FLOWSERVE®

USER INSTRUCTIONS

Logix 3400MD

Digital Positioner

FCD LGENIM3405-03 2/16

Installation &

Reference Guide

Experience In Motion

Contents

Introduction

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About This Manual

This manual is intended as a 'how to' reference for installing, wiring, configuring, starting up, and operating the Valtek Logix 3400MD digital positioner with FOUNDATION fieldbus (FF).

This manual provides detailed information for installation and operation to assist first-time Logix 3400MD digital positioner users.

This manual is written as the technical guide for the experienced fieldbus user. It does not contain information on fieldbus communications and usage. It is recommended that a user new to fieldbus attend the training courses that are taught by the Fieldbus Foundation to obtain the background knowledge that is needed to operate a fieldbus segment.

The sections of information contained in the manual follow this order:

*   Background and pre-installation

*   Logix 3400MD digital positioner mechanical and electrical installation

*   Logix 3400MD digital positioner configuration

*   Operation

*   Reference information

Symbol Abbreviations

⚠ This caution symbol on the equipment refers the user to the installation manual for additional information. This symbol appears next to required information in the manual.

ATTENTION, Electro-Static Discharge (ESD) hazard. Observe precautions for handling electrostatic sensitive devices.

⏚ Earth Ground. Functional earth connection. **NOTE:** This connection shall be bonded to protective earth at the source of supply in accordance with national and local electrical code requirements.

Abbreviations

AI   Analog Input

AO   Analog Output

AWG	American Wire Gauge
DB	Database
DD	Device Description
DDL	Device Description Language
DI	Digital Input
DO	Digital Output
EEPROM	Electrically Erasable Programmable Read Only Memory
EMI	Electromagnetic Interference
FB	Function Block
FBAP	Function Block Application Processor
FF	FOUNDATION fieldbus
IS	Input Selector
mA	Milliamperes
MD	Maintenance and Diagnostics
mmHg	Millimeters of Mercury
LAS	Link Active Scheduler
MSP	Manufacturer's Signal Processing
NM	Network Management
NMA	Network Management Agent
NMIB	Network Management Information Base
NPT	National Pipe Taper (pipe threads)
NV	Non-volatile
OD	Object Dictionary
OOS	Out-of-service
OS	Output Splitter
PC	Personal Computer (workstation)
PID	Proportional Integral Derivative
PROM	Programmable Read Only Memory
PWA	Printed Wiring Assembly
RAM	Random Access Memory
RFI	Radio Frequency Interference
ROM	Read Only Memory
SM	System Management
SMA	System Management Agent
SMIB	System Management Information Base
VCR	Virtual Communication Reference
VDC	Volts Direct Current
VFD	Virtual Field Device
XDTBMAIN	Main Transducer Block
XDTBTECH	Tech Transducer Block
XDTBMD	MD Transducer Block
XMTR	Transmitter

Definitions

Term	Abbrev.	Defininition
Alarm		The detection of a block leaving a particular state and when it returns back to that state.
Application		A software program that interacts with blocks, events and objects. One application may interface with other applications or contain more than one application.
Block		A logical software unit that makes up one named copy of a block and the associated parameters its block type specifies. It can be a resource block, transducer block or a function block.
Configuration (of a system or device)		A step-in system design: selecting functional units, assigning their locations and identifiers, and defining their interconnections.
Device		A physical entity capable of performing one or more specific functions. Examples include transmitters, actuators, controllers, operator interfaces.
Device Description		DD Description of FBAPs within a device.
Device Description Language		A standardized programming language (similar to C) used to write device descriptions.
Device Tag		User-defined identifier for device.
Event		An instantaneous occurrence that is significant to scheduling block execution and to the operational (event) view of the application.
FOUNDATION fieldbus	FF	Communications protocol for a digital, serial, two-way system that interconnects industrial field equipment such as sensors, actuators, and controllers.
Function Block	FB	An executable software object that performs a specific task, such as measurement or control, with inputs and outputs that connect to other entities in a standard way.
Function Block Application Process	FBAP	The part of the device software that executes the function blocks (PID, AO, transducer, or resource blocks).
Link Active Scheduler	LAS	A device which is responsible for keeping a link operational. The LAS executes the link schedule, circulates tokens, distributes time messages and probes for new devices.
Macrocycle		The least common multiple of all the loop times on a given link.
Manufacturer's Signal Processing	MSP	A term used to describe signal processing in a device that is not defined by FF specifications.
Network Management	NM	A set of objects and services that provide management of a device's communication system.
Network Management Agent		$_{NMA}$ Part of the device software that operates on network management objects.
Network Management Information Base	NMIB	A collection of objects and parameters comprising configuration, performance and fault-related information for the communication system of a device.
Objects		Entities, such as blocks, alert objects, trend objects, parameters, display lists, etc.
Object Dictionary	OD	Definitions and descriptions of network visible objects ofa device. Various object dictionaries are contained within a device. The dictionaries contain objects and their associated parameters which support the application in which they are contained.
Parameters		A value or variable which resides in block objects.
Proportional Integral Derivative Control	PID	A standard control algorithm. Also refers to a PID function block.
System Management	SM	Provides services that coordinate the operation of various devices in a distributed fieldbus system.
System Management Agent	SMA	Part of the device software that operates on system management objects.
System Management Information Base	SMIB	A collection of objects and parameters comprising configuration and operational information used for control of system management operations.
Status		A coded value that qualifies dynamic variables (parameters) in function blocks. This value is usually passed along with the value from block to block. Fully defined in the FFFBAP specifications.
Virtual Communication Reference	VCR	A defined communication end-point. Fieldbus communications can primarily only take place along active communications path that consists of two VCR end points. For example, to establish communications between a transducer AO block and another function block, a VCR must be defined at the transducer block and a VCR must be defined at the function block between the two function blocks.
Virtual Field Device	VFD	A logical grouping of 'user layer' functions. Function blocks are grouped into a VFD, and system and network management are grouped into a VFD.

References

Publications from the Fieldbus Foundation

Flowserve recommends that the user obtain these publications, which provide additional information on Fieldbus technology:

Publication Title	Publication Number	Publisher
Technical Overview ,FOUNDATION fieldbus	FD-043	Available from the Fieldbus Foundation
Wiring and Installation 31.25 kbit/s, Voltage Mode, Wire MediumApplication Guide	AG-140	
31.25 kbit/s Intrinsically Safe Systems Application Guide	AG-163	
Engineering Guidelines	AG-181	
Function Block Application Process parts1&2	FF-890,FF-891	Contained in the User Layer Specification FF-002
Fieldbus Specifications	Various Documents	

Technical Assistance

If the user encounters a problem with the Logix 3400MD digital positioner, the configuration of the Logix 3400MD digital positioner should be checked to verify that all selections are consistent with the application. If the problem persists, call your local Flowserve representative or Flowserve Digital Products support listed in the contact information at www.valvesight.com.

Do not return a Logix 3400MD digital positioner without authorization from Flowserve Product Technical Assistance, or until an RGA (Return Goods Authorization) has been issued by Flowserve.

Fieldbus Device Version Checking

To assure the proper operation of the fieldbus device, always make sure the DDs loaded in the host configurator's library are the correct ones for the hardware version. Several different hardware versions of your fieldbus devices can possibly reside on various segments at the same time. Fieldbus Foundation has provided a means to tell which version of DD is needed for a particular device in its resource block.

The resource block contains the following standard parameters:

• MANUFAC_ID-- This contains the manufacture's Fieldbus FoundationÔregistration ID number. Make sure this number matches the device used.

• DEV_TYPE-- This is the Foundation registered device type to designate what kind of device it is. Make sure the device type is correct for the unit.

• DEV_REV-- This is the current revision of the device.

• DD_REV-- This is the required DD revision level for this device. **Make sure the DD supports this revision level. An improper DD may cause unexpected operation or inability to use certain features.**

The DD files used with the host have names derived from DEV_REV and DD_REV as follows:

<DEV_REV><DD_REV>.ffo

<DEV_REV><DD_REV>.sym

Example: IF DEV_REV is 0x01 and DD_REV is 0x03, then the DD files would be 0103.ffo and 0103 sym.

In addition to these Fieldbus Foundation specified parameters, some manufactures may add additional device version information. The example below is of the resource block for a Flowserve Logix 3400MD digital positioner. The revision array is an optional resource parameter, but gives additional information about the internal firmware code versions. This array resides at the bottom of the parameter listing.

- **MANUFAC_ID:** This should always equal Flowserve or 0x464c53 (4607059).

- **DEV_TYPE:** This will be 0x0203 (515). This indicates the device is a Logix 3400MD digital positioner.

- **DEV_RE**V: This is the revision level of the device.

- **DD_REV:** This is the revision level of the DDs.

- **REVSION_ARRAY:** Contains four elements. These should be viewed in decimal.

    - Element number 1 (closest to the top) Fieldbus main software version IE.(300 = 3.00)

    - Element number 2 Fieldbus Softing Stack version number IE.(212 = 2.12).

    - Element number 3 The Major software version

    - Element number 4 The Minor software version.
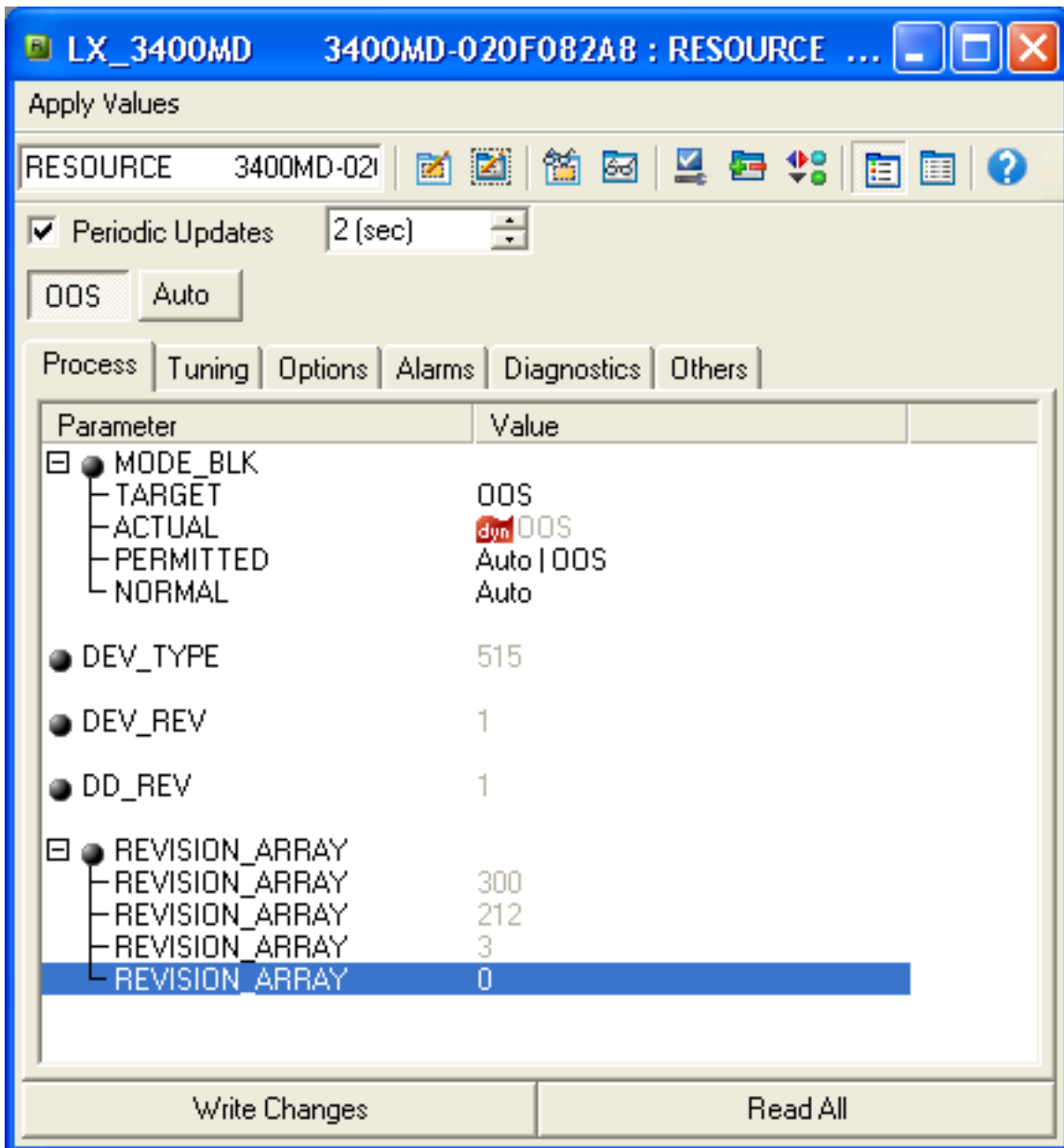
1   Logix 3400MD Digital Positioner Description

1.1   Introduction

This section is intended for users who have never worked with the Logix 3400MD digital positioner fieldbus positioner interface. It provides some general information to acquaint the user with the Logix 3400MD digital positioner.

⚠ **CAUTION:** Flowserve recommends NI-FBUS Configurator software that runs on a variety of Personal Computer (PC) platforms using Windows NT™, Windows XP™, Windows VISTA™ or Windows 7™. It is a bundled Windows software and PC-interface hardware solution that allows quick, error-free configuration and diagnosis of Flowserve control products with FOUNDATION fieldbus communications. The NI-FBUS Configurator allows users to communicate with the Logix 3400MD digital positioner from a remote location to:

- Configure the Logix 3400MD digital positioner by selecting and setting operating parameters.

- Access diagnostic information to identify configuration, communication, Logix 3400MD digital positioner or process problems.

- Calibrate Logix 3400MD digital positioner.

- Request and display Logix 3400MD digital positioner data.

- Configure the Fieldbus network.

1.2   Fieldbus Logix 3400MD Digital Positioner

About the Logix 3400MD Digital Positioner
The Logix 3400MD digital positioner includes FOUNDATION fieldbus electronics for operating in a Fieldbus network as an H1 device. It features standard fieldbus function blocks with manufacturer specific additions for enhanced operation. This Logix 3400MD digital positioner is a Link Master device, which means it can function as the backup Link Active Scheduler in a fieldbus network.

In addition to providing the Fieldbus Interface the Logix 3400MD digital positioner can also perform loop control functions. In conjunction with other FOUNDATION fieldbus compliant devices, its function block set allows the formation of an extensive set of basic control applications.
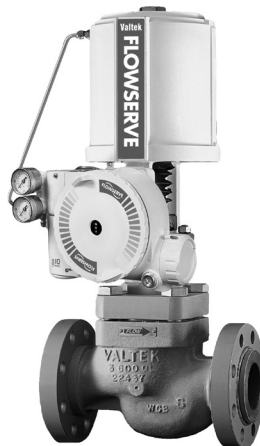
Figure 1.1 Fieldbus Positioner (Logix 3400MD Digital Positioner)

The Logix 3400MD digital positioner in conjunction with any valve will, in essence, form a Fieldbus valve. When configured in conjunction with an Honeywell ST3000 fieldbus transmitter (for example) a complete control loop can be configured. Figure 1.2 shows a block diagram of the Logix 3400MD digital positioner digital positioner operating with other instrument
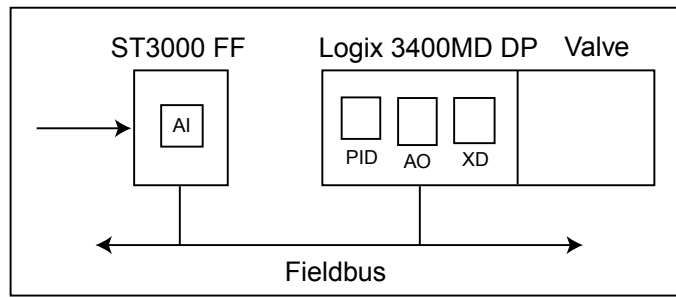
Figure 1.2 Functional Block Diagram of Logix 3400MD Digital Positioner Operating with other Instruments

Theory of Operation
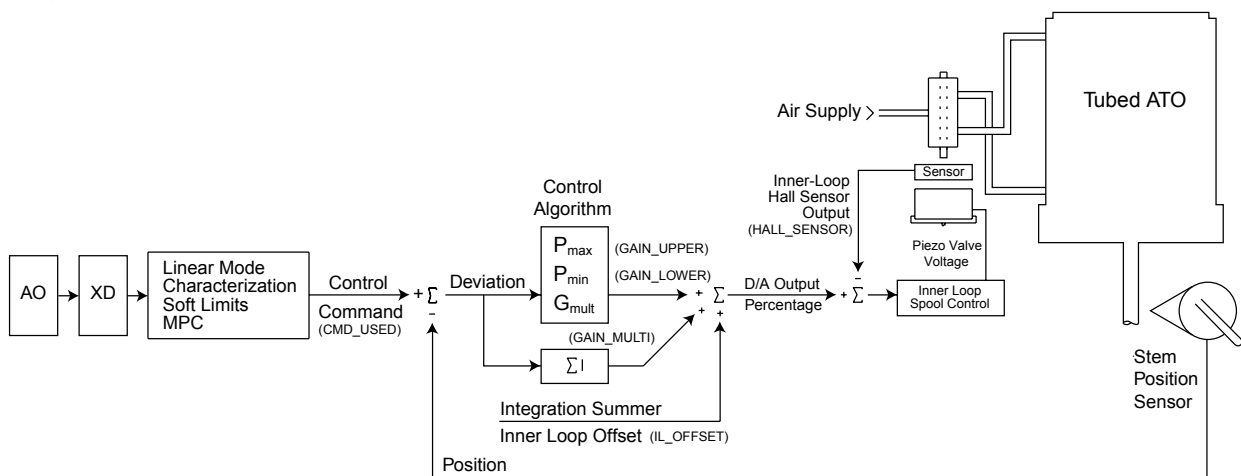
Figure 1.3 Logix 3400MD Digital Positioner Block Diagram

NOTE: Variable names in Figure 1.3 are reference names only and not accessible to the user. They are for reference use only.

The Logix 3400MD digital positioner receives power from the two-wire, fieldbus input signal. A digital signal, sent via fieldbus, is used as the command source. A value of 0 percent is **always** defined as the valve closed position and a value of 100 percent is **always** defined as the valve open position.

Next, the command value is passed through a characterization/limits algorithm block. The positioner no longer uses cams or other mechanical means to characterize the output of the positioner. This function is done in software, which allows for in-the-field customer adjustment. The positioner has two basic modes: linear and custom characterization. In linear mode, the command signal is passed straight through to the control algorithm in a 1:1 transfer. If custom characterization is enabled, the command source is mapped to a new output curve via a 21-point, user-defined curve. In addition, two-user defined features, **Soft Limits** and **MPC** (Minimum Position Cutoff; in fieldbus terminology these are called FINAL_VALUE_CUTOFF_HI and FINAL_VALUE_CUTOFF_LO), may affect the final command signal. The actual command being used to position the stem is called FINAL_VALUE. The FINAL_VALUE is the actual positioning command after any characterization or user limits have been evaluated.

The Logix 3400MD digital positioner uses a two-stage, stem positioning algorithm. The two stages are comprised of an inner-loop, spool control and an outer-loop, stem position control. Referring again to Figure 1.3, a stem position sensor provides a measurement of the stem movement. The control command is compared against the stem position. If any deviation exists, the control algorithm sends a signal to the inner-loop control to move the spool, up or down, depending upon the deviation. The inner-loop then quickly adjusts the spool position. The actuator pressures change and the stem begins to move. The stem movement reduces the deviation between control command and stem position. This process continues until the deviation goes to zero. The control algorithm is both proportional and integral. This algorithm will be further explained later in the document.

A more detailed example to explain the control function follows. Assume the following configuration:

• Unit will receive its command from the FBAP

• Custom characterization is disabled (therefore characterization is linear)

- Soft limits or MPC functions are disabled

- Valve has zero deviation with a present input command of 50 percent

- Actuator is tubed air-to-open

Given these conditions, 50 percent represents a command of 50 percent. Custom characterization is disabled so the command is passed 1:1 to the FINAL_VALUE. Since zero d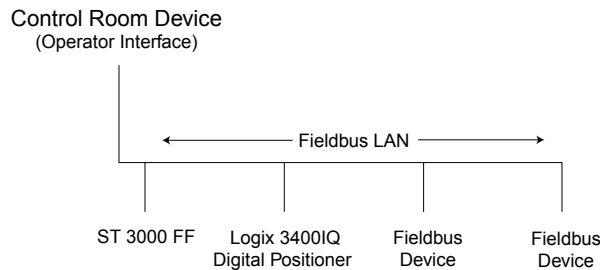eviation exists, the stem position is also at 50 percent. With the stem at the desired position, the spool valve will be at a position in which no air flow is allowed to either side of the actuator. This is commonly called the null or balanced spool position. Upon a change in the command from 50 percent to 75 percent the positioner sees this as a command of 75 percent. With linear characterization, the FINAL_VALUE becomes 75 percent. Deviation is the difference between control command and stem position: Deviation = 75 percent - 50 percent= +25 percent, where 50 percent is the present stem position. With positive deviation, the control algorithm sends a signal to move the spool **up** from its present position. As the spool moves **up,** the supply air is applied to the bottom of the actuator and air is exhausted from the top of the actuator. This new pressure differential causes the stem to start moving towards the desired position of 75 percent. As the stem moves, the deviation begins to decrease. The control algorithm begins to reduce the spool opening. This process continues until the deviation goes to zero. At this point, the spool will be back in its null or balanced position. Stem movement will stop. Desired stem position has now been achieved.

One important parameter should be discussed at this point: Inner loop offset or spool offset. Referring to Figure 1.3, a number called inner loop offset (SPOOL_OFFSET) is added to the output of the control algorithm. In order for the spool to remain in its null or balanced position, the control algorithm must output a non-zero spool command. This is the purpose of the inner loop offset. The value of this number is equivalent to the signal that must be sent to spool position control to bring it to a null position with zero stem deviation. This parameter is important for proper control and will be discussed further in the Control and Tuning section.

1.3   Fieldbus Overview

Understanding Fieldbus

Fieldbus is an all-digital, serial, two-way communication system which interconnects industrial 'field' equipment such as sensors, actuators, and controllers. Fieldbus is a Local Area Network (LAN) for field instruments with built-in capability to distribute the control application across the network. See Figure 1.4.

Control Room Device
(Operator Interface)

Fieldbus LAN

ST 3000 FF   Logix 3400IQ   Fieldbus   Fieldbus
                  Digital Positioner   Device   Device

Figure 1.4 Fieldbus Connecting Control Room and Field Devices

The Fieldbus Foundation has defined standards to which field devices and operator/control stations communicate with one another. The communications protocol is an open system to allow all field devices and control equipment which are built to the FOUNDATION fieldbus standard to be integrated into a control system, regardless of the device manufacturer. This inter operability of devices using fieldbus technology is becoming the industry standard for automation and distributed control systems.

Hardware Architecture

The physical architecture of fieldbus allows installation of fieldbus devices using a twisted-pair cable. Often, existing wiring from analog devices can be used to wire up digital fieldbus devices. Multiple field devices can be connected on one cable (a multi-drop link), rather than conventional point-topoint wiring used for analog devices. See Wiring the Logix 3400MD Digital Positioner to a Fieldbus Network.

Software Architecture

Fieldbus software architecture provides for more control functions to be available in the microprocessor-based field device. Since fieldbus is a digital communication system, more data is available to operators for process monitoring, trend analysis, report generation, and trouble analysis. Device software changes can be downloaded to field devices remotely from the operator station (or PC) in the control room.

Application

An application is software that contains function block data and operating parameters (objects) which help define the operation of a device such as, sensor data acquisition or control algorithm processing. Some devices may contain more than one application.

Function Blocks

Usually, a device has a set of functions it can perform. These functions are represented as function blocks within the device. See Figure 1.5. Function blocks are software that provide a general structure for specifying different device functions. Each function block is capable of performing a control function or algorithm. Device functions may include analog input, analog output, and Proportional Integral Derivative (PID) control. These blocks can be connected together to build a process loop. The action of these blocks can be changed by adjusting the block's configuration and operating parameters.
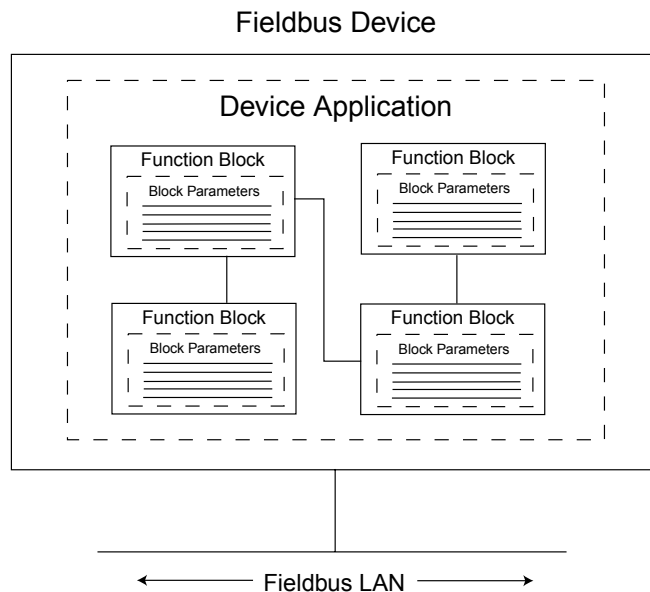
Figure 1.5 Fieldbus Devices Contain Device Applications and Function

Logix 3400MD Digital Positioner Interface Application

The Logix 3400MD digital positioner contains the electronics interface compatible for connecting to a fieldbus network. Logix 3400MD digital positioner application is configured using a fieldbus configuration software program. The NI-FBUS Configurator software allows the user to configure blocks, change operating parameters and create linkages between blocks that make up the Logix 3400MD digital positioner application. The changes to the Logix 3400MD digital positioner application are then written to the device and initialized.

2   Installation Overview

2.1   Introduction

This section provides a list of components needed to install and operate the Logix 3400MD digital positioner. Also provided is a list of typical start-up tasks and places where the user can find detailed information about performing the tasks.

2.2   Installation Components

Components Needed for Installation

The Logix 3400MD digital positioner contains electronics that enable it to operate using the FOUNDATION fieldbus. This digital interface requires a number of components to provide control and data communications between field devices and the control room environment. Table 2.1 outlines the basic component parts needed to install and operate the Logix 3400MD digital positioner on a fieldbus network.

Table 2.1 Components Required for Logix 3400MD Digital Positioner Installation

Components	Description
Logix3400MDDigitalPositioner	Fieldbus positioner.
Power supply	Furnishes DC power to fieldbus devices.
Power conditioner	Acts as a filter to prevent the power supply from interfering with the fieldbus signaling. (May be part of a fieldbus power supply.)
Fieldbus cable	Twisted pair shielded wire used to interconnect fieldbus devices.
Fieldbus terminators	A signal termination device used to prevent reflected signals (noise) from distorting fieldbus communications.
Fieldbus IS Barriers (For hazardous area installations)	Intrinsic safety wire barriers are required for hazardous location installations.
Fieldbus wiring blocks	Wiring blocks allowing easy connection of devices, cable, terminators, surge suppressors and other fieldbus network components.

Operator Interface

In the control room an operator station, a personal computer or host computer acts as the operator interface to the fieldbus network. Using supervisory control software applications, the field devices on a fieldbus network can be monitored and controlled at the operator interface. Figure 2.1 shows how these components go together to operate on a fieldbus network.
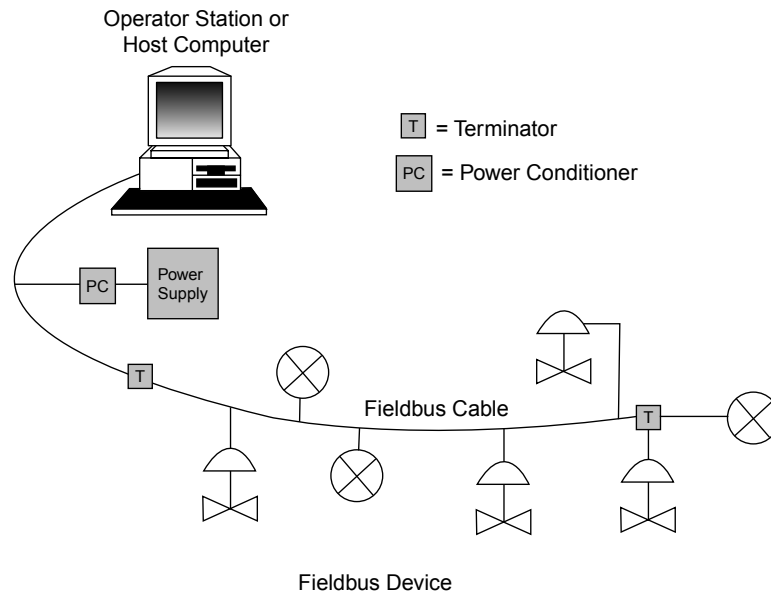
Figure 2.1 Fieldbus Network Components

2.3   Installation / Operation Tasks

Installation of the Logix 3400MD digital positioner is not difficult. The tasks for installing and operating the Logix 3400MD digital positioner are outlined in Table 2.2.

Table 2.2 Installation / Operation Task Summary

Task	Procedure	Refer to . . .
-	Bench Check (optional) (Bench configuration)	Section 3, Bench Configuration (Optional)
1	Pre-installation Considerations	Section 4, Pre-installation Considerations
2	Install Logix 3400MD digital positioner Mounting • Wiring	Section 5, Logix 3400MD Digital Positioner Installation Refer to Logix 3400MD Digital Positioner IOM
3	Power Up Logix 3400MD digital positioner	Section 5.4, Powering Up the Logix 3400MD Digital Positioner
4	Establish Communications • Initial checks	Section 6.7, Establishing Communications Section 6.8, Making Initial Checks
5	Configure Logix 3400MD digital positioner	Section 6.9, Configuration Tasks. The user manual supplied with the fieldbus configuration application.
6	Operation	Section 7, Operation. Also see supervisory control application documentation.
-	Periodic Maintenance • Calibration	Section 9, Calibration Section 10, Troubleshooting
-	Troubleshooting (if problems arise)	Section 11, Software Maintenance
-	Replacement (if needed)	Section 9, Calibration

3   Bench Configuration (Optional)

3.1   Introduction

The bench configuration is an optional procedure for checking your device. This section provides a procedure for configuring the Logix 3400MD digital positioner. This allows the user to load configuration information into the device before it is connected in a fieldbus network. This enables the user to perform a bench check and configuration of the device before installation. Calibration is also possible before the device is installed in the field.

Device Calibration

A stroke calibration should be performed upon installation of the valve. The actuator pressure calibration should be verified on all advanced and pro models (Logix 341X MD and 342X MDdigital positioner). Instructions for performing this calibration can be found in Section 10.

3.2   Bench Check

Configure Logix 3400MD Digital Positioner Before Installation

Using the NI-FBUS Configurator (or other fieldbus device configuration application), the user can perform an bench check of the Logix 3400MD digital positioner before it is mounted and connected to the process hardware and the fieldbus network. By wiring the device to the fieldbus interface of a PC and using a fieldbus power supply to furnish power to the device, the user can read and write parameters in the Logix 3400MD digital positioner.

1. Connect fieldbus cable to junction block fieldbus interface card to the fieldbus network.

⚠ **CAUTION:** Observe polarity of fieldbus cable throughout the network.

2. Loosen end-cap lock and remove end-cap cover from terminal block end of positioner housing.

3. The Logix 3400MD is not polarity sensitive. Connect either wire to either terminal screw.
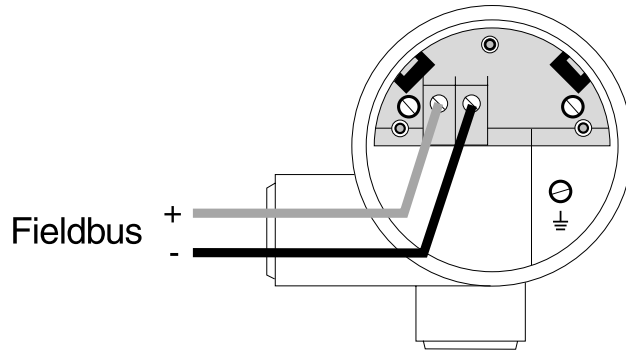
Figure 3.1 Connecting wiring device.

4. At the junction block, connect a fieldbus terminator in parallel with the device.

5. Connect a power supply , power conditioner (if needed) and a fieldbus terminator to the fieldbus cable.

!Note: Do not connect the shield at the device connect only at the marshalling cabinet.

6. Turn on PC.

7. Turn on power supply.

8. Start fieldbus configuration application on PC. **9.** Establish communications.

Once communications have established between the Logix 3400MD digital positioner and the PC, the user can then query the Logix 3400MD digital positioner.

Assign Bus Address and Device Tag

Check the device ID of the Logix 3400MD digital positioner and assign a network node address to the device and assign tag names to the device.

Note that the Logix 3400MD digital positioner is shipped with default node addresses and tag names that appear at start-up. These can be changed to actual network addresses and tag names.

Typically the device tag and block tags are modified to be unique throughout the network.

Device Configuration

The user can view the various block parameters that make up the Logix 3400MD digital positioner configuration. Enter parameter values for your process application and write them to the device. **Refer to the Logix 3400MD Digital Positioner Start-up Guide for supplemental help.**

Note: it is recommended to set the device address to at least 20hex or above if using the LAS feature to avoid possible conflicts with the host system.

4   Pre-installation Considerations

4.1   Introduction

This section reviews several topics which should be considered before installing the Logix 3400MD digital positioner. If replacing an existing Logix 3400MD digital positioner, this section can be skipped.

