

YVP Management software

ValveNavi

IM 21B04C50-01E 5th Edition

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1. INTRODUCTION

This User's Manual gives instructions on handling of YVP Management Software "ValveNavi" (Model: YVP20S).

This software is to be used to setup the YVP110 advanced valve positioner; therefore, it is indispensable for users to read, understand and follow the instructions on the YVP110 user's manual (IM 21B04C01-01E) BEFORE actually starting the operation.

It is also highly recommended to become well-informed about Foundation Fieldbus Communication by reading the materials as follows.

Referential materials issued by Yokogawa Electric Corp.

TI 38K02A01-01E Fieldbus Book - A Tutorial

TI 38K03A01-01E Fieldbus Technical Information

For the continuous usage of the software, the registration is required. Please read the corresponding part in this manual and complete the necessary procedures.

1.1 About This Manual

- This manual should be delivered to the end user.
- The information contained in this manual is subject to change without prior notice.
- The information contained in this manual, in whole or part, shall not be transcribed or copied without YOKOGAWA's written permission.
- In no case does this manual guarantee the merchantability of the positioner or the software or its adaptability to a specific client needs.
- Should any doubt or error be found in this manual, submit inquiries to your local dealer.
- Changes to specifications, structure, and components used may not lead to the revision of this manual unless such changes affect the function and performance of the products.

1.2 Software License Agreement

Following is the software License Agreement which should be agreed by users before start using the software. The agreement will be shown when you install the software.

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1.3 About This Software

This software is intended for use only with Yokogawa YVP positioners. The positioners are intended for use with industrial compressed air systems only. Ensure that an adequate pressure relief provision is installed if application of system supply pressure could cause downstream equipment to malfunction. Installation should be in accordance with local and national compressed air and instrumentation codes.

Positioners certified for use in explosionproof/flameproof or intrinsically safe installations MUST:

- a) Be installed in accordance with local and national codes for hazardous area installations;
- b) Be maintained only by qualified personnel with adequate training on hazardous area instrumentation; and
- c) Be maintained only by qualified personnel with adequate training in the use of Foundation fieldbus.

This software is not intended for use in life support systems. This software is not intended for use in safety shutdown systems. Substitution of positioner parts and components may lead to unsafe operation or compromise performance.

Items sold by Yokogawa Electric Corp. are warranted to be free from defects in materials and workmanship for a period of one year from the date of shipment, provided said items are used according to Yokogawa's recommended usages.

Yokogawa reserves the right to discontinue manufacture of any product or change product materials, design, or specifications without notice.

1.4 Important Safety Warnings

These instructions contain WARNING, CAUTION, IMPORTANT, and NOTE where necessary to alert you to safety related or other important information. Please read these instructions carefully BEFORE this instrument is installed or maintained.

Although WARNING hazards is related to personal injury, and the CAUTION hazards involve equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance which may lead to personal injury or death. Therefore, comply fully with all WARNING, CAUTION, and IMPORTANT notices.



WARNING

indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



CAUTION

indicates a potentially hazardous situation which, if not avoided, could result in injury or damage to the instrument.

**IMPORTANT**

indicates a potentially hazardous situation which, if not avoided, may result in damage to the instrument or a system failure.

**NOTE**

Indicates important facts and conditions.

1.5 Trademarks, Copyrights, and Patents

YOKOGAWA and YVP are registered trademarks of Yokogawa Electric Corporation. HART is a registered trademark of the HART Communications Foundation. Pentium is a trademark of Intel Corporation. Internet Explorer and Windows are trademarks of Microsoft Corporation. FOUNDATION is a trademark of the Fieldbus Foundation, Inc. NI-FBUS is a trademark of National Instruments, Inc. Netscape and Navigator are trademarks of Netscape Communications Corporation. Masoneilan is a trademark of Dresser, Inc. Other company names and product names used in this manual are the registered trademarks or trademarks of their respective owners.

2. INTRODUCTION TO ValveNavi

2.1 What is ValveNavi?

ValveNavi is a Windows software tool that makes it easy to configure, calibrate, and operate Foundation fieldbus pneumatic control valve positioners YVP110 with internal process control and limit switches. It fully supports the Foundation fieldbus specifications.

2.2 ValveNavi Specifications

Table 2.1 ValveNavi Specifications

Product name	YVP Management Software (R2.3)
Compatible OS	Windows 2000 service pack 4, XP service pack 2, or Vista service pack 1
Interface Cards supported	National Instruments AT-FBUS, PCI-FBUS, or PCMCIA-FBUS Interface card
Application Interface Software	NI-FBUS Communication Manager V. 3.0 or later For Vista V. 3.2.1 or later
Connection	Direct connected to segment.
Positioners supported	Model YVP110-F
Blocks supported	Resource Block (RB) Transducer Block (TB) with Device Description AO, DI, OS PID (optional)
Companion Device	Model YVP110-F
Online Help	HTML help files viewed with browser
Configuration capability	Device tag, node address, block tag, Transducer Block (TB) parameters
Query capability	All block parameters
Trending	A polling method

T001.eps

2.3 Combination of ValveNavi & YVP

The table in below shows the limitation of the functions according to the combination between each revision of YVP110 and ValveNavi.

Table 2.2 Supported Functions by Release Number

	Dev Rev	R1	R2.1	R2.2	R2.3
Without software download functions	2	✓	✓	✓	✓
	3	*1	✓	✓	✓
	4	*2	*2	*2	✓
With software download functions	1	N/A	✓	✓	✓
	2	N/A	*2	*2	✓

✓: Applicable

*1: Not applicable to link master and signature functions

*2: Not applicable to double acting actuator

N/A: Not applicable

T002.eps

2.4 What is FOUNDATION® Fieldbus?

The Fieldbus Foundation summarizes the technology:

FOUNDATION fieldbus is an all-digital, serial, two-way communications system that serves as a Local Area Network (LAN) for factory/plant instrumentation and control devices. The fieldbus environment is the base level group of the digital networks in the hierarchy of plant networks. FOUNDATION fieldbus is used in both process and manufacturing automation applications.

Unlike proprietary network protocols, FOUNDATION fieldbus is neither owned by any individual company, or regulated by a single nation or standards body. The technology is controlled by the Fieldbus Foundation, a not-for-profit organization consisting of more than 100 of the world's leading controls and instrumentation suppliers and end users.

While FOUNDATION fieldbus retains many of the desirable features of the 4-20 mA analog system, such as a standardized physical interface, bus-powered devices, and intrinsic safety options, it offers a host of additional benefits to users.

● Device Interoperability

With interoperability, one fieldbus device can be replaced by a similar device with added functionality from a different supplier on the same fieldbus network while maintaining specified operations. This permits users to “mix and match” field devices and host systems from various suppliers. Individual fieldbus devices can also transmit and receive multivariable information, and communicate directly with each other over a common fieldbus.

● Enhanced Process Data

With FOUNDATION fieldbus, multiple variables from each device can be brought into the plant control system for archival, trend analysis, process optimization studies, and report generation. This access to accurate, high resolution data enables processes to be fine-tuned for better manufacturing throughout and reduced plant downtime. These efficiencies add up to higher plant performance and profitability.

● Expanded View of the Process

Modern fieldbus devices, with powerful, microprocessor-based communications capabilities, permit process errors to be recognized faster, and with greater certainty. As a result, plant operators are notified of abnormal conditions or the need for preventive maintenance, and can make better production decisions. Problems that detract from operating efficiency are more quickly corrected, enabling yields to go up while raw material costs and regulatory problems decrease.

● Improved Plant Safety

Fieldbus technology will help manufacturing plants keep up with increasingly stringent safety requirements. By providing operators with earlier notification and warning of pending and current hazardous conditions, fieldbus allows for corrective action before an unplanned shutdown. Enhanced plant diagnostic capabilities also reduce the need for frequent access to hazardous areas, thus minimizing the risks to field personnel.

● Easier Predictive Maintenance

Enhanced device diagnostics capabilities make it possible to monitor and record such conditions as valve wear and transmitter fouling. Plant personnel are able to perform predictive maintenance without waiting for a scheduled shutdown, thus avoiding or reducing downtime.

● Reduced Wiring and Installation Costs

FOUNDATION fieldbus' use of existing wiring and multi-drop connections provides significant savings in network installation costs. This includes reductions in intrinsic safety barrier termination and cable costs, particularly in areas where wiring is already in place. Additional cost savings can be achieved through the decreased time required for construction and start-up, as well as simplified programming of control and logic functions using software control

2.4.1 Guide to a successful Foundation fieldbus installation

There are many levels of skills required for a successful Foundation fieldbus installation. It is beyond the scope of the ValveNavi software user's manual to cover all phases of fieldbus design and installation. Prior to using the ValveNavi software the fieldbus segment must be running properly, without wiring, installation, power supply, or configuration irregularities. The YVP positioner must be mounted on a control valve. Numerous resources are available to cover each of these installation issues.

3. INSTALLATION OF HARDWARE AND SOFTWARE

3.1 What you need to get started with ValveNavi

To begin using ValveNavi the following tools and software are needed.

- ValveNavi software on its installation CD-ROM
- A PC running Windows 2000 service pack 4 , XP service pack 2, or Vista service pack 1
- National Instruments AT-FBUS, PCI-FBUS or PCMCIA-FBUS interface card and NI-FBUS software V. 3.0 or later, for Vista V. 3.2.1 or later
- Instruction manuals for the NI-FBUS interface card and software
- The Model YVP110 positioner installed on a valve
- The Model YVP110 User's Manual
- A Foundation fieldbus power supply and power conditioner with terminators
- Additional fieldbus devices that will be installed on the bus segment (optional)

Before we can describe installation of ValveNavi software we must first describe the process for installing the Foundation fieldbus communications hardware and software. To help to reduce the need for terminology that used in digital communications, we will refer to an example reference process and Foundation fieldbus segment.

3.2 Reference Model Process

Throughout this manual we will use a simplified Fieldbus Reference Model Process. This is an example of a simple process (It is not a practical process) that illustrates many elements of Foundation fieldbus that are required in a successful installation.

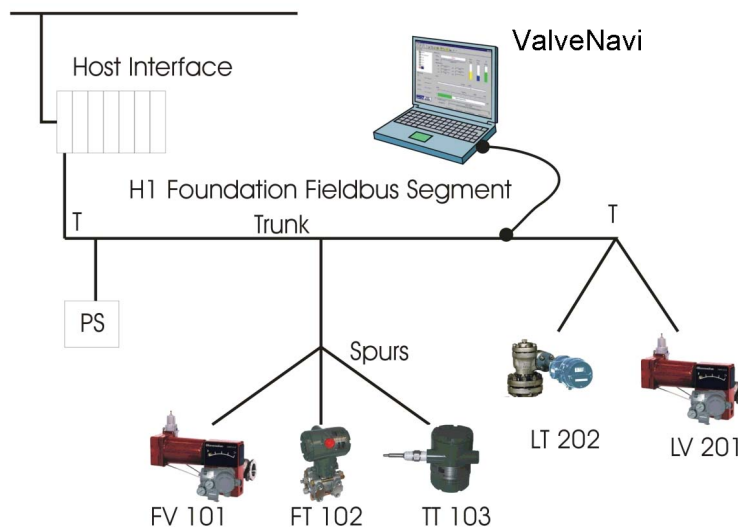


Figure 3.1 ValveNavi Reference Model Fieldbus Segment

This User's manual is intended to instruct the use of the ValveNavi software with a Yokogawa YVP valve positioner. ValveNavi may be used offline but is normally connected to a YVP positioner. Prior to using ValveNavi:

- The positioner must be correctly installed on a valve and connected to an air supply. See the YVP110 User's Manual(IM 21B04C01-01E).
- The PC running ValveNavi must have a National Instrument AT-FBUS, PCI-FBUS or PCMCIA-FBUS interface card installed and configured in the Windows registry. Carefully follow the installation instructions provided with the interface card.



WARNING

Improper setup can interfere with process control.

- NI-FBUS communications manager software must be setup and running.
- The positioner must be assigned a fieldbus node address and a device tag. It is recommended that this be performed while the device is connected as a single device to a test segment, not while connected to an operating control segment. This will require a different configuration of the interface card.
- The entire fieldbus segment must be configured, with all required function blocks soft-wired and scheduled.

Wiring practices for Foundation fieldbus differs significantly from 4 to 20 mA instrument wiring. Please Refer to the Foundation Fieldbus Application Guide 31.25 kbits/s Wiring and Installation, AG-140 Revision 1.0 or later. However, a few remarks regarding wiring of the devices are included here. The positioner must be installed properly on a segment before the ValveNavi software can be used.

3.2.1 Wiring requirements

Note that there are cable requirements that must be met for reliable installations. The cable used must support the digital data signals without reflections, noise or attenuation. The type A cable should be used whenever possible and especially for long transmission distances or for segments with many branches (spurs).

● Power conditioner

Use a power conditioner for each segment. The conditioner must be foundation fieldbus compliant. The power conditioner functions to isolate the digital signals from the power source.

● Power supply

The YVP positioner complies with the foundation specification voltage requirements of 9 to 32 volts. The power supply must conform to these requirements with consideration for the current drawn by all devices powered by the segment. The YVP maximum current consumption is 17 mA.

● Terminator

Every fieldbus segment requires two (and only two) approved terminators. Terminators are passive circuits that damp signal reflections in the circuit. For simple segments having short runs and few spurs, the terminator location can be at each end of the longest cable. For very short cables both terminators can even be located in the power conditioner.

3.3 Installing NI-FBUS

ValveNavi software interfaces to the fieldbus segment through an interface card that must be installed in the PC running ValveNavi. The card is supplied with NI-FBUS installation software. ValveNavi is designed to operate only with National Instruments NI-FBUS cards, which are AT-FBUS, PCI-FBUS, or PCMCIA-FBUS.

Prior to using ValveNavi, install the NI-FBUS card and its software in accordance with the instructions provided by National Instruments, Inc. Note that the instructions are different for the AT card used in a desktop and the PCMCIA card normally used with a laptop. Furthermore, the instructions are different for Windows 2000, for Windows XP, and Windows Vista.

Note that there are two NI configuration tools that serve separate purposes:

- NI-FBUS Interface Configuration Utility- This is used to install and set up interface boards. It provides access to IRQ and memory settings needed for Windows. It provides tools for importing DD's. It is described in the Getting Started manual supplied with the NI-FBUS interface card.
- NI-FBUS Fieldbus Configuration System- This is the tool for configuring the Foundation fieldbus network, including the devices, setting up the control strategy, and schedule. It is described in the NI-FBUS Configurator User Manual installed in the program online help. After opening the NI-FBUS Fieldbus Configuration System, click Help>>Online Help to open the manual in PDF format.



WARNING

Do not configure the interface as a Link Master when connecting to the segment with an existing host. Disruption of control may result.

3.3.1 Configure the NI-FBUS interface card safely for different tasks

The configuration of a portable PC for use with ValveNavi will vary depending on the immediate task. If ValveNavi will be used to maintain or configure a valve on an existing Foundation fieldbus segment, the PC running ValveNavi must be configured carefully so it does not interfere with control communication. Two configurations are described in the following sections.

Table 3.1 Two configurations of the NI-FBUS Interface Card

To configure a positioner in the Foundation fieldbus segment with a host computer.	The NI-FBUS Interface card must be configured as a BASIC DEVICE at a <u>Visitor</u> address.
To configure a positioner in the segment without other host (Initial Setup, for example).	The NI-FBUS Interface card must be configured as a LINK MASTER DEVICE at a <u>FIXED</u> address (0×10 is recommended).

T0301.EPS



NOTE

A Visitor device will not start until connected to a running segment with an active LAS that can assign a node address to the visitor.

● Configuring the interface card to safely connect to the Foundation fieldbus segment with a host computer

If the YVP positioner is connected on a segment that has a host computer, the interface card and PC must be configured as a BASIC DEVICE at a Visitor address. Open the configuration utility (NI-FBUS Interface Configuration Utility) and follow the instructions in the NI manual.

Select Port and click Edit to bring up the Port dialog shown in Figure 3.2. Set the parameters exactly as shown in the figure, and click OK. (The Device Tag can be set to any name that will be meaningful when seen by a remote interface operating on the same segment.)



WARNING

ValveNavi is the tool for setup and maintenance. Do not connect it to the operating process. That may change the mode of YVP and cause unpredictable stop or events on the process. Use it only when the process is OFFLINE.

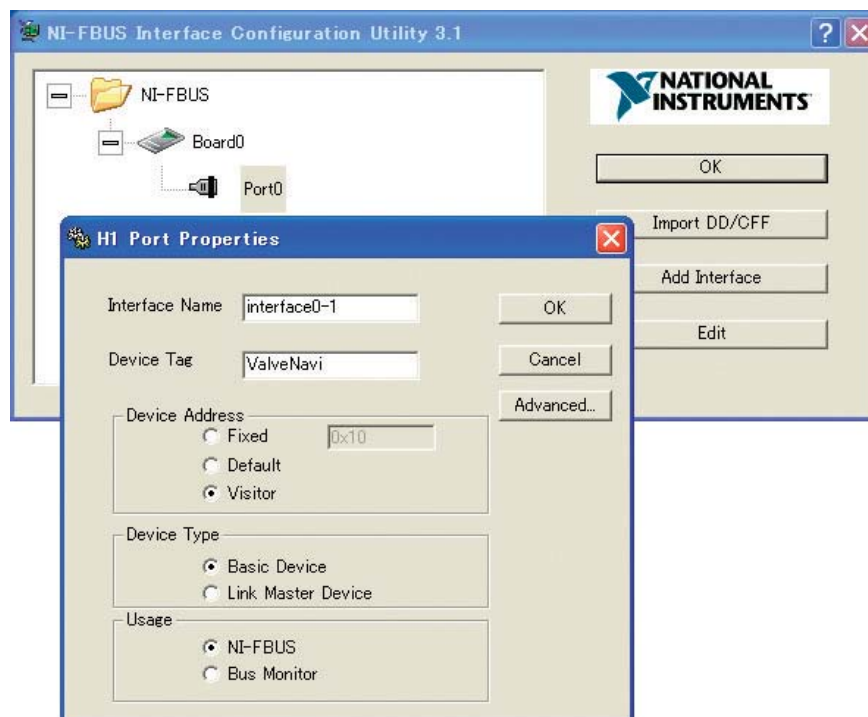


Figure 3.2 NI-FBUS Interface configuration utility setting the card as a Basic Device

● Configure the interface card for one to one Communication

The visitor configuration described previously will not work if the only devices that are connected to the segment are YVP positioner and the NI-FBUS interface card, because there will be no link master to schedule messages. It is necessary, therefore, to configure the interface card as a link master, exactly as shown in Figure 3.3. (The interface name and Device Tag may be any convenient names. The names will not be seen by any other interfaces and are not important.)

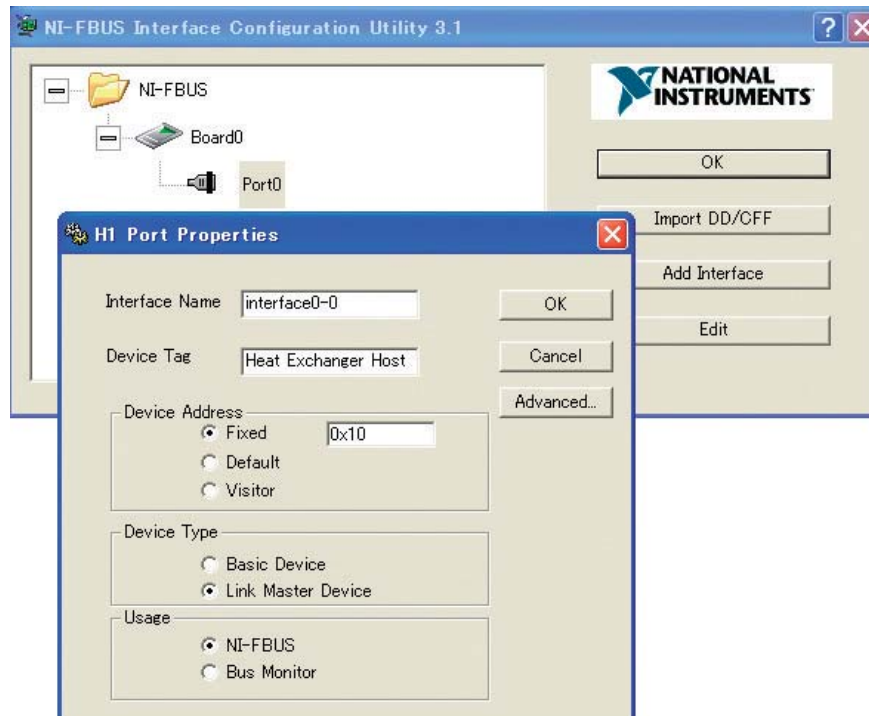


Figure 3.3 Configure the interface as Link Master

3.3.2 Installing the Device Descriptions (DD) with NI-FBUS Interface Configuration Utility

The NI-FBUS Interface Configuration Utility must be used to install the DD for the YVP, and also to install the standard dictionary. If you do not have the DD file, you can download it from our web site. Visit the following web site or contact our subsidiaries.

<http://www.yokogawa.com/fld>

Step 1 Click [Import DD/CFF] and in the new dialog click [Browse]. Select the desired .ffo file or .cff file and click [Open]. In the import DD dialog click [OK]

Step 2 Repeat for each device that will communicate with ValveNavi.

3.3.3 Location of DD files and .DCT file

After the DDs have been successfully installed, they will appear in the installation subdirectory of NI-FBUS. The form of the directory tree will be as shown in Table 3.2.

Table 3.2 NI-FBUS Installation Subdirectory Structure

NIFBUS (or other install directory name)
Data
594543 (YOKOGAWA's ID)
0001 (for YVP110 without software download function)
02nn.ffo*
02nn.sym
03nn.ffo
03nn.sym
04nn.ffo
04nn.sym
0007 (for YVP110 with software download function)
01nn.ffo*
01nn.sym
02nn.ffo
02nn.sym
03nn.ffo
03nn.sym
XXXX (Other device type)

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Note: 'nn' stands for two-digit value. The number may be changed by revision up.

4. ValveNavi ADMINISTRATION

In the previous chapter, we described the installation of the Foundation fieldbus communications software and hardware. In this chapter, we will describe the procedures for installing ValveNavi software.

The ValveNavi installation procedures outlined in this chapter assume a working knowledge of Microsoft Windows, the Yokogawa YVP positioner, and of Foundation fieldbus communications and function block technology. For further information about the YVP positioner, see YVP110 User's Manual (IM 21B04C01-01E).

4.1 Hardware and Software Requirements

ValveNavi runs on a standard IBM-compatible computer. To successfully install and run ValveNavi, the computer system must meet minimum hardware and software requirements. The following lists the minimum hardware and software requirements:

- Windows 2000 service pack 4, XP service pack 2, or Vista service pack 1 operating system
- Pentium 166 MHz microprocessor or faster
- CD-ROM drive
- National Instruments NI-FBUS interface card and server software
- 500 MB of free hard disk space to install and run ValveNavi

4.2 Installing ValveNavi

ValveNavi is distributed on a CD-ROM for Windows 2000, Windows XP, or Windows Vista.

1. Insert the ValveNavi installation CD-ROM into the CD-ROM drive.
2. Click Start > Run, then type x:setup (x is the letter of the CD-ROM drive.)
3. Follow the prompts on your screen to complete the installation process.

ValveNavi Administration and ValveNavi Help are also installed along with ValveNavi. After successful installation of ValveNavi software, the system administrator of ValveNavi should change the default logon and password and set up user accounts through the ValveNavi Administration program. Secure the ValveNavi CD-ROM in order to provide system security. Anyone with access to the setup disk could reload the software and thereby get access to YVP devices. For more details, see 4.6.



NOTE

In case of ValveNavi install folder (ex: C:\Program Files\ValveNavi) is not writable, some functions can not be used.

4.3 Trial Period

To start up ValveNavi, double-click the ValveNavi icon generated on the desktop.

This will open the Registration screen. Type your name and company name there. ValveNavi can be used for 60 days without entering the serial number after installation on a PC. If you are not a licensed user, leave the serial number box blank, then press OK. The evaluation or trial period for the software is up to 60 days from the first day it is used, and this time process will not be cleared even when uninstalling and reinstalling the software.



Figure 4.1 Dialog box showing trial limits

Click OK and logon in the ValveNavi Logon dialog (Figure 4.2). See page 4-6 for setting up individual ValveNavi accounts and privileges.

