USER INSTRUCTIONS

Logix 3400IQ Digital Positioner

Installation & Reference Guide

FCD LGENIM3402-00

Experience In Motion

Introduction

Contents

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About This Publication

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

This manual provides detailed information for installation and operation to assist first-time Logix 3400IQ 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.

Refer to Contacting the Fieldbus Foundation on page 9.

About This Manual

This manual provides installation, operation, maintenance for the Logix 3400IQ digital positioner with FOUNDATION fieldbus communications. Reference information is also provided.

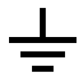
The sections of information contained in the manual follow this order:

- Background and pre-installation
- Logix 3400IQ digital positioner mechanical and electrical installation
- Logix 3400IQ digital positioner configuration
- Operation
- Reference information

Symbol Definitions

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

AO	Analog Output
AWG	American Wire Gauge
DB	Database
DD	Device Description
DDL	Device Description Language
EEPROM	Electrically Erasable Programmable Read Only Memory
EMI	Electromagnetic Interference
FB	Function Block
FBAP	Function Block Application Processor
FF	FOUNDATION fieldbus
mA	Milliamperes
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
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
XMTR	Transmitter

Definitions

Term	Abbrev.	Definition
Alarm		The detection of a block leaving a particular state and when it returns back to that state.
Analog Output (function block)	AO	One of the standard function blocks defined by the Fieldbus Foundation.
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	DDL	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.

Term	Abbrev.	Definition
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 of a 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 FF FBAP specifications.
Transducer Block	XD	Similar to a function block, but performs functions specific to the device transducer, including measurement and calibration.
Virtual Communication Reference	VCR	A defined communication end-point. Fieldbus communications can primarily only take place along a active communications 'path' that consists of two VCR endpoints. 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 31.25kbit/s, Voltage Mode, Wire Medium Application Guide	AG-140	
31.25 kbit/s Intrinsically Safe Systems Application Guide	AG-163	
Engineering Guidelines	AG-181	
Function Block Application Process parts 1 & 2	FF-890, FF-891	Contained in the User Layer Specification FF-002
Fieldbus Specifications	Various Documents	

Contacting the Fieldbus Foundation

To order these publications and other information products produced by the Fieldbus Foundation, contact them at:

Fieldbus Foundation
9390 Research Boulevard
Suite II-250
Austin, TX 78759
USA
www.fieldbus.org/information/

Technical Assistance

If the user encounters a problem with the Logix 3400IQ digital positioner, the configuration of the Logix 3400IQ digital positioner should be checked to verify that all selections are consistent with the application. If the problem persists, call Flowserve's U. S. Technical Assistance between the hours of 8:00 am to 4:30 pm MST — Monday through Friday — for direct factory technical assistance.

Phone: 801 489 2409
Fax: 801 489 2599
Help Desk: 801 489 2678
E-mail: digitalproducts@flowserve.com

An engineer will discuss the problem with the user. Please have the complete model number, serial number, and software revision number on hand for reference. The model and serial numbers can be found on the Logix 3400IQ digital positioner nameplate. The firmware revision numbers of the electronics boards and boot code can be found by accessing and reading the REVISION_ARRAY parameter in the resource block of the device. (For further details, see Simulation Dip Switch in section 6.5.)

If the engineer determines a hardware problem exists, a replacement Logix 3400IQ digital positioner or part will be shipped with instructions for returning the defective unit. Do not return the Logix 3400IQ digital positioner without authorization from Valtek Product Technical Assistance, or until the replacement has been received and a RGA (Return Goods Authorization) has been issued by Flowserve.

NOTE: Flowserve does not offer technical support for National Instruments' NI-FBUS Configurator software. Contact National Instruments' technical support at (512) 795- 8248, or their local office, for assistance.

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.**

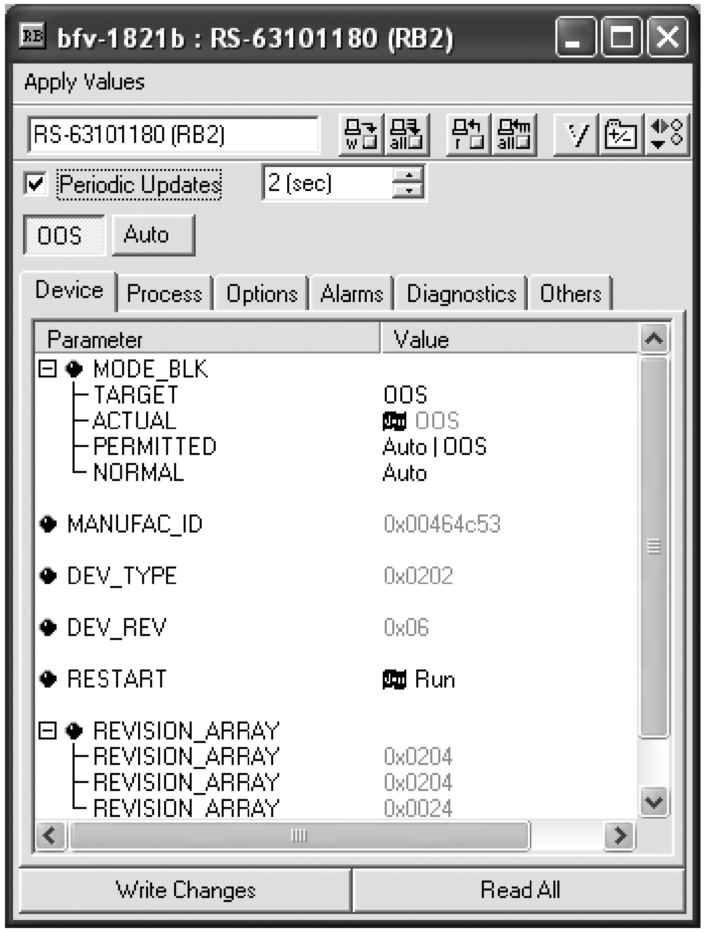
The DD files used with the host have names derived from DEV_REV and DD_REV as follows:

- <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 3400IQ 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 a 0x00464c53 (4607059), which is Flowserve's FF Manufacturer ID number. Converting this number to ASCII will produce FLS.
- **DEV_TYPE**: This will be 0x0202. This tells the configurator that the device is a Logix 3400IQ 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**: Three elements can be found in REVISION_ARRAY. Element number 1 (closest to the top) is the fieldbus (Honeywell) embedded software version. Element number 2 is the boot code revision level. The final element is the positioner embedded code revision.


bfv-1821b : RS-63101180 (RB2)
Apply Values
RS-63101180 (RB2)
Periodic Updates
2 (sec)
OOS
Auto
Device
Process
Options
Alarms
Diagnostics
Others
Parameter
Value
MODE_BLK
TARGET
OOS
ACTUAL
OOS
PERMITTED
Auto | OOS
NORMAL
Auto
MANUFAC_ID
0x00464c53
DEV_TYPE
0x0202
DEV_REV
0x06
RESTART
Run
REVISION_ARRAY
REVISION_ARRAY
0x0204
REVISION_ARRAY
0x0204
REVISION_ARRAY
0x0024
Write Changes
Read All

1 Logix 3400IQ Digital Positioner Description

1.1 Introduction

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

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

- Configure the Logix 3400IQ digital positioner by selecting and setting operating parameters.
- Access diagnostic information to identify configuration, communication, Logix 3400IQ digital positioner or process problems.
- Calibrate Logix 3400IQ digital positioner.
- Request and display Logix 3400IQ digital positioner data.
- Configure the Fieldbus network.

NI-FBUS Configurator (version 2.36 or higher) is compatible with the latest Logix 3400IQ digital positioner. Please contact a Flowserve representative for more information.

1.2 Fieldbus Logix 3400IQ Digital Positioner

About the Logix 3400IQ Digital Positioner
The Logix 3400IQ digital positioner is furnished with FOUNDATION fieldbus interface to operate in a compatible distributed fieldbus system. See Section 1.4 for an overview of fieldbus.

The Logix 3400IQ digital positioner includes FOUNDATION fieldbus electronics for operating in a 31.25 kbit/s fieldbus network. It features standard fieldbus function blocks with manufacturer-specific additions for enhanced operation. This Logix 3400IQ 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 3400IQ 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 3400IQ Digital Positioner)

The Logix 3400IQ 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 3400IQ digital positioner digital positioner operating with other instrument

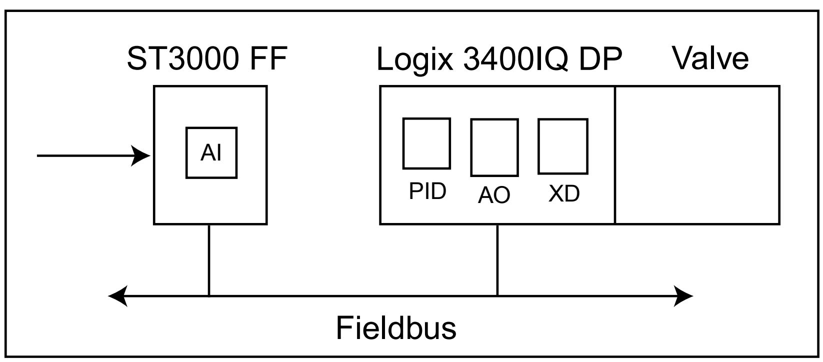


Figure 1.2 Functional Block Diagram of Logix 3400IQ Digital Positioner Operating with other instruments

Theory of Operation

Figure 1.3 shows the basic positioning block diagram for the Logix 3400IQ digital positioner.

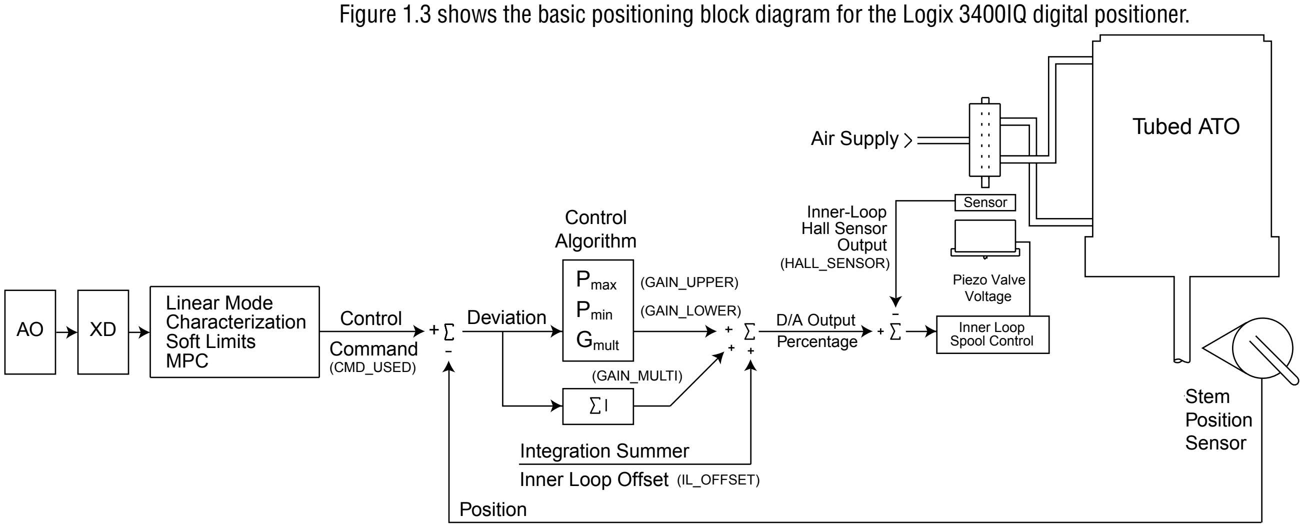


Figure 1.3 Digital Positioner Block Diagram

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

The Logix 3400IQ 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 CMD_USED. The CMD_USED is the actual positioning command after any characterization or user limits have been evaluated.

The Logix 3400IQ 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 1.1, 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 CMD_USED. Since zero deviation 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 CMD_USED 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. Referring to Figure 1.1, a number called inner loop offset (IL_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.

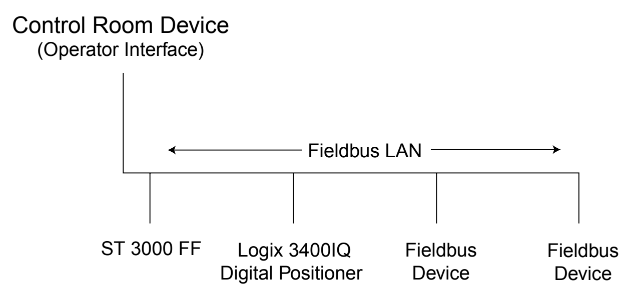


Figure 1.4 Fieldbus Connecting Control Room and Field Devices

Open System Design

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-to-point wiring used for analog devices. See Wiring the Logix 3400IQ Digital Positioner to a Fieldbus Network on page 27.

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.

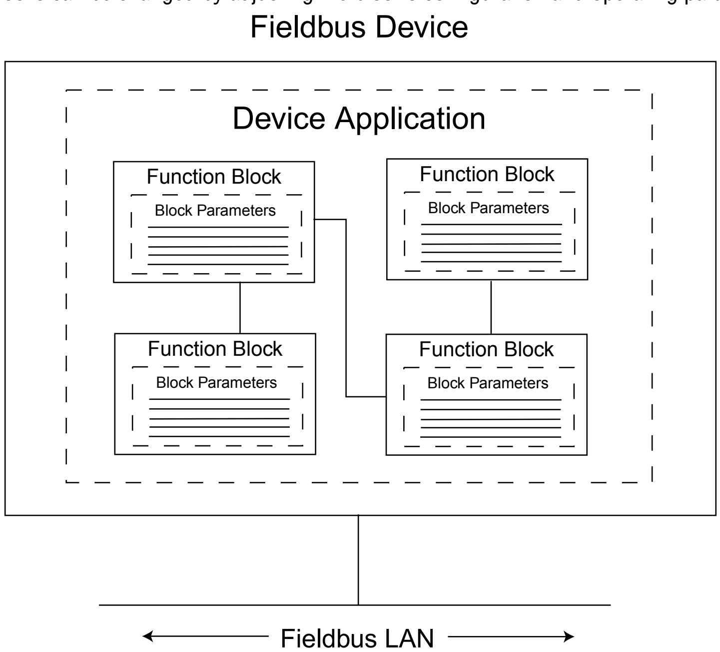


Figure 1.5 Fieldbus Devices Contain Device Applications and Function

Logix 3400IQ Digital Positioner Interface Application

The Logix 3400IQ digital positioner contains the electronics interface compatible for connecting to a fieldbus network. Logix 3400IQ 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 3400IQ digital positioner application. The changes to the Logix 3400IQ digital positioner application are then written to the device and initialized.

2 Installation Overview

2.1 Introduction

About This Section
This section provides a list of components needed to install and operate the Logix 3400IQ 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 3400IQ digital positioner contains electronics that enable it to operate using the FOUNDATION fieldbus protocol. 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 3400IQ digital positioner on a fieldbus network.

Table 2.1 Components Required for Logix 3400IQ Digital Positioner Installation

Components	Description
Logix 3400IQ Digital Positioner	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.

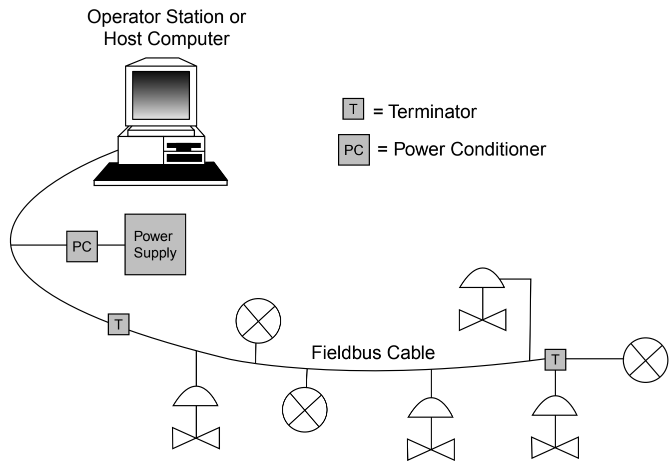


Figure 2.1 Fieldbus Network Components

2.3 Installation / Operation Tasks

Installation Tasks

Installation of the Logix 3400IQ digital positioner is not difficult. The tasks for installing and operating the Logix 3400IQ 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 3400IQ digital positioner Mounting • Wiring	Section 5, Logix 3400IQ Digital Positioner Installation Refer to Logix 3400IQ Digital Positioner IOM
3	Power Up Logix 3400IQ digital positioner	Section 5.4, Powering Up the Logix 3400IQ Digital Positioner
4	Establish Communications • Initial checks	Section 6.7, Establishing Communications Section 6.8, Making Initial Checks
5	Configure Logix 3400IQ 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

About This Section
The bench configuration is an optional procedure for checking your device. This section provides a procedure for configuring the Logix 3400IQ 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 advanced models (Logix 3400IQ digital positioner). Instructions for performing this calibration can be found in Section 10.

3.2 Bench Check

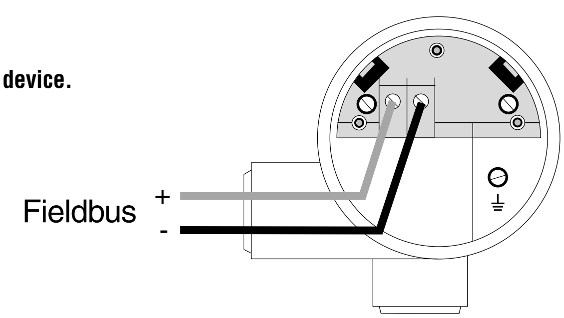
Configure Logix 3400IQ Digital Positioner Before Installation
Using the NI-FBUS Configurator (or other fieldbus device configuration application), the user can perform an bench check of the Logix 3400IQ digital positioner before it is mounted and connected to the process hardware and the fieldbus network. 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 3400IQ 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 3400IQ 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.

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 3400IQ digital positioner and the PC, the user can then query the Logix 3400IQ digital positioner.

Assign Bus Address and Device Tag
Check the device ID of the Logix 3400IQ digital positioner and assign a network node address to the device and assign tag names to the device.

Note that the Logix 3400IQ 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 3400IQ digital positioner configuration. Enter parameter values for your process application and write them to the device. **Refer to the Logix 3400IQ 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

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

4.2 Considerations for Logix 3400IQ Digital Positioner

Evaluate Conditions
The Logix 3400IQ 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.

- 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

Figure 4.1 illustrates typical mounting area considerations to make before installing Logix 3400IQ digital positioner.

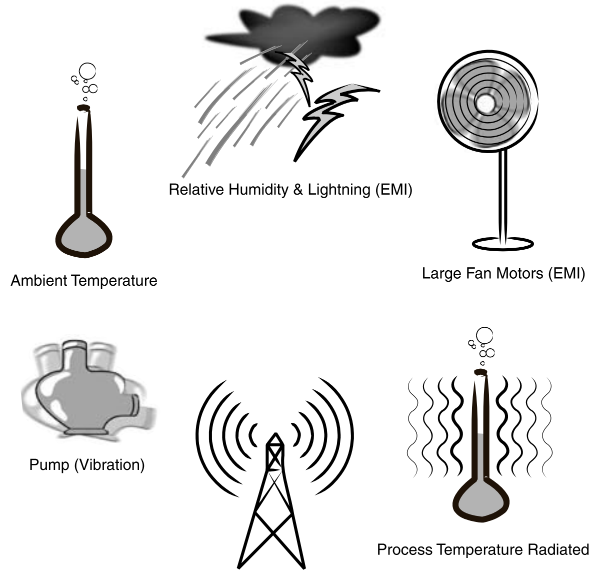


Figure 4.1 Typical Mounting Area Considerations Prior to Installation

Temperature Limits

Table 4.1 lists the operating temperature limits for Logix 3400IQ 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 3400IQ digital positioner	-4 to 60	-20 to 140	-40 to 55	-40 to 131	-40 to 80	-40 to 176

Power Requirements

The Logix 3400IQ 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 3400IQ digital positioner.