4.2   Considerations for Logix 3400MD Digital Positioner

Evaluate Conditions

The Logix 3400MD digital positioner is designed to operate in common indoor industrial environments as well as outdoors. To assure optimum performance, conditions at the mounting area should be evaluated relative to published device specifications and accepted installation practices for electronic positioners including, but not limited to the following:

- Environmental Conditions:

  - Ambient Temperature

  - Relative Humidity

- Potential Noise Sources:

  - Radio Frequency Interference (RFI)

  - Electromagnetic Interference (EMI)

- Vibration Sources:

  - Pumps

  - Motorized Valves

  - Process Characteristics:

  - Temperature

  - Maximum Pressure Rating

Relative Humidity & Lightning (EMI)

Large Fan Motors (EMI)

Ambient Temperature

Pump (Vibration)

Process Temperature Radiated

Transceivers (RFI)
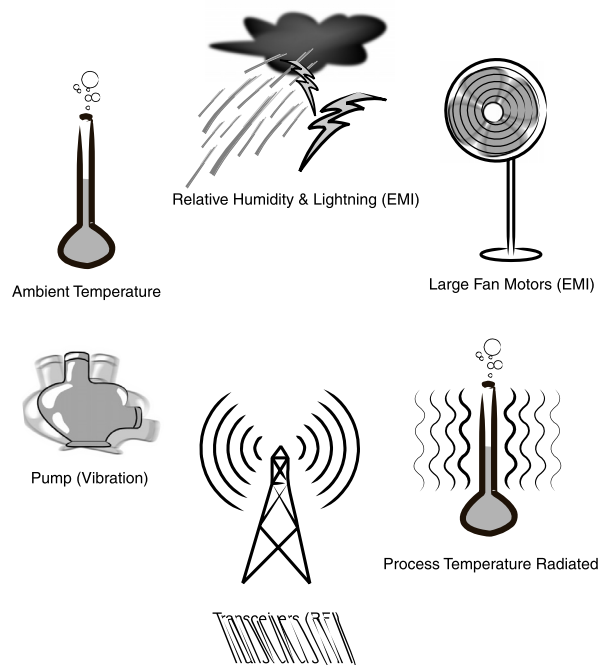
Figure 4.1 Typical Mounting Area Considerations Prior to Installation

Temperature Limits

Table 4.1 lists the operating temperature limits for Logix 3400MD digital positioner.

Table 4.1 Operating Temperature Limits

	Ambient Temperature For Intrinsically Safe Applications		Electronics Ratings for Explosion-proof Applications		Mechnical Rating	
	°C	°F	°C	°F	°C	°F
Logix 3400MD digital positioner	-52 to 60	-61 to 140	-52 to 85	-40 to 131	-40 to 80	-40 to 176

Power Requirements

The Logix 3400MD digital positioner is a bus-powered (two-wire) device, meaning that it receives its power from the VDC on a fieldbus wiring segment. Certain guidelines and limitations exists regarding the wiring of fieldbus devices. See Section 5.4 for more information on wiring the device.

Table 4.2 lists the operating power requirements for the Logix 3400MD digital positioner.

Table 4.2 Logix 3400MD Power Requirements

Static Power	Minimum	Maximum
	10 VDC @ 23mA	32 VDC @ 23mA

Air Supply Requirements

The Logix 3400MD digital positioner requires an external air filter (preferably the Valtek coalescing air filter).

The air supply should conform to ISA Standard S7.3 (with a dew point at least 18 °F (10°C) below ambient temperature, particle size below one micron, and oil content not to exceed one part per million). For a model with advanced or pro diagnostics (Logix 341X or 342X digital positioner), the internal pressure sensors are rated for continuous operation up to 150 psig.

Minimum supply pressure for proper operation is 30 psig.

Use of a regulator is highly recommended as it aids in the use of the diagnostics feature.

5 Logix 3400MD Digital Positioner Installation

5.1 Introduction

This section provides information about the mechanical and electrical installation of the Logix 3400MD digital positioner. It includes procedures for mounting, piping and wiring the Logix 3400MD digital positioner for operation. Refer to Logix 3400MD Digital Positioner IOM in for detailed information.

5.2 Mounting Variations

The Logix 3400MD digital positioner can be mounted to a:

• Valtek control valve

• Other manufacturer's control valve

NOTE: Figure 5.1 through Figure 5.4 show typical installations for comparison
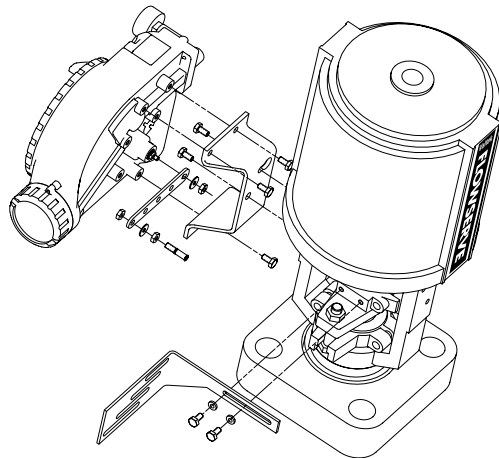
Figure 5.1 Typical Linear Actuator-mounted Installation
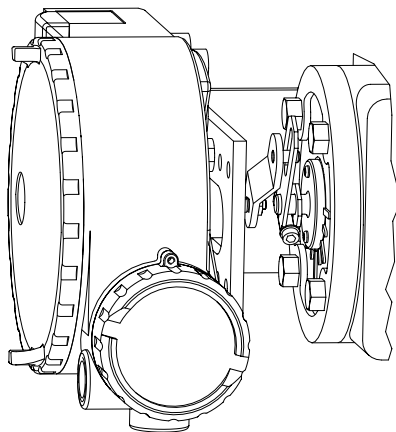
Figure 5.2 Rotary Transfer Case Mounting
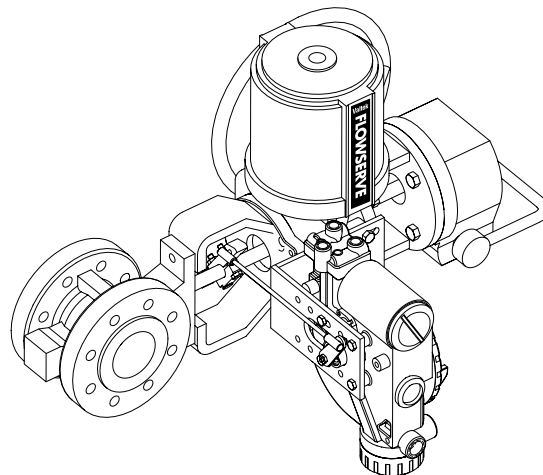
Figure 5.3 Rotary Valve with Four-bar Linkage
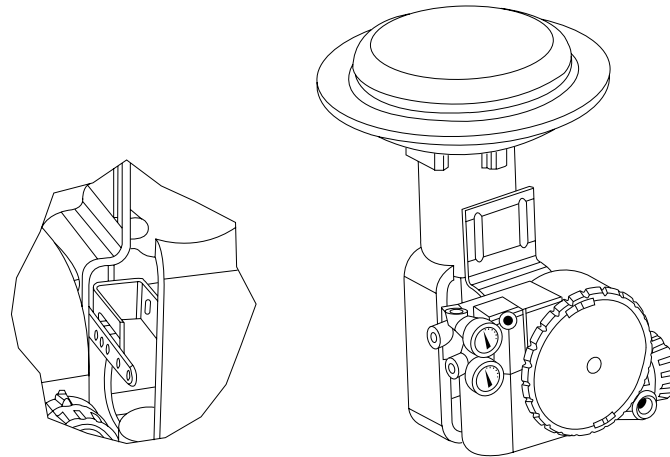
Figure 5.4 Logix 3400MD Digital Positioner Mounted to a Diaphragm Actuator

5.3   Wiring Logix 3400MD Digital Positioner

Wiring the Logix 3400MD Digital Positioner to a Fieldbus Network

The Logix 3400MD digital positioner is designed to operate in a two-wire fieldbus network. Although wiring the Logix 3400MD digital positioner to a fieldbus network is a simple procedure, a number of rules exist that should be followed when constructing and wiring a network. This section provides general guidelines that should be considered when wiring the Logix 3400MD digital positioner to a fieldbus network segment. A procedure is given in this section for properly wiring the Logix 3400MD digital positioner.

For Detailed Fieldbus Wiring Information

Refer to Fieldbus Foundation document AG-140, Wiring and Installation 31.25 kbit/s, Voltage Mode, Wire Medium Application Guide, for complete information on wiring fieldbus devices and building fieldbus networks.

Fieldbus Device Profile Type

The Logix 3400MD digital positioner is identified as either of the following fieldbus device profile types in Table 5.1, (as per Fieldbus document FF-816):

Table 5.1 FOUNDATION fieldbus Profile Types

Device Profile Type:		Characteristic
111	113	
X	X	Uses standard-power signaling to communicate on a fieldbus network.
X	X	Is a bus-powered device. (The Logix 3400MD digital positioner does not have an internal power supply and so it receives its DC power from the fieldbus.)
X		Is acceptable for intrinsically safe (I.S.) applications
	X	Is acceptable for non I.S. applications
X	X	FISCO

⚠️ **CAUTION:** If the user is installing intrinsically safe field devices in hazardous areas, several points should be considered. See Intrinsically Safe Applications section.

Logix 3400MD Digital Positioner Wire Connections

Fieldbus signal communications and DC power are supplied to the Logix 3400MD digital positioner using the same fieldbus twisted-pair cable.

Inside the electronics housing of the Logix 3400MD digital positioner is the terminal block for connecting external wiring as shown in Figure 5.5. Table 5.2 explains the usage of the wiring terminals for fieldbus use.
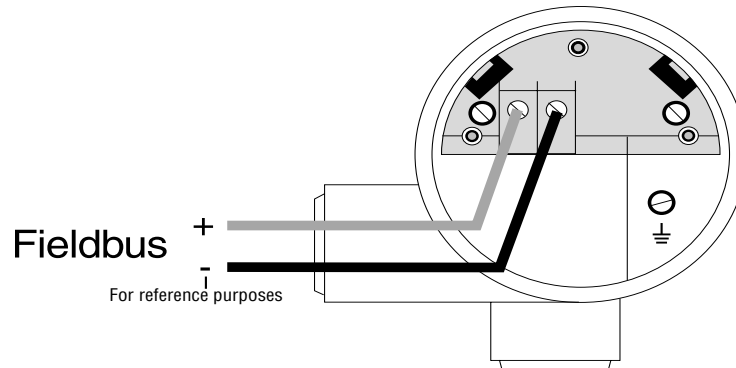
Figure 5.5 Logix 3400MD Digital Positioner Terminal Block

Table 5.2 Logix 3400MD Digital Positioner Wiring Terminals

Wiring Terminal		Use
Screw terminals	Non-polarized	Fieldbus cable connections

Internal Ground Connection

An internal ground terminal is available next to the terminal. (See Figure 5.5.) The terminal can be used to connect the Logix 3400MD digital positioner to earth ground.

External Ground Connections

While grounding the Logix 3400MD digital positioner is not necessary for proper operation, an external ground terminal on the outside of the electronics housing provides additional noise suppression as well as protection against lightning and static discharge damage. Note that grounding may be required to meet optional approval body certification.

Intrinsically Safe Applications

Fieldbus barriers should be installed per manufacturer's instructions for Logix 3400MD digital positioners to be used in intrinsically safe applications.

The Logix 3400MD digital positioner carries an intrinsically safe barrier rating of 125 mA. Currents up to 125 mA will not damage the device.

The number of field devices on a segment may be limited due to power limitations in hazardous area installations. Special fieldbus barriers and special terminators may be required. Also, the amount of cable may be limited due to its capacitance or inductance per unit length.

Detailed Intrinsically Safe Information

Refer to Fieldbus Foundation document AG-163, 31.25 kbit/s Intrinsically Safe Systems Application Guide, for detailed information on connecting fieldbus devices for intrinsically safe applications.

Logix 3400MD Digital Positioner Wiring Procedure

The following procedure shows the steps for connecting fieldbus cable to the Logix 3400MD digital positioner.

⚠️ **CAUTION:** All wiring must comply with local codes, regulations, and ordinances.

1. Loosen end-cap lock and remove end-cap cover from terminal block end of positioner housing.

2. Feed fieldbus cable through one of conduit entrances on either side of electronics housing. Plug whichever entrance not used.

⚠ **CAUTION:** The Logix 3400MD digital positioner accepts up to 16 AWG (1.5 mm diameter) wire.

Fieldbus +
        -

For reference purposes
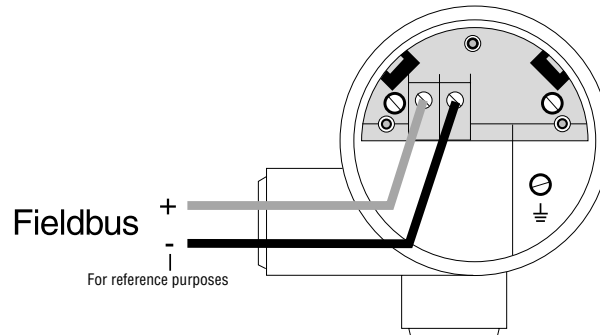
Figure 5.6 Logix 3400MD Digital Positioner Terminal Block

3. Check ground on the fieldbus cable shield (Fieldbus Cable Shield Connection). Normal practice for grounding a fieldbus cable segment is that the cable shield should be grounded in only one place, preferably a ground point at the power supply, intrinsically safe barrier or near the fieldbus interface.

4. Replace end-cap, and tighten end-cap lock.

5. Connect a flat-braided wire to the external ground screw of the Logix 3400MD digital positioner housing.

6. Using the shortest length possible, connect the other end of the braided wire to a suitable earth ground.

Lightning Protection

The Logix 3400MD digital positioner contains moderate protection against near lightning strikes. External lightning protection measures should be employed as needed.

Conduit Seal

Logix 3400MD digital positioners installed as explosion-proof in a Class I, Division 1, Group B Hazardous (Classified) Location in accordance with ANSI/NFPA 70, the US National Electrical Code (NEC), require a 'LISTED' explosion-proof seal to be installed in the conduit, within 18 inches of the Logix 3400MD digital positioner.

Crouse-Hinds® type EYS/EYD or EYSX/EYDX are examples of 'LISTED' explosionproof seals that meet this requirement.

Logix 3400MD digital positioners installed as explosion-proof in a Class I, Division 1, Group B, C or D Hazardous (Classified) Locations do not require an explosion-proof seal to be installed in the conduit.

It is recommended that all seals installed on the Logix 3400MD positioner provide an environmental seal to keep moisture from entering into User Interface chamber of the positioner.

NOTE: Installation should conform to all national and local electrical code requirements.

⚠ **CAUTION:** Do not install in a Hazardous Location without following industry guidelines.

Electrical Wiring Summary

Verify polarity when making field termination connection. The Logix 3400MD digital positioner is reverse polarity protected. With a fieldbus power supply connected, verify that an LED is blinking to determine if the electronics are running. Only one LED will blink at any given time. Refer to guidelines in FF AG-181 for proper wiring and segment checkout methods.

Electrical Wiring Frequently Asked Questions

Question: My DCS uses 24VDC, can I run a Logix 3400MD?

Answer: FF specifies a 10-32V operation range. A fieldbus compatible power supply with terminators should be used. NOTE: The Logix 3400MD is driven from a voltage source, not the typical 4-20 mA supply.

Question: I accidentally reversed the voltage supply across the Logix 3400MD digital positioner. How do I know if I damaged something?

Answer: The Logix 3400MD is non-polarized. Inadvertent connection of the fieldbus supply shouldn't damage the unit.

Question: What is the input resistance of the Logix 3400MD digital positioner?

Answer: The Logix 3400MD digital positioner does not have a simple resistive input. This is because the Logix 3400MD digital positioner is an active device. The fieldbus specifications dictate that the input impedance cannot be less than 3k ohms. This will vary according to frequency of the fieldbus communications. Typical power requirements are 23 mA @ 10-32 VDC.

NOTE: The user cannot measure across the terminals of an un-powered Logix 3400MD digital positioner and get the effective resistance. It is an impedance device, not a resistive device.

5.4   Powering Up the Logix 3400MD Digital Positioner

Pre-power Checklist

- Before applying power to the fieldbus network the user should make the following checks:

- Verify that the Logix 3400MD digital positioner has been properly mounted and connected to a system.

- The Logix 3400MD digital positioner has been properly wired to a fieldbus network.

- The Logix 3400MD digital positioner housing has been properly connected to a suitable earth ground.

- The operator station or host computer has been installed and connected to the fieldbus network.

NOTE: If the user wants to enable the write-protect feature or change the operating mode of the Logix 3400MD digital positioner to simulation mode, the user must change hardware dip switches on the internal electronics boards. This may require that the power be removed from the Logix 3400MD digital positioner. See Section 6.5, Setting Write-protect Feature and Section 10.9, Simulation Mode for details.

Power Up Procedure

To apply power to the fieldbus network, perform the following steps:

1. Turn on all power supplies that furnish DC power to the fieldbus network.

2. Use a digital voltmeter and measure the DC voltage across the + and - Signal terminals to the Logix 3400MD digital positioner.

3. Verify that the terminal voltage is within the limits listed in Table 4.2, Logix 3400MD Digital Positioner Power Requirements.

6   Logix 3400MD Digital Positioner Configuration

6.1   Introduction

This section explains the tasks to establish communications and configure the Logix 3400MD digital positioner for the process application. An overview is given of the configuration tasks using the NI-FBUS Configurator application as an example. Detailed information on using the configurator application is found in the user manual supplied with the software.

Prior to installing the Logix 3400MD refer to sections 5, 6 and 7 in the Logix 3400MD IOM for information on how to mount, install, wire and start up a Logix 3400MD.

CAUTION Before proceeding with the tasks in this section the Logix 3400MD digital positioner must be installed and wired correctly. The user should be somewhat familiar with the fieldbus configuration.

If the Logix 3400MD digital positioner has not been installed and wired, or if the user is not familiar with device configuration, and/or does not know if the Logix 3400MD digital positioner is configured, please read the other sections of this manual before configuring the Logix 3400MD digital positioner.

6.2   Logix 3400MD Digital Positioner Communications

Communications and Control

All communications with the Logix 3400MD digital positioner is through an operator station or host computer running supervisory control and monitoring applications. These applications provide the operator interface to fieldbus devices and the fieldbus network.

Configuration Applications

CAUTION Configuration of the Logix 3400MD digital positioner for the process application is performed also through the operator interface (operator station or PC) running a fieldbus configuration software application. A number of applications are available for the user to configure fieldbus devices. The examples presented in this manual refer to the NI-FBUS Configurator application.

Software Compatibility

The NI-FBUS Configurator application version specified in Section 1.1 is fully compatible with all Valtek control products with FOUNDATION fieldbus communications option.

6.3   Logix 3400MD Digital Positioner Configuration Process

Logix 3400MD Digital Positioner Configuration

Configuration of the Logix 3400MD digital positioner (device) involves the following steps:

1. Establishing communication between the operator interface and the device (bringing the Logix 3400MD digital positioner on-line in a fieldbus network). See Section 6.7, Establishing Communications.

2. Making initial checks on the device serial number and firmware revision numbers. See Section 6.8, Making Initial Checks.

3. Using a fieldbus configuration application, creating or making changes to the device configuration. See Section 6.9, Configuration Tasks.

4. Writing the device configuration changes to the device. See Section 6.9, Configuration Tasks. **5.** Saving device configuration to disk. See Section 6.9, Configuration Tasks.

6.4   Device Configuration

Function Block Application Process

All fieldbus devices contain one or more Function Block Application Processes (FBAP) as part of their device configuration. The FBAP in the Logix 3400MD digital positioner is a software application that defines the particular characteristics of the Logix 3400MD digital positioner. The FBAP comprises function blocks, a transducer block and a resource block, plus other functions which support these blocks. Each function block contains a set of operating parameters (some of which can be userconfigured) that define the operating characteristics of the Logix 3400MD digital positioner.

Function blocks perform (or execute) their specific functions according to a schedule. This schedule provides the sequence and timing of events which occur within a device and also between other fieldbus devices. This schedule is coordinated with the function block execution schedules in the device and other fieldbus devices on the network. Additional information on the FBAP contained in the Logix 3400MD digital positioner is found in Section 8, Device Configuration.

Fieldbus Configuration Application

The Logix 3400MD digital positioner is configured using a fieldbus configuration application running on a operator station or host computer. The configuration tool allows the user to:

Connect function block inputs and outputs according to the process requirements.

• Make changes to function block parameters according to the process requirements

• Make changes to the schedule of function block execution.

• Write the FBAP changes to the device.

Mechanical Configuration Issues

Air Action: Air-to-open and Air-to-close are determined by the actuator tubing, not the software. When air action selection is made during configuration, the selection is telling the control which way the actuator is tubed. The tubing should be verified as correct prior to a stroke calibration. The top output port on the positioner is called port 1. It should be tubed to the increase open side of the actuator. That is, for an air-to-open actuator, port 1 should go to the bottom of the actuator.

The Logix 3400MD positioner has an electrical measurement range of 130°. That is, the electronics will sense stem position over a 130° range of travel of the follower arm. On a rotary valve, the typical rotation is 90°. When installing a Logix 3400MD positioner on a rotary valve, the 90° valve rotation must be centered within the 130° electrical range. If mechanical movement falls outside the electrical measurement range, the positioner can have a dead band at one end of travel in which valve movement cannot be sensed.

Question: How do I know if the rotary linkage is centered within the 130° electrical range?

Answer: The slot in the take-off arm has enough clearance around the roller pin to move the follower arm slightly. Move the valve to the fully closed position. At this position, move the follower arm within the slot clearance. If the valve does not respond to the movement; linkage adjustment is necessary. Repeat this test at the fully open position.

To adjust the stem position linkage, use the A/D feedback variable viewed using AD_RAW_FB parameter. Set TEST_MODE bit 'Enable diagnostic Variable access.' With the valve in its mechanical fail position (i.e. no pressure applied), slightly move the follower arm while watching the A/D feedback. If the number does not change, the arm is not centered in the electrical range. (The number will bounce one or two counts due to noise at a fixed position and should not be considered a change, it should move greater than 10 to 20 counts if the linkage is centered correctly). Rotate the take-off arm, if necessary, to bring the linkage in range. This procedure is only necessary on a rotary mounting. For Linear mountings, the red LED will blink if 65° travel is exceeded. Refer to the Calibration section for further information on stroke calibration errors.

Default Configuration

An FBAP containing default configuration parameters is resident in the firmware of the device and is loaded on power-up. By using the NI-FBUS Configurator (or other fieldbus configuration) application, the user can create or make changes to a FBAP for the device's process application.

Device Configuration

Configuring the Logix 3400MD digital positioner results in:

• Function blocks that execute according to a user-defined schedule

• Measurements that are processed according to various user-configured parameters found within function blocks

• An output published on the fieldbus network according to a user-defined publishing schedule.

Device Configuration Example

A sample printout of a typical device configuration for the Logix 3400MD digital positioner is given in Appendix A, Sample Configuration Record.

LAS Capability

The Logix 3400MD digital positioner is capable of operating as the Link Active Scheduler (LAS). The LAS is a fieldbus device which controls traffic on the network, such as controlling token-rotation and coordinating data publishing. This fieldbus function is active in only one device at any given time on a network. Devices which can be designated as the LAS may be an operator station or a field device.

The Logix 3400MD digital positioner can be designated as a LAS so that, in the event of a failure of the primary LAS, control in the field could continue.

Please note that the Logix 3400MD digital positioner is not designed to be the primary LAS, and, therefore, the LAS capability in the positioner is regarded as a backup LAS. In some remote applications where there is no host computer continuously connected this device may be configured as the primary LAS.

The LAS may be disabled by defining the Logix 3400MD as a Basic device in the host system or performing a factory default reset. Factory default resets the positioner to a basic device

6.5   Setting Write-Protect Feature

Write-protect Feature

The Logix 3400MD digital positioner is available with a write protect feature. It consists of a dip switch located on the device's electronics board that can be set to enable read only access (write-protect) to the device's configuration. When the dip switch is in the "On" position and the corresponding device parameter is set, the device's configuration parameters and calibration data can only be read or viewed, (device configuration is write protected).

ATTENTION: The dip switch is factory set for read- and write-access (not write-protected) "Off" position. (If the dip switch is in the "On" position, the positioner must be powered down before changing the dip switch.)

NOTE: The write protect dip switch is used in conjunction with the FEATURE_SEL parameter and is explained below.

Refer to the following steps to set the write protect dip switch.

1. Remove power to Logix 3400MD.

2. Loosen cap lock and unscrew the main housing cover of housing.

3. **ATTENTION:** Using a ground strap or ionizer is highly recommended when handling the electronics module because electrostatic discharges can damage certain circuit components.

4. Locate the dip switch on the main electronics boards in the housing.

5. Set write-protect dip switch to the appropriate position on the electronics board. See Figure 6.1 and Table 6.1.

6. Replace the cover and lock the locking screw
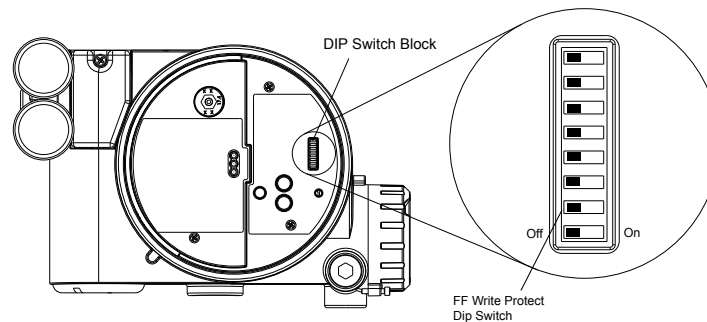
Figure 6.1 Write-protect DIP Switch Location on Main PCB Cover

Table 6.1 Write Protect dip Switch Settings

To	Set the Dip Switch to:	
Enable read and write access to the device's configuration. (Factory-set default)	Off position on the dip switch.	Off On
Enable read only access to device's configuration. (Write-protect)	On position on the dip switch.*	Off On

Enabling Write Protect Feature

The write-protect feature is activated only when the HARD_W_LOCK option is set in the FEATURE_SEL parameter. Once the bit is set and W/R DIP switch is in R position, the device will remain write-protected until the device is powered down and the DIP switch is placed in the off position. See Table 6.2 for truth table.

Table 6.2 Write-protect Feature Truth Table

When the Write-protect dip switch main PCB cover is set to:	... and the FEATURE_SEL HARD_W_LOCK option is set to:	
	0 (No)	1 (Yes)
Off position	Write-protect Disabled	Write Protect Disabled
On position	Write-protect Disabled	Write Protect Enabled

6.6   Simulation Dip Switch

Simulation dip switch

A simulation parameter in the AO block is used to aid in system 'debug' if the process is not running. A hardware dip switch is provided to enable or disable the simulate parameter. See Section 10.8 for details on setting the simulation dip switch. (See Figure 10.1.)

6.7   Establishing Communications

Starting Communications

Once the Logix 3400MD digital positioner is connected to the fieldbus network and powered up, the user is ready to start communicating with the device.

The procedure in Table 6.3 outlines the steps to initiate communications with a Logix 3400MD digital positioner using the NI-FBUS Configurator.

Table 6.3 Starting Communications with Logix 3400MD Digital Positioner

Step	Action
1. Check that the fieldbus is powered up.	Verify that the power supply is on and connected with the proper polarity. See Table 4.2, Logix 3400MD Digital Positioner Power Requirements for proper voltage levels.
2. Verify that the operator interface is loaded with the NI-FBUS Configurator or other configuration application.	Start the application on the computer.
3. View the active devices connected to the network.	Start the NI-FBUS fieldbus driver and Configurator. **NOTE:** Network guidelines as out lined in AG-181 have been followed
4. Access the Logix 3400MD digital positioner's blocks and parameters.	Start the NI-FBUS Configurator application.

Tag Name Assignments

If device or block tags have not been assigned to a device, the NI-FBUS Configurator will automatically assign a default device tag name. This is done so that the devices are visible on the network. The user can then change tag names according to the process requirements.

6.8   Making Initial Checks

Identifying the Logix 3400 Digital Positioner

Before proceeding, verify the following to make sure that the user is communicating with the correct Logix 3400MD digital positioner:

• Device type = 0 x 0203

• Device ID = 464C530203-FLS-LX3400MD-00nnnnnnnn

• Device tag, (tag description of the Logix 3400MD digital positioner)

• Firmware revision level (revision level of the firmware elements)

Table 6.4 Logix 3400MD Digital Positioner Identification

Step	View Parameter	Verify
1	RS.DEV_TYPE	The value is = 0x0203
2	DEVICE_REVISION DD_REVISION	The values are correct for the DD files provided.
3	Physical Device Tag **NOTE:** The device tag name is not contained in a parameter. It can be set and viewed using the field bus device configurator application.	The physical device tag is correct.

6.9   Configuration Tasks

Device Configuration Procedure Overview

A typical device configuration consists of the following tasks listed in Table 6.5 using the NI-FBUS Configurator application. Details on using the configurator application are found in the NI-FBUS Configurator user manual supplied with the application software.

This procedure assumes that the hardware installation of the Logix 3400MD digital positioner is complete and the Logix 3400MD digital positioner is powered up.

Table 6.5 Logix 3400MD Digital Positioner Configuration Task List

Task	Procedure	Result
1	Start the fieldbus process application	Scans the fieldbus network and provides a listing of all active fieldbus devices on the network or selected link.
2	Start the fieldbus configurator application	Configurator windows are displayed on screen listing the active fieldbus devices.
3	Select a fieldbus device for configuration	
4	Change the device and block tags, if desired.	Any unassigned tags are given a default tag name by the configurator.
5	Select/add/edit function blocks to create a function block application process. **NOTE:** Configure block objects in the following order: 1. Resource block 2. Transducer block 3. Analog Output block 4. PID block	Shows a representation of function blocks in the graphical interface window.
6	Connect (or wire) function blocks to define process loops.	Linkages between function block inputs and outputs are created by using wiring tools. Pre-configured templates can also be used.
7	Change block parameters, if necessary.	Parameters changed for the process requirements.
8	Configure trends and alarms	Trending and alarms configured according to the process requirements.
9	Adjust the block execution schedule.	The function block execution schedule changed according to the process requirements.

| 10 | Write configuration to the fieldbus network. | The configuration changes are sent to the appropriate fieldbus devices on the network. |
| 11 | Save the device configuration to disk. | A copy of the device configuration file is saved on the hard disk of the computer or other disk. |

7   Operation

7.1   Introduction

This section outlines the tasks for operating and monitoring the Logix 3400MD digital positioner on a fieldbus network. Refer to the Logix 3400MD Digital Positioner Start-up Guide, for additional information.

7.2   Operation Tasks

Fieldbus Device Operations

Positioning – For the most basic operation of the Logix 3400MD digital positioner the user must write the desired final position value to OUT in the AO block. The AO block MODE_BLK would be set to Manual. The AO block SHED_OPT must be set to anything but uninitialized and the CHANNEL is set to1. The Transducer block MODE_BLK is set to Auto. The Resource block MODE_BLK is set to Auto.

Note: A valid schedule must have been downloaded into the device for control from the AO block.

Calibration – Set the AO block and Resource block to OOS. Next set the Transducer block MODE_ BLK to Out-of-Service (OOS). Write the desired calibration to CALIBRATE to perform the calibration routine. If performing the actuator pressure transducer calibration, the user will need to first write the supply pressure value into PRESSURE_SUPPLY_CAL_ REF and the correct pressure units (Same as PRESSURE_SUP-PLY_CAL REF units) into PRESSURE_UNITS. These are found under the XDTB_MAIN block. When calibrating a pro model positioner (342X model) enter the ACT_SIZE and ACT_AREA before starting the calibration routine.

8   Configuration Description

8.1   Introduction

This section provides information about the construction and contents of the Logix 3400MD digital positioner Function Block Application Process (FBAP) — the application that defines Logix 3400MD digital positioner function and operation in the process application.) This infor-

mation provides some understanding of the elements that make up the configuration of the device application.

For More Information on FBAP

The FBAP elements are described as they apply to the Logix 3400MD digital positioner in the following sections. More detailed information can be found in Fieldbus Foundation documents FF-890 and FF-891 Foundation Specification Function Block Application Process.

8.2   Function Block Application Process

Introduction

The FBAP comprises a set of elementary functions which are modeled as function blocks. Function blocks provide a general structure for defining different types of device functions (such as analog inputs, analog outputs and PID control). The FBAP also contains other objects that

provide other device functions, such as furnishing alarm information, historical data and links to other blocks for transferring data.

FBAP Elements

The key elements of the FBAP are:

- Logix block objects and their parameters (and consist of the following block types)

  - Resource block

  - Transducer blocks

  - PID Function block

  - AO Function block

  - DO Function block

  - DI Function block

  - IS Function block

  - OS Function block

  - Link Objects

  - Alert Objects

  - Trend Objects

  - View Objects

  - Domain Objects

Device Objects

Link objects allow the transfer of process data from one block to another. View, Alert and Trend objects handle function block parameters for operator interface of views, alarms and events, and historical data. A brief description of these objects is presented in the following sections.

8.3   Block Description

Block Objects

Blocks are elements that make up the FBAP. The blocks contain data (block objects and parameters) that define the application, such as the inputs and outputs, signal processing and connections to other applications. The Logix 3400MD digital positioner application contains the following block objects:

- Resource block
- Main Transducer block
- Tech Transducer block
- MD Transducer block
- Analog Output (AO) function block
- Digital Output (DO) function block
- Digital Input (DI) function block (DI_HI and DI_LO)
- Proportional Integral Derivative (PID) controller function block
- Input Selector (IS) function block
- Output Selector (OS) function block

Section 10.15 describes the funtion block execution times.

Table 8.1 briefly describes the operation of these blocks.

