option

The Binary Input option features two independent binary inputs with internal supply for connection of sensors. A connected switch is loaded with 3.5 V and 0.15 mA.

If the binary input option board is installed by the manufacturer, the Resource Block Parameter DEVICE_OPTIONS is set to the correct value. If a binary input option will be installed after shipping, you have to check the value of DEVICE_OPTIONS and activate this option by setting the appropiate Bit in this parameter.

Using the Analog Output Block parameter BININ_CONF, you can configure an active signal to activate an alarm status or force the actuator to go to 0% or 100% or hold last value.

Table 18: Binary Input parameter

Set Bit	Value	DD Text	Explanation
0	1	In1->0%	Position will change to 0 %, when binary input channel 1 is set (switch open)
1	2	In2->100%	Position will change to 100 %, when binary input channel 2 is set (switch open)
0 and 1	3	In1->0% | In2->100%	Hold last written value, if switches 1 and 2 are open.
2	4	Enb diag In1	Status BINARY_INPUT_SET will be set in DIAGNOSIS, when binary input channel 1 is set
3	8	Enb diag In2	Status BINARY_INPUT_SET will be set in DIAGNOSIS, when binary input channel 2 is set

The actual binary input status can be read in the Analog Output Parameter BININ_STAT.

Table 19: Binary Input Status parameter

Set Bit	Value	DD Text	Explanation
0	1	In1 act	Binary input channel 1 is set to its active state
1	2	In2 act	Binary input channel 2 is set to its active state
0 and 1	3	In1 act | In2 act	Binary input channels 1 and 2 are set to its active state
7	128	Setp forced	Setpoint is forced by an active binary input

If binary input 1 is set, the read value will be 129 (*In1 act* | *Setp forced*). If binary input 2 is set, the read value will be 130 (*In2 act* | *Setp forced*). If binary inputs 1 and 2 are set, the read value will be 131 (*In1 act* | *In2 act* | *Setp forced*).

4.6 Configure Binary Output Option

The Binary Output option enables you to define which alarm status activates the binary outputs.

There are two independent binary output channels available, when a binary output option board is connected to the main electronics. Please refer to Master Instruction MI EVE0105 D-(en) for further details of how to connect electrically.

If the binary output option board is installed by the manufacturer, the Resource Block Parameter DEVICE_OPTIONS is set to the correct value. If a binary output option will be installed after shipping, you have to check the value of DEVICE_OPTIONS and activate this option by setting the matching Bit in this parameter.

Table 20: Binary Output parameter

Set Bit	Value	DD Text	Explanation
0	1	hi alarm	Switch to active state in case of first (warning) position high alarm status (position is higher than the value in Analog Output parameter POS_VALVE_HI_ALARM)
1	2	lo alarm	Switch to active state in case of first (warning) position low alarm status (position is lower than the value in Analog Output parameter POS_VALVE_LO_ALARM)
2	4	hihi alarm	Switch to active state in case of main position high alarm status (position is higher than the value in Analog Output parameter POS_VALVE_HIHI_ALARM)
3	8	lolo alarm	Switch to active state in case of main position low alarm status (position is lower than the value in Analog Output parameter POS_VALVE_LOLO_ALARM)
7	128	inverted alarm	Invert active state of alarm

Using the Analog Output Block Parameters BINOUT1_CONFIG and BINOUT2_CONFIG, you can configure the desired active states for each output channel. You can choose the polarity for the active state: Bit7 = 0 means active high level, Bit 7 = 1 means active low level.

4.7 Configure Pressure Sensors

The SRD991 can be ordered with two built-in pressure sensors. Because they are part of the main board, the electronics has to be exchanged for conversion to this option. Refer to Master Instruction MI EVE0105 D-(en) for details.

The pressure sensor option is installed by the manufacturer, therefore the Resource Block Parameter DEVICE_OPTIONS is set to the correct value.

No additional configuration is needed. The user can choose the engineering unit for displaying the actual measured sensor values. The values of Analog Output Block parameter SENSOR1_VALUE or SENSOR2_VALUE will be shown in the engineering unit set in Analog output Block parameter SENSOR1_UNITS or SENSOR2_UNIT.

4.8 Setting Fault State Parameters

The following parameters determine the behaviour of the device for fault state:

FSTATE_TIME, FSTATE_VALUE and IO_OPTS.

FSTATE_TIME contains the time in seconds from detection of remote setpoint fault to output action if this condition still exists.

FSTATE_VALUE contains the preset analog setpoint value to use when fault occurs.

IO_OPTS offers the user several opportunities to configure the device in case of fault state condition or restart with FSTATE_VAL. Please refer to chapter 3.7 for details.

4.9 Restart the Device

Fieldbus offers several levels of Restart functions, which can be initiated by choosing the desired function in the Resource Block Parameter RESTART.

- Restart Resource: Performing a Restart Resource has no effect on the SRD991.
- Restart Processor: Performing a Restart Processor has the same effect as hitting the reset button on the device or power-cycle the device.
- Restart with Defaults: Performing a Restart with Defaults will reset all configurable function block application objects to their initialized state. It will also clear all configured Trend and Link Objects. A restart of the processor will be performed automatically after re-initialization has been done.