Table 4.2 Logix 3400IQ Power Requirements

	Minimum	Maximum
Static Power	9 VDC @ 23mA	32 VDC @ 23mA

Air Supply Requirements

The Logix 3400IQ 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 diagnostics (Logix 341X 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 3400IQ Digital Positioner Installation

5.1 Introduction

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

5.2 Mounting Variations

Overview
The Logix 3400IQ 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

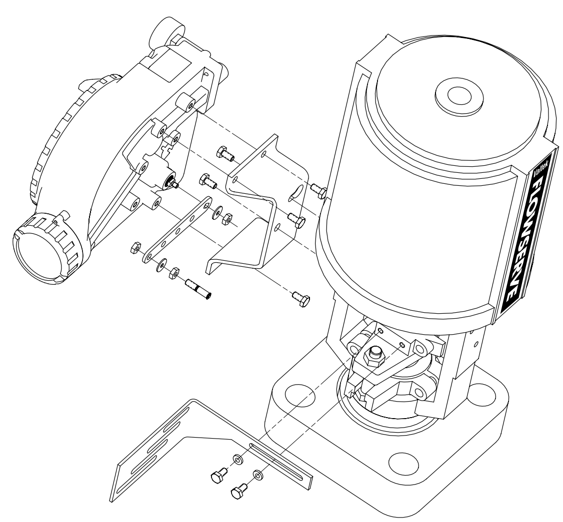


Figure 5.1 Typical Linear Actuator-mounted Installation

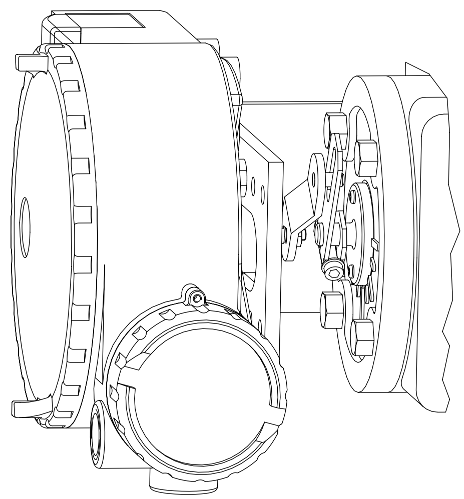


Figure 5.2 Rotary Transfer Case Mounting

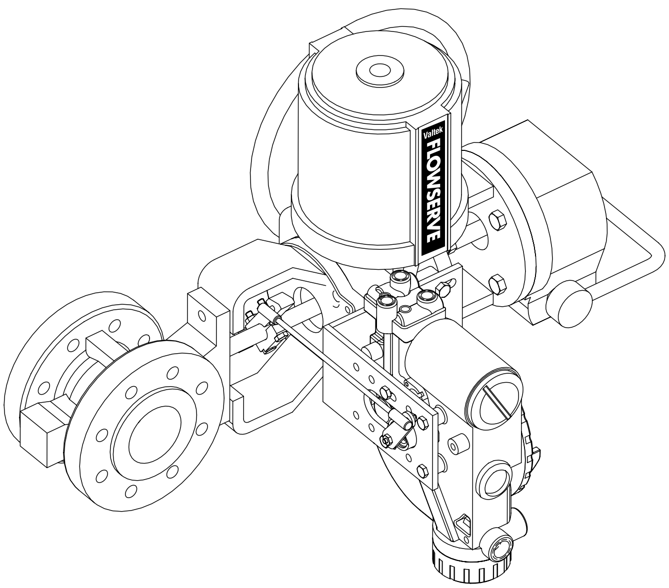


Figure 5.3 Rotary Valve with Four-bar Linkage

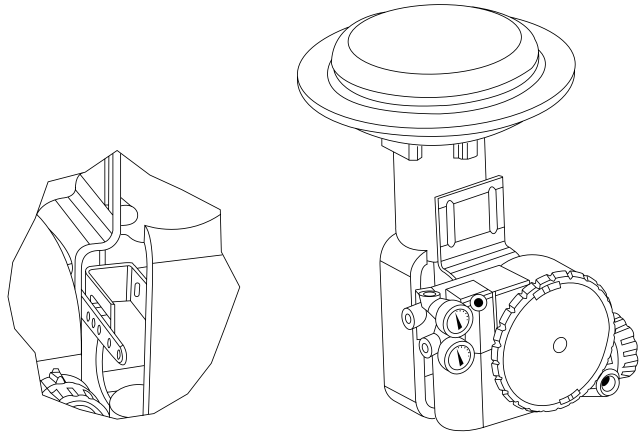


Figure 5.4 Logix 3400IQ Digital Positioner Mounted to a Diaphragm Actuator

5.3 Wiring Logix 3400IQ Digital Positioner

Wiring the Logix 3400IQ Digital Positioner to a Fieldbus Network
The Logix 3400IQ digital positioner is designed to operate in a two-wire fieldbus network. Although wiring the Logix 3400IQ 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 3400IQ digital positioner to a fieldbus network segment. A procedure is given in this section for properly wiring the Logix 3400IQ 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 3400IQ 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 3400IQ 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
		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 3400IQ Digital Positioner Wire Connections
Fieldbus signal communications and DC power are supplied to the Logix 3400IQ digital positioner using the same fieldbus twisted-pair cable.

Inside the electronics housing of the Logix 3400IQ 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.

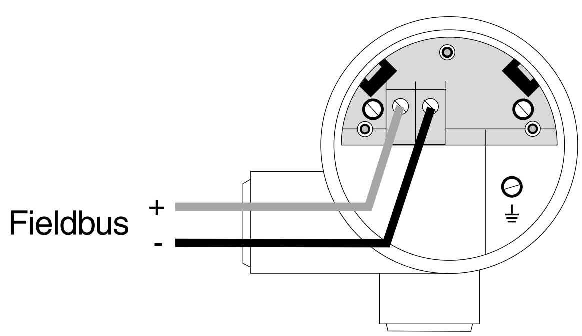


Figure 5.5 Logix 3400IQ Digital Positioner Terminal Block

Table 5.2 Logix 3400IQ Digital Positioner Wiring Terminals

Wiring Terminal		Use
Screw terminals	Non-polarized	Fieldbus cable connections
Quick clip terminals	Signal + and -	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 3400IQ digital positioner to earth ground.

External Ground Connections

While grounding the Logix 3400IQ 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 3400IQ digital positioners to be used in intrinsically safe applications.

The Logix 3400IQ 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 3400IQ Digital Positioner Wiring Procedure

The following procedure shows the steps for connecting fieldbus cable to the Logix 3400IQ 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 3400IQ digital positioner accepts up to 16 AWG (1.5 mm diameter) wire.

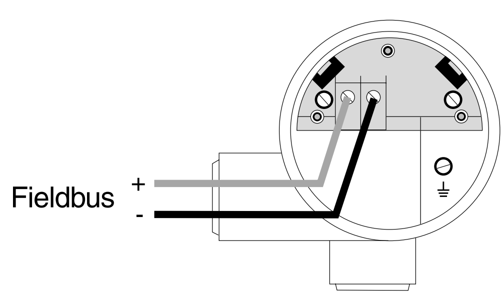


Figure 5.6 Logix 3400IQ Digital Positioner Terminal Block

3. Connect 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 3400IQ 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 3400IQ digital positioner contains moderate protection against near lightning strikes. External lightning protection measures should be employed as needed.

Conduit Seal

Logix 3400IQ digital positioners installed as explosion-proof in a Class I, Division 1, Group A 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 3400IQ digital positioner.

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

Logix 3400IQ 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 3400IQ 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 3400IQ 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.

Electrical Wiring Frequently Asked Questions

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

Answer: FF specifies a 9-32V operation range. A fieldbus compatible power supply with terminators should be used. NOTE: The Logix 3400IQ is driven from a voltage source, not the typical 4-20 mA supply.

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

Answer: The Logix 3400IQ is reverse polarity protected. Inadvertent connection of the fieldbus supply shouldn't damage the unit.

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

Answer: The Logix 3400IQ digital positioner does not have a simple resistive input. This is because the Logix 3400IQ 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 @ 9-32 VDC.

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

5.4 Powering Up the Logix 3400IQ Digital Positioner

Pre-power Checklist

- Before applying power to the fieldbus network the user should make the following checks:
- Verify that the Logix 3400IQ digital positioner has been properly mounted and connected to a system.
- The Logix 3400IQ digital positioner has been properly wired to a fieldbus network.
- The Logix 3400IQ 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 3400IQ 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 3400IQ digital positioner. See Section 6.5, Setting Write-protect Feature and Section 10.8, 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 3400IQ digital positioner.
3. Verify that the terminal voltage is within the limits listed in Table 4.2, Logix 3400IQ Digital Positioner Power Requirements.

6 Logix 3400IQ Digital Positioner Configuration

6.1 Introduction

About This Section

This section explains the tasks to establish communications and configure the Logix 3400IQ 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 3400IQ refer to sections 5, 6 and 7 in the Logix 3400IQ IOM for information on how to mount, install, wire and start up a Logix 3400IQ.

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

If the Logix 3400IQ 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 3400IQ digital positioner is configured, please read the other sections of this manual before configuring the Logix 3400IQ digital positioner.

6.2 Logix 3400IQ Digital Positioner Communications

Communications and Control

All communications with the Logix 3400IQ 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 3400IQ 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 3400IQ Digital Positioner Configuration Process

Logix 3400IQ Digital Positioner Configuration

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

1. Establishing communication between the operator interface and the device (bringing the Logix 3400IQ 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 3400IQ digital positioner is a software application that defines the particular characteristics of the Logix 3400IQ 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 user-configured) that define the operating characteristics of the Logix 3400IQ 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 3400IQ digital positioner is found in Section 8, Device Configuration.

Fieldbus Configuration Application

The Logix 3400IQ 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.

Linear vs. Rotary The positioner has two configuration settings: Linear and Rotary. In order to get better resolution, stem position sensor gains are adjusted based on the angle of rotation of the linkage. The linear setting allows for linkage rotation up to 65°. The rotary setting allows for linkage rotation up to 95°. These settings only determine the angle of sensor rotation and do not affect control parameters. If a positioner is set to linear linkage and a red LED blinks after calibration, the most common cause is that the sensor movement was greater than 65°. This can occur if the roller pin was placed in the wrong hole on the follower arm or the stem clamp is placed too high. The take-off arm should always be level with the stem clamp on linear mountings.

The Logix 3400IQ 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 3400IQ 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 3400IQ 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 3400IQ digital positioner is given in Appendix A, Sample Configuration Record.

LAS Capability

The Logix 3400IQ 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 3400IQ 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 3400IQ digital positioner in 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 3400IQ as a Basic device in the host system.

Special Non-volatile Parameter and NVM Wear Out
All function block parameters designated as non-volatile (N) in the FF specifications are updated to non-volatile memory (NVM) on a periodic basis. NV_CYCLE_T parameter in the resource block specifies this update interval.

To provide predictable restart behavior in the transmitter, the following non-volatile parameters are updated to NVM each time they are written over the fieldbus.

- MODE.TARGET for all blocks
- SP.VALUE for the PID block
- SP and OUT in the AO block

Since these are user-written parameters, additional updates to NVM contribute negligibly to NVM wear-out. However, users are cautioned not to construct control configurations where the above parameters are written continuously (via a computer application for example) or at rates greater than the NV_CYCLE_T interval. This consideration will help minimize the possibility of NVM wear-out.

In the case of MODE, this should not be a problem. When users wish to provide setpoints to the PID block via a computer application, users should use RCAS mode with its corresponding set-point value RCAS_IN. RCAS_IN is updated only at the NV_CYCLE_T update rate and this mode supports full shedding functionality and PID initialization necessary for a robust application.

6.5 Setting Write-Protect Feature

Write-protect Feature
The Logix 3400IQ 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 3400IQ.

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 electronic 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.

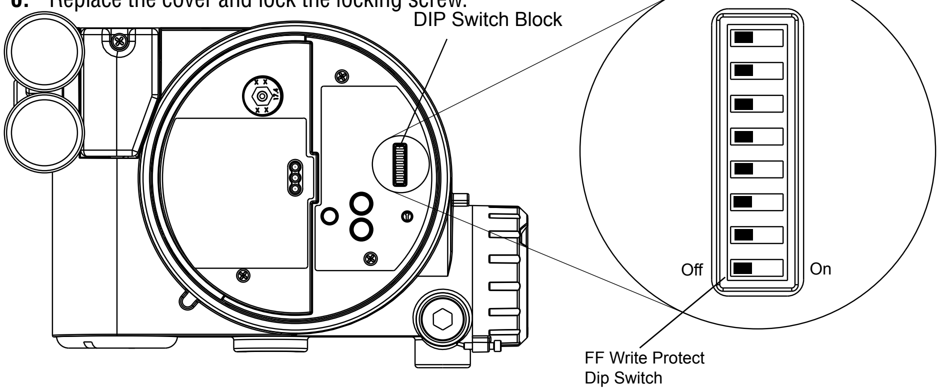


Figure 6.1 Write-protect Jumper Location on Controller Board

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

* FEATURE_SEL parameter must also be set accordingly to enable write protect. (Set FEATURE_SEL = Hard W Lock in the Resource Block)

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 jumper is in R position, the device will remain write-protected until the device is powered down and the jumper is placed in the W 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 3400IQ 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 3400IQ digital positioner using the NI-FBUS Configurator.

Table 6.3 Starting Communications with Logix 3400IQ 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 3400IQ 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 3400IQ 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 3400IQ digital positioner:

- Device type = 0 x 0202
- Device ID = 464C530202-FLS-LX3400-00nnnnnnnn
- Device tag, (tag description of the Logix 3400IQ digital positioner)
- Firmware revision level (revision level of the firmware elements)

Table 6.4 lists the block parameters for quickly identifying the Logix 3400IQ digital positioner.

Table 6.4 Logix 3400IQ Digital Positioner Identification

Step	View Parameter	Verify
1	RS.DEV_TYPE	The Logix 3400IQ digital positioner is the proper device type: For the Logix 3400IQ digital positioner, the value is = 0x0202
2	RS.REVISION_ARRAY REVISION_ARRAY = REVISION_ARRAY = REVISION_ARRAY =	The revision number of the: Fieldbus board boot code (0x204) Fieldbus board boot code (Not critical) Positioner board firmware (0x0024 or 0x0025) ***NOTE:** These numbers are helpful when troubleshooting the device.*
3	Physical Device Tag **NOTE:** The device tag name is not contained in a parameter. It can be set and viewed using the fieldbus 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 3400IQ digital positioner is complete and the Logix 3400IQ digital positioner is powered up.

Table 6.5 Logix 3400IQ 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.

Table 6.5 Logix 3400IQ Digital Positioner Configuration Task List

Task	Procedure	Result
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

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

7.2 Operation Tasks

Fieldbus Device Operations
Positioning – For the most basic operation of the Logix 3400IQ 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 PRESS_CAL in psig.

8 Configuration Description

8.1 Introduction

About This Section
This section provides information about the construction and contents of the Logix 3400IQ digital positioner Function Block Application Process (FBAP) — the application that defines Logix 3400IQ digital positioner function and operation in the process application.) This information 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 3400IQ 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 (Parts 1 and 2).

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 block
  - PID Function block
  - AO 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 3400IQ digital positioner application contains the following block objects:

- Resource block
- Transducer block
- Analog Output (AO) function block
- Proportional Integral Derivative (PID) controller function block

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.
Transducer	Isolates 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.
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
PID Controller function block	Performs standard or robust proportional integral derivative algorithm used in closed-loop processing.

FBAP Block Diagram
Figure 8.1 shows the important elements of the Logix 3400IQ digital positioner FBAP. Many parameters are omitted for clarity.

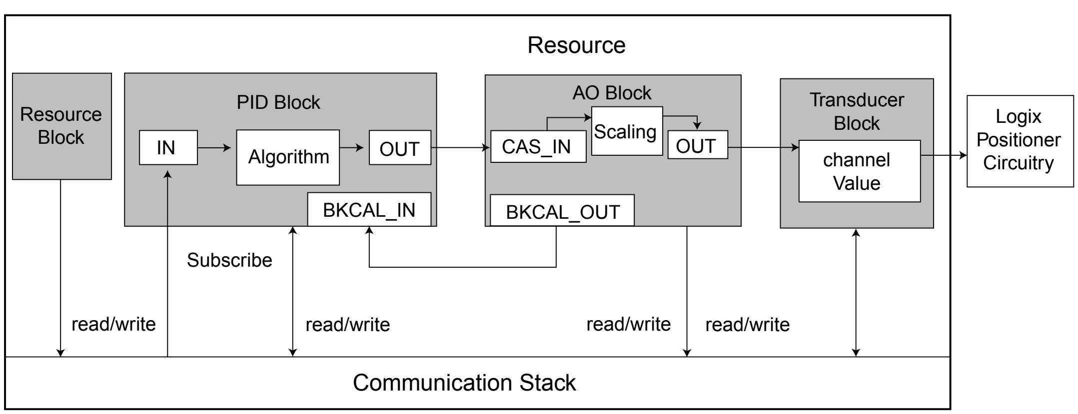


Figure 8.1 FBAP Block Diagram Example

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 3400IQ 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.
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.
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.

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	Name	Data Type/Structure	Store	Default Value
1	ST_REV	Unsigned 16	S	0
2	TAG_DESC	Octet string	S	all blanks
3	STRATEGY	Unsigned16	S	0
4	ALERT_KEY	Unsigned8	S	0
5	MODE_BLK	Mode	MIX	Target = OOS*
6	BLOCK_ERR	Bit string	D	
7	RS_STATE	Unsigned8	D	
8	TEST_RW	Test	D	
9	DD_RESOURCE	Visible string	S	
10	MANUFAC_ID	Unsigned32	S	464C54
11	DEV_TYPE	Unsigned16	S	0202
12	DEV_REV	Unsigned8	S	
13	DD_REV	Unsigned8	S	
14	GRANT_DENY	Access permissions	N	0
15	HARD_TYPES	Bit string	S	
16	RESTART	Unsigned8	D	
17	FEATURES	Bit string	S	
18	FEATURE_SEL	Bit string	S	0
19	CYCLE_TYPE	Bit string	S	scheduled
20	CYCLE_SEL	Bit string	S	0
21	MIN_CYCLE_T	Unsigned32	S	4000
22	MEMORY_SIZE	Unsigned16	S	
23	NV_CYCLE_T	Unsigned32	S	28800000
24	FREE_SPACE	Floating point	D	
25	FREE_TIME	Floating point	D	
26	SHED_RCAS	Unsigned32	S	640000
27	SHED_ROUT	Unsigned32	S	640000
28	FAULT_STATE	Unsigned8	N	clear
29	SET_FSTATE	Unsigned8	D	
30	CLR_FSTATE	Unsigned8	D	
31	MAX_NOTIFY	Unsigned8	S	8
32	LIM_NOTIFY	Unsigned8	S	8
33	CONFIRM_TIME	Unsigned32	S	540000
34	WRITE_LOCK	Unsigned8	S	not locked

Table 8.3 Resource Block Parameters

Index	Name	Data Type/Structure	Store	Default Value
35	UPDATE_EVT	Event - update	D	
36	BLOCK_ALM	Alarm - discrete	D	
37	ALARM_SUM	Alarm - summary	MIX	
38	ACK_OPTION	Bit string	S	0
39	WRITE_PRI	Unsigned8	S	0
40	WRITE_ALM	Alarm - discrete	D	
Valtek Device Products Parameters				
41	DL_CMD1	Unsigned8	D	
42	DL_CMD2	Unsigned8	D	
43	DL_APPSTATE	Unsigned16	S	
44	DL_SIZE	Unsigned32	S	
45	DL_CHECKSUM	Unsigned16	S	
46	REVISION_ARRAY	Unsigned32	S	
47	BLOCK_TEST	Unsigned8	D	
48	ERROR_DETAIL	Unsigned16	D	

* OOS = Out-of-service

Resource Block Valtek Product-defined Parameter Descriptions

Table 8.4 describes the Valtek product-defined parameters in the resource block, which are used during the application download procedure.

Table 8.4 Resource Block Parameter Descriptions

Name	Description or Parameter Contents
DL_CMD1 DL_CMD2	Used to unlock or access the domain (flash memory area) of the device for download. Entering a series of values in these two parameters changes the internal state of the device so that it will accept the downloaded application software. The download cannot begin until the device is put into the correct internal state. The internal state of the device is read in the DL_APPSTATE parameter.
DL_APPSTATE	Contains the state of the downloaded(ing) application.
DL_SIZE	Contains the size of the downloaded application. (This will always be an even number.)
DL_CHECKSUM	Contains the 16-bit check-sum of the downloaded application.
REVISION_ARRAY	A read-only parameter that contains the application firmware revision level for: Fieldbus board application Fieldbus board boot code Positioner board application.
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 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 3400IQ 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.