Table 8.1 Function Block Application Process Elements

Block Type	Function
Resource	Contains data which describes the hardware (physical) characteristics of the device. The resource block does not perform any action, but contains parameters that support application downloads.
Main Transducer	Transducer blocks Isolate the function blocks from I/O devices such as sensors, actuators, and switches. The transducer block interfaces with the hardware to produce an output. It also contains device-specific parameters, such as calibration and diagnostics parameters. The main transducer block contains all of the parameters/data required for basic functionality of the device
Tech Transducer	The tech transducer block contains parameters/data that can be used to troubleshoot or analyze the device.
MD Transducer	The MD transducer block contains parameters/data that are associated with the advanced or pro diagnostics of the device.
Analog Output (AO) function block	Performs basic automation functions that are integral to automated control and processing operations. The AO block performs functions like engineering units scaling, output scaling, alarming, and back calculation, when connected as a cascade to a PID or other block
Digital Output (DO) function block	The DO block converts the value in SP_D to something useful for the hardware found at the CHANNEL selection.
Digital Input (DI) function block	The DI block takes the manufacturer's discrete input data, selected by channel number, and makes it available to other function blocks at its output.
Input Selector (IS) function block	This block is intended to be used in a forward path only and is not intended to receive signals from the output of a controller. There is no back calculation support or propagation of control status values.
Output Splitter (OS) function block	
PID Controller function block	Performs standard or robust proportional integral derivative algorithm used in closed-loop processing.
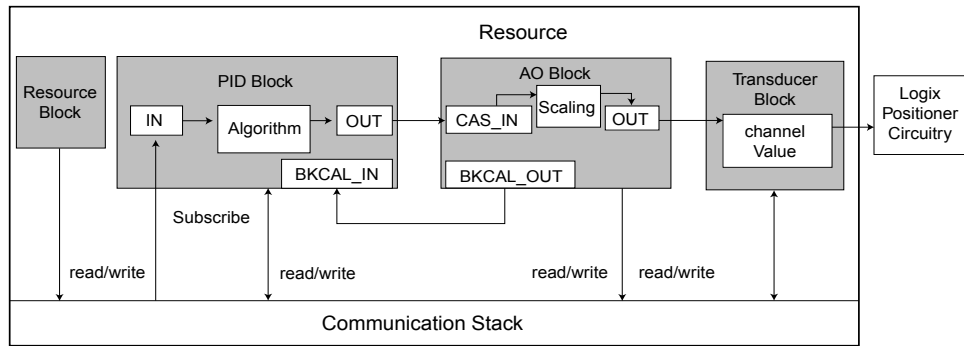
Figure 8.1 FBAP Block Diagram Example

Block Descriptions

Each block contains parameters that are standard Fieldbus Foundation-defined parameters. In other words, the parameters are pre-defined as part of the FF protocol for all fieldbus devices. Additionally, parameters exist which are defined by Flowserve and are specific to the Valtek Logix 3400MD digital positioner.

The following block descriptions list the predefined FF parameters included as part of the block as well as the Flowserve-defined parameters. A complete description for the FF parameters is provided in the Fieldbus Foundation document FF-891, Foundation Specification Function Block Application Process Part 2. The Flowserve parameter descriptions are included here as part of the block descriptions.

Block Parameter Column Descriptions

Tables on the following pages list all of the block parameters contained in each of the block objects. Table 8.2 explains the column headings for the parameter listings.

Table 8.2 Block Parameter List Column Description

Column Name	Description
Index	A number that corresponds to the sequence of the parameter in the block parameter segment of the object dictionary. See Object Dictionary, Section 8.16.
Origin	**STND** – Standard Fieldbus Parameter defined in FF specifications **MFG** – Enhanced Parameter Manufacturer defined
Name	The mnemonic character designation for the parameter.
Data Type / Structure	Data type or structure for the parameter value: 1. Data types consist of simple variables or arrays and are: • **Unsigned8, Unsigned16 Unsigned32** - An unsigned variable of 8, 16 or 32 bits. • **Floating point** - Floating point variable. • **Visible string** - Visible string variable. • **Octet string** - Octet string variable. • **Bit string** - Bit string variable. 2. Data Structures consist of a record which may be: • **Value and Status** - float - Value and status of a floating point parameter. • **Scaling** - Static data used to scale floating point values for display purposes. • **Mode** - Bit strings for target, actual, permitted and normal modes. • **Access permissions** - Access control flags for access to block parameters. • **Alarm - float** - Data that describes floating point alarms. • **Alarm - discrete** - Data that describes discrete alarms. • **Event - update** - Data that describes a static revision alarm. • **Alarm - summary** - Data that summarizes 16 alerts. • **Simulate - Float** - Simulate and transducer floating point value and status,and a simulate enable/disable discrete. • **Test** - Function block test read/write data.
Store	Indicates the type of memory where the parameter is stored: **S** - Static — Writing to the parameter changes the static revision counter parameter ST_REV **N** - Non-volatile — Parameter must be retained during a power cycle. It is not under the static update code. **D** - Dynamic — The value is calculated by the block, or read from another block. **R** - Readable — The value is readable by the host. **W** - Writeable — The value is writeable by the host.
Default Value	Default values for the block parameters. These are the values that are used when: • the FBAP is initialized for the first time, or • selecting restart with defaults of the resource block parameter RESTART. • Performing a factory reset

8.4 Resource Block

Resource Block Function

The resource block contains data and parameters related to overall operation of the device and the FBAP. Parameters that describe the hardware specific characteristics of the device and support application download operations make up the resource block.

Resource Block Parameters Table 8.3 lists the FF and Flowserve-defined parameters and their default values contained in the resource block.

Table 8.3 Resource Block Parameters

Index	Origin	Name	Store		Date Type	Default Value
0	STND	RESOURCE_BLOCK_2	SRW	Record	BLOCK	0
1	STND	ST_REV	SR	Simple	UNSIGNED16	0
2	STND	TAG_DESC	SRW	Simple	OCTET_STRING	" "
3	STND	STRATEGY	SRW	Simple	UNSIGNED16	0
4	STND	ALERT_KEY	SRW	Simple	UNSIGNED8	0
5	STND	MODE_BLK	SRW	Record	MODE	0x01;0x01;0x11;0x10
6	STND	BLOCK_ERR	R	Simple	BIT_STRING	0
7	STND	RS_STATE	R	Simple	UNSIGNED8	4
8	STND	TEST_RW	WR	Record	TEST	0
9	STND	DD_RESOURCE	SR	Simple	VISIBLE_STRING	" "

Index	Origin	Name	Store		Date Type	Default Value
10	STND	MANUFAC_ID	SR	Simple	UNSIGNED32	RES_VAL_MANUFAC_ID
11	STND	DEV_TYPE	SR	Simple	UNSIGNED16	RES_VAL_DEV_TYPE
12	STND	DEV_REV	SR	Simple	UNSIGNED8	RES_VAL_DEV_REV
13	STND	DD_REV	SR	Simple	UNSIGNED8	RES_VAL_DD_REV
14	STND	GRANT_DENY	NRW	Record	ACCESS_PERM	0
15	STND	HARD_TYPES	SR	Simple	BIT_STRING	RES_VAL_HARD_TYPES
16	STND	RESTART	RWB	Simple	UNSIGNED8	1
17	STND	FEATURES	SR	Simple	BIT_STRING	RES_VAL_FEATURES
18	STND	FEATURE_SEL	SRW	Simple	BIT_STRING	RES_FEATURE_SEL
19	STND	CYCLE_TYPE	SR	Simple	BIT_STRING	0x0001
20	STND	CYCLE_SEL	SRW	Simple	BIT_STRING	0x0000
21	STND	MIN_CYCLE_T	SR	Simple	UNSIGNED32	RES_VAL_MIN_CYCLE_T
22	STND	MEMORY_SIZE	SR	Simple	UNSIGNED16	0
23	STND	NV_CYCLE_T	SR	Simple	UNSIGNED32	0
24	STND	FREE_SPACE	R	Simple	FLOATING_POINT	0
25	STND	FREE_TIME	R	Simple	FLOATING_POINT	0
26	STND	SHED_RCAS	SRW	Simple	UNSIGNED32	640000
27	STND	SHED_ROUT	SRW	Simple	UNSIGNED32	640000
28	STND	FAULT_STATE	NR	Simple	UNSIGNED8	1
29	STND	SET_FSTATE	RW	Simple	UNSIGNED8	1
30	STND	CLR_FSTATE	RW	Simple	UNSIGNED8	1
31	STND	MAX_NOTIFY	SR	Simple	UNSIGNED8	RES_VAL_MAX_NOFITFY
32	STND	LIM_NOTIFY	SRW	Simple	UNSIGNED8	RES_VAL_MAX_NOFITFY
33	STND	CONFIRM_TIME	SRW	Simple	UNSIGNED32	640000
34	STND	WRITE_LOCK	SRW	Simple	UNSIGNED8	0
35	STND	UPDATE_EVT	RW	Record	ALARM_EVENT	0;0;0,0;0;0;9;0
36	STND	BLOCK_ALM	RW	Record	ALARM_DISC	0;0;0,0;0;0;0;8;0;0
37	STND	ALARM_SUM|ALARM_SUM_RES2	SRW	Record	ALARM_SUMMARY	0;0;0;0
38	STND	ACK_OPTION|ACK_OPTION_RES2	SRW	Simple	BIT_STRING	0
39	STND	WRITE_PRI	SRW	Simple	UNSIGNED8	0
40	STND	WRITE_ALM	RW	Record	ALARM_DISC	0;0;0,0;0;0;0;10;0;0
41	STND	ITK_VER	NR	Simple	UNSIGNED16	RES_VAL_ITK_VER
42	MFG	DL_CMD1	RW	Simple	UNSIGNED8	0
43	MFG	DL_CMD2	RW	Simple	UNSIGNED8	0
44	MFG	DL_APPSTATE	SR	Simple	UNSIGNED16	0
45	MFG	DL_SIZE	SR	Simple	UNSIGNED32	0
46	MFG	DL_CHECKSUM	SR	Simple	UNSIGNED16	0
47	MFG	REVISION_ARRAY	SR	Array	UNSIGNED16	0,0,0,0
48	MFG	AUX_FEATURE	RW	Simple	BIT_STRING	0
49	MFG	RES_BLOCK_TEST	R	Array	UNSIGNED8	0,0,0,0,0,0,0,0
50	MFG	ERROR_DETAIL	R	Array	UNSIGNED16	0,0,0

Resource Block Valtek Product-defined Parameter Descriptions

Table 8.4 describes the Valtek product-defined parameters in the resource block, which are specific to the Logix 3400MD.

Table 8.4 Resource Block Parameter Descriptions

Name	Description or Parameter Contents
DL_CMD1 DL_CMD2	

DL_APPSTATE	
DL_SIZE	
DL_CHECKSUM	
REVISION_ARRAY	A read-only parameter that contains the application firmware revision level for: FB Board Software Revision: Byte 0-4 Future Growth Stack Revision Byte 5 FF Board NV Ram CRC LSB CMD Board Major Revision Byte 6 FF Board NV Ram CRC MSB CMD Board Minor Revision Byte 7 FF Board EF Results
RES_BLOCK_TEST	An internal Valtek product test parameter.
ERROR_DETAIL	An internal Valtek product parameter array, which contains details of BLOCK_ERR conditions.

8.5   Main Transducer Block

Transducer Block Function

The transducer block de-couples (or insulates) function blocks from local I/O devices, such as sensors or actuators. In the Logix 3400MD digital positioner, the transducer block takes the position from the analog output block and sends it, along with other parameters, to the positioner subsystem.

Transducer Block Parameters

Table 8.5 lists the FF and Valtek product-defined parameters and their default values in the transducer block. The main transducer block contains the most widely used parameters for general operation and ID.

Table 8.5 Main Transducer Block Parameters

Index	Origin	Name	Store		Date Type	Default Value
0	STND	XDTB_MAIN	SRW	Record	BLOCK	0
1	STND	ST_REV	SR	Simple	UNSIGNED16	1
2	STND	TAG_DESC	SRW	Simple	OCTET_STRING	"7 "
3	STND	STRATEGY	SRW	Simple	UNSIGNED16	2
4	STND	ALERT_KEY	SRW	Simple	UNSIGNED8	4
5	STND	MODE_BLK	SRW	Record	MODE	0x01;0x01;0x11;0x10
6	STND	BLOCK_ERR	R	Simple	BIT_STRING	0
7	STND	UPDATE_EVT	RW	Record	ALARM_EVENT	0;0;0,0;0;0;0;0
8	STND	BLOCK_ALM	RW	Record	ALARM_DISC	0;0,0,0;0;0;0;0;0;0
9	STND	TRANSDUCER_DIRECTORY	NR	Array	UNSIGNED16	0
10	STND	TRANSDUCER_TYPE	NR	Simple	UNSIGNED16	106
11	STND	XD_ERROR	R	Simple	UNSIGNED8	0
12	STND	COLLECTION_DIRECTORY	NR	Array	UNSIGNED32	0
13	STND	FINAL_VALUE	NRW	Record	FLOAT_S	0x80;0.0
14	MFG	WORKING_SP	RW	Simple	FLOATING_POINT	0
15	MFG	FINAL_POSITION_VALUE	NR	Record	FLOAT_S	0x80,0.0
16	MFG	CONTROLLER_STATE_STATUS	R	Simple	BIT_STRING	0
17	MFG	CONTROLLER_STATE_MASKING	NRW	Simple	BIT_STRING	0
18	MFG	POSITIONER_STATUS	R	Simple	BIT_STRING	0
19	MFG	POSITIONER_MASKING	NRW	Simple	BIT_STRING	0
20	MFG	DEVIATION_VALUE	R	Simple	FLOATING_POINT	0
21	MFG	PRESSURE_SUPPLY	R	Simple	FLOATING_POINT	0
22	MFG	PRESSURE_PORT_A	R	Simple	FLOATING_POINT	0
23	MFG	PRESSURE_PORT_B	R	Simple	FLOATING_POINT	0
24	MFG	TEST_MODE	RW	Simple	BIT_STRING	0
25	MFG	CALIBRATE	RW	Simple	UNSIGNED8	0

26	MFG	CALIBRATION_STATUS	R	Simple	BIT_STRING	0
27	MFG	MAIN_RESERVED_1	NRW	Simple	FLOATING_POINT	0
28	MFG	P_GAIN	SRW	Simple	FLOATING_POINT	2
29	MFG	I_GAIN	SRW	Simple	INTEGER16	10
30	MFG	D_GAIN	SRW	Simple	UNSIGNED16	2
31	MFG	PRESS_CTRL_GAIN	SRW	Simple	FLOATING_POINT	0
32	MFG	PRESS_CTRL_WINDOW	SRW	Simple	FLOATING_POINT	0
33	MFG	FINAL_VALUE_CUTOFF_HI	SRW	Simple	FLOATING_POINT	100
34	MFG	FINAL_VALUE_CUTOFF_LO	SRW	Simple	FLOATING_POINT	0
35	MFG	STOP_HI_POS	SRW	Simple	FLOATING_POINT	110
36	MFG	STOP_LO_POS	SRW	Simple	FLOATING_POINT	10
37	MFG	STROKE_TIME_OPEN_LIM	NRW	Record	FLOAT_S	0x02,0.0
38	MFG	STROKE_TIME_CLOSE_LIM	NRW	Record	FLOAT_S	0x02,0.0
39	MFG	MAIN_RESERVED_2	NRW	Simple	FLOATING_POINT	0
40	MFG	PRESSURE_SUPPLY_CAL_REF	NRW	Simple	FLOATING_POINT	0
41	MFG	CYCLE_CNTR	NRW	Simple	UNSIGNED32	0
42	MFG	CYCLE_CNTR_LIM	SRW	Simple	UNSIGNED32	4294967294
43	MFG	CYCLE_CNTR_DEADBAND	SRW	Simple	FLOATING_POINT	20
44	MFG	TRAVEL_ACCUM	NRW	Simple	UNSIGNED32	0
45	MFG	TRAVEL_ACCUM_LIM	SRW	Simple	UNSIGNED32	0
46	MFG	TRAVEL_ACCUM_DEADBAND	SRW	Simple	FLOATING_POINT	20
47	MFG	STROKE_LENGTH	SRW	Simple	FLOATING_POINT	0
48	MFG	POS_ALERT_HI	SRW	Simple	FLOATING_POINT	110
49	MFG	POS_ALERT_LO	SRW	Simple	FLOATING_POINT	10
50	MFG	POS_DEADBAND	SRW	Simple	FLOATING_POINT	10
51	MFG	POS_DEVIATION_TIME	SRW	Simple	FLOATING_POINT	60
52	MFG	INTERNAL_TEMP	R	Simple	FLOATING_POINT	0
53	MFG	HOURS_SINCE_LAST_POWERUP	NRW	Simple	FLOATING_POINT	0
54	MFG	HOURS_SINCE_LAST_RESET	NRW	Simple	FLOATING_POINT	0
55	MFG	HOURS_LIFE_TIME	NRW	Simple	FLOATING_POINT	0
56	MFG	SIG_START	NRW	Simple	FLOATING_POINT	0
57	MFG	SIG_STOP	NRW	Simple	FLOATING_POINT	100
58	MFG	SIG_RATE	NRW	Simple	FLOATING_POINT	100
59	MFG	SIG_HOLD	NRW	Simple	FLOATING_POINT	10
60	MFG	SIG_INDEX	NRW	Simple	UNSIGNED16	0
61	MFG	SIG_FLAGS	NRW	Simple	BIT_STRING	0
62	MFG	TRAVEL_ACCUM_UNITS	SRW	Simple	UNSIGNED8	57
63	MFG	PRESSURE_UNITS	SRW	Simple	UNSIGNED8	0x06
64	MFG	INTERNAL_TEMP_UNITS	SRW	Simple	UNSIGNED8	0x21
65	MFG	XD_FSTATE_OPT	SRW	Simple	UNSIGNED8	0
66	MFG	ELECTRONICS_SN	NR	Simple	VISIBLE_STRING	"00000000"
67	MFG	SOFTWARE_VER_MAJOR	NR	Simple	UNSIGNED16	0
68	MFG	SOFTWARE_VER_MINOR	NR	Simple	UNSIGNED16	0
69	MFG	SOFTWARE_DATE_CODE	SRW	Simple	VISIBLE_STRING	" "
70	MFG	VALVE_MAN_ID	NRW	Simple	UNSIGNED8	99
71	MFG	VALVE_MODEL_NUM	NRW	Simple	VISIBLE_STRING	" "
72	MFG	VALVE_TYPE	NRW	Simple	UNSIGNED8	99
73	MFG	VALVE_SIZE	NRW	Simple	UNSIGNED8	99
74	MFG	VALVE_CLASS	NRW	Simple	UNSIGNED8	99
75	MFG	VALVE_ENDCON	NRW	Simple	UNSIGNED8	99
76	MFG	VALVE_BODYMAT	NRW	Simple	UNSIGNED8	99
77	MFG	VALVE_PACKTYPE	NRW	Simple	UNSIGNED8	99

78	MFG	LEAK_CLASS	NRW	Simple	UNSIGNED8	99
79	MFG	VALVE_FLAGS	NRW	Simple	UNSIGNED8	99
80	MFG	VALVE_TRIMMAT	NRW	Simple	UNSIGNED8	99
81	MFG	VALVE_TRIMCHAR	NRW	Simple	UNSIGNED8	99
82	MFG	VALVE_TRIMTYPE	NRW	Simple	UNSIGNED8	99
83	MFG	VALVE_TRIMNO	NRW	Simple	UNSIGNED8	99
84	MFG	VALVE_SN	NRW	Simple	VISIBLE_STRING	" "
85	MFG	STEM_DIAM	NRW	Simple	FLOATING_POINT	0
86	MFG	RATED_TRAV	NRW	Simple	FLOATING_POINT	0
87	MFG	INLET_PRESS	NRW	Simple	FLOATING_POINT	0
88	MFG	OUTLET_PRESS	NRW	Simple	FLOATING_POINT	0
89	MFG	ACT_MAN_ID	NRW	Simple	UNSIGNED8	0
90	MFG	ACT_FAIL_ACTION	NRW	Simple	UNSIGNED8	0
91	MFG	ACT_MODEL_NUM	NRW	Simple	VISIBLE_STRING	All " "
92	MFG	ACT_SN	NRW	Simple	VISIBLE_STRING	All " "
93	MFG	ACT_TYPE	NRW	Simple	UNSIGNED8	99
94	MFG	ACT_SIZE	NRW	Simple	UNSIGNED8	105
95	MFG	ACT_AREA	NRW	Simple	FLOATING_POINT	23.8
96	MFG	SPRING_TYPE	NRW	Simple	UNSIGNED8	99
97	MFG	PO_DATE	NRW	Simple	VISIBLE_STRING	" "
98	MFG	INSTALL_DATE	NRW	Simple	VISIBLE_STRING	" "
99	MFG	MFG_PHONE	NRW	Simple	VISIBLE_STRING	" "
100	MFG	PUR_ORDER_NUM	NRW	Simple	VISIBLE_STRING	" "
101	MFG	FINAL_VALUE_RANGE	SRW	Record	SCALE	100.0,0.0,0x53e,1
102	MFG	XD_CAL_LOC	SRW	Simple	VISIBLE_STRING	" "
103	MFG	XD_CAL_DATE	SRW	Simple	VISIBLE_STRING	" "
104	MFG	XD_CAL_WHO	SRW	Simple	VISIBLE_STRING	" "
105	MFG	MAIN_RESERVED_3	RW	Simple	FLOATING_POINT	0
106	MFG	MAIN_RESERVED_4	RW	Simple	FLOATING_POINT	0
107	MFG	CONTROL_CONFIG	NRW	Simple	BIT_STRING	0
108	MFG	MISC_CONFIG	NRW	Simple	BIT_STRING	0
109	MFG	MAIN_BLOCK_TEST	R	Array	UNSIGNED8	0,0,0,0,0,0,0,0
110	MFG	MAIN_RESERVED_5	RW	Simple	FLOATING_POINT	0
111	MFG	EXEC_DELAY	SRW	Simple	UNSIGNED16	0
112	MFG	MAIN_RESERVED_6	RW	Simple	FLOATING_POINT	0
113	MFG	BLINK_CODE	R	Simple	UNSIGNED8	0

Access Type

NOTE: How the Fieldbus board accesses the respective Control board variable.

- Std - Standard Parameters. These values are constantly updated from the Control Board, except during the 'Signature' capture.

- Info - Device Information Parameters. These values are read only at start-up or when any of them are changed. The number -n is used to group parameters into manageable sizes.

- Diag - Advanced Diagnostic

- Parameters - These values are active only when the parameter 'Enable diagnostic Variable Access' is set in TEST_MODE.

Transducer Block Diagram

Figure 8.2 is a block diagram showing the basic components of the transducer block.
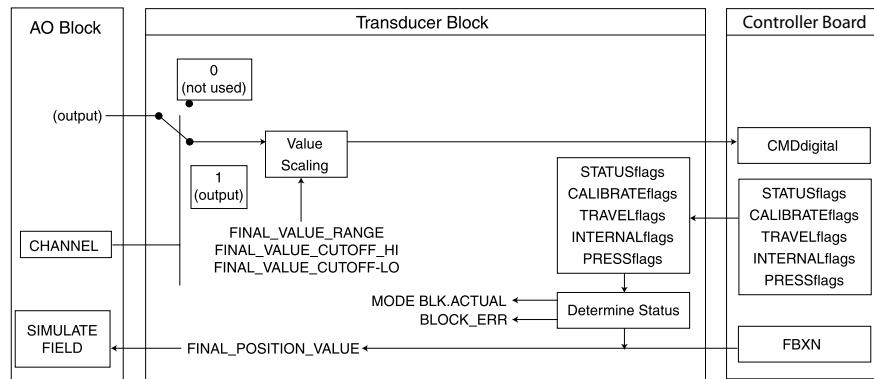
Figure 8.2 Transducer Block Diagram

Transducer Block Valtek Product-defined Parameters

Table 8.6 describes the Logix parameters included in the transducer block.

Table 8.6 Transducer Block Parameter Descriptions

Parameter	Default Value	Function
FINAL_VALUE_CUTOFF_HI	110%	This will saturate the actuator in an open position if FINAL_VALUE becomes greater than the cutoff value.
FINAL_VALUE_CUTOFF_LO	1%	This will saturate the actuator in a close position if FINAL_VALUE becomes less than the cutoff value. This is the same as the Minimum Position Cutoff feature of the Logix1200 digital positioner. The new terminology matches FF terminology.
FINAL_POSITION_VALUE	Dynamic	Actual stem position in percent of stroke
FINAL_VALUE_RANGE	110%to-10%	The high and low range limit values, the engineering units code and the number of digits to the right of the decimal point to be used to display the final value.
TEST_MODE	0	Used to enable certain parameter outputs and diagnostic control.
CONTROL_CONFIG	0	Used to configure the positioner.
PGAIN	2	Proportional gain.
DGAIN	2	Derivative gain.
IGAIN	10	Integral gain.
SOFTSTOP_HIGH	110%	Software upper stroke limit
SOFTSTOP_LOW	-10%	Software lower stroke limit
PRESS_UNITS	Psi	Units pressure sensors reading are expressed in.
TEMP_UNITS	DegF	Units temperature is expressed in.

Parameter Definitions

The following list summarizes some of the key parameters within the Logix 3400MD digital positioner. For definitions of parameters not listed, use the help window in the DD view. The Logix positioner automatically stores changed parameters in non-volatile memory when a change is made.

FINAL_VALUE: This is the set-point or command received by the 3400MD.

FINAL_VALUE_CUTOFF_HI : If FINAL_VALUE is greater than FINAL_VALUE_CUTOFF_HI, the positioner will saturate the actuator in an open position. A 1 percent hysteresis is added, so FINAL_ VALUE must be more than 1 percent smaller than FINAL_VALUE_CUTOFF_HI, before the positioner will allow the valve to start closing. This feature is disabled in SOFTSTOP_HIGH is less than or equal to 100 percent.

FINAL_VALUE_CUTOFF_LO: If FINAL_VALUE is less than FINAL_VALUE_CUTOFF_LO the positioner will saturate the actuator in a closed position. There is a 1 percent hysteresis added, so FINAL_VALUE must be more than 1 percent of FINAL_VALUE_CUTOFF_LO, before the positioner will allow the valve to start opening. This feature is disabled in SOFTSTOP_LOW is less than or equal to 0 percent.

FINAL_POSITION_VALUE: This is the valve's stem position, as sensed by the positioner. This value is always reported in percent of stroke.

TEST_MODE: This parameter is used to enable the diagnostic parameters in the Transducer Tech Block for continuous update. Also, this can be used to set the mode to allow write to the DAC directly to test the spool control.

CONTROL_CONFIG: These are flags used to set the configuration of the positioner.

- Local Panel disable allows the user to disable any button pushes or changes to be made at the device.

- Continuous Friction Mode Enable allows the user to enable or disable the continuous friction mode.

- Pressure Control Enabled allows the user to enable or disable the pressure control function.

- Pressure Sensor Board Present is set by the device indicating that a functioning pressure board has been installed into the device.

- Single Action Enabled allows the user to select between single acting and double acting.

PGAIN: The Logix 3400MD digital positioner uses a special gain algorithm. The proportional gain increases with a decrease in error. This allows for maximum resolution and speed. GAIN_UPPER is the upper limit to proportional gain.

DGAIN: The Logix 3400MD digital positioner uses a special gain algorithm. The proportional gain increases with a decrease in error. This allows for maximum resolution and speed. GAIN_ LOWER is the lower limit to proportional gain.

IGAIN: In addition to proportional gain the Logix uses integral as well. This in the integral gain setting. Typically this is set to 10.

CALIBRATE: This parameter initiates calibration. Two types of calibration are available Stroke, Pressure Sensors (advanced/pro models only). To learn more about calibration refer to the Calibration section of this document.

STOP_HIGH_POS: Software imposed stroke limit. The positioner will not allow the valve to open beyond the value shown in this parameter.

STOP_LOW_POS: Software imposed stroke limit. The positioner will not allow the valve to close beyond the value shown in this parameter, normally psi.

CYCLE_CNTR This parameter counts the number of cycles that have occurred.

CYCLE_DEADBAND In order for a cycle to be counted it must be greater than the value in this field.

CYCLE_CNTR_LIM_CNTR If CYCLE_COUNTER exceeds this value, the LED lights will start to blink Green, Red, Green, Green and a warning will be generated in TRAVEL_FLAGS.

TRAVEL_ACCUM: Total distance the valve stem has traveled.

TRAVEL_ACCUM_DEADBAND: Amount in percent of stroke the valve must move in order for the movement to be added to TRAVEL_ENG.

TRAVEL_ALERT:_LIM If TRAVEL_ENG exceeds this value, the LED lights will start to blink Green, Red, Green, Green and a warning will be generated in TRAVEL_FLAGS.

STROKE_LENGTH: Stoke length of valve. This value is used to calculate TRAVEL_ENG.

TRAVEL_UNITS Units of measure used to calculate TRAVEL_ENG.

PRESS_UNITS Units of measure that pressure sensor readings are expressed in.

TEMP_UNITS Units of measure that temperature is expressed in.

Note: The stroke limiting feature could be used to make a valve very responsive to small steps. By increasing the nominal gain values, and limiting the stroke speed, small steps would be subject to very high gains. When active, the algorithm scales back large step sizes, thus limiting the undesired effects large gains normally demonstrate on large step sizes, such as overshoot.

Signatures See Section 10.13, Initiating a Valve Signature for more details on using the signature acquisition functions of the Logix 3400MD digital positioner.

Custom Characterization See Section 10.11, Stroke Characterization for more details on using the custom characterization features of the Logix 3400MD digital positioner.

8.6   Tech Transducer Block

The Tech Transducer block contains the parameters used by a technician to troubleshoot a positioner. Many of these parameters are not updated on a regular basis. In order to cause these parameters to update on a regular basis the TEST_MODE parameter in the Main Transducer block must have the diagnostics enabled.

Section 10.16 Lists the parameters that do not update unless TEST_MODE is selected.