> **CAUTION** - When you do a "Defaults" RESTART command in the Resource Block, the configured parameters will automatically default to the values predetermined by the Foundation, which are NOT the same as the factory defaults. The Defaults RESTART should only be used when the configuration in the valve positioner has been incorrect and the user cannot fix the problem by using the troubleshooting information. In all cases, try cycling the power to the valve positioner first. Then go back to the block with the problem and try to write the changes to the valve positioner. If that does not clear the problem, proceed with the Default RESTART procedure.
>
> If you want to run a Restart with Factory Defaults, you can use the local keys on the device. Select Menu 9 (Calibrate functions for workshop) and choose entry 1 (resetting of configuration to "ex-factory"). If in doubt how to use the local keys, please refer to Master Instruction MI EVE0105 D-(en).

If you use National Instruments NIFBUS-Configurator System you can access RESTART in the following way:

Open the Resource Block and put it in the OOS mode.

In the Process tab, make sure the MODE_BLK • ACTUAL reads OOS.

In the Options tab, open the RESTART box and select one of the following:

- Un-initialized – do not use.
- Run – this is the default setting, the nominal state when not restarting.
- Resource – do not use. This selection has no effect on the positioner.
- Defaults – Sets the parameters to the Foundation defaults. This will reset all configurable function block application objects. It will also clear all configured Trend and Link Objects. Network and system management data are not changed.

- Processor – does a warm restart of CPU and has the same effect as cycling the power (OFF/ON) to the positioner.

1. Click on the Write Changes button.

2. Put the Resource Block back into AUTO mode (the RESTART selection will automatically default to the Run position).

3. If you performed a "Defaults" RESTART, reconfigure the appropriate function blocks, link object and trends.

> Note: There is a Restart function in the National configuration software and it is the equivalent to a Processor Restart mentioned above.

4.10 Device Parameters

During the first commissioning user-specific data have to be entered to the following parameters within the ranges specified in chapter 3.1:

Resource-specific:

CONFIRM_TIME,
CYCLE_SEL,
FEATURES_SEL.

Control-specific:

CUTOFF_HYSTERESIS,
IO_OPTS,
SP_HI_LIM,
SP_LO_LIM,
SP_RATE_DN,
SP_RATE_UP,
STATUS_OPTS,
PV_SCALE,
XD_SCALE,
ACT_FAIL_ACTION,
FINAL_VALUE_CUTOFF_HI,
FINAL_VALUE_CUTOFF_LO,
FINAL_VALUE_RANGE,
LIN_TYPE,
TRAVEL_DEC_LIM,
TRAVEL_INC_LIM.

Diagnostics:

POS_VALVE_HI_ALARM,
POS_VALVE_HIHI_ALARM,
POS_VALVE_LO_ALARM,
POS_VALVE_LOLO_ALARM,
CONTROL_DIFF_LIMIT,
CONTROL_DIFF_TIME,
CYCLE_COUNT_LIMIT,
LOW_PRESSURE_LIMIT,
TRAVEL_SUM_DEADBAND,
TRAVEL_SUM_LIMIT.

Optionally the user may enter data to the following parameters:

ALERT_KEY,
LOCAL_OP_ENA,
MESSAGE_1 to MESSAGE_5,
STRATEGY,
TAG_DESC,
WRITE_LOCK,
ACT_MAN_ID,
ACT_MODEL_NUM,
ACT_SN,
TRAVEL_POS_UNITS,
TRAVEL_SPAN,
VALVE_MAN_ID,
VALVE_MODEL_NUM,
VALVE_SN,
VALVE_TYPE.

4.11 Maintenance

Maintaining and trouble-shooting information provides Master Instruction MI EVE0105 D-(en).

Additional descriptions can be found about diagnostic functions in chapter 3.5 and alarming in chapter 4.4.

5 CONFIGURATION PROCEDURE USING A FIELDBUS HOST

Note: These instructions assume the following:

a) You are using the National Instruments Fieldbus Configurator System Software (NI-FBUS).

b) You are familiar with the NI software and have loaded the DD's.

c) The NI-FBUS software is running "Online" and connected to a functional valve positioner.

d) If you cannot find any parameter in the tab mentioned, do a right mouse click anywhere on the block window and select "Customize Parameters". Check the box for the parameter you need. When you click again on the window, that parameter will be added to that window. When you go to close out that window, you will be prompted to save your customization. Click on Yes.

e) The following procedure covers 98% of all typical installations. For complex or advanced situations, the user will have to reconfigure other parameters for their application.

f) The FoxCAE Configurator in a Foxboro I/A Series System is similar to the National Configurator software. If you are attaching the valve positioner to an I/A System, please refer to B0400FD for specific details on parameter configuration limitations.

1. The valve position must be completely mounted to the valve. Also, the air supply and power from the fieldbus power supply must be activated. Connect the fieldbus wiring to the OUTPUT terminals. The valve positioner is polarity independent, so it cannot be wired backwards (no plus/minus labels). Refer to MI EVE0105 D for instructions.

2. The factory default for the DEV_TAG parameter has been factory defaulted to a unique value, such as "SRD991$16/010020". The user may reconfigure this tag, but it must be unique. Right click on the Device and select Set Tag. Type in a new tag name/number. Make sure the Set to OOS block is checked. Click on OK.