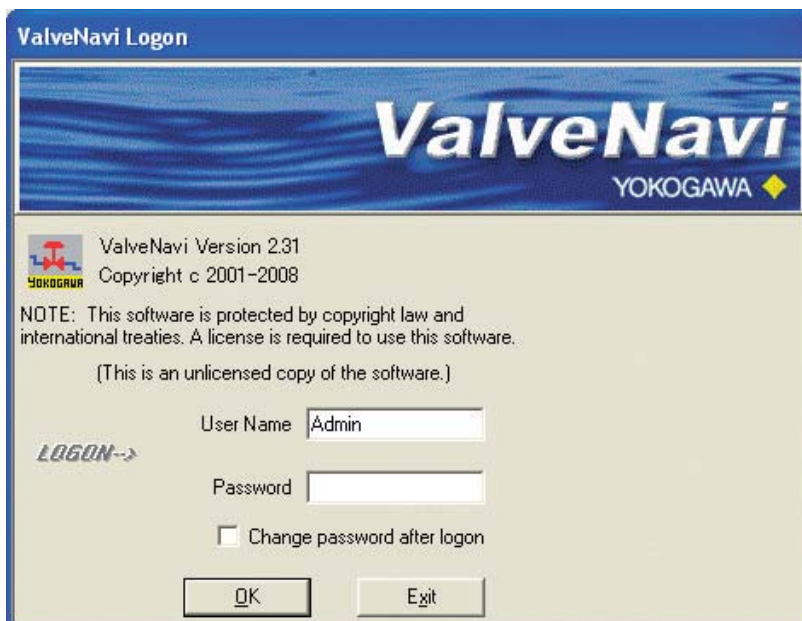


Figure 4.2 Logon dialog

4.4 Licensed User Process

Permanent use of this software requires a license for each computer on which it will be used. If you purchased a licensed copy of ValveNavi, you will have received a CD-ROM with a serial number. DO NOT LOSE THIS SERIAL NUMBER. KEEP IT IN A SECURE LOCATION.

To start using ValveNavi as a licensed user, in the required information in the Installation dialog (Figure 4.3), including the name of the person responsible for the registered software, the company name and the software serial number, and press OK.

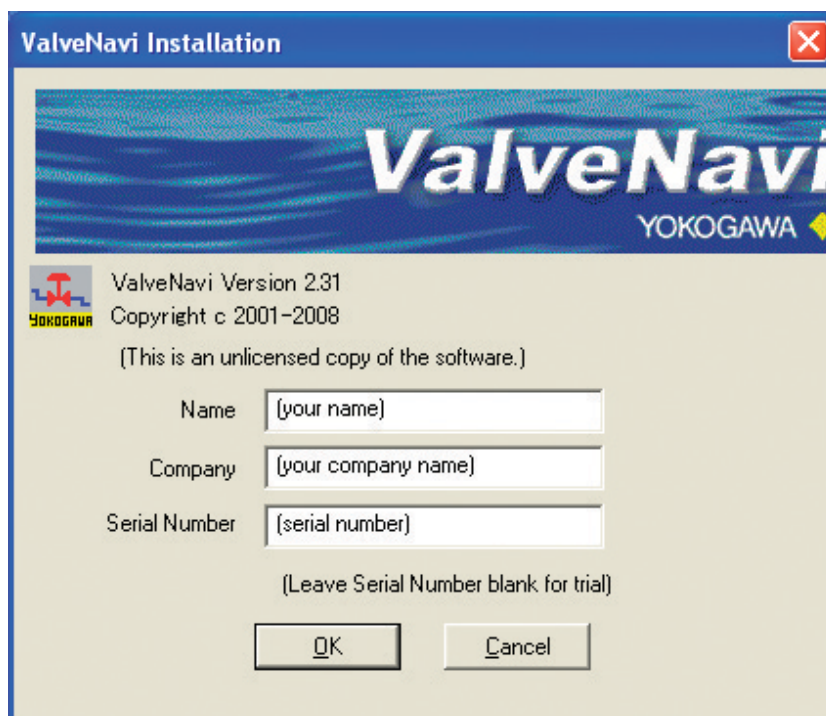


Figure 4.3 Installation Dialog

Once licensed with proper registration information, this registration dialog will no longer open unless it is opened from the Help menu. Click Help/Installation Info to access the Registration dialog.

4.5 Logging on with Registration

Once you complete the registration of the software, you will enter from the logon screen as shown in Figure 4.4.

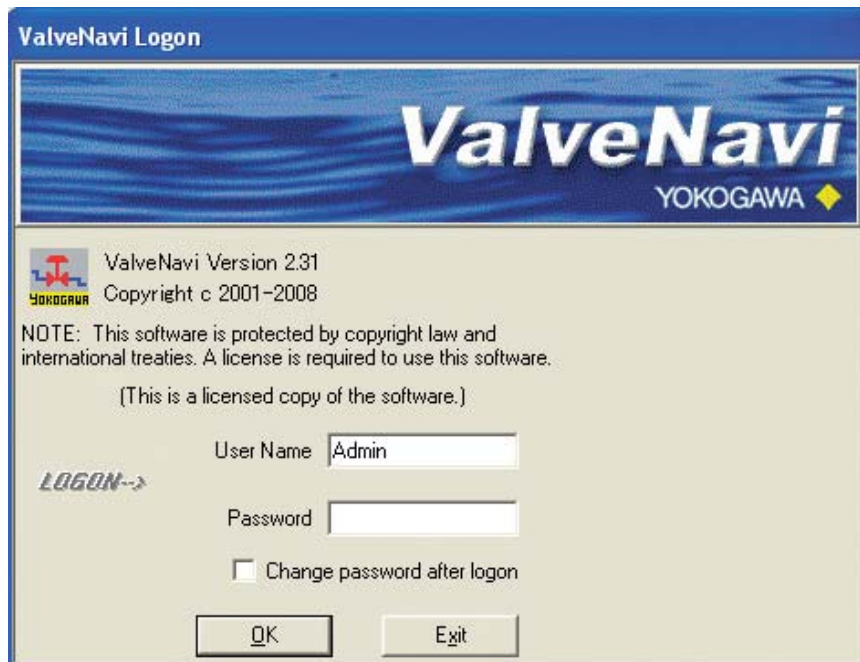


Figure 4.4 Logon Screen

4.6 Setting Up User Accounts

4.6.1 System Administration, Passwords, and Privilege Levels

In a plant with many users with various levels of training and responsibility, it is often desirable to restrict certain users access to a limited range of functions. Starting the ValveNavi program requires a valid account with a user name and a password for each user. The privilege level associated with a ValveNavi account determines which functions of the program the user is allowed to access.

The ValveNavi Administration program allows the administrator to perform all user account administrative functions to run ValveNavi and to control access to the functionality of the YVP positioner.

These administrative functions include:

- Adding new user accounts
- Deleting existing user accounts
- Changing existing user accounts
- Adjusting privilege levels

4.6.2 Start the Administration Program

After installation of ValveNavi, the ValveNavi administrator should change the default passwords, set up the initial user accounts through the Admin program, and secure the setup disk. Anyone with access to the setup disk could reload the software and thereby get access to YVP devices.

To start ValveNavi Administration, select Start->Program->ValveNavi->ValveNavi Administration. The administrative program prompts you for a logon name and password. Log in for the first time with an administrator account. Enter the default logon name ("Admin") and leave password blank. (Note: The system is case sensitive, and you must type the default names in correct case.) Then, clicking OK to open the VFAdmin dialog (Figure 4.5).

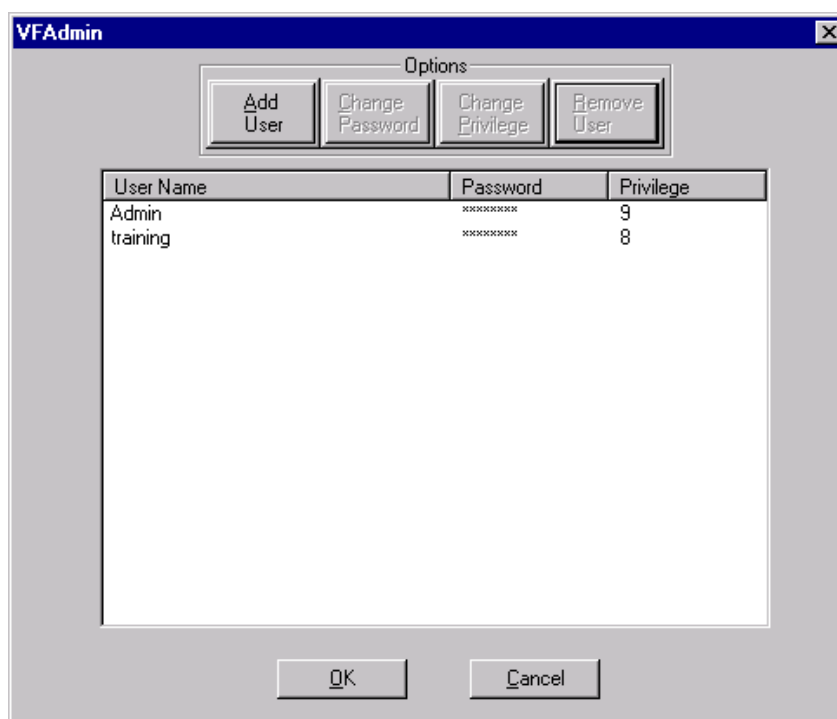


Figure 4.5 Add Users in VFAdmin dialog

The program already contains two accounts.

- The first account is the administrator account, which you are using, with the logon name “Admin” (note that this is case sensitive with a capital A) and the initial password is blank (no password). Immediately use the administration program to install a password for administration to make the system secure from unauthorized use.
- The second account enables use of the YVP process controller simulator with the logon name of “training” (lower case) and password of “training” (lower case). The process control simulator will simulate, in software, a process with a dead time of one second and a lag of five seconds. The process controller simulator is useful for training users on the many functions and features of the YVP positioner and its PID function block.



WARNING

Do not logon with a “training” account to use ValveNavi with a valve that is not isolated from the operating process. Control links will be destroyed by using the simulate function.



CAUTION

It is important that the administrator change the default logon names and passwords for the administrator account and the training account. Continued use of the default logon account names and passwords makes the system less secure.

4.6.3 Privilege Levels

Each user is assigned an account. For each account, there is an associated privilege level. Privilege levels range from 0 to 9, with level 0 the lowest and 9 the highest. The following defines several privilege levels, which control access to specific functions of the ValveNavi program. Services which are not accessible to a particular level are “grayed” out.

Level 0

Allows the user to logon to ValveNavi only if the connected YVP is in Auto. The user can send commands that will reply with configuration, calibration, and status information, but the user cannot change any information. Level 0 users cannot go to Out Of Service or Manual.

Level 1

Allows the user access Auto, Manual or Out Of Service states. The user can transfer from one mode or state to another (i.e. the user can take the YVP out of Auto and put it in Manual). The user can then set valve position. However, the user cannot change the calibration or configuration. The level 1 user cannot access the PID dialog.

Level 2

This level is not defined.

Level 3

Allows the user to change the configuration or calibration values, but does not allow the user to perform calibration and tuning operations that stroke the valve (Find Stops, Autotune or diagnostics).

The user may open the PID dialog and use it to change PID modes and to move the valve in manual or change process variable setpoint. The user can enter tuning parameters for the process variable PID control.

Level 4

Allows the user to perform all operations except Download Configuration to YVP.

Level 5

This level is not defined.

Level 6

This level is not defined.

Level 7

This level is not defined.

Level 8

This level is intended for training and should be used cautiously. It grants all of the privileges of level 4 plus allows access to the Simulation State of the process controller. (The simulation of the PID Block allows the user to run the process controller without connecting a process variable input to the YVP and is useful for learning how to operate the process controller).

**WARNING**

The simulation state must not be used if the valve is connected in a control loop or the if the valve is controlling process flow.

The simulation state will permanently remove important control loop configuration information from the YVP valve positioner. The soft-wired connection between the PID functions block and its input function block must be restored after simulation is used.

Reconfigure function block links after using simulate. The Clear Device command must be used when downloading restored configuration.

Level 9

Allows access to all YVP functions. In addition, it is the only level allowed to logon to the administration program.

The administrator has an account of privilege level 9. There must be at least one user of privilege level 9 in order to get access to the administration program.

4.7 Finish ValveNavi

To finish ValveNavi, select Exit from File Menu. Clicking Yes to the Confirmation message will finish ValveNavi.

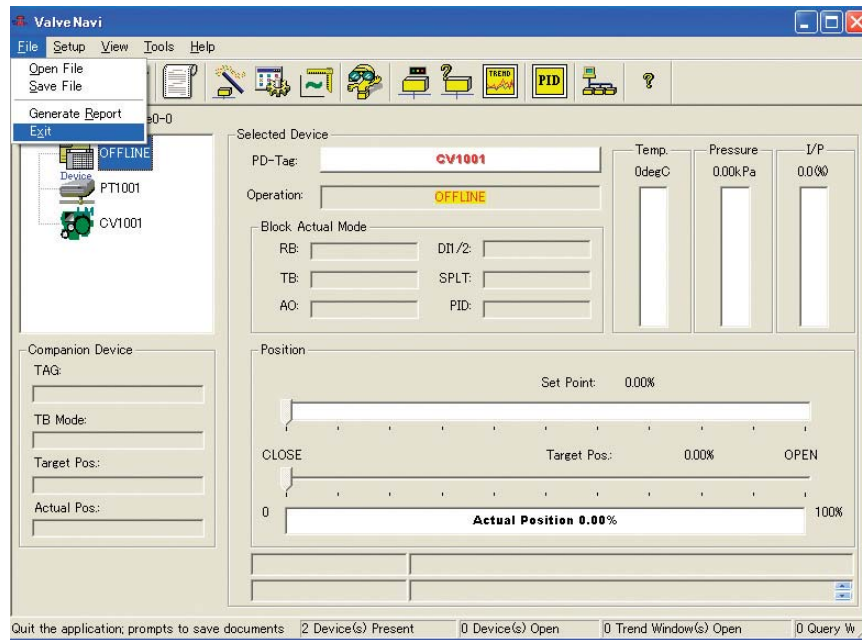


Figure 4.6 To Finish ValveNavi

5. FOUNDATION FIELDBUS OVERVIEW

This chapter will introduce concepts that are used in most parts of the manual. It will briefly introduce Foundation Fieldbus blocks, and some of the essential block concepts. Throughout the manual we will reference a simple process example. The example is a simple heat exchanger with two control valves, and three measurement devices. The controls are configured in a cascade arrangement to illustrate concepts of transfer between modes and states of the various levels of control.

5.1 Reference Model Process Used in This User's Manual

The heat exchanger model is shown in Figure 5.1. It is not a practical process, but incorporates elements that illustrate important features of ValveNavi. Note that each of the devices has a device tag that will be used to identify devices in ValveNavi. The process consists of a vessel with a product vapor inflow, which is condensed, and flows out as a liquid outflow. The tank level is controlled by an outflow control valve, LV 201. The tank contents are chilled by coolant water. The temperature is controlled by a temperature controller cascaded to a flow controller. The coolant flow is controlled by control valve FV 101.

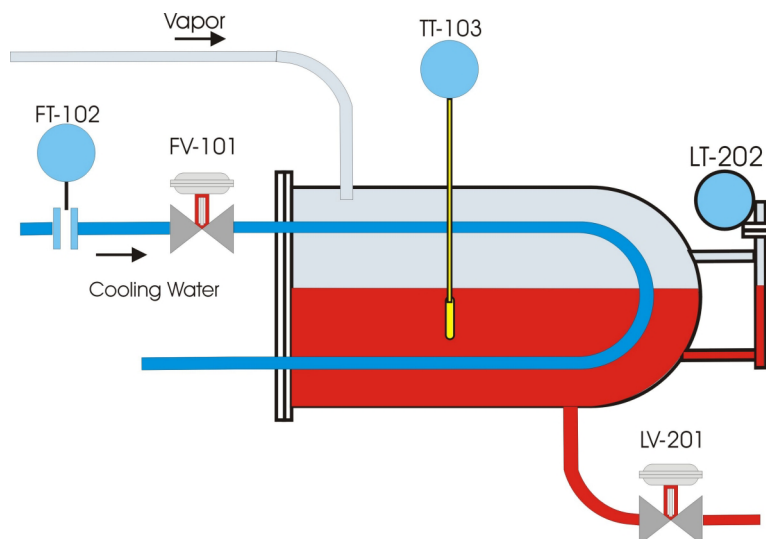


Figure 5.1 Heat exchanger

5.1.1 P & ID

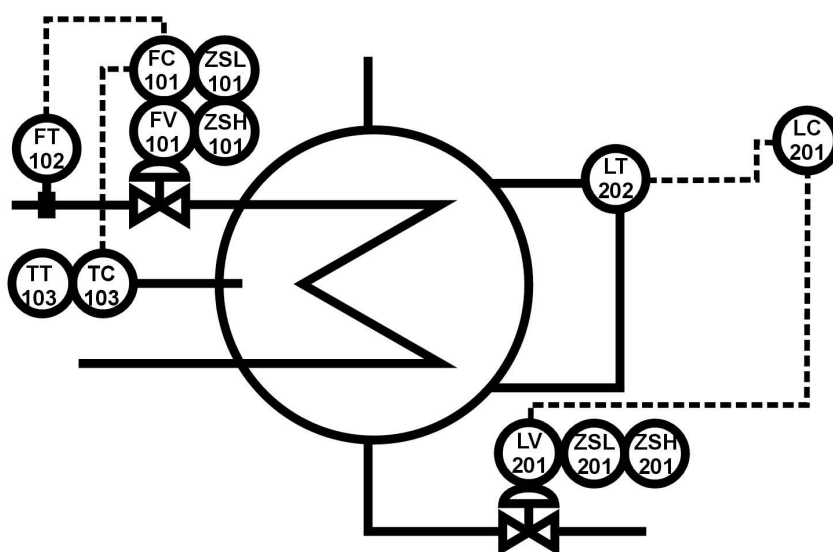


Figure 5.2 Piping and Instrumentation Diagram

The piping and instrument diagram (Figure 5.2) shows, in schematic form, the physical devices and indicates the measurement and control functions that reside in each device. The coolant flow transmitter, FT 102, has only a transmitter function, but the coolant flow control valve, FV 101, has a PID control, two limit switches (DI blocks) and an AO block all located in the YVP valve positioner. The flow of control information between devices is indicated by dashed lines. The DI blocks, ZSL 101 and ZSH 101, serve as low and high stem position limit switches, respectively.

Liquid level is controlled by a remote controller LC201 (to demonstrate Remote Cascade operation). The controller receives the process measurement from level transmitter LT 202. The PID control regulates the valve LV201 (an YVP positioner with an Analog Output Block, and 2 DI function blocks. The DI blocks, ZSL 201 and ZSH 201, serve as low and high stem position limit switches, respectively.

5.1.2 Function block links

Each of the control functions is represented in the Control configuration as Foundation fieldbus Function Blocks. All the blocks in the temperature cascade are shown in Figure 5.3. They are grouped according to the physical device containing them, and they are shown with the links between the blocks (“soft wiring” connections) for data flow.

Similarly, the level loop function blocks are shown in Figure 5.4.

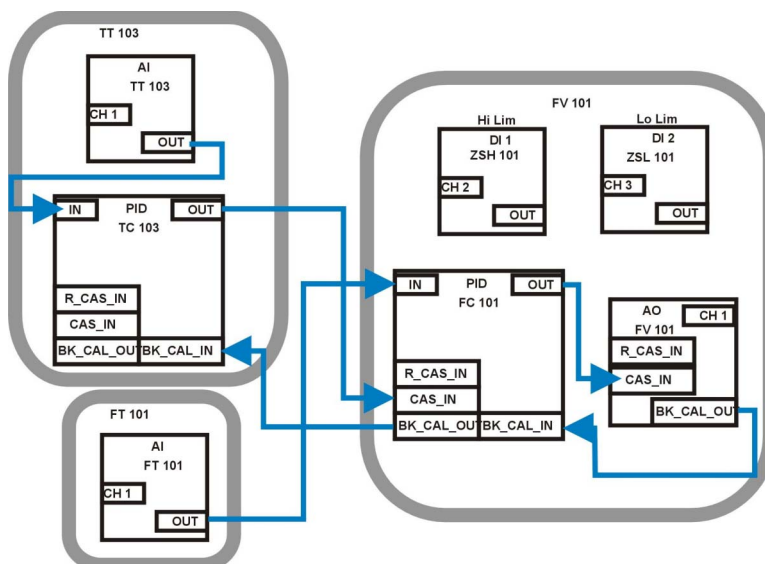


Figure 5.3 Temperature Cascade Block Diagram

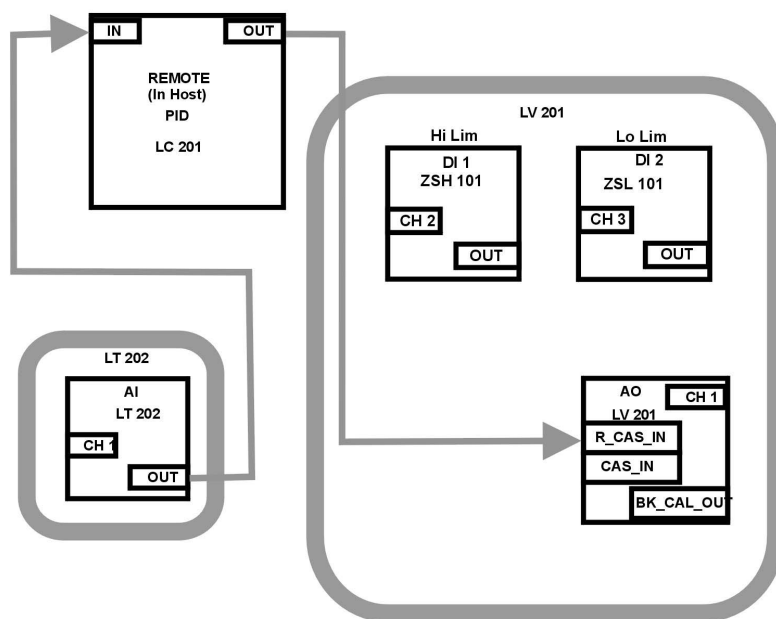


Figure 5.4 Level loop block diagram

Finally, to complete the model, ValveNavi is shown, in Figure 5.5, temporarily connected to the heat exchanger's Foundation fieldbus wiring at an intermediate point. The Heat Exchanger Reference Model segment consists of a Heat Exchanger Host in a control center with a Foundation fieldbus trunk running to two junction boxes. One junction box has spurs to the flow and temperature control devices and the other connects to the devices controlling tank level. A power supply with isolation electronics and two terminators are also shown. The interface cards (NI-FBUS) used with the ValveNavi computer must be configured so that it will not interfere with the Heat Exchanger Host.

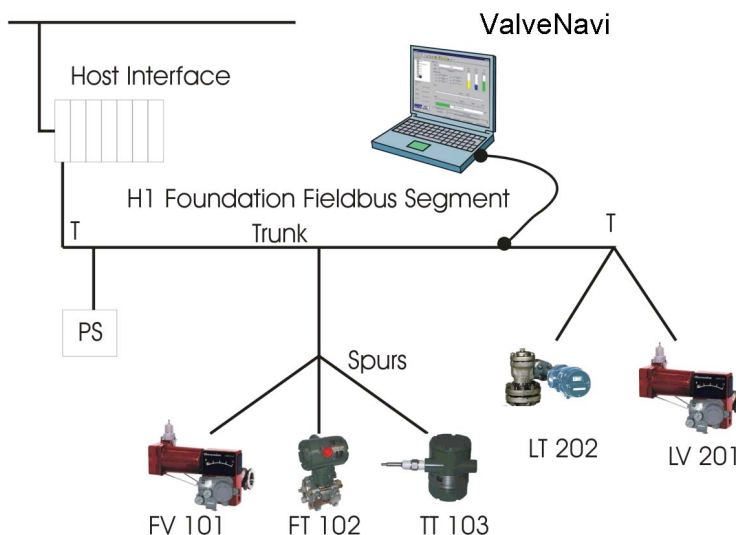


Figure 5.5 ValveNavi connected as a visitor device



WARNING

Do not connect a ValveNavi PC to an operating segment.



WARNING

Do not cause a short circuit in a working segment while connecting any device.

5.2 Device Operational States and Block Modes

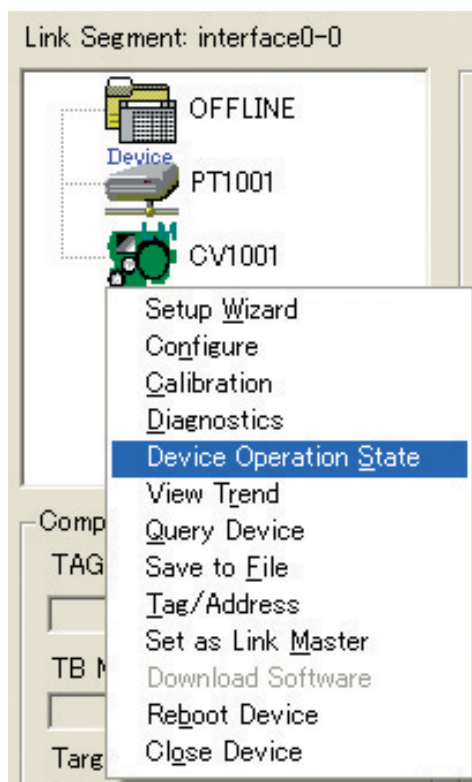


Figure 5.6 Device Operation State in Pop-up Menu

The Operation State can be accessed several ways. From the Device Selection frame, right click the desired device to pop up a menu list and select Device Operation State. In the tool bar click the Device Operation State icon. Or choose Tools>Device operation State from the Menu bar.