Table 8.7 Tech Transducer Block Parameters

Index	Origin	Name	Store		Date Type	Default Value
0	STND	XDTB_TECH	SRW	Record	BLOCK	0
1	STND	ST_REV	SR	Simple	UNSIGNED16	1
2	STND	TAG_DESC	SRW	Simple	OCTET_STRING	"7 "
3	STND	STRATEGY	SRW	Simple	UNSIGNED16	2
4	STND	ALERT_KEY	SRW	Simple	UNSIGNED8	4
5	STND	MODE_BLK	SRW	Record	MODE	0x01;0x01;0x11;0x10
6	STND	BLOCK_ERR	R	Simple	BIT_STRING	0
7	STND	UPDATE_EVT	RW	Record	ALARM_EVENT	0;0;0,0;0;0;0;0
8	STND	BLOCK_ALM	RW	Record	ALARM_DISC	0;0;0,0;0;0;0;0;0;0
9	STND	TRANSDUCER_DIRECTORY	NR	Array	UNSIGNED16	0
10	STND	TRANSDUCER_TYPE	NR	Simple	UNSIGNED16	106
11	STND	XD_ERROR	R	Simple	UNSIGNED8	0
12	STND	COLLECTION_DIRECTORY	NR	Array	UNSIGNED32	0
13	MFG	ELECTRONIC_STATUS	R	Simple	BIT_STRING	0
14	MFG	ELECTRONIC_MASKING	NRW	Simple	BIT_STRING	0
15	MFG	INNERLOOP_STATUS	R	Simple	BIT_STRING	0
16	MFG	INNERLOOP_MASKING	NRW	Simple	BIT_STRING	0
17	MFG	OUTERLOOP_STATUS	R	Simple	BIT_STRING	0
18	MFG	OUTERLOOP_MASKING	NRW	Simple	BIT_STRING	0
19	MFG	CONFIGURATION_STATUS	R	Simple	BIT_STRING	0
20	MFG	CONFIGURATION_MASKING	NRW	Simple	BIT_STRING	0
21	MFG	PRESSURE_STATUS	R	Simple	BIT_STRING	0
22	MFG	PRESSURE_MASKING	NRW	Simple	BIT_STRING	0
23	MFG	DEVIATION_EFFORT	R	Simple	FLOATING_POINT	0
24	MFG	PRESS_CTRL_EFFORT	R	Simple	FLOATING_POINT	0
25	MFG	INTEGRAL_EFFORT	R	Simple	FLOATING_POINT	0
26	MFG	SPOOL_OFFSET	RW	Simple	FLOATING_POINT	0
27	MFG	SPOOL_COMMAND	RW	Simple	FLOATING_POINT	0
28	MFG	BACKOFF_EFFORT	R	Simple	FLOATING_POINT	0
29	MFG	SPOOL_POSITION	R	Simple	FLOATING_POINT	0
30	MFG	SPOOL_EFFORT	R	Simple	FLOATING_POINT	0
31	MFG	PIEZO_OFFSET	R	Simple	FLOATING_POINT	0
32	MFG	PIEZO_COMMAND	R	Simple	FLOATING_POINT	0
33	MFG	USER_INTERFACE_INSTANT	R	Simple	BIT_STRING	0
34	MFG	USER_INTERFACE_ACTIVE	RW	Simple	BIT_STRING	0
35	MFG	P_GAIN_EFFECTIVE	R	Simple	FLOATING_POINT	0
36	MFG	P_GAIN_MULT	SRW	Simple	FLOATING_POINT	0.05

Index	Origin	Name	Store		Date Type	Default Value
37	MFG	D_GAIN_EFFECTIVE	R	Simple	UNSIGNED16	0
38	MFG	D_GAIN_FILTER	SRW	Simple	UNSIGNED16	0
39	MFG	PRESS_CTRL_GAIN_EFFECTIVE	R	Simple	FLOATING_POINT	0
40	MFG	PRESS_CTRL_GAIN_MULT	SRW	Simple	FLOATING_POINT	0.05
41	MFG	PRESS_CTRL_SP	SRW	Simple	FLOATING_POINT	0
42	MFG	FINAL_VALUE_CUTTOFF_HYSTERESIS	SRW	Simple	FLOATING_POINT	0
43	MFG	CURVEX	SRW	Array	FLOATING_POINT	All 21
44	MFG	CURVEY	SRW	Array	FLOATING_POINT	All 21
45	MFG	STROKE_TIME_CAL	R	Simple	FLOATING_POINT	0
46	MFG	STROKE_TIME_DOWN	R	Simple	FLOATING_POINT	0
47	MFG	STROKE_TIME_UP	R	Simple	FLOATING_POINT	0
48	MFG	HALL_DOWN	SRW	Simple	UNSIGNED16	0
49	MFG	HALL_UP	SRW	Simple	UNSIGNED16	0
50	MFG	HALL_RANGE	SRW	Simple	UNSIGNED16	0
51	MFG	HALL_AD_COUNT	R	Simple	UNSIGNED16	0
52	MFG	HALL_NULL	SRW	Simple	UNSIGNED16	0
53	MFG	FB_ZERO	SRW	Simple	UNSIGNED16	0
54	MFG	FB_OPEN	SRW	Simple	UNSIGNED16	23505
55	MFG	FB_RANGE	SRW	Simple	INTEGER32	0
56	MFG	FB_AD_COUNT	R	Simple	UNSIGNED16	0
57	MFG	PORT_A_ZERO	SRW	Simple	UNSIGNED16	0
58	MFG	PORT_A_FULL	SRW	Simple	UNSIGNED16	1200
59	MFG	PORT_A_RANGE	SRW	Simple	INTEGER16	1200
60	MFG	PORT_A_AD_COUNT	R	Simple	UNSIGNED16	0
61	MFG	PORT_B_ZERO	SRW	Simple	UNSIGNED16	0
62	MFG	PORT_B_FULL	SRW	Simple	UNSIGNED16	1200
63	MFG	PORT_B_RANGE	SRW	Simple	INTEGER16	1200
64	MFG	PORT_B_AD_COUNT	R	Simple	UNSIGNED16	0
65	MFG	SUPPLY_PRESS_REF_PSI	R	Simple	FLOATING_POINT	0
66	MFG	PIEZO_COUNTER	R	Simple	UNSIGNED32	0
67	MFG	PIEZO_INTERVAL	NRW	Simple	UNSIGNED16	0
68	MFG	HALL_TGT	R	Simple	FLOATING_POINT	0
69	MFG	FB_VOLTS	R	Simple	FLOATING_POINT	0
70	MFG	HALL_VOLTS	R	Simple	FLOATING_POINT	0
71	MFG	PIEZO_VOLTS	R	Simple	FLOATING_POINT	0
72	MFG	REF_VOLTS	R	Simple	FLOATING_POINT	0
73	MFG	FB_POSITION_FILTER	SRW	Simple	UNSIGNED16	0
74	MFG	LOAD_EE_DEFAULTS	RW	Simple	UNSIGNED8	0
75	MFG	NVRAM_WRITE_CYCLES	NR	Simple	UNSIGNED32	0
76	MFG	GENERIC_PARAMETER	RW	Record	GENERIC_S	0;0;0
77	MFG	SPI_TEST_RCV	R	Array	UNSIGNED8	All 0
78	MFG	SPI_TEST_TX	R	Array	UNSIGNED8	All 0
79	MFG	TECH_BLOCK_TEST	R	Array	UNSIGNED8	0,0,0,0,0,0,0,0
80	MFG	EXEC_DELAY	SRW	Simple	UNSIGNED16	0
81	MFG	LX_SPI_STATUS_FLAGS	NR	Simple	BIT_STRING	0
82	MFG	SUPPLY_PRESSURE_PCT	R	Simple	FLOATING_POINT	0
83	MFG	PORT_A_PRESSURE_PCT	R	Simple	FLOATING_POINT	0
84	MFG	PORT_B_PRESSURE_PCT	R	Simple	FLOATING_POINT	0
85	MFG	TEMPERATURE_HIST	R	Array	FLOATING_POINT	All 0
86	MFG	ERROR_HIST	R	Array	UNSIGNED8	All 0
87	MFG	CURVE_SELECT	SRW	Simple	UNSIGNED8	0

Index	Origin	Name	Store		Date Type	Default Value
88	MFG	SIG_DATA1	R	Array	INTEGER16	All 0
89	MFG	SIG_DATA2	R	Array	INTEGER16	All 0
90	MFG	SIG_DATA3	R	Array	INTEGER16	All 0
91	MFG	SIG_DATA4	R	Array	INTEGER16	All 0
92	MFG	SIG_DATA5	R	Array	INTEGER16	All 0
93	MFG	SIG_DATA6	R	Array	INTEGER16	All 0
94	MFG	SIG_DATA7	R	Array	INTEGER16	All 0
95	MFG	SIG_DATA8	R	Array	INTEGER16	All 0
96	MFG	SIG_DATA9	R	Array	INTEGER16	All 0
97	MFG	SIG_DATA10	R	Array	INTEGER16	All 0
98	MFG	SIG_DATA11	R	Array	INTEGER16	All 0
99	MFG	SIG_DATA12	R	Array	INTEGER16	All 0
100	MFG	SIG_DATA13	R	Array	INTEGER16	All 0
101	MFG	SIG_DATA14	R	Array	INTEGER16	All 0
102	MFG	SIG_DATA15	R	Array	INTEGER16	All 0
103	MFG	SIG_DATA16	R	Array	INTEGER16	All 0
104	MFG	SIG_DATA17	R	Array	INTEGER16	All 0
105	MFG	SIG_DATA18	R	Array	INTEGER16	All 0
106	MFG	SIG_DATA19	R	Array	INTEGER16	All 0
107	MFG	SIG_DATA20	R	Array	INTEGER16	All 0
108	MFG	SIG_DATA21	R	Array	INTEGER16	All 0
109	MFG	SIG_DATA22	R	Array	INTEGER16	All 0
110	MFG	SIG_DATA23	R	Array	INTEGER16	All 0
111	MFG	SIG_DATA24	R	Array	INTEGER16	All 0
112	MFG	SIG_DATA25	R	Array	INTEGER16	All 0
113	MFG	SIG_DATA26	R	Array	INTEGER16	All 0

Parameter Definitions

The Tech Transducer Block contains many of the parameters that are used by a technician. Make sure the TEST_MODE parameter in the Main Transducer Block has been set to enable diagnostic parameters when viewing the parameter in this block.

P_**GAIN_MULT:** The Logix 3400MD digital positioner uses a special gain algorithm. The proportional gain increases with a decrease in error. This allows for maximum resolution and speed. GAIN_MULT adjust the transition rate between GAIN_UPPER and GAIN_LOWER.

SPOOL_OFFSET: This parameter tells the positioner where the spool valve's null position is. This value is set during a stroke calibration procedure and requires no further adjustment.

USER_INTERFACE_INSTANT: This parameter shows the instant value of the front panel DIP switches, button presses, and gain selector switch. These values are stored into the USER_INTERFACE_ACTIVE parameter during a Quick-Cal.

USER_INTERFACE_ACTIVE: This parameter is actually used by the system and allows the user to change the front panel settings without actually changing the setting on the physical device. If these settings match the DIP switches then this parameter should not have to be changed. The settings that are changed through this parameter are as follows:

- Air Action ATO Enabled: allows the user to set the device to Air-to-Close or Air-to-Open.

- Characterization Linear: allows the user to select what characterization is requested. When this is set to "other" then the CURVE_SELECT parameter must be set.

- Autotune Enabled: allows the user to enable or disable the autotune feature.

- Low Friction Mode: allows the user to specify the device to operate in low or high friction mode.

- Calibration Auto: allows the user to specify the auto calibration (default) or to enter into a job calibration mode.

LX_SPI_STATUS_FLAGS Should a loss of communications occur between the fieldbus card and positioner card this parameter sets the fail mode of the valve. Nothing selected will cause the positioner to hold the last known command should a loss of communications occurs.

STROKE_TIME_UP: Allows the user to limit the stroking speed of the positioner. Input the number of seconds for the desired opening stroke speed. Disable this feature by writing 0 to the variable.

STROKE_TIME_DN: Allows the user to limit the stroking speed of the positioner. Input the number of seconds for the desired closing stroke speed. Disable this feature by writing 0 to the variable.

CURVE_SELECT: This parameter allows the user to select what type of characterization curves the positioner will use. The selections are Equal Percent, Quick Open, or Custom. If Custom is selected, the parameters CURVEX and CURVEY must be initialized.

NVRAM_WRITE_CYCLES: This is a diagnostic parameter that allows the user to monitor the number of times the NVRAM is written to. This can be a useful diagnostic tool for checking if the host system is writing to the Fieldbus board memory too often. This is often a configuration error in the host system setup. Excessive write cycles can cause configuration upsets and possible communications slowdowns and errors. It also will shorten the operational life of a Fieldbus device by exceeding the finite number of write cycles NVRAM chips can be used reliably to. These devices typically have a minimum 10,000,000 write cycle endurance. Even though this is a very high number that would typically never be reached during the operational life of the device, a misbehaving host configuration routing could drive up the number of write cycles very quickly, and should be corrected as all devices in the configuration will be adversely affected by this continuous download.

8.7 MD Transducer Block

The MD Transducer block contains the parameters used by the advanced and pro model of the Logix 3400MD. These parameters are used for diagnostics and error detection of the system.

Table 8.8 Transducer Block Parameters

Index	Origin	Name	Store	Date Type		Default Value
0	STND	XDTB_MD	SRW	Record	BLOCK	0
1	STND	ST_REV	SR	Simple	UNSIGNED16	1
2	STND	TAG_DESC	SRW	Simple	OCTET_STRING	"7 "
3	STND	STRATEGY	SRW	Simple	UNSIGNED16	2
4	STND	ALERT_KEY	SRW	Simple	UNSIGNED8	4
5	STND	MODE_BLK	SRW	Record	MODE	0x01;0x01;0x11;0x10
6	STND	BLOCK_ERR	R	Simple	BIT_STRING	0
7	STND	UPDATE_EVT	RW	Record	ALARM_EVENT	0;0;0,0;0;0;0;0
8	STND	BLOCK_ALM	RW	Record	ALARM_DISC	0;0;0,0;0;0;0;0;0;0
9	STND	TRANSDUCER_DIRECTORY	NR	Array	UNSIGNED16	0
10	STND	TRANSDUCER_TYPE	NR	Simple	UNSIGNED16	106
11	STND	XD_ERROR	R	Simple	UNSIGNED8	0
12	STND	COLLECTION_DIRECTORY	NR	Array	UNSIGNED32	0
13	MFG	LD_MD_MODE	R	Simple	UNSIGNED8	0
14	MFG	MECHANICAL_STATUS	R	Simple	BIT_STRING	0
15	MFG	MECHANICAL_MASKING	NRW	Simple	BIT_STRING	0
16	MFG	VALVE_TRAVEL_DISTANCE	R	Simple	FLOATING_POINT	0
17	MFG	VALVE_TRAVEL_HIGH_START	RW	Simple	FLOATING_POINT	0
18	MFG	VALVE_TRAVEL_HIGH_END	RW	Simple	FLOATING_POINT	0
19	MFG	VALVE_TRAVEL_PERCENT_YELLOW	NR	Simple	FLOATING_POINT	0
20	MFG	VALVE_CYCLE_COUNT	R	Simple	UNSIGNED32	0
21	MFG	VALVE_CYCLE_HIGH_START	RW	Simple	UNSIGNED32	0
22	MFG	VALVE_CYCLE_HIGH_END	RW	Simple	UNSIGNED32	0
23	MFG	VALVE_CYCLE_PERCENT_YELLOW	NR	Simple	FLOATING_POINT	0
24	MFG	PST_TIME_BREAKAWAY	NR	Simple	FLOATING_POINT	0
25	MFG	PST_PRESSURE_DIFF	R	Simple	FLOATING_POINT	0

Index	Origin	Name	Store	Date Type		Default Value
26	MFG	PST_TIME_TO_TARGET	NR	Simple	FLOATING_POINT	0
27	MFG	PST_RESULT	R	Simple	UNSIGNED8	0
28	MFG	PST_TIMELIMIT	RW	Simple	FLOATING_POINT	0
29	MFG	ACTUATOR_RATIO	RW	Simple	FLOATING_POINT	0
30	MFG	ACTUATOR_RATIO_HIGH_START_LIMIT	RW	Simple	FLOATING_POINT	0
31	MFG	ACTUATOR_RATIO_HIGH_END_LIMIT	RW	Simple	FLOATING_POINT	0
32	MFG	ACTUATOR_RATIO_PERCENT_YELLOW	NR	Simple	FLOATING_POINT	0
33	MFG	SPOOL_CYCLE_HIGH_START_LIMIT	RW	Simple	UNSIGNED32	0
34	MFG	SPOOL_CYCLE_HIGH_END_LIMIT	RW	Simple	UNSIGNED32	0
35	MFG	SPOOL_CYCLES	NR	Simple	UNSIGNED32	0
36	MFG	CYCLE_TRAVEL_RESET	RW	Simple	BIT_STRING	0
37	MFG	SPOOL_CYCLE_PERCENT_YELLOW	NR	Simple	FLOATING_POINT	0
38	MFG	SPOOL_TRAVEL_HIGH_START_LIMIT	RW	Simple	FLOATING_POINT	0
39	MFG	SPOOL_TRAVEL_HIGH_END_LIMIT	RW	Simple	FLOATING_POINT	0
40	MFG	SPOOL_TRAVEL_PERCENT	R	Simple	FLOATING_POINT	0
41	MFG	SPOOL_TRAVEL_PERCENT_YELLOW	NR	Simple	FLOATING_POINT	0
42	MFG	TREND_STATE	RW	Simple	UNSIGNED8	1
43	MFG	TREND_INDEX	RW	Simple	UNSIGNED8	0
44	MFG	TREND_DATESTAMP	R	Array	UNSIGNED8	0,0,0,0,0,0
45	MFG	MD_RESERVED_1	RW	Simple	FLOATING_POINT	0
46	MFG	MD_RESERVED_2	RW	Simple	FLOATING_POINT	0
47	MFG	MD_RESERVED_3	RW	Simple	FLOATING_POINT	0
48	MFG	MD_RESERVED_4	RW	Simple	FLOATING_POINT	0
49	MFG	MD_RESERVED_5	RW	Simple	FLOATING_POINT	0
50	MFG	SPOOL_RESPONSE_TIME	NR	Simple	FLOATING_POINT	0
51	MFG	SPOOL_START_LIMIT	NRW	Simple	FLOATING_POINT	0
52	MFG	SPOOL_END_LIMIT	NRW	Simple	FLOATING_POINT	0
53	MFG	SPOOL_PERCENT	R	Simple	FLOATING_POINT	0
54	MFG	PNEUMATIC_LEAK	NR	Simple	FLOATING_POINT	0
55	MFG	PNEUMATIC_LEAK_START	NRW	Simple	FLOATING_POINT	0
56	MFG	PNEUMATIC_LEAK_END	NRW	Simple	FLOATING_POINT	0
57	MFG	PNEUMATIC_LEAK_PERCENT_YELLOW	NR	Simple	FLOATING_POINT	0
58	MFG	FORCE_PRESSURE	R	Simple	INTEGER16	0
59	MFG	FORCE_SPRING	R	Simple	INTEGER16	0
60	MFG	FORCE_ACTUATOR	R	Simple	INTEGER16	0
61	MFG	DEVIATION_TIMES_EFFECTIVE_GAIN	R	Simple	INTEGER16	0
62	MFG	WORST_VALVE_HEALTH	R	Simple	FLOATING_POINT	0
63	MFG	WORST_ACTUATOR_HEALTH	R	Simple	FLOATING_POINT	0
64	MFG	WORST_POSITIONER_HEALTH	R	Simple	FLOATING_POINT	0
65	MFG	WORST_CONTROL_HEALTH	R	Simple	FLOATING_POINT	0
66	MFG	SUPPLY_PRESSURE_HIGH_START_LIMIT	RW	Simple	FLOATING_POINT	0
67	MFG	SUPPLY_PRESSURE_LOW_START_LIMIT	RW	Simple	FLOATING_POINT	0
68	MFG	SUPPLY_PRESSURE_LOW_END_LIMIT	RW	Simple	FLOATING_POINT	0
69	MFG	SUPPLY_PRESSURE_HIGH_PERCENT	NR	Simple	FLOATING_POINT	0
70	MFG	SUPPLY_PRESSURE_LOW_PERCENT	NR	Simple	FLOATING_POINT	0
71	MFG	FRICTION	R	Simple	INTEGER16	0
72	MFG	FRICTION_STARTING	R	Simple	UNSIGNED16	0
73	MFG	FRICTION_HIGH_START_LIMIT	RW	Simple	UNSIGNED16	0
74	MFG	FRICTION_HIGH_END_LIMIT	RW	Simple	UNSIGNED16	0
75	MFG	FRICTION_LOW_START_LIMIT	RW	Simple	UNSIGNED16	0
76	MFG	FRICTION_LOW_END_LIMIT	RW	Simple	UNSIGNED16	0
77	MFG	FRICTION_HIGH_PERCENT_YELLOW	NR	Simple	FLOATING_POINT	0

Index	Origin	Name	Store	Date Type		Default Value
78	MFG	FRICTION_LOW_PERCENT_YELLOW	NR	Simple	FLOATING_POINT	0
79	MFG	PRESSURE_DIFFERENTIAL	R	Simple	FLOATING_POINT	0
80	MFG	MD_BLOCK_TEST	R	Array	UNSIGNED8	0,0,0,0,0,0,0,0
81	MFG	EXEC_DELAY	SRW	Simple	UNSIGNED16	0
82	MFG	FRICTION_UNITS	RW	Simple	UNSIGNED8	0
83	MFG	TREND_DATA_1	R	Array	INTEGER16	All 0
84	MFG	TREND_DATA_2	R	Array	INTEGER16	All 0
85	MFG	TREND_DATA_3	R	Array	INTEGER16	All 0
86	MFG	TREND_DATA_4	R	Array	INTEGER16	All 0
87	MFG	TREND_DATA_5	R	Array	INTEGER16	All 0
88	MFG	TREND_DATA_6	R	Array	INTEGER16	All 0
89	MFG	TREND_DATA_7	R	Array	INTEGER16	All 0
90	MFG	TREND_DATA_8	R	Array	INTEGER16	All 0
91	MFG	TREND_DATA_9	R	Array	INTEGER16	All 0

8.8   Analog Output Function Block

AO Block Description

The Analog Output function block serves as the external interface for the transducer function block. The value of SP is used to produce the OUT value which is then sent to the transducer block to specify the valve position. PV reflects the actual valve position reported by the transducer block.

The AO function block operates on the output value from a control block [such as PID] and performs the following primary functions (most can be user configured):

Set-point source selection limiting

• Units conversion

• Fault state action

• Position read back

• Alarming

• Mode control

• Output calculation

The database contains the standard AO block database, as defined in the FF FBAP specifications. Flowserve product extensions are specified in the Logix 3400MD digital positioner parameter dictionary and are described below.

The interface to the AO block contains the following:

• Execute function block

• Database read access

• Alarm acknowledgment

• Database write access

AO Block Connections

CAS_IN is the only linkable input parameter and is used with a PID function block for direct cascade connection. RCAS_IN is a contained input parameter used for remote cascade connection.

OUT and BKCAL_OUT are linkable output parameters. RCAS_OUT is a contained output parameter for remote cascade connection.

The OUT parameter of the AO block is used to set the FINAL_POSITION_VALUE in the transducer block, as modified by the FINAL_VALUE_ RANGE.

READBACK_OUT tracks the valve position in percent.

Fail-safe Handling

The fail-safe parameters determine the response of an output block to the following conditions. FSTATE_TIME is the number of seconds without communication or with Initiate Fail Safe at the CAS_IN status, required to put this block into the fail safe state. The FAULT_STATE parameter of the resource block may also put this block into the fail safe state. The Failsafe Type I/O option determines whether the action is simply to hold, or to move to FSTATE_VAL.

The Target to Manual if IFS I/O option may be used to latch the fail safe state when IFS appears in the CAS_IN status. This will cause a fail-safe block alarm. After the cause of the IFS status is removed, the target mode may be returned manually to CAS mode when it is safe to do so Section 10.17 described how to setup the fail-safe handling.

AO Block Parameter List

Table 8.8 lists the block parameters and default values for the AO function block.

Table 8.9 AO Function Block Parameter List

Index	Origin	Name	Store		Date Type	Default Value
0	STND	ANALOG_OUTPUT_BLOCK	SRW	Record	BLOCK	0
1	STND	ST_REV	SR	Simple	UNSIGNED16	0
2	STND	TAG_DESC	SRW	Simple	OCTET_STRING	" "
3	STND	STRATEGY	SRW	Simple	UNSIGNED16	0
4	STND	ALERT_KEY	SRW	Simple	UNSIGNED8	0
5	STND	MODE_BLK	SRW	Record	MODE	0x01;0x01;0x79;0x10
6	STND	BLOCK_ERR	R	Simple	BIT_STRING	0
7	STND	PV	R	Record	FLOAT_S	0;0.0
8	STND	SP	NRW	Record	FLOAT_S	AO_VAL_SP_STATUS;AO_VAL_SP_VALUE
9	STND	OUT	NRWO	Record	FLOAT_S	0x80;0.0
10	STND	SIMULATE	RW	Record	SIM_FLOAT	0;0.0;0;0.0;1
11	STND	PV_SCALE	SRW	Record	SCALE	100.0;0.0;0;0
12	STND	XD_SCALE	SRW	Record	SCALE	100.0;0.0;0;0
13	STND	GRANT_DENY	RW	Record	ACCESS_PERM	0;0
14	STND	IO_OPTS|IO_OPTS_AO	SRW	Simple	BIT_STRING	0
15	STND	STATUS_OPTS|STATUS_OPTS_AO	SRW	Simple	BIT_STRING	0
16	STND	READBACK	R	Record	FLOAT_S	0x80;0.0
17	STND	CAS_IN	NRWI	Record	FLOAT_S	0xC3;0.0
18	STND	SP_RATE_DN	SRW	Simple	FLOATING_POINT	FLT_MAX
19	STND	SP_RATE_UP	SRW	Simple	FLOATING_POINT	FLT_MAX
20	STND	SP_HI_LIM	SRW	Simple	FLOATING_POINT	100
21	STND	SP_LO_LIM	SRW	Simple	FLOATING_POINT	0
22	STND	CHANNEL	SRW	Simple	UNSIGNED16	1
23	STND	FSTATE_TIME	SRW	Simple	FLOATING_POINT	0
24	STND	FSTATE_VAL	SRW	Simple	FLOATING_POINT	0
25	STND	BKCAL_OUT	RO	Record	FLOAT_S	0xcc;0.0
26	STND	RCAS_IN	NRW	Record	FLOAT_S	0x1C;0.0
27	STND	SHED_OPT	SRW	Simple	UNSIGNED8	0
28	STND	RCAS_OUT	R	Record	FLOAT_S	0xcc;0.0
29	STND	UPDATE_EVT	RW	Record	ALARM_EVENT	0;0;0;0;0;0;9;0
30	STND	BLOCK_ALM	RW	Record	ALARM_DISC	0;0;0;0;0;0;0;8;0;0
31	MFG	WSP	RW	Record	FLOAT_S	0,0.0
32	MFG	READBACK_OUT	RO	Record	FLOAT_S	0x80;0.0
33	MFG	AO_BLOCK_TEST	R	Array	UNSIGNED8	0,0,0,0,0,0,0,0

AO Block Diagram

Figure 8.3 is a block diagram showing the key components of the AO function block.
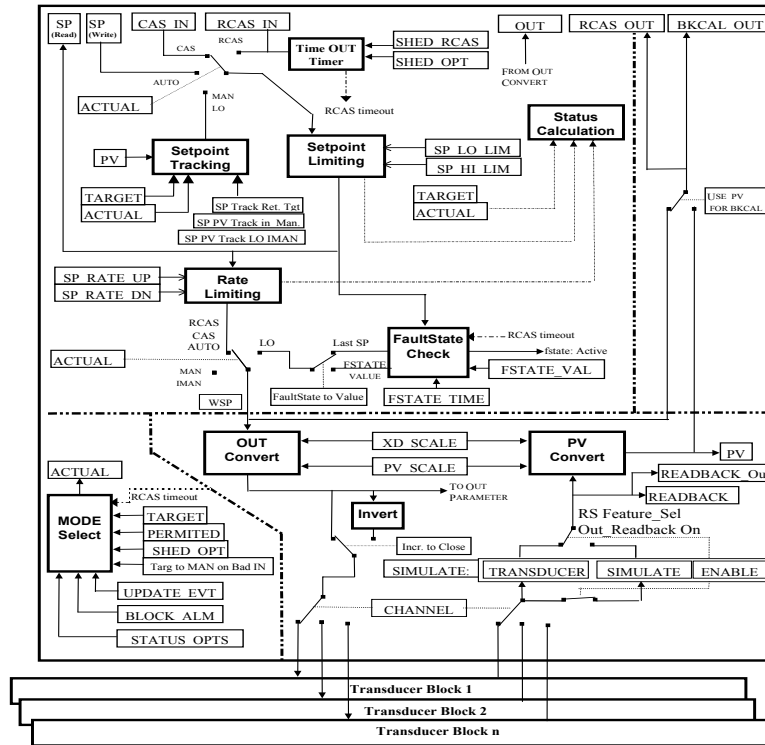

Figure 8.3 AO Function Block Diagram

Clearing Block Configuration Errors

Block configuration errors prevent the block from leaving OOS mode. The parameter BLOCK_ERR will show whether a block configuration error is present. Table 10.7 is a list of parameters that can cause the status of CONFIGURATION ERROR to be set in the AO BLOCK_ERR parameter. **NOTE:** CONFIGURATION ERROR can only be cleared if the function block is being executed. One way of determining block execution is by performing a series two or three reads of the BLOCK_TEST parameter and confirming that the first byte of the parameter is incrementing. This will work if the execute rate is fast relative to the speed of reading BLOCK_TEST. A very slowly executing block may not appear to execute because block parameters are updated only when the block executes.

Mode-restricted Write Operations

Table 8.7 lists the AO block parameters which may be write restricted based upon the block's mode. Listed in the table are the TARGET and/or ACTUAL modes required for the write to be accepted. Other limitations listed in the last column must also be met.

SIMULATE, READBACK and PV Determination

In the AO Function Block, these three parameters provide the values and status of the actuator position, where SIMULATE (or optionally OUT) generates the READBACK parameter and READBACK is then re-scaled to produce the PV.

The following sub-sections describe each of these parameters.

SIMULATE Parameter SIMULATE is the interface parameter between the AO and the Transducer Function Blocks. Each time the AO block executes, SIMULATE.TRANSDUCER is updated with the FINAL_POSITION_VALUE from the transducer block.

When the SIMULATE.ENABLE is FALSE, SIMULATE.TRANSDUCER is copied into SIMULATE. SIMULATE. When SIMULATE.ENABLE is TRUE, SIMULATE.SIMULATE is not updated with SIMULATE.TRANSDUCER and the user may write a value and status to SIMULATE.SIMULATE.

NOTE: SIMULATE.ENABLE can only be set TRUE when the Simulate dip switch is in the "On" position when the device is powered up or a processor restart is issued.

READBACK Parameter The value and status of READBACK will come from either the OUT parameter or SIMULATE.SIMULATE, determined by the state of the OUT_READBACK feature in the Resource Block. READBACK is in XD units.

When RS.FEATURE.OUT_READBACK is set TRUE, SIMULATE.SIMULATE is used for READBACK. When FEATURE.OUT_READBACK is FALSE, OUT will be used for READBACK.

NOTE: The default value for RS.FEATURE.OUT_READBACK is FALSE. With the Logix 3400MD, this feature should always be set TRUE to allow the transducer block position value to be the source of READBACK.

READBACK_OUT ALLOWS THE USER A LINKABLE PARAMETER FOR VALVE POSITION.

PV Parameter The PV value is simply the READBACK value, re-scaled from XD units to PV units. PV status is copied directly from READBACK

status.

8.9   Digital Output Function Block

DO Block Description

Operates according to Section 10.18

Table 8.10 DO Function Block Parameter List

Index	Origin	Name	Store		Date Type	Default Value
0	STND	DISCRETE_OUTPUT_BLOCK	SRW	Record	BLOCK	0
1	STND	ST_REV	SR	Simple	UNSIGNED16	0
2	STND	TAG_DESC	SRW	Simple	OCTET_STRING	" "
3	STND	STRATEGY	SRW	Simple	UNSIGNED16	0
4	STND	ALERT_KEY	SRW	Simple	UNSIGNED8	0
5	STND	MODE_BLK	SRW	Record	MODE	0x01;0x01;0x79;0x30
6	STND	BLOCK_ERR	R	Simple	BIT_STRING	0
7	STND	PV_D	R	Record	DISC_S	0;0
8	STND	SP_D	NRW	Record	DISC_S	DO_VAL_SP_D_STATUS;DO_VAL_SP_D_VALUE
9	STND	OUT_D	NRWO	Record	DISC_S	0x1C;0
10	STND	SIMULATE_D	RW	Record	SIM_DISC	0;0;0;0;1
11	STND	PV_STATE	SRW	Simple	UNSIGNED16	0
12	STND	XD_STATE	SRW	Simple	UNSIGNED16	0
13	STND	GRANT_DENY	RW	Record	ACCESS_PERM	0;0
14	STND	IO_OPTS|IO_OPTS_DO	SRW	Simple	BIT_STRING	0
15	STND	STATUS_OPTS|STATUS_OPTS_DO	SRW	Simple	BIT_STRING	0
16	STND	READBACK_D	R	Record	DISC_S	0;0
17	STND	CAS_IN_D	RWI	Record	DISC_S	0x1C;0
18	STND	CHANNEL	SRW	Simple	UNSIGNED16	0
19	STND	FSTATE_TIME	SRW	Simple	FLOATING_POINT	0
20	STND	FSTATE_VAL_D	SRW	Simple	UNSIGNED8	0
21	STND	BKCAL_OUT_D	RO	Record	DISC_S	0;0
22	STND	RCAS_IN_D	RW	Record	DISC_S	0x1C;0
23	STND	SHED_OPT	SRW	Simple	UNSIGNED8	0
24	STND	RCAS_OUT_D	R	Record	DISC_S	0;0
25	STND	UPDATE_EVT	RW	Record	ALARM_EVENT	0;0;0,0;0;0;9;0
26	STND	BLOCK_ALM	RW	Record	ALARM_DISC	0;0;0,0;0;0;0;8;0;0

The functionality of these parameters follows the standard Fieldbus definitions as defined in the Foundation Fieldbus specifications.

8.10   Digital Input Function Block

DI Block Description

The DI block takes the manufacturer's input data, selected by channel number, and makes it available to other function blocks at its output. This block operates according to the Foundation Fieldbus specifications. Also found in Section 10.19

Table 8.11 DI Function Block Parameter List

Index	Origin	Name	Store		Date Type	Default Value
0	STND	DISCRETE_INPUT_BLOCK	SRW	Record	BLOCK	0
1	STND	ST_REV	SR	Simple	UNSIGNED16	0
2	STND	TAG_DESC	SRW	Simple	OCTET_STRING	" "
3	STND	STRATEGY	SRW	Simple	UNSIGNED16	0
4	STND	ALERT_KEY	SRW	Simple	UNSIGNED8	0
5	STND	MODE_BLK	SRW	Record	MODE	0x01;0x01;0x19;0x10
6	STND	BLOCK_ERR	R	Simple	BIT_STRING	0
7	STND	PV_D	R	Record	DISC_S	0;0
8	STND	OUT_D	NRWO	Record	DISC_S	0;0
9	STND	SIMULATE_D	RW	Record	SIM_DISC	0;0;0;0;1
10	STND	XD_STATE	SRW	Simple	UNSIGNED16	0
11	STND	OUT_STATE	SRW	Simple	UNSIGNED16	0
12	STND	GRANT_DENY	RW	Record	ACCESS_PERM	0;0
13	STND	IO_OPTS|IO_OPTS_DI	SRW	Simple	BIT_STRING	0
14	STND	STATUS_OPTS|STATUS_OPTS_DI	SRW	Simple	BIT_STRING	0
15	STND	CHANNEL	SRW	Simple	UNSIGNED16	0
16	STND	PV_FTIME	SRW	Simple	FLOATING_POINT	0
17	STND	FIELD_VAL_D	R	Record	DISC_S	0;0
18	STND	UPDATE_EVT	RW	Record	ALARM_EVENT	0;0;0,0;0;0;9;0
19	STND	BLOCK_ALM	RW	Record	ALARM_DISC	0;0;0,0;0;0;0;8;0;0
20	STND	ALARM_SUM|ALARM_SUM_DI	SRW	Record	ALARM_SUMMARY	0;0;0;0
21	STND	ACK_OPTION|ACK_OPTION_DI	SRW	Simple	BIT_STRING	0
22	STND	DISC_PRI	SRW	Simple	UNSIGNED8	0
23	STND	DISC_LIM	SRW	Simple	UNSIGNED8	0
24	STND	DISC_ALM	RW	Record	ALARM_DISC	0;0;0,0;0;0;0;7;0;0

The functionality of these parameters follows the standard Fieldbus definitions as defined in the Foundation Fieldbus specifications.

8.11   Input Selector Function Block

IS Block Description

The signal selector block provides selection of up to four inputs and generates an output based on the configured action. This block normally receives its inputs from AI blocks. The block performs maximum, minimum, middle, average and 'first good' signal selection. With a combination of parameter configuration options the block can function as a rotary position switch, or a validated priority selection based on the use of the first good parameter and the disable_n parameter. As a switch the block can receive switching information from either the connected inputs or from an operator input. The block also supports the concept of a middle selection. Although the normal configuration for this feature would be with three signals the block should generate an average of the middle two if four signals are configured or the average of two if three are configured and a bad status is passed to one of the inputs. Logic is provided for handling uncertain and bad signals in conjunction with configured actions. The intended application of this block is to provide control signal selection in the forward path only, therefore, no back calculation support is provided. SELECTED is a second output that indicates which input has been selected by the algorithm.