3. The factory default for the DEV_ADD (Device Address) parameter has been factory defaulted to a number, such as "29(0x1d)". The user may reconfigure this address, but it must be a unique value. Right click on the Device and select Set Address. Use the up and down arrows to select a new address or type in a unique value. Make sure the Set to OOS block is checked. Click on OK.

> **CAUTION** – The DEV_ADD address of multiple valve positioners from Foxboro and or other devices from other manufacturers can be identical. Care must be taken to make sure the address is not duplicated in another Fieldbus device on the same wiring segment.

4. If you do not see the Transducer block on the NI-FBUS screen, click on the Show/Hide Transducers & Device ID's icon on the menu bar. The icon has a capital letter T with a red X. The factory default for the BLOCK_TAG parameter in the Transducer Block has been assigned a unique value, such as "SRD991_TD$16/010020". The user may reconfigure this tag, but it must be unique. Right click on the Transducer Block and select Set Tag. Type in a new name/number. Make sure the Set to OOS block is checked. Click on OK.

5. The factory default for the BLOCK_TAG parameter in the Resource Block has been assigned a unique device ID, such as “SRD991_RES$16/010020”. The user may reconfigure this tag, but it must be unique. Right click on the Resource Block and select Set Tag. Type in a new name/number. Make sure the Set to OOS block is checked. Click on OK.

6. The factory default for the BLOCK_TAG parameter in the Analog Output Block has been assigned a unique tag, such as “SRD991_AO$16/010020”. The user may reconfigure this tag, but it must be unique. Right click on the AO block and select Set Tag. Type in a new tag identification. Make sure the Set to OOS block is checked. Click on OK.

7. Open the **Resource Block**. Click on the OOS box to put the block Out Of Service. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads OOS.

8. Open the **Transducer Block.** Click on the OOS box to put the block Out Of Service. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads OOS.

9. In the Others Tab, make sure the VALVE_ACT parameter is set to the proper type of actuator on the valve. From the drop down box, set to single-acting (factory default) or double-acting.

10. Review the POSITION_LINEARIZATION parameter. It should be set as follows:

Actuator Type	**POSITION_LINEARIZATION (See Note)**
Linear (sliding stem or stroke)	stroke left mounted (factory default) or stroke right mounted
Rotary	rotary opening counterclockwise or rotary opening clockwise

Note: When viewing the front face of the positioner.

11. The TRAVEL_POS_UNITS should be set based upon the POSITION_LINEARIZATION parameter. If set to Stroke, the TRAVEL_POS_UNITS should be set to either mm or inch. If set to rotary, the TRAVEL_POS_UNITS should be set to degree. Although this parameter does not need to be configured for proper operation, it is used by many other parameters, especially in regards to diagnostics. Therefore, we strongly recommend it is configured properly.

12. Click on the Write Changes button at the bottom of the page to download the changes to the valve positioner.

13. The valve positioner is now ready to perform an AUTOSTART. The AUTOSTART procedure will automatically set 13 different parameters, by stroking the valve numerous times from 0 to 100% of travel. Select “Autostart” from the drop down box in the SELF_CALIB_CMD parameter.

CAUTION: The AUTOSTART opens and closes the valve and will override the existing setpoint. Do not initiate an AUTOSTART with the valve holding process pressure or fluid. The AUTOSTART procedure may take several minutes to complete.

14. Click on the Write Changes button at the bottom of the Transducer Block page, which will initiate the AUTOSTART procedure. Directly under the SELF_CALIB_CMD parameter is a read-only parameter called STAT_AUTOINIT. Once the value of STAT_AUTOINIT returns to zero (0), the Autostart is completed. If the value of STAT_AUTOINIT displays a value of 1, there was an error during the procedure. Refer to MI EVE0105 D for information on troubleshooting. Fix the problem. Do another Autostart.

The AUTOSTART automatically sets the values for the following parameters:

Parameter Name	**Block**	**Tab**
ACT_STROKE_TIME_INC (Read-Only Parameter)	Transducer	Other
ACT_STROKE_TIME_DEC (Read-Only Parameter)	Transducer	Other
ADC_GAIN (Do **NOT** change)	Transducer	Other
MOTOR_PAR (Do **NOT** change)	Transducer	Other
SPRING_ACT	Transducer	Other
SERVO_GAIN	Transducer	Other
SERVO_GAIN2	Transducer	Other
SERVO_RATE	Transducer	Other
SERVO_RATE2	Transducer	Other
SERVO_RESET	Transducer	Other
SERVO_RESET2	Transducer	Other
STAT_AUTOINIT	Transducer	Other
POWER_UP_ACTION (Read-Only Parameter)	Transducer	Other

Note: A **short** autostart should be used when a diagnostic error is displayed, or if the actuator/valve/positioner was mechanically disconnected for adjustments, or replacement after an autostart had been performed.