Table 8.5 Transducer Block Parameters

Index	Fieldbus Parameter Name	Fieldbus Datatype	Storage	Read/ Write	Access Type	Notes, Default Values
1	ST_REV	Unsigned16	S	R		FF Parameter, 0
2	TAG_DESC	Octet String	S	R/W		FF Parameter, blanks
3	STRATEGY	Unsigned16	S	R/W		FF Parameter, 0
4	ALERT_KEY	Unsigned8	S	R/W		FF Parameter, 1
5	MODE_BLK	DS-69	Mixed	R/W		FF Parameter, OOS
6	BLOCK_ERR	Bit String	D	R		FF Parameter
7	UPDATE_EVT	DS-73	D	R		FF Parameter
8	BLOCK_ALM	DS-72	D	R/W		FF Parameter
9	TRANSDUCER_DIRECTORY	Unsigned16	S	R		FF Parameter
10	TRANSDUCER_TYPE	Unsigned16	S	R		FF Parameter
11	XD_ERROR	Unsigned8	D	R		FF Parameter
12	COLLECTION_DIRECTORY	Unsigned32	S	R		FF Parameter
13	FINAL_VALUE	DS_65	N	R/W*	Std	Write restricted to AO OOS
14	FINAL_VALUE_RANGE	DS-68	S	R/W		FF Parameter
15	FINAL_VALUE_CUTOFF_HI	float	S	R/W*	Info-1	110
16	FINAL_VALUE_CUTOFF_LO	float	S	R/W*	Info-1	1
17	FINAL_POSITION_VALUE	DS_65	N	R	Std	
18	ACT_FAIL_ACTION	Unsigned8	S	R		Not used – see FAIL_MODE
19	ACT_MAN_ID	Unsigned8	S	R/W		FF Parameter
20	ACT_MODEL_NUM	Visible String	S	R/W		FF Parameter
21	ACT_SN	Visible String	S	R/W		FF Parameter
22	VALVE_MAN_ID	Unsigned8	S	R/W		FF Parameter
23	VALVE_MODEL_NUM	Visible String	S	R/W		FF Parameter
24	VALVE_SN	Visible String	S	R/W		FF Parameter, FLWSERVE
25	VALVE_TYPE	Unsigned8	S	R/W		FF Parameter
26	XD_CAL_LOC	Visible String	S	R/W		FF Parameter
27	XD_CAL_DATE	Visible String	S	R/W		FF Parameter, Original type "Date" is Y2K compatible
28	XD_CAL_WHO	Visible String	S	R/W		FF Parameter
Manufacturer Specific Parameters — Owned by Logix Control Processor						
29	DAC_PERCENT	float	D	R	Std	
30	CONTROL_FLAGS	Bit String	N	R/W*	Std	
31	GAIN_UPPER	float	S	R/W*	Std	2
32	GAIN_LOWER	float	S	R/W*	Std	1

Table 8.5 Transducer Block Parameters

In-dex	Fieldbus Parameter Name	Fieldbus Datatype	Storage	Read/ Write	Access Type	Notes, Default Values
33	GAIN_MULT	float	S	R/W*	Std	0,05
34	IGAIN	Integer16	S	R/W*	Std	10
35	IL_OFFSET	float	S	R/W*	Diag	55, Activate Test Mode
36	STATUS_FLAGS	Bit String	N	N	R	Std
37	CMD_USED	float	D	R	Std	
38	CALIBRATE	Unsigned8	D	R/W*	Std	
39	DAC_VALUE	Unsigned16	D	R/W*	Diag	
40	PRESS_CAL	float	S	R/W	Info-1	60
41	CALIBRATE_FLAGS	Bit String	D	D	R	Std
42	SOFTSTOP_HIGH	float	S	R/W*	Info-1	110
43	SOFTSTOP_LOW	float	S	R/W*	Info-1	-10
44	CYCLE_COUNTER	Unsigned32	N	R/W	Std	
45	CYCLE_DEADBAND	float	S	R/W	Info-1	20
46	CYCLE_LIMIT	Unsigned32	S	R/W	Info-1	4294967294
47	TRAVEL_ENG	float	S	R/W	Std	
48	TRAVEL_DEADBAND	float	S	R/W	Info-1	20
49	TRAVEL_ALERT	float	S	R/W	Info-1	2e+ 006
50	STROKE_ENG	float	S	R/W	Info-1	1
51	TRAVEL_UNITS	Unsigned8	S	R/W	Info-1	Inches
52	CURVEX	Float[21]	S	R/W*	Info-4	
53	CURVEY	Float[21]	S	R/W*	Info-4	
54	TRAVEL_FLAGS	Bit String	D	D	R	Std
55	TEMPERATURE	Integer16	D	R	Std	
56	PORT_1_PRESSURE (Port 1)	float	D	R	Std	
57	PORT_2_PRESSURE (Port 2)	float	D	R	Std	
58	SUPPLY_PRESSURE		D	D	R	Std
59	VOLTAGE_REFERENCE	float	D	R	Std	
60	HALL_SENSOR	float	D	R	Std	
61	DAC_CHECK	float	D	R	Std	
62	MOD_CURRENT	float	D	R	Std	
63	IL_CHK	Integer16	D	R	Std	
64	INTERNAL_FLAGS	Bit String	D	D	R	Std
65	PRESS_FLAGS	Bit String	D	D	R	Std
66	PRESS_UNITS	Unsigned8	S	R/W	Info-1	psi
67	TEMP_UNITS	Unsigned8	S	R/W	Info-1	Deg F
68	ELECTRONICS_SN	Visible String	S	R/W*	Info-1	
69	SOFTWARE_VER	Unsigned16	S	R	Info-1	
70	FAIL_MODE	Unsigned8	S	R/W*	Info-1	Hold last position
Manufacturer Specific Parameters - Owned by Logix Control Processor						
71	AD_RAW_FB	Integer16	D	R	Diag	
72	ERROR	float	D	R	Diag	
73	PGAIN	float	D	R	Diag	
74	INTEGRAL_SUM	float	N	R	Std	
75	ALPHA_FILT	float	S	R/W*	Diag	0,5
76	PRESS_WINDOW	float	S	R/W*	Info-2	0,01
77	PRESS_HYST	float	S	R/W*	Info-2	0,02
78	PRESS_GAIN	float	S	R/W*	Info-2	0,03
79	TP_ZERO	Integer16	S	R/W*	Diag	2
80	TP_SPAN	Integer16	S	R/W*	Diag	1175
81	TP_FULL_SCALE	Integer16	S	R/W*	Diag	1173
82	BP_ZERO	Integer16	S	R/W*	Diag	1175
83	BP_SPAN	Integer16	S	R/W*	Diag	1175
84	BP_FULL_SCALE	Integer16	S	R/W*	Diag	1173
85	FB_ZERO	Integer16	S	R/W*	Diag	
86	FB_SPAN	Integer16	S	R/W*	Diag	
87	FB_SCOUNT	Integer16	S	R/W*	Diag	

Table 8.5 Transducer Block Parameters

Index	Fieldbus Parameter Name	Fieldbus Datatype	Storage	Read/ Write	Access Type	Notes, Default Values
88	HALL_NULL	Unsigned16	S	R/W*	Diag	150
89	HALL_DOWN	Unsigned16	S	R/W*	Diag	250
90	HALL_UP	Unsigned16	S	R/W*	Diag	50
91	POSALERT_HIGH	float	S	R/W	Info-2	110
92	POSALERT_LOW	float	S	R/W	Info-2	-10
93	POSDEV_DEADBAND	float	S	R/W	Info-2	2
94	POSDEV_TIME	float	S	R/W	Info-2	60
95	SIG_START	float	N	R/W*	Info-3	0
96	SIG_STOP	float	N	R/W*	Info-3	100
97	RAMP_RATE	float	N	R/W*	Info-3	200
98	STEP_TIME	float	N	R/W*	Info-3	10
99	SIG_FLAGS	Unsigned8	N	R/W*	Info-3	
100	SAMPLE_TIME	float	N	R/W*	Info-3	0,1
101	SIG_COUNTER	Unsigned16	D	R	Info-3	
102	INTAD_RAW1	Unsigned16	D	R	Diag	
103	INTAD_RAWTP	Unsigned16	D	R	Diag	
104	INTAD_RAWBP	Unsigned16	D	R	Diag	
105	INTAD_RAW3	Unsigned16	D	R	Diag	
106	INTAD_RAW4	Unsigned16	D	R	Diag	
107	INTAD_RAW5	Unsigned16	D	R	Diag	
108	INTAD_RAW6	Unsigned16	D	R	Diag	
109	INTAD_RAW8	Unsigned16	D	R	Diag	
110	TEST_MODE	Unsigned8	D	R/W*	Info-2	
111	VALVE_SIZE	Unsigned8	S	R/W	Info-2	Uninitialized
112	VALVE_CLASS	Unsigned8	S	R/W	Info-2	Uninitialized
113	VALVE_ENDCON	Unsigned8	S	R/W	Info-2	Uninitialized
114	VALVE_BODYMAT	Unsigned8	S	R/W	Info-2	Uninitialized
115	VALVE_TRIMMAT	Unsigned8	S	R/W	Info-2	Uninitialized
116	VALVE_TRIMCHAR	Unsigned8	S	R/W	Info-2	Uninitialized
117	VALVE_TRIMTYPE	Unsigned8	S	R/W	Info-2	Uninitialized
118	VALVE_TRIMNO	Unsigned8	S	R/W	Info-2	Uninitialized
119	VALVE_PACKTYPE	Unsigned8	S	R/W	Info-2	Uninitialized
120	STEM_DIAM	float	S	R/W	Info-2	Uninitialized
121	LEAK_CLASS	Unsigned8	S	R/W	Info-2	Uninitialized
122	INLET_PRESS	float	S	R/W	Info-2	Uninitialized
123	OUTLET_PRESS	float	S	R/W	Info-2	Uninitialized
124	VALVE_FLAGS	Unsigned8	S	R/W	Info-2	Uninitialized
125	RATED_TRAV	float	S	R/W	Info-2	Uninitialized
126	ACT_TYPE	Unsigned8	S	R/W	Info-2	Uninitialized
127	ACT_SIZE	Unsigned8	S	R/W	Info-2	Uninitialized
128	SPRING_TYPE	Unsigned8	S	R/W	Info-2	Uninitialized
129	SPOOL_ID	Unsigned8	S	R/W	Info-2	Uninitialized
130	PO_DATE[8]	Visible String	S	R/W	Info-2	MMDDYYYY
131	INSTALL_DATE[8]	Visible String	S	R/W	Info-2	MMDDYYYY
132	LOAD_EE_DEFAULTS	Unsigned8	D	R/W*	Info-2	
133	ENG_RELEASE_NUM	Unsigned16	S	R	Info-1	
134	MISC_FLAGS	Unsigned8	N	R/W*	Info-2	
Manufacturer Specific Parameters - Owned by Fieldbus Processor						
135	SIG_INDEX	Unsigned16	D	R/W		Honeywell
136	SIG_DATA[4]	float[4]	D	R		Honeywell
137	MFG_PHONE[18]	Visible String	S	R/W		Honeywell
138	PUR_ORDER_NUM[18]	Visible String	S	R/W		Honeywell
139	STROKE_TIME_OPEN	float w/status	S	R/W		
140	STROKE_TIME_CLOSE	float w/status	S	R/W		

Table 8.5 Transducer Block Parameters

In-dex	Fieldbus Parameter Name	Fieldbus Datatype	Storage	Read/ Write	Access Type	Notes, Default Values
141	CAL_FULLSCALE	UINT 16 w/ status	S	R/W		
142	AUTO_TUNE_MULT	float w/ status	S	R/W		
143	NVRAM_WRITE_CYCLES	Unsigned 32	N	R		
144	GENERIC_PARM_NUM	DS-66	D	R/W		Honeywell sts: type val: Logix Var Num
145	GENERIC_PARM_VAL	Unsigned32	D	R/W		Honeywell
146	SPI_TEST_RCV	Unsigned8[]	D	R		Honeywell
147	SPI_TEST_TX	Unsigned8[]	D	R		Honeywell
148	BLOCK_TEST	Unsigned8[]	D	R/W		Honeywell

* Must be out-of-service to write.
** After parameters have been changed, it is necessary to perform an update to activate. If an update is not performed when the parameters have been changed the parameters will be updated during the next update cycle.

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.

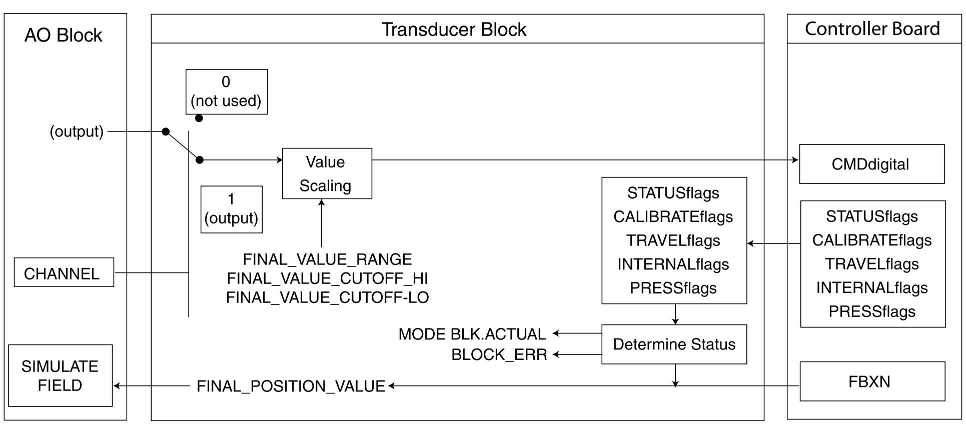


Figure 8.2 Transducer Block Diagram

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
MODE_BLK:TARGET	OOS	Determines the mode of the function block
FINAL_VALUE	No default	Command going to positioner before characterization, soft stops or MPC.

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 has the Minimum Position Cutoff feature of the Logix 1200 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.
DAC_PERCENT	Dynamic	DAC output in percent
CONTROL_FLAGS		Used to tell positioner type of actuator and characterization to use. **Note:** Must match DIP switch settings.
GAIN_UPPER	2	Maximum proportional gain used.
GAIN_LOWER	1	Minimum proportional gain used.
GAIN_MULT	0,05	Adjust the rate of change between GAIN_UPPER and GAIN_LOWER.
IGAIN	10	Integral gain.
IL_OFFSET	30-70%	DAC value to hold spool in a null position
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	Deg F	Units temperature is expressed in.

Parameter Definitions

The following list summarizes some of the key parameters within the Logix 3400IQ 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 3400IQ.

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.

CONTROL_FLAGS Six options are provided under CONTROL_FLAGS. Each option has a significant effect on how the positioner controls the valve. The CONTROL_FLAGS should be configured correctly. These settings must match the settings of the DIP switches in the Logix 3400IQ to avoid possible operational issues.

- **Quick Opening Curve:** The Logix 3400IQ digital positioner comes with a default quick opening curve. If this response is desired, check the Quick Opening Curve and Custom Characterization Active boxes
- **Equal Percent Curve**: The Logix 3400IQ digital positioner comes with a default equal percent curve. If this response is desired, check the Equal Percent Curve and Custom Characterization Active boxes.
- **Positioner Model:** This parameter is automatically set at power-up. It tells the positioner if it is an advanced (pressure sensors) model or standard (no pressure sensors). If the user wishes to over-ride the Auto Model Detect feature consult the factory.
- **ActuatorStyle**: Check this box only if the positioner is mounted on a rotary type actuator.
- **Custom Characterization Active:** Check this box the FINAL_VALUE parameter is to be characterized. If the Quick Opening or Equal Percent box is also checked the positioner will use a factory defined curve. If only Custom Characterization Active is checked, a user-defined curve will be used. Note that when this box is checked the curve can not be changed. If the user wishes to use a different curve, or edit the custom curve, this box must be unchecked.
- **Air Action:** Check this box only if the actuator is tubed to be Air-to-Close (ATC). After configuring CONTROL_FLAGS, click the write button to apply the values.

GAIN_UPPER The Logix 3400IQ 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.

GAIN_LOWER The Logix 3400IQ 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.

GAIN_MULT The Logix 3400IQ 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.

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

IL_OFFSET This parameter tells the positioner where the spool valves null position is.

These values are set during a stroke calibration procedure and typically require no further adjustments, if Auto Tune is enabled on the user interface.

CMD_USED This is the set point or command to which the positioner is controlling. After FINAL_VALUE is acted on by Characterization, Softstops, and FINAL_VALUE_CUTOFF, CMD_USED reports the modified or used command value.

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

PRESS_CAL Before doing a pressure sensor calibration, enter the supply pressure being used in units expressed by PRESS_UNITS.

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

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

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

TRAVEL_ENG Total distance the valve stem has traveled.

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

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

STROKE_ENG 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.

FAIL_MODE 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_OPEN: 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_CLOSE: 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.

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.

CAL_FULLSCALE: This variable allows the user to determine the minimum amount of movement (A/D counts) required to prevent a calibration error. To use this feature, first make sure the positioner is configured as a rotary valve in CONTROL_FLAGS. With the air removed from the positoner, carefully loosen the follower farm on the back of the positioner, or the potentiometer screws inside the positioner so that it can be rotated. Move the arm, or rotate the pot, until just barely in range - the LED code that is blinking will change. Set ‚Auto Feedback Gain Enabled‘ in MISC_FLAGS. Re-start the calibration. This time calibration should complete with out any problems. Refer to the Logix 3400IQ IOM for more details on this adjustment.

AUTO_TUNE_MULT: The positioner gains can be set automatically during a stroke calibration. Adjustments to the auto gain settings can be adjusted by using this variable.

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 or write cycles very quickly, and should be corrected as all devices in the configuration will be adversely affected by this continuous download.

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

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

8.6 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 3400IQ 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.

AO Block Parameter List

Table 8.7 lists the block parameters and default values for the AO function block.

Table 8.7 AO Function Block Parameter List

Block Index	Name	Store Type	Data Type (Units)	Valid Range	Write Restrictions	Default Value
1	ST_REV	S	Unsigned16		Read Only	0
2	TAG_DESC	S	Octet String			All spaces
3	STRATEGY	S	Unsigned16			0
4	ALERT_KEY	S	Unsigned8			0
5	MODE_BLK	Mix	MODE_BLK			Target = OOS Permitted = OS + MAN + AUTO + CAS + RCAS Normal = AUTO
6	BLOCK_ERR	D	Bit String		Read Only	
7	PV	D	ANALOG (PV)		Read Only	
8	SP	N	ANALOG (PV)	PV_SCALE, +/- 10%	Target mode must be AUTO, CAS or RCAS, not permitted during cascade initialization, tracking cannot be operative.	
9	OUT	N	ANALOG (XD)	XD_SCALE, +/- 10%	Target mode must be Man or OOS	
10	SIMULATE	D	SIM_FLOAT			Enable = OFF
11	PV_SCALE	S	SCALING		Actual mode must be Man or OOS	0 – 100
12	XD_SCALE	S	SCALING		Actual mode must be Man or OOS	0 – 100
13	GRANT_DENY	D	ACCESS_ PERM_T			
14	IO_OPTS	S	Bit String		Target mode must be OOS	0
15	STATUS_OPTS	S	Bit String		Target mode must be OOS	0
16	READBACK	D	ANALOG (XD)		Read Only	
17	CAS_IN	N	ANALOG (PV)			
18	SP_RATE_DN	S	Float (PV / seconds)	Positive		+INF
19	SP_RATE_UP	S	Float (PV / seconds)	Positive		+INF
20	SP_HI_LIM	S	Float (PV)	PV_SCALE, +/- 10%		100
21	SP_LO_LIM	S	Float (PV)	PV_SCALE, +/- 10%		0
22	CHANNEL	S	Unsigned16	Must be 1	Target mode must be OOS	0
23	FSTATE_TIME	S	Float (seconds)	Positive		0
24	FSTATE_VAL	S	Float (PV)	PV_SCALE, +/- 10%		0
25	BKCAL_OUT	D	ANALOG (PV)		Read Only	
26	RCAS_IN		N	ANALOG (PV)		
27	SHED_OPT	S	Unsigned8	1 to 8		0
28	RCAS_OUT	D	ANALOG (PV)		Read Only	
29	UPDATE_EVT	D	EVENT			
30	BLOCK_ALM	D	ALARM_ DISCRETE			
32	WSP*	D	ANALOG (PV)			

Table 8.7 AO Function Block Parameter List

Block Index	Name	Store Type	Data Type (Units)	Valid Range	Write Restrictions	Default Value
31	READBACK_ OUT	D	ANALOG (PV)		Read Only	
33	BLOCK_TEST*	D	Array of Unsigned8		Read Only	All zeros

* Extension parameter

AO Block Diagram

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

AO Block Diagram

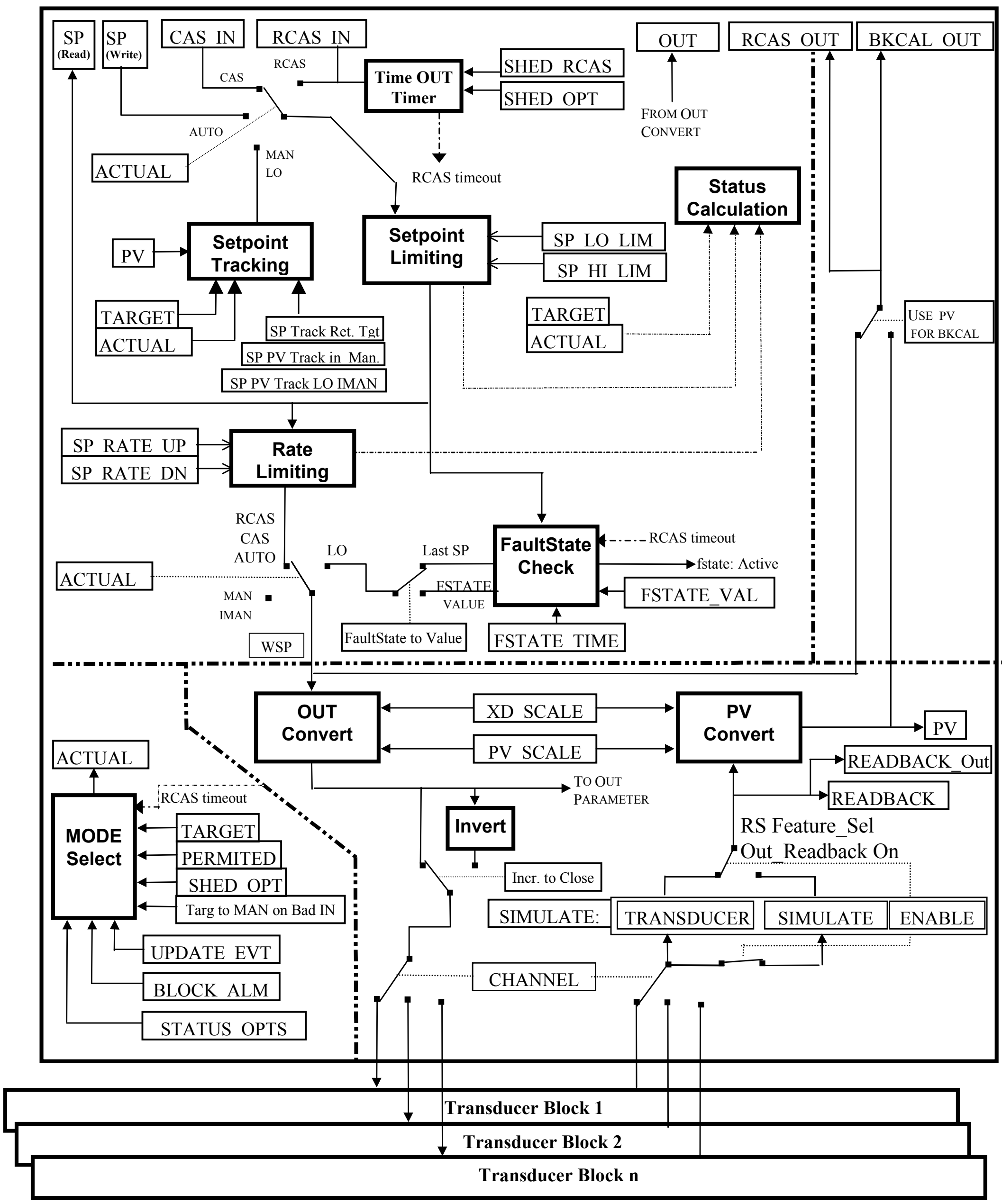


Figure 8.3 AO Function Block Diagram

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.