The Device operation State dialog will then appear offering choice of Out Of Service, Manual and Normal states.

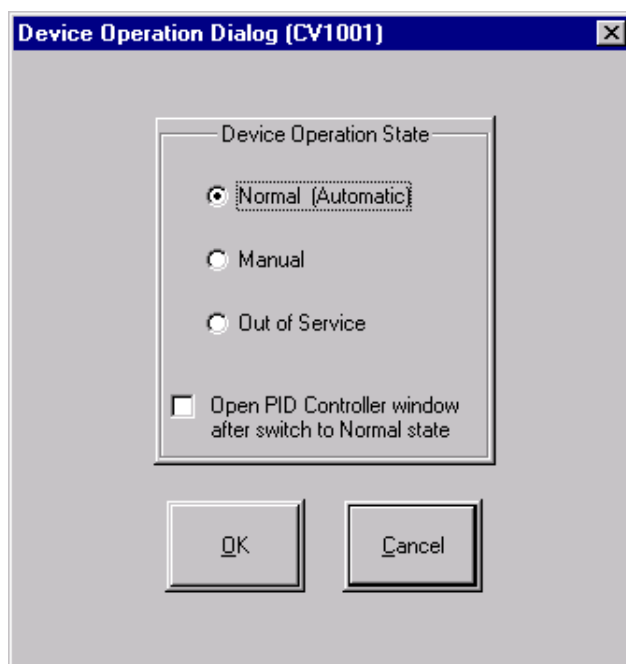


Figure 5.7 Device Operation State Dialog

ValveNavi manages the operational states of the positioner and its embedded PID controller by controlling the target modes for each of the function blocks. The actual mode of each block may be different from the target mode. The actual mode is controlled by the block itself in accordance with mode rules based on the quality of the data and modes of the linked blocks. A brief summary of modes follows, but a thorough discussion of modes is beyond the scope of this instruction. The interested reader is referred to the Fieldbus Foundation that specifies the formal rules for mode changing.

Three operational states are set by ValveNavi (Figure 5.6 and Figure 5.7). The Out Of Service (OOS) state forces all of the blocks to Out Of Service Mode. The outputs remain at the values prior to the state change. All output calculation is suspended. Back calculation values are passed to other linked blocks to enable initialization. Note that the PID will remain in OOS after configuration changes unless it is put into one of its allowed modes from the PID dialog. The PID dialog can be started from the Device Operation Dialog.

Table 5.1 Allowed Block Modes For Three Operational States

Operational state	Function Block and Block Modes			
	PID	AO	TB(Auto)	RB(Auto)
Out of Service (OOS)	OOS	1 or more block is in OOS		
	<i>IMan</i>	OOS	OOS	OOS
	<i>Man</i>	Man	Auto	Auto
	<i>Auto</i>	Auto		
	<i>CAS</i>	CAS		
	<i>RCAS</i>	RCas		
Manual operating state	OOS	Man	Auto	Auto
	<i>Iman</i>			
Normal Operating state	<i>RCas</i>	Each block must be one of the modes below		
	<i>IMan</i>	Auto	Auto	Auto
	<i>Man</i>	Cas		
	<i>Auto</i>	RCas		
	<i>Cas</i>			

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Note: Italics indicate a permitted actual mode but a dis-allowed target mode.
 Bold type indicates a target mode.

5.3 Block Modes

All blocks (function/transducer/resource) have operating modes. There are eight modes defined in the Foundation fieldbus specification. Not all modes are supported by every block. For example, the Discrete Input (DI) block supports just Auto, Man, and OOS. The action of the modes are described in the following paragraphs. Transfers between modes are managed by the function blocks in response to manual commands, in response to changes in the modes of linked blocks, and in response to changes in the quality of the parameters that are transmitted. Control and status options can be set to manage mode changing behavior.

(1) Remote-Output (Rout)

The block output is being set by a Control Application running on an interface Device through the remote-output-in parameter. The algorithm is bypassed and the remote block controls its output directly. The algorithm must initialize so no bump is experienced when the mode switches to auto. A remote-output-out parameter is maintained by the block to support initialization of the control application when the block mode is not remote-output. The setpoint may be maintained or, optionally, be initialized to the process variable value.

(2) Remote-Cascade (RCas)

The block setpoint is being set by a Control Application running on an interface device through the remote-cascade in parameter. Based on this setpoint, the normal block algorithm determines the primary output value. A remote-cascade out parameter is maintained by the block to support initialization of the control application when the block mode is not remote-cascade.

(3) Cascade (Cas)

A setpoint value supplied by another function block through the Cascade input parameter is used by the normal block algorithm in determining the primary output value. This connection between function blocks is defined by a link object.

(4) Automatic (Auto)

A local setpoint value is used by the normal block algorithm in determining the primary output value. The local setpoint value may be written by an operator through an interface device.

(5) Manual (Man)

The block output is not being calculated, although it may be limited. It is directly set by the operator through an interface device. The algorithm must initialize so no bump is experienced when the mode switches. The setpoint may be maintained or, optionally, be initialized to the process variable parameter value or to the setpoint value associated with the previous (retained) target mode.

(6) Local Override (LO)

Applies to control and output blocks that support a track input parameter. In the local override mode, the block output is being set to track the value of the track input parameter. The algorithm must initialize so no bump is experienced when the mode switches from LO back to the target mode. The setpoint may be maintained or, optionally, be initialized to the process variable parameter value.

(7) Initialization Manual (IMan)

The block output is being set in response to the back-calculation input parameter status. When the status indicates there is no path to the final output element, then the control blocks must initialize to provide for bumpless transfer when the condition clears. A back-calculation out parameter is supported by all output and control class function blocks. The setpoint may be maintained or, optionally, initialized to the process variable parameter value.

(8) Out of Service (OOS)

The block is not being evaluated. The output and setpoint are maintained at last value.

(9) Multiple Modes and States

The AO block must go to CAS mode to connect to a PID function block in cascade. To stop the setpoint signal from the AO to the transducer block, the AO block must go into OOS mode.

The following, Table 5.2, shows examples of mode operation (not showing all cases).

Table 5.2 Mode operation

Operation	(AI)	PID	AO	TB
Configure the transducer block (Auto tuning, travel calibration, diagnostics, etc.)			OOS	OOS
Configure transducer block (Changing position control parameters, etc.)				OOS
Manual valve positioning from ValveNavi or other human interface.			Man	Auto
Manual valve positioning from a PID controller human interface		Manual	CAS	Auto
PID single loop control	Auto	Auto	Cas	Auto
PID cascade loop control	Auto	primary :Auto secondary :CAS	Cas	Auto

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When a block is in OOS mode, its output status will be “bad,” so that any connected blocks will know and automatically change their modes. For example, when a PID block sees bad status in its BKCAL IN, it will go to IMAN mode for initialization to the downstream block while awaiting the status to return to “good cascade. ”

5.4 Examples of IVI Operational States

Examples of operational states that are combinations of block modes are shown in the following figures.

A new device or a newly configured device may start up in the out of service (OOS) state shown in Figure 5.8.

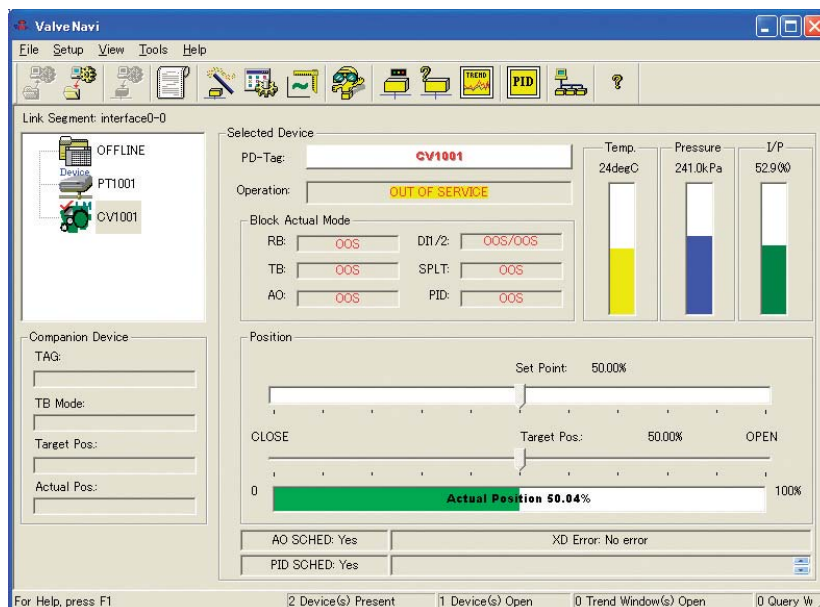


Figure 5.8 Out of service at startup

To transfer to the manual state which allows ValveNavi to adjust the valve position, click the Operating State icon and select Manual. Enter a setpoint in the Set Point text box (Figure 5.9) then click OK, or drag the Set Point slider to the desired value. If the positioner is configured with a non-linear (such as =%) characteristic, the Target Position will be computed from the setpoint but may differ in value. The configuration options of Tight Shutoff Below, Full Open Above, as well as high and low position limits will be applied to the Set Point to arrive at the correct Target Position.

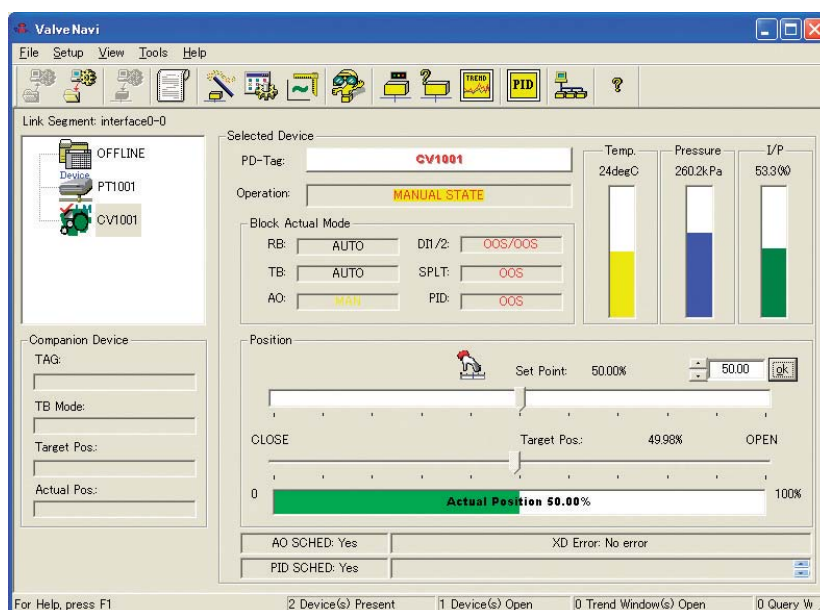


Figure 5.9 Manual State

When the positioner has been placed in normal, it waits for the PID block to begin to send it a setpoint. It will remain in auto mode at the current valve position. When this condition exists, it is necessary to place the PID block in its normal mode.

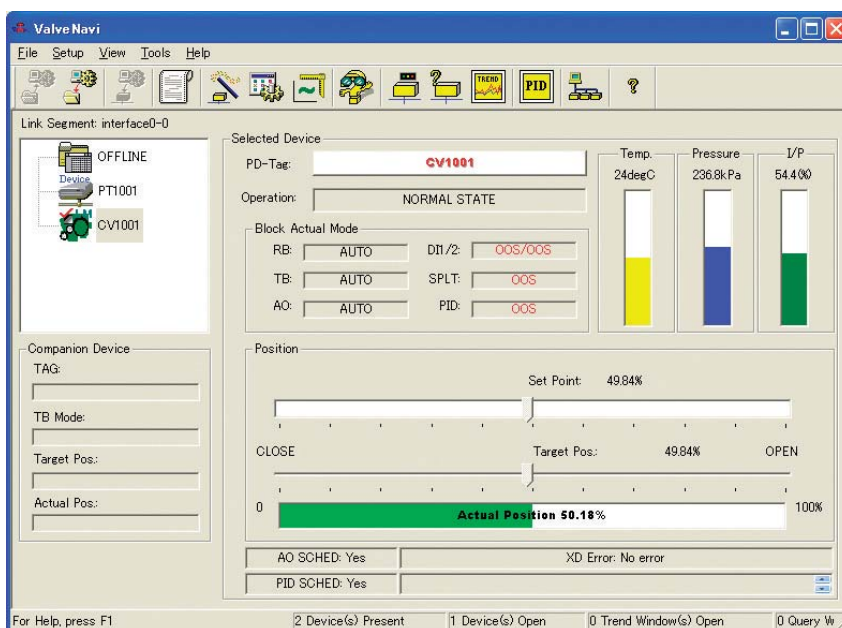


Figure 5.10 Normal State Waiting For internal Controller block

When the process control PID is located within the positioner and when the PID receives its setpoint from a Foundation fieldbus function block, the normal state will be as shown in Figure 5.11. Both the PID and AO blocks are in Cas mode.

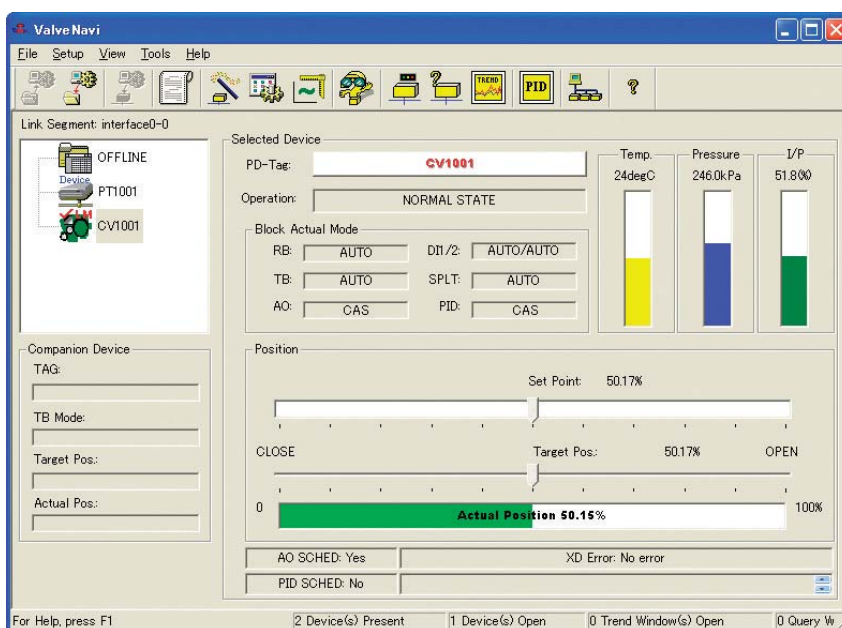


Figure 5.11 IVI Showing Cascade Normal State

When the positioner is receiving its position setpoint from a remote computer system such as a DCS then the normal state for the positioner will be as shown in Figure 5.12. In this example the level control valve LV201 is receiving its signal from a DCS. The AO block is shown in RCas mode.

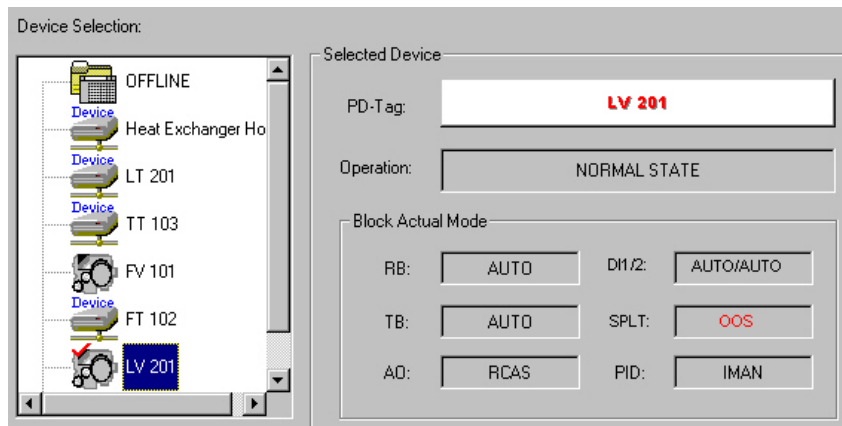


Figure 5.12 Remote Cascade Normal State

If an internal PID is used in a cascade where the PID receives a setpoint from a remote computer system, then the normal state will have the PID in RCas mode and the AO will be in Cas mode (not shown).

5.5 Changing Operational States

The Foundation fieldbus Application process specifies the mode handling for interoperable function blocks. It also specifies which mode a block must be in when each parameter is written. ValveNavi provides an intelligent, optimized process for managing configuration and calibration changes. For efficiency, it does not place blocks into Out Of Service mode unless the parameter requires OOS. It analyzes the requested changes and then sets the correct mode for each affected function block. The actual block modes are displayed in the IVI.

The Foundation fieldbus specifies a mechanism for transferring between function block modes. The user declares a target for the block mode, but the actual mode is set by the block in accordance with rules. The rules allow modes based on the quality of input data and quality of the connection to the process. YVP function blocks comply with the FF rules. ValveNavi sets target modes for individual function blocks as required by configuration, calibration, diagnostics and other services. It sets target modes for group of function blocks to achieve three operational states of the positioner: Out of Service, Manual, and Normal.

(1) Changing Target Operational State

When a configuration or other process requires any of the affected function blocks to go into OOS mode, ValveNavi opens a Warning dialog as shown in Figure 5.13

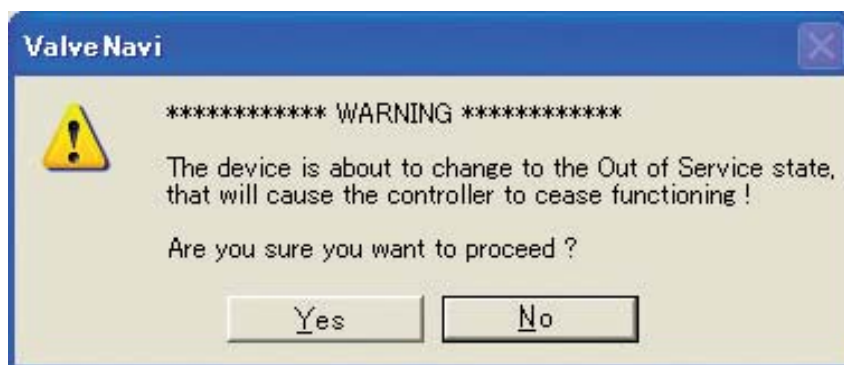


Figure 5.13 Out Of Service State Change Warning

(2) Changing to Auto from OOS

In OOS, the YVP can be switched to Auto in order to return the device to the previous Auto state by clicking on Auto. In the event the user has selected "bumpless transfer" the device will execute the bumpless transfer routine.

6. QUICK TOUR OF ValveNavi

In the quick tour we will briefly introduce each of the tools provided by ValveNavi. The chapters that describe the tools in details follow the quick tour.

6.1 Introduction

ValveNavi uses an integrated valve interface, IVI, to display all valve and positioner variables and to provide access to services, such as configuration and calibration tools. The information and controls for services are arranged in frames within IVI. From the IVI the user has single click access to the PID Controller interface. IVI displays and updates real time values for valve position, valve setpoint and actuator pressure numerically and graphically.

Data objects are grouped in “frames” within the IVI display as described below.

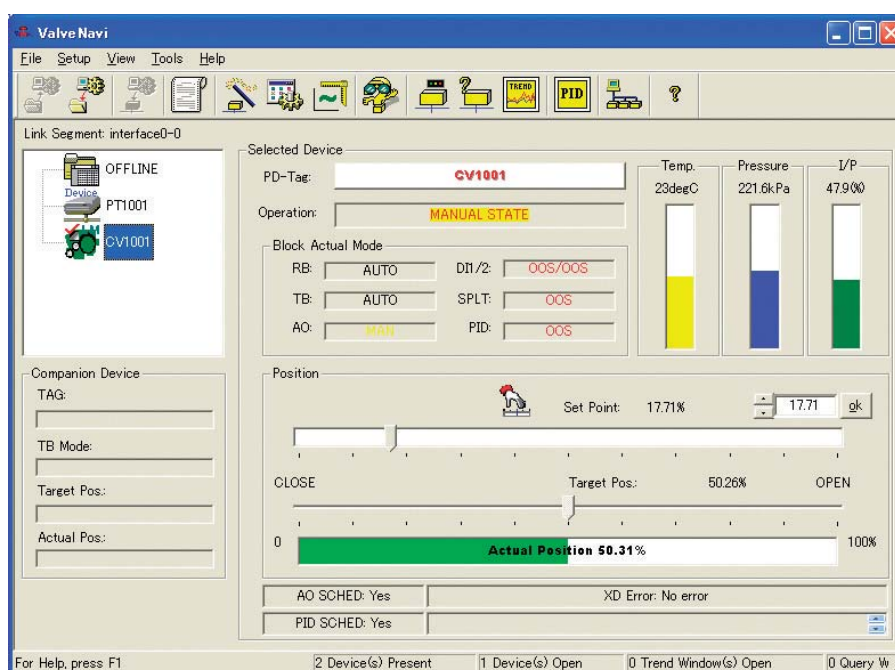


Figure 6.1 Integrated Valve Interface (IVI)

6.2 Fieldbus Device Tree

All of the devices on the bus segment live list are shown as icons in the Device Selection box.

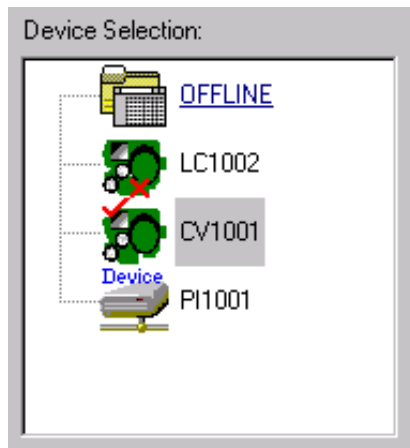


Figure 6.2 Device Tree

Click on the YVP device to open a communications session with the positioner. The fieldbus segment live list is continuously scanned and devices are shown when present. Devices that have communications failure are shown with a red X. The selected device is shown with a red check-mark.

When a device is selected, a warning dialog informs that an attempt is made to connect to a new device. Then the Read configuration dialog displays progress uploading device data.

6.3 Menu Bar and Tool Bar

The IVI offers tools and wizards using standard Windows conventions, offering multiple paths to functions to suit a user's preferences. Use the menu bar, the tool bar icons, or popup menus in the Device Selection frame. When the cursor is moved over an icon a Tool Tip appears to identify the icon's purpose.

6.3.1 Menu items

Pull down menus are listed below and shown in Figure 6.3.



Figure 6.3 Menu and tool bars

- File
- Setup
- View
- Tools
- Help

Help use Web Browser technology to provide flexible access to help for all ValveNavi windows. It is good practice to open help.

6.3.2 Toolbar icons

Toolbar services are listed in Table 6.1. An icon may be “grayed out” to indicate that its function is disabled.

Table 6.1 Toolbar Icons

Open configuration file		Diagnostics	
Save Configuration file		Change device operation state	
Download configuration		Query device	
Generate a report file		View Trend	
Setup Wizard		PID Process controller	
Configuration management		Rescan the field bus segment	
Calibration management		About ValveNavi version	

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6.4 Control Valve Faceplate

The control valve faceplate frame encloses displays and controls for working with the positioner.