Table 8.12 IS Function Block Parameter List

Index	Origin	Name	Store		Date Type	Default Value
0	STND	INPUT_SELECTOR	SRW	Record	BLOCK	0
1	STND	ST_REV	SR	Simple	UNSIGNED16	0
2	STND	TAG_DESC	SRW	Simple	OCTET_STRING	" "
3	STND	STRATEGY	SRW	Simple	UNSIGNED16	0
4	STND	ALERT_KEY	SRW	Simple	UNSIGNED8	0
5	STND	MODE_BLK	SRW	Record	MODE	0x01;0x01;0x19;0x10
6	STND	BLOCK_ERR	R	Simple	BIT_STRING	0
7	STND	OUT	NRWO	Record	FLOAT_S	0x1C;0.0
8	STND	OUT_RANGE	SRW	Record	SCALE	100.0;0.0;0;0
9	STND	GRANT_DENY	RW	Record	ACCESS_PERM	0;0
10	STND	STATUS_OPTS|STATUS_OPTS_IS	SRW	Simple	BIT_STRING	0
11	STND	IN_1	RWI	Record	FLOAT_S	0x08;0.0
12	STND	IN_2	RWI	Record	FLOAT_S	0x08;0.0
13	STND	IN_3	RWI	Record	FLOAT_S	0x08;0.0
14	STND	IN_4	RWI	Record	FLOAT_S	0x08;0.0
15	STND	DISABLE_1	RWI	Record	DISC_S	0x08;0
16	STND	DISABLE_2	RWI	Record	DISC_S	0x08;0
17	STND	DISABLE_3	RWI	Record	DISC_S	0x08;0
18	STND	DISABLE_4	RWI	Record	DISC_S	0x08;0
19	STND	SELECT_TYPE	SRW	Simple	UNSIGNED8	0
20	STND	MIN_GOOD	SRW	Simple	UNSIGNED8	0
21	STND	SELECTED	RO	Record	DISC_S	0x1C;0
22	STND	OP_SELECT	RWI	Record	DISC_S	0x08;0
23	STND	UPDATE_EVT	RW	Record	ALARM_EVENT	0;0;0,0;0;0;9;0
24	STND	BLOCK_ALM	RW	Record	ALARM_DISC	0;0;0,0;0;0;0;8;0;0

The functionality of these parameters follows the standard Fieldbus definitions as defined in the Foundation Fieldbus specifications.

8.12   Output Splitter Function Block

OS Block Description

The output splitter block provides the capability to drive two control outputs from a single input. Each output is a linear function of some portion of the input. Back calculation support is provided using the same linear function in reverse. Cascade initialization is supported by a decision table for combinations of input and output conditions.

This block would normally be used in split ranging or sequencing of multiple valve applications. A typical split range application has both valves closed when the splitter input is 50%. One valve opens fully as the input drops to 0%. The other valve opens as the input rises above 50%. A typical sequencing application has both valves closed at 0% input. One valve opens fully as the input rises to 50%, and the other stays shut. The second valve opens as the input rises above 50%, and the first valve may remain open or shut off quickly. Because this block is in the control path, it is able to pass limit and cascade initialization information back to the upstream block.

Table 8.13 OS Function Block Parameter List

Index	Origin	Name	Store		Date Type	Default Value
0	STND	OUTPUT_SPLITTER	SRW	Record	BLOCK	0
1	STND	ST_REV	SR	Simple	UNSIGNED16	0
2	STND	TAG_DESC	SRW	Simple	OCTET_STRING	" "
3	STND	STRATEGY	SRW	Simple	UNSIGNED16	0
4	STND	ALERT_KEY	SRW	Simple	UNSIGNED8	0
5	STND	MODE_BLK	SRW	Record	MODE	0x01;0x01;0x31;0x10
6	STND	BLOCK_ERR	R	Simple	BIT_STRING	0
7	STND	SP	RW	Record	FLOAT_S	0;0.0

Index	Origin	Name	Store		Date Type	Default Value
8	STND	OUT_1	RWO	Record	FLOAT_S	0x1C;0.0
9	STND	OUT_2	RWO	Record	FLOAT_S	0x1C;0.0
10	STND	OUT_1_RANGE	SRW	Record	SCALE	100.0;0.0;0;0
11	STND	OUT_2_RANGE	SRW	Record	SCALE	100.0;0.0;0;0
12	STND	GRANT_DENY	RW	Record	ACCESS_PERM	0;0
13	STND	STATUS_OPTS|STATUS_OPTS_OS	SRW	Simple	BIT_STRING	0
14	STND	CAS_IN	RWI	Record	FLOAT_S	0x08;0.0
15	STND	BKCAL_OUT	RO	Record	FLOAT_S	0x1C;0.0
16	STND	IN_ARRAY	SRW	Array	FLOATING_POINT	0.0,50.0,51.0,100.0
17	STND	OUT_ARRAY	SRW	Array	FLOATING_POINT	0.0,50.0,51.0,100.0
18	STND	LOCKVAL	SRW	Simple	UNSIGNED8	0
19	STND	BKCAL_IN_1	RWI	Record	FLOAT_S	0x08;0.0
20	STND	BKCAL_IN_2	RWI	Record	FLOAT_S	0x08;0.0
21	STND	BAL_TIME	SRW	Simple	FLOATING_POINT	0
22	STND	HYSTVAL	SRW	Simple	FLOATING_POINT	0
23	STND	UPDATE_EVT	RW	Record	ALARM_EVENT	0;0;0.0;0;0;9;0
24	STND	BLOCK_ALM	RW	Record	ALARM_DISC	0;0;0.0;0;0;0;8;0;0

8.13 PID Function Block

PID Block Description

The PID function block provides a choice of selecting either a standard PID control equation (Ideal) or a robust PID.

Table 8.14 lists the block parameters and default values for the PID function block.

Table 8.14 PID Control Function Block Parameters

Index	Origin	Name	Size		Date Type	Default Value
0	STND	PID_BLOCK	62	Record	BLOCK	0
1	STND	ST_REV	2	Simple	UNSIGNED16	0
2	STND	TAG_DESC	32	Simple	OCTET_STRING	" "
3	STND	STRATEGY	2	Simple	UNSIGNED16	0
4	STND	ALERT_KEY	1	Simple	UNSIGNED8	0
5	STND	MODE_BLK	4	Record	MODE	0x01;0x01;0xF9;0x10
6	STND	BLOCK_ERR	2	Simple	BIT_STRING	0
7	STND	PV	5	Record	FLOAT_S	0x80;0.0
8	STND	SP	5	Record	FLOAT_S	PID_VAL_SP_STATUS;PID_VAL_SP_VALUE
9	STND	OUT	5	Record	FLOAT_S	0x80;0.0
10	STND	PV_SCALE	11	Record	SCALE	100.0;0.0;0;0
11	STND	OUT_SCALE	11	Record	SCALE	100.0;0.0;0;0
12	STND	GRANT_DENY	2	Record	ACCESS_PERM	0,0
13	STND	CONTROL_OPTS|CONTROL_OPTS_PID	2	Simple	BIT_STRING	0
14	STND	STATUS_OPTS|STATUS_OPTS_PID	2	Simple	BIT_STRING	0
15	STND	IN	5	Record	FLOAT_S	0x80;0.0
16	STND	PV_FTIME	4	Simple	FLOATING_POINT	0
17	STND	BYPASS	1	Simple	UNSIGNED8	0
18	STND	CAS_IN	5	Record	FLOAT_S	0x1C;0.0
19	STND	SP_RATE_DN	4	Simple	FLOATING_POINT	FLT_MAX
20	STND	SP_RATE_UP	4	Simple	FLOATING_POINT	FLT_MAX
21	STND	SP_HI_LIM	4	Simple	FLOATING_POINT	100
22	STND	SP_LO_LIM	4	Simple	FLOATING_POINT	0

Index	Origin	Name	Size		Date Type	Default Value
23	STND	GAIN	4	Simple	FLOATING_POINT	1
24	STND	RESET	4	Simple	FLOATING_POINT	FLT_MAX
25	STND	BAL_TIME	4	Simple	FLOATING_POINT	0
26	STND	RATE	4	Simple	FLOATING_POINT	0
27	STND	BKCAL_IN	5	Record	FLOAT_S	0xCe;0.0
28	STND	OUT_HI_LIM	4	Simple	FLOATING_POINT	100
29	STND	OUT_LO_LIM	4	Simple	FLOATING_POINT	0
30	STND	BKCAL_HYS	4	Simple	FLOATING_POINT	0.5
31	STND	BKCAL_OUT	5	Record	FLOAT_S	0xcf;0.0
32	STND	RCAS_IN	5	Record	FLOAT_S	0xce;0.0
33	STND	ROUT_IN	5	Record	FLOAT_S	0xce;0.0
34	STND	SHED_OPT	1	Simple	UNSIGNED8	0
35	STND	RCAS_OUT	5	Record	FLOAT_S	0xcf;0.0
36	STND	ROUT_OUT	5	Record	FLOAT_S	0xcf;0.0
37	STND	TRK_SCALE	11	Record	SCALE	100.0;0.0;0;0
38	STND	TRK_IN_D	2	Record	DISC_S	0x1C;0
39	STND	TRK_VAL	5	Record	FLOAT_S	0x1C;0.0
40	STND	FF_VAL	5	Record	FLOAT_S	0x1C;0.0
41	STND	FF_SCALE	11	Record	SCALE	100.0;0.0;0;0
42	STND	FF_GAIN	4	Simple	FLOATING_POINT	1
43	STND	UPDATE_EVT	16	Record	ALARM_EVENT	0;0;0,0;0;0;0;0
44	STND	BLOCK_ALM	18	Record	ALARM_DISC	0;0;0,0;0;0;0;8;0;0
45	STND	ALARM_SUM|ALARM_SUM_PID	8	Record	ALARM_ SUMMARY	0;0;0;0
46	STND	ACK_OPTION|ACK_OPTION_PID	2	Simple	BIT_STRING	0
47	STND	ALARM_HYS	4	Simple	FLOATING_POINT	0.5
48	STND	HI_HI_PRI	1	Simple	UNSIGNED8	0
49	STND	HI_HI_LIM	4	Simple	FLOATING_POINT	FLT_MAX
50	STND	HI_PRI	1	Simple	UNSIGNED8	0
51	STND	HI_LIM	4	Simple	FLOATING_POINT	FLT_MAX
52	STND	LO_PRI	1	Simple	UNSIGNED8	0
53	STND	LO_LIM	4	Simple	FLOATING_POINT	FLT_MAX
54	STND	LO_LO_PRI	1	Simple	UNSIGNED8	0
55	STND	LO_LO_LIM	4	Simple	FLOATING_POINT	FLT_MAX
56	STND	DV_HI_PRI	1	Simple	UNSIGNED8	0
57	STND	DV_HI_LIM	4	Simple	FLOATING_POINT	FLT_MAX
58	STND	DV_LO_PRI	1	Simple	UNSIGNED8	0
59	STND	DV_LO_LIM	4	Simple	FLOATING_POINT	FLT_MAX
60	STND	HI_HI_ALM	21	Record	ALARM_FLOAT	0;0;0,0;0;0.0;0;4;0;0
61	STND	HI_ALM	21	Record	ALARM_FLOAT	0;0;0,0;0;0.0;0;2;0;0
62	STND	LO_ALM	21	Record	ALARM_FLOAT	0;0;0,0;0;0.0;0;1;0;0
63	STND	LO_LO_ALM	21	Record	ALARM_FLOAT	0;0;0,0;0;0.0;0;3;0;0
64	STND	DV_HI_ALM	21	Record	ALARM_FLOAT	0;0;0,0;0;0.0;0;6;0;0
65	STND	DV_LO_ALM	21	Record	ALARM_FLOAT	0;0;0,0;0;0.0;0;5;0;0
66	MFG	PID_FORM	1	Simple	UNSIGNED8	1
67	MFG	ALGO_TYPE	1	Simple	UNSIGNED8	1
68	MFG	OUT_LAG	4	Simple	FLOATING_POINT	0
69	MFG	GAIN_NLIN	4	Simple	FLOATING_POINT	1
70	MFG	GAIN_COMP	4	Simple	FLOATING_POINT	1
71	MFG	ERROR_ABS	4	Simple	FLOATING_POINT	0
72	MFG	WSP	5	Record	FLOAT_S	0xc0,0.0

Index	Origin	Name	Size		Date Type	Default Value
73	MFG	FUTURE1	4	Simple	FLOATING_POINT	0
74	MFG	PID_BLOCK_TEST	8	Array	UNSIGNED8	0,0,0,0,0,0,0,0

Table 8.15 Flowserve PID Parameters

Parameter Name	Description/Parameter Contents
PID_FORM	Configuration parameter specifies the IDEAL or ROBUST PID equation to be used: IDEAL PID (default). Non-Interactive form of a three mode control equation that provides Proportional, Integral and Derivative (PID) control action. Linear and non-linear gain parameters are available. ROBUST PID. The same as Ideal PID. Additionally, the equation supports a user-configured lag filter applied to calculated output value. (See OUT_LAG parameter.) Linear and non-linear gain parameters are available.
ALGO_TYPE	Configuration parameter specifies algorithm type which can be A, B, or C: Type A equation where Proportional, Integral and Derivative act on ERROR. Type B equation where Proportional and Integral act on ERROR and Derivative acts on PV. Type C equation where Integral acts on ERROR and Proportional and Derivative act on PV.
OUT_LAG	Time constant of single exponential LAG filter applied to the OUT parameter (primary output). Units (in seconds). For ideal PID equation the lag filter is fixed at 1/16 and cannot be configured.
GAIN_NLIN	Dimensionless gain factor. When the gain factor is multiplied by absolute value of the error and added to the linear GAIN, the result is a gain response which is proportional to the deviation. Default is zero, resulting in no response due to non-linear gain action.
GAIN_COMP	The composite gain quantity including both linear and non-linear gain parameters. (Read-only parameter.)

Table 8.16 PID Parameters

Parameter Name	Description/Parameter Contents
ERROR_ABS	Absolute value of the difference between PV and working set-point. (Read only parameter.)
WSP	Working set-point. This is the set-point value after absolute and rate limits have been applied. Deviation alarms are computed on this value. (Read only parameter.)
PID_BLOCK_TEST	An internal test parameter.

PID Block Diagram

Figure 8.4 is a block diagram showing the key components of the PID control function block.
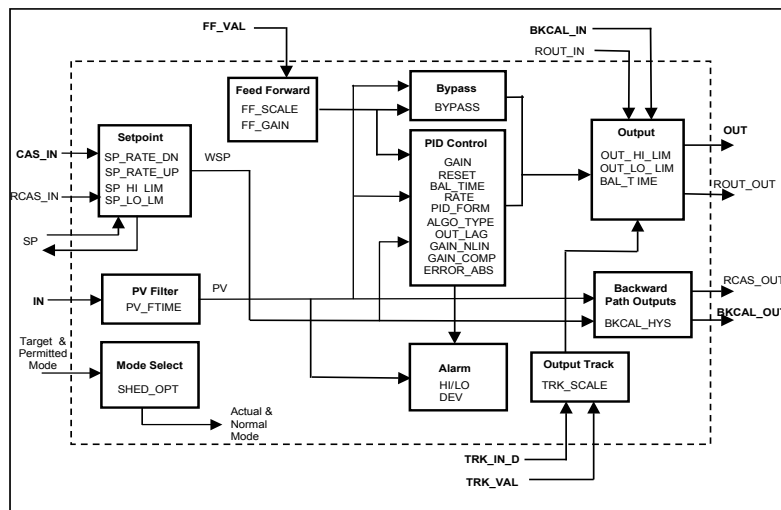
Figure 8.4 PID Control Block

PID Block Description

PID control function block is an algorithm that produces an output signal in response to the measured variable and the set-point. The PID function block allows the user to choose either a standard PID control equation (Ideal) or a robust PID equation defined by Honeywell. This selection is defined in the PID_FORM parameter.

The output has three terms: Proportional, Integral and Derivative. The output is adjusted by tuning constants. Three tuning constants are contained in the ideal PID equation.

The robust PID uses four tuning constants.

1. GAIN is the tuning constant of the Proportional term.

2. RESET is the tuning constant of the Integral term.

3. RATE is the tuning constant of the Derivative term. RATE is usually modified by a lag, which is set at some fixed ratio higher than the rate time to create a rate gain. No lag occurs with the rate in this implementation.

4. OUT_LAG is the fourth tuning constant used in the robust PID, it adds roll off to the output response. The action is similar to PID with rate gain.

PID Ideal and PID Robust

The ideal equation is a parallel or non-interacting implementation of PID control using three tuning constants. It automatically fixes OUT_LAG to 16 times the RATE time constant. This produces response characteristics equivalent to the algorithms used in TPS products.

The robust equation is the same parallel implementation of ideal PID control but allows the engineer to set the OUT_LAG and effectively change the rate gain.

ALGO_TYPE is a configuration parameter that contains one of three selected algorithm types, A, B, or C.

Where:

• A RATE, GAIN and RESET all act on the error between set point and measured variable.

• B RATE acts on the measured variable only, GAIN and RESET use the error.

• C RATE and GAIN act on the measured variable only, and RESET uses the error.

PID Tuning Parameters

Table 8.10 lists the valid ranges for the tuning parameters for the PID block. Note that OUT_LAG parameter cannot be configured when ideal PID is selected (PID_FORM = 1) and can be configured when robust PID is selected (PID_FORM = 2).

The values given for these tuning parameters are valid under the following conditions:

• The values assume that the minimum configured PID function block execution period (Ts) is 0.125 seconds.

• Algorithm type setting (i.e. A, B, or C) has no effect on the validation of these tuning parameters.

• The PID function block will reject all values outside the ranges.

Mode-restricted Writes to PID Parameters

Writing to certain PID block parameters are restricted by the block's TARGET and/or ACTUAL mode. The MODE_BLK.TARGET or MODE_BLK. ACTUAL parameter must equal one of the modes in the 'Write Restrictions Column' in Table 8.8 before the user can write values to the parameters listed.

Note: Do not select anything in CONTROL_OPTS in order to set the PID action to reverse acting.

8.14   Link Objects

The function blocks configured to control a process are linked, or connected by objects within the devices. These links allow the user to transfer process and event data from one block to another. These links are defined through link objects.

Link Object Description

Link objects define Virtual Communication Relationships (VCRs), which are used to communicate between blocks. Link objects contain information needed to define communication links between function blocks and interface devices and other field devices. This information may be read by an interface device which will access information in field devices.

For example, link objects may be used to link the output parameter of one function block to the input of another block, or a trend object, or alert object.

Link objects are used for alarms and events, function block linking and trending. In the Logix 3400MD digital positioner links objects are available for:

• The PID block (6 input parameters)

• The PID and AO blocks (4 output parameters)

• Every alert object

• Every trend object

Link Object for	Parameter or Number of Objects
Input parameters	PID function block: BKCAL_IN CAS_IN FF_VAL IN TRK_IN_D TRK_VAL
Output parameters	AO function block: OUT PID function block: BKCAL_OUT OUT READBACK_OUT
Alert objects	3
Trend objects	2
TOTAL	16 objects

8.15   View Objects

Description

View objects support management and control of function blocks by providing user visibility of function block configuration and operation. View objects allow parameter data to be grouped and accessed (for viewing on an operator interface) by the user. This provides for information groups to be communicated efficiently. At least four view objects (View1, View2, View3 and View4.) are defined for each block in a device.

Block parameters can be grouped and displayed depending on how the data is to be used. Four standard view objects (groups) are defined for accessing the following types of information:

1. View1 - used to display dynamic operation data

2. View2 - used to display static operation data

3. View3 - used to display all dynamic data

4. View4 - used to display other static data.

Logix 3400MD Digital Positioner View Objects

In the Logix 3400MD digital positioner, four view objects have been defined for each of the blocks. All standard blocks follow the Fieldbus defined views found in the Foundation Fieldbus specification.

All nonstandard blocks are shown below in the following order:

- Resource block
- Transducer blocks
- AO block
- PID block

Note: Many of the transducer block parameters are not defined in the views since they are used only with the DTM, provided for technician access, or used only in advanced or pro mode.

Table 8.17 Resource Block View List

Index	Name	View1	View2	View3	View4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	RS_STATE	1		1	
8	TEST_RW				
9	DD_RESOURCE				
10	MANUFAC_ID				4
11	DEV_TYPE				2
12	DEV_REV				1
13	DD_REV				1
14	GRANT_DENY		2		
15	HARD_TYPES				2
16	RESTART				
17	FEATURES				2
18	FEATURE_SEL		2		
19	CYCLE_TYPE				2
20	CYCLE_SEL		2		
21	MIN_CYCLE_T				4
22	MEMORY_SIZE				2
23	NV_CYCLE_T		4		
24	FREE_SPACE		4		
25	FREE_TIME	4		4	
26	SHED_RCAS		4		
27	SHED_ROUT		4		
28	FAULT_STATE	1		1	
29	SET_FSTATE				
30	CLR_FSTATE				

Index	Parameter Name				
31	MAX_NOTIFY				1
32	LIM_NOTIFY		1		
33	CONFIRM_TIME		4		
34	WRITE_LOCK		1		
35	UPDATE_EVT				
36	BLOCK_ALM				
37	ALARM_SUM	8		8	
38	ACK_OPTION				2
39	WRITE_PRI				1
40	WRITE_ALM				
	Manufacturer Specific Parameters				
41	DL_CMD1				
42	DL_CMD2				
43	DL_APPSTATE			2	
44	DL_SIZE			4	
45	DL_CHECKSUM			2	
46	REVISION_ARRAY				6
47	BLOCK_TEST			8	
48	ERROR_DETAIL			6	
	Total	22	30	44	35

Table 8.18 Transducer Block View List

Index	Parameter Name	Access	Size	V 1	V 2	V 3_1	V 3_2	V 4_1	V 4_2	V 4_3	V 4_4	No View
0	XDTB_MAIN	SRW	62									
1	ST_REV	SR	2	2	2	2	2	2	2	2	2	
2	TAG_DESC	SRW	32									32
3	STRATEGY	SRW	2					2				
4	ALERT_KEY	SRW	1					1				
5	MODE_BLK	SRW	4	4		4						
6	BLOCK_ERR	R	2	2		2						
7	UPDATE_EVT	RW	16									16
8	BLOCK_ALM	RW	18									18
9	TRANSDUCER_DIRECTORY	NR	2							2		
10	TRANSDUCER_TYPE	NR	2							2		
11	XD_ERROR	R	1			1						
12	COLLECTION_DIRECTORY	NR	4							4		
13	FINAL_VALUE	NRW	5	5		5						
14	WORKING_SP	RW	4	4		4						
15	FINAL_POSITION_VALUE	NR	5	5		5						
16	CONTROLLER_STATE_STATUS	R	1	1		1						
17	CONTROLLER_STATE_MASKING	NRW	1	1		1						
18	POSITIONER_STATUS	R	1	1		1						
19	POSITIONER_MASKING	NRW	1	1		1						
20	DEVIATION_VALUE	R	4			4						
21	PRESSURE_SUPPLY	R	4	4		4						
22	PRESSURE_PORT_A	R	4	4		4						
23	PRESSURE_PORT_B	R	4	4		4						
24	TEST_MODE	RW	1			1						
25	CALIBRATE	RW	1	1		1						
26	CALIBRATION_STATUS	R	1	1		1						
27	MAIN_RESERVED_1	NRW	4									4

28	P_GAIN	SRW	4		4							
29	I_GAIN	SRW	2		2							
30	D_GAIN	SRW	2		2							
31	PRESS_CTRL_GAIN	SRW	4		4							
32	PRESS_CTRL_WINDOW	SRW	4		4							
33	FINAL_VALUE_CUTOFF_HI	SRW	4		4							
34	FINAL_VALUE_CUTOFF_LO	SRW	4		4							
35	STOP_HI_POS	SRW	4		4							
36	STOP_LO_POS	SRW	4		4							
37	STROKE_TIME_OPEN_LIM	NRW	5							5		
38	STROKE_TIME_CLOSE_LIM	NRW	5							5		
39	MAIN_RESERVED_2	NRW	4									4
40	PRESSURE_SUPPLY_CAL_REF	NRW	4	4								
41	CYCLE_CNTR	NRW	4	4		4						
42	CYCLE_CNTR_LIM	SRW	4		4							
43	CYCLE_CNTR_DEADBAND	SRW	4		4							
44	TRAVEL_ACCUM	NRW	4	4		4						
45	TRAVEL_ACCUM_LIM	SRW	4		4							
46	TRAVEL_ACCUM_DEADBAND	SRW	4		4							
47	STROKE_LENGTH	SRW	4		4							
48	POS_ALERT_HI	SRW	4		4							
49	POS_ALERT_LO	SRW	4		4							
50	POS_DEADBAND	SRW	4		4							
51	POS_DEVIATION_TIME	SRW	4		4							
52	INTERNAL_TEMP	R	4	4		4						
53	HOURS_SINCE_LAST_POWERUP	NRW	4							4		
54	HOURS_SINCE_LAST_RESET	NRW	4							4		
55	HOURS_LIFE_TIME	NRW	4							4		
56	SIG_START	NRW	4				4					
57	SIG_STOP	NRW	4				4					
58	SIG_RATE	NRW	4				4					
59	SIG_HOLD	NRW	4				4					
60	SIG_INDEX	NRW	2				2					
61	SIG_FLAGS	NRW	1				1					
62	TRAVEL_ACCUM_UNITS	SRW	1		1							
63	PRESSURE_UNITS	SRW	1		1							
64	INTERNAL_TEMP_UNITS	SRW	1		1							
65	XD_FSTATE_OPT	SRW	1		1							
66	ELECTRONICS_SN	NR	8						8			
67	SOFTWARE_VER_MAJOR	NR	2						2			
68	SOFTWARE_VER_MINOR	NR	2						2			
69	SOFTWARE_DATE_CODE	SRW	8						8			
70	VALVE_MAN_ID	SRW	1					1				
71	VALVE_MODEL_NUM	NRW	32								32	
72	VALVE_TYPE	NRW	1					1				
73	VALVE_SIZE	NRW	1						1			
74	VALVE_CLASS	NRW	1						1			
75	VALVE_ENDCON	NRW	1						1			
76	VALVE_BODYMAT	NRW	1						1			
77	VALVE_PACKTYPE	NRW	1						1			
78	LEAK_CLASS	NRW	1						1			
79	VALVE_FLAGS	NRW	1						1			
80	VALVE_TRIMMAT	NRW	1						1			
81	VALVE_TRIMCHAR	NRW	1						1			
82	VALVE_TRIMTYPE	NRW	1						1			

83	VALVE_TRIMNO	NRW	1						1			
84	VALVE_SN	NRW	32					32				
85	STEM_DIAM	NRW	4						4			
86	RATED_TRAV	NRW	4						4			
87	INLET_PRESS	NRW	4						4			
88	OUTLET_PRESS	NRW	4						4			
89	ACT_MAN_ID	NRW	1					1				
90	ACT_FAIL_ACTION	NRW	1								1	
91	ACT_MODEL_NUM	NRW	32								32	
92	ACT_SN	NRW	32								32	
93	ACT_TYPE	NRW	1						1			
94	ACT_SIZE	NRW	1						1			
95	ACT_AREA	NRW	4						4			
96	SPRING_TYPE	NRW	1						1			
97	PO_DATE	NRW	8					8				
98	INSTALL_DATE	NRW	8					8				
99	MFG_PHONE	NRW	18						18			
100	PUR_ORDER_NUM	NRW	18						18			
101	FINAL_VALUE_RANGE	SRW	11		11							
102	XD_CAL_LOC	SRW	32							32		
103	XD_CAL_DATE	SRW	8					8				
104	XD_CAL_WHO	SRW	32							32		
105	MAIN_RESERVED_3	RW	4									4
106	MAIN_RESERVED_4	RW	4									4
107	CONTROL_CONFIG	NRW	1	1		1						
108	MISC_CONFIG	NRW	1									1
109	MAIN_BLOCK_TEST	R	8									8
110	MAIN_RESERVED_5	RW	4									4
111	EXEC_DELAY	SRW	2									2
112	MAIN_RESERVED_6	RW	4									4
113	BLINK_CODE	R	1									1
	Total Bytes		672	57	85	59	21	64	92	88	107	102

R   Parameter is Readable

W   Parameter is Writeable

N   Parameter is stored in NV-RAM

S   Parameter is STATIC

Table 8.19 AO Block View Table

Index	Name	View1	View2	View3	View4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV	5		5	
8	SP	5		5	
9	OUT	5		5	
10	SIMULATE				
11	PV_SCALE		11		
12	XD_SCALE		11		

13	GRANT_DENY		2		
14	IO_OPTS				2
15	STATUS_OPTS				2
16	READBACK	5		5	
17	CAS_IN	5		5	
18	SP_RATE_DN				4
19	SP_RATE_UP				4
20	SP_HI_LIM		4		
21	SP_LO_LIM		4		
22	CHANNEL				2
23	FSTATE_TIME				4
24	FSTATE_VAL				4
25	BKCAL_OUT			5	
26	RCAS_IN			5	
27	SHED_OPT				1
28	RCAS_OUT			5	
29	UPDATE_EVT				
30	BLOCK_ALM				
	ManufacturerSpecificParameters				
31	WSP	5		5	
32	BLOCK_TEST		8		
	Total	38	34	61	28

Table 8.20 PID Block View Table

Index	Name	View1	View2	View3	View4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV	5		5	
8	SP	5		5	
9	OUT	5		5	
10	PV_SCALE		11		
11	OUT_SCALE		11		
12	GRANT_DENY		2		
13	CONTROL_OPTS				2
14	STATUS_OPTS				2
15	IN			5	
16	PV_FTIME				4
17	BYPASS		1		
18	CAS_IN	5		5	
19	SP_RATE_DN				4
20	SP_RATE_UP				4

21	SP_HI_LIM		4		
22	SP_LO_LIM		4		
23	GAIN				4
24	RESET				4
25	BAL_TIME				4
26	RATE				4
27	BKCAL_IN			5	
28	OUT_HI_LIM		4		
29	OUT_LO_LIM		4		
30	BKCAL_HYS				4
31	BKCAL_OUT			5	
32	RCAS_IN			5	
33	ROUT_IN			5	
34	SHED_OPT				1
35	RCAS_OUT			5	
36	ROUT_OUT			5	
37	TRK_SCALE				11
38	TRK_IN_D	2		2	
39	TRK_VAL	5		5	
40	FF_VAL			5	
41	FF_SCALE				11
42	FF_GAIN				4
43	UPDATE_EVT				
44	BLOCK_ALM				
45	ALARM_SUM	8		8	
46	ACK_OPTION				2
47	ALARM_HYS				4
48	HI_HI_PRI				1
49	HI_HI_LIM				4
50	HI_PRI				1
51	HI_LIM				4
52	LO_PRI				1
53	LO_LIM				4
54	LO_LO_PRI				1
55	LO_LO_LIM				4
56	DV_HI_PRI				1
57	DV_HI_LIM				4
58	DV_LO_PRI				1
59	DV_LO_LIM				4
60	HI_HI_ALM				
61	HI_ALM				
62	LO_ALM				

63	LO_LO_ALM				
64	DV_HI_ALM				
65	DV_LO_ALM				
	Manufacturer Specific Parameters				
66	PID_FORM		1		
67	ALGO_TYPE		1		
68	OUT_LAG		4		
69	GAIN_NLIN		4		
70	GAIN_COMP	4		4	
71	ERROR_ABS	4		4	
72	WSP	5		5	
73	FUTURE1				
74	BLOCK_TEST			8	
	Total	56	53	104	104

8.16 Alert Objects

Alert objects support the reporting of alarms and update events to operator interface devices and other field devices. Alert objects are used to communicate notification messages when alarms or events are detected. These objects are defined in the function block application.

Alert objects contain:

- The value of the data

- Block index (a number)

- Alert key (parameter)

- Time stamp

- Priority

Logix 3400MD Digital Positioner Alert Objects

Three alert objects are defined in the Logix 3400MD digital positioner for event and alarm reporting.

- 1 for events

- 1 for discrete alarms

- 1 for analog alarms

8.17 Alarm and Event Reporting

Fieldbus Alarms, Events and Alert Objects

Alarms are generated when a block leaves or returns from a particular state.

Events are instantaneous occurrences such as the change of a parameter.

Alarms and event messages are communicated to operator interfaces and other devices using alert objects.

Fieldbus Alarm Messages

Alarm messages are usually transparent to the user. A host system typically receives these messages and presents them to the user. Acknowledgment of alarms by the operator may be necessary to satisfy operation requirements.

Event Messages

- Event messages contain a time stamp

- Events also must be confirmed; otherwise the block will continually report the event.

  - Acknowledgment of events may be necessary to satisfy operation requirements

Internal Positioner Alarms

NOTE: These are standard fieldbus alarms.

The Logix 3400MD digital positioner has several internal alarms which monitor electronics operation, the valve and actuator health and the mechanical linkage.