Parameter	Initial Value	Valid Range	Corrective action
CHANNEL	0	1	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.
SP_HI_LIM SP_LO_LIM	100 0	PV_SCALE +/- 10%	Verify that SP_HI_LIM > SP_LO_LIM.

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 3400IQ, 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.

8.7 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 defined in Table 8.9 on page 59.

PID Block Parameter List

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

Table 8.8 PID Control Function Block Parameters

Index	Name	Store Type	Data Type (Units)	Valid Range	Write Restrictions	Default Value
1	ST_REV*	s	Unsigned16		Read Only	0
2	TAG_DESC	s	Octet String			All blanks
3	STRATEGY	s	Unsigned16			0
4	ALERT_KEY	s	Unsigned8			0
5	MODE_BLK	Mix	MODE_BLK		Actual is Read Only	Target = OOS Permitted = OS + MAN + AUTO+ CAS + RCAS + ROUT Normal = AUTO
6	BLOCK_ERR	d	Bit String		Read Only	
7	PV	D	ANALOG (PV)		Read Only	
8	SP	N	ANALOG (PV)	PV_SCALE, +/- 10%	Target mode must be AUTO, CAS or RCAS, not in cascade initialization, and tracking cannot be operative.	
9	OUT	N	ANALOG (OUT)	OUT_SCALE, +/- 10%	Target mode must be Man or OOS	
10	PV_SCALE	S	SCALING (PV)		Actual mode must be Man or OOS	0 – 100
11	XD_SCALE	S	SCALING (XD)		Actual mode must be Man or OOS	0 – 100
12	GRANT_DENY	D	ACCESS_ PERM_T			
13	CONTROL_ OPTS	S	Bit String		Target mode must be OOS	0 (reverse acting)
14	STATUS_OPTS	S	Bit String		Target mode must be OOS	0
15	IN	N	ANALOG (PV)			
16	PV_FTIME	S	Float (seconds)	0 – 200.0	Actual mode = Man or OOS	0
17	BYPASS	S	Unsigned8	1 – Off 2 – On	To turn BYPASS On, Control Opts. Bypass Enable must be TRUE	0 (Un-initialized)
18	CAS_IN	N	ANALOG (PV)			
19	SP_RATE_DN	S	Float (PV / second)	Positive		+INF
20	SP_RATE_UP	S	Float (PV / second)	Positive		+INF
21	SP_HI_LIM	S	Float (PV)	PV_SCALE, +/- 10%		100
22	SP_LO_LIM	S	Float (PV)	PV_SCALE, +/- 10%		0
23	GAIN	S	Float	0.0 or 0.004 – 250.0	0	
24	RESET	S	Float (seconds)	(2 • Ts) - 7500		+INF

Table 8.8 PID Control Function Block Parameters

Index	Name	Store Type	Data Type (Units)	Valid Range	Write Restrictions	Default Value
25	BAL_TIME	S	Float (seconds)		0	
26	RATE	S	Float (seconds)	(32 • Ts) - 7500		0
27	BKCAL_IN	N	ANALOG (PV)			
28	OUT_HI_LIM	S	Float (OUT)	OUT_SCALE, +/- 10%	Must be greater or equal to OUT_LO_LIM except in OOS	100
29	OUT_LO_LIM	S	Float (OUT)	OUT_SCALE, +/- 10%	Must be less or equal to OUT_HI_LIM except in OOS	0
30	BKCAL_HYS	S	Float (percent)	0.0 – 50.0		0.5
31	BKCAL_OUT	D	ANALOG (PV)		Read Only	
32	RCAS_IN	N	ANALOG (PV)			
33	ROUT_IN	D	ANALOG (OUT)			0
34	SHED_OPT	S	Unsigned8	1 – 8		0 (Un-initialized)
35	RCAS_OUT	D	ANALOG (PV)		Read Only	
36	ROUT_OUT	D	ANALOG (OUT)		Read Only	
37	TRK_SCALE	S	ANALOG (TRK)		Actual mode must be Man or OOS	
38	TRK_IN_D	N	DISCRETE			
39	TRK_VAL	N	ANALOG (TRK)			
40	FF_VAL	N	ANALOG (FF)			
41	FF_SCALE	S	SCALING (FF)			0 - 100
42	FF_GAIN	S	Float (none)		Actual mode must be Man or OOS	0
43	UPDATE_EVT	D	EVENT		Read Only	
44	BLOCK_ALM	D	ALARM_ DISCRETE			
45	ALARM_SUM	D	ALARM_ SUMMARY			
46	ACK_OPTION	S	Bit String			0
47	ALARM_HYS	S	Float (percent)	0.0 – 50.0		0.5
48	HI_HI_PRI	S	Unsigned8	0 - 15		0
49	HI_HI_LIM	S	Float (PV)	+INF, PVSCALE	Must be less than HI_LIM except in OOS	+INF
50	HI_PRI	S	Unsigned8	0 – 15		0
51	HI_LIM	S	Float (PV)	+INF, PVSCALE	LO_LIM - HI_HI_LIM except in OOS	+INF
52	LO_PRI	S	Unsigned8	0 – 15		0
53	LO_LIM	S	Float (PV)	-INF, PVSCALE	LO_LO_LIM - HI_LIM except in OOS	-INF
54	LO_LO_PRI	S	Unsigned8	0 – 15		0
55	LO_LO_LIM	S	Float (PV)	-INF, PVSCALE	Must be greater than LO_LIM except in OOS	-INF
56	DV_HI_PRI	S	Unsigned8	0 – 15		0
57	DV_HI_LIM	S	Float (PV)	+INF, PVSCALE		+INF
58	DV_LO_PRI	S	Unsigned8	0 – 15		0
59	DV_LO_LIM	S	Float (PV)	-INF, PVSCALE		-INF
60	HI_HI_ALM	D	ALARM_ FLOAT			
61	HI_ALM	D	ALARM_ FLOAT			
62	LO_ALM	D	ALARM_ FLOAT			

Table 8.8 PID Control Function Block Parameters

Index	Name	Store Type	Data Type (Units)	Valid Range	Write Restrictions	Default Value
63	LO_LO_ALM	D	ALARM_ FLOAT			
64	DV_HI_ALM	D	ALARM_ FLOAT			
65	DV_LO_ALM	D	ALARM_ FLOAT			
66†	PID_FORM	S	Unsigned8	1 = IDEAL 2 = ROBUST	Actual mode must be Man or OOS	1
67†	ALGO_TYPE	S	Unsigned8	1 = Type A 2 = Type B 3 = Type C	Actual mode must be Man or OOS	1
68†	OUT_LAG	S	Float (seconds)	(2 • Ts) – 7500.0	PID_FORM must = 2 (ROBUST)	
69†	GAIN_NLIN	S	Float (none)		Actual mode must be Man or OOS	0
70†	GAIN_COMP	D	Float (none)		Read Only	
71†	ERROR_ABS	D	Float (PV)		Read Only	
72†	WSP	D	ANALOG (PV)		Read Only	
73†	BLOCK_TEST	D	Array of Unsigned8		Read Only	All zeros

** Special NVM parameter which is update on parameter write.*

† Extension parameter.

Honeywell-defined PID Parameters

The Honeywell-defined parameters provide a robust PID algorithm. A description of these parameters is in Table 8.9.

Table 8.9 Honeywell 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 8.9 Honeywell 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.)
BLOCK_TEST	An internal Honeywell test parameter.

PID Block Diagram

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

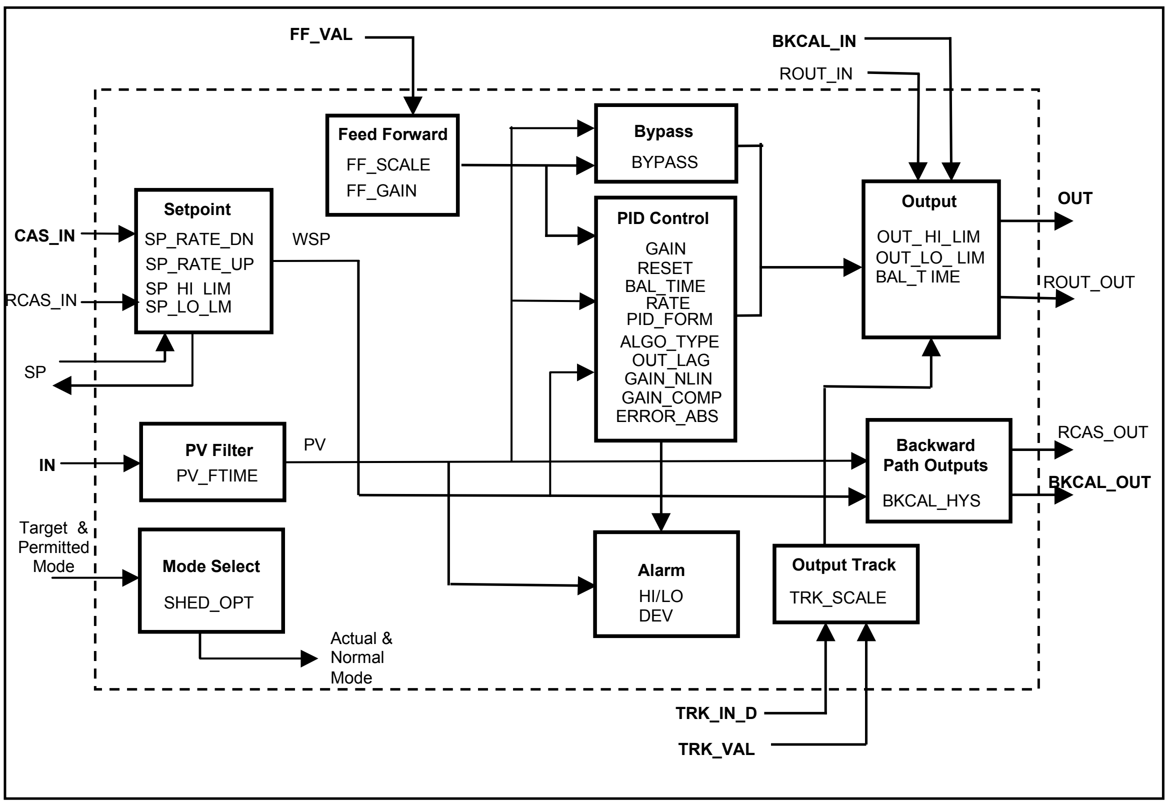


Figure 8.4 PID Control Block

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 is 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 these ranges.

Table 8.10 PID Tuning Parameter Values

Parameter	Initial Value	Minimum Value	Maximum Value	Comment
PV_FTIME	0	0	200	Units: seconds.
GAIN	0	.004	250	
GAIN_NLIN	0	.004	250	
RATE (sec.)	0	32 • Ts	7500	The value of ZERO is permitted to turn off rate action.
RESET (sec.)	+INF	2 • Ts	7500	The value of +INF is permitted to turn off reset action. (Some versions of NI-FBUS Configurator program cannot set +/- INF)
OUT_LAG Ideal PID	N/A	N/A	N/A	Fixed for ideal PID form - cannot be configured.
Robust PID	0	2• Ts	7500	Zero permitted, which implies no output lag.
BAL_TIME	0	N/A	N/A	Not used in Honeywell Implementation.

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.

8.8 Block Parameter Summary

Table Description

Table 8.11 provides a description of the block parameter attributes that are listed in the Block Parameter Summary, Table 8.14 to Table 8.17.

Table 8.11 Table Description for Block Parameter Summary

Column Title Attribute	Meaning
Obj Type Object Type	Object type for the parameter value: **S** - Simple Variable **R** - Record **A** - Array of simple variables
Data Type/Structure	Data Type or Structure for the parameter value: 1. Data Types consist of a simple variable or array and are: **Unsigned8, Unsigned16 Unsigned32** - An unsigned variable of 8, 16 or 32 bits. Float - Floating point 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.

Table 8.11 Table Description for Block Parameter Summary

Column Title Attribute	Meaning
Use/Model Use and Model Reference (The letter for use is separated by a slash from the model name.)	The manner in which the parameter will participate in inter-device communications. Use is defined as: **I** - Function block Input. The input may be connected to a function block output or used as a constant. **O** - Function block Output. An output may be referenced by other function block inputs. **C** - Parameter value Contained in the block, available for interface (operation, diagnostic) and/or configuration. Model is: The name of the parameter. In this case, the attribute indicates that it is a contained parameter and may not be referenced by link objects for use as an input to function blocks.
Store	Indicates the type of memory where the parameter is stored: **S** - Static. Writing to the parameter changes the static revision counter 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.
Size	The number of octets.
Valid Range	Range of valid values the parameter is restricted to for use in the function block. For bit strings: 0 (zero) is always valid as the state of a bit and is the inverse of the described value. For enumeration: 0 (zero) means that the value is invalid. This is required for initialization of an un-configured block. Plus or minus infinity (+INF or -INF) may be included in the valid range to indicate that it is permissible to use them to turn off a limit comparison, such as an alarm limit.
Initial Value	The value inserted when the block is created. All limits are set to plus or minus infinity (+INF or -INF), which is the same as no limit. All dynamic values are initialized to zero as a result of a clear memory instruction.
Perm. Permission	Defines the setting of the GRANT_DENY parameter that allows write access to the parameter, for interface devices that obey this parameter.
Mode	Indicates the lowest priority target mode required to allow a change to the parameter. The actual mode must match the target mode, so that the block is not in another mode than that chosen by the operator. Scaling changes are protected by mode, because the block may be using scaling to calculate its output.
Other	DD handling for: Positive Ordered and Read only. NOTE: For parameters that are inputs: If it is linked, it is read-only. If it is not linked, it can be written to.
Range Check	Flag to check that the value is within the valid range given in the table.

Parameter Summary

A summary of the Fieldbus Foundation-defined parameters can be found in FF-890 and FF-891 Foundation Specification Function Block Application Process Parts 1 and 2.

Table 8.12 Resource Block Parameter Summary

Parameter Mnemonic	Obj. Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value Units	Perm.	Mode	Other	Range Check
DL_CMD1	S	Unsigned8	C/Contained	D	1				OOS	written sequentially	
DL_CMD2	S	Unsigned8	C/Contained	D	1				OOS	written sequentially	
DL_APPSTATE	S	Unsigned16	C/Contained	S	2					Read-only	
DL_SIZE	S	Unsigned32	C/Contained	S	4					Read-only	
DL_CHECKSUM	S	Unsigned16	C/Contained	S	2					Read-only	
REVISION_ ARRAY	A[3]	Unsigned16	C/Contained	S	6					Read-only	
BLOCK_TEST	A [8]	Unsigned8	C/Contained	D	8						
ERROR_DETAIL	A [3]	Unsigned16	C/Contained	D	6		0,0,0			Read-only	

Table 8.13 Transducer Block Parameter Summary

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm	Mode	Other	Range Check
TRANSDUCER_ DIRECTORY	S	Unsigned16	C/Contained	S	2						Read-only	
TRANSDUCER_ TYPE	S	Unsigned16	C/Contained	S	2	106	106				Read-only	Fixed Value
XD_ERROR	S	Unsigned8	C/Contained	D	1						Read-only, Not used	
COLLECTION_ DIRECTORY	S	Unsigned32	C/Contained	S	4						Read-only	
FINAL_VALUE	R	DS-65	C/Contained	N	5							
FINAL_VALUE_ RANGE	R	DS-68	C/Contained	S	11		-5 to 105					Units only
FINAL_VALUE_CUT OFF_HI	S	Float	C/Contained	S	4		110					
FINAL_VALUE_ CUTOFF_LO	S	Float	C/Contained	S	4		-10					
FINAL_POSITION_ VALUE	R	DS-65	C/Contained	N	5						Read-only	
ACT_FAIL_ACTION	S	Unsigned8	C/Contained	S	1	0 – none 1-closed, 2-open, 3-in place	none				See FAIL_ MODE	
ACT_MAN_ID	S	Unsigned32	C/Contained	S	4	enum.	Note 5					
ACT_MODEL_NUM	S	Visible String	C/Contained	S	32		NULL					
ACT_SN	S	Visible String	C/Contained	S	32		NULL					
VALVE_MAN_ID	S	Unsigned32	C/Contained	S	4	enum.	Note 5					

Table 8.13 Transducer Block Parameter Summary

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm	Mode	Other	Range Check
VALVE_MODEL_NO	S	Visible String	C/Contained	S	32		NULL					
VALVE_SN	S	Visible String	C/Contained	S	32		NULL					
VALVE_TYPE	S	Unsigned8	C/Contained	S	1	enum.	Note 5					
XD_CAL_LOC	S	Visible String	C/Contained	S	32		NULL					
XD_CAL_DATE	S	Visible String	C/Contained	S	8		NULL					
XD_CAL_WHO	S	Visible String	C/Contained	S	32		NULL					
Manufacturer Specific Parameters												
DAC_PERCENT	S	float	C/Contained	D	4	0-100					Read-only Note 1	
CONTROL_FLAGS	S	Bit String	C/Contained	N	1	enum.	Note 4			O/S	Note 3	
GAIN_UPPER	S	float	C/Contained	S	4		2			O/S	Note 3	
GAIN_LOWER	S	float	C/Contained	S	4		1			O/S	Note 3	
GAIN_MULT	S	float	C/Contained	S	4		0.05			O/S	Note 3	
IGAIN	S	Integer16	C/Contained	S	2		10			O/S	Note 3	
IL_OFFSET	S	float	C/Contained	S	4		55			O/S	Note 3	
STATUS_FLAGS	S	Bit String	C/Contained	N	1	enum.	0				Read-only	
CMD_USED	S	float	C/Contained	D	4	-10 to 110					Read-only	
CALIBRATE	S	Unsigned8	C/Contained	D	1	enum.	Normal Operation			O/S	Note 3	
DAC_VALUE	S	Unsigned16	C/Contained	D	2	0 - 4095				O/S	Note 2, 3	
PRESS_CAL	S	float	C/Contained	S	4		60				Note 3	
CALIBRATE_FLAGS	S	Bit String	C/Contained	D	1	enum.					Read-only	
SOFTSTOP_HIGH	S	float	C/Contained	S	4	-10 to 110	110			O/S	Note 3	
SOFTSTOP_LOW	S	float	C/Contained	S	4	-10 to 110	-10			O/S	Note 3	
CYCLE_COUNTER	S	Unsigned32	C/Contained	N	4	0 – 4.29x109	0				Note 3	
CYCLE_DEADBAND	S	float	C/Contained	S	4	.10 – 100	20				Note 3	
CYCLE_LIMIT	S	Unsigned32	C/Contained	S	4	0 – 4.29x109	4294967294				Note 3	
TRAVEL_ENG	S	float	C/Contained	S	4	0 – 4.29x109	0				Note 3	
TRAVEL_ DEADBAND	S	float	C/Contained	S	4	.10 – 100	20				Note 3	
TRAVEL_ALERT	S	float	C/Contained	S	4	0 – 4.29x109 2e+006					Note 3	
STROKE_ENG	S	float	C/Contained	S	4	0 – 4.29x109	1				Note 3	
TRAVEL_UNITS	S	Unsigned8	C/Contained	S	1	0 – 4.29x109	inches				Note 3	