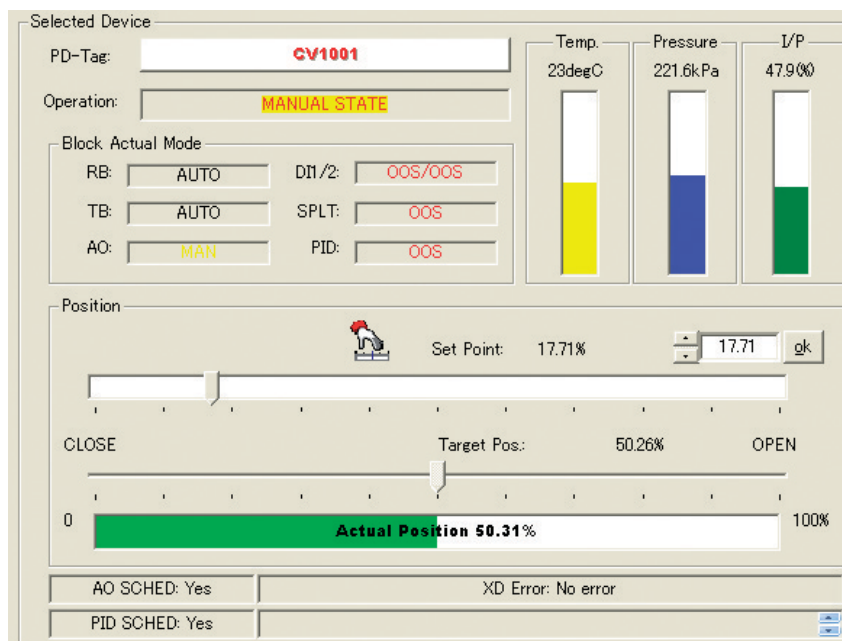


Figure 6.4 IVI Positioner Faceplate Frame

Figure 6.4 shows an example of the control valve faceplate frame in the IVI. The positioner's tag is shown in the PD-Tag field. The current operating state of the positioner is shown in the Operation control button displaying, in this example, "NORMAL STATE." Individual block modes are displayed for each of the positioners internal function blocks. The valve position Set Point is displayed by the graphical position of a slider control and numerically to two decimal places. Below the setpoint display, the target position and actual position are shown as a slider and bar respectively, with values shown to two decimal places.

The Target Position is derived from the Set Point signal based on the parameters defined in Configuration Services, on the valve characterization and on the configuration of air-to-open or air-to-close. It is further modified by any limits that may be configured.

6.5 Companion Device Display Frame

This Companion Device frame displays and updates real time values for transducer block mode, target position, and valve position. It is used to observe summary information from a second positioner connected in the same segment as the selected device.

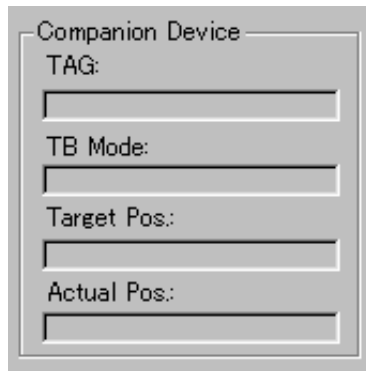


Figure 6.5 IVI Companion Device Frame

6.6 Status Frame

Below the position bar display, the Status Frame displays Analog Output (AO) block and PID block Scheduling status. In addition, the transducer block error (XD ERROR) is displayed. The communication error text box accumulates error messages that can be copied to a text file for analysis.

To clear the error text box, click View>Clear Comm Error Display.

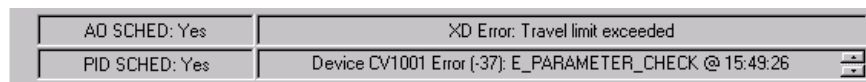


Figure 6.6 Status frame

6.7 Accessing Services in ValveNavi

Services in ValveNavi are accessed by three methods that are standard Windows techniques.

- By the Tools menu, after a device has been selected and opened, or



- By the toolbar icon, after a device has been selected and opened, or



- From the Device tree with a popup menu, by right clicking on the desired device.



6.8 Setup Wizard

This setup wizard provides, in a single tool, all the services for setting up a basic positioner. It includes a sequence for basic configuration and basic tuning. It is most useful for first time setup of the positioner. Follow the step-by-step instructions to quickly complete the basic setup and start running the valve.



Figure 6.7 Setup wizard

6.8.1 Actuator Wizard

This is the setup page in the setup wizard to configure the valve actuator information contained in Transducer (TB) block. For a description of the parameters, refer to Actuator in the Configuration window.

Setup Wizard - Actuator (CV1001)

Select options in each category to identify the valve/actuator configurations that this device operates on.

Valve Action

- ☒ Air-To-Open (P1 Increase Opens)
- ☐ Air-To-Close (P1 Increase Closes)

Actuator Type

- ☐ Single Acting
- ☒ Double Acting

Relay Type

- ☒ Normal (Direct Acting Instrument)
- ☐ (Hardware) Reverse

Valve Type

- ☒ Linear (Reciprocating)
- ☐ Rotary

< Back Next > Abort Trend Query Device

Figure 6.8 Actuator Wizard

6.8.2 Tuning Wizard

This tuning step in wizard allows the user to execute the combination of Search Stops and Auto Tune described in Tuning in Calibration.



WARNING

Tuning will stroke the valve over its entire travel. Isolate the valve from the process prior to the calibration.

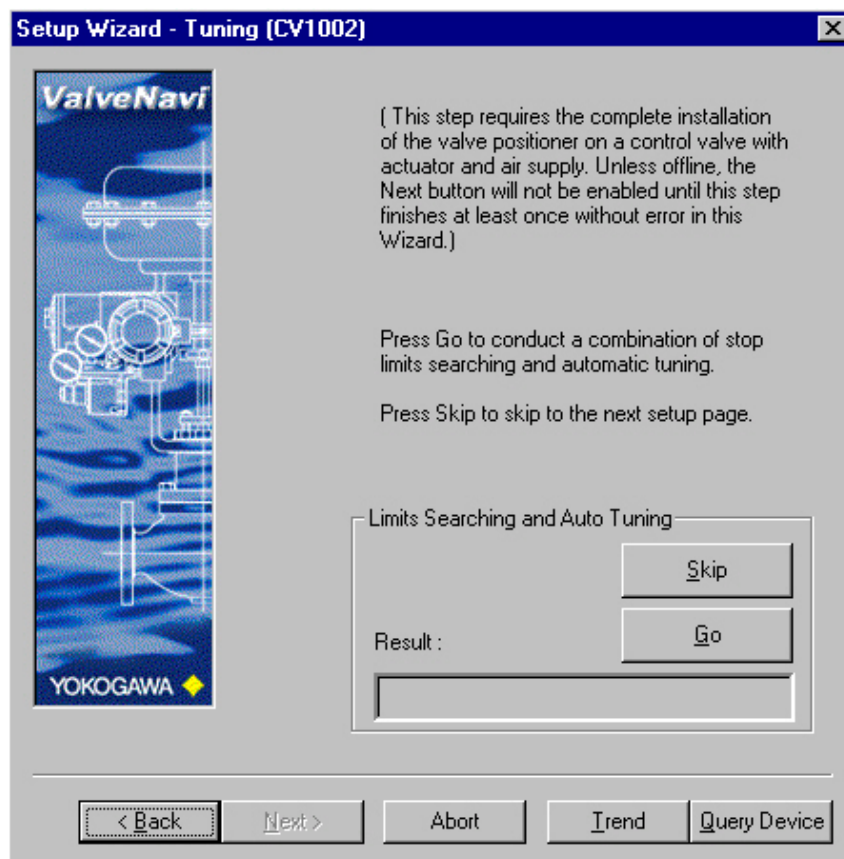


Figure 6.9 Tuning Wizard

6.8.3 Travel Calibration Wizard

This travel calibration page in the setup wizard allows the user to calibrate the 0%, 50%, or 100% position points, when necessary. For a description of all the parameters and controls, refer to Travel calibration.



Figure 6.10 Travel Calibration Wizard

6.8.4 Position Control Limits - Wizard

This position control limits page in the setup wizard allows the user to change the position limit setting for the valve position configuration parameters in TB block. For a description of all the parameters, refer to Position in Configuration window.

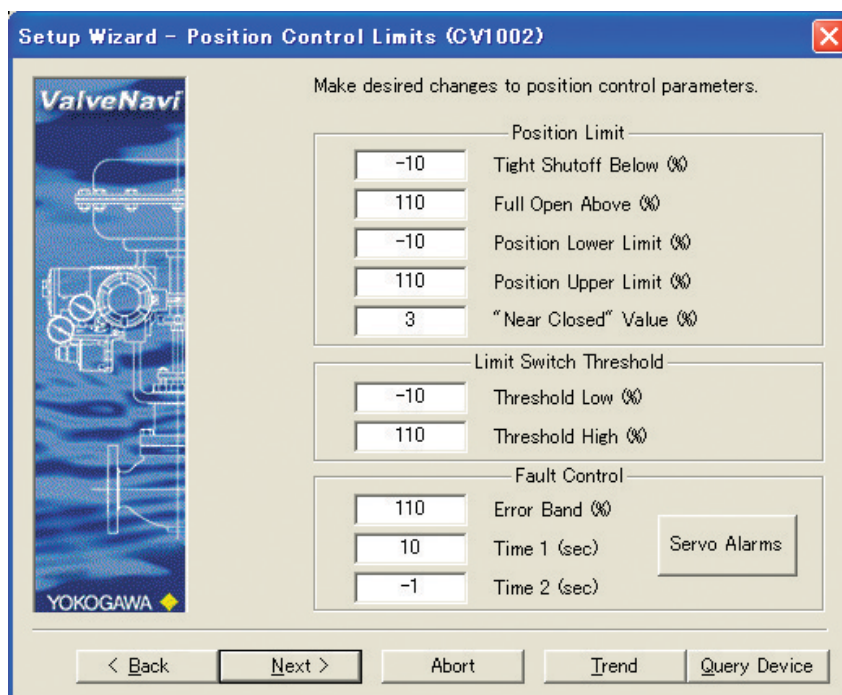


Figure 6.11 Position Control Limits Wizard

6.8.5 Finish - Setup Wizard

This is the final screen of the Setup Wizard that indicates that the basic setup is valid and that provides a choice of Device Operation State before completing this setup. The Wizard is not completed until the Finish button is pressed.



Figure 6.12 Setup Wizard Finished

6.9 Configuration Services

This page of the general configuration of the device includes Device Info, Block Tag Info, and device installation options.

The screenshot shows the 'Configure (CV1001)' dialog box with the 'General' tab selected. The 'Device Info' section contains the following fields:

- Tag: CV1001
- Node Address: 0x17
- Device ID: 5945430001J0003672
- Manufacturer ID: 594543
- Device Type: 1
- Device Rev.: 3
- D.D. Rev.: 1
- Model: YVP110-F1A1N/BP/LC1
- Descriptor: (empty)

The 'Block Tag Info' section contains the following fields:

- RB: RS
- TB: TB
- AO: AO
- DI1: DI1
- DI2: DI2
- PID: PID
- SPLT: OS

The 'Others Installed' section contains the following checkboxes:

- ☒ PID Block
- ☒ Pressure Sensor
- ☒ Link Master
- ☒ Signature

At the bottom of the dialog are three buttons: OK, Cancel, and Query Device.

Figure 6.13 Configuration - General

6.10 Calibration Services

The calibration page has a tab for adjusting the positioner to the actual stroke (range) of the valve, and for autotuning the position control algorithm. It also has a travel calibration service that provides for making further adjustments to the valve stroke. The advanced tab provides access to non-linear factors used to optimize dynamic performance.

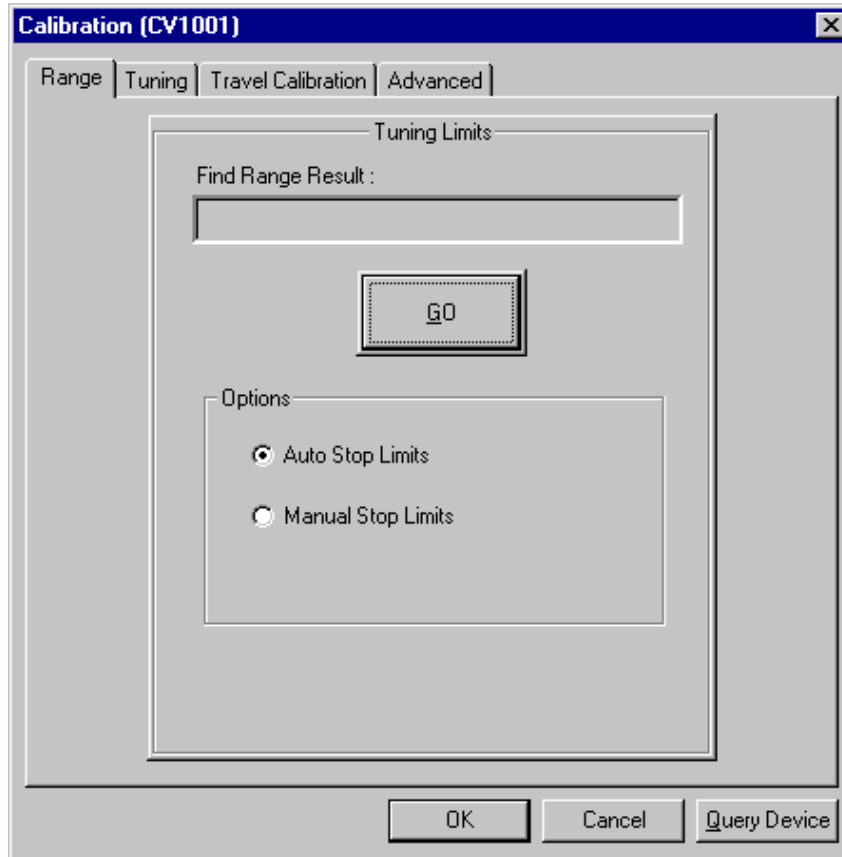


Figure 6.14 Calibration with Range, Tuning, Travel, and Advanced Tabs

6.11 Diagnostic Services

The diagnostic page provides controls to perform the actuator and positioner signature test procedures. It also displays the continuous diagnostic data that is an accumulation of valve service.

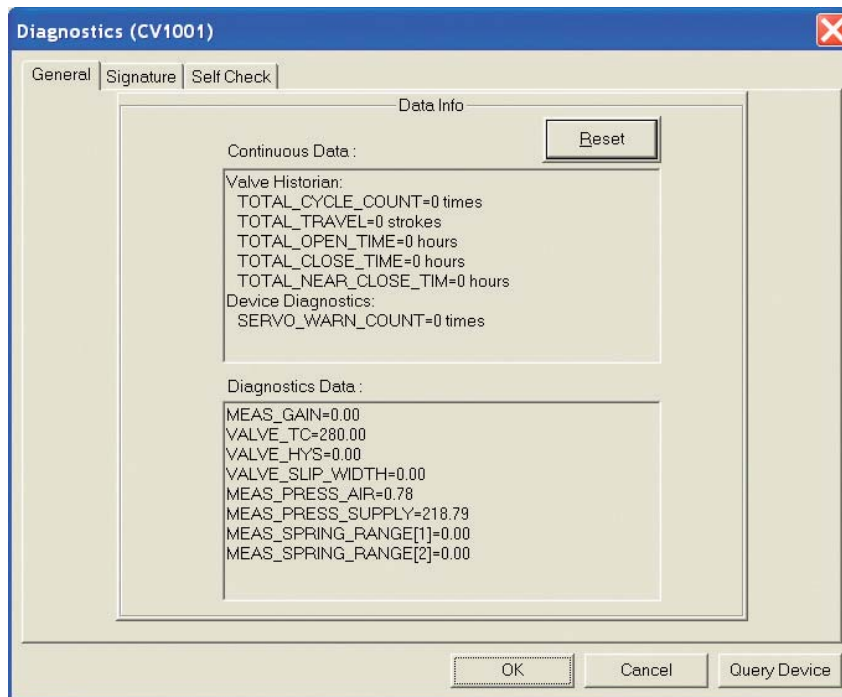


Figure 6.15 General Tab of Diagnostics

6.12 Operation State

The Operation State Dialog controls switching between the block modes. Three types of the state of operation are offered, and modes of each function block are set according to the selected state.



Figure 6.16 Operation State

6.13 Device Query

The General page in Query Device provides access to device data in predefined categories. Simply select the category name from the drop down list box, then press Read to get all the parameter values in the category. For each device, there is a query window available and it is possible to open multiple query windows for multiple positioner devices at the same time. The query window can be run while accessing other windows.

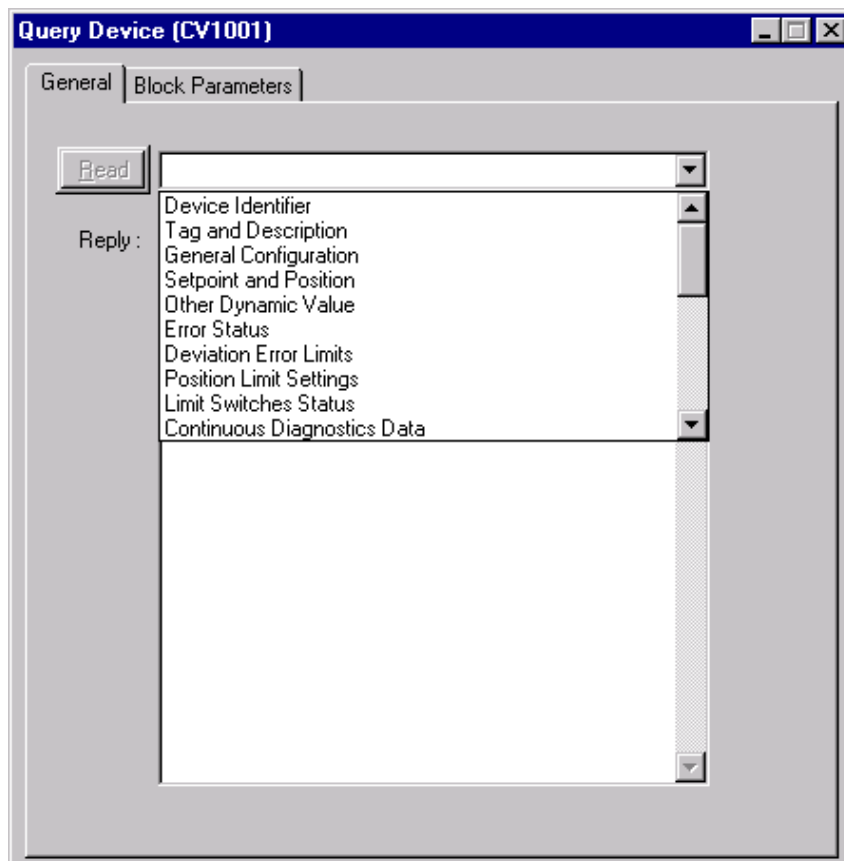


Figure 6.17 Query Device

The two tabs in the Device Query offer quick access to read parameters stored in the YVP. The general tab accesses general data while the Block Parameters present all parameters in each function block.

6.14 PID Control Dialog

The PID Process Controller dialog contains the tools for managing the PID function block. It is composed of frames that group controls and displays. The PID State frame displays and controls the PID states (block modes), the setpoint and process variable, and the Device tagname. In Manual State (M), drag the PID output slider to move the valve. In Local State (L), drag the Setpoint Slider (or enter a value in the Setpoint text box) to change the process variable setpoint. In Cascade (C), and in Remote cascade (R), the setpoint is controlled by a function block or remote application.

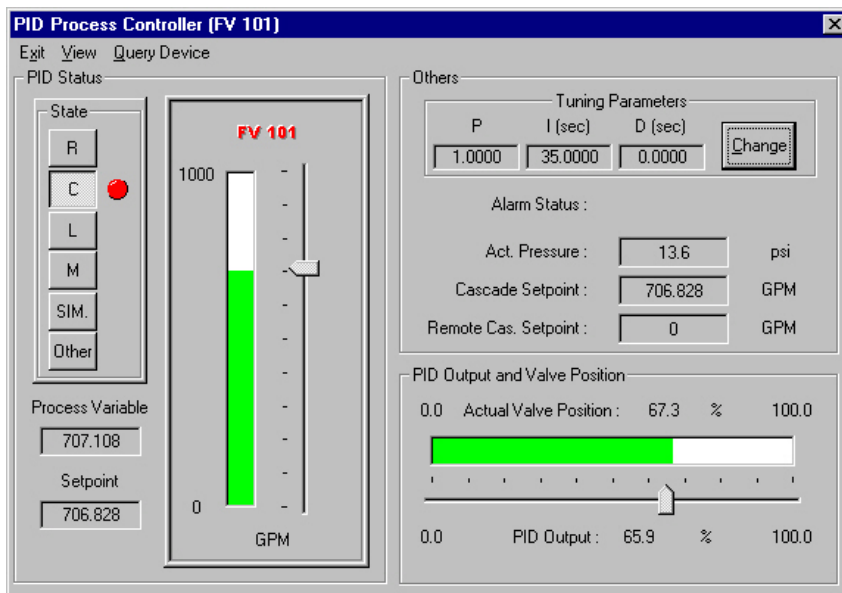


Figure 6.18 PID Process Controller Dialog

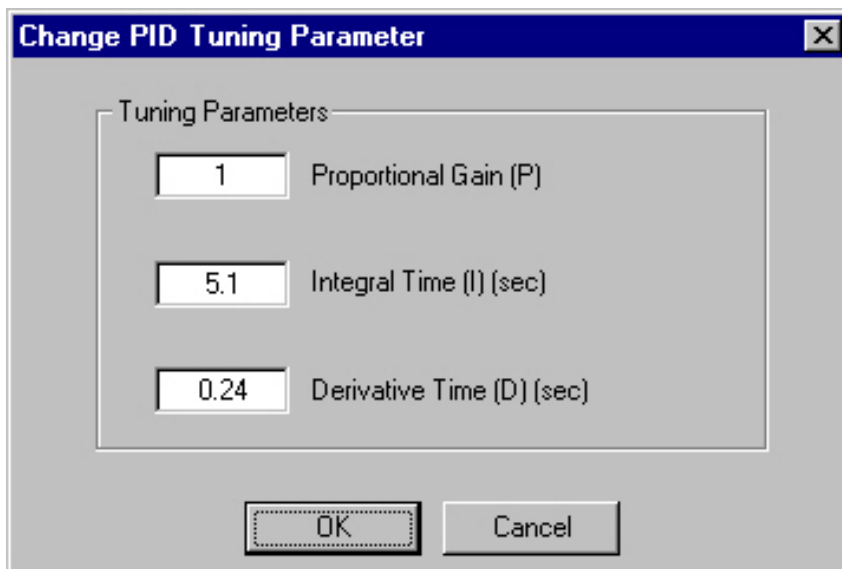


Figure 6.19 Change Tuning Parameters Dialog

6.15 Rescan

Clicking Rescan button or selecting Tools > Re-scan Devices will refresh connections to all working devices on the fieldbus segment. It will close the opened device you will lose control until you have reselected a device. You will be prompted to confirm that a rescan is acceptable.

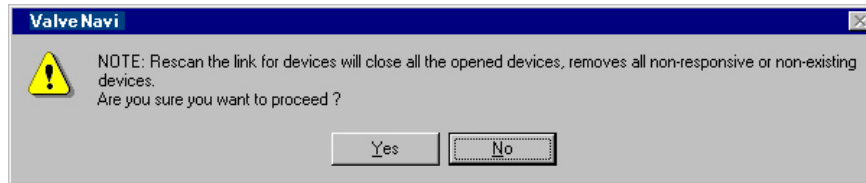


Figure 6.20 Rescan Dialog

6.16 About

Clicking the About icon or selecting Help>About ValveNavi will display the version of ValveNavi and the copyright notice.

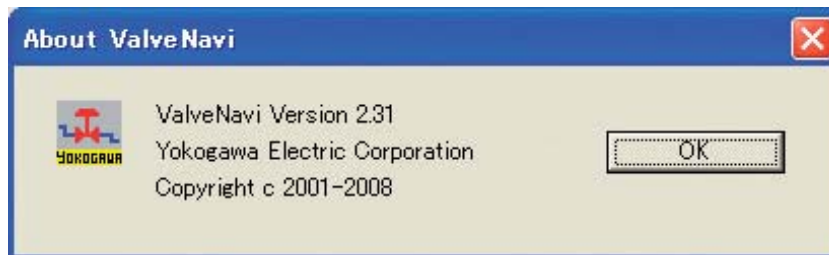


Figure 6.21 About ValveNavi

6.17 Online Help

ValveNavi uses Web based technology for its online help. Click on Help>Help Topics to start your normal browser (Internet Explorer or Netscape navigator).