Refer to the following parameters to view positioner alarms:

- CONTROLLER_STATE_STATUS

- POSITIONER_STATUS

- MECHANICAL_STATUS

- ELECTRONIC_STATUS

- PRESSURE_STATUS

- INNERLOOP_STATUS

- OUTERLOOP_STATUS

- CONFIGURATION_STATUS

3400MD Status Alarms

Table 8.20 Status Alarms Table

Function Block	Parameter	3400 Alert/Alarm Items GREYED OUT	Defined Bits	XD_MAIN_ BLOCK_ERR	BLINK_ CODE	LED Blink
MAIN	CONTROLLER_STATE_STATUS	INITIALIZING	0X01	NONE	0	YGGR
		FACTORY_RESET_STATE	0X02	MAINT_NOW	1	RGRR
		JOG_COMMAND_MODE	0X10	NONE	4	YGYY
		SIGNATURE_IN_PROGRESS	0X20	NONE	5	YGYY
		CONTINUOUS_FRICTION_MODE	0X40	NONE	6	NONE
MAIN	POSITIONER_STATUS	POSITION_DEVIATION_ALARM	0X01	MAINT_NOW	8	RRRR
		SOFT_STOP_UPPER_LIMIT	0X02	NONE	9	GYGY
		SOFT_STOP_LOWER_LIMIT	0X04	NONE	10	GYGY
		POSITION_UPPER_LIMIT	0X08	NONE	11	GYGG
		POSITION_LOWER_LIMIT	0X10	NONE	12	GYGG
		MPC_ACTIVE	0X20	NONE	13	GGGY
		LOCAL_INTERFACE_DISABLED	0X40	NONE	14	GGYG
		ERROR_HISTOR_RESET	0X80	NONE	15	NONE
MD	MECHANICAL_STATUS	ACTUATOR_RATIO_WARNING	0X01	MAINT_SOON	16	YYYY
		PNEUMATIC_INABILITY_TO_FAI_SAFE	0X02	MAINT_SOON	17	YRRR
		FRICTION_HIGH_WARNING	0X04	MAINT_SOON	18	YRYG
		FRICTION_LOW_WARNING	0X08	MAINT_SOON	19	YRGY
		FRICTION_HIGH_ALARM	0X10	MAINT_SOON	20	RRGR
		FRICTION_LOW_WARNING	0X20	MAINT_SOON	21	RRGY
		VALVE_CYCLES_WARNING	0X40	MAINT_SOON	22	GRGG
		VALVE_TRAVEL_WARNING	0X80	MAINT_SOON	23	GRGG
TECH	ELECTRONIC_STATUS	TEMPERATURE_HIGHT_WARNING	0X01	MAINT_SOON	32	YYGG
		TEMPERATURE_LOW_WARNING	0X02	MAINT_SOON	33	YYGG
		SHUNT_VOLTAGE_REFERENCE_ERROR	0X04	MAINT_SOON	34	RRRY
		PIEZO_VOLTAGE_ERROR	0X08	MAINT_SOON	35	RRYG
		WATCH_DOG_TIME_OUT	0X10	MAINT_SOON	36	RRRY
		NV_RAM_CHECKSUM_ERROR	0X20	MAINT_SOON	37	RRRY
		LOSS_OF_INTER_PCB_COMM	0X40	MAINT_SOON	38	RRRG
		ELECTRONIC_INABILITY_TO_FAIL_SAFE	0X80	MAINT_SOON	39	YRRY
TECH	PRESSURE_STATUS	SUPPLY_PRESSURE_LOW_ALARM	0X01	MAINT_SOON	40	RYYG
		SUPPLY_PRESSURE_HIGH_WARNING	0X02	MAINT_SOON	41	YYGR
		SUPPLY_PRESSURE_LOW_WARNING	0X04	MAINT_SOON	42	YYYG
		PORT_1_VALUE_OUT_OF_RANGE	0X08	MAINT_SOON	43	YYGY
		PORT_2_VALUE_OUT_OF_RANGE	0X10	MAINT_SOON	44	YYGY
		PORT_1_RANGE_TOO_SMALL	0X20	MAINT_SOON	45	YYGY
		PORT_2_RANGE_TOO_SMALL	0X40	MAINT_SOON	46	YYGY
		PNEUMATIC_LEAK_WARNING	0X80	MAINT_SOON	47	YRGR
TECH	INTERLOOP_STATUS	SPOOL_STICKING_WARNING	0X01	MAINT_SOON	48	YRGG
		SPOOL_STICKING_ALARN	0X02	MAINT_SOON	49	RRGG
		SPOOL_CYCLES_WARNING	0X04	MAINT_SOON	50	GRGG
		SPOOL_TRAVEL_WARNING	0X08	MAINT_SOON	51	GRGG
		HALL_SENSOR_UPPER_POSITION	0X10	MAINT_SOON	52	RRYR
		HALL_SENSRO_LOWER_POSITION	0X20	MAINT_SOON	53	RRYR
TECH	OUTER_LOOP_STATUS	FEEDBACK_RANGE_TOO_SMALL	0X01	MAINT_SOON	56	RGGY
		POSITION_OUT_OF_RANGE_0	0X02	MAINT_SOON	57	RGGY
		POSITION_OUT_OF_RANGE_100	0X04	MAINT_SOON	58	RGGY
		NO_MOTION_TIME_OUT	0X08	MAINT_SOON	59	RGYY
		NON_SETTLE_TIME_OUT	0X10	MAINT_SOON	60	RGYG
		INNER_LOOP_OFFSET_TIME_OUT	0X20	MAINT_SOON	61	RGGR
		JOG_CALIBRATE_SET_100_POSITION	0X40	MAINT_SOON	62	YGYR
TECH	CONFIGURATION_STATUS	PRESSURE_SENSOR_BOARD_PRESENT	0X01	NONE	72	NONE
		PRESSURE_CONTROL_LOCKED	0X04	NONE	74	NONE
		REVERSED_POT_ROTATION	0X08	NONE	75	NONE
		REVERSED_SPRING	0X10	NONE	76	NONE
		INSUFFICIENT_SPRING	0X20	NONE	77	NONE
		NO_SPRING	0X40	NONE	78	NONE

Pressure Alarms

Pressure alarms are only available on models with advanced diagnostics (Logix 3400MD digital positioner). Advanced diagnostic models add top and bottom pressure sensors. These sensor readings and alarms are only accessible from the communicator when the configuration has been set to Advanced.

Loss of Pressure: The loss of pressure alarm becomes active when the supply pressure is near the minimum positioner operating pressure of 30 psig. The LEDs will blink Red, Yellow, Yellow, Green. This alarm is meant to alert the user to low supply pressure as well as complete loss of pressure.

Top Sensor, Bottom Sensor: Each sensor is checked during actuator calibration. If a calibration reading appears to be out of range, the appropriate alarm will become active. The pressure sensors are located on the collector board assembly.

Internal Positioner Alerts

MPC: (FINAL_VALUE_CUTOFF_HI, FINAL_VALUE_CUTOFF_LO) The MPC or tight shutoff feature of the Logix 3400MD digital positioner allows the user to control the level at which the command signal causes full actuator saturation in the closed (or open) position. This feature can be used to guarantee actuator saturation in the closed (or open) position or prevent throttling around the seat at small command signal levels. To enable, use configuration to apply the desired MPC threshold. Note: The positioner automatically adds a 1 percent hysteresis value to the MPC setting to prevent jumping in and out of saturation when the command is close to the MPC setting.

Question: I set the FINAL_VALUE_CUTOFF_LO at 5 percent. How will the positioner operate?

Answer: Assume that the present command signal is at 50 percent. If the command signal is decreased, the positioner will follow the command until it reaches 5 percent. At 5 percent, the spool will be driven in order to provide full actuator saturation. The positioner will maintain full saturation below 5 percent command signal. Now, as the command increases, the positioner will remain saturated until the command reaches 6 percent (remember the 1 percent hysteresis value added by the positioner). At this point, the stem position will follow the command signal.

Question: I have FINAL_VALUE_CUTOFF_LO set to 3 percent but the valve will not go below 10 percent?

Answer: Is a lower soft limit enabled? The lower soft limit must be less than or equal to 0 percent in order for the MPC to become active. If soft stops are active (SOFTSTOP_LOW>30, SOFTSTOP_HIGH<100) FINAL_VALUE_HI or _LO is disabled.

Position Alerts

Position alerts notify the user that the valve has traveled past a configured limit. The default settings are –10 percent and 110 percent which are outside normal travel and, therefore, disabled. Position alerts only notify the user that a limit has been exceeded and do not limit stem movement. Position alerts will cause a green LED code to blink.

Soft Limits

Unlike position alerts, soft limits (SOFTSTOP_LOW, SOFTSTOP_HIGH) prevent the stem position from going below or above the configured limits. If the command signal is trying to drive the position past one of the limits, the green LED code will blink, but the stem position will remain at the set limit.

Travel Accumulator

The travel accumulator is equivalent to a car odometer and sums the total valve movement. Using the user-defined stroke length and travel dead band, the Logix 3400MD digital positioner keeps a running total of valve movement. When the positioner first powers up, high and low dead band limits are calculated around the present position. When the stem position exceeds the travel dead band, the movement from the center of the dead band region to the new position is calculated and added to the travel accumulator. From this new position, dead band high and low limits are again calculated.

Example: The Logix 3400MD digital positioner has a default dead band configuration of 20 percent and the valve has a 4-inch linear stroke. When the valve first powers up, the command signal is 50 percent. The unit will calculate a high-travel threshold of 70 percent (50 percent present position plus 20 percent dead band) and a low-travel threshold of 30 percent (50 percent present position minus 20 percent dead band). As long as the stem position remains greater than 30 percent and less than 70 percent, no additions are made to the travel accumulator. Now, assume the stem position moves to 80 percent, which is outside the present dead band. The Logix 3400MD digital positioner calculates the stem movement and adds this number to the travel accumulator.

80 percent (present position) – 50 percent (previous) = 30 percent movement x 4-inch stroke = 1.2 inches

So, 1.2 inches is added to the travel accumulator. New dead band thresholds of 100 percent (80 percent present position plus 20 percent dead band) and 60 percent (80 percent present position minus 20 percent dead band) are calculated. This process continues as the stem position moves throughout its stroke range.

Cycle Counter

The cycle counter is another means of monitoring valve travel. Unlike the travel accumulator, the stem position must do two things to count as a cycle: exceed the cycle counter dead band and change direction. A cycle counter limit can also be written into the positioner. If this limit is exceeded, the LEDs will blink Green, Red, Green, Green.

Position Deviation

If the stem position differs from the control command by a certain amount for a given length of time, the LED's will blink Red, Red, Red, Red to signify excess deviation. The trip point and settling times are set in the transducer block.

8.18   Trend Objects

Trend objects support the management and control of function blocks by providing access to history information. Trend objects provide for short-term history data to be collected and stored within a resource. The collected data may be input and output parameters, and status information from selected function blocks. Trend objects are available anytime for reading.

A user will not typically view trend objects directly. A host system may receive the data and build displays using the history data.

The Logix 3400MD digital positioner has one defined trend object.

8.19   Domain Objects

Description Domain objects support download services which are used to download firmware to a device. Standard generic download services (defined by Fieldbus Foundation) are used in the domain object of the Logix 3400MD digital positioner.

8.20   Device Description

Device Descriptions and ODs

A Device Description (DD) provides a clear and structured text description of a field device. The descriptions found in a DD supplement the object dictionary definitions of device applications. So an OD description used in conjunction with the DD will provide a complete detailed description of the device operation. (See the FF Fieldbus Specifications for more details about the usage of DDs and ODs.)

DD Download

The DD for the Logix 3400MD digital positioner can be downloaded by going to the Software Download section on the Flowserve website at www.flowserve. com.

Device Description Contents

A typical DD contains information about the device parameters and operation, such as:

• Attributes, like coding, name, engineering unit, write protection, how-to-display, etc.

• The menu structure for listing parameters, including names of menus and sub-menus.

• The relationship of one parameter to others

• Information about help text and help procedures

• Maintenance, calibration and other necessary operation information.

• Methods Wizard to help configure and commission the positioner

Standard and Device-specific DD

Standard DD descriptions for function blocks and transducer blocks are maintained by the Fieldbus Foundation. These descriptions can be used as part of a field device DD by manufacturers to describe the standard features of their devices. Device-specific descriptions are developed by manufacturers to describe custom features which are unique to that particular device.

These two types of DDs (the standard and device-specific) can then be combined to provide a complete DD for the field device.

8.21   Object Dictionary

Object Dictionary Description

AP objects are described in the Object Dictionary (OD) with each entry describing an individual AP object and its message data. The message data may consist of a number of characteristics defined for that particular object. The OD allows the FBAP of a device to be visible to the fieldbus communications system. Refer to the Fieldbus documentation for more information about OD.

8.22   System Management

System Management (SM) operates on special objects in the System Management Information Base (SMIB) which is part of the Management Virtual Field Device (VFD).

System Management Key Features

The key features of system management operation:

• Provide system application clock time synchronization

• Provide scheduling of function blocks

• Manage automatic device address assignment

• Provide tag search service

• System Management Information Base (SMIB)

The SMIB contains various objects that are associated with system management operation. Table 8.22 shows a listing of the SMIB object dictionary. Groups of objects (along with their starting index number) are included in the SMIB for the Logix 3400MD digital positioner. The numbers in parenthesis indicate the number of objects.

Supported Features

The features supported by system management include the key features listed above as well as the ones designated in Table 8.23. The object SM_SUPPORT indicates which features are supported by system management in the FBAP. The features are mapped to the bits in the bit string shown below.

Table 8.21 System Management Supported Features

SM_SUPPORT bit	Feature	Supported?	
0	Set physical device tag (agent)	yes	
1	Set field device address (agent)	yes	
2	Clear address (agent)	yes	
3	Identify (agent)	yes	
4	Locating function blocks (agent)	yes	
5	Set physical device tag (manager)		no
6	Set field device address (manager)		no
7	Clear address (manager)		no

8	Identify (manager)		no
9	Locating function blocks (manager)		no
10	FMS server role	yes	
11	Application clock synch (timeslave)	yes	
12	Scheduling function block	yes	
13	Application clock synch (time publisher)		no
14	to31Reservedforfutureuse.		no

SM_SUPPORT Bits

Any bit (of the object SM_SUPPORT) will be set that corresponds to a supported feature listed in Table 8.23. The resulting value in the object SM_SUP-PORT is 1C1F (hex).

SM Agent Objects

Four SM agent objects are contained in the SMIB object dictionary. One object, SM_SUPPORT, was described previously. The three other objects are timers associated with SM operations. Table 8.22 identifies the SM Agent objects with their object directory index and default values.

Table 8.22 SM Agent Objects

Object	Description	OD Index	Default Value
SM_SUPPORT	Variable that indicates the features supported by SM in this device. See Table 8.22, Logix 3400MD Digital Positioner SMIB Object Dictionary	258	0x1C1F
T1	Value of the SMstep timer in 1/32 of a millisecond ticks.	259	96,000* (3 seconds)
T2	Value of the SM set address sequence timer in 1/32 of a millisecond ticks.	260	1,920,000* (60 seconds)
T3	Value of the SM set address wait timer in 1/32 of a millisecond ticks.	261	480,000 * (15 seconds)

* The default value is specified by the communications profile for the application area

System Application Clock Time Synchronization

Each link in a fieldbus network contains an application clock time publisher responsible for distributing application time on the link.

A clock synchronization message is periodically sent by the time publisher to all fieldus devices. The application clock time is independently maintained in each device based on its own internal crystal clock.

Clock synchronization provides the capability for devices to time stamp data (events and alarms when they occur).

Sync and Scheduling Objects

These objects are used by system management to provide application clock synchronization and macro cycle scheduling for the device. Table 8.23 identifies the sync and scheduling objects with their object directory index and default values.

Table 8.23 SM Sync and Scheduling Objects

Object	Description	OD index	DefaultValue
CURRENT_TIME	The current application clock time.	262	Dynamic
LOCAL_TIME_DIFF	Used to calculate local time from CURRENT_TIME.	263	0
AP_CLOCK_SYNC_INTERVAL	The interval in seconds between time messages on the link (bus).	264	Set by SM (mgr.) during address assignment

TIME_LAST_RCVD	The application clock time contained in the last clock message.	265	Dynamic
PRIMARY_AP_TIME_ PUBLISHER	The node address of the primary time publisher for the local link (bus).	266	Set by SM (mgr.) during address assignment
TIME_PUBLISHER_ADDR	The node address of the device which sent the last clock message.	267	Dynamic
Unused		268	
MACROCYCLE_DURATION	The length of the macro cycle in 1/32 of a millisecond ticks.	269	Set by SM (mgr.) during address assignment

Device ID, Tag Name and Device Address

Each fieldbus device on the network is uniquely identified by:

- Device ID that is set by the manufacturer to identify the device.

- Device Name (Tag) set by the user to identify operation

- Device Address - a unique numerical address on the fieldbus segment. Address may be set automatically by system management.

Address Assignment Objects

Table 8.24 is a description of the address assignment objects with their object directory index and default values.

Table 8.24 SM Address Assignment Objects

Object	Description	OD index	Default Value
DEV_ID	The device ID set by the manufacturer.	270	464C530201-VAL-LX1 400-0nnnnnnnn
PD_TAG	The physical device tag to be set using SET_PD_TAG service.	271	All Spaces
OPERATIONAL_ POWERUP	Controls the state of SM of the device upon power-up.	272	TRUE (SM goes operational after power up)

Virtual Field Device (VFD) List Objects Two objects identify the VFDs in the device:

Table 8.25 Virtual Field Device (VFD) List Objects

OD Index	VFD_REF	VFD_TAG
273	1	'MIB'
274	2	'Resource'

Function Block Scheduling The SMIB contains a schedule, called the function block schedule, that indicates when that device's function blocks are to be executed.

System Management schedules the start of each function block relative to the macro cycle of the device. The macro cycle represents one complete cycle of the function block schedule in a device. The macro cycles of all devices on the link are synchronized so that function block executions and their corresponding data transfers are synchronized in time.

Using the configurator software, the device's function block schedule can be pre-configured.

Function Block Scheduling Objects

Four scheduling objects are defined in the Logix 3400MD digital positioner. Table 8.25 lists the function block scheduling objects with their object directory index and default values.

Table 8.25 Function Block Scheduling Objects

Object	Description	OD Index	Default Value
VERSION_OF_SCHEDULE	The version number of the function block schedule.	275	0
FBScheduleEntry#1	Default setting is the AO block	276	START_TIME_OFFSET -0FB_OBJECT_INDEX-257 VFD_REF-1
FBScheduleEntry#2	Default setting in the PID block	277	START_TIME_OFFSET-16000 FB_OBJECT_INDEX-310 VFD_REF-1
FBScheduleEntry#3		278	0xFFFFFFFF
FBScheduleEntry#4	Available	279	0

8.23   Network Management

Network management provides for the management of a device's communication system by an external network manager application.

Network management operates on special objects in the Network Management Information Base (NMIB) which is part of the Management Virtual Field Device (VFD).

Network Management Features

Network Management provides the following features:

Loading a Virtual Communication Relationship (VCR), which may be a list or a single entry. See VCR list objects.

• Loading/changing the communication stack configuration

• Loading the Link Active Schedule (LAS)

• Performance monitoring

Network Management Objects

⚠ **CAUTION:** Normally most of the network management objects appear transparent to the user. In other words, the parameters and objects used for network management are not normally viewed or changed as part of device configuration.

The network management objects in the Logix 3400MD digital positioner FBAP are listed in the following paragraphs, although most, (if not all) of these objects are not directly user-configured.

Network Management Information Base (NMIB)

The NMIB contains various objects that are associated with network management operation. Table 8.28 lists the NMIB object dictionary. The groups of network management objects (along with their index starting numbers) are included in the NMIB for the Logix 3400MD digital positioner. The numbers in parenthesis indicate the number of objects.

Virtual Communications Reference (VCR) Objects

The objects listed above contain parameters which define network management operations. These operations include communications between applications in different field devices (or field devices and operator interface). In order for this communication to take place, a communications relationship must be set up using the network management objects and parameters. The parameters for this communication relationship are stored in a Virtual Communications Reference (VCR) object.

VCR Attributes

The attributes for the VCR types (VCR name) defined in the Logix 3400MD digital positioner device are standard fieldbus attributes. There are 16 available VCR's available in the Logix 3400MD. For detailed descriptions of these attributes, see

Unsupported Services

The following is a list of services which are not supported (not used) in the Logix 3400MD digital positioner FBAP:

• FB_Action (all function blocks are static)

• Put_OD (all ODs are static)

• Domain upload

• Program invocation

• Reception of alert and trend indications

• Access protection and check of password

• AlertEventConditionMonitoring

• Write to variable lists

• Create/Modify/Delete variable lists

• Read and write access by name

• Phys Read, Phys Write

• Read With Type, Write With Type

• Information Report With Type

8.24   Logix 3400MD Digital Positioner Variable Enumeration

The following table defines the Logix 3400MD digital positioner variables enumeration.

⚠ **CALIBRATE:** This variable initiates calibration procedures, and reports current state of calibration during the procedure.

CONTROL PARAMETERS

Table 8.26 Control Parameters Table

Parameter Name	Bit or Byte Values	Description
TEST_MODE	Bit 0 0x01 Bit 7 0x08	Enagle diagnostic variable access Write to DAC value
Calibrate	0 1 2 5	Select Calibration Type Perform a Stroke Calibration Perform a Pressure and Friction Calibration ABORT Calibration Procedure
Calibration_Status	Bit 0 0x01 Bit 2 0x04 Bit 4 0x08 Bit 5 0x20 Bit 6 0x40	Stroke Calibration in Progress Pressure Calibration in Progress Setting Spool Offset Pressure Calibration Required Stroke Calibration Required
SIG_FLAGS	Bit 0 0X01 Bit 1 0x02 Bit 2 0x04 Bit 3 0x08 Bit 4 0x10 Bit 5 0x 20 Bit 6 0x40 Bit 7 0x80	RUN/Begin Signature Signature Complete TEST REPEAT Mode Rum Ram Signature Valve INIT End of Singnature Data Encountered TEST DAC Mode Run Partial Stroke Test (PST)

Parameter Name	Bit or Byte Values	Description
XD_FSTATE_OPT	No Bit 0x00 Bit 1 0x01 Bit 2 0x02	Fail to Last Known Set Point Fail Valve Closed Fail Valve Open
CONTROL_CONFIG	Bit 0 0X01 Bit 1 0x02 Bit 2 0x04 Bit 3 0x08 Bit 4 0x10 Bit 5 0x 20 Bit 6 0x40 Bit 7 0x80	Local Panel Disabled Continuous Friction Mode Enabled For Future Use Pressure Control Enabled Pressure Sensor Board Present Single Action Enabled For Future Use For Future Use
MISC_CONFIG	Bit 0 0X01 Bit 1 0x02 Bit 2 0x04 Bit 3 0x08 Bit 4 0x10 Bit 5 0x 20 Bit 6 0x40 Bit 7 0x80	For Future Use For Future Use For Future Use For Future Use For Future Use For Future Use For Future Use For Future Use
USER_INTERFACE_ACTIVE	Bit 0 0X0001 Bit 1 0x0002 Bit 2 0x0004 Bit 3 0x0008 Bit 4 0x0010 Bit 5 0x 0020 Bit 6 0x0040 Bit 7 0x0080 Bit 8 0x0100 Bit 9 0x0200 Bit 10 0x0400 Bit 11 0x0800 Bit 12 0x1000 Bit 13 0x2000 Bit 14 0x 4000 Bit 15 0x8000	Air Action ATO Enabled Characterization Linear Auto Tune Enabled Low Friction Mode Calibration Auto DIP SW 6 Spare Up Button Not Pressed Dn Button Not Pressed Bit 1 of Gain Selector Bit 2 of Gain Selector Bit 3 of Gain Selector For Future Use Qucik Cal Button Not Pressed For Future Use For Future Use For Future Use
LOAD_EE_DEFAULTS	0 1 2	Normal Operation Reset Non-Volatile Variables Reset Calibration Variables
CURVE_SELECT	0 1 2	Equal Percent Quick Opening Custom (CurveX,CurveY)

Unit Parameters

Table 8.27 Unit Parameters Table

Parameter Name	Bit or Byte Values	Description
TRAVEL_UNITS	57	Percent
PRESSURE_UNITS	6 7 10 12	PSI BAR Kg/cm^2 Kpa
INTERNAL_TMEP_UNITS	32 33	Deg C Deg F
FRICTION_UNITS	0	Pounds

Diagnostic Parameters

Table 8.28 Diagnostics Parameters Table

Parameter Name	Bit or Byte Values	Description
DIAGNOSTIC_LEVEL	0 2 3	Standard Advanced Pro
PST_RESULT	0 1	Fail Pass
CYCLE_TRAVEL_RESET	Bit 0 0x01 Bit 1 0x02 Bit 2 0x04 Bit 3 0x08	Valve Cycle Reset Valve Travel Reset Spool Cycle Reset Spool Travel Reset
TREND_STATE	0 1 3	Unlock Trend Data Lock Trend Data Clear Trend Data

Informational Parameters

Table 8.29 Informational Parameters Table

Parameter Name	Bit or Byte Values	Description
VALVE_MAN_ID	0 1 2 00	Valtek Kammer NAF Other
VALVE_TYPE	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 99	Mark One Mark One-X Mark 100 Mark two Mark Six Mark Eight Mark Ten ShearStream SB ShearStream HP Maxflo 3 Valdisk BX HpFlow LinedFlow TotalFlow ColdFlow DrainFlow SmallFlow CleanFlow Multi-Z 020000 025000 030000 185000 FlowTop FlowPak FlowPro VariCool Setball Duball Trunnball Torex Unex Other

Parameter Name	Bit or Byte Values	Description
VALVE_CLASS	0	0.25 inch / DN 6
	1	0.5 inch / DN 15
	2	0.75 inch / DN 20
	3	1.0 inch / DN 25
	4	1.25 inch / DN 32
	5	1.5 inch / DN 40
	6	2.0 inch / DN 50
	7	2.5 inch / DN 65
	8	3.0 inch / DN 80
	9	4.0 inch / DN 100
	10	5.0 inch / DN 125
	11	6.0 inch / DN 150
	12	8.0 inch / DN 200
	13	10.0 inch / DN 250
	14	12.0 inch / DN 300
	15	14.0 inch / DN 350
	16	16.0 inch / DN 400
	17	18.0 inch / DN 450
	18	20.0 inch / DN 500
	19	24.0 inch / DN 600
	20	28.0 inch / DN 700
	21	32.0 inch / DN 800
	22	36.0 inch / DN 900
	23	40.0 inch / DN 1000
	99	Other
VALVE_CLASS	1	CL 150
	2	CL 300
	3	CL 600
	4	CL 900
	5	CL 1500
	6	CL 2500
	7	CL 4500
	8	PN 10
	9	PN 16
	10	PN 25
	11	PN 40
	12	PN 63
	13	PN 100
	14	PN 160
	15	PN 250
	16	PN 400
	17	PN 4000
	99	Other
VALVE_ENDCON	0	Sep Flange
	1	Intergral Flange
	2	Weld End
	3	Flangeless/Wafer
	4	Clamped
	5	Screwed
	99	Other
VALVE_BODYMAT	0	Alloy 20
	1	Aluminum
	2	Bronze
	3	Carbon Steel
	4	Special Alloy
	5	Hastelloy
	6	Inconel
	7	Monel 400
	8	Nickel
	9	Titanium
	10	Type 304
	11	Type 316
	99	Other

Parameter Name	Bit or Byte Values	Description
VALVE_PACKTYPE	0 1 2 3 4 99	Single Packing PTFE Single Packing Graphite Double Packing PTFE Double Packing Graphite Spring Loaded Other
LEAK_CLASS	1 2 3 4 5 6 99	Class I Class II Class III Class IV Class V Class VI Other
VALVE_FLAGS	0 1 2 3 4 99	Flow Over Flow Under Shaft Upstream Shaft Downstream Shaft Center Other
VALVE_TRIMMAT	0 1 2 3 4 99	Stainless Steel Sainless Steel Hardened Alloy 6 Soft Seated Special Alloys Other
VALVE_TRIMCHAR	0 1 2 3 99	Equal Percent (=%) Linear Quick Open Bi-Linear Other
VALVE_TRIMTYPE	0 1 2 3 4 5 6 7 8 9 10 11 12 13 99	Cav Control Channel Stream High Pressure Mega Stream Standard Tiger Tooth Stealth MicroCav CavStream MultiStream SilentPack Kammer Type I-III Z-Trim Multi Stage Other

Parameter Name	Bit or Byte Values	Description
VALVE_TRIMNO	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 99	0.10 - 0.12 in (2.5 - 3.0 mm) 0.13 - 0.15 in (3.1 - 3.8 mm) 0.16 - 0.19 in (3.9 - 4.8 mm) 0.20 - 0.24 in (4.9 - 6.1 mm) 0.25 - 0.30 in (6.2 - 7.6 mm) 0.31 - 0.37 in (7.7 - 9.4 mm) 0.38 - 0.45 in (9.5 - 11.4 mm) 0.46 - 0.55 in (11.5 - 14.0 mm) 0.56 - 0.67 in (14.1 - 17.0 mm) 0.68 - 0.81 in (17.1 - 20.6 mm) 0.82 - 0.98 in (20.7 - 24.9 mm) 0.99 - 1.18 in (25.0 - 30.0 mm) 1.19 - 1.42 in (30.1 - 36.1 mm) 1.43 - 1.7 in (36.2 - 43.0 mm) 1.8 - 2.1 in (44 - 54 mm) 2.2 - 2.7 in (55 - 68 mm) 2.8 - 3.3 in (69 - 84 mm) 3.4 - 4.1 in (85 - 103 mm) 4.2 - 4.9 in (104 - 125 mm) 5.0 - 6.0 in (126 - 152 mm) 6.1 - 7.3 in (153 - 184 mm) 7.4 - 8.8 in (185 - 223 mm) 8.9 - 10.5 in (224 - 268 mm) 10.6 - 12.7 in (269 - 322 mm) 12.8 - 15.2 in (323 - 386 mm) 15.3 - 18.2 in (387 - 462 mm) 18.3 - 21.8 in (463 - 552 mm) Other
ACT_MAN_ID	0 1 2 3 4 5 6 99	Valtek Piston Kammer Valtek Diaphragm Rotary Automax NAF Valtek Diaphragm Linear Fisher Other
ACT_FAIL_ACTION	0 1 2 3	None Mechanical Fail Closed Mechanical Fail Open Mechanical Fail In Place
ACT_TYPE	0 1 2 3 4 99	Linear (piston) Linear (diaphragm) Rotary (piston) Rotary (diaphragm) Rotary (Rack & Pinion) Other
ACT_SIZE	0 1 2 3 4 5 6 7 8 9 10 12 13 14 15 16 17 18 19	Valtek Piston 25 Valtek Piston 50 Valtek Piston 100 Valtek Piston 100C Valtek Piston 150C Valtek Piston 200 Valtek Piston 200C Valtek Piston 300 Valtek Piston 400 Valtek Piston 500 Valtek Piston 600 Kammer 37 Kammer 38 Kammer 39 Kammer 3D Kammer 47 Kammer 48 Kammer 49 Kammer 4D

Parameter Name	Bit or Byte Values	Description
ACT_SIZE	20	Kammer P0
	21	Kammer P1
	22	Kammer P2
	23	Kammer P3
	24	Kammer P4
	25	Kammer P5
	26	Kammer P6
	27	Kammer P7
	29	Valtek Diaphragm Rotary NR1
	30	Valtek Diaphragm Rotary NR2
	31	Valtek Diaphragm Rotary NR3
	32	Automax B050D
	33	Automax B063D
	34	Automax B085D
	35	Automax B100D
	36	Automax B115D
	37	Automax B125D
	38	Automax B150D
	39	Automax B175D
	40	Automax B200D
	41	Automax SNA250
	42	Automax SNA300
	43	Automax R205
	44	Automax R206
	45	Automax R207
	46	Automax R208
	47	Automax R310
	48	Automax R312
	49	Automax R314
	50	Automax R316
	51	Automax R414
	52	Automax R416
	53	Automax R418
	54	Automax R420
	55	Automax R422
	56	Automax R514
	57	Automax R516
	58	Automax R518
	59	Automax R520
	60	Automax R522
	61	Automax R524
	63	NAF 02
	64	NAF 11
	65	NAF12
	66	NAF 21
	67	NAF 22
	68	NAF 31
	69	NAF 32
	70	NAF 41
	71	NAF 42
	72	NAF 51
	73	NAF 52
	75	Valtek Diaphragm Linear 127
	76	Valtek Diaphragm Linear 252
	77	Valtek Diaphragm Linear 502
	78	Valtek Diaphragm Linear 700
	79	Valtek Diaphragm Linear 1502
	80	Valtek Diaphragm Linear 3002
	82	Fisher 657-30
	83	Fisher 657-34
	84	Fisher 657-40
	85	Fisher 657-45

Parameter Name	Bit or Byte Values	Description
ACT_SIZE	86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 105	Fisher 657-46 Fisher 657-50 Fisher 657-60 Fisher 657-70 Fisher 657-80 Fisher 657-87 Fisher 657-100 Fisher 667-30 Fisher 667-34 Fisher 667-40 Fisher 667-45 Fisher 667-46 Fisher 667-50 Fisher 667-60 Fisher 667-70 Fisher 667-80 fisher 667-87 Fisher 667-100 Other
SPRING_TYPE	0 1 2 3 4 5 99	88
USER_INTERFACE_INSTANT	Bit 0 0x0001 Bit 1 0x0002 Bit 2 0x0004 Bit 3 0x0008 Bit 4 0x0010 Bit 5 0x0020 Bit 6 0x0040 Bit 7 0x0080 Bit 8 0x0100 Bit 9 0x0200 Bit 10 0x0400 Bit 11 0x0800 Bit 12 0x1000 Bit 13 0x2000 Bit 14 0x4000 Bit 15 0x8000	Air Action ATO Enabled Characterization Linear Auto Tune Enabled Low Friction Mode Calibration Auto DIP SW 6 Spare Up Button Not Pressed DN Button Not Pressed Bit 1 of Gain Selector Bit 2 of Gain Slelector Bit 3 of Gain Selector For Future Use Quick Cal Button Not Pressed For Future Use For Future Use For Future Use

9   Calibration

9.1   Introduction

This section provides information about calibrating the Logix 3400MD digital positioner's sensors.

9.2   Overview

About Calibration

When re-calibration is required, the Logix 3400MD digital positioner does not need to be removed from the process and may be calibrated in the field.

NOTE: Calibration will cause the valve to fully stroke, so calibration must not be initiated while the valve is on line in the process.

⚠ **CAUTION:** The configurator application can be used to perform the calibration procedures. The software application is not a calibrated measurement source. It is a digital diagnostic tool that provides verification of device parameter values.