Table 8.13 Transducer Block Parameter Summary

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm	Mode	Other	Range Check
CURVEX	A[21]	float	C/Contained	S	84	-10 to 110%				O/S	Note 3	
CURVEY	A[21]	float	C/Contained	S	84	-10 to 110%				O/S	Note 3	
TRAVEL_FLAGS	S	Bit String	C/Contained	D	1	enum.	0				Read-only	
TEMPERATURE	S	Integer16	C/Contained	D	2						Read-only	
PORT_1_ PRESSURE	S	float	C/Contained	D	4						Read-only	
PORT_2_ PRESSURE	S	float	C/Contained	D	4						Read-only	
SUPPLY_ PRESSURE	S	float	C/Contained	D	4						Read-only	
VOLTAGE_ REFERENCE	S	float	C/Contained	D	4						Read-only	
HALL_SENSOR	S	float	C/Contained	D	4						Read-only	
DAC_CHECK	S	float	C/Contained	D	4						Read-only	
MOD_CURRENT	S	float	C/Contained	D	4						Read-only	
IL_CHK	S	Integer16	C/Contained	D	2						Read-only	
INTERNAL_FLAGS	S	Bit String	C/Contained	D	1	enum.	0				Read-only	
PRESS_FLAGS	S	Bit String	C/Contained	D	1	enum.	0				Read-only	
PRESS_UNITS	S	Unsigned8	C/Contained	S	1	enum.	psi				Note 3	
TEMP_UNITS	S	Unsigned8	C/Contained	S	1	enum.	Deg. F				Note 3	
ELECTRONICS_SN	A[8]	Visible String	C/Contained	S	8						Read-only	
SOFTWARE_VER	S	Integer16	C/Contained	S	2						Read-only	
FAIL_MODE	S	Unsigned8	C/Contained	S	1	enum	Hold last position			O/S	Note 3	
AD_RAW_FB	S	Integer16	C/Contained	D	2	0 – 4095					Read-only Note 1	
ERROR	S	float	C/Contained	D	4						Read-only Note 1	
PGAIN	S	float	C/Contained	D	4						Read-only Note 1	
INTEGRAL_SUM	S	float	C/Contained	N	4	-20 to 20 %					Read-only	
ALPHA_FILT	S	float	C/Contained	S	4		0.5			O/S	Note 1, 3	
PRESS_WINDOW	S	float	C/Contained	S	4	0 – 100 %	0.01			O/S	Note 3	
PRESS_HYST	S	float	C/Contained	S	4	0 – 100 %	0.02			O/S	Note 3	
PRESS_GAIN	S	float	C/Contained	S	2	0 – 100	0.03			O/S	Note 3	
TP_ZERO	S	Integer16	C/Contained	S	2	1 – 4094	2			O/S	Note 1,3	
TP_SPAN	S	Integer16	C/Contained	S	2	1 – 4094	1175			O/S	Note 1,3	
TP_FULL_SCALE	S	Integer16	C/Contained	S	2	1 – 4093	1173			O/S	Note 1,3	
BP_ZERO	S	Integer16	C/Contained	S	2	1 – 4094	2			O/S	Note 1,3	
BP_SPAN	S	Integer16	C/Contained	S	2	1 – 4094	1175			O/S	Note 1,3	
BP_FULL_SCALE	S	Integer16	C/Contained	S	2	1 – 4093	1173			O/S	Note 1,3	
FB_ZERO	S	Integer16	C/Contained	S	2	1 – 4094				O/S	Note 1,3	

Table 8.13 Transducer Block Parameter Summary

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm	Mode	Other	Range Check
FB_SPAN	S	Integer16	C/Contained	S	2	1 – 4094				O/S	Note 1,3	
FB_SCOUNT	S	Integer16	C/Contained	S	2	1 – 4093				O/S	Note 1,3	
HALL_NULL	S	Unsigned16	C/Contained	S	2	0 – 1024	150			O/S	Note 1,3	
HALL_DOWN	S	Unsigned16	C/Contained	S	2	0 – 1024	250			O/S	Note 1,3	
HALL_UP	S	Unsigned16	C/Contained	S	2	0 – 1024	50			O/S	Note 1,3	
POSALERT_HIGH	S	float	C/Contained	S	4	-10 to 110%	110				Note 3	
POSALERT_LOW	S	float	C/Contained	S	4	-10 to 110%	-10				Note 3	
POSDEV_ DEADBAND	S	float	C/Contained	S	4	100 to .1%	5	%			Note 3	
POSDEV_TIME	S	Float	C/Contained	S	4		60	SEC			Note 3	
SIG_START	S	float	C/Contained	N	4	110 to –10%	0			O/S	Note 3	
SIG_STOP	S	float	C/Contained	N	2	110 to –10%	100			O/S	Note 3	
RAMP_RATE	S	float	C/Contained	N	4	>1	200			O/S	Note 3	
STEP_TIME	S	float	C/Contained	N	4	0 -650 s	10			O/S	Note 3	
SIG_FLAGS	S	Bit String	C/Contained	N	1					O/S	Note 3	
SAMPLE_TIME	S	float	C/Contained	N	4	.1 – 2.55 s	0.1			O/S	Note 3	
SIG_COUNTER	S	Unsigned16	C/Contained	D	2						Read-only	
INTAD_RAW1	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAWTP	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAWBP	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAWSP	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAW3	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAW4	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAW5	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAW6	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAW8	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
TEST_MODE	S	Bit String	C/Contained	D	1	Enum				O/S	Note 3	
VALVE_SIZE	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	
VALVE_CLASS	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	
VALVE_ENDCON	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	
VALVE_BODYMAT	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	
VALVE_TRIMMAT	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	
VALVE_TRIMCHAR	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	

Table 8.13 Transducer Block Parameter Summary

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm	Mode	Other	Range Check
VALVE_TRIMTYPE	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	
VALVE_TRIMNO	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	
VALVE_PACKTYPE	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	
STEM_DIAM	S	float	C/Contained	S	4		1.0				Note 3	
LEAK_CLASS	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	
INLET_PRESS	S	float	C/Contained	S	4		0				Note 3	
OUTLET_PRESS	S	float	C/Contained	S	4		0				Note 3	
VALVE_FLAGS	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	
RATED_TRAV	S	float	C/Contained	S	4		0				Note 3	
ACT_TYPE	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	
ACT_SIZE	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	
SPRING_TYPE	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	
SPOOL_ID	S	Unsigned8	C/Contained	S	1	Enum	Note 5				Note 3	
PO_DATE[8]	A[8]	Visible String	C/Contained	S	8		Mmddyyyy				Note 3	
INSTALL_DATE[8]	A[8]	Visible String	C/Contained	S	8		Mmddyyyy				Note 3	
LOAD_EE_ DEFAULTS	S	Unsigned8	C/Contained	D	1	Enum	Normal Operation			O/S	Note 3	
ENG_RELEASE_ NUM	S	Unsigned16	C/Contained	S	2						Read-only	
MISC_FLAGS	S	Bit String	C/Contained	N	1	Enum	0			O/S	Note 3	
SIG_INDEX	S	Unsigned16	C/Contained	D	2		0				Note 3	
SIG_DATA	A[4]	Float	C/Contained	D	4						Read-only	
MFG_PHONE	A[18]	Visible String	C/Contained	S	18		8014898611					
PUR_ODER_NUM	A[18]	Visible String	C/Contained	S	18		NULL					
STROKE_TIME_ OPEN	R	float w/status	C/Contained	S	5		0			O/S		
STROKE_TIME_ CLOSE	R	float w/status	C/Contained	S	5		0			O/S		
CAL_FULLSCALE	R	UINT16 w/status	C/Contained	S	3		1500	Counts		O/S		
AUTO_TUNE_MULT	R	float w/status	C/Contained	S	5		100	%		O/S		
NVRAM_WRITE_ CYCLES		Unsigned32	C/Contained	N	4						Read-only	
GENERIC_PARM_ NUM	R	DS-66	C/Contained	D	2		Signed int					
GENERIC_PARM_ VAL	S	Unsigned32	C/Contained	D	4		0					
SPI_TEST_RCV	A [16]	Unsigned8	C/Contained	D	16						Read-only	
SPI_TEST_TX	A [16]	Unsigned8	C/Contained	D	16						Read-only	
BLOCK_TEST	A [8]	Unsigned8	C/Contained	D	8							

Notes for Transducer Blocks, all releases:

1. Diagnostic Parameter. This parameter is only accessible if TEST_MODE bit 7 'Enable Diagnostic Scan List' is set.
2. DAC_VALUE can only be written if TEST_MODE bit 7 AND bit 0 'Write to DAC_Value' are set.
3. Parameter may not be written if SIG_FLAGS bit 0 'BEGIN_SIG' is set. (The Signature Analysis program is running.)
4. 0x00 if the positioner is a standard model. Advanced Model if the positioner is an advanced type (pressure sensors). This is determined from hardware settings at start-up
5. This enumeration shows 'Uninitialized' when value is 0.

Table 8.14 Analog Output Function Block Parameter Summary

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm.	Mode	Other	Range Check
OUT	F	Value and Status - float	C/Contained	N	4		0					
BLOCK_TEST	A [8]	Unsigned8	C/Contained	D	8							
WSP	S	DS-65	C/Contained	D	5	PV_SCALE	0				Read-only	

Table 8.15 PID Function Block Parameter Summary

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm.	Mode	Other	Range Check
PID_FORM	S	Unsigned8	C/Contained S	1	1: Ideal 2:Robust	1	enum		MAN			
ALGO_TYPE	S	Unsigned8	C/Contained S	1	1: A, 2: B 3: C	0	enum		MAN			
OUT_LAG	S	Float	C/Contained	S	4		0	sec.	TUNE	MAN	Positive	
GAIN_NLIN	S	Float	C/Contained	S	4		0	TUNE	MAN			
GAIN_ COMP	S	Float	C/Contained	D	4		0				Read-only	
ERROR_ ABS	S	Float	C/Contained	D	4	PV Scale	0	PV			Read-only	
WSP	R	DS-65	C/Contained	D	5	PV Scale	0	PV			Read-only	
BLOCK_ TEST	A [8]	Unsigned8	C/Contained	D	8							

8.9 Link Objects

Background

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.

Example

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.

Logix 3400IQ Digital Positioner Link Objects

Link objects are used for alarms and events, function block linking and trending. In the Logix 3400IQ 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

Table 8.16 lists the link objects defined in the Logix 3400IQ digital positioner

Table 8.16 Link Objects Defined for Logix 3400IQ Digital Positioner

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

8.10 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 resource block, function block, and transducer 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 3400IQ Digital Positioner View Objects
In the Logix 3400IQ digital positioner, four view objects have been defined for each of the four blocks - for a total of 16 view objects. Some parameters are accessible in all four views, while others are available in one view.

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				
31	MAX_NOTIFY				1
32	LIM_NOTIFY		1		
33	CONFIRM_TIME		4		
34	WRITE_LOCK		1		
35	UPDATE_EVT				

Table 8.17 Resource Block View List

Index	Name	View1	View2	View3	View4
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 View Block List

Index	Parameter Name	Views									
		1	2	3	3_2	4	4_2	4_3	4_4	4_5	4_6
1	ST_REV	2	2	2	2	2	2	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	UPDATE_EVT										
8	BLOCK_ALM										
9	TRANSDUCER_ DIRECTORY										2
10	TRANSDUCER_ TYPE										2
11	XD_ERROR				1						
12	COLLECTION_ DIRECTORY										4
13	FINAL_VALUE	5		5							
14	FINAL_VALUE_ RANGE		11								
15	FINAL_VALUE_ CUTOFF_HI		4								
16	FINAL_VALUE_ CUTOFF_LO		4								

Table 8.18 Transducer View Block List

Index	Parameter Name	Views									
17	FINAL_ POSITION_VALUE	5		5							
18	ACT_FAIL_ ACTION										1
19	ACT_MAN_ID					1					
20	ACT_MODEL_ NUM										32
21	ACT_SN										32
22	VALVE_MAN_ID					4					
23	VALVE_MODEL_ NUM										32
24	VALVE_SN					32					
25	VALVE_TYPE					1					
26	XD_CAL_LOC									32	
27	XD_CAL_DATE					8					
28	XD_CAL_WHO									32	
Manufacturer's Specific Parameters											
29	DAC_PERCENT	4		4							
30	CONTROL_ FLAGS	1		1							
31	GAIN_UPPER		4								
32	GAIN_LOWER		4								
33	GAIN_MULT		4								
34	IGAIN					4					
35	IL_OFFSET									4	
36	STATUS_FLAGS	1		1							
37	CMD_USED	4		4							
38	CALIBRATE	1		1							
39	DAC_VALUE				2						
40	PRESS_CAL					4					
41	CALIBRATE_ FLAGS	1		1							
42	SOFTSTOP_ HIGH		4								
43	SOFTSTOP_LOW		4								
44	CYCLE_ COUNTER	4		4							
45	CYCLE_ DEADBAND		4								
46	CYCLE_LIMIT		4								
47	TRAVEL_ENG	4		4							

Table 8.18 Transducer View Block List

Index	Parameter Name	Views									
48	TRAVEL_ DEADBAND		4								
49	TRAVEL_ALERT		4								
50	STROKE_ENG		4								
51	TRAVEL_UNITS		1								
52	CURVEX							84			
53	CURVEY								84		
54	TRAVEL_FLAGS	1		1							
55	TEMPERATURE	2		2							
56	PORT_1_ PRESSURE	4		4							
57	PORT_2_ PRESSURE	4		4							
58	SUPPLY_ PRESSURE	4		4							
59	VOLTAGE_ REFERENCE	4		4							
60	HALL_SENSOR	4		4							
61	DAC_CHECK	4		4							
62	MOD_CURRENT	4		4							
63	IL_CHK	2		2							
64	INTERNAL_ FLAGS	1		1							
65	PRESS_FLAGS	1		1							
66	PRESS_UNITS					1					
67	TEMP_UNITS					1					
68	ELECTRONICS_SN						8				
69	SOFTWARE_VER						2				
70	FAIL_MODE		1								
71	AD_RAW_FB				2						
72	ERROR				4						
73	PGAIN				4						
74	INTEGRAL_SUM	4		4							
75	ALPHA_FILT									4	
76	PRESS_ WINDOW		4								
77	PRESS_HYST		4								
78	PRESS_GAIN		2								
79	TP_ZERO									2	
80	TP_SPAN									2	
81	TP_FULL_SCALE									2	
82	BP_ZERO									2	

Table 8.18 Transducer View Block List

Index	Parameter Name	Views									
83	BP_SPAN									2	
84	BP_FULL_SCALE									2	
85	FB_ZERO									2	
86	FB_SPAN									2	
87	FB_SCOUNT									2	
88	HALL_NULL									2	
89	HALL_DOWN									2	
90	HALL_UP									2	
91	POSALERT_HIGH		4								
92	POSALERT_LOW		4								
93	POSDEV_ DEADBAND		4								
94	POSDEV_TIME		4								
95	SIG_START			4							
96	SIG_STOP			4							
97	RAMP_RATE			4							
98	STEP_TIME			4							
99	SIG_FLAGS			1							
100	SAMPLE_TIME			4							
101	SIG_COUNTER			2							
102	INTAD_RAW1				2						
103	INTAD_RAWTP				2						
104	INTAD_RAWBP				2						
105	INTAD_RAW3				2						
106	INTAD_RAW4				2						
107	INTAD_RAW5				2						
108	INTAD_RAW6				2						
109	INTAD_RAW8				2						
110	TEST_MODE				1						
111	VALVE_SIZE						1				
112	VALVE_CLASS						1				
113	VALVE_ENDCON						1				
114	VALVE_BODYMAT						1				
115	VALVE_TRIMMAT						1				
116	VALVE_TRIMCHAR						1				
117	VALVE_TRIMTYPE						1				
118	VALVE_TRIMNO						1				
119	VALVE_PACKTYPE						1				
120	STEM_DIAM						4				
121	LEAK_CLASS						1				
122	INLET_PRESS						4				

Table 8.18 Transducer View Block List

Index	Parameter Name	Views									
123	OUTLET_PRESS						4				
124	VALVE_FLAGS						1				
125	RATED_TRAV						4				
126	ACT_TYPE						1				
127	ACT_SIZE						1				
128	SPRING_TYPE						1				
129	SPOOL_ID						1				
130	PO_DATE					8					
131	INSTALL_DATE					8					
132	LOAD_EE_ DEFAULTS				1						
133	ENG_RELEASE_ NUM						2				
134	MISC_FLAGS	1		1							
135	SIG_INDEX				2						
136	SIG_DATA				16						
137	MFG_PHONE						18				
138	PUR_ORDER_ NUM						18				
139	STROKE_TIME_ OPEN					5					
140	STROKE_TIME_ CLOSE					5					
141	CAL_FULLSCALE					3					
142	AUTO_TUNE_ MULT					5					
143	NVRAM_ WRITE_CYCLES				4						
144	GENERIC_ PARM_NUM				2						
145	GENERIC_ PARM_VAL				4						
146	SPI_TEST_RCV				16						
147	SPI_TEST_TX				16						
148	BLOCK_TEST				8						
	TOTAL VIEW SIZE	78	89	101	101	95	81	86	86	98	107
	NUMBER OF PARAMETERS	27	23	34	24	18	25	2	2	17	8

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				
Manufacturer Specific Parameters					
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	

Table 8.20 PID Block View Table

Index	Name	View1	View2	View3	View4
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

Table 8.20 PID Block View Table

Index	Name	View1	View2	View3	View4
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

8.11 Alert Objects

Description

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 3400IQ Digital Positioner Alert Objects
Three alert objects are defined in the Logix 3400IQ digital positioner for event and alarm reporting.

- 1 for events
- 1 for discrete alarms
- 1 for analog alarms

8.12 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 3400IQ digital positioner has several internal alarms which monitor electronics operation. An internal alarm causes the red LED code to blink. Positioner alarms differ from alerts because the action of the positioner may be erratic during the alarm conditions. Alert warns operations that a predefined, user-configured condition has occurred that may require service in the near future. Alarms cause the red LED code to blink, while alerts cause the green LED code to blink.

Refer to the following parameters to view positioner alarms:

- STATUS_FLAGS
- CALIBRATE_FLAGS
- TRAVEL_FLAGS
- INTERNAL_FLAGS
- PRESS_FLAGS

12 bit A/D Reference Alarm The Logix 3400IQ digital positioner utilizes a 12-bit Analog- to-Digital (A/D) converter to acquire stem position readings. If the precision reference used by the A/D drifts outside rated tolerances, the 12 bit A/D Reference Alarm will become active. A reference error will cause change in calibration and control readings. If a continuous 12 bit A/D reference alarm exists, the main PCB assembly must be replaced. Refer to the Logix Series 3400IQ Digital Positioner IOM for spare parts kit numbers.

1.23 V Reference Alarm The 1.23 V reference is used by the inner-loop spool position control. If it drifts outside normal tolerances, the 1.23 V reference alarm will become active. If a continuous 1.23 V reference alarm exists, the main PCB assembly must be replaced. Refer to the Logix Series 3400IQ Digital Positioner IOM for spare parts kit numbers.

12-bit D/A Alarm The Logix 3400IQ digital positioner utilizes a 12-bit Digital-to-Analog (D/A) converter to send a control signal from the micro controller to the inner-loop spool positioning circuit. The output of the D/A converter is independently measured to verify correct operation. A 12 bit D/A alarm indicates that the D/A may be malfunctioning. If a continuous 12 bit D/A alarm exists, the main PCB assembly must be replaced. Refer to the Logix Series 3400IQ Digital Positioner IOM for spare parts kit numbers.

Temperature Alarm The main PCB assembly contains an ambient temperature sensor. If the ambient temperature readings goes outside the operating range, -40°F to +185°F (-40°C to +85°C), the temperature alarm will become active. The red LED will also blink. If this alarm is present and the ambient temperature reading is incorrect, the main PCB assembly must be replaced. Refer to the Logix Series 3400IQ Digital Positioner IOM for spare parts kit numbers.

Hall sensor Alarm As described in Theory of Operation in section 1, the Logix 3400IQ digital positioner incorporates an inner-loop, spool positioning stage. A hall sensor is used for spool control. If the electronics senses a problem with the sensor, the hall sensor alarm will become active. Some common reasons for a hall sensor alarm are loose or missing cable connection to the collector board assembly or a broken wire. In the rare event that the actual hall sensor is defective, the driver module assembly must be replaced. Refer to the Logix Series 3400IQ Digital Positioner IOM for spare parts kit numbers.

Note: A loss of air supply can trigger a Hall Sensor alarm.

Modulator current Alarm In the Logix 3400IQ the modulator current is no longer measured. The value that is being measured is peizo voltage. If the piezo voltage is out of range, an alarm will trigger. To determine the actual piezo voltage, read the value from MOD_Current. Move the decimal place one to the right to obtain the actual piezo voltage. Replacement of the driver module may be necessary if the alarm persists and the positioner does not function.