15. The FINAL_VALUE_RANGE sub-parameters are factory defaulted to:

EU_100	100
EU_0	0
UNITS_INDEX	% (Do **NOT** change)
DECIMAL	1

These parameters are normally left at the factory defaults, unless there is a reason why you do not want the valve to fully open or fully close. For example, if the valve was attached to the suction side of a compressor, you can configure the EU_0 to a value such as 10. This would not allow the positioner to close the valve any less than 10 percent of its total travel, thereby protecting the compressor

16. The FINAL_VALUE_CUTOFF_LO is factory defaulted to 0 (percent). If the FINAL_VALUE (requested valve position) is lower than the value in this parameter, the valve is forced to its minimum low value (fully closed). This is similar to the low flow cutoff in a flow transmitter. If this parameter were set to 5, then whenever the set point to the positioner was less than 5 percent, the valve would be forced fully closed.

17. The FINAL_VALUE_CUTOFF_HI is factory defaulted to 100 (percent). If the FINAL_VALUE (requested valve position) is higher than the value in this parameter, the valve is forced to its maximum high value (fully open).

18. The CUTOFF_HYSTERESIS is used in conjunction with the FINAL_VALUE_CUTOFF parameters in the previous steps. Increasing the value will increase the hysteresis. For example, if the FINAL_VALUE_CUTOFF_LO parameter were set to 10%, then the valve would be completely closed for any input that was below 10% of scale. If the CUTOFF_HYSTERESIS were set to 1%, then the set point input would have to be 11% to start opening the valve. The factory default is 0.005%.

19. The LINEARIZATION_TYPE parameter is used for characterizing the setpoint. The default is linear, with additional choice of Equal Percentage (1:50), Quick Open or Customer Specific.

20. The CONTROL_DIFF_TIME value (default = 60 seconds) is used by the CONTROL_DIFF_LIMIT parameter in the next step.

21. The CONTROL_DIFF_LIMIT parameter is defaulted to 5%. If the control difference (set point vs valve position) is greater than this value in percent, for the period of time entered into the CONTROL_DIFF_TIME parameter, the CONTROL_DIFF_LIMIT status will be set in the DIAGNOSIS parameter. For example, using the default settings, if the control difference exceeds 5% for more than 60 seconds, a status bit will be set in the DIAGNOSIS parameter in the Others tab of the Resource Block.

22. The TRAVEL_SPAN parameter must be set to the stroke of the actuator (in mm or inches for linear). If the POSITION_LINEARIZATION parameter is set for rotary, the TRAVEL_SPAN must be set to Degrees.

23. Click on the Write Changes button at the bottom of the page to download the changes to the valve positioner.

24. Set the Target Mode in the Transducer block to Auto. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads Auto. If the block does not change to Auto, go to the Troubleshooting section. Fix problem and close the Transducer Block window.

25. Open Analog Output Block and click on the OOS box to put the valve positioner Out Of Service. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads OOS. Ignore this step if the ACTUAL mode reads OOS.

26. In the Process tab, make sure the CHANNEL parameter is set to 1.

27. In the Scaling tab, set the XD_SCALE parameters to the same values used in the FINAL_VALUE_RANGE parameters in the Transducer Block. The factory default values are

EU_100	100
EU_0	0
UNITS_INDEX	%
DECIMAL	1

28. The factory default values for the PV_SCALE parameters are:

EU_100	100
EU_0	0
UNITS_INDEX	%
DECIMAL	1

These values should NOT be changed.

29. In the Limits tab, the SP_RATE_UP (default = 1.#INF) and the SP_RATE_DOWN (default = 1.#INF) determine the ramp rates for setpoint changes in PV units per second when the AO block is in Auto mode. If these parameters are set to zero, or the AO block is in a mode other than Auto, the setpoint change will be used immediately. These parameters affect the ramp rate in both testing and normal operation.

30. The SP_LO_LIM (default = 0) determines the lowest setpoint (SP, CAS_IN or RCAS_IN) that can be used by the block. Please note that the FINAL_VALUE_RANGE EU_0 parameter set in step #15 limits the minimum setpoint value during normal operation.

31. The SP_HI_LIM (default = 100) determines the highest setpoint (SP, CAS_IN or RCAS_IN) that can be used by the block. Please note that the FINAL_VALUE_RANGE EU_100 parameter set in step #15 limits the maximum setpoint value during normal operation.

32. Click on the Write Changes button at the bottom of the page to download the changes to the valve positioner. Now click on the AUTO button. The MODE_BLK • ACTUAL in the Process tab should change to Auto, and the OUT value on the Process tab should display a good value.

If the OUT value is not correct you may have to schedule the device with your configurator software as follows:

- Double click on the Function Block Application to open a new window
- Drag the AO block to the middle window. You can now configure the outputs of the AO blocks and assign them if necessary.
- Click on the Download Project icon and answer questions.
- Check the OUT value of the AO blocks. If good, basic configuration completed.

If the block does not change to Auto, go to the BLOCK_ERR parameter in the Diagnostics tab to see what is wrong. An explanation of the BLOCK_ERR is described in the Troubleshooting section. Fix problem and make sure that in the Process tab that the MODE_BLK • ACTUAL value reads Auto. Close out the "configured" Analog Output Block window.

33. The *basic* configuration of the positioner is now complete. **The valve response to an input setpoint change should be tested at this time.** Valve response can be observed by changing the SP_VALUE parameter in the Process tab of the Analog Output block. Refer to section 2.3 for details.