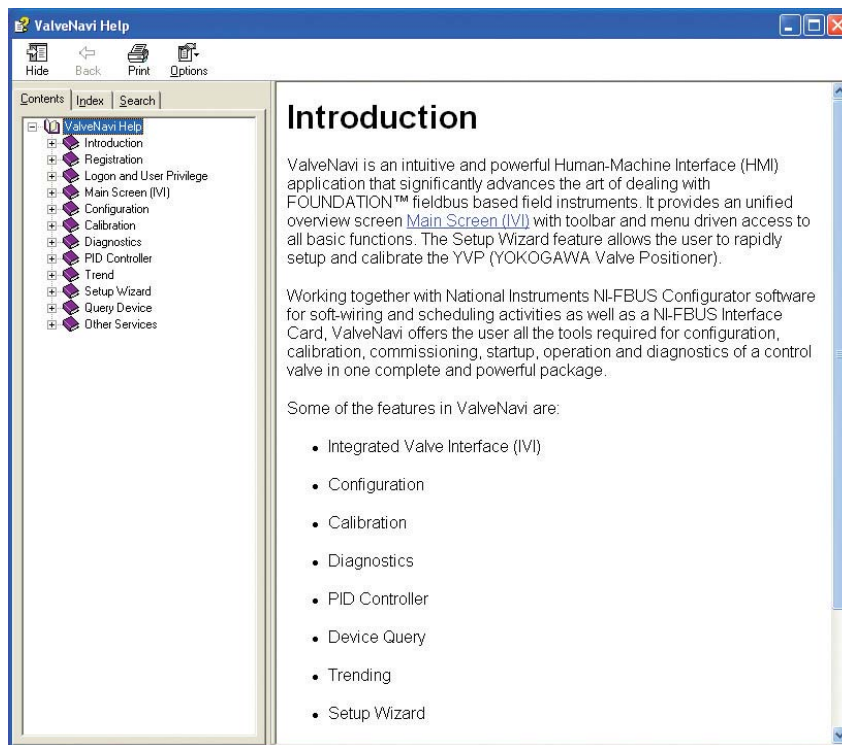


Figure 6.22 Online Help

7. INTEGRATED VALVE INTERFACE (IVI)

The main application screen of ValveNavi is the Integrated Valve Interface (IVI) that is displayed after a successful logon (ValveNavi Logon). It monitors the operation state and status of the valve. It provides access to all other services.

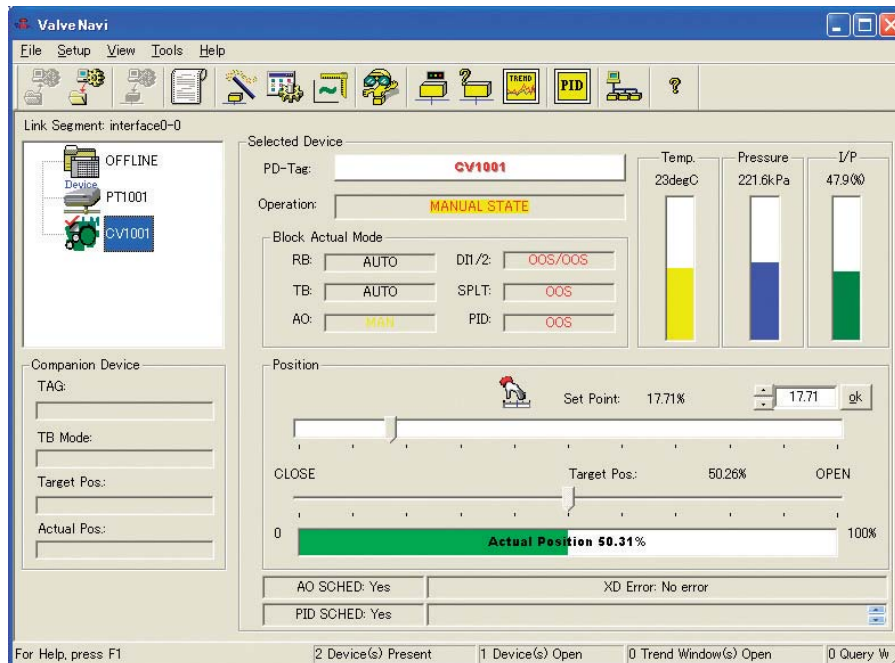


Figure 7.1 IVI

ValveNavi operation begins with the Integrated Valve Interface, IVI. The IVI is a window with a menu bar, a toolbar, a status bar, and frames containing displays and controls for fieldbus data objects. Each of the data objects relates to Foundation fieldbus parameters. The menu and tool bars provide access to services to work with files, devices and blocks. The status bar shows status of the fieldbus segment. The frames are used to group the device list tree, positioner data, Analog Output (AO) Block, and PID scheduling status, and block modes, as well as device tag.

IVI displays all valve and positioner variables and provides access to services such as Setup Wizard, Configuration, Calibration, and Diagnostics tools. The information and controls for services are logically arranged in frames within IVI. From the IVI the user has single click access to the PID Controller interface. IVI displays and updates real time values for valve position, valve setpoint, and actuator pressure, etc.

The IVI offers tools and wizards using standard Windows conventions, offering multiple paths to functions to suit a user's preferences. When the cursor is moved over an icon, a Tool Tip appears to identify the icon's purpose.

Menu items

Menu bar contains File, Setup, View, Tools, and Help menus.

Toolbar icons

Toolbar services are listed below, in the order of the icons shown on the Toolbar. While a function is disabled its icon is “grayed out.”

Table 7.1 Toolbar Icons

Open configuration file		Diagnostics	
Save Configuration file		Change device operation state	
Download configuration		Query device	
Generate a report file		View Trend	
Setup Wizard		PID Process controller	
Configuration management		Rescan the field bus segment	
Calibration management		About ValveNavi version	

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The positioner's tag is shown in the PD Tag field. The current operating state of the positioner is shown the text box. Individual block modes are displayed for each of the positioners internal function blocks. The valve position Set Point is displayed by the graphical position of a slider and numerically to two decimal places. Below the setpoint display, the target position and actual position are shown as a slider and bar respectively, with values shown to two decimal places.

The Target Position is derived from the Set Point signal based on the parameters defined in Configuration Services, as well as the characterization and the configuration of air-to-open or air-to-close. If linear characteristics and air-to-open are configured, without limits, the position setpoint is equal to input signal expressed in percentage. When the configuration is nonlinear with limits, the incoming setpoint and the target position differ because the Analog Output (AO) Block and Transducer (TB) Block re-compute the target to conform.

7.1 Device Selection

All of the devices on the bus segment live list are shown as icons in the Device Selection box. Click on any device to open a communications session with the positioner. The fieldbus segment live list is continuously scanned, and devices are shown when present. Devices that have communications failure are shown with a red X. The selected device is shown with a red checkmark.

When a device is selected, a warning dialog informs that an attempt is made to connect to a new device. Then the Read configuration dialog displays progress uploading device data.

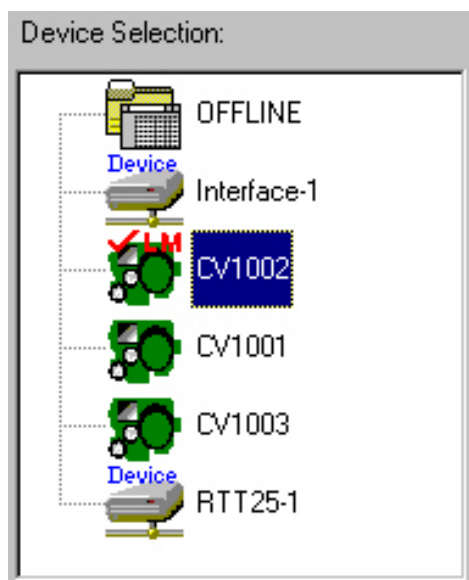


Figure 7.2 Device Selection

If the device has Link Master capability, the device will be shown with the letter 'LM'. When the device is set as a basic device, the letter LM will be shown in red. When the device is set as a Link Master device, the letter LM will be shown in blue.



NOTE

If the AO block is not scheduled, the confirmation dialog is displayed when the IVI display is started to ask whether or not to automatically schedule it with the Offset time to 0 second. Click Yes to automatically schedule it.

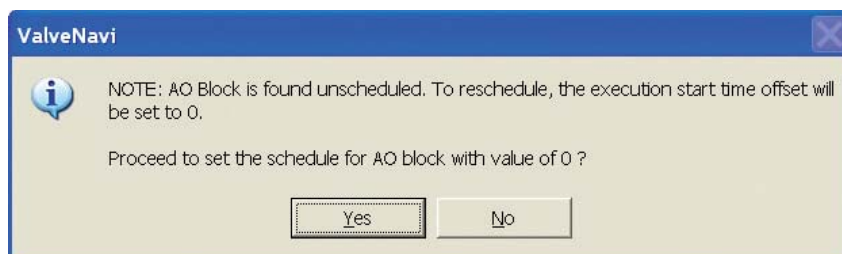


Figure 7.3 AO Block Scheduling Dialog

7.1.1 The Pop-Up Menu In Device Selection

The pop-up menu in device selection offers quick access to services.



Figure 7.4 Device Tree Popup



CAUTION

Do not change Device Tag or Node Address while NI Configurator or other host software with automatic address assigning function is running. All function block linkages will be cleared. These network parameters should be changed only when configuring a positioner independently.

7.1.2 Setting Device as LM or Basic Device

This feature is available only when the opened device has the Link Master(LM) capability.



WARNING

The procedures will reboot the device. Check that the device is isolated from the operating process.

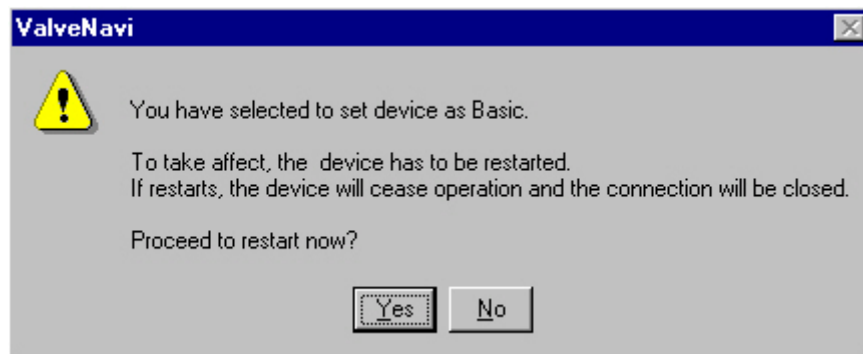


Figure 7.5 Change to Basic Device

Clicking Yes will set device as Link Master or Basic device. This procedure will set the NMIB parameter BootOperatFunctionalClass to LM or Basic first, then restart the device processor.

After the operation successes, the color of the letter 'LM' on the device icon on the device list will change.

7.2 Control Valve Faceplate

7.2.1 Selected Device

The Selected Device Frame provides a dedicated view for the selected device which includes device tag and operation state, blocks actual mode, valve position and setpoint, other status, and other parameters bar graph. It encloses displays and controls for working with the positioner and control valve.

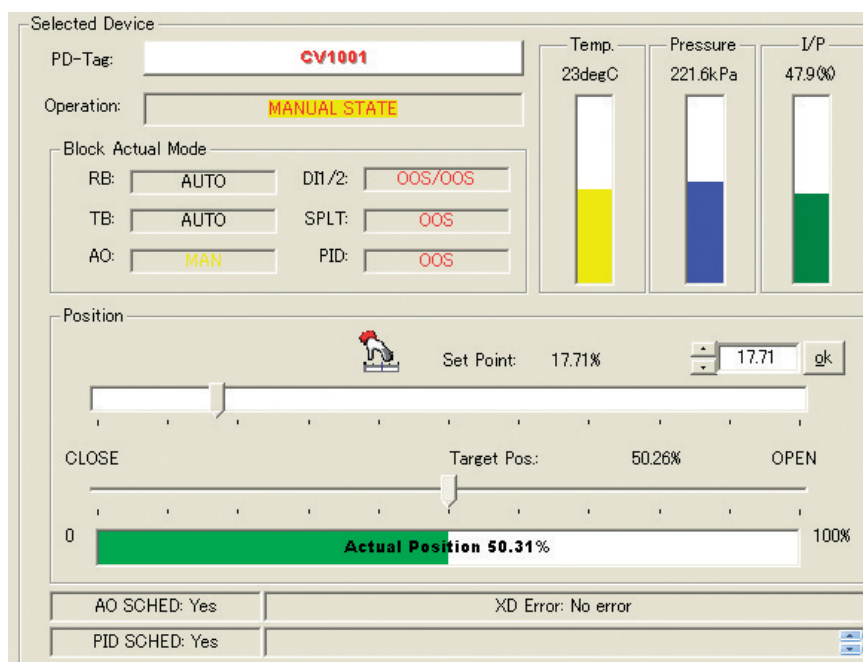


Figure 7.6 Control Valve Faceplate with =% Characteristic

Figure 7.6 shows an example of the control valve faceplate frame in the IVI. The positioner's tag is shown in the PD-Tag field. The current operating state of the positioner is shown in the Operation control button displaying. Individual block modes are displayed for each of the positioners internal function blocks. The valve position Set Point is displayed by the graphical position of a slider control and numerically to two decimal places. Below the setpoint display, the target position and actual position are shown as a pointer and bar respectively, with values shown to two decimal places.

The Target Position is derived from the Set Point signal based on the calibration parameters defined in Calibrate, on the valve characterization and on the configuration of air-to-open or air-to-close as defined in Configure. It is further modified by any limits that may be configured.

Each of the parameters displayed in the control faceplate dialog has a function block and parameter name (shown in the form of BLOCK.PARAMETER). These are listed in Table 7.1.

Table 7.1 IVI Faceplate Parameters

Display parameter	Display type	Parameter name	Remarks
PD-Tag		[PD.TAG]	This indicates the YVP's tag.
Operational State	Active control	Device Operation State may be one of the following: NORMAL (Automatic) MANUAL Out Of Service If no physical device is selected, it displays OFFLINE as the operation state.	A right clicking on this display can change the operation status.
Setpoint Signal		[AO.OUT]	Desired valve position before application of characterization and limits
Target Position	Slider and XX.XX%	TB.FINAL_VALUE	Desired valve position as derived by the FF input value into the YVP.
Valve Position	Bar and XX.XX%	TB.FINAL_POSITION_VALUE	This indicates valve stem or shaft position in percent of ranged travel.
Temperature	Bar and XX deg	TB.ELECT_TEMP	Device environmental temperature [-40, 85] Deg C or [-40, 185] Deg F Color: Yellow
Pressure	Bar and XX.XX Psi	TB.OUT_PRESSURE	YVP output pressure for a Single Acting actuator or output pressure of out1 for a Double Acting actuator. Blue color. Scale = TB.SUPPLY_PRESSURE
I/P	Bar and XX.XX%	TB.SERVO_OUTPUT_SIGNAL	Yellow: [0 to 20] % Green: [20 to 80] % Red: [80 to 100] %
Block modes	Color coded Individual boxes	Block.MODE BLK Block = RB, TB, AO, DI, or PID	AUTO,CAS: Black MAN: Yellow OOS: Red

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7.2.2 Block Actual Mode

The following table lists the supported modes of the valve positioner for each block.

Table 7.2 Block Modes

Block	Supported Modes
Resource	Auto, O/S
Transducer	Auto, O/S
AO	RCas, Cas, Auto, Man, (LO), (IMAN), O/S
DI	Auto, Man, O/S
OS	Cas, Auto, (IMan), O/S
PID	ROut, RCas, Cas, Auto, Man, (LO), (IMAN), O/S

7.2.3 Position

This frame displays the valve position setpoint with the slider and a bargraph. The corresponding target position is displayed with a slider. The actual position is displayed with a bargraph.

7.2.4 Other Status

It displays Analog Output (AO) and PID block schedule status, transducer (XD) Error description, and communication error.

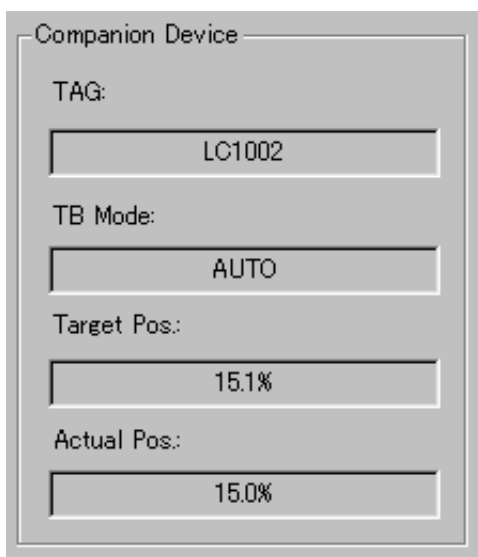
7.2.5 Temperature, Pressure, and I/P Graphs

Internal temperature, output pressure (optional code/BP) and servo output to I/P module are displayed as bargraphs.

Click View > (Bar Name) to toggle the bar on or off.

7.3 Companion Device

The Companion Device frame provides a view of a device which is a companion to the selected device, such as a valve related to the selected valve. To select a companion device, there must be a focus device selected and viewed in the Selected Device frame. Pull down the View menu or right click a non-selected device to access the Select/Deselect as Companion dialog. Currently, the companion device is limited to the YVP.



The image shows a software window titled "Companion Device". Inside the window, there are four labeled input fields, each with a text box containing a value:

- TAG:** The text box contains "LC1002".
- TB Mode:** The text box contains "AUTO".
- Target Pos.:** The text box contains "15.1%".
- Actual Pos.:** The text box contains "15.0%".

Figure 7.7 Companion Device

- **Tag**

The physical device tag of the selected companion device.

- **TB Mode**

The actual mode of TB Block of the selected companion device.

- **Target Position**

The target valve position of the selected companion device.

- **Actual Position**

The actual valve position of the selected companion device.

8. SETUP WIZARD

To install and configure a YVP positioner the Setup Wizard is recommended. It combines basic calibration and tuning functions in a single sequence.

8.1 Introduction to Setup Wizard

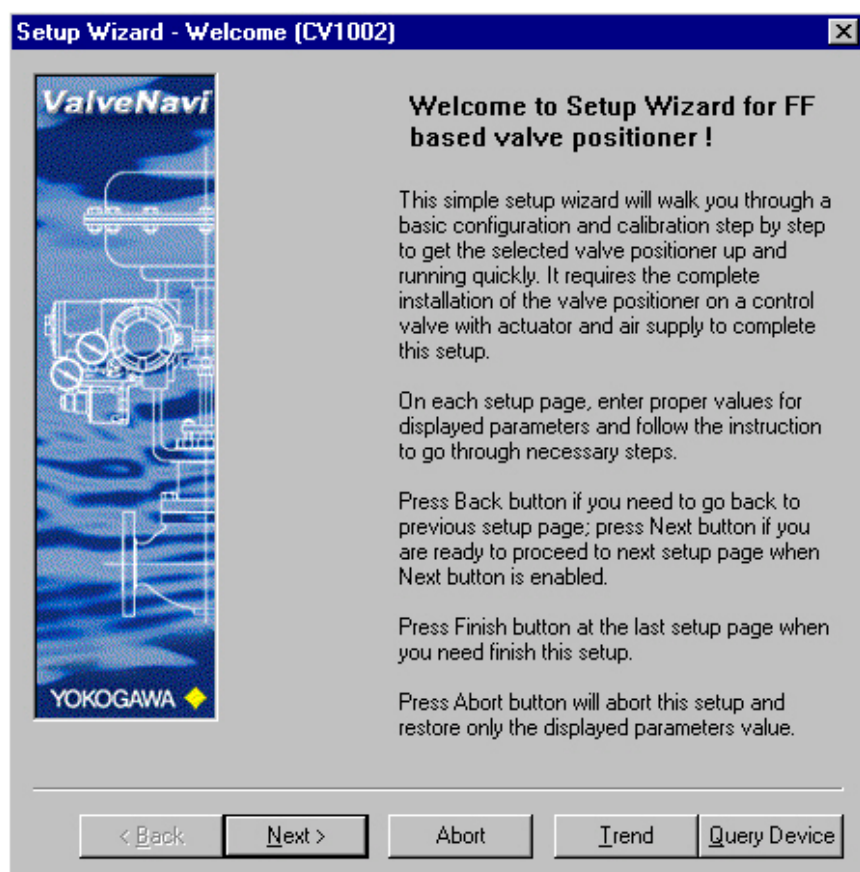


Figure 8.1 Setup Wizard

This setup wizard provides, in a single tool, all the services for setting up a basic valve positioner. It includes a sequence of wizards for basic configuration and basic tuning. It is most useful for first-time setup of the positioner. Follow the step-by-step instructions in five dialogs to complete the basic setup and to start running the valve.

Click Next to begin the setup with the Acuator Wizard.

8.2 Actuator Wizard

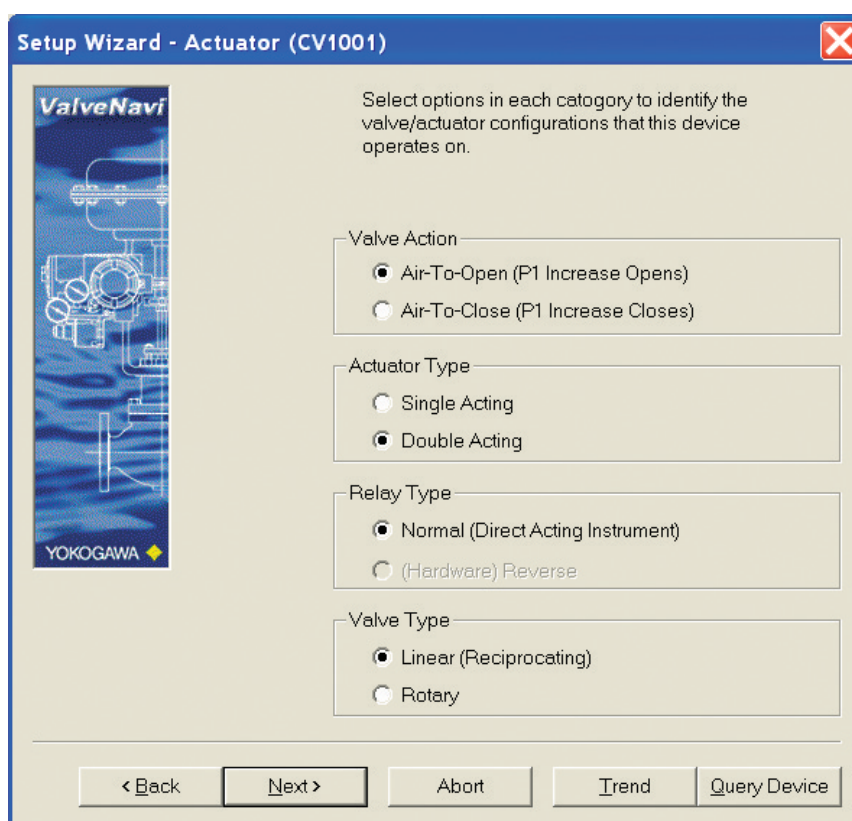


Figure 8.2 Actuator Wizard

In the actuator setup menu select the valve action, actuator type, relay type, and valve type. Then, click Next to begin calibration and tuning.



NOTE

If “linear” is incorrectly selected (when the valve is rotary), there will be large angle span error message. To correct this, you must use the Configuration Services- Actuator dialog followed by the Calibration Services- Tuning dialog.



NOTE

Supply pressure must not exceed the Actuator pressure rating marked on the actuator. Positioner supply pressure should be at least 35 kPa higher than the upper spring range of the valve.

8.3 Tuning Wizard

The positioner will automatically search for the mechanical valve travel limits and tune the valve position PID control algorithm. Click Go to begin. This will take several minutes to complete and will stroke the valve.

If this is not a first time setup of the valve, you may skip this step by clicking the Skip button.



WARNING

Before beginning the Auto or Manual range calibration, confirm that the valve is isolated from the process. This procedure exhausts and then fills the valve actuator to supply pressure and therefore strokes the valve over its full range.

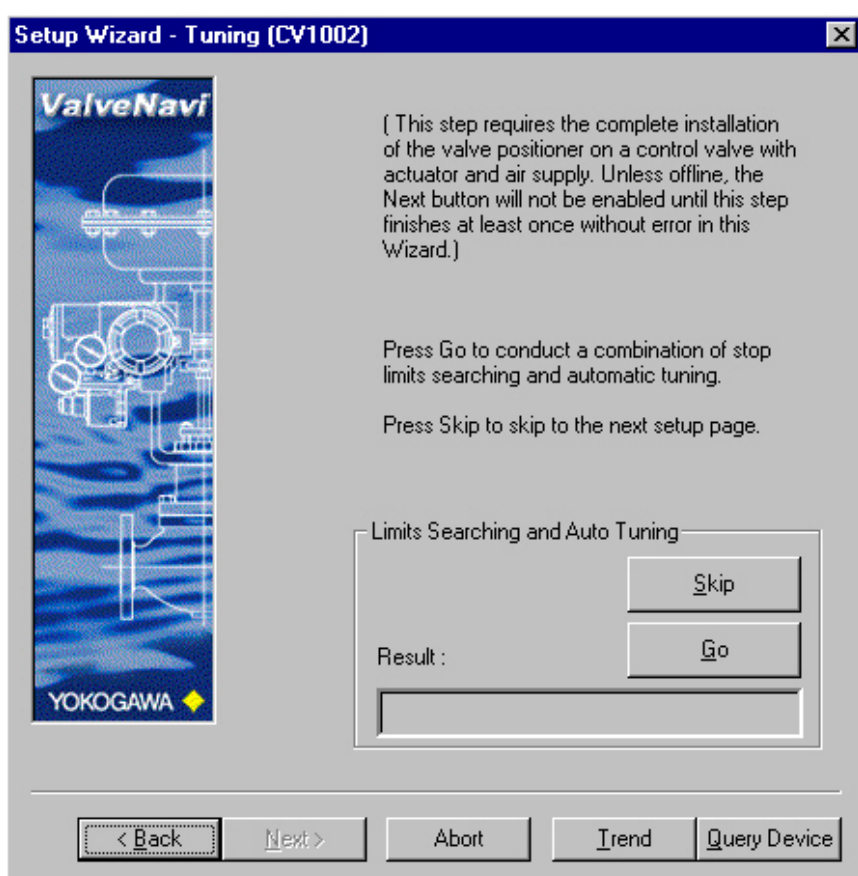


Figure 8.3 Tuning Wizard

The air supply to the valve must be on and set to the correct pressure.