Calibration Process

In general, calibration procedures follow these processes:

1. Prepare the device. **(Note:** The transducer function block must be out-of-service in order to perform any calibration.)

2. Write to CALIBRATE.

3. Observe the positioner performance.

The calibration parameter values and calibration commands are written to the device using a fieldbus configuration application, (such as the NI-FBUS Configurator).

Alternatively, use the Re-Cal button on the Logix 3400MD digital positioner to perform the stroke calibration. Confirm that positioner is configured properly, then proceed.

1. Prepare the device and safe the area for the removal of the main housing cover.

2. Remove the cover.

3. Press and hold the Re-Cal button for at least five seconds to initiate the stroke calibration. **(NOTE:** The transducer block must be out-of-service before the Re-Cal button will be active.) If Auto Tune is selected, this will also auto tune the positioner response.

4. Replace cover and return to operation. (Refer to Logix 3400MD Digital Positioner IOM for more details.)

9.3   Calibration

The output position of the Logix 3400MD digital positioner is calibrated using the transducer block CALIBRATE parameter. The positioner performance must be verified by the operator.

Calibration Parameters

Table 9.1 lists transducer block parameters and their values used in the calibration procedures.

Table 9.1 Transducer Block Calibration Parameters

Parameter	Description	Value - Meaning	Comments
MODE_BLK	The operating mode of the transducer block	Permitted modes: Auto — Auto (target mode) OOS — Out of Service	The transducer block must be in the OOS mode to perform Logix 3400MD digital positioner calibration.
CALIBRATE	One-byte value which selects the calibration operation to be performed.	0 Normal operation. Valve tracks FINAL_VALUE 1 Initiates stroke calibration. Closes valve. 2 Initiates actuator pressure transducers calibration. 3 Moving valve closed position 4 Moving valve to open position 5 Calibrating Supply 6 Calibrating actuator sensor - closed 7 Calibrating actuator sensor - open 8 Monitoring of Re-Cal button. 9 Error occurred during calibration 10 Inner-loop offset adjustment	Calibration and correction commands are executed when the command is written. Messages only Nulls the spool block

		11 Auto Tune Positioner	Only active when Re-Cal is done
		12 JogCal - Waiting for user to set point	Initiates the monitoring of the button for five seconds
		13 Range Checking	
		14 Normal Operation (Rev 0x23). Checkjog call setting in MISC_FLAGS	Jog Cal must be enabled in MISC_FLAGS before it can be initiated
PRESURE_ SUPPLY_ CAL_REF	Input referenc or actual supply pressure for calibration	0 – 150 psig max.	Used to calibrate the span of the actuator pressure sensors

Two-point Calibration

The Logix 3400MD digital positioner has two-point calibration. The stroke position feedback potentiometer and the actuator pressure transducers are calibrated this way. The positioner must be pre-configured to the proper air action and valve type (linear or rotary)before the calibration is done.

Procedure: Stroke and pressures are calculated when the user follows the steps below.

1. Using a fieldbus configuration application as the operator interface to device, set the transducer and resource block MODE_BLK parameter to OOS (Out of Service).

2. For stroke, write the value 1 to CALIBRATE. The valve will close and then open automatically. The value will change values as the calibration continues. Once completed, CALIBRATE will return to '0.' (This may take 10 seconds to ~2 minutes depending on the actuator size.)

3. For actuator pressure transducers (if so equipped), input the measured supply pressure (in psig) in PRESSURE_SUPPLY_CAL_REF. Write the value 2 to CALIBRATE. The valve will close and then open automatically. The value will change values as the calibration continues. Once completed, CALIBRATE will return to '0' (This may take 1 minute to ~10 minutes depending on the actuator size.)

4. The positioner will return to tracking FINAL_VALUE.

5. Change MODE_BLK to desired mode

6. When calibration is completed, set transducer and resource block to auto mode to resume normal device operation.

Canceling Calibration

Write ABORT to CALIBRATE. The previous values are restored and CALIBRATE returns to NONE.

Additional Calibration Features

Re-Cal button: Re-Cal is a method by which the valve can be stroke-calibrated without using the fieldbus configurator. **Important: This feature is provided to allow stroke calibration being initiated at the positioner. However, the Logix 3400MD digital positioner Transducer block must be placed in Out-of-Service mode for the button to become active. After completion of the calibration cycle, the block must be returned to normal mode for operation to resume.**

Re-Cal only affects position calibration. Any previous configuration or stored information is not affected. Re-Cal must be used to Auto Tune the positioner.

10 Troubleshooting

10.1 Introduction

This section contains information about identifying device faults and suggested actions to correct them. The approach to troubleshooting is determining the cause of the fault through definition of the symptoms (such as a device not visible on network or not able to write values to parameters).

The information is organized the following way:

- **Device troubleshooting tables** list some of the more commonly encountered faults and suggestions to check in order to find out where the problem is and correct it.

- **Positioner status tables** define some of the conditions that cause critical or non-critical faults in the transmitter. **Critical and non-critical faults** are described and suggestions are given on where to find further information.

- **Device diagnostics** briefly explains about some of the background diagnostics that are active in the device during normal operation. Device parameters are described that provide information about hardware and software status within the device.

- **Block configuration errors** summarize conditions within the device which may be caused by configuration errors and suggestions on where to look to correct the errors.

- **Simulation mode** describes how to set up the transmitter to generate a user-defined simulated input. This feature is useful in debugging the system when the process is not running.

10.2 Overview

Device Status and Failures

Logix 3400MD digital positioner is constantly running internal background diagnostics to monitor the functions and status of device operation. When errors and failures are detected, they are reported in the status bits of various parameters in each block object, e.a. BLOCK_ERR or ERROR_DETAIL. Other parameters can be viewed showing a status description and/or a value which may identify a fault.

Device status and certain operational faults are identified by viewing the parameter status or values and interpreting their meaning using the tables in this section.

⚠️ **CAUTION:** Additional diagnostics may be available through supervisory and control applications that monitor and control fieldbus networks. These diagnostics and messages are dependent upon the capabilities of the application and control system used.

Troubleshooting with the NI-FBUS Configuration Tool

The diagnostic messages generated by the Logix 3400MD digital positioner and block parameters can be accessed and evaluated using the NI-FBUS Configurator. Troubleshooting of some Logix 3400MD digital positioner faults and corrective actions also can be performed using the configurator.

Fault Summary

Diagnostic messages can be grouped into one of these three categories.

1. **Non-critical Failures (Blink Code Starts Y)** — Logix 3400MD digital positioner continues to calculate PV output.

2. **Critical Failures (Blink Code Starts R)** — Logix 3400MD digital positioner drives PV output to fail-safe state.

3. **Configuration Errors** — Incorrect parameter values may cause the Logix 3400MD digital positioner to generate a fault.

A description of each condition in each category is given in the following tables. The condition is described, a probable cause is stated and a recommended corrective action is given for each fault.

10.3   Device Troubleshooting

Device Not Visible on Network

If the device is not seen on the fieldbus network, the device may not be powered up or possibly the supervisory or control program is not looking for (or polling) the node address of that device. (See Table 10.1 for possible causes and recommended actions.)

Table 10.1 Device Troubleshooting A

Symptom		
• Device not visible on network		
Possible Cause	**Items to Check**	**Recommended Action**
Device may have a node address that is with-in the unpolled range of addresses.	Look at the following settings of the host system: • First Unpolled Node • Number of Unpolled Nodes	Set number of unpolled nodes to 0.
No power to the device.	Measure the DC voltage at the device's SIGNAL terminals. Voltage must be within the limits as shown in Table 4.2 on page 15.	If no voltage or voltage is out of operating limits, determine cause and correct.
Insufficient current to device	Measure DC current to device. It should be between 23 and 27 mA.	If current is insufficient, determine cause and correct.
More than two or less than two terminators wired to fieldbus link	Check to see that only two terminators are present on link.	Correct, if necessary.
Insufficient signal to device	Measure the peak-to-peak signal amplitude; it should be: • Output 0.75 to 1.0 Vp-p. • Input 0.15 to 1.0 Vp-p. Measure the signal on the + and - SIGNAL terminals and at a frequency of 31.25k Hz.	If signal amplitude is insufficient, determine the cause and correct.

Incorrect or Non-compatible Tools

If the user is using non-compatible versions of fieldbus software tools, such as Standard Dictionary or Device Description (DD) files, or if the user is using the incorrect revision level of device firmware, then device objects or some block objects may not be visible or identified by name. (See Table 10.2 for possible causes and recommended actions.)

Table 10.2 Device Troubleshooting B

Symptom		
• Device and/or block objects not identified (UNKnown), or,		
• Parameters are not visible or identified by name, or		
• Flowserve-defined parameters are not visible.		
Possible cause	**Items to check**	**Recommended Action**
Incorrect standard dictionary, device description (DD) or symbols on host computer	Verify that the standard dictionary, the DD or symbols files are correct for the device.	Install the compatible version of standard dictionary and DD for the device on the host computer. See Fieldbus Device Version Checking on page xi.
Incorrect path-names to descriptions on host computer.	Check that the path name to locations of the standard dictionary, and DD files on the host computer is correct.	Make sure that the path name of the standard dictionary and DD are in the correct location for the fieldbus software application. (C:\. . . \release\)
Incorrect revision of Device Resource Block firmware	Read the four (4) elements of the REVISION_ARRAY parameters: which are: • Board Firware Rev • Stack Rev Transducer Board Firmware Major Rev Transducer Board Firmware Minor Rev	Perform a code download of the correct device firmware. See Code Download on page 133.

| Incorrect revision level of the device firmware. | Read the three elements of the REVISION_ARRAY parameter, which are:

• Stack board firmware

• Stack board boot code

• Transducer board firmware NOTE: The numbers, when viewed as hexadecimal numbers, are in the format MMmm.Where, MM is the major revision number and mm is the minor revision number. | Perform a code download of the correct device firmware. See Code Download in section 11. |

Non-functioning Blocks

• Device block objects may not be running (executing their function block schedules) or the blocks may be in Out-of-Service (OOS) mode. For example, if the AO function block is in OOS mode, the block will not provide updated output values although the AO block may be running. When troubleshooting non-functioning block objects, start with the resource block. For example, if the resource block is in OOS mode all other blocks in the device will also be in OOS mode. (See Table 10.3 for possible causes and recommended actions.)

Table 10.3 Device Troubleshooting C

Symptom		
• Device output is not updating.		
Possible Cause	**Items to Check**	**Recommended Action**
Resource block mode is OOS	Read MODE_BLOCK. ACTUAL of Resource block.	If necessary, set MODE_BLOCK.TARGET to Auto.
Resource block is not running.	Read the first element of BLOCK_TEST. Number should be increasing indicating that block is running. If block is not running, check the second element of BLOCK_TEST. Check BLOCK_ERR for other errors. If an error is present in BLOCK_ERR, then read ERROR_DE-TAIL.	If second element of BLOCK_TEST is not zero, write all zeroes to element. See Sub-section 10.7 for details on BLOCK_ERR. Set RESTART to processor (or '4') to soft-restart the device.
Incorrect revision of resource block firmware.	Read DEV_TYPE , DEV_REV, and DD_REV.	See Incorrect or non-compatible tools above in Sub-section 10.3.
Incorrect revision level of the device firmware.	Read REVISION_ARRAY.	See Incorrect or non-compatible tools above in Sub-section 10.3.
Transducer block mode is OOS	Read MODE_BLK . ACTUAL.	Set MODE_BLK.TARGET to auto. NOTE: Transducer block must be in AUTO mode for the sensor signal to be passed to 'AO block.'
Transducer block is not producing valid primary data.	1. Read the first element of BLOCK_TEST. Number should be increasing indicating that block is running. If block is not running, check the second element of BLOCK_TEST. 2. Read BLOCK_ERR. 3. Verify parameter FINAL_VALUE is not valid STATUS = good or uncertain VALUE = active 4. Read FINAL_POSITION VALUE; should contain the position. Isolate valve from process and check calibration.	If second element of BLOCK_TEST is not zero, write all zeroes to element. See Sub-section 10.7 for details on BLOCK_ERR. Report information to factory.
Analog Output block mode is OOS	Read MODE_BLK.ACTUAL of AO block.	Set MODE_BLK .TARGET to auto.
AO block is not initialized	1. CHANNEL 2. SHED_OPT	1. Set to 1 2. Set to a value other than Un-initialized
PID block is not initialized	SHED_OPT	Set to a value other than uninitialized.
PID block mode is OOS	Read MODE_BLK.ACTUAL of PID block.	Set MODE_BLK.TARGET to Auto.
PID block is not running.	Read the first element of BLOCK_TEST. Number should be increasing indicating that block is running. If block is not running, check the second element of BLOCK_TEST.	If second element of BLOCK_TEST is not zero, write all zeroes to element. Download valid schedule to device.

10.4   Device Diagnostics

Logix 3400MD Digital Positioner Memory

The Logix 3400MD digital positioner contains a number of areas of memory. An EEPROM provides a non-volatile memory area for static and non-volatile parameter values. The positioner also contains areas of RAM and ROM.

Background Diagnostics

Block objects (resource, transducer and function blocks), the communications stack and other device objects each have a designated area of memory where their database resides. Diagnostic routines are performed in the background during device operation which check the integrity of these individual databases. When a failure is detected, a status bit is set in the BLOCK_ERR parameter in the appropriate block object.

Diagnostic checks are performed continuously on the device functional databases of the Logix application shown in Table 10.4.

Table 10.4 Areas of Device Memory Where Data is Stored

Device Functional Area	Location
Block object database (DB)	RAM and EEPROM
Communication stack database (DB)	RAM and EEPROM
Boot ROM	ROM
Program ROM	ROM
Trend and link object databases (DB)	RAM and EEPROM

BLOCK_ERR Parameter

BLOCK_ERR parameter shows diagnostic faults of hardware and software components within the transmitter. Each block object in the transmitter device application contains a BLOCK_ERR parameter. BLOCK_ERR is actually a bit string which provides a means to show multiple status or error conditions. A status message identifying the fault can be viewed by accessing the parameter. Table 10.5 shows the bit mapping of the BLOCK_ERR parameter

To verify that block and background diagnostics are executing in a particular block: View the BLOCK_TEST parameter of the block.
If the first element of the parameter (BLOCK_TEST =) is incrementing, the block is executing and the diagnostics are active.

⚠ CAUTION: If the first element value is not increasing, the block is not executing.

Table 10.5 BLOCK_ERR Parameter Bit Mapping

BLOCK_ERR Bit	Message Name*	Description
No bit set	NO_ERROR	If no bits are set there is no error
0	OUT_OF_SERVICE	Indicates the block is out of service (OOS)
1	POWER_UP	Not used
2	NEEDS_MAINT_NOW	This indicates that the device needs maintenance now. Diagnostics has indicated that something has failed causing the positioner to not be able to operate. (Transducer block only).
3	REEDBACK_CHECK_ FAILED	Communication failure to serial EEPROM (Resource block only) (Checksum Error)
4	LOST_NV_DATA	EEPROM write to block DB failed, EEPROM write to Stack DB failed (Resource block only), EEPROM write to Link or Trend DB failed (Resource block only)
5	LOST_STATIC_DATA	Block Non-Volatile (NV) memory failure Stack NV memory failure Link or Trend Object NV memory failure
6	MEMORY_FAILURE	Not used
7	OUTPUT_FAILURE	Indicates there was an output failure to the transducer block (AOand DO blocks only)
8	INPUT_FAILURE	Indicates there was an input failure to the block (AO, DI and DO blocks only)

9	NEEDS_MAINT_SOON	This indicates that the device needs maintenance soon. Diagnostics has indicated something is out of tolerance or is going to fail, causing the positioner to possibly be operating with reduced functionality (Transducer block only)
10	FAULT_STATE_SET	Indicates if the fault state has been set (Resource Block only)
11	LOCAL_OVERRIDE	Indicates if the block has gone into Local Override mode (LO)
12	SIMULATE_ACTIVE	The SIMULATE parameter is being used as the input to the AO block. This occurs if the simulate jumper is set to Y on the electronics board and the ENABLE_DISABLE field of the SIMULATE parameter is set to 2
13	LINK_CONFIG_ERR	Set by the system. Indicates if all the links for the block configurations are available
14	BLOCK_CONFIG_ERR	Invalid parameter value in block. See Clearing Block configuration Errors
15	OTHER	
Depending on the fieldbus interface application, device operating status and parameter values may appear as text messages. The text in the table is typical of values or messages seen when using the NI-FBUS Configurator		

Table 10.6: Transducer Block BLOCK_ERR diagnostics mapping

Diagnostic Flag	BLOCK_ERR Alarm Issued
POSITION_DEVIATION _ALARM	BLK_ERR_DEV_NEEDS_MAIN_NOW
FACTORY_RESET_STATE	BLK_ERR_DEV_NEEDS_MAIN_NOW
STROKE_CAL_REQUIRED	BLK_ERR_DEV_NEEDS_MAIN_NOW
SUPPLY_PRESS_LOW_ALARM	BLK_ERR_DEV_NEEDS_MAIN_NOW
LOSS_INTERBOARD_PCB	BLK_ERR_DEV_NEEDS_MAIN_NOW
MECHANICAL_STATUS not ZERO	BLK_ERR_DEV_NEED_MAINT_SOON
ELECTRONIC_STATUS not ZERO	BLK_ERR_DEV_NEED_MAINT_SOON
SUPPLY_PRESS_HIGH_WARNING	BLK_ERR_DEV_NEED_MAINT_SOON
SUPPLY_PRESS_LOW_WARNING	BLK_ERR_DEV_NEED_MAINT_SOON
PORT_A_VALUE_OUT_OF _RANGE	BLK_ERR_DEV_NEED_MAINT_SOON
PORT_B_VALUE_OUT_OF_RANGE	BLK_ERR_DEV_NEED_MAINT_SOON
PORT_A_RANGE_TOO_SMALL	BLK_ERR_DEV_NEED_MAINT_SOON
PORT _B_RANGE_TOO_SMALL	BLK_ERR_DEV_NEED_MAINT_SOON
PNUEMAITC_LEAK_WARN ING	BLK_ERR_DEV_NEED_MAINT_SOON
SPOOL_STICKING_WARNING	BLK_ERR_DEV_NEED_MAINT_SOON
SPOOL_STICKING_ALARM	BLK_ERR_DEV_NEED_MAINT_SOON
SPOOL_CYCLES_WARNING	BLK_ERR_DEV_NEED_MAINT_SOON
SPOOL_TRAVEL_WARNING	BLK_ERR_DEV_NEED_MAINT_SOON
HALL_SENSOR_UPPER_POSITION	BLK_ERR_DEV_NEED_MAINT_SOON
HALL_SENSOR_LOWER_POSITION	BLK_ERR_DEV_NEED_MAINT_SOON
FEEDBACK_RANGE_TOO_SMALL	BLK_ERR_DEV_NEED_MAINT_SOON
POSITION_OUT_OF_RANGE_LOW	BLK_ERR_DEV_NEED_MAINT_SOON
POSITION_OUT_OF_RANGE_HIGH	BLK_ERR_DEV_NEED_MAINT_SOON
NO_MOTION_TIME_OUT	BLK_ERR_DEV_NEED_MAINT_SOON
NON_SETTLE_TIME_OUT	BLK_ERR_DEV_NEED_MAINT_SOON
INNER_LOOP_OFFSET_TIME_OUT	BLK_ERR_DEV_NEED_MAINT_SOON
JOG_CALIBRATE_SET_100_POS	BLK_ERR_DEV_NEED_MAINT_SOON

10.5   Block Configuration Errors

Configuration Errors

Block configuration errors prevent a device block from leaving OOS mode. The BLOCK_ERR parameter (bit 1) shows whether a block configuration error is present. Table 10.7 summarizes the conditions that may be the result of block configuration errors, which in turn cause a device fault. Follow the recommended actions to correct these errors.

Table 10.7 Summary of Configuration Errors

Problem/Fault	Probable Cause	Recommended Action
Name of parameters are not visible	Missing or incorrect version of device description file on host computer.	1. Check path to device description. 2. Load correct version of DD.
Unable to write successfully to MODE_BLK of any block.	Mode not supported in TARGET and/or PERMITTED modes for the given block.	• Verify that the mode being written is supported by the block. • If writing TARGET mode only, then the desired mode must already be set in the PERMITTED field. • If writing the whole MODE_BLK record, then the mode set in TARGET must also be set in the PERMITTED field. Other modes may also be set in the PERMITTED field, but target mode must be set.
Unable to write to a parameter	1. Parameter is read-only.	1. None
	2. Sub-index of the parameter is read-only. Some parameters have fields that are not writable individually (such as MODE_BLK.ACTUAL).	2. None
	3. Write-locking is active. Resource block parameter WRITE_LOCK value is 2.	3. Remove write protect jumper (see Subsection 6.5)
	4. Corresponding block is in the wrong mode. Some parameters can only be written to in OOS mode only, or in OOS or manual modes.	4. Write valid mode to MODE_BLK parameter of block (OOS or MAN modes). See Mode Restricted Writes to Parameters in Sub-sections 8.6 and 8.7.
	5. Data written to the parameter is out of the valid range for that parameter.	5. Write valid range values to parameter.
Unable to change resource block to auto mode	1. The second element of BLOCK_TEST is not zero.	1. Write all zeroes to the second element of the BLOCK_TEST parameter.
	2. Resource block is in OOS mode.	2. Write auto mode to MODE_BLK.TARGET of the resource block.
	3. The second element of BLOCK_TEST is non-zero.	3. Write all zeroes to the second element of the BLOCK_TEST parameter.
	4. A configuration error occurred in the block.	4. Find and correct any configurable parameter outside its valid range. See Clearing Block Configuration Errors in Sub-section 10.6.
Unable to change analog output block from OOS mode	1. The block has not been configured to execute. It is neither in the function block schedule in the system management information base, nor is it linked to another executing block via the next block to execute field in the block record (relative parameter index).	1. Build and download an execution schedule for the block including links to and from AO block with other function blocks.
	2. Resource block is in OOS mode.	2. Write auto mode to MODE_BLK of resource block.
	3. Block configuration error.	3. a. Check the parameters SHED_OPT and CHANNEL. All values must be non-zero. b. BLOCK_ERR for bit 1 set. If set, check all configurable parameters for possible invalid values. See Clearing Block Configuration Errors in Sub-section 10.6.
	4. The second element of BLOCK_TEST is not zero.	4. Write all zeroes to the second element of the BLOCK_TEST parameter.

AO block is in the correct mode but does not seem to be operating	1. Simulation active.	1. Disable simulation. See Sub-section 10.8 for procedure.
	2. The block has not been configured to execute. It is neither in the function block schedule in the system management information base, nor is it linked to another executing block via the next block to execute field in the block record (relative parameter index 0).	2. Build and download an execution schedule for the block including links to and from AO block with other function blocks.
	3. The second element of BLOCK_TEST is not zero.	3. Write all zeroes to the second element of the BLOCK_TEST parameter.

10.6   Clearing Block Configuration Errors

Clearing Block Configuration Errors

Table 10.8 and Table 10.9 list the parameters in the AO and PID blocks which can cause the status bit of block configuration error to be set in their respective BLOCK_ERR parameters. The tables also provide the initial values and the valid range for the parameters.

NOTE: Block configuration errors can only be cleared if the function block is being executed (running). One way of determining block execution is by doing a series of two or three reads of the BLOCK_TEST parameter and confirming that the first byte of the parameter is incrementing. This will work if the execute rate is fast relative to the speed of reading BLOCK_TEST. A very slowly executing block may not appear to execute because block parameters are updated only when the block executes.

Table 10.8 AO Block Parameters

Parameter	Initial Value	Valid Range	Corrective Action
ALERT_KEY	0	non-zero	Initial value is a configuration error. Set value to non-zero number.
SIMULATE	1(disabled)	1-2 (disabled-enabled) Set value in valid range.	
XD_SCALE	0to100	EU_100 > EU_0, UNITS_INDEX matches output of transducer block	Set values to valid range(s).
CHANNEL	0	1-2	Initial value is a configuration error. Set value to valid range.
SP_RATE_DN SP_RATE_UP	+INF	0-15	Set value to valid range.
SP_HI_LIM,	100	0-100	Set value to valid range.
SP_LO_LIM	0	0-100	Set value to valid range.
SHED_OPT	0	1-8(seeShedOptionsinthe FFspecs.)	Initial value is a configuration error. Set value in valid range.
BYPASS	0	1:OFF;2:ON	Initial value is a configuration error. Set value in valid range.
SHED_OPT	0	1-8(seeShedOptionsinthe FFspecs.)	Initial value is a configuration error. Set value in valid range.
HI_HI_LIMHI_LIM	+INF +INF		PV_SCALE, +INF Values must be set in rank order (e.g.LO_LIM > LO_LO_LIM but < HI_LIM etc.)
LO_LIMLO_LO_LIM	-INF -INF	PV_SCALE,-INF	Values must be set in rank order.
OUT_HI_LIM OUT_LO_LIM	100 0	OUT_SCALE+/-10%	Verify that OUT_HI_LIM > OUT_LO_LIM.
SP_HI_LIMSP_LO_LIM	100 0	PV_SCALE+/-10%	Verify that SP_HI_LIM > SP_LO_LIM.

Table 10.9 PID Function Block Parameters

Parameter	Initial Value	Valid Range	Corrective Action
BYPASS	0	1:OFF,2:ON	Initial value is a configuration error. Set value in valid range.
SHED_OPT	0	1-8(see Shed Options in the FF specs.)	Initial value is a configuration error. Set value in valid range.
HI_HI_LIM HI_LIM	+INF +INF	PV_SCALE, +INF	Values must be set in rank order (e.g.LO_LIM > LO_LO_LIM but < HI_LIM etc.)
LO_LIM LO_LO_LIM	-INF -INF	PV_SCALE, -INF	Values must be set in rank order.
OUT_HI_LIM OUT_LO_LIM	100 0	OUT_SCALE +/-10%	Verify that OUT_HI_LIM > OUT_LO_LIM.
SP_HI_LIM SP_LO_LIM	100 0	PV_SCALE +/-10%	Verify that SP_HI_LIM > SP_LO_LIM.

10.7   Additional Troubleshooting

As a general rule, follow the suggestions for corrective action for suspected problems described this document. If a problem is still present, perform step 1 below. If the problem still persists, perform step 2 and so on.

1. In the resource block set the RESTART parameter to 'Processor'. Then return to 'run'.

2. Cycle power to the Logix 3400MD digital positioner

3. Re-start fieldbus driver software on the host computer with the Logix 3400MD digital positioner un-powered, then power-up the Logix 3400MD digital positioner.

4. Call Flowserve's Valtek Control Product Technical Assistance. (See Technical Assistance on page 10.)

10.8   Simulation Mode

Simulation Mode Dip Switch

A simulation mode is available in the positioner, which is used to aid in system debug if the process is not running. When simulation mode is enabled, the SIMULATE parameter in the AO block provides a user-selected value as the readback input to the AO block.

Setting Simulation Dip Switch

ATTENTION: A hardware dip switch on the main PCB cover is set to enable or disable the S IMULATE parameter. See Figure 10.1 for dip switch selection. Table 10.10 shows how to set the simulation dip switch on the main PCB cover.
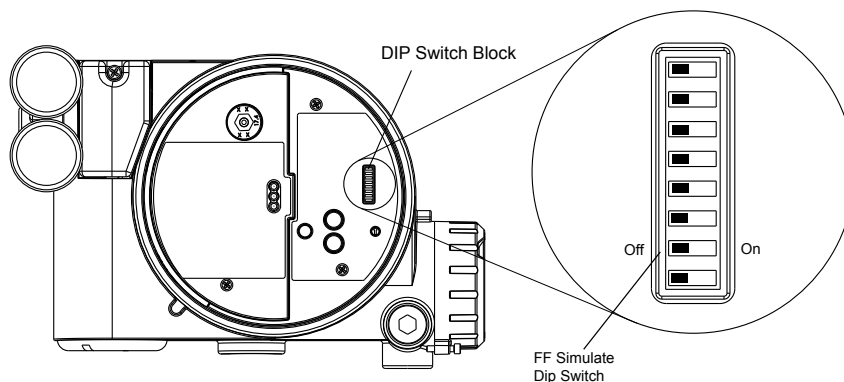
Figure 10.1 Simulation DIP Switch Location on the PCB Cover

Table 10.10 Setting the Simulation Dip Switch

To	Set the Dip Switch to:	
Enable read and write access to the device's configuration. (Factory-set default)	Off position on the dip switch.	Off On
Enable read only access to device's configuration. (Write-protect)	On position on the dip switch.*	Off On

Enabling Simulation Mode

The SIMULATE parameter is enabled by setting the hardware simulation jumper to the Y position.

Additionally, AO block SIMULATE parameter must be set to the following values: SIMULATE

STATUS = Good: :[alarm status]: constant (suggested setting)

SIMULATE_VALUE = (supplied by user) used as the readback input to the AO block.

ENABLE_DISABLE = Active enabled

Simulation Mode Truth Table

The truth table in Table 10.11 shows the states of the simulation jumper and SIMULATE parameter to activate the simulation mode.

Table 10.11 Simulation Mode Truth Table

When the Simulation Dip Switch on main PCB cover is set to:	.. and the SIMULATE Enable_Disable is set to:	
	1 (Disabled)	2 (Active)
Off Position	Simulation Disabled	Simulation Disabled
On Position	Simulation Disabled	Simulation Active

Simulation Mode A simulation mode is available in the AO function block to set the value and status of READBACK when it is necessary to override the transducer value or status.

The SIMULATE parameter contains the following elements:

• SIMULATE_VALUE Contains the value that is copied to the READBACK parameter.

• SIMULATE_STATUS Contains the status that is copied to the READBACK parameter.

• TRANSDUCER_VALUE Contains the value read from the transducer position source.

• TRANSDUCER_STATUS Contains the status read from the transducer position source.

• ENABLE_DISABLE Enables simulation of the SIMULATE_VALUE and SIMULATE_STATUS when selected.

Enabling Simulation

Before the ENABLE_DISABLE in the SIMULATE parameter may be selected, the hardware simulation must be enabled for the device.

To enable simulation in the device, set the SIMULATE dip switch to the "On" position, select RESTART_PROCESSOR in the Resource block RESTART parameter.

To ensure that simulate is permitted in the device, go to the Resource Block and read the BLOCK_ ERR parameter. It should indicate Simulation Enabled.

Simulating the Transducer

To simulate the READBACK parameter, set the SIMULATE parameter as follows:

1. Set ENABLE_DISABLE to ACTIVE and write the parameter.

2. Set SIMULATE_VALUE and SIMULATE_STATUS as desired and write the parameter.

3. Read the READBACK parameter. This should reflect the value and status which was set in the SIMULATE parameter.

NOTE: The TRANSDUCER_VALUE and TRANSDUCER_STATUS will continue to be updated by the transducer source as described in the next section.

Transducer Position Source Selection

The source of the TRANSDUCER_VALUE and TRANSDUCER_STATUS in the SIMULATE param

eter is determined by the FEATURE_SEL parameter in the Resource Block. If FEATURE_SEL OUT_READBACK not selected (default) then the transducer source will be the AO OUT parameter. If FEATURE_SEL OUT_READBACK is selected then the transducer source will be the FINAL_ POSITION_ VALUE from the Transducer Block.

Because the FINAL_POSITION_VALUE in Logix 3400MD transducer block reflects the actual actuator position, the OUT_READBACK feature should be always be selected during normal operation.

AO Block Mode

To connect the AO block input to the output, the AO block must be in AUTO mode.

10.9   Logix 3400MD Digital Positioner

Troubleshooting Guide

Table 10.12 Symptom Chart

Failure or Problem	Probable Cause(s)	Refer to Section(s)
Mounting and Installation		
LED won't blink	1. Input voltage not correct	1. See Electrical Wiring Summary in Section 5.
	2. Termination may be incorrect.	
	3. Calibration is in process.	
Valve moves in wrong direction with no change in input signal	1. May be tubed for wrong air action.	1. See Air Action in Section 6.
	2. Spool stuck.	2. See Spool Valve instructions in Logix 3400MD Digital Positioner IOM.
Unit does not respond to fieldbus command.	1. Unit is not configured correctly.	1. See Theory of Operation on page 3.
	2. Error occurred during calibration.	2. See Calibration in Section 9.
Calibration		
LEDs blink RGGY after a Re-Cal operation. Valve stays in fully open or closed position.	1. Configured for linear on a rotary mounting.	1. See Re-Cal button Section 9.
	2. Feedback linkage out of range.	
	1. Valve didn't fully stroke during calibration (low or no air supply).	1. See Re-Cal button Section 9.
	2. Stuck Spool.	2. See Spool Valve instruction in Logix 3400MD Digital Positioner IOM.
On a rotary, valve has a dead band at the fully open or closed position.	1. Mechanical travel is not centered within the electrical measurement range (position sensor out of range).	1. See Linear vs. Rotary in Section 6.
Control and Tuning		
Valve won't saturate at closed position.	1. May need to enable MPC	1. See MPC in Section 8.
	2. Calibration required.	
Valve won't go below or above a certain limit.	1. Soft limits are not enabled	1. See Advanced Features in Section 10.
	2. MPC is not enabled	

Sticking or hunting operation of the positioner.	1. Contamination of spool valve assembly	1. See Air Supply Requirements on page 15. See Spool Valve in Section 10.
	2. P+I setting incorrect	2. See Setting P+I Parameters in Section 10.
	3. Excessive Stiction	3. Enable Hi Friction Feature
Large initial deviation; only present on initial power-up.	1. Inner loop offset not correct.	1. See Setting P+I Parameters in Section 10.
Stem position movement is not linear with command.	1. Custom characterization is enabled	1. See Custom Characterization in Section 10.
Fieldbus Communication		
Logix 3400MD digital positioner will not communicate with fieldbus.	1. Power problem.	1. See Wiring the Logix 3400MD Digital Positioner to a Fieldbus Network on page 19.
	2. FB card connection.	2. Verify FB protocol being used.
Configurator displays 'Unknown' after it connects.	1. DD has not been loaded in the configurator correctly.	1. Reload DD making sure Valtek products are listed.
Erratic communications occur.	1. Maximum cable length or impedance exceeded	1. See Wiring the Logix 3400MD Digital Positioner to a Fieldbus Network on page 19.
	2. Card not receiving enough power. (Laptop batteries possibly low)	2. Refer to AGA-181 for Network checkout procedure.
	3. Interference with I.S. barrier	
Alarms		
Temperature alarm occurs.	1. Ambient temperature has exceeded electronics ratings	1. See Temperature Alarm in Section 8.
Hall sensor alarm occurs.	1. Hall connector may have bad connection	1. See Hall sensor Alarm in Section 8.
	2. Sensor may be damaged	
	3. Low air supply pressure	3. Check air supply
Modulator current alarm occurs.	1. Modulator minimum pressure may be too low.	1. See Modulator current Alarm in Section 8.
	2. Clogged orifice	
	3. Bad cable connection	
EEPROM checksum alarm occurs.	1. Error when reading non-volatile memory storage	1. See EEPROM checksum Alarm in Section 8.
Multiple internal flags occur.	1. Bad micro-controller on main PCB assembly.	
LEDs		
LED four blink sequence begins with green	1. Any sequence beginning with a green light is a normal operating mode .	1. Go to Section 7.9 in the Logix 3400MD IOM
LED four blink sequence begins with yellow	1. Any sequence starting with a yellow light indicates that the unit is in a special calibration or test mode, or that there was a calibration problem.	1. Go to Section 7.9 in the Logix 3400MD IOM
LED four blink sequence begins with red	1. Any sequence starting with a red light indicates that there is an operational problem with the unit	1. Go to Section 7.9 in the Logix 3400MD IOM
Advanced Features		
Will not display pressure readings.	1. Is configuration set to advanced?	1. See Standard vs. Advanced Diagnostics in Section 10.
MPC will not function.	1. Is lower soft limit >= 0%. 2. Set-point should be 1 percent hysteresis around MPC.	1. See MPC in Section 8.