EEPROM checksum Alarm Configuration data is stored in EEPROM. When power is lost, configuration information is retrieved from EEPROM and operation resumes. A check is done by the micro-controller after a power-up to make sure data saved in EEPROM has not been corrupted. The checksum is a number that is calculated based on configuration data. It is also saved in EEPROM every time data is stored. If after a power-up, this number does not match the data in memory, an EEPROM checksum alarm is generated and the red LED will blink. If this occurs, try powering the Logix 3400IQ digital positioner off and then back on. If the error does not clear, try saving configuration data again using FB Configurator. If previous configuration has not been saved, must be reset and reconfigure. If these steps still do not clear the error, the main PCB assembly must be replaced. Refer to the Logix Series 3400IQ Digital Positioner IOM for spare parts kit numbers.

Pressure Alarms

Pressure alarms are only available on models with advanced diagnostics (Logix 3400IQ 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, Green Yellow, Red. 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 3400IQ 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 3400IQ 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 3400IQ 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 3400IQ 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, Green, Yellow Green..

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

8.13 Trend Objects

Description
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.

Logix 3400IQ Digital Positioner Trend Objects
The Logix 3400IQ digital positioner has one defined trend object.

8.14 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 3400IQ digital positioner.

8.15 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 3400IQ 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.

8.16 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.

Logix 3400IQ Digital Positioner Block Parameter Index

Table 8.21 lists the index numbers for all block parameters defined in the FBAP for Logix 3400IQ digital positioner.

Table 8.21 Block Parameter Index Table

Index	Parameter
Index	AO Function Block
257	BLOCK
258	ST_REV
259	TAG_DESC
260	STRATEGY
261	ALERT_KEY
262	MODE_BLK
263	BLOCK_ERR
264	PV
265	SP
266	OUT
267	SIMULATE
268	PV_SCALE
269	XD_SCALE
270	GRANT_DENY
271	IO_OPTS
272	STATUS_OPTS
273	READBACK
274	CAS_IN
275	SP_TIME_DN
276	SP_TIME_UP
277	SP_HI_LIM
278	SP_LO_LIM
279	CHANNEL
280	FSAFE_TIME
281	FSAFE_VAL
282	BKCAL_OUT
283	RCAS_IN
284	SHED_OPT
285	RCAS_OUT
286	UPDATE_EVT
287	BLOCK_ALM
288	WSP
289	READBACK_OUT
290	BLOCK_TEST
PID Function Block	
310	BLOCK
311	ST_REV
312	TAG_DESC
313	STRATEGY
314	ALERT_KEY
315	MODE_BLK
316	BLOCK_ERR
317	PV
318	SP
319	OUT
320	PV_SCALE
321	OUT_SCALE
322	GRANT_DENY
323	CONTROL_OPTS
324	STATUS_OPTS
325	IN
326	PV_FTIME
327	BYPASS
328	CAS_IN
329	SP_TIME_DN
330	SP_TIME_UP
331	SP_HI_LIM
332	SP_LO_LIM
333	GAIN
334	RESET
335	BAL_TIME
336	RATE
337	BKCAL_IN
338	OUT_HI_LIM
339	OUT_LO_LIM
340	BKCAL_HYS
341	BKCAL_OUT
342	RCAS_IN
343	ROUT_IN
344	SHED_OPT
345	RCAS_OUT
346	ROUT_OUT
347	TRK_SCALE
348	TRK_IN_D
349	TRK_VAL
350	FF_VAL
351	FF_SCALE
352	FF_GAIN
353	UPDATE_EVT
354	BLOCK_ALM
355	ALARM_SUM
356	ACK_OPTION
357	ALARM_HYS
358	HI_HI_PRI
359	HI_HI_LIM
360	HI_PRI
361	HI_LIM
362	LO_PRI
363	LO_LIM
364	LO_LO_PRI
365	LO_LO_LIM
366	DV_HI_PRI
367	DV_HI_LIM
368	DV_LO_PRI
369	DV_LO_LIM
370	HI_HI_ALM
371	HI_ALM
372	LO_ALM
373	LO_LO_ALM
374	DV_HI_ALM
375	DV_LO_ALM
376	PID_FORM
377	ALGO_TYPE
378	OUT_LAG
379	GAIN_NLIN
380	GAIN_COMP
381	ERROR_ABS
382	WSP
383	BLOCK_TEST
Resource Block	
400	BLOCK
401	ST_REV
402	TAG_DESC
403	STRATEGY
404	ALERT_KEY
405	MODE_BLK
406	BLOCK_ERR
407	RS_STATE
408	TEST_RW
409	DD_RESOURCE
410	MANUFAC_ID
411	DEV_TYPE
412	DEV_REV
413	DD_REV
414	GRANT_DENY
415	HARD_TYPES
416	RESTART
417	FEATURES
418	FEATURE_SEL
419	CYCLE_TYPE
420	CYCLE_SEL
421	MIN_CYCLE_T
422	MEMORY_SIZE
423	NV_CYCLE_T
424	FREE_SPACE
425	FREE_TIME
426	SHED_RCAS
427	SHED_ROUT
428	FAIL_SAFE
429	SET_FSAFE
430	CLR_FSAFE
431	MAX_NOTIFY
432	LIM_NOTIFY
433	CONFIRM_TIME
434	WRITE_LOCK
435	UPDATE_EVT
436	BLOCK_ALM
437	ALARM_SUM
438	ACK_OPTION
439	WRITE_PRI
440	WRITE_ALM
441	ITK_VER
442	DL_CMD1
443	DL_CMD2
444	DL_APPSTATE
445	DL_SIZE
446	DL_CHECKSUM
447	REVISION_ARRAY
448	BLOCK_TEST
449	ERROR_DETAIL
450	AUX_FEATURES
Transducer Block	
460	BLOCK
461	ST_REV
462	TAG_DESC
463	STRATEGY
464	ALERT_KEY
465	MODE_BLK
466	BLOCK_ERR
467	UPDATE_EVT
468	BLOCK_ALM

Index	Parameter
469	TRANSDUCER_DIRECTORY
470	TRANSDUCER_TYPE
471	XD_ERROR
472	COLLECTION_DIRECTORY
473	FINAL_VALUE
474	FINAL_VALUE_RANGE
475	FINAL_VALUE_CUTOFF_HI
476	FINAL_VALUE_CUTOFF_LO
477	FINAL_POSITION_VALUE
478	ACT_FAIL_ACTION
479	ACT_MAN_ID
480	ACT_MODEL_NUM
481	ACT_SN
482	VALVE_MAN_ID
483	VALVE_MODEL_NO
484	VALVE_SN
485	VALVE_TYPE
486	XD_CAL_LOC
487	XD_CAL_DATE
488	XD_CAL_WHO
489	DAC_PERCENT
490	CONTROL_FLAGS
491	GAIN_UPPER
492	GAIN_LOWER
493	GAIN_MULT
494	IGAIN
495	IL_OFFSET
496	STATUS_FLAGS
497	CMD_USED
498	CALIBRATE
499	DAC_VALUE
500	PRESS_CAL
501	CALIBRATE_FLAGS
502	SOFTSTOP_HIGH
503	SOFTSTOP_LOW
504	CYCLE_COUNTER
505	CYCLE_DEADBAND
506	CYCLE_LIMIT
507	TRAVEL_ENG
508	TRAVEL_DEADBAND
509	TRAVEL_ALERT
510	STROKE_ENG
511	TRAVEL_UNITS
512	CURVEX

Index	Parameter
513	CURVEY
514	TRAVEL_FLAGS
515	TEMPERATURE
516	PORT_1_PRESSURE
517	PORT_2_PRESSURE
518	SUPPLY_PRESSURE
519	VOLTAGE_REFERENCE
520	HALL_SENSOR
521	DAC_CHECK
522	MOD_CURRENT
523	IL_CHK
524	INTERNAL_FLAGS
525	PRESS_FLAGS
526	PRESS_UNITS
527	TEMP_UNITS
528	ELECTRONICS_SN
529	SOFTWARE_VER
530	FAIL_MODE
531	AD_RAW_FB
532	ERROR
533	PGAIN
534	INTEGRAL_SUM
535	ALPHA_FILT
536	PRESS_WINDOW
537	PRESS_HYST
538	PRESS_GAIN
539	TP_ZERO
540	TP_SPAN
541	TP_FULL_SCALE
542	BP_ZERO
543	BP_SPAN
544	BP_FULL_SCALE
545	FB_ZERO
546	FB_SPAN
547	FB_SCOUNT
548	HALL_NULL
549	HALL_DOWN
550	HALL_UP
551	POSALERT_HIGH
552	POSALERT_LOW
553	POSDEV_DEADBAND
554	POSDEV_TIME
555	SIG_START
556	SIG_STOP

Index	Parameter
557	RAMP_RATE
558	STEP_TIME
559	SIG_FLAGS
560	SAMPLE_TIME
561	SIG_COUNTER
562	INTAD_RAW1
563	INTAD_RAWTP
564	INTAD_RAWBP
565	INTAD_RAW3
566	INTAD_RAW4
567	INTAD_RAW5
568	INTAD_RAW6
569	INTAD_RAW8
570	TEST_MODE
571	VALVE_SIZE
572	VALVE_CLASS
573	VALVE_ENDCON
574	VALVE_BODYMAT
575	VALVE_TRIMMAT
576	VALVE_TRIMCHAR
577	VALVE_TRIMTYPE
578	VALVE_TRIMNO
579	VALVE_PACKTYPE
580	STEM_DIAM
581	LEAK_CLASS
582	INLET_PRESS
583	OUTLET_PRESS
584	VALVE_FLAGS
585	RATED_TRAV
586	ACT_TYPE
587	ACT_SIZE
588	SPRING_TYPE
589	SPOOL_ID
590	PO_DATE
591	INSTALL_DATE
592	LOAD_EE_DEFAULTS
593	ENG_RELEASE_NUM
594	MISC_FLAGS
595	SIG_INDEX
596	SIG_DATA
597	MFG_PHONE
598	PUR_ODER_NUM
599	STROKE_TIME_OPEN
600	STROKE_TIME_CLOSE

Index	Parameter
601	CAL_FULLSCALE
602	AUTO_TUNE_MULT
603	NVRAM_WRITE_CYCLES
604	GENERIC_PARM_NUM
605	GENERIC_PARM_VAL
606	SPI_TEST_RCV
607	SPI_TEST_TX
608	BLOCK_TEST

8.17 Management Virtual Field Device

VFD

Refer to FF documentation for details about this Virtual Field Device (VFD).

8.18 System Management

Description

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 3400IQ digital positioner. The numbers in parenthesis indicate the number of objects.

Table 8.22 Logix 3400IQ Digital Positioner SMIB Object Dictionary

Dictionary Index	Object
Header	Reserved
	Directory of Revision Number (1)
	Number of Directory Objects (1)
	Total Number of Directory Entries (5)
	Directory Index of First Composite List Reference (0)
	Number of Composite List References (0)
258	System Management Agent Starting OD Index
	Number of System Management Agent Objects (4)
262	Sync and Scheduling Starting OD Index
	Number of Sync and Scheduling Objects (8)
270	Address Assignment Starting OD Index
	Number of Address Assignment Objects (3)
273	VFD List Starting OD Index
	Number of VFD List Objects (2)
275	FB Schedule Starting OD Index
	Number of FB Schedule Objects (2)

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 8.23 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 (time slave)	yes	
12	Scheduling function block	yes	
13	Application clock synch (time publisher)		no
14	to 31 Reserved for future use.		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_SUPPORT 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 8.24 identifies the SM Agent objects with their object directory index and default values.

Table 8.24 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 3400IQ 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 nternal 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 8.25 identifies the sync and scheduling objects with their object directory index and default values.

Table 8.25 SM Sync and Scheduling Objects

Object	Description	OD index	Default Value
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_NTERVAL	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 8.26 is a description of the address assignment objects with their object directory index and default values.

Table 8.26 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:

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 3400IQ digital positioner. Table 8.27 lists the function block scheduling objects with their object directory index and default values.

Table 8.27 Function Block Scheduling Objects

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

8.19 Network Management

Description
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 3400IQ 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 3400IQ digital positioner. The numbers in parenthesis indicate the number of objects.

Table 8.28 Logix 3400IQ Digital Positioner NMIB Object Dictionary

Dictionary Index	Object
Header	Reserved
	Directory of Revision Number
	Number of Directory Objects
	Total Number of Directory Entries
	Directory Index of First Composite List Reference
	Number of Composite List References
290	Stack Management OD Index
	Number of Objects in Stack Management (1)
291	VCR List OD Index
	Number of Objects in VCR List (5)
330	DLL Basic OD Index
	Number of Objects in DLL Basic (3)
332	DLL Link Master OD Index
	Number of Objects in DLL Link Master (7)
340	Link Schedule OD Index
	Number of Objects in Link Schedule
Not Used	DLL Bridge OD Index
	Number of Objects in DLL Bridge
337	Phy LME OD Index
	Number of Objects in Phy LME (2)
337	Phy LME OD Index
	Number of Objects in Phy LME (2)

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 3400IQ digital positioner device are standard fieldbus attributes. There are 16 available VCR's available in the Logix 3400IQ. 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 3400IQ 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
- PhysRead, PhysWrite
- ReadWithType, WriteWithType
- InformationReportWithType

8.20 Logix 3400IQ Digital Positioner Variable Enumeration

The following list defines the Logix 3400IQ digital positioner variables enumeration.

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

Value	Function
0	Normal operation, position control enabled
1	Automatically calibrate stroke, Re-Cal stroke
2	Automatically calibrate actuator pressure sensors
*5	Moving valve to closed position, get feedback at 0%
*6	Moving valve to open position, get feedback at 100%
*7	Calibrating SUPPLY sensor
*8	Moving valve to closed position, calibrating actuator sensor
*9	Moving valve to open position, calibrating actuator sensor
*11	Check that Re-Cal button is depressed
*12	Error occurred during calibration
*16	Automatically determine inner-loop offset
18	Perform step time test

** Read-only — user cannot send CALIBRATE in this mode.*

CALIBRATE_FLAGS: Each bit within this variable is a flag indicating parameters relevant to calibration. A logic 1 indicates error is active.

Bit	Description
0	0=No error 1= Calibration time-out
1	
2	0= No error 1= Position A/D converter saturated at 0% position
3	0=no error 1= Position A/D converter saturated at 100% position
4	
5	0= No error 1= Position A/D converter span error
6	
7	

CONTROL_FLAGS: Each bit within this variable is a flag that indicates parameters relevant to position control and calibration.

Bit	Name	Action
0	Air Action	0 = ATO 1 = ATC
2	Characterization Active	0 = Linear stem positioning 1 = Custom characterization stem positioning
3	Actuator Gains	0 = Linear actuator gains used 1 = Rotary actuator gains used
4	Model	0 = Standard positioner model (no pressure sensors) 1 = Advanced positioner model (pressure sensors)
6	Equal-percent Curve	0 = Use custom curve (user may edit) 1 = Use default equal-percent curve
7	Quick-opening Curve	0 = Use custom curve (user may edit) 1 = Use default quick-opening curve

NOTE: When bit 2 is set, if bit 6 and 7 = 0, the positioner will use the custom modifiable curve. The code will prevent both bits from being set at the same time. When bit 2 is set, if either bit 6 or 7 are set, the corresponding default characterization curve will be used. If bit 2 = 0, the positioner will use linear stem positioning, regardless of the value of bits 6 and 7.

FAIL_MODE: This variable is used to indicate the desired fail action of the Logix digital position should a loss of communications occur. If this variable = 0x00, the fail action will be 'last known position.' Logix software prevents more than 1 bit being set at a time.

Bit	Description
0	1 = Fail to last commanded position
1	1 = Fail valve to closed (0%) position
2	1 = Fail valve to full opened (100%) position

INTERNAL_FLAGS: Each bit within this variable is a flag indicating parameters relevant to the internal operation of the positioner electronics. A logic 1 indicates error is active.

Bit	Description
0	0 = No error 1 = 12 bit A/D reference error
1	0 = No error 1 = 1.23V reference error
2	0 = No error 1 = 12 bit DAC error
3	0 = No error 1 = Temperature error
4	0 = No error 1 = Hall Sensor error
5*	0 = No error 1 = Excessive modulator current*
6	
7	0 = No error 1 = EEPROM checksum error

* Even though excessive modulator current is being reported, modulator current is not actually measured in the Logix 3400IQ. The value that is actually being is measured and reported is that the piezo voltage is out of range.

LOAD_EE_DEFAULTS: This variable will load the positioner's card EEPROM with factory default values.

Value	Function
1	Reset variables
2	Reset calibration constants

MISC_FLAGS: This bit mapped variable is used to enable/disable various features ofthe Logix 3400IQ digital positioner. The user does not view it.

Bit	Name	Function
0	Re-Cal Disable	0 = Re-Cal enabled 1 = Re-Cal disabled
1	Large Act. Cal Enable	0 = Normal calibration 1 = Large actuator calibration
2	Auto Model Detect Disable	0 = Auto model detect enabled 1 = Auto model detect disabled
3	Pressure Control	0 = Pressure control disabled 1 = Pressure control enabled
4	Auto Feedback Gain	0 = Auto feedback gain select disabled 1 = Auto feedback gain select enabled
5	Not used	
6	Internal Flags on Position Deviation Alarming	0 = Disabled 1 = Enabled
7	Jog Calibration Set	0 = Disabled 1 = Enabled

PRESS_FLAGS: Each bit within this variable is a flag indicating parameters relevant to the pressure sensors (Advanced model ONLY). A logic 1 indicates error is active.

Bit	Description
0	0 = No error 1 = Loss of supply
1	Not used
2	0 = No error 1 = Output port 1 sensor failure (low pressure reading during calibration)
3	0 = No error 1 = Output port 2 sensor failure (low pressure reading during calibration)
4	Not used
5	Not used
6	Not used
7	Not used

PRESS_UNITS: This is an enumerated byte that indicates the engineering units being utilized for pressure sensor reporting. The embedded code supports units of psig, barg, KPag, and Kg/cm2g. The unit codes are defined as follows:

- 6 = psi
- 7 = bar
- 10 = Kg/cm2
- 12 = Kpa

SIG_FLAGS: Byte which will be added to the end of each signature data frame to show progress and end-of-signature. One flag will set STEP or RAMP STATUS_flags

STATUS_FLAG: Status flag variable for fieldbus. When a bit is set, the corresponding flag variable is reporting an alarm condition.

Bit	Description
0	0 = No error 1 = Error reported in CALIBRATE flags
1	0 = No error 1 = Error reported in TRAVEL flags
2	0 = No error 1 = Error reported in INTERNAL flags
3	0 = No error 1 = Error reported in PRESSURE flags
4	0 = No error 1 = Communications error
5	Not used
6	Not used
7	Not used

TEMP_UNITS: This is an enumerated byte that indicates the engineering units being utilized for temperature reporting. The embedded code supports °C and ° F. The unit codes are defined as follows:

- 32 = °C
- 33 = °F

TEST_MODE: This variable is bit mapped variable that will allow special tests to be done to the positioner.

Bit	Test
0	DAC control given to PC, write to DAC_value
1	Blink red LED, used for electronics board test. Bits 2 & 3 may not be set when active
2	Blink yellow LED, used for electronics board test. Bits 1 & 3 may not be set when active
3	Blink green LED, used for electronics board test. Bits 1 & 2 may not be set when active
4	Reserved
5	Reserved
6	Reserved
7	Enable diagnostic scan list

TRAVEL_FLAGS: Each bit within this variable is a flag indicating errors or alerts related to valve travel. Logic one indicates the flag is active.

Bit	Description
0	0 = No alert 1 = Final_Value_Cutoff active (this can be either high or low)
1	0 = No alert 1 = Lower soft stop active
2	0 = No alert 1 = Upper soft stop active
3	0 = No alert 1 = Lower position alert
4	0 = No alert 1 = upper position alert
5	0 = No alert 1 = Cycle counter limit exceeded
6	0 = No alert 1 = Travel accumulator limit exceeded
7	0 = No alert 1 = Position deviation alert

TRAVEL_UNITS: This is an enumerated byte that indicates the engineering units being utilized for the travel accumulator and stroke. The unit codes are defined as follows:

- 47 = inches
- 49 = millimeters

9 Calibration

9.1 Introduction

About This Section
This section provides information about calibrating the Logix 3400IQ digital positioner's sensors.

9.2 Overview

About Calibration
When re-calibration is required, the Logix 3400IQ 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 3400IQ 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 3400IQ Digital Positioner IOM for more details.)

9.3 Calibration

The output position of the Logix 3400IQ 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 3400IQ digital positioner calibration.
CALIBRATE	One-byte value which selects the calibration operation to be performed.	0 Normal operation. Valve tracks FINAL_VALUE	Calibration and correction commands are executed when the command is written.
		1 Initiates stroke calibration. Closes valve.	
		2 Initiates actuator pressure transducers calibration.	
		3 Moving valve to closed position	Messages only
		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	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
PRES_CAL	Input supply pressure for calibration	0 – 150 psig max.	Used to calibrate the span of the actuator pressure sensors

Two-point Calibration

The Logix 3400IQ 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, valve type (linear or rotary), positioner model (standard or advanced) before the calibration is done. (CONTROL_FLAGS =16 -> Air to Open, Linear, Advanced = default values)

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 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 PRES_CAL. 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.'
4. The positioner will return to tracking FINAL_VALUE.
5. Change MODE_BLK to desired mode
6. When calibration is completed, set transducer 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 3400IQ 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.