WARNING

Isolate the valve from the process and keep clear of moving parts before using Limit Searching or Autotune.”

If Limit Searching and Auto Tuning is performed successfully, a tuning result dialog will be shown for user's confirmation.

If Accept is clicked, the new servo parameters will apply to the system. Otherwise, the original servo parameters will be restored to the device.

Double acting specific parameters are applicable only for double acting actuator type.

Servo Parameters		Advance Servo Parameters		Double Acting Specific	
Original	Now	Original	Now	Original	Now
120	Gain	18125	1.9	Boost On Threshold 1	1.9
15	I (s)	5	2.9	Boost On Threshold 2	2.9
0.22	D (s)	0.118431	1	Boost Off Threshold 1	1
5	Derivative Gain	5	1	Boost Off Threshold 2	1
0	Dead Zone (%)	0	8	Boost Value 1	12
			10	Boost Value 2	14
			0	Servo I Sleep Limit	0.504547
			0	Servo P Alpha	0
			5	Internal Gain	21897
			55	Servo Offset	490781

To apply new servo parameters, click Accept. To keep original servo parameters, click Not Accept.

Figure 8.4 Tuning Result

When the mechanical limits have been found and the tuning is complete, the result is displayed (Figure 8.5).

Left Dialog: Result: Succeeded

Right Dialog: Result: Failed

Figure 8.5 Tuning Wizard Succeeded or Failed

If the self calibration and autotuning procedures are unsuccessful, there will be messages shown as in Figure 8.6

Left Dialog: Result: Small supply air pressure warning

Right Dialog: Result: Small angle span error

Figure 8.6 Tuning Wizard Error/Warning Messages

8.4 Travel Calibration Wizard

The mechanical stops on some actuators may allow the valve to move beyond its rated travel. The next wizard allows adjustment of the valve travel to correspond to the travel indicator on the actuator. In the example shown the valve has been moved to 100% travel mark on the actuator by trial and error. The YVP positioner indicates that the position corresponding to 100% rated travel is 93.5% of the measured mechanical travel. If this is correct, select the span calibration and click Apply Calibration. Click yes to the confirmation dialog “Are you sure you want to apply travel calibration?” The same method can also be used to adjust the 0% position to correspond to the valve’s actual closed position. It may also be used to correct non-linear travel by adjusting the position at which the valve is 50% open.



Figure 8.7 Travel Calibration Wizard



NOTE

Before running the Travel Calibration Wizard, check that the Tight shut Off and Full Open Features, and the Position Limits are disabled. Click next to see the Position Control limits Wizard (Figure 8.7), then click Back to return to Travel Calibration. If it is necessary to make changes, click next to Finish the Wizard and install the changes. Then, restart the Setup Wizard.

8.5 Position Control limits Wizard

Click next to move to the Position Control Limits Wizard. If it is decided to limit the travel, set the appropriate values here. These values will alter the valve performance. Use them with caution.

The values shown in Figure 8.8 are the initial values to use if there are no special requirements. The parameters are defined below.

Setup Wizard - Position Control Limits (CV1002)

Make desired changes to position control parameters.

Position Limit

10	Tight Shutoff Below (%)
90	Full Open Above (%)
-10	Position Lower Limit (%)
110	Position Upper Limit (%)
3	"Near Closed" Value (%)

Limit Switch Threshold

-10	Threshold Low (%)
110	Threshold High (%)

Fault Control

110	Error Band (%)
10	Time 1 (sec)
-1	Time 2 (sec)

Servo Alarms

< Back Next > Abort Trend Query Device

Figure 8.8 Position Control Limits Wizard

● Position Limit

Tight Shutoff Below

If the valve position setpoint is less than this value, the valve is forced to fully close. A value of -10 removes this function from the normal travel range. Set this between 1 and 3 to minimize seat leakage. There is a dead band.



NOTE

When Tight Shutoff below is configured to a positive value, small flows will not be controllable.

Full Open Above

If the valve position setpoint is more than this value, the valve is forced to fully open. A value of 110 removes this function from the normal travel range.

Position Lower Limit

The valve position setpoint may not be less than this value. This will prevent the valve from closing. Use only when required by the control strategy. A value of -10 removes this function from the normal travel range.

Position Upper Limit

The valve position setpoint may not exceed this value. This will prevent the valve from closing. A value of 110 removes this function from the normal travel range.

“Near Closed” Value

The threshold below which the valve is considered “near closed.” “Near Close” term is useful for estimating when to change the valve trim. This value does not affect valve travel, and it is used only for reporting the time that valve is near the seat.

Set this between Position Lower Limit and Position Upper Limit.

● Limit Switch Threshold

The Limit switch thresholds apply to the DI block setpoints.

Threshold Low

The threshold for the low limit switch that communicated by the DI block.

Threshold High

The threshold for the high limit switch that communicated by the DI block.

● Fault Control

Error Band

The position deviation limit to start deviation timer of Time 1 and Time 2.

Time 1

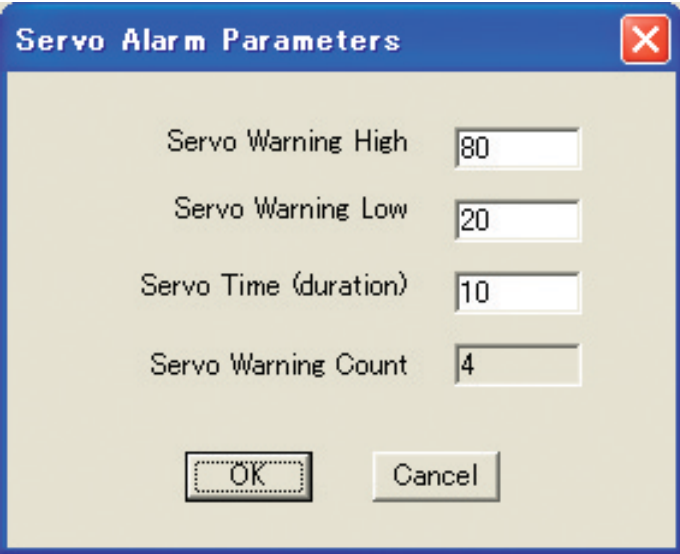
The position deviation time limit to show the block alarm. A negative value turns off this function.

Time 2

The position deviation time limit to trigger the failsafe action. Enter “-1” to disable this function. A negative value turns off this function. Use of the Time 2 failsafe may result in unwanted process shutdowns.

● Servo Alarms (I/P Module Operating Point Fault Control)

This function is applicable only to the device revision 4 or higher (or the device revision 2 or higher when the software download functions are available).



Parameter	Value
Servo Warning High	80
Servo Warning Low	20
Servo Time (duration)	10
Servo Warning Count	4

Figure 8.9 Servo Alarms Setting

Servo Warning High

If the operating point of the I/P module is more than this value, the timer that measures the time after the I/P module operating point error starts.

Servo Warning Low

If the operating point of the I/P module is less than this value, the timer that measures the time after the I/P module operating point error starts. Input a value that is less than that for Servo Warning High.

Servo Time (duration)

If the duration in which the I/P module operating point is out of the range from Servo Warning Low to Servo Warning High reaches this set time, block alarm "Servo output drift warning" is generated. If the duration in which the I/P module operating point is less than 10% or more than 90% of the range reaches this set value, block alarm "Severe servo output drift" is generated. A negative value turns off these I/P module operating point warning detection functions.

Servo Warning Count

Number of times of generation of block alarm "Servo output drift warning."

To reset servo warning count to zero can be performed from General tab of Diagnostics.

8.6 Finish-Setup Wizard

This is the final screen of the Setup Wizard that indicates that the basic setup is valid and that provides a choice of Device Operation State before completing this setup. The Wizard is not completed until the Finish button is pressed.



Figure 8.10 Setup Wizard Finished

9. CONFIGURATION SERVICES

Configuration services provide the tools to read and/or set parameters required for successful communications and control. Each set of tools is grouped in a page with a tab.



CAUTION

Do not turn off power for 60 seconds after writing configuration data. Data may not be saved. See positioner instruction manual.

9.1 Configuration - General

This page of the general configuration of the device includes Device Info, Block Tag Info and device installation options.

Figure9.1 Configure General



WARNING

Do not change Device Tag or Node Address while NI Configurator or other host software is running. These network parameters should be changed only when configuring a positioner connected to a segment that is not controlling a process.

9.1.1 Device Info

● Tag

The physical device tag (PD-Tag). The device tag is defined in Foundation fieldbus as a string of maximum 32 characters. Make sure the tag is unique in the entire control network. When a device is selected, this field is grayed out for read only. Therefore, the access to the device tag change is handled in Main Screen (IVI) by selecting the Setup menu or by right clicking the device icon in Device Selection.

● Node Address

The node address is the address of the physical device on the fieldbus segment. The device address is defined in Foundation Fieldbus as a value between 1 and 255. Make sure the address is unique in the segment. When a device is selected, this field is grayed out for read only. Therefore, the access to the device address change is handled in Main Screen (IVI) by selecting the Tools menu or by right clicking the device icon in Device Selection.

● Device ID

The device ID number consists of manufacturer id number, device number, and device model related number. It is unique in all the devices among manufacturers and read only.

● Manufacturer ID

The 6 digits number of the device manufacturer ID is assigned by the Fieldbus Foundation and is read-only.

● Device Type

The type of the device is read only.

● Device Rev.

The revision of the device is read only.

● D. D. Rev.

The revision of the Device Description is read only.

● Model

The model of the device is read only.

● Descriptor

User may use this field for a description of the device or for memo.

9.1.2 Block Tag Info

Each block is assigned a default tag-name that should be renamed by the user.

- **RB**

The tag of the resource block.

- **TB**

The tag of the transducer block.

- **AO**

The tag of the analog output block.

- **DI1**

The tag of the discrete input 1 block.

- **DI2**

The tag of the discrete input 2 block.

- **PID**

The tag of the PID block.

- **SPLT**

The tag of the output splitter block.

9.1.3 Others Installed

- **PID Block**

Checked when the device PID block is activated. Read only.

- **Pressure Sensor**

Checked when the device pressure sensor is installed. Read only.

- **Link Master**

Checked when the device link master function is equipped. Read only.

- **Signature**

Checked when the device signature option (/BP) is installed. Read only.

9.2 Configuration - Position

This is the setup page for the valve position configuration parameters in Transducer (TB) block.

9.2.1 Servo Parameters

The servo parameters are normally set by autotuning in Tuning of Calibration. They determine dynamic response of the valve position control.

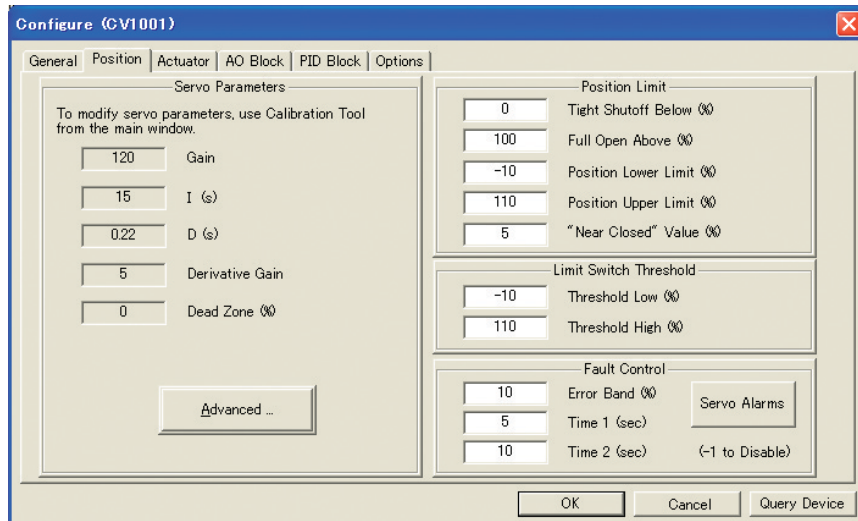


Figure 9.2 Configure Position

9.2.2 Position Limit

The Position Limits frame provides parameters that allow you to limit the valve, to force the valve to close tightly or open fully at specified positions, to set the trip points of the limit switches (DI Block). You can also activate a warning when a deviation lasts longer than the Time 1 or to force the valve to its failsafe position if the deviation lasts longer than time 2.

Since there is a dead zone of 1%, Tight Shut Off is disabled if the valve position setpoint is 1% more than this value.



WARNING

Position Limit parameters are powerful tools to alter the valve performance to be non-linear. Use them with caution and only when the process requires special performance

● Tight Shutoff Below

If the valve target position is less than this value, the valve is forced to fully close. A value of -10 removes this function from the normal travel range, unless the calibration of valve travel has been adjusted. Set this between 1 and 3 to minimize seat leakage. There is a dead band.

Since there is a dead zone of 1%, Full Open Above is disabled if the valve position setpoint is 1% less than this value.



CAUTION

When Tight Shutoff below is configured to a positive value, small flows will not be controllable.

● Full Open Above

If the valve target position is more than this value, the valve is forced to fully open. A value of 110 removes this function from the normal travel range.



WARNING

Use of Full Open Above at values less than 110 may result in rapid increase in flow rate if input reaches this value. Use with extreme caution.

● Position Lower Limit

The valve target position may not be less than this value. This will prevent the valve from closing. Use only when required by the control strategy. A value of -10 removes this function from the normal travel range.

● Position Upper Limit

The valve target position may not exceed this value. This will prevent the valve from closing. A value of 110 removes this function from the normal travel range.

● “Near Closed” Value

The threshold below which the valve is considered “near closed.” “Near Close” term is useful for estimating when to change the valve trim. This value does not affect valve travel. It is used only for reporting the time that valve is near the seat.

9.2.3 Limit Switch Threshold

The Limit switch thresholds apply to the Discrete Input (DI) block setpoints.

- **Threshold Low**

The threshold for the low limit switch that communicated by the DI block.

- **Threshold High**

The threshold for the high limit switch that communicated by the DI block.

9.2.4 Fault Control

- **Error Band**

The position deviation limit to start deviation timer of Time 1 and Time 2.
Set this value to a value that is exceeded only in abnormal performance.

- **Time 1**

The position deviation time limit to show the block alarm. A negative value turns off this function. Set this value greater than the stroking time.

- **Time 2**

The position deviation time limit to trigger the failsafe action. Enter “-1” to disable this function. A negative value turns off this function. Use of the Time 2 failsafe may result in unwanted process shutdowns.



WARNING

Use the Time 2 failsafe only for a critical process that must be forced into its failsafe position if the valve is unable to respond to its position setpoint after a reasonable time delay. Do not set the error band to a value that is too small. If Time 2 is used, it must be longer than the valve stroking time. A Time 2 value that is too small will result in nuisance failsafe behavior.

9.2.5 Servo Alarms (I/P Module Operating Point Fault Control)

This function is applicable only to the device revision 4 or higher (or the device revision 2 or higher when the software download functions are available).

- **Servo Warning High**

If the operating point of the I/P module is more than this value, the timer that measures the time after the I/P module operating point error starts.

- **Servo Warning Low**

If the operating point of the I/P module is less than this value, the timer that measures the time after the I/P module operating point error starts. Input a value that is the same as or less than that for Servo Warning High.

● Servo Time (duration)

If the duration in which the I/P module operating point is out of the range from Servo Warning Low to Servo Warning High reaches this set time, block alarm “Servo output drift warning” is generated. If the duration in which the I/P module operating point is less than 10% or more than 90% reaches this set value, block alarm “Severe servo output drift” is generated. A negative value turns off these I/P module operating point warning detection functions.

● Servo Warning Count

Number of times of generation of block alarm “Servo output drift warning.”

To reset servo warning count to zero can be performed from General tab of Diagnostics.

9.2.6 Advanced

Refer to Advanced Position.

9.2.7 Configuration - Advanced Position

This is the page for advanced position control parameters configuration contained in Transducer (TB) block. It is intended for technician use only. It lists here as read only. To modify the value of any parameter, go to Calibrate Advanced Position.

Advanced Servo Tuning Parameters		Double-Acting Specific	
1.9	Boost On Threshold 1	0	X Boost On Threshold 1
2.9	Boost On Threshold 2	0	X Boost On Threshold 2
1	Boost Off Threshold 1	0	X Boost Off Threshold 1
1	Boost Off Threshold 2	0	X Boost Off Threshold 2
8	Boost Value 1	0	X Boost Value 1
10	Boost Value 2	0	X Boost Value 2
0	Servo I Sleep Limit		
0	Servo P Alpha		
5	Internal Gain		
55	Servo Offset		

Figure 9.3 Advanced Servo Tuning Parameters

9.3 Configuration - Actuator

This is the setup page related to the valve actuator and diagnostics limit information contained in Transducer(TB) block.

Figure 9.4 Configuration - Actuators

9.3.1 Valve Action

This is the ACT_FAIL ACTION parameter.

- **Air To Open**

It specifies the final failure position of the actuator as air-to-open.

- **Air To Close**

It specifies the actuator as air-to-close.

9.3.2 Actuator Type

This is the ACTUATOR TYPE parameter.

- **Single Acting**

It specifies the actuator as single acting type.

- **Double Acting**

It specifies the actuator as double acting type.

9.3.3 Relay Type

This is the RELAY TYPE parameter.

- **Normal (Direct Acting Instrument)**

It specifies the control relay as normal type.

- **(Hardware) Reverse**

It specifies the control relay as reverse type. This parameter is currently not available.

9.3.4 Valve Type

This is the VALVE TYPE parameter.

- **Linear (Reciprocating)**

It specifies the valve as linear (reciprocating) type.

- **Rotary**

It specifies the valve as rotary type.

9.3.5 Continuous Data Limit

The following diagnostic parameters may be set to values useful to notify if service may be needed. The maximum (default) value for each of the continuous data limits is 2^{32} (4294967295). Enter realistic values that represent useful maintenance life values.

- **Travel Limit (strokes)**

The total travel limit to show the block alarm.

- **Cycle Count Limit (times)**

The total cycle count limit to show the block alarm.

- **Open Time Limit (hours)**

The total valve open time limit to show the block alarm.

- **Close Time Limit (hours)**

The total valve close time limit to show the block alarm.

- **Near Close Time Limit (hours)**

The total valve near close time limit to show the block alarm.

9.3.6 Model And Serial Number of Valve

The items in this section can be set and modified by users as a record of the information related with the valve.

- **Valve Manufacture**

The valve manufacturer's identification number as defined by the Fieldbus Foundation.

- **Valve Model**

The valve model number.

- **Valve S/N**

The valve serial number.

- **Act. Manufacture**

The actuator manufacturer's identification number as defined by the Fieldbus Foundation.

- **Actuator Model**

The actuator model number.

- **Actuator S/N**

The actuator serial number.

9.4 Configuration - AO Block

This is the setup page related to the setpoint that is received from another function block or a remote application. And I/O option contained in Analog Output (AO) Block.

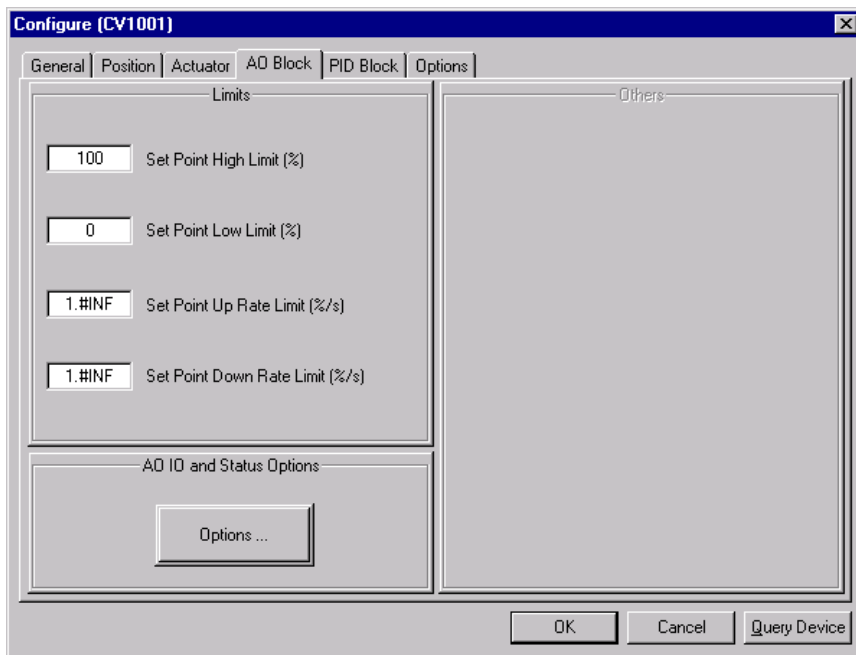


Figure 9.5 Configuration - AO Block

9.4.1 Limits

- **Setpoint High Limit (%)**

Use this to limit the setpoint from another function block or remote application.

- **Setpoint Low Limit (%)**

Use this to limit the setpoint from another function block or remote application.

- **Setpoint Rate High Limit (%/s)**

The setpoint from another function block or remote application may also be limited to change at a configurable ramp rate. The ramp rate up and the ramp rate down may be individually configured. The default value is 1.#INF (infinity) which eliminates ramp rate limiting.

- **Setpoint Rate Low Limit (%/s)**

See Set Point Up Rate Limit (%/s)



NOTE

The AO Block setpoint limits are different from the Position limits configured in the Configure Position tab. The Position Limits apply to Target Position.

9.4.2 Configuration - AO Block Options

This setup page consists of both I/O Options and Status Options for the AO block. For each parameter, it is enabled/disabled if it is checked/unchecked. IO_OPTS and STATUS_OPTS are parameters that control options about the AO block's signal processing and mode transitions.

● SP Tracks PV if Man

Permits the setpoint to track the process variable when the target mode of the block is Man.

● SP Tracks PV if LO

Permits the setpoint to track the process variable when the actual mode of the block is LO.

● SP Tracks RCas or Cas if LO or Man (SP Track retained target)

In LO mode, SP is set to RCAS IN if target mode is Rcas. SP is set to CAS IN if target mode is Cas.

● Increase to close

Indicates whether the output value should be inverted before it is communicated to the I/O channel of the TB. Inverts the SP signal before passing it to OUT.

● Fault State type

The output action to take when a fault occurs. (uncheck to freeze, check to go to a preset value). The initial preset value is 0. To change this parameter, use a configurator to change FSTATE _VALUE in the AO block. Zero (0) is recommended for an air-to-open actuator and 100 is recommended for an air to close actuator.

● Fault State restart

At a restart uses the same value that is preset for fault state type .

● Target to Man (if Fault State activated)

Set the target mode to Man, thus losing the original target, if Fault State is activated. This latches an output block into the manual mode. Sets the target mode to Man upon activation of the fault state.

● (Use) PV for BKCAL OUT

The BKCAL OUT value is normally the working SP. This option changes it to the PV. Sets the value of PV in BKCAL OUT and RCAS OUT.

AO Status Options

● Propagate Fail Bkwd (Fault Backward)

Controls the handling of the value, data status and related alarm of BKCAL OUT and RCAS OUT.

When this option is selected, then the quality of the status of BKCAL OUT is set to Bad and its sub-status is set to sensor failure. The BKCAL OUT value is not affected. The AO block does not alarm (but enables an upstream block to alarm).

When this option is not selected, then the quality of BKCAL OUT is set to Bad and its sub-status is set to non-specific. A block alarm is generated by the AO block.

9.5 Configuration - PID Block

This is the setup page for the PID process controller configuration parameters mainly in PID block.

Figure 9.6 Configure PID block

9.5.1 PID Parameters

- **Proportional Gain**

Dimensionless value used by PID block algorithm in calculating the block output.

- **Integral Time**

The integral time constant, in second per repeat.

- **Derivative Time**

The derivative time constant, in second.

- **FF Gain**

The gain that is applied to an optional feed-forward input before it is added to the calculated control output.

- **FF Value (Manual Reset Bias)**

The optional feed-forward value.

9.5.2 Limits

- **Set Point High Limit**

The highest value that is allowed for the PID set point.

- **Set Point Low Limit**

The lowest value that is allowed for the PID set point.