10.10 Internal Positioner Issues

Positioner Inner loop Control and Tuning

Setting P+I Parameters: Using the configurator, the user can set individual tuning parameters. To use the Auto Tune feature of the Logix 3400MD refer to section 7.4 in the Logix 3400MD IOM. A few key points are mentioned below.

GAIN_UPPER, GAIN_LOWER and GAIN_MULT: These three parameters are related by the following formula.

Proportional gain = maximum gain - | deviation | x gain multiplier

If proportional gain < minimum gain, then proportional gain = minimum gain
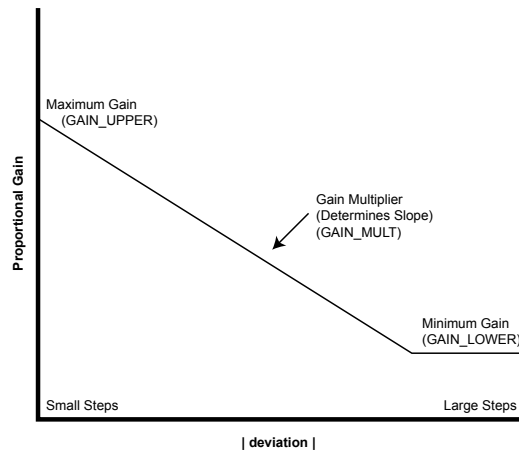
Figure 10.2 Gain Effect Diagram

This algorithm allows for quicker response to smaller steps yet stable control for large steps. (Refer to Figure 10.2.) Setting the gain multiplier to zero and max gain = min gain results in a typical fixed proportional gain.

The higher the gain multiplier, the larger the required deviation before the gain increases. Default values upon initiating a reset to the factory defaults are maximum gain= 2.0, minimum gain = 1.0, and gain multiplier = 0.05. These values will allow stable control on all Valtek control product actuator sizes.

Integral Gain (IGAIN): The integral gain is primarily for deviations due to temperature drift within the inner loop spool control. The factory default value is 10. Although higher numbers can speed the time it takes to reach zero deviation, it can add overshoot if too large. It is recommended that maximum and minimum gains be adjusted while leaving Integral Gain fixed at 10. Integration is disabled below a stem position of 3 percent and above a stem position of 97 percent. This is to prevent integration windup from calibration shifts due to lower pressure or a damaged seat which may prevent fully closing the valve.

Integration Summer: The integral summer within the Logix 3400MD digital positioner is clamped at +20.00 percent and −20.00 percent. If the integration summer is fixed at +20% or −20%, it usually indicates a control problem. Some reasons for a clamped integration summer are listed below:

• Stroke calibration incorrect

• Any failure which prevents stem position movement: stuck spool, handwheel override, low pressure.

• Incorrect inner loop offset

• Loss of air supply on a fail in place actuator

Writing a zero to integral gain will clear the integral summer. The integral gain can then be returned to its original value.

Inner Loop Offset (IL_OFFSET): Referring to Figure 1.3 in section 1, three control numbers are summed to drive the inner loop spool position control: proportional gain, integral summer, and inner loop offset. Inner loop offset is the parameter that holds the spool in the null or balance position with a control deviation of zero. This value is written by the positioner during stroke calibration and is a function of the mechanical and electrical spool sensing tolerances. However, if replacing the Driver Module Assembly is necessary, or the software reset has been performed, it may be necessary to adjust this value. The method below should be used to adjust inner-loop offset. Or simply perform a new stroke calibration.

From the fieldbus configurator,

- Send a 50 percent command.

- Set integral to zero.

- Locate the DAC_PERCENT

- Write this percentage value to IL_OFFSET.

- Write original value to Integral

Table 10.13 Logix 3400MD Digital Positioner Factory Tuning Sets

Brand	Tuning Set	GAIN_LOWER	GAIN_UPPER	GAIN_MULT	Igain	Comparable Actuator
Valtek	VFactory_A	1.00	2.00	0.05	10.0	25 sq. in.
	VFactory_B	1.00	2.50	0.05	10.0	50 sq. in.
	VFactory_C	2.00	3.00	0.05	10.0	100 sq. in.
	VFactory_D	4.00	5.00	0.05	10.0	200 sq. in.
	VFactory_E	4.00	7.00	0.05	10.0	300 sq. in.
Kammer	Trooper 48	0.40	0.50	0.05	25.0	31 sq. in.
	Trooper 49	3.00	4.00	0.05	10.0	77.5 sq. in.
Automax	R1	0.30	0.50	0.05	10.0	3 to 5 sq. in.
	R2	1.00	1.50	0.05	10.0	9 to 12 sq. in.
	R3	1.30	2.00	0.05	10.0	16 to 19 sq. in.
	R4	2.00	2.50	0.05	10.0	27 to 37 sq. in.
	R5	2.50	3.60	0.05	10.0	48 to 75 sq. in.
	R6	4.00	5.00	0.05	10.0	109 sq. in.

Spool Valve

The spool valve is a four-way directional valve with precision features to provide optimal control and low air consumption. To help prevent spool valve malfunction, the positioner supply air must conform to ISA Standard S7.3 (a dew point at least 18 degrees below ambient temperature, particle size below 1 microns, oil content not to exceed 1 part per million). Flowserve's standard coalescing filter is highly recommended to help meet these requirements.

Small particles, oil that has varnished, corrosion, ice, burrs, and extreme wear could cause the spool valve to act abnormally. If the spool valve is suspected of sticking, it can be inspected by performing the following.

1. Make sure the valve is bypassed or in a safe condition.

2. Disconnect the power and air supply to the unit.

3. Remove the spool valve cover by removing the screw and sliding the cover assembly backwards until the tab is clear of the slot.

4. Inspect the coalescing filter element in the spool valve cover for signs of oil, water and debris that may have come from the air supply. A clean filter is white.

5. Remove the two phillips-head screws holding the spool valve to the housing. Inspect the free movement of the spool by carefully sliding the block up and down on the spool about 0.25 inches. The block should slide on the spool with no resistance. Carefully remove the block, ensuring it is removed concentric with the spool.

6. Inspect the block and spool for oil, water, debris and wear. If oil, water and/or debris are found, the spool and block can be cleaned with a non-residue cleaner, lint-free cloth and soft bristle brush. If wear is found, replace the driver module assembly per the IOM manual.

7. Before re-assembly, verify that the three O-rings are in the counter-bores on the machined platform where the spool valve block is to be placed.

8. Carefully slide the block over the spool, using the machined surface of the housing base as a register. Slide the block toward the driver module until the two retaining holes line up with the threaded holes in the base. If resistance is still encountered, re-clean both parts or replace the driver module assembly. Refer to the IOM manual for spare part kit numbers.

Refer to the instructions in the Logix Series 3400MD Digital Positioner IOM under Driver Module Assembly for further instructions.

Advanced Features

Standard vs. Advanced Diagnostics

Answer: The model with advanced diagnostics adds top and bottom sensors. This allows for the collection of data for more diagnostic calculations, such as loss of pressure, friction, advanced signatures, and troubleshooting.

Question: Can I upgrade from a standard to an advanced model?

Answer: Yes. Advanced pressure board assembly can be purchased (see IOM). Simply install the advanced pressure board. All connectors on the pressure board are keyed and unique for easy cable re-connection. Using FB configurator, perform an actuator pressure calibration.

Temperature and Pressure Units: The desired temperature and pressure units can be set during configuration. Once set, all readings will be displayed in the desired units. Parameters TEMP_UNITS and PRESS_UNITS in the transducer block.

Stroke Length: Stroke length is used by the travel accumulator (TRAVEL_ENG). When the stroke length and units are set, the length is used to determine the total travel accumulated. The travel accumulator will have the units associated with stroke. Parameters STROKE_ENG and TRAVEL_UNITS in the transducer block.

Example: Stroke length is set to 4 inches. If the valve is moved from 0 percent to 100 percent, 4 inches will be added to the travel accumulator. The travel accumulator units will be inches. If stroke length is 90 degrees for a rotary, the travel accumulator will now have units of degree. A 0 percent to 100 percent stroke will add 90 to the travel accumulator.

NOTE: Stroke length is for information only.

Custom Characterization: Custom characterization can be thought of as a soft cam. The user can choose between an equal percentage, quick opening, or custom user-defined characterization curve using 21-points. The control will linearly interpolate between points. Points do not have to be equally spaced in order to allow more definition at critical curve areas.

The Logix 3400MD digital positioner has two modes: linear and characterization. Linear is a straight 1:1 mapping of command to control command. It does not use the 21-point curve definition. When custom characterization is disabled, the positioner is automatically in linear mode. If custom characterization is enabled, the Logix 3400MD digital positioner uses one of the 21-point user defined curves.

Question: Does a default custom characterization curve exist?

Answer: Yes. The Logix 3400MD digital positioner comes with a factory-default equal percent (and quick opening) curve in Figure 10.3.

NOTE: The quick opening curve is the inverse of the equal percent curve.

Table 10.14 Logix 3400MD Digital Positioner Characteristic Curves

FINAL_VALUE (%FS)	Quick Open	CMD_USED (%FS) Equal Percent	Linear
0	0.0	0.00	0
5	18.8	1.00	5
10	37.6	2.00	10
15	56.4	3.00	15
20	74.0	4.00	20
25	84.3	5.24	25
30	90.0	6.47	30
35	92.0	8.02	35

40	93.4	9.57	40
45	94.2	11.86	45
50	94.8	14.15	50
55	95.5	17.54	55
60	96.0	20.93	60
65	96.5	25.94	65
70	97.0	30.95	70
75	97.5	38.36	75
80	98.0	45.77	80
85	98.5	55.66	85
90	99.0	67.68	90
95	99.5	82.31	95
100	100.0	100.0	100

NOTE: Custom characterization points can only be entered with the FB configurator.
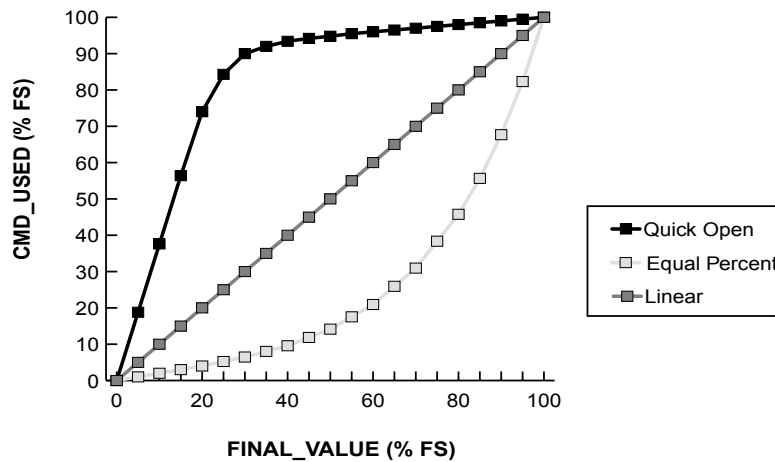
Figure 10.3 Logix 3400MD Digital Positioner Characteristic Curves

10.11 Stroke Characterization

In addition to three pre-defined and embedded characterization curves, the Logix 3400MD positioner has a 21-point custom stroke characterization feature. This allows the user to define a unique set of operating parameters customizable to his process conditions.

Table 10.15 Transducer Block Characterization Parameters

Parameter	Description	Value — Meaning	Comments
MODE_BLK	The operating mode of the transducer block	Permitted Modes: Auto - Auto (target mode) OOS - Out of Service	The transducer block must be out-of-service before the user can edit or change characterization.
CONTROL_FLAGS	Byte values which select positioner operation features	1 Quick Opening Curve*	Loads factory defined QO curve as custom curve.
		2 Equal Percent Curve	Loads factory defined equal percent curve as custom curve.
		4 Positioner Model	
		5 Actuator Style	
		6 Custom Characterization Active	Activates custom curve. If Off, response is Linear.
		8 Air Action	
CURVEX	Numeric X value array for custom point. (1x21 array points)	X-axis value for custom stroke characterization point. Range -10 to 110	Pair each X-value with corresponding Y-value to define the desired point. Values must be in ascending (or equal) order.
CURVEY	Numeric Y value array for custom point. (1x21 array points)	Y-axis value for custom stroke characterization point. Range -10 to 110	

* Must not be selected if a custom curve is to be created or edited.

10.12 Characterization Procedure

The following procedure outlines the basic way setting up a custom stroke characterization takes place.

Steps:

1. Verify the process is in a safe condition and that the valve may be taken out of service.

2. Put the Transducer block MODE_BLK OOS

3. Make sure that "Custom' is selected in CURVE_SELECT.

4. Enter the values for CURVEX and CURVEY to define the desired response. Care must be taken to assure that each CURVEX value has the correct corresponding CURVEY value. The user may choose any number in the range to define the curve. The 21 CURVEX points do not need to be evenly spaced, if so desired. However, the CURVEX values must be in ascending (or equal) order. The CURVEY points may be any value in the range, ascending or descending. The response is a linear interpolation, or straight-line, response between points. All 21-points must be defined. (i.e. If only 5 point sets were needed to define the desired operation, the remaining 16 points would need to be set to 110.).

5. Write the changes to the Logix 3400MD digital positioner.

6. Verify the proper operation of the stroke response by incrementally writing values to FINAL_ VALUE. (The Resource Block must also be OOS first.) CMD_USED, FINAL_POSITION_VALUE, and the valve response should track the desired curve.

7. Return the valve to service by returning both MODE_BLKs back to Auto.

Characterization Retention

Once a custom curve has been loaded into the Logix 3400MD digital positioner's memory it is retained in the EPROM until it is either edited or replaced. Turning 'Custom Characterization Active' on or off now selects between a linear response (Off), or the new custom curve (On). If either of the other two factory curves is selected it will overwrite the custom curve in RAM, only. The custom curve will automatically be activated again when the factory curve is deselected.

10.13 Initiating a Valve Signature

A feature of the Logix 3400MD positioner is the ability to capture and store a valve diagnostic signature in the positioner's volatile RAM. A signature is the collected data response of the valve to a pre-defined set of operating conditions. This stored data can later be uploaded to the host system for analysis of potential problems. By comparing a baseline signature, when the valve is new, to subsequent signatures at later times, a rate of change can be tracked which can help predict possible faults in the valve before they happen. This is called 'predictive maintenance'. It is important to note that the purpose of the positioner is to act as the data acquisition device for the signature. Analysis of the data is not done on the device, but in the supervisory system.

System Preparation

⚠ **CAUTION:** By definition, the collection of the signature requires the unmanaged operation of the positioner. Therefore, the process must be in a safe operating mode where unexpected movement of the valve will not cause a hazardous condition. Before a valve signature can be run, the Transducer Block must be out of service (OOS).

Table 10.16 Transducer Block Signature Parameters

Parameter	Description	Value-Meaning	Comments
MODE_BLK	The operating mode of the Transducer block	Permitted Modes: Auto-Auto (target mode) OOS-Out of Service	The transducer block must be in the OOS mode to perform a Signature
SIG_START	Beginning position point for signature to start.	Value is in percent and should be set in the range of -10% to 110%.	
SIG_STOP	Ending position point for signature.	Value is in percent and should be set in the range of -10% to 110%.	
RAMP_RATE	Desired time for ramp signature in seconds..	Minimum value is 1	RAMP_RATE is only used in the ramp signature. This is ignored in step signatures.
SIG_HOLD	Time in seconds after step or ramp that the the system will log data.		
SIG_FLAGS	Byte value which select Which signature options Are used	0x01 RUN/BEGIN_SIG 0x02 SIG_COMPLETE 0x04 TEST REPEAT MODE 0x08 RUN RAMP 0x10 VALVE_ 0x20 END OF DAT 0x40 TEST DAC MODE 0x80 RUN PST	Select to initiate the signature Status set when signature is complete Select to run a ramp signature otherwise it defaults to a step signiature. Initializes valve for signature capture (read only End of signiature data encountered when uploading. Select for special DAC mode Run Partial Stroke Test (PST)
SIG_INDEX	Pointer used for data transfer	Write the desired packet value.	Writing any value to SIG_INDEX will initiate a sig data transfer and will populate the SIG_DATAn parameters in the XDTB_TECH block.
SIG_DATAn	Arrays to hold the signature data after transfer from controller board.		The DIG_DATAn parameters are populated with the latest signature data when a write to the SIG_INDEX parameter is done.

10.14 Signature Procedure

The following steps are an example of how to initiate a **ramp signature** capture.
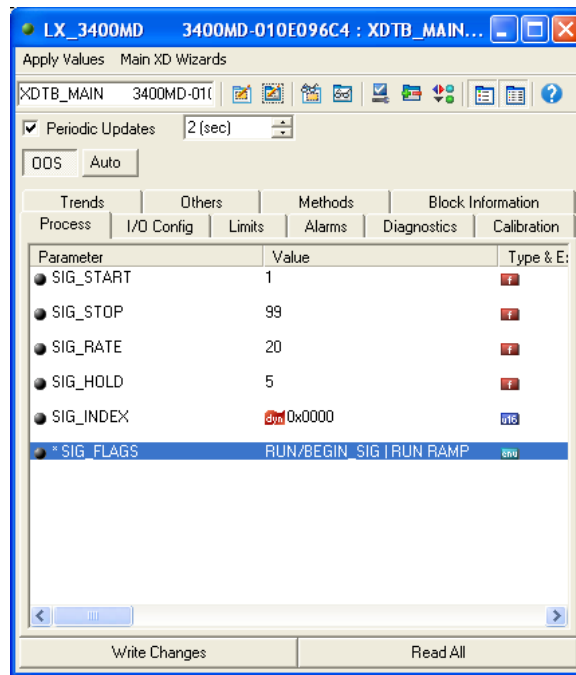
1. Make sure the process is in a safe condition and notify the control room that the valve will temporarily be taken off-line.

2. Verify preparedness to proceed.

3. Put the Transducer block MODE_BLK OOS.

4. Set SIG_START to desired value.

5. Set SIG_STOP to desired value.

6. Set SIG_RATE to desired value.

7. Set SIG_HOLD to desired value.

8. In SIG_FLAGS select: RUN/BEGIN, RUN RAMP.

9. Write values to the Logix 3400MD digital positioner.

10. The valve will stroke to the beginning position, as defined by SIG_START ,and will begin ramping to the desired ending position, as defined by SIG_STOP. Notice that SIG_COUNTER will increment while this takes place

11. SIG_FLAGS indicates SIG COMPLETE.

12. Notify control room the valve is back on-line. The stored signature will remain in the Logix 3400MD digital positioner NON volatile RAM until the either the unit is reset, or another signature is taken which overwrites the previous one.

13. Return the MODE_BLK to Auto

STEP SIGNATURE

If a step signature was desired, simply do not select STEP_RAMP in SIG_FLAGS, and then set the STEP_TIME prior to selecting BEGIN_SIG.

Collection of Stored Signature

The collection of the stored signature is accomplished by the host system. It is not part of the device. See host system programming.

A simple utility using National Instruments NIFBUS is available from Flowserve for retrieving a signature file. This file is stored in a text format that can be imported into other programs for plotting and analysis.

Contact Flowserve for more details.

Retrieve a Signature

After a signature has been run the data is stored on the Logix 3400MD device. Because of the amount of data in a signature it has to be retrieved from the device. To retrieve this data it is recommended that you use the valvesight DTM. However you can also retrieve the raw data view it in the parameters XDTB_TECH.SIG_DATA1 – SIG_DATA26. To retrieve this data using the parameters you can simply write a non zero value to the parameter XDTB_MAIN.SIG_INDEX. When you do this you will see this parameter start changing and the signature data can then be viewed in the signature parameters. This procedure may take the device several minutes to complete.

The data will be formatted in following order:

       Command
       Position
       Spool Command
       Hall Position in Percent
       Port 1 Pressure in Percent
       Port 2 Pressure in Percent
       Future Use
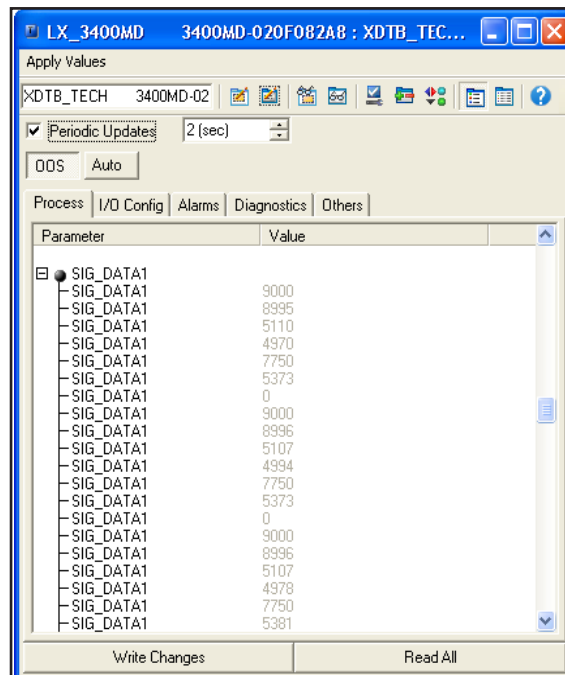
10.15 Logix 3400MD Function Block Execution Times

      XDTB_TECH_BLOCK   15 mS

XDTB_MAIN_BLOCK	15 mS
XDTB_MD_BLOCK	15 mS
PID	20 mS
DI_LO	15 ms
DI_HI	15 mS
ANALOG_OUT	15 mS
DISCRETE_OUT	15 mS
OUTPUT_SPLITTER	20 mS
iNPUT _SELECTOR	20 mS

10.16 Logix 3400MD Diagnostic Parameters Enabled with TEST_MODE

The following Logix 3400MD parameters are only populated with valid data when the ENABLE_DIAGNOSTIC bit in the parameter TEST_MODE has been selected:

LX_XDTB_TECH_DEVIATION_EFFORT
LX_XDTB_TECH_PRESS_CTRL_EFFORT
LX_XDTB_TECH_INTEGRAL_EFFORT
LX_XDTB_TECH_SPOOL_COMMAND
LX_XDTB_TECH_BACKOFF_EFFORT
LX_XDTB_TECH_SPOOL_POSITION
LX_XDTB_TECH_SPOOL_EFFORT
LX_XDTB_TECH_PIEZO_OFFSET
LX_XDTB_TECH_PIEZO_COMMAND
LX_XDTB_TECH_P_GAIN_EFFECTIVE
LX_XDTB_TECH_P_GAIN_MULT
LX_XDTB_TECH_D_GAIN_EFFECTIVE
LX_XDTB_TECH_D_GAIN_FILTER
LX_XDTB_TECH_PRESS_CTRL_GAIN_EFFECTIVE
LX_XDTB_TECH_PRESS_CTRL_GAIN_MULT
LX_XDTB_TECH_PRESS_CTRL_SP
LX_XDTB_TECH_FINAL_VALUE_CUTTOFF_HYSTERESIS
LX_XDTB_TECH_STROKE_TIME_CAL
LX_XDTB_TECH_STROKE_TIME_DOWN
LX_XDTB_TECH_STROKE_TIME_UP
LX_XDTB_TECH_HALL_DOWN
LX_XDTB_TECH_HALL_UP
LX_XDTB_TECH_FB_AD_COUNT
LX_XDTB_TECH_HALL_RANGE
LX_XDTB_TECH_HALL_AD_COUNT
LX_XDTB_TECH_HALL_NULL
LX_XDTB_TECH_PIEZO_COUNTER
LX_XDTB_TECH_PIEZO_INTERVAL
LX_XDTB_TECH_HALL_TGT
LX_XDTB_TECH_FB_VOLTS
LX_XDTB_TECH_HALL_VOLTS
LX_XDTB_TECH_PIEZO_VOLTS
LX_XDTB_TECH_REF_VOLTS
LX_XDTB_TECH_FB_POSITION_FILTER
LX_XDTB_TECH_LOAD_EE_DEFAULTS

10.17 Logix 3400MD Fault States

The following procedure describes hot to setup the fault states in the Logix 3400MD:

- In the Resource block verify the Faultstate is checked in the FEATURE_SEL parameter

- In the AO block make sure the SHED_OPT parameter is initialized correctly for your system. (NormalShed_NormalReturn is most common)

To Fail In Place

- In the AO block verify the Fault State to Value is NOT checked in the OP_OPTS parameter.

To Fail Closed / Open / or to a designated value

- In the AO block verify the Fault State to Value is checked in the OP_OPTS parameter.

- In the AO block set the FSTATE_VAL parameter to the position you wish to fail to between 0 and 100. (0 for closed or 100 for open or anything in between)

  In the AO block set the FSTATE_TIME parameter. This parameter will delay the fault state action by the amount of time indicated. The default for this is 0 (zero) seconds or no delay. Some will recommend this value be set to something other than zero to ac count for momentary faults that recover itself.

To Test the fault state is set correct

- In the Resource Block set the SET_FSTATE parameter to SET. The device should move to the desired fault state.

- When the test is complete in the Resource Block set the CLR_FSTATE parameter to CLEAR. The device should start functioning properly at this point.

10.18 Logix 3400MD Digital Ouput (DO) Operation

The DO block is designed to be able to set the position to a predetermined position based on the OUT_d parameter of the DO block. To implement, schedule the DO block to run and set the DO OUT_d parameter to the desired value based on the following table.

!Note: this will only work when the block is in AUTO mode.

A value of 16 in the DO OUT_d parameter will disable the DO and revert control back to the AO block.

Table 10.17 DO OUT_d Table

OUT_D_VALUE	Position
00	0%
01	100%
02	50%
03	7.0%
04	14%
05	21%
06	28%
07	35%
08	42%
09	49%
10	56%
11	63%
12	70%
13	77%
14	84$
15	91%
16	Diables DO

10.19 Logix 3400 MD Digital Input (DI) Operation

The DI (LO) is a discrete that is set when the actual position of the actuator is equal or less than the XDTB_MAIN.pos_alert_lo parameter. To implement, schedule the DI(LO) block to run and set the XDTB_MAIN.pos_alert_lo to the value that you want the trigger point to be. DI (HI) is a discrete that is set when the actual position when the actual position of the actuator is equal or greater than the XDTB_MAIN.pos_alert_hi parameter. To implement, schedule the DI (HI) block and set the XDTB_MAIN.pos_alert_hi to the value that you're the trigger to be.

10.20 Field Diagnostics

Table 10.18 describes how the ValveSight DTM converts alarm information coming from the Resource Block. Reference FF-891 FF 1.10 Section 5.5.8.

Table 10.18 Field Diagnostics Table

Bit	Name Text	Valvesight Equivalent Alarm	Recommended action text
0	Check Function	NA	No Action Required
1	Reverse Pot	REVERSE_POT_ROTATION	Informational only no action required
2	Reverse Spring	REVERSED_SPRING	Informational only no action required
3	Insufficient Spring	INSUFICIENT_SPRING	Informational only no action required
4	No Spring	NO_SPRING	Informational only no action required
5	Position Limit	POSITION_UPPER_LIMIT POSITION_LOWER_LIMIT	Check the position limits are at desired values
6	Soft Stop Limit	SOFT_STOP_UPPER_LIMIT SOFT_STOP_LOWER_LIMIT	Check the soft stops are at desired values
7	Spool Cyc/trav Warn	SPOOL_CYCLES_WARNING SPOOL_TRAVEL_WARNING	Check XDTB_TECH Inner Loop Status flags
8	Vlv Cyc/trav Warn	VALVE_CYCLES_WARNING VALVE_TRAVEL_WARNING	Check XDTB_MD Mechanical Status flags
9	Pneu leak Warn	PNEUMATIC_LEAK_WARNING	Check for any air leaks
10	Friction Warn	FRICTION_HIGH_WARNING FRICTION_LOW_WARNING	Check XDTB_MD Mechanical Status flags
11	Spool Sticking Warn	SPOOL_STICKING_WARNING	Check XDTB_TECH Inner Loop Status flags
12	Pneumatic Warn	ACTUATION_RATIO_WARNING PNEU_INABILITY_TO_FAIL_SAFE	Check XDTB_MD Mechanical Status flags
13	Temperature Warn	TEMPERATURE_HIGH_WARNING TEMPERATURE_LOW_WARNING	Check the temperature of the device
14	Port Press Range	PORT_A_VALUE_OUT_OF_RANGE PORT_B_VALUE_OUT_OF_RANGE PORT_A_RANGE_TOO_SMALL PORT_B_RANGE_TOO_SMALL	Check XDTB_TECH Pressure Status flags and recalibrate
15	Sup Press Warn	SUPPLY_PRESS_HIGH_WARNING SUPPLY_PRESS_LOW_WARNING	Check the supply pressure
16	Position Deviation	POSITION_DEVIATION_ALARM	Check other failures for root cause
17	Friction ALM	FRICTION_HIGH_ALARM FRICTION_LOW_ALARM	Check XDTB_MD Mechanical Status flags
18	Spool Sticking ALM	SPOOL_STICKING_ALARM	Check XDTB_TECH Inner Loop Status flags
19	Hall Sensor Position	HALL_SENSOR_UPPER_POSITION HALL_SENSOR_LOWER_POSITION	Check XDTB_TECH Inner Loop Status flags

20	Electronics Failure	SHUNT_VOLT_REF_ERROR PIEZO_VOLTAGE_ERROR WATCH_DOG_TIME_OUT NV_RAM_CHECKSUM_ERROR LOSS_OF_INTER_PCB_COMM ELEC_INABILITY_TO_FAIL_SAFE	Check XDTB_TECH Electronic Status flags
21	Sup Press Low ALM	SUPPLY_PRESS_LOW_ALARM	Check the supply pressure
22	Factory Reset State	FACTORY_RESET_STATE	Perform a calibration
23	Position Range	FEEDBACK_RANGE_TOO_SMALL POSITION_OUT_OF_RANGE_LOW POSITION_OUT_OF_RANGE_HIGH	Check for mechanical obstructions and run calibration
24	Outer Loop motion	NO_MOTION_TIME_OUT NON_SETTLE_TIME_OUT INNER_LOOP_OFFSET_TIME_OUT JOG_CALIBRATE_SET_100_POS	Check for mechanical obstructions and run calibration
25	Future Use		No Action Required
26	Future Use		No Action Required
27	Future Use		No Action Required
28	Future Use		No Action Required
29	Future Use		No Action Required
30	Future Use		No Action Required
31	Future Use		No Action Required

11   Software Maintenance

Appendix A: Sample Configuration Record

Sample Device Configuration

The following pages provide a printout example of the Function Block Application portion of a Logix 3400MD digital positioner device configuration file. The printout was generated using the NI-FBUS Configurator application and shows function block parameters and values for a typical control loop. The printout is shown at the left side of the page. Comments and notes on the configuration are given on the left-hand side.

Glossary

A/D: Also called ADC or analog-to-digital converter. An A/D converts an analog signal into an integer count. This integer count is then used by the micro controller to process information such as position, pressure and temperature.

D/A: Also called DAC or digital-to-analog converter. A D/A converts an integer count into an analog output signal. The D/A is used to take a number from the micro controller and command an external device such as a pressure modulator.

EEPROM: Electrically Erasable Programmable Read Only Memory. A device which retains data even when power is lost. Electrically erasable means that data can be changed. EEPROM have a limited number of times data can be re written.

Micro controller: In addition to an integral CPU (microprocessor), the micro controller has built in memory and I/O functions such as A/D and D/A.

Microprocessor: Semiconductor device capable of performing calculations, data transfer, and logic decisions. Also referred to as CPU (Central Processing Unit).

Protocol: A set of rules governing how communications messages are sent and received. **PV:** Primary Variable or Process Variable.

Resolution: Resolution is a number which indicates the smallest measurement which can be made. You will often see Analog-to-Digital (A/D) converters referred to as a 10-bit A/D or a 12-bit A/D. 10-bit and 12-bit are terms which indicate the total number of integer counts which can be used to measure a sensor or other input. To determine the total integer count, raise 2 to the power of the number of bits.

Example: 12-bit A/D

Total integer number = 2Number of Bits = 212= 4096

Resolution is the measurement range divided by the maximum integer number.

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