34. Please go to the next section to review or change the “Optional Parameters” which in most applications do not need to be re-configured from the factory default. Some parameters are used for customizing the application in regards to testing, alarms, failsafe actions, normal behavior and other such functions. Other parameters are only used for storing information and the data is not checked or processed by any of the blocks.

Note: After reviewing the “Optional Parameters” section, proceed with the “Optional Features” section if the actuator is equipped with any optional features.

5.1 Optional Parameter Configuration

35. Open the Transducer Block, Resource Block and Analog Output block and click on the OOS box to put the blocks Out Of Service. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads OOS.

36. In the Diagnostic or Process tab of the Transducer Block, Resource Block and Analog Output block, the factory default for the MODE_BLK • NORMAL parameter is Auto. If for some reason you want the valve positioner to start in the Out Of Service mode, or other selection when power is first applied, set the parameters in all three blocks to the desired action.

37. In the Options tab of the Transducer Block, Resource Block and Analog Output block, the ALERT_KEY parameter (default = 0) can be set to any number between 1 and 255 to be used by the host system as an identification number for sorting alarms, etc.

38. In the Options tab of the Transducer Block, Resource Block and Analog Output block, the STRATEGY parameter (default = 0) can be set to a number between 0 and 32767 for identifying grouping of blocks.

39. In the Others tab of the Resource block, review the ALARM_SUM • DISABLED parameter. There are a wide variety of selections in the drop down box, such as Disc Alm Disabled, HiHi Alm Disabled, etc. The factory default is that all alarms will have a check mark, which disables all "Fieldbus Alarms". If the host control system supports Fieldbus Alarms, remove the check marks to the appropriate alarms to make them active, and the set the appropriate alarm limits. The "Fieldbus Alarms" are different, and they have no effect on the alarming and diagnostic capabilities built into the positioner and mentioned in this configuration procedure.

40. In the Process tab of the Transducer Block, Resource Block and Analog Output block, the parameter TAG_DESC can be used for identification of the application. For example – “Valve for Controlling Drum #2 Level”. Type in the information desired.

41. Open the **Transducer Block.** In the Other tab, there are some parameters to identify the actuator and the valve. Review or change any information in the following parameters:

ACT_MAN_ID, ACT_MODEL_NUM, ACT_SN
VALVE_MAN_ID, VALVE_MODEL_NUM, VALVE_SN
VALVE_TYPE

42. There are 3 parameters that can be filled out in regards to the calibration of the positioner. The XD_CAL_WHO parameter can be filled in with the name of the person who did the last calibration (i.e. John Smith, etc). The XD_CAL_LOC parameter can be used to identify the location of the last calibration. The XD_CAL_DATE can signify the date of the last calibration.

43. The TRAVEL_DEC_LIM parameter represents the fastest one time constant response (63.2%) for a decreasing full span travel and is factory defaulted at 0.4 seconds. You can set this to zero for a very fast responding actuator. Or you could increase the value to make the response slower. This parameter may be changed if the valve testing in step #34 was unsatisfactory (refer to section 2.3 for details).

44. The TRAVEL_INC_LIM parameter represents the fastest one time constant response (63.2%) for an increasing full span travel and is factory defaulted at 0.4 seconds. You can set this to zero for a very fast responding actuator. Or you could increase the value to make the response slower. . This parameter may be changed if the valve testing in step #34 was unsatisfactory (refer to section 2.3 for details).

45. The CYCLE_COUNT_LIMIT is defaulted to 90 million. If the valve manufacturer publishes a suggested maintenance interval based upon a cycle value, use that value. When the actual value of the cycle counter has reached 95% of the configured CYCLE_COUNT_LIMIT, the AO-Block BLOCK_ERR parameter will be set to “Device needs maintenance soon”. When the actual cycle count exceeds this value, a status bit (CYCLECNT_LIM) will be set in the DIAGNOSIS parameter.

46. The TRAVEL_SUM_DEADBAND parameter (default = 1%) is used to eliminate very small movements of the valve (hunting) from the summarized travel value. With the default of 1%, any valve movement less than 1% of the total stroke will not be counted in the summarized travel value.

47. The TRAVEL_SUM_LIMIT is defaulted to 90 million. If the valve manufacturer publishes a suggested maintenance interval based upon totalized stem travel, use that value. When the actual value of the cycle counter has reached 95% of the configured TRAVEL_SUM_LIMIT, the AO-Block BLOCK_ERR parameter will be set to “Device needs maintenance soon”. When the actual travel exceeds this value, the TRAVEL_SUM_LIMIT status bit will be set in the DIAGNOSIS parameter in the Others tab of the Resource Block.

48. The ACT_FAIL_ACTION parameter can be configured based upon the failsafe action for the actuator. This parameter is for information only and has no effect on the positioner or actuator during any fault or failure. The choices are:

Self-closing
Self-opening
Hold on last good value
Maximum value
Minimum value
Uninitialized (Fieldbus default – do not use)
Indeterminate (Factory Default)

49. Click on the Write Changes button at the bottom of the page to download the changes to the valve positioner. Now click on the AUTO button. The MODE_BLK • ACTUAL in the Process tab should change to Auto. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads Auto. If the block does not change to Auto, go to the Troubleshooting section. Fix problem and close the Transducer Block window.