Position 0 percent Calibration Flag: During stroke calibration, the Logix 3400IQ digital positioner checks to see if the linkage is placing the stem position sensor in range. If the valve stroke causes stem position measurement to go out of range in the closed position, a 'Position 0 percent Flag' will be generated. The valve stem will stop in the closed position and the LEDs will blink Yellow Red Yellow Red. Linkage must be adjusted to bring the sensor in range. *Special LED indication: If the linkage is out of range, the LEDs can be used as an adjustment guide. The LEDs will blink Yellow Red Green Green when the linkage is brought into range. Refer to IOM for additional information.*

Position 100 percent Calibration Flag: During stroke calibration, the Logix 3400IQ digital positioner checks to see if the linkage is placing the stem position sensor in range. If the valve stroke causes stem position measurement to go out of range in the open position, a 'Position 100 percent Flag' will be generated. The valve stem will stop in the open position and the LEDs will blink Yellow Red Red Yellow. Linkage must be adjusted to bring the sensor in range. *Special LED indication: If the linkage is out of range, the LEDs can be used as an adjustment guide. The LEDs will blink Yellow Red Green Green when the linkage is brought into range.*

Position Span Flag: Position span is a check during stroke calibration to verify that the valve stem moved. The algorithm waits to see if no movement is detected when the valve is automatically stroked open. Anything that could prevent the valve from stroking will generate a position span error (no supply pressure, malfunctioning spool valve). When an error occurs the LEDs will blink Yellow, Red, Red, Red.

10 Troubleshooting

10.1 Introduction

About This Section
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 3400IQ 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 3400IQ digital positioner and block parameters can be accessed and evaluated using the NI-FBUS Configurator. Troubleshooting of some Logix 3400IQ 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** — Logix 3400IQ digital positioner continues to calculate PV output.
2. **Critical Failures** — Logix 3400IQ digital positioner drives PV output to fail-safe state.
3. **Configuration Errors** — Incorrect parameter values may cause the Logix 3400IQ 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 within 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.

Note: AG-181 can be a valuable tool in troubleshooting network problems.

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 following resource block parameters: • DEV_REV (contains the revision level of the resource block). • DD_REV (contains the revision level of the resource block).	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 OOSmode. (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.	If second element of BLOCK_TEST is not zero, write all zeroes to element.
	Check BLOCK_ERR for other errors.	See Sub-section 10.7 for details on BLOCK_ERR.
	If an error is present in BLOCK_ ERR, then read ERROR_DETAIL.	See Sub-section 10.7 for details on ERROR_DETAIL parameter.
		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.	If second element of BLOCK_TEST is not zero, write all zeroes to element.
	2. Read BLOCK_ERR.	See Sub-section 10.7 for details on 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.	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	1. Set to 1
	2. SHED_OPT	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. Read BLOCK_ERR.	If second element of BLOCK_TEST is not zero, write all zeroes to element. Download valid schedule to device. See Sub-section 11.7 for details on BLOCK_ERR.
PID block is not initialized.	Read parameters: BYPASS SHED_OP	The default values of these parameters are configuration errors and they must be set to a valid range. See Clearing Block Configuration Errors, Sub-section 11.9.
	Read parameters: IN.STATUS should be set to 'good' OUT.STATUS should be set to 'good'	

10.4 Device Diagnostics

Logix 3400IQ Digital Positioner Memory

The Logix 3400IQ 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.

Background Diagnostics Execution, BLOCK_TEST 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.
- If the first element value is not increasing, the block is not executing.

Table 10.5 BLOCK_ERR Parameter Bit Mapping

BLOCK_ERR Bit	Value or Message*	Description
0	Not used	Least Significant Bit (LSB)
1	Block configuration error	Invalid parameter value in block. See Clearing Block configuration Errors.
2	Not used	
3	Simulate parameter 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. See Sub-section 10.8 also.
4	Not used	
5	Not used	
6	Not used	
7	Input failure/process variable has BAD status	Internal failure
8	Not used	
9	Memory failure	Block database (DB) error or ROM failure (resource block only)
10	Lost static data	Block Non-Volatile (NV) memory failure Stack NV memory failure Link or Trend objects NV memory failure
11	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)
12	Read-back check failed (Checksum error)	Communication failure to serial EEPROM (Resource block only)
13	Not used	
14	Not used	
15	Out-Of-Service	Out-Of-Service — The block's actual mode is OOS Most Significant Bit (MSB)

** 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.*

ERROR_DETAIL Parameter

ERROR_DETAIL parameter in the resource block contains data that describes the cause of any device-critical error. This category of error will cause the resource block to remain in OOS actual mode regardless of its target mode. This in turn causes all other blocks to remain in OOS actual mode.

ERROR_DETAIL is an array of three unsigned integers, each 16 bits in size. The three sub-elements are generally defined as follows:

1. Error Type
2. Location
3. Sub-type

ERROR_DETAIL Enumeration

Table 10.6 lists the enumerated values for the error type element only. The location and sub-type elements have no significant meaning for users.

Table 10.6 ERROR_DETAIL Parameter Enumeration

ERROR_DETAIL	Message
0	No error
1	Control board ROM checksum
2	HC16 boot ROM checksum
3	HC16 application ROM checksum
4	Interprocessor error (startup)
5	Interprocessor error (operation)
6	EEPROM corrupt (background diagnostics)
7	EEPROM driver error
8	EEPROM - fieldbus write
9	Sensor error
10	Internal software error
11	Other

Using ERROR_DETAIL for Troubleshooting

If a critical error occurs in the resource block, the user should read and record the ERROR_DETAIL value. Then reset the device (write RESTART parameter Processor). Wait 30 seconds after reset and read ERROR_DETAIL again to check if error cleared.

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. 2. Sub-index of the parameter is read-only. Some parameters have fields that are not writable individually (such as MODE_BLK. ACTUAL).	1. None 2. None

	3. Write-locking is active. Resource block parameter WRITE_LOCK value is 2. 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. 5. Data written to the parameter is out of the valid range for that parameter. 6. Subindex used is invalid for that parameter	3. Remove write protect jumper (see Subsection 6.5) 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. Write valid range values to parameter. 6. Enter valid subindex for parameter.
Unable to change resource block to auto mode	1. The second element of BLOCK_TEST is not zero. 2. Resource block is in OOS mode. 3. The second element of BLOCK_TEST is non-zero. 4. A configuration error occurred in the block.	1. Write all zeroes to the second element of the BLOCK_TEST parameter. 2. Write auto mode to MODE_BLK. TARGET of the resource block. 3. Write all zeroes to the second element of the BLOCK_TEST parameter. 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). 2. Resource block is in OOS mode. 3. Block configuration error. 4. The second element of BLOCK_TEST is not zero.	1. Build and download an execution schedule for the block including links to and from AO block with other function blocks. 2. Write auto mode to MODE_BLK of resource block. 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. 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. 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). 3. The second element of BLOCK_TEST is not zero.	1. Disable simulation. See Sub-section 10.8 for procedure. 2. Build and download an execution schedule for the block including links to and from AO block with other function blocks. 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	0 to 100	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 (see Shed Options in the FF specs.)	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 (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.

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 3400IQ digital positioner

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

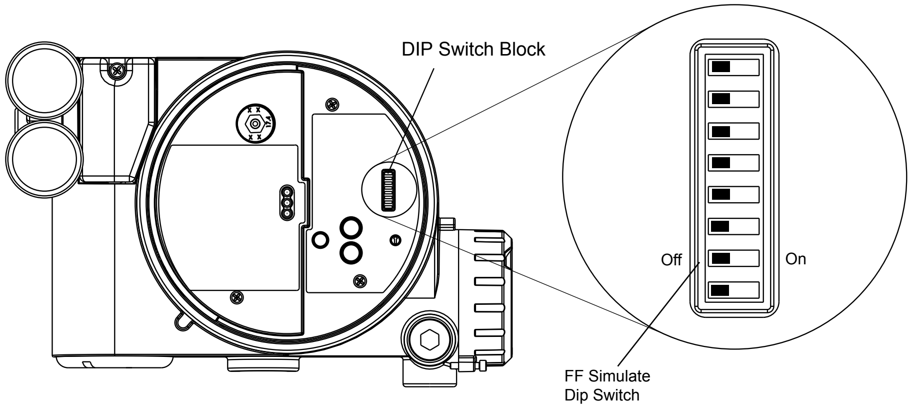
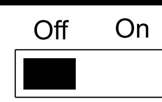
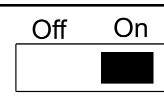


Figure 10.1 Simulation Dip Switch Location on the PCB Cover

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.	
Enable read only access to device's configuration. (Write-protect)	On position on the dip switch.*	

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 parameter 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 3400IQ 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 3400IQ 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 2. Termination may be incorrect. 3. Calibration is in process.	1. See Electrical Wiring Summary in Section 5.

Table 10.12 Symptom Chart

Failure or Problem	Probable Cause(s)	Refer to Section(s)
Valve moves in wrong direction with no change in input signal	1. May be tubed for wrong air action. 2. Spool stuck.	1. See Air Action in Section 6. 2. See Spool Valve instructions in Logix 3400IQ Digital Positioner IOM.
Unit does not respond to fieldbus command.	1. Unit is not configured correctly. 2. Error occurred during calibration.	1. See Theory of Operation on page 3. 2. See Calibration in Section 9.
Calibration		
LEDs blink YRYR or YRRY after a Re-Cal operation. Valve stays in fully open or closed position.	1. Configured for linear on a rotary mounting. 2. Feedback linkage out of range.	1. See Re-Cal button Section 9.
LEDs blink YRRR after a Re-Cal, or calibration operation.	1. Valve didn't fully stroke during calibration (low or no air supply). 2. Stuck Spool.	1. See Re-Cal button Section 9. 2. See Spool Valve instruction in Logix 3400IQ 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 2. Calibration required.	1. See MPC in Section 8.
Valve won't go below or above a certain limit.	1. Soft limits are not enabled 2. MPC is not enabled	1. See Advanced Features in Section 10.
Sticking or hunting operation of the positioner.	1. Contamination of spool valve assembly 2. P+I setting incorrect 3. Excessive Stiction	1. See Air Supply Requirements on page 15. See Spool Valve in Section 10. 2. See Setting P+I Parameters in Section 10. 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 3400IQ digital positioner will not communicate with fieldbus.	1. Power problem. 2. FB card connection.	1. See Wiring the Logix 3400IQ Digital Positioner to a Fieldbus Network on page 19. 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 2. Card not receiving enough power. (Laptop batteries possibly low) 3. Interference with I.S. barrier	1. See Wiring the Logix 3400IQ Digital Positioner to a Fieldbus Network on page 19. 2. Refer to AGA-181 for Network checkout procedure.
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 2. Sensor may be damaged 3. Low air supply pressure	1. See Hall sensor Alarm in Section 8. 3. Check air supply
Modulator current alarm occurs.	1. Modulator minimum pressure may be too low. 2. Clogged orifice 3. Bad cable connection	1. See Modulator current Alarm in Section 8.
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.	

Table 10.12 Symptom Chart

Failure or Problem	Probable Cause(s)	Refer to Section(s)
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 3400IQ 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 3400IQ 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 3400IQ 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. Setpoint 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 3400IQ refer to section 7.4 in the Logix 3400IQ 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

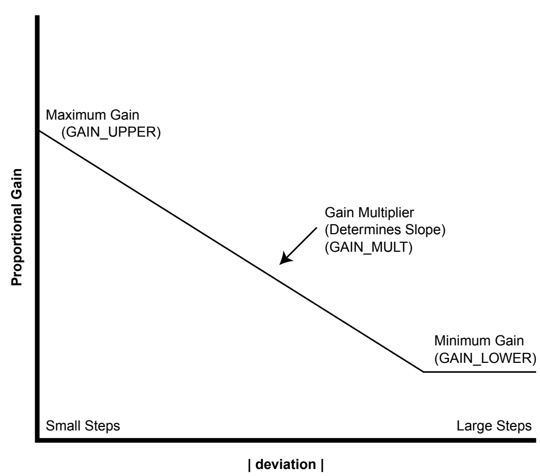


Figure 10.2 Gain Effect Diagram

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 3400IQ 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 3400IQ 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.
	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.
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 3400IQ Digital Positioner IOM under Driver Module Assembly for further instructions.

Advanced Features

Standard vs. Advanced Diagnostics:

Question: What is the difference between a model with standard diagnostics and a model with 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 3400IQ 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 3400IQ digital positioner uses one of the 21-point user defined curves.

Question: Does a default custom characterization curve exist?

Answer: Yes. The Logix 3400IQ 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 3400IQ Digital Positioner Characteristic Curves

FINAL_VALUE (%FS)	CMD_USED (%FS)		
	Quick Open	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.

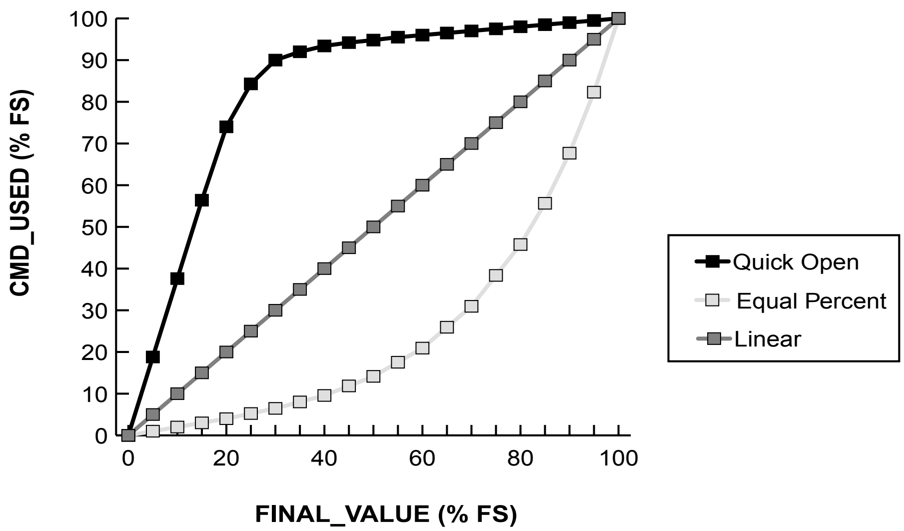


Figure 10.3 Logix 3400IQ Digital Positioner Characteristic Curves

10.11 Stroke Characterization

In addition to three pre-defined and embedded characterization curves, the Logix 3400IQ 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.

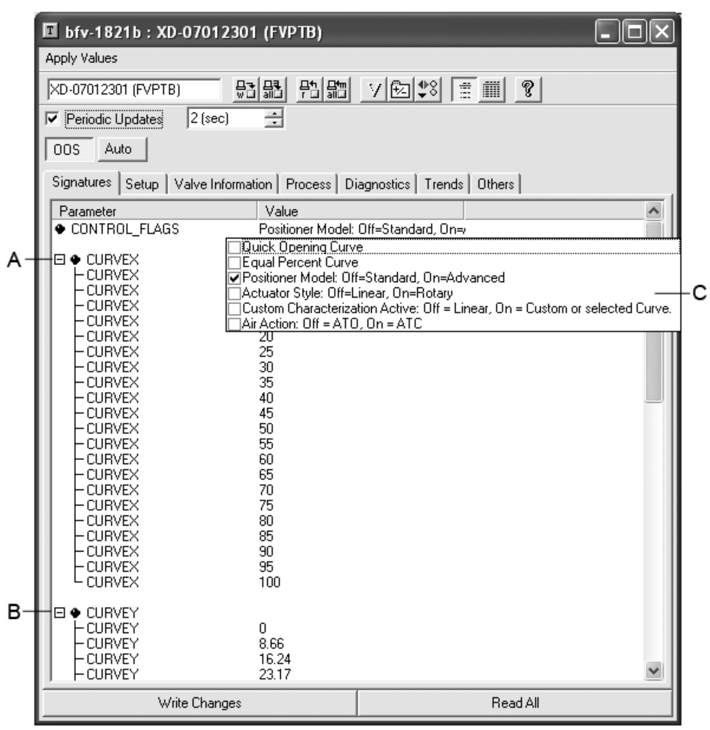
Table 10.15 Transducer Block Characterization Parameters

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 ActuatorStyle	
		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.



A = X-axis variables (21) B = Y-axis variables (21) C = Control Flags

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 'Quick Opening Curve', 'Equal Percent Curve', nor ' Custom Characterization Active' are selected in CONTROL_FLAGS.

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 3400IQ digital positioner.

6. Activate the custom curve by selecting 'Custom Characterization Active' in CONTROL_FLAGS. (NOTE: Make sure that neither 'Quick Opening Curve' nor 'Equal Percent Curve' has been selected, if you are using your own custom curve.)

7. Write the changes to the Logix 3400IQ digital positioner.

8. 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.

9. 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 3400IQ 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 3400IQ 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 operatingmode 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_FLAGS	Byte values which select which signature options are used	0 - VALVE INIT Initializes valve for signature capture. Read-only 1 - STEP_RAMP Selects which type of signature is desired. Select for ramp signature. 2 - SIG_COMPLETE Status byte set when the signature has been completed, Read-only 4 - PRESS_MEAS Selects if actuator pressure readings are desired as part of the signature. Select for readings 5 - BEGIN_SIG Set to initiate the signature routine.	Select the desired signature options and then make sure the signature parameters are set to the desired operation before beginning the signature.
SIG_START	Beginning position point (%) for signature -10% to 110% position range	Set higher than the stop position for a valve closing signature.	
SIG_STOP	Ending position point (%) for signature	-10% to 110% position range	Set lower than the starting position for a closing signature
RAMP_RATE*	Desired rate (% per Minute) for ramp	%/Min. Minimum value is 1.0	Typically this is set to 100. Very long times could result in completely filling the 10K RAM buffer. Can only be set when STEP_RAMP in SIG_FLAGS has been selected.
SAMPLE_ TIME	Data acquisition time between samples	Seconds. Range 0.1 to 2.55. Set to a valid value before running signature. Typically 0.1	Determines the number of data points stored in the signature.
STEP_TIME*	Delay time after step	Seconds. Range 0-650.0 Typically set to 0.1	Allows settling time to capture valve response to the step. Can only be set when STEP_RAMP in SIG_FLAGS is not selected.
SIG_INDEX	Pointer used for data transfer	Write the desired packet value.	Writing a value between 1 and the max number shown in SIG_COUNTER moves that packet of data into the SIG_DATA array for retrieval.
SIG_ COUNTER	Indicates number of data points collected	Increments by 1 as each data packet is collected	
SIG_DATA	Array for the storage and transfer of signature data		Order of data is: Command (%) Position (%) Port 2 pressure Port 1 pressure
STROKE_ TSTPSI	Supply pressure in PSI for stroke test	150 psi max.	

Table 10.16 Transducer Block Signature Parameters

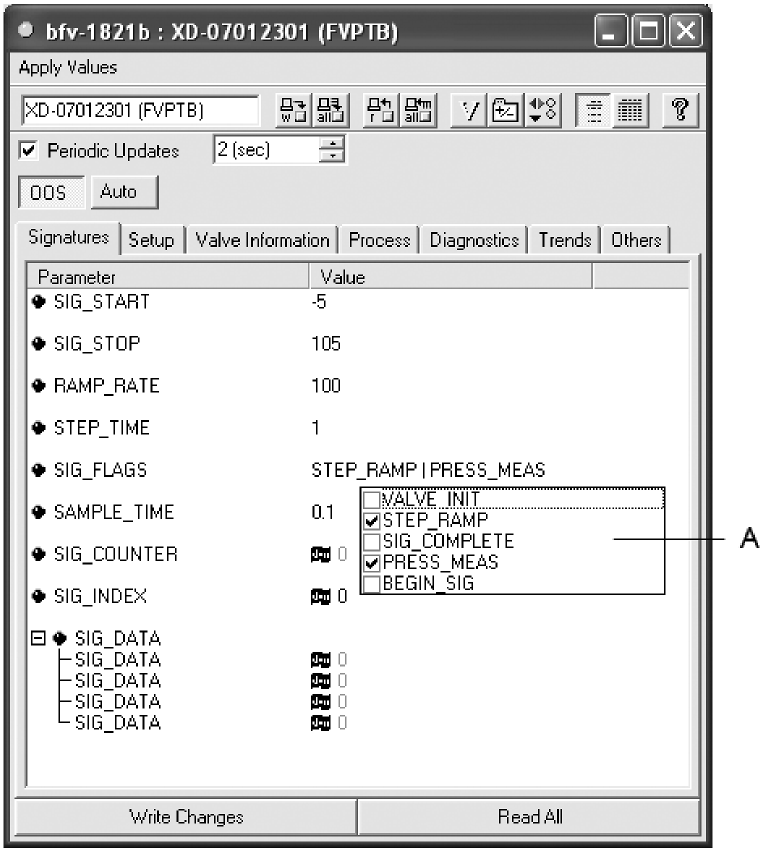
Parameter	Description	Value-Meaning	Comments
STROKE_ OPENTIM	Stroking time during opening	Seconds	Determined during the last stroke calibration where the Step Time Test option was ran
STROKE_ CLOSEDTIM	Stroking time during closing	Seconds	Determined during the last stroke calibration where the Step Time Test option was ran

*** Special Note:** *Because of the internal Database size limit of 10K within the Fieldbus device, the values for RAMP_RATE or STEP_TIME may be recalculated to the most reasonable value to allow using the database. The new value will appear in the parameter after the desired one is written. This is done to prevent accidental overflow of the database.*

It is still possible that the database may overflow, because of timing constraints. If this should happen, SIG_COMPLETE will not appear, but BEGIN_SIG will be turned off. BLOCK_TEST element 6 will be set to 10 (0x0a) as an error indication. Since this does not affect operation of the positioner itself, no actual error will be reported over Fieldbus.