- **Output High Limit**

The limit for the maximum PID output value.

- **Output Low Limit**

The limit for the minimum PID output value.

- **Deviation Alarm High Limit**

This is the parameter in PID block called DV_HI_LIM. It is the setting of the high deviation alarm limit.

- **Deviation Alarm Low Limit**

This is the parameter in PID block called DV_LO_LIM. It is the setting of the low deviation alarm limit.

- **High Alarm Limit**

This is the parameter in PID block called HI_LIM. It is the setting of the high alarm.

- **Low Alarm Limit**

This is the parameter in PID block called LO_LIM. It is the setting of the low alarm.

- **High/High Alarm**

This is the parameter in PID block called HI_HI_LIM. It is the setting of the high high alarm.

- **Low/Low Alarm**

This is the parameter in PID block called LO_LO_LIM. It is the setting of the low low alarm.

9.5.3 PV Scale

● Units

The engineering units code used for PID process variable.

● Upper Range (EU100)

Upper limit value

● Lower Range (EU0)

Lower limit value

9.5.4 Configuration - PID Options

This setup page consists of both Control Options and Status Options for PID block. For each parameter, it is enabled/disabled if it is checked/unchecked.

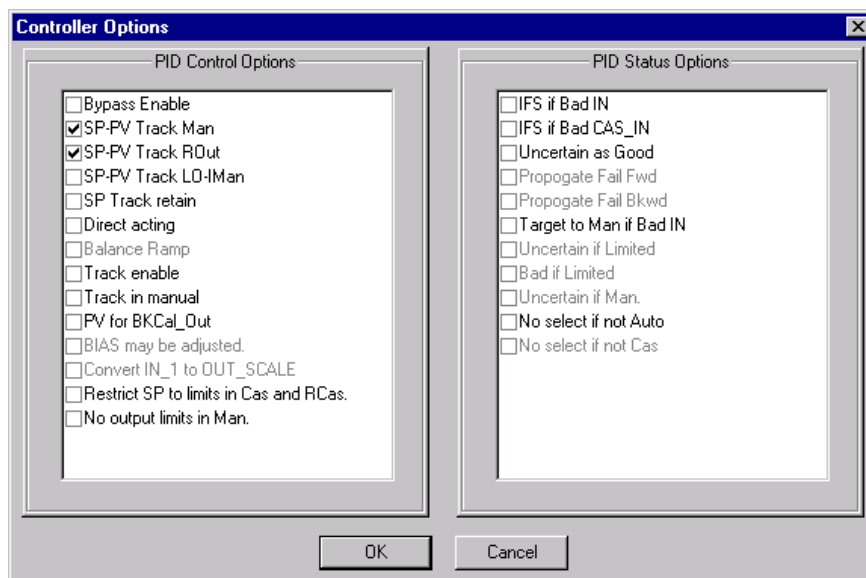


Figure 9.7 PID Control and Status Options

● PID Control and Status Options

Bypass Enable

The normal control algorithm may be bypassed through the BYPASS parameter. When bypass is set, the setpoint value (in percent) will be directly transferred to the output. To prevent a bump on transfer to/from bypass, the setpoint will automatically be initialized to the output value or process variable, respectively, and the path broken flag will be set for one execution. BYPASS is not permitted unless the BYPASS ENABLED option is set.

SP-PV Track in Man

Permits the setpoint to track the process variable when the target mode of the block is Man.

SP-PV Track in ROut

Permits the setpoint to track the process variable when the actual mode of the block is ROut.

SP-PV Track in LO or IMan

Permits the setpoint to track the process variable when the actual mode of the block is LO or IMan.

SP Track retained target

Permits the setpoint to track the RCas or Cas parameter based on the retained target mode when the actual mode of the block is IMan, LO, Man, or ROut. When SP-PV track options are enabled, then SP Track retained target will have precedence in the selection of the value to track when the actual mode is Man, IMan, Rout, and LO.

Direct Acting

Defines the relationship between a change in PV and corresponding change in output. When Direct is selected, an increase in PV results in an increase in the output.

Track Enable

This enables the external tracking function. If true, the value in TRK_VAL will replace the value of OUT if TRK_IN_D becomes true and the target mode is not Man.

Track in Manual

This enables TRK_VAL to replace the value of OUT when the target mode is Man and TRK_IN_D is true. The actual mode will then be LO.

Use PV for BKCAL OUT

The BKCAL OUT and RCAS OUT values are normally the working SP. If this option is enabled, then the PV value will be used after the cascade is closed.

Restrict (Obey) SP limits if Cas or RCas

Normally the setpoint will not be restricted to the setpoint limits except when entered by a human interface device. However, if this option is selected, the setpoint will be restricted to the setpoint absolute limits in the Cas and RCas modes.

No OUT limits in Manual

Do not apply OUT_HI_LIM or OUT_LO_LIM when target and actual modes are Man. Trust the operator to do the right thing.

● PID Status Options**IFS if BAD IN**

Set Initiate Fault State status in the OUT parameter if the status of the IN parameter is BAD.

IFS if BAD CAS IN

Set Initiate Fault State status in the OUT parameter if the status of the CAS_IN parameter is BAD.

Use Uncertain as Good

If the status of the IN parameter is Uncertain, treat it as Good. Otherwise, treat it as BAD.

Target to Manual if BAD IN

Set the target mode to Man if the status of the IN parameter is BAD. This latches a PID block into the Man state if the input ever goes bad.

No Select if not auto (Target to next permitted mode if BAD CAS IN)

Sets the target mode to next permitted mode if the target mode is CAS and the status of CAS_IN falls to BAD.

9.6 Configuration - Options

This is the setup page for other configuration settings including characterization, pressure range and units, bumpless transfer, display language, and temperature units.

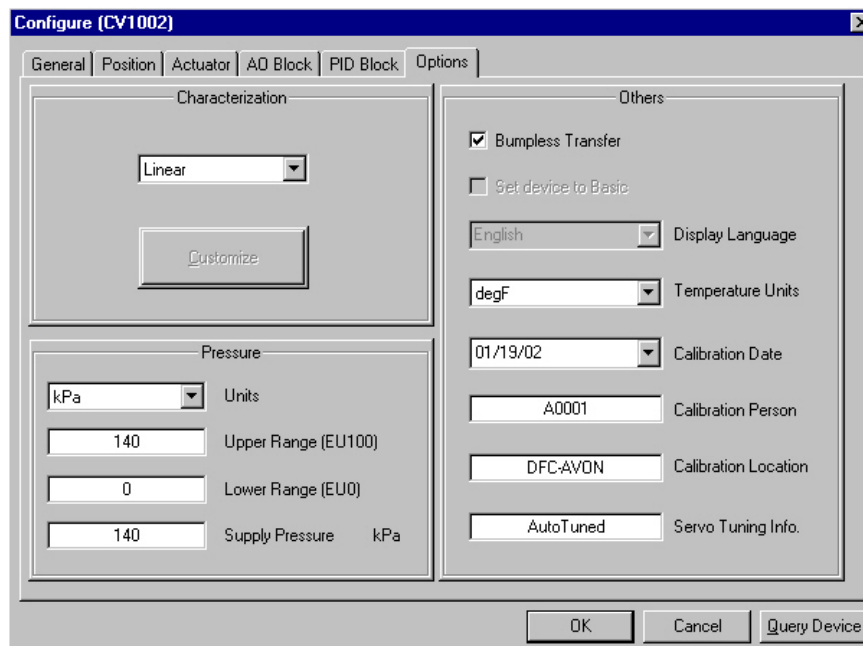


Figure 9.8 Configuration - Options

9.6.1 Characterization Frame

The positioner is supplied with a choice of characteristics that modify the characteristic built into the plug and actuator. Choose a characteristic that works with the control valve's inherent characteristic to provide a desired overall installed characteristic. Avoid the common mistake of choosing an Equal Percent characteristic in the positioner if the valve has an Equal Percent characteristic built into the plug.

Possible choices are: linear, equal percent (50:1), equal percent (30:1), quick open, camflex percentage or (custom) define.

- **Linear**

The valve position is proportional to the input to YVP positioner.

- **Equal Percent (50)**

Equal percentage with rangeability of 50 to 1. For equal increments of the input, the valve position has equal percentage changes of current valve position.

- **Equal Percent (30)**

Equal percentage with rangeability of 30 to 1. For equal increments of the input, the valve position has equal percentage changes of current valve position.

- **Quick Opening**

The quick opening characterization is the inverse to the Equal Percentage (50) characterization curve.

● Camflex Percentage

This function is used to equalize the flow rate characteristic with the Equal Percent characterization feature that is provided by mechanical positioners from Masoneilan.

● Define

A custom characterization defines the relationship between the input signal and the output position of the valve. Selecting this option will display an additional window where you can configure a characterization curve with 10 adjustable segments to fit your needs. The curve can have up to 9 adjustable points and points in between are linearly interpolated.

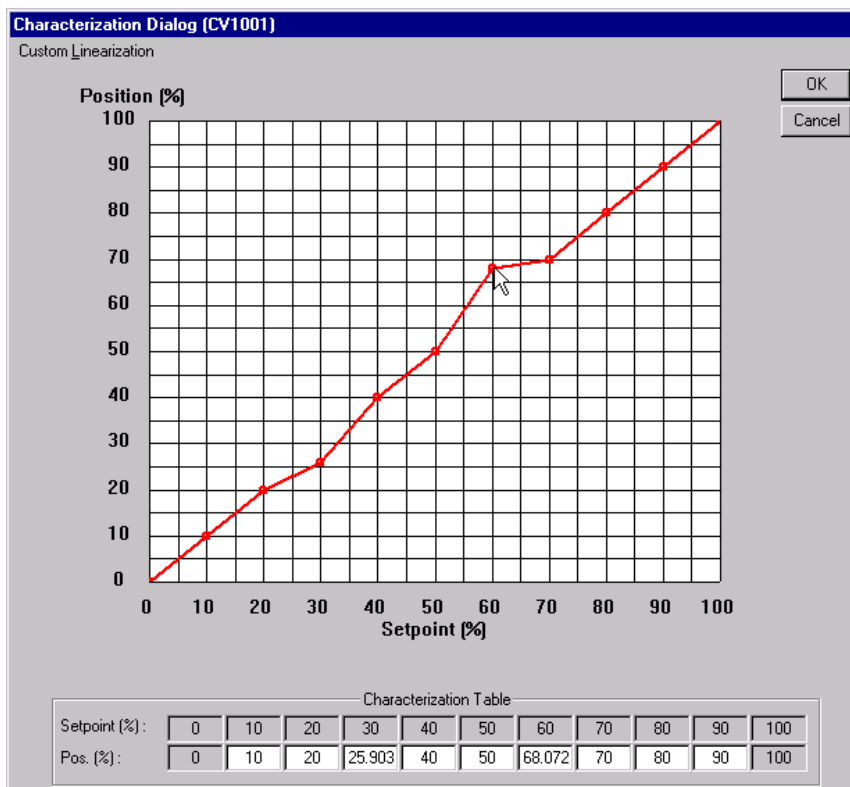


Figure 9.9 Custom Characterization Dialog

● Custom Characterization Dialog

The Characterization Dialog lets the user define his own characterization. There are 9 definable points for the valve position at 10% increments of position setpoint. Use the mouse to drag the points on the curve or enter numerical values in the table to define the characterization.

To configure a custom characteristic curve, enter the values in the edit boxes at the bottom of the screen and press the Tab key. The graph is updated when the value is entered.

Alternatively, change the shape of the curve by clicking a point, holding the left mouse button down, and dragging the cursor to a new position before releasing the mouse button.

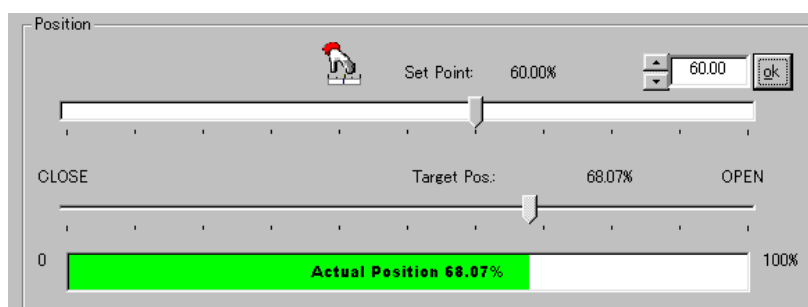


Figure 9.10 Display mismatch for non-linear characteristic

After configuring the curve, click the OK button to accept the value and exit the Characterization dialog, and click the OK button of Configure dialog, or click the Cancel button to exit without changing the values. To prevent a user from entering unreasonable points, ValveNavi will check the curve based on established rules and pop up a warning message when the curve does not meet the rules. The characteristic points are saved in YVP with a resolution of five digits.

The unfinished curve in Figure 9.9 illustrates that the curve must be monotonic. (Each point must be greater than the previous point.) To smoothly blend a point between its adjacent points, right click the point. For all non-linear characteristics the set point will differ from the target position.

Click OK to accept the custom characteristic.



NOTE

When the characteristic is linear, the displays of position setpoint and target valve position will all match. For all other (non-linear) characteristics the valve target position will differ from the setpoint. See Figure 9.10

● Custom Linearization Dialog

Select the Custom Linearization menu item in the Characterization Dialog to display the Custom Linearization dialog (Figure 9.11).

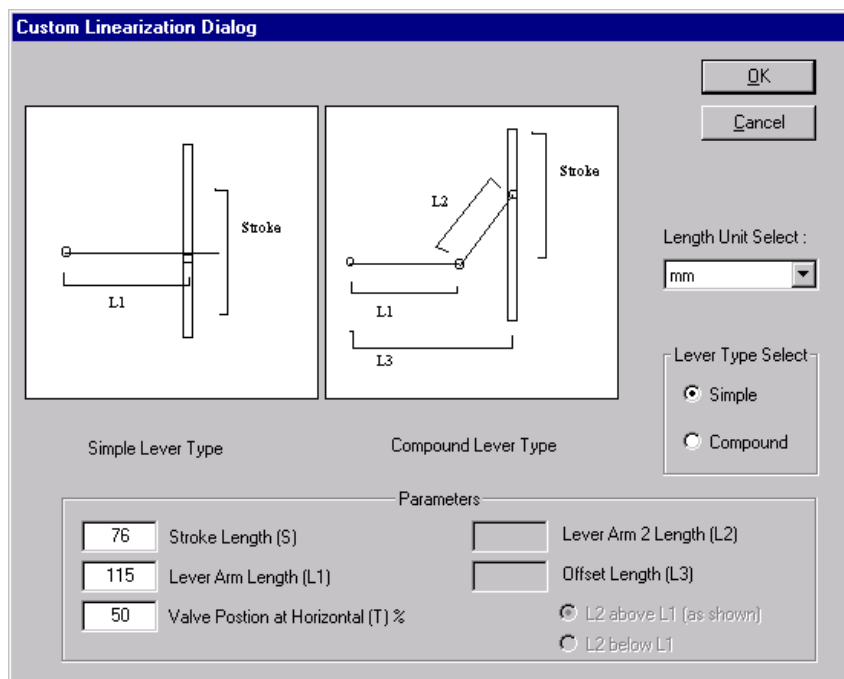


Figure 9.11 Custom Linearization Dialog

A custom linearization method built into ValveNavi can be used to correct non-linearity. The method automatically generates a custom characterization that matches the specific linkage used. Custom characterization must be the selected configuration option to use the generated curve. This option is selected automatically when the user clicks OK to accept the displayed curve.

A custom linearization cannot be used in combination with the equal percentage or quick opening characteristics. If a non-linearity correction and equal percentage or quick opening characteristics are both required, use the non-linearity correction in Calibration>Travel Calibration dialog and adjust the 50% point.

To configure custom linearization, click the Custom Linearization button. The Custom Linearization window will appear.

Two types of linkages are modeled: simple and compound. Most linkages use the compound linkage system.



NOTE

Custom Linearization uses the same data as Custom Characterization. Therefore, only one of these configuration options may be used at any one time. Any custom characterization data will be discarded when Custom Linearization is used.

Simple Lever

The simple lever has the pivot point (the position sensor in the YVP) mounted a fixed distance (L1) from the valve stem pickup point. In order to compute the proper correction curve, the stroke length, the distance from the pivot to the valve stem pickup point and the valve position at horizontal must be entered.

Compound Lever

The compound linkage has Lever1 attached at one end to the pivot (the position sensor in the YVP) and at the other end to Link L2. In order to compute the proper correction curve, the user must enter the stroke length, first lever segment length (L1), second lever segment length (L2), the distance from the pivot to the valve stem pickup (L3), and the valve position at horizontal. Most linkages use a linkage with L3 equal to L1, i.e. the second lever arm is vertical when the first lever arm is horizontal. The correction computation will correctly compute the correction curve when L3 is not equal to L1. However, L3 must be greater than 0, which requires that the valve stem pickup not be lined up with the pivot and that the pickup be on the same side of the pivot as the link between the first and second lever.

Click OK to compute the correction and display the curve. A Dialog will appear to show the angle the linkage will move.

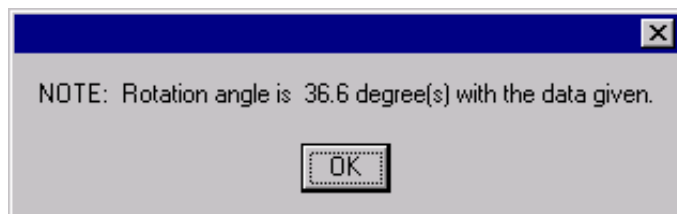


Figure 9.12 Rotation Angle Message

The (custom) define characterization must be the selected configuration option to use the generated curve. Click OK to accept the displayed curve.

9.6.2 Pressure Frame

- **Pressure Units**

This is the unit code in TB_SPRING_RANGE parameter which affects output pressure unit code as well. However, it has no effect in controlling function.

- **Pressure Upper Range (EU100)**

This is EU100 of SPRING_RANGE of TB parameter for upper end engineering unit value.

- **Pressure Lower Range (EU0)**

This is EU0 of SPRING_RANGE of TB parameter for lower end engineering unit value.

- **Supply Pressure**

This is the supply pressure in engineering units specified in SPRING_RANGE parameter. It is for information only and has no effect on control.

9.6.3 Others Frame

- **Bumpless Transfer**

When this option is selected, returning from manual to normal operation state is deferred until the current valve position and the position setpoint match. This is to assure the smooth valve position transition when switching the operation state to avoid a process disturbance.

For most Foundation fieldbus installations, the initialization function built into the function blocks will handle bumpless transfer. Leave the box unchecked unless there is a special requirement.

- **Display Language**

It is currently unused.

- **Temperature Units**

This is the temperature unit used in the device which has choice of either degC or degF.

10. CALIBRATION SERVICES

Calibration Services provide tools to set valve stroke, and to tune the dynamic parameters for control of position. Each set of tools is grouped in a tab.

10.1 Calibration - Range

To calibrate the position sensor to match the actual valve travel, use the Auto Stop Limits or the Manual Stop Limits function to search for the mechanical stop limits of the valve.

To check if the calibration is done properly, move the valve to the stops in the Main Screen (IVI) in manual operating state.

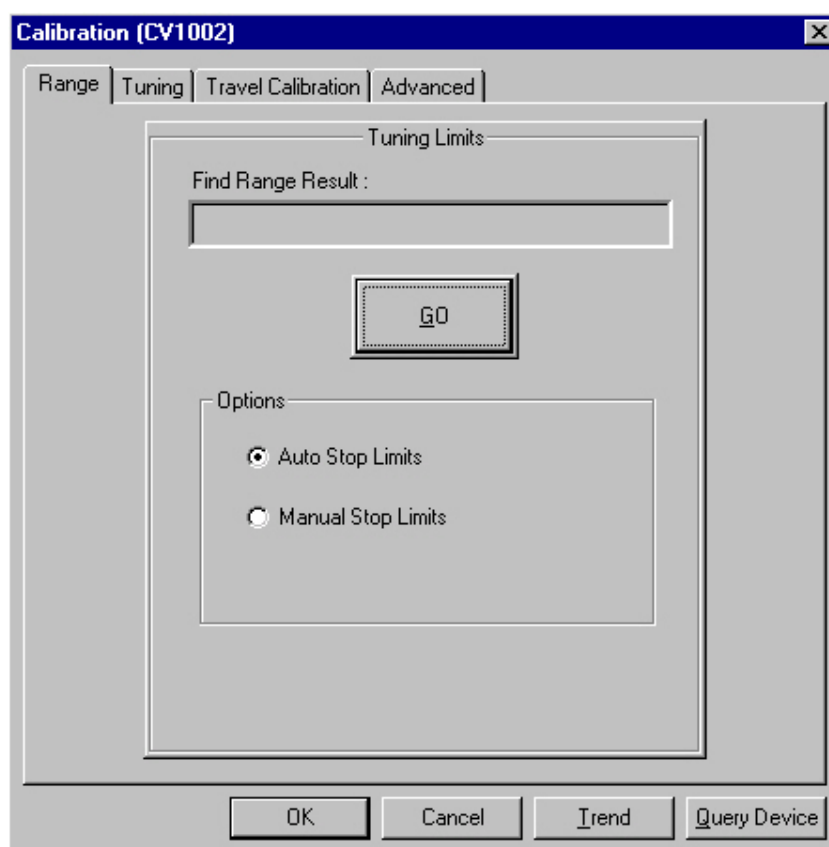


Figure 10.1 Range Calibration



WARNING

Range Calibration strokes the valve over its entire travel. Isolate the valve from the process prior to using the calibration procedure.

10.1.1 Find Range Result

Display the result of the calibration execution after GO button is pressed.

10.1.2 GO

Start button to execute the selected calibration.

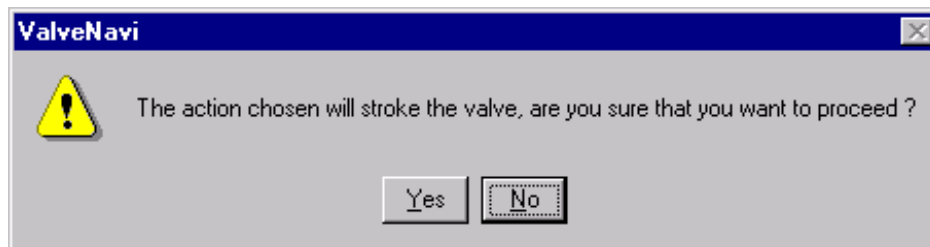


Figure 10.2 Warning

10.1.3 Auto Stop Limits

When Auto Stop Limits is selected, press GO button to execute the automatic position calibration process. The actuator will be fully exhausted, then fully filled. The position at each stop will be measured and saved. In some cases when the actuator size is extremely large, the process may time out and the Manual Stop Limits can be used instead.

For further information about error messages, see YVP User's manual (IM 21B04C01-01E).



Figure 10.3 Stop Progress

10.1.4 Manual Stop Limits

If Manual Stop Limits is selected, press GO button to execute a manual position calibration process. The actuator moves to one stop and waits for user's confirmation, and then moves to the other stop for the other confirmation. The position at each stop will be measured and saved. Wait until the valve has stopped moving before pressing the confirmation button.