50. Open the Resource Block. In the others tab, you can enter up to 32 characters in the MESSAGE parameters (MESSAGE_1 to MESSAGE_5). These messages are just for information purposes only, and are not used in a diagnostic message.

51. In the Alarms tab, the CONFIRM_TIME parameter (default = 640000 millisecond) is the amount of time the resource will wait for confirmation of receipt of a report before trying again.

52. In the Others tab, the CYCLE_SEL parameter (default = Scheduled and Block Execution) selects the block execution method. Add or remove a check mark to the applicable selections of Scheduled, Block Execution and/or Manuf Specific.

53. The FEATURES_SEL parameter allows the user to chose what resource block options are used. The defaults are Reports, Faultstate, Soft W Lock and Out Readback. Add or remove a check mark to the applicable selections.

54. The LOCAL_OP_ENA parameter can be set to prevent anyone from reconfiguring the positioner database using the local keys on the positioner. The default is local operation enabled. Select local operation disabled if you want to disable the local keys.

55. The WRITE_LOCK parameter can be set to prevent anyone from reconfiguring the positioner database using the local keys on the positioner and from any remote configurator. The default is unlocked which allows full reconfiguration capability from any and all configurators. If the value is set to locked, the only command the device will accept is to unlock that parameter. If the WRITE_LOCK parameter is set to Locked, an alert will be generated when the parameter is changed back to unlocked.

56. Click on the Write Changes button at the bottom of the page to download the changes to the valve positioner. Now click on the AUTO button. The MODE_BLK • ACTUAL in the Process tab should change to Auto. If the block does not change to Auto, go to the Troubleshooting section. Fix problem and close the Resource Block window.

57. Open the Analog Output Block. Click on the OOS box to put the block Out Of Service. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads OOS. Ignore this step if the ACTUAL mode reads OOS.

58. In the Others tab, there are four parameters that determine what valve position will set a status bit in the DIAGNOSIS parameter in the Others tab of the Resource Block. The four parameters, the allowable range and the factory defaults are:

Parameter	Allowable Range	Factory Default
POS_VALVE_LOLO_ALARM	±INF	-10
POS_VALVE_LO_ALARM	±INF	-10
POS_VALVE_HI_ALARM	±INF	110
POS_VALVE_HIHI_ALARM	±INF	110

With the factory defaults set beyond the valve position limits (FINAL_VALUE_RANGE), this will result in NO error messages about the valve position status in the DIAGNOSIS parameter in the Resource Block.

59. In the Options tab, set the STATUS_OPTS parameter to the desired option by adding a check mark in the appropriate box. Refer to Chapter 3.8 for a description of the options. The factory default is no check marks.

60. The IO_OPTS parameter allows options to alter the input and output block processing. Refer to Chapter 3.7 for details. The factory default is there are NO checkmarks. Note - only one option is currently defined by the Foundation for an Analog Output block, and that is Propagate Fault Backwards.

61. Click on the Write Changes button at the bottom of the page to download the changes to the valve positioner. Now click on the AUTO button. The MODE_BLK • ACTUAL in the Process tab should change to Auto. If the block does not change to Auto, go to the Troubleshooting section. Fix problem, set block to Auto, and close the **Analog Output Block** window.

62. If you do not have any optional feature on the positioner, proceed to the next step. If you do have optional feature(s), skip the next step and proceed to the Optional Features Configuration section below.

63. If necessary, adjust the execution times of the primary Link Active Scheduler (LAS). The valve positioner can be used as the primary or back-up LAS for the wiring segment. Also, define the links between the blocks on the wiring segment. Refer to the host configurator software for details. Configuration is completed, unless there are “Optional Features” included in the positioner.

5.2 Optional Features Configuration

The “Optional Features Configuration” must be completed if the actuator is equipped with any of the following options:

- Inductive Limit Switch (Note 1)
- Two Pressure Sensors (Note 2)
- Position Feedback 4-20 mA and One Binary Alarm Output (Note 3)
- Two Binary Inputs (Note 3)
- Two Binary Outputs (Note 3)

Notes:

1) The inductive limit switch option is external to the positioner and has no effect on configuration parameters and does not limit the amount of other options internal to the positioner.

2) The Two Pressure Sensor option is available with or without any of the other options.

3) Only one of these options per positioner (only the Binary Inputs, or only the Binary Outputs or only the Pos Feedback).

5.2.1 Position Feedback 4-20 mA and Alarm

The position feedback option regulates a 4 to 20 mA signal on a separate pair of wires for use as an input to another device. User must provide separate power to the pair of wires between

8 and 48 V (lower power for hazardous areas). The 0 and 100% value positions (stroke of valve) will generate a linear 4 to 20 mA signal.

In addition to the 4 to 20 mA signal, this option also includes one binary output channel for external alarming over another pair of wires. When the positioner activates certain error messages in the DIAGNOSIS parameter, the binary output channel will also be activated. Refer to the Binary Output section for configuration.

64. Open the **Resource Block**. Click on the OOS box to put the block Out Of Service. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads OOS.