10.14 Signature Procedure

The following steps are an example of how to initiate a **ramp signature** capture.



A. Signature Flags box

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 SAMPLE_TIME to desired value. (Typically 0.1)
7. In SIG_FLAGS, select; STEP_RAMP, PRESS_MEAS.
8. Write values to the Logix 1400 digital positioner.
9. Set RAMP_RATE to desired value. (Typically 100)
10. Write value to the Logix 1400 digital positioner.
11. In SIG_FLAGS, select BEGIN_SIG.
12. Write value to the Logix 1400 digital positioner.

13. 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. (Typically- approx. 670 data sets will be collected with the above settings and full stroke of the valve. Exact numbers will vary)

14. SIG_FLAGS indicates SIG COMPLETE.

15. Return the MODE_BLK to Auto

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

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.

11 Software Maintenance

11.1 Code Download

Code Download Utility
A code download may be recommended to upgrade the fieldbus firmware. A download utility program is used to perform the upgrade. A code download also updates other files necessary for proper operation; specifically, new versions of the Standard Dictionary and Device Description files are loaded on the host computer. These files are compatible with the new code.

A PC-based application is available to download new firmware into a Logix 3400IQ digital positioner. Refer to the documentation accompanying that application for instructions.

CAUTION A code download can be performed on an active live network. Prepare the control loop by blocking in the final control device to a safe state. The positioner will be off-line for about 30 minutes. Save the present configuration before downloading. When the download is complete, the positioner will revert to its default settings.

The Effects of a Code Download on a Device
The effects on a device (as a result of the download) are that all configuration data in the device, with the exception of calibration data, is cleared. This includes:

- Device and block tags
- Block parameters
- The function block schedule
- Link object, trend object, and VCR configurations
- The network schedule

This requires the user to reconfigure the block tags and the control system, and then download the configuration (FBAP file) to the device and other device on the network.

The device ID may appear differently on the network, due to differences between the new and older software versions. The device may appear as a new device since the NI configuration system uses the device ID as the key identification variable for a device. The Logix 3400IQ LEDs will blink RRRG during the code download because communications to the controller board is interrupted. This will return to normal blink when the process is completed.

Appendix A: Sample Configuration Record

Sample Device Configuration
The following pages provide a printout example of the Function Block Application portion of a Logix 3400IQ 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.

All parameters, including read-only parameters, are included for completeness.

Table 11.1 Logix 1400-011 : RS-011 (RB)

Configuration File Data	Comments
(1) ST_REV = 0x0000	Device tag : Block tag name Block tagname (Resource block) (index) Parameter mnemonic = value
(2) TAG_DESC =	
(3) STRATEGY = 0x0000	
(4) ALERT_KEY = 0x00	
(5) MODE_BLK = TARGET = Auto ACTUAL = Auto PERMITTED = Auto I OOS NORMAL = Auto	
(6) BLOCK_ERR = 0x0000	
(7) RS_STATE = Online	
(8) TEST_RW = VALUE_1 = FALSE VALUE_2 = 0x00 VALUE_3 = 0x0000 VALUE_4 = 0x00000000 VALUE_5 = 0x00 VALUE_6 = 0x0000 VALUE_7 = 0x00000000 VALUE_8 = 0 VALUE_9 = (NULL) VALUE_10 = (NULL) VALUE_11 = 01/01/00 00:00:00 (MM/DD/YY HH:MM:SS) VALUE_12 = 01/01/84 00:00:00 (MM/DD/YY HH:MM:SS) VALUE_13 = 0:00:00:00 (DD:HH:MM:SS) VALUE_14 = 0x0000 VALUE_15 = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS)	
(9) DD_RESOURCE = (NULL)	
(10) MANUFAC_ID = 0x00464c53	
(11) DEV_TYPE = 0x0202	
(12) DEV_REV = 0x06	
(13) DD_REV = 0x01	

Table 11.1 Logix 1400-011 : RS-011 (RB)

Configuration File Data	Comments
(14) GRANT_DENY = GRANT = 0x00 DENY = 0x00	
(15) HARD_TYPES = Scalar Input	
(16) RESTART = Run	
(17) FEATURES = Reports I Faultstate	
(18) FEATURE_SEL = 0x0000	
(19) CYCLE_TYPE = Scheduled	
(20) CYCLE_SEL = 0x0000	
(21) MIN_CYCLE_T = 0x00000fa0millisec	
(22) MEMORY_SIZE = 0x0000Kbytes	
(23) NV_CYCLE_T = 0x01b77400millisec	
(24) FREE_SPACE = 0%	
(25) FREE_TIME = 89.5693%	
(26) SHED_RCAS = 0x0009c400millisec	
(27) SHED_ROUT = 0x0009c400millisec	
(28) FAULT_STATE = Clear	
(29) SET_FSTATE = OFF	
(30) CLR_FSTATE = Off	
(31) MAX_NOTIFY = 0x08	
(32) LIM_NOTIFY = 0x08	
(33) CONFIRM_TIME = 0x0009c400millisec	
(34) WRITE_LOCK = Not Locked	
(35) UPDATE_EVT = UNACKNOWLEDGED = Un-initialized UPDATE_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) STATIC_REVISION = 0x0000 RELATIVE_INDEX = 0x0000	
(36) BLOCK_ALM = UNACKNOWLEDGED = Unacknowledged ALARM_STATE = Active-Not Reported TIME_STAMP = 10/07/98 11:46:49 (MM/DD/YY HH:MM:SS) SUB_CODE = OutOfService VALUE = 0x00	
(37) ALARM_SUM = CURRENT = Block Alarm UNACKNOWLEDGED = Block Alm Unack UNREPORTED = Block Alm Unrep DISABLED = 0x0000	
(38) ACK_OPTION = 0x0000	

Table 11.1 Logix 1400-011 : RS-011 (RB)

Configuration File Data	Comments
(40) WRITE_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = Discrete state 0	
(41) DL_CMD1 = 0x00	
(42) DL_CMD2 = 0x00	
(43) DL_APPSTATE = 0x0000	
(44) DL_SIZE = 0x000351b0	
(45) DL_CHECKSUM = 0xff6f	
(46) REVISION_ARRAY = REVISION_ARRAY = 0x0100 REVISION_ARRAY = 0x0100 REVISION_ARRAY = 0x0020	
(47) BLOCK_TEST = BLOCK_TEST = 0x37 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00	Constantly increases
(48) ERROR_DETAIL = ERROR_DETAIL = 0x0000 ERROR_DETAIL = 0x0000 ERROR_DETAIL = 0x0000	

Table 11.2 Logix 3400IQ-011 : XD-011 (FVPTB)

Configuration File Data	Comments
(1) ST_REV = 0x0000	Block tagname (Transducer Block) (index) parameter mnemanic = value
(2) TAG_DESC =	
(3) STRATEGY = 0x0000	
(4) ALERT_KEY = 0x00	
(5) MODE_BLK = TARGET = Auto ACTUAL = Auto PERMITTED = Auto I OOS NORMAL = Auto	
(6) BLOCK_ERR = 0x0000	

Table 11.2 Logix 3400IQ-011 : XD-011 (FVPTB)

Configuration File Data	Comments
(7) UPDATE_EVT = UNACKNOWLEDGED = Un-initialized UPDATE_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) STATIC_REVISION = 0x0000 RELATIVE_INDEX = 0x0000	
(8) BLOCK_ALM = UNACKNOWLEDGED = Unacknowledged ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = OutOfService VALUE = 0x00	
(9) TRANSDUCER_DIRECTORY = 0x0000	
(10) TRANSDUCER_TYPE = 0x0000	
(11) XD_ERROR = None	
(12) COLLECTION_DIRECTORY = 0x00000000	
(13) FINAL_VALUE = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(14) FINAL_VALUE_RANGE = EU_100 = 105 EU_0 = -5 UNITS_INDEX = % DECIMAL = 0x01	
(15) FINAL_VALUE_CUTOFF_HI = 105	
(16) FINAL_VALUE_CUTOFF_LO = 1	
(17) FINAL_POSITION_VALUE = STATUS = Good_NonCascade::NonSpecific:NotLimited VALUE = 83.07	
(18) SERVO_GAIN = 1	
(19) SERVO_RESET = 0	
(20) SERVO_RATE = 0	
(21) ACT_FAIL_ACTION = UNDEFINED	
(22) ACT_MAN_ID = 0x00000000	
(23) ACT_MODEL_NUM = (NULL)	
(24) ACT_SN = (NULL)	
(25) VALVE_MAN_ID = 0x00000000	
(26) VALVE_MODEL_NUM = (NULL)	
(27) VALVE_SN = (NULL)	
(28) VALVE_TYPE = UNDEFINED	
(29) XD_CAL_LOC =	
(30) XD_CAL_DATE = 01/01/00 00:00:00 (MM/DD/YY HH:MM:SS)	
(31) XD_CAL_WHO = (NULL)	
(32) DAC_PERCENT = 0	
(33) CONTROL_FLAGS = 0x6f	

Table 11.2 Logix 3400IQ-011 : XD-011 (FVPTB)

Configuration File Data	Comments
(34) GAIN_UPPER = 2	
(35) GAIN_LOWER = 1	
(36) GAIN_MULT = .05	
(37) IGAIN = 10	
(38) IL_OFFSET = 0.05	
(39) STATUS_FLAGS = 0x08	
(40) CMD_USED = 55	
(41) CALIBRATE = 0x00	
(42) DAC_VALUE = 0x0000	
(43) PRESS_CAL = 0.62	
(44) CALIBRATE_FLAGS = 0x00	
(45) SOFTSTOP_HIGH = 110	
(46) SOFTSTOP_LOW = -10	
(47) CYCLE_COUNTER = 0x00000006	
(48) CYCLE_DEADBAND = 20	
(50) TRAVEL_ENG = 4.9729	
(51) TRAVEL_DEADBAND = 20	
(52) TRAVEL_ALERT = 2e+006	
(53) STROKE_ENG = 1	
(54) TRAVEL_UNITS = 0x2f	
(55) FUTUREXD1 = 0x0000	
(56) FUTUREXD2 = 0x0000	
(57) TRAVEL_FLAGS = 0x00	
(58) TEMPERATURE = 0x9200	
(59) TOP_PRESSURE = 45	
Table 11.2 Logix 1400-011 : XD-011 (FVPTB) (4 of 5)	
Configuration File Data	Comments
(60) BOTTOM_PRESSURE = 0.01	
(61) SUPPLY_PRESSURE = 65	
(62) VOLTAGE_REFERENCE = 0.032	
(63) HALL_SENSOR = 0	
(64) DAC_CHECK = 0	
(65) MOD_CURRENT = 0	
(66) IL_CHK = 0x0000	
(67) INTERNAL_FLAGS = 0x00	
(68) PRESS_FLAGS = 0x00	
(69) PRESS_UNITS = psi	
(70) TEMP_UNITS = Degrees Celsius	
(71) ELECTRONICS_SN = (NULL)	
(72) SOFTWARE_VER = 0x20F4	
(73) FUTUREXD3 = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = Discrete state 0	
(74) FUTUREXD4 = 0x00000000	

Table 11.2 Logix 3400IQ-011 : XD-011 (FVPTB)

Configuration File Data	Comments
(75) SPI_TEST_RCV = SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00	
(76) SPI_TEST_TX = SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00	
(77) BLOCK_TEST = BLOCK_TEST = 0x34 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00	Constantly increases

Table 11.3 Logix 3400IQ-011 : AO-011 (AO)

Configuration File Data	Comments
(1) ST_REV = 0x0002	Block tagname (Analog output) (index) parameter mnemonic = value
(2) TAG_DESC =	
(3) STRATEGY = 0x0000	
(4) ALERT_KEY = 0x00	
(5) MODE_BLK = TARGET = Auto ACTUAL = Auto PERMITTED = RCas I Cas I Auto I Man I OOS NORMAL = Auto	
(6) BLOCK_ERR = 0x0000	
(7) PV = STATUS = Good_NonCascade::UnacknowledgedBlockAlarm: NotLimited VALUE = 82.78	
(8) SP = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 83.04	
(9) OUT = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(10) SIMULATE = SIMULATE_STATUS = Bad::NonSpecific:NotLimited SIMULATE_VALUE = 0 TRANSDUCER_STATUS = Good_Cascade::NonSpecific: NotLimited TRANSDUCER_VALUE = 0 ENABLE_DISABLE = Un-initialized	
(11) PV_SCALE = EU_100 = 100 EU_0 = 0 UNITS_INDEX = 0x0000 DECIMAL = 0x00	
(12) XD_SCALE = EU_0 = 0 UNITS_INDEX = 0x0000 DECIMAL = 0x00	
(13) GRANT_DENY = GRANT = 0x00 DENY = 0x00	
(14) IO_OPTS = 0x0000	
(15) STATUS_OPTS = 0x0000	
(16) READBACK = STATUS = Good_NonCascade::NonSpecific:NotLimited VALUE = 82.78	

Table 11.3 Logix 3400IQ-011 : AO-011 (AO)

Configuration File Data	Comments
(17) CAS_IN = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(18) SP_RATE_DN = 1.#INFPV/Sec	
(19) SP_RATE_UP = 1.#INFPV/Sec	
(20) SP_HI_LIM = 100	
(21) SP_LO_LIN = 0	
(22) CHANNEL = 0x0001	
(23) FSTATE_TIME = 0Sec	
(24) FSTATE_VAL = 0	
(25) BKCAL_OUT = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(26) RCAS_IN = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0 Initialized value = Un-initialized, must be set to valid value	
(27) SHED_OPT = NormalShed_NormalReturn	
(28) RCAS_OUT = STATUS = Good_Cascade::NotInvited:NotLimited VALUE = 83.04	
(29) UPDATE_EVT = UNACKNOWLEDGED = Unacknowledged UPDATE_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) STATIC_REVISION = 0x0002 RELATIVE_INDEX = 0x001b	
(30) BLOCK_ALM = UNACKNOWLEDGED = Unacknowledged ALARM_STATE = Active-Not Reported TIME_STAMP = 10/07/98 11:53:59 (MM/DD/YY HH:MM:SS) SUB_CODE = OutOfService VALUE = 0x00	
(31) WSP = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 83.04	
(32) BLOCK_TEST = BLOCK_TEST = 0xb9 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x0f BLOCK_TEST = 0xc4	Constantly increases

Table 11.4 Logix 3400IQ-011 : PID-011 (PID)

Configuration File Data	Comments
(1) ST_REV = 0x0002	Block tagname (PID Control Block) (index) Paramter mnemonic = value
(2) TAG_DESC =	
(3) STRATEGY = 0x0000	
(4) ALERT_KEY = 0x00	
(5) MODE_BLK = TARGET = Auto ACTUAL = Auto PERMITTED = ROut I RCas I Cas I Auto I Man I OOS NORMAL = Auto	
(6) BLOCK_ERR = 0x0000	
(7) PV = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(8) SP = STATUS = Good_Cascade::NonSpecific:LowLimited VALUE = 0	
(9) OUT = STATUS = Good_Cascade::NonSpecific:NonLimited VALUE = 0	
(10) PV_SCALE = EU_100 = 100 EU_0 = 0 UNITS_INDEX = 0x0000 DECIMAL = 0x00	
(11) OUT_SCALE = EU_100 = 100 EU_0 = 0 UNITS_INDEX = 0x0000 DECIMAL = 0x00	
(12) GRANT_DENY = GRANT = 0x00 DENY = 0x00	
(13) CONTROL_OPTS = 0x0000	
(14) STATUS_OPTS = 0x0000	
(15) IN = STATUS = Good_NonCascade::NonSpecific:NotLimited VALUE = 0	
(16) PV_FTIME = 0Sec	
(17) BYPASS = Off Initialized value = uninitialized, must be set to valid value	
(18) CAS_IN = STATUS = Good_NonCascade::NonSpecific:NotLimited VALUE = 0	
(19) SP_RATE_DN = 1.#INFPV/Sec	
(20) SP_RATE_UP = 1.#INFPV/Sec	

Table 11.4 Logix 3400IQ-011 : PID-011 (PID)

Configuration File Data	Comments
(21) SP_HI_LIM = 100	
(22) SP_LO_LIM = 0	
(23) GAIN = 0	
(24) RESET = 5Sec	
(25) BAL_TIME = 0Sec	
(26) RATE = 0Sec	
(27) BKCAL_IN = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(28) OUT_HI_LIM = 100	
(29) OUT_LO_LIM = 0	
(30) BKCAL_HYS = 0.5%	
(31) BKCAL_OUT = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(32) RCAS_IN = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(33) ROUT_IN = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(34) SHED_OPT = NormalShed_NormalReturn Initialized value = uninitialized, must be set to a valid value	
(35) RCAS_OUT = STATUS = Good_Cascade::NotInvited:Constant VALUE = 0	
(36) ROUT_OUT = STATUS = Good_Cascade::NotInvited:LowLimited VALUE = 0	
(37) TRK_SCALE = EU_100 = 100 EU_0 = 0 UNITS_INDEX = 0X0000 DECIMAL = 0X00	
(38) TRK_IN_D = STATUS = Bad::OutOfService:NotLimited VALUE = Discrete State 0	
(39) TRK_VAL = STATUS = Bad::OutOfService:NotLimited VALUE = 0	
(40) FF_VAL = STATUS = Bad::OutOfService:NotLimited VALUE = 0	

Table 11.4 Logix 3400IQ-011 : PID-011 (PID)

Configuration File Data	Comments
(41) FF_SCALE = EU_100 = 100 EU_0 = 0 UNITS_INDEX = 0x0000 DECIMAL = 0x00	
(42) FF_GAIN = 0	
(43) UPDATE_EVT = UNACKNOWLEDGED = Unacknowledged UPDATE_STATE = Active-Not Reported TIME_STAMP = 10/07/98 11:53:12 (MM/DD/YY HH:MM:SS) STATIC_REVISION = 0x0002 RELATIVE_INDEX = 0x0022	
(44) BLOCK_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 10/07/98 11:53:12 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = 0x00	
(45) ALARM_SUM = CURRENT = 0x0000 UNACKNOWLEDGED = 0x0000 UNREPORTED = 0x0000 DISABLED = 0x0000	
(46) ACK_OPTION = 0x0000	
(47) ALARM_HYS = 0.5%	
(48) HI_HI_PRI = 0x00	
(49) HI_HI_LIM = 1.#INF	
(50) HI_PRI = 0x00	
(51) HI_LIM = 1.#INF	
(52) LO_PRI = 0x00	
(53) LO_LIM = 1.#INF	
(54) LO_LO_PRI = 0x00	
(55) LO_LO_LIM = -1.#INF	
(56) DV_HI_PRI = 0x00	
(57) DV_HI_LIM = 1.#INF	
(58) DV_LO_PRI = 0x00	
(59) DV_LO_LIM = -1.#INF	
(60) HI_HI_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = 0	

Table 11.4 Logix 3400IQ-011 : PID-011 (PID)

Configuration File Data	Comments
(61) HI_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = 0	
(62) LO_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = 0	
(63) LO_LO_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = 0	
(64) DV_HI_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = 0	
(65) DV_LO_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = 0	
(66) PID_FORM = IDEAL PID	
(67) ALGO_TYPE = PID Type A	
(68) OUT_LAG = 0	
(69) GAIN_NLIN = 0	
(70) GAIN_COMP = 0	
(71) ERROR_ABS = 0	
(72) WSP = STATUS = Good_Cascade::NonSpecific:LowLimited VALUE = 0	
(73) FUTURE1 = 0	

Table 11.4 Logix 3400IQ-011 : PID-011 (PID)

Configuration File Data	Comments
(74) BLOCK_TEST = BLOCK_TEST = 0x3d BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x0b BLOCK_TEST = 0xd1	Constantly increases

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.

Example: A valve has a 2-inch stroke and a 12-bit A/D is used to measure position.
Resolution = Stroke/(maximum integer for 12-bit) = 2 inch/4096= 0.000488 inches

Sampling: Taking readings at periodic time intervals.

Serial Transmission: Serial transmission is a method of sending information from one device to another. One bit is sent after another in a single stream.

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