65. In the Others tab, the DEVICE_OPTIONS parameter has a drop down box listing the following choices:

- ☒ pos ret
- ☐ press
- ☐ binin
- ☐ binout
- ☐ sens (Do not select - reserved for future options)

Make sure there is a check mark next to the pos ret selection. Do not remove any check marks for the other optional features.

66. Click on the Write Changes button at the bottom of the page to download the changes to the valve positioner. Now click on the AUTO button. The MODE_BLK • ACTUAL in the Process tab should change to Auto. If the block does not change to Auto, go to the Troubleshooting section. Fix problem and close the **Resource Block** window.

67. If you want to configure the one binary output, skip down to Step #74

5.2.2 Two Binary Inputs

The Binary Inputs option is used to override the valve position based upon the activation of one or two external user-supplied switches wired separately to the positioner. When the switch is closed, the voltage in the pair of wires will be approximately 3.5 Volts DC, and there will be a current flow of approximately 0.15 mA. User should select correct switches for this application. The option card supplies the power and the switches control the current flow.

68. Open the **Resource Block**. Click on the OOS box to put the block Out Of Service. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads OOS.

69. In the Others tab, the DEVICE_OPTIONS parameter has a drop down box listing the following choices:

- ☐ pos ret
- ☐ press
- ☒ binin
- ☐ binout
- ☐ sens (Do not select - reserved for future options)

Make sure there is a check mark next to the binin selection. Do not remove any check marks for the other optional features.

70. Click on the Write Changes button at the bottom of the page to download the changes to the valve positioner. Now click on the AUTO button. The MODE_BLK • ACTUAL in the Process tab should change to Auto. If the block does not change to Auto, go to the Troubleshooting section. Fix problem and close the Resource Block window.

71. Open the Analog Output Block. Click on the OOS box to put the block Out Of Service. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads OOS.

72. In the Others tab, the BININ_CONF parameter configures an active signal to force the actuator to go to 0% or 100% and/or activate an alarm status.

This option will override the configuration of the valve and actuator parameters. Based upon the condition of the switches, the **positioner** will react as follows:

Input 1	**Input 2**	**Positioner Action**	**BININ_CONF**
Closed	Closed	IN SERVICE (normal operation)	
Open (Active)	Closed	Forces Valve to 0%, if -------→	check mark on In1->0% box
Closed	Open (Active)	Forces Valve to 100%, if ----→	check mark on In2->100% box
Open (Active)	Open (Active)	Holds on Last Good Value	

CAUTION: If the closing or opening limits are set by changing the FINAL_VALUE_RANGE parameters to values above 0% or below 100%, the actuator will force the valve fully open or closed by the action of the Binary Inputs.

Based upon the condition of the switches, an Analog Output Block alarm with sub-code OTHER can be generated as follows:

Input 1	**Input 2**	**Alarm Generated**	**BININ_CONF**
Closed	Closed	No	
Open (Active)	Closed	Yes, if ----------→	check mark on Enb diag In1 box
Closed	Open (Active)	Yes, if ----------→	check mark on Enb diag In2 box
Open (Active)	Open (Active)	Yes, if ----------→	check mark on Enb diag In1 or Enb diag In2 box

73. Click on the Write Changes button at the bottom of the page to download the changes to the valve positioner. Now click on the AUTO button. The MODE_BLK • ACTUAL in the Process tab should change to Auto. If the block does not change to Auto, go to the Troubleshooting section. Fix problem, set block to Auto, and close the Analog Output Block window.

5.2.3 Two Binary Outputs

There are two galvanically isolated binary output channels for external alarming over two separate pairs of wires based on the configurable limits of the measured valve position. When the positioner activates certain error messages in the DIAGNOSIS parameter, the binary output channel will also be activated. This option is usually called the "solid state programmable limit switches".

The user has to provide an external supply with 8 to 48 VDC. A current below 50 µA means the positioner is defective, lower than 1 mA means the valve position is below the configured limit and a current greater than 2.2 mA means the valve position is above configured limit.

You can configure these limits by configuring the Transducer Block parameters

POS_VALVE_LOLO_ALARM
POS_VALVE_LO_ALARM
POS_VALVE_HIHI_ALARM
POS_VALVE_HI_ALARM

The values of BINOUT1_CONFIG and BINOUT2_CONFIG determine which one of these limits will be responsible for activating a binary output.

74. Open the Resource Block. Click on the OOS box to put the block Out Of Service. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads OOS.

75. In the Others tab, the DEVICE_OPTIONS parameter has a drop down box listing the following choices:

- ☐ pos ret
- ☐ press
- ☐ binin
- ☒ binout
- ☐ sens (Do not select - reserved for future options)

Make sure there is a check mark next to the binout selection. Do not remove any check marks for the other optional features.

76. Click on the Write Changes button at the bottom of the page to download the changes to the valve positioner. Now click on the AUTO button. The MODE_BLK • ACTUAL in the Process tab should change to Auto. If the block does not change to Auto, go to the Troubleshooting section. Fix problem and close the Resource Block window.

77. Open the Transducer Block. Click on the OOS box to put the block Out Of Service. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads OOS.

78. In the Others tab, the BINOUT1_CONFIG and BINOUT2_CONFIG parameters have a drop down box with the following choices:

- ☐ hi alarm
- ☐ lo alarm
- ☐ hihi alarm
- ☐ lolo alarm
- ☐ inverted alarm

Select one choice of alarming for each parameter (BINOUT1_CONFIG and BINOUT2_CONFIG) as follows:

Selecting *hi alarm* in BINOUT1_CONFIG means that the value of POS_VALVE_HI_ALARM (first warning) is the configured limit for binary output1.

Selecting *hihi alarm* in BINOUT1_CONFIG means that the value of POS_VALVE_HI_HI_ALARM (main alarm) is the configured limit for binary output1.

Selecting *lo alarm* in BINOUT1_CONFIG means that the value of POS_VALVE_LO_ALARM (first warning) is the configured limit for binary output1.

Selecting *lolo alarm* in BINOUT1_CONFIG means that the value of POS_VALVE_LO_LO_ALARM (main alarm) is the configured limit for binary output1.

The option *inverted alarm* switches the active signal (i.e. valve position above configured limits will lead to a current lower than 1 mA, valve position below limit will lead to a current above 2.2 mA).

79. Based upon the selections in the previous step, configure the appropriate POS_VALVE_xxyy_ALARM parameter(s) to the desired limits required to activate the binary output(s).

80. Click on the Write Changes button at the bottom of the page to download the changes to the valve positioner. Now click on the AUTO button. The MODE_BLK • ACTUAL in the Process tab should change to Auto. If the block does not change to Auto, go to the Troubleshooting section. Fix problem and close the Transducer Block window.

5.2.4 Two Pressure Sensors

The pressure sensor option consists of two pressure sensors. One sensor measures the supply pressure, and the second sensor measures the pressure applied to the actuator. If the supply pressure falls below a configurable limit, a message will appear in the DIAGNOSIS parameter.

81. Open the Resource Block. Click on the OOS box to put the block Out Of Service. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads OOS.

82. In the Others tab, the DEVICE_OPTIONS parameter has a drop down box listing the following choices:

- ☐ pos ret
- ☒ press
- ☐ binin
- ☐ binout
- ☐ sens (Do not select - reserved for future options)

Make sure there is a check mark next to the press selection. Do not remove any check marks for the other optional features.

83. Click on the Write Changes button at the bottom of the page to download the changes to the valve positioner. Now click on the AUTO button. The MODE_BLK • ACTUAL in the Process tab should change to Auto. If the block does not change to Auto, go to the Troubleshooting section. Fix problem and close the Resource Block window.

84. Open the Analog Output Block. Click on the OOS box to put the block Out Of Service. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads OOS.

85. In the Others tab, set the SENSOR1_UNITS and SENSOR2_UNITS parameters for the EGU's for the pressure sensors (kPa, Bar or psi). All available sensors should be set to the

same EGU to eliminate confusion. The actual pressure being measured by the pressure sensors are displayed in the SENSOR1_VALUE and SENSOR2_VALUE parameters. Sensor #1 is the supply pressure and Sensor #2 is output Y1.

86. Click on the Write Changes button at the bottom of the page to download the changes to the valve positioner. Now click on the AUTO button. The MODE_BLK • ACTUAL in the Process tab should change to Auto. If the block does not change to Auto, go to the Troubleshooting section. Fix problem, set block to Auto, and close the Analog Output Block window.

87. Open the Transducer Block. Click on the OOS box to put the block Out Of Service. Make sure that in the Process tab that the MODE_BLK • ACTUAL value reads OOS.

88. In the Others tab, if sensor #1 (supply pressure) falls below the LOW_PRESSURE_LIMIT value, the PRESS TOO LOW status bit will be set in the DIAGNOSOIS parameter in the Others tab of the Resource Block. Most users set the limit to a pressure at or slightly above the pressure required to stroke the actuator fully open (actuator spring rate value). The factory default is -0.5 Bar to insure that no diagnostic bits are set initially.

89. Click on the Write Changes button at the bottom of the page to download the changes to the valve positioner. Now click on the AUTO button. The MODE_BLK • ACTUAL in the Process tab should change to Auto. If the block does not change to Auto, go to the Troubleshooting section. Fix problem and close the Transducer Block window.

6 REFERENCE DOCUMENTS

[Ref. 1] **Foundation Specification System Architecture**
FF-800

[Ref. 2] **Foundation Specification Communication Profile**
FF-940

[Ref. 3] **Foundation Specification System Management**
FF-880

[Ref. 4] **Foundation Specification Network Management**
FF-801

[Ref. 5] **Foundation Specification Fieldbus Message Specification**
FF-870

[Ref. 6] **Foundation Specification Fieldbus Access Sublayer**
FF-875

[Ref. 7] **Foundation Specification Data Link Services Subset**
FF-821

[Ref. 8] **Foundation Specification Data Link Protocol Specification**
FF-822

[Ref. 9] **Foundation Specification Function Block Application Process Part 1 + 2**
FF-890 + FF-891

[Ref. 10] **Foundation Specification Transducer Block Application Process Part 1 + 2**
FF-902 + FF-903

[Ref. 11] **PC20 Master Instruction**
MI 020-495

[Ref. 12] **SRD991 Intelligent Positioner Master Instruction**
MI EVE0105 D-(en)