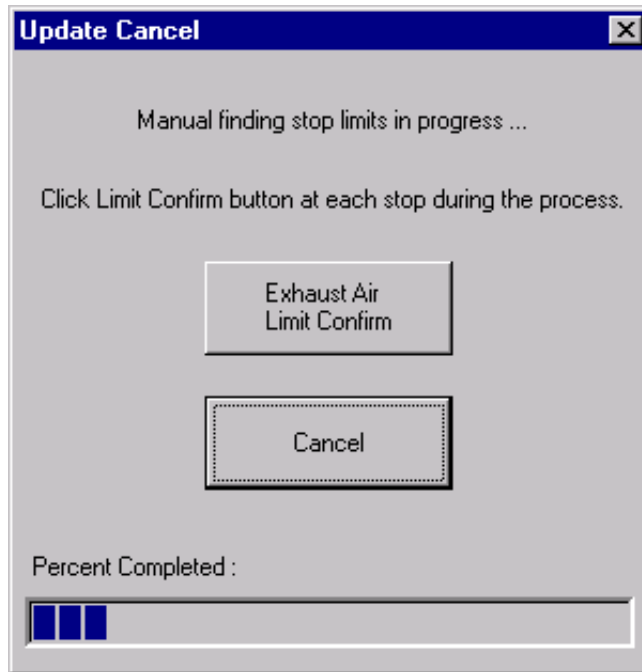


Figure 10.4 Confirm Exhaust

10.2 Calibration - Tuning

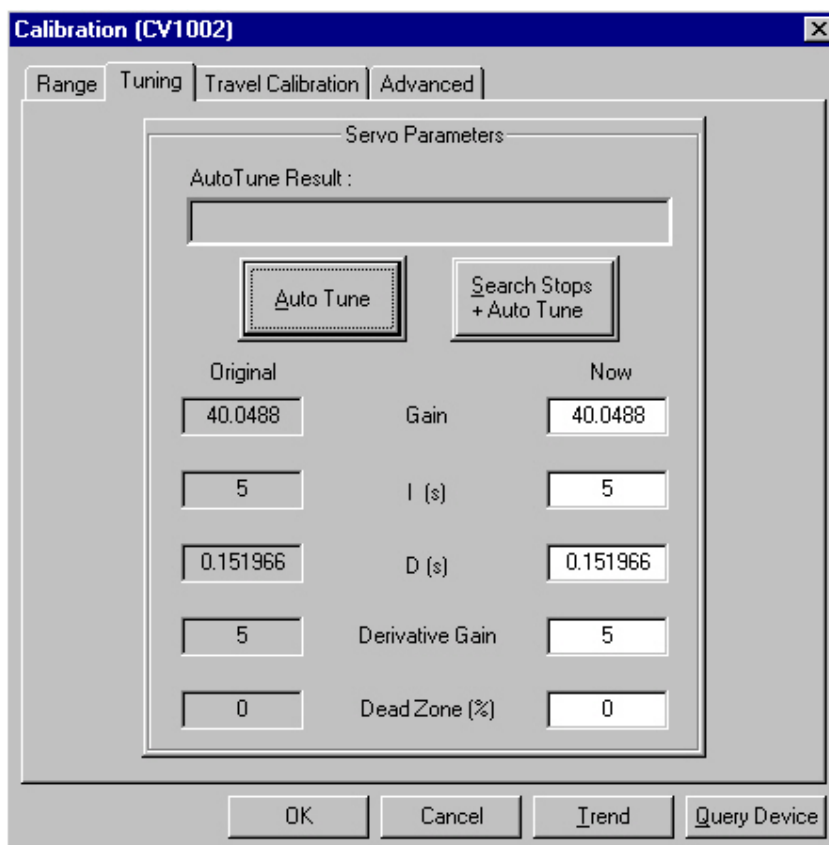


Figure 10.5 Tuning

This tab allows the user to automatically tune the positioner's control algorithm and examine the positioner servo parameters. The parameters display provides two views for comparison, the left half displays the original set before performing autotune, the right half will be updated after the auto tuning. The parameters can be manually modified here as well. To see the description of the parameters, refer to the Position setup page.



WARNING

Before beginning the Autotune procedure, confirm that the valve is isolated from the process. This procedure exhausts the valve actuator to atmosphere and then fills the valve actuator to supply pressure and therefore strokes the valve over its full range. Keep clear of moving valve and actuator parts.

10.2.1 Auto Tune

Click the Auto Tune button to execute the auto tuning procedure.

After clicking Auto Tune, a dialog will appear to warn that the valve will stroke. Click yes if the valve is isolated from the process and if it is safe to proceed. Observe all safety precautions.

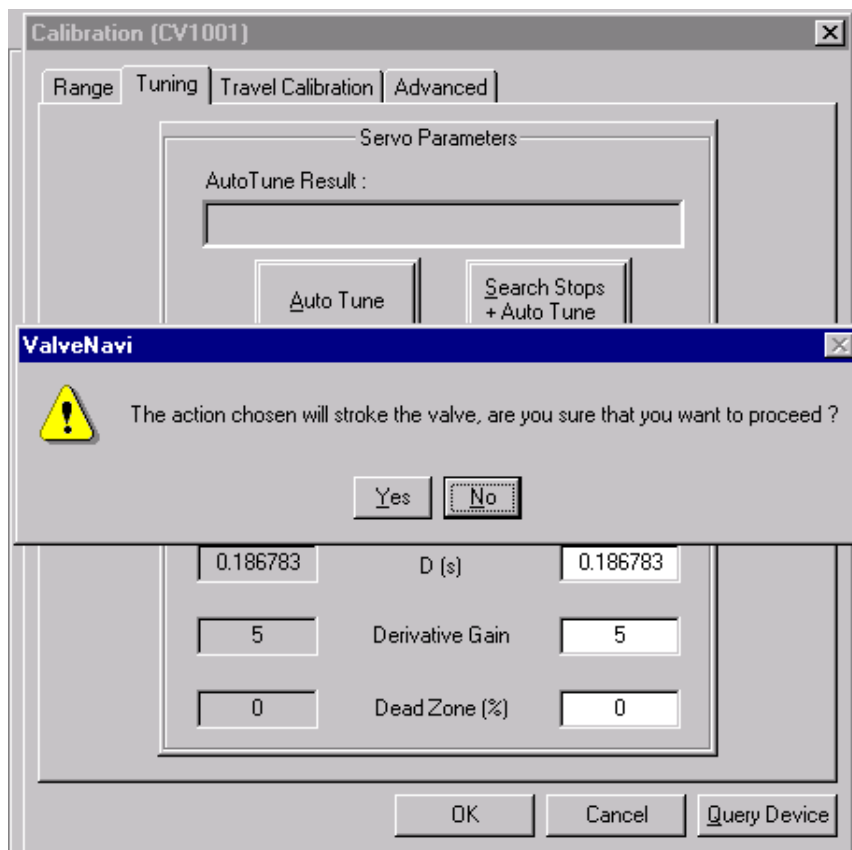


Figure 10.6 Autotune warning dialog



Figure 10.7 Progress Tuning

The Progress dialog will appear to indicate progress. The procedure will fully stroke the valve and then tune for a few minutes. Click Cancel to stop tuning and the return parameters to their prior values.



WARNING

During this process, the valve strokes over its full range. Keep clear of moving valve and actuator parts.

The parameters before tuning are shown on the left (Original). The parameters determined by auto tune are shown on the right (Now). The new values (Now) will become effective when you click OK. Click Cancel to return the Original values.

10.2.2 Auto Tune Result

After Tuning is complete, the result is displayed in the Auto Tune Result text box.

10.2.3 Search Stops and Auto Tune In One Step

This is the combination of Auto Stop Limits (Find Stops) followed by Auto Tuning to execute two processes by a single click.

Click Search Stops + Auto Tune to begin the procedure.

Note the warning dialog that states the valve will stroke. Observe all safety precautions. Click Yes to proceed. The Progress dialog will appear to indicate progress. The procedure will fully stroke the valve and then tune for a few minutes. If you click Cancel the tuning will stop and the parameters will remain at their prior values.

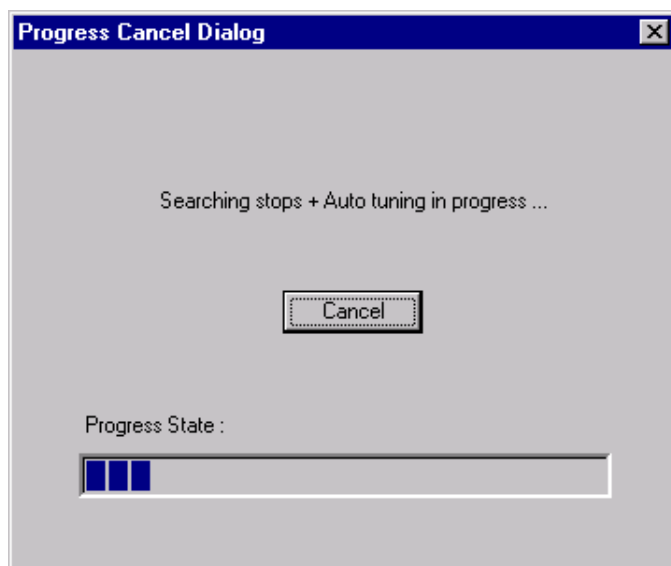


Figure 10.8 Progress Stop & Tune

10.2.4 Manual parameter adjustment

After auto tuning is complete, or as an alternative to auto tuning, the parameters may be manually entered in the text boxes (Now).

● Positioner Tuning Parameters

The position controller is a type of non-linear PID control algorithm with 5 standard parameters listed below. See Table 10.1 Servo Tuning Parameter Ranges for the allowed and default parameter ranges. There are an additional 16 advanced servo tuning parameters. See Section 10.4.

P (dimensionless)

Proportional gain P is the ratio of change of output due to proportional control action to the change in position error. Common values for the positioner are 50 for small actuators and up to 5000 for large actuators. The larger this gain, the faster the valve will respond with increasing tendency to overshoot. If the gain is too low friction may cause limit cycles. Air supply pressure affects this value. Therefore, the position controller should be re-tuned in case of air supply pressure changes. The default value of 120 is normally changed by Auto Tune.

I (s)

Integral time or reset time is the time constant of integral control. Higher values of "I" cause less integral control action and increase loop stability. However, higher values of "I" will also increase the time to eliminate a steady-state position error. The special value of "0" turns off integral action and will result in a steady-state position error. Sustained deviation may result in failsafe action if T2 is set. Therefore, "0" should be avoided for use in most real applications. The default value of 15 seconds is normally changed by Auto Tune.

D (s)

Derivative time or rate time is the time constant of derivative control. Larger derivative time causes more derivative control action. The special value of "0" disables derivative action.

Derivative Gain (dimensionless)

Derivative gain controls the maximum response to rapid position change. The default value of 5 is normally adequate.

Dead Zone (%)

When the valve position is within its setpoint +/- the dead zone, no additional position control is performed. This value is normally 0%, however for high friction valves (e.g. valves with graphite packing) a higher dead zone will help avoid limit cycling due to the stick/slip action of the valve. In these cases the dead zone may be set at 0.1% to 5%.

Table 10.1 Servo Tuning Parameter Ranges

Parameter	Defaults	Range	Units
Proportional Gain	120	0.5 to 1300	(Dimensionless)
Integral Time	15	0 (disables); 2 to 50	Seconds
Derivative	0.22	0 (disables); 0.05 to 1.0	Seconds
Derivative Gain	5	2 to 20	(Dimensionless)
Dead Zone	0	0 to 50	%

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10.3 Travel Calibration

The Travel Calibration tab allows the user to adjust calibration at 0%, and 100% to match the valve's working stroke when there is over-travel at one or both stops. Additionally, if the valve linkage introduces a non-linearity, it can be corrected by setting a correction at 50%. The corrections in this dialog are applied over corrections applied with Open Stops tool and over the Custom Linearization tools. It is recommended that only one set of correction tools be used for adjusting zero, span, and non-linearity calibrations.



IMPORTANT

Before performing Travel Calibration, check that the Tight shut Off and Full Open Features, and the Position Limits are disabled.



IMPORTANT

If travel calibration is used to change zero and span more than 10% then the Position Limits defaults may be incorrect.

Step 1 Perform Auto or Manual stops procedures to clear previous calibration adjustments. (See Page 10-1)

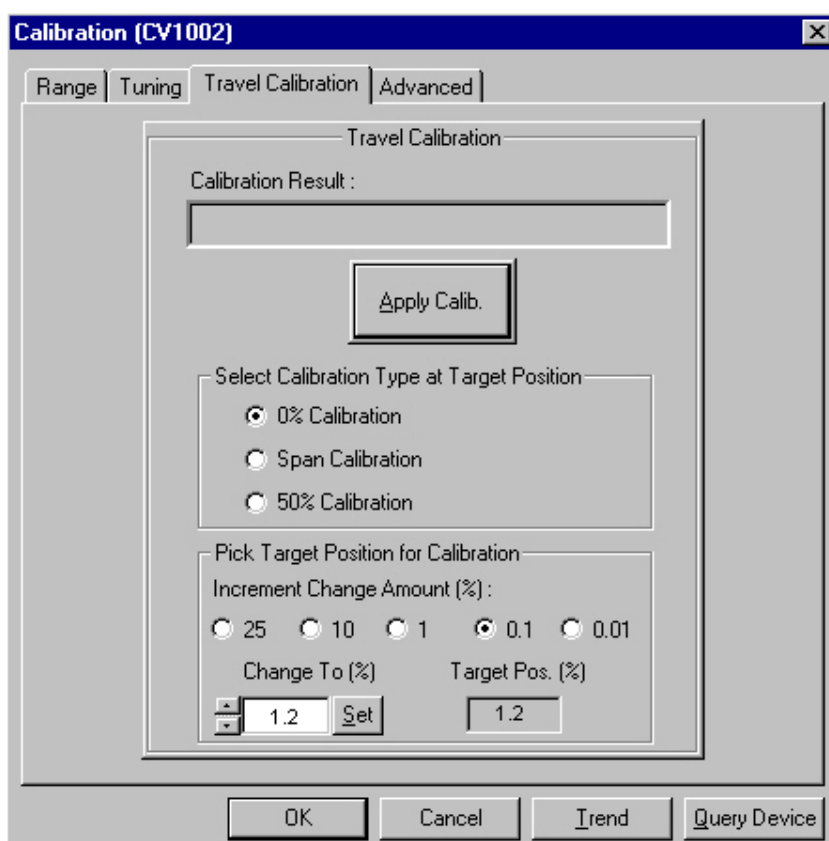


Figure 10.9 Increment the closed position (0% Calibration)

- Step 2 Select 0% Calibration. Move the valve by entering a value in the Current Target Position (Change To) text box, and clicking Set, until the valve is in the desired closed position. The valve can be jogged by selecting the Increment change amount (0.1 for example, in Figure 10.9) and by clicking the up or down arrow beside the Change to (%) text box. Click once and wait until the position value shows the change. Repeat until the valve is at the desired 0% position. (It is not necessary to click Set, when using the increment arrows.)
- Step 3 When the valve is in the closed position click the Apply Calib. Button. A dialog appears to confirm that you want to apply the calibration. Click Yes.
- Step 4 Select Span Calibration. Change the Current Target Position value by entering a number or by incrementing until the valve is in the desired 100% open position, using the same procedure as in Step 2 .
- Step 5 When the valve is in the open position (refer to the mechanical travel indicator on the valve), click the Apply Calib. Button. A dialog appears to confirm that you want to apply the calibration. Click Yes.
- Step 6 To apply a correction for non-linearity, select 50% Calibration. Move the valve until it is at the mechanically indicated 50% position, using the same procedure as in Step 2 .

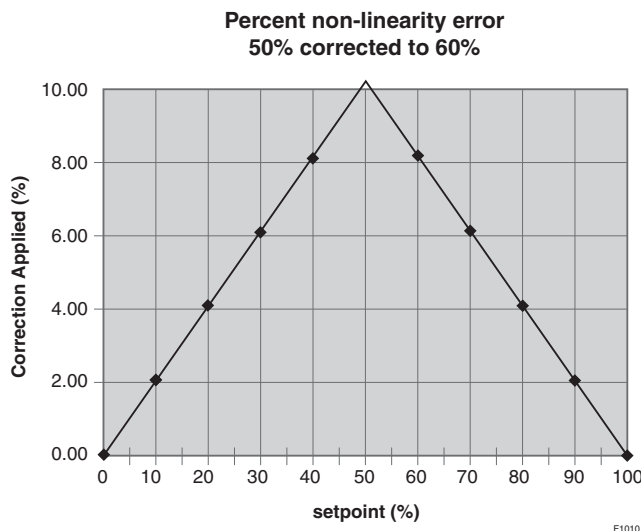


Figure 10.10 Non-linearity Travel Correction

- Step 7 When the valve is at the desired 50% position (refer to the mechanical travel indicator on the valve), click the Apply Calib. Button. A dialog appears to confirm that you want to apply the calibration. Click Yes. This provides non-linearity correction with two line segments as shown in Figure 10.10, in which "55" was entered in the Current Target Position. Note that 55 is an extreme correction!



WARNING

Applying a correction to the 0% and 100 % position calibration may alter the effect of other limits and settings. For example, the Tight Shutoff Below and Full Open Above parameter may need to be re-configured.

10.3.1 Calibration Result

The result display of the travel calibration execution after Apply Calib button pressed.

10.3.2 Apply Calib

Start button to execute the selected travel calibration.

10.3.3 Pick Target Position for Calibration

To select a position for calibration, the valve needs to be moved to that position as displayed by Current Target Position edit box (Change To). You can either type in the target position directly into the edit box then press Set button on the right to position the valve or click up-down button to incrementally move the valve by the Increment Change Amount above the edit box specified with 25, 10, 1, 0.1, or 0.01% of the total travel.

10.4 Calibration - Advanced Position Servo Tuning Parameters

Normally dynamic position control parameters are established by the Auto Tune procedure. This is the page for manually configuring dynamic position control parameters that are contained in Transducer(TB) block. It is intended for technician use only. The advanced Servo Tuning Parameters display provides two views for comparison, the left half is the original one before changing the configuration, the right half will be downloaded to the positioner and implemented after clicking OK.

Advanced Servo Tuning Parameters		
Original		Now
0.9	Boost On Threshold 1	1.0
1.9	Boost On Threshold 2	1.9
0.5	Boost Off Threshold 1	0.5
0.5	Boost Off Threshold 2	0.5
12	Boost Value 1	12
14	Boost Value 2	14
0.949631	Servo I Sleep Limit	0.949631
0	Servo P Alpha	0

OK Cancel Query Device

Figure 10.11 Advanced Servo Tuning Parameter

- **Boost On Threshold 1, 2**

This position control parameter reduces the effect of deadband in control relay.

- **Boost Off Threshold 1, 2**

This position control parameter reduces the effect of deadband in control relay.

- **Boost Value 1, 2**

This position control parameter reduces the effect of deadband in control relay.

- **Servo I Sleep Limit**

This position control parameter prevents unnecessary overshoot for large step inputs.

- **Servo P Alpha**

This position control parameter adjusts the gain under very large hysteresis conditions.

● Internal Gain

This position control parameter shows the total gain for an I/P module, control relay and valve.

● Servo Offset

Initial valve of an integrator.

Table 10.2 Advanced Servo Tuning Parameters Ranges

Parameter	Initial Value	Range of Values	Units
Boost On Threshold 1	1.9	0 (disables); 0.1 to 10.	%
Boost On Threshold 2	2.9	0 (disables); 0.1 to 10. (1) ≥ (2)	%
Boost Off Threshold 1	1	0 (disables); 0.1 to 10.	%
Boost Off Threshold 2	1	0 (disables); 0.1 to 10.	%
Boost Value 1	8	0 to 50	% of MV
Boost Value 2	10	0 to 50	% of MV
Servo I Sleep Lmt	0	0 to 10	seconds
Servo P Alpha	0 (Off)	0 to 100	%
Internal Gain	5	0.5 to 50	rad. /mA
Servo Offset	50	0 to 100	% of MV

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In the case of the double acting actuator type, clicking on the More button allows for setting the following parameters for the double acting actuator type.

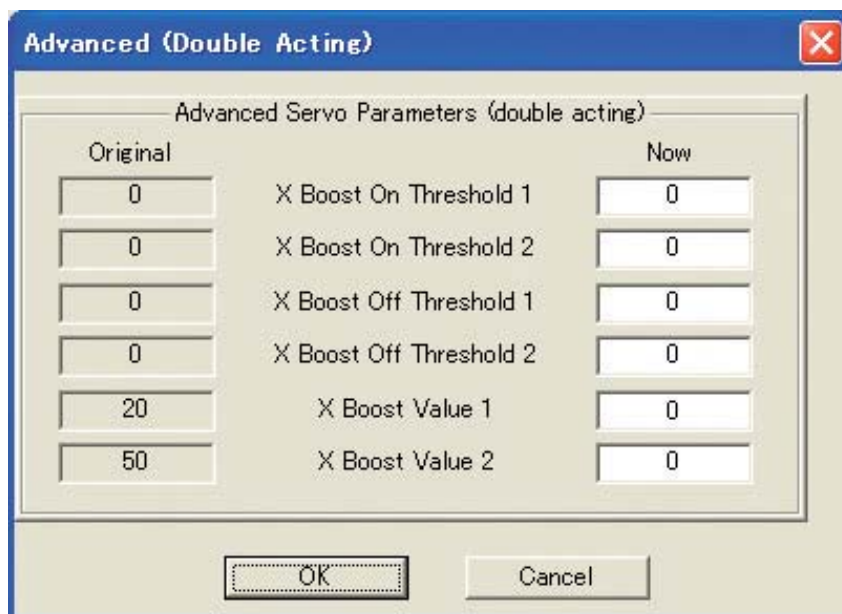


Figure 10.12 Advanced Servo Parameters (doubleacting)

● X Boost On Threshold 1 and X Boost On Threshold 2 (Exhaust Boost On Threshold 1/2)

This control parameter makes the boost on the exhaust side asymmetric to that on the air supply side. Based on the Boost On Threshold 1 and Boost On Threshold 2 values, input a difference for change.

● X Boost Off Threshold 1 and X Boost Off Threshold 2 (Exhaust Boost Off Threshold 1/2)

This control parameter makes the boost on the exhaust side asymmetric to that on the air supply side. Based on the Boost Off Threshold 1 and Boost Off Threshold 2 values, input a difference for change.

● X Boost Value 1 and X Boost Value2 (Exhaust Boost Value 1/2)

This control parameter makes the boost on the exhaust side asymmetric to that on the air supply side. Based on the Boost Value 1 and Boost Value 2 values, input a difference for change.

Parameter	Initial Value	Range of Values	Units
X Boost On Threshold 1	0	–10 to 10	%
X Boost On Threshold 2	0	–10 to 10	%
X Boost Off Threshold 1	0	–10 to 10	%
X Boost Off Threshold 2	0	–10 to 10	%
X Boost Value 1	0	–50 to 50	% of MV
X Boost Value 2	0	–50 to 50	% of MV

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11. PID BLOCK SERVICES

The PID Process Controller dialog contains the tools for managing the PID function block.

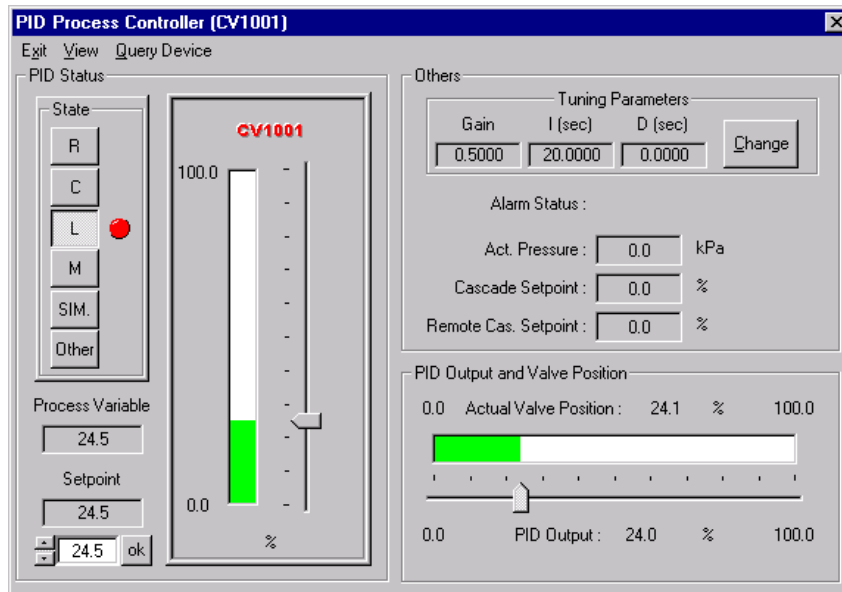


Figure 11.1 PID Process Controller Dialog

The PID Process Controller dialog, like the IVI, is composed of frames that group controls and displays. The PID State frame Displays and controls the PID states (modes), the setpoint and process variable, and the Device tagname.



NOTE

You will be prompted to close the trend service before switching to the PID Controller Dialog.

11.1 States and Modes

The permitted states of the PID block are:

- **RCas** selected by the R button. In this mode, the setpoint of the PID block is set by a remote application that writes to the RCAS_IN parameter regularly. This mode is allowed only if a remote application is “soft-wired” to the RCAS_IN parameter of the PID block.
- **Cas** selected by the C button. In this mode, the setpoint of the PID block is set by a Foundation fieldbus function block. This mode is allowed only if a Foundation fieldbus function block OUT is “soft-wired” to the CAS_IN parameter of the PID block, and scheduled.
- **Auto** selected by the L button. In this mode, the setpoint of the PID block is set by the setpoint slider or the setpoint text box.
- **Man** selected by the M button. In this mode, the output of the PID is set by the output slider or the output text box. The PID algorithm is not processed in Man.
- **Simulate** selected by the SIM. Button. The ValveNavi user must have the permission level 8 (training level).

Note that Simulate should never be used with a device that is connected to a real process. Simulate will destroy any existing control linkages. See 11.3 before actually using this function.

- **Other** (usually IMan or OOS) indicated by Other button. This button is an indicator only. It will not change the mode of the PID block.

11.2 Tuning Parameters

Process tuning parameters may be adjusted from the PID Process controller dialog. Click Change in the Tuning Parameters frame. The Proportional Gain, Integral Time and Derivative Time may be entered without changing control mode. Using the Trend service to view the effect of tuning can be performed by selecting the View>Trend menu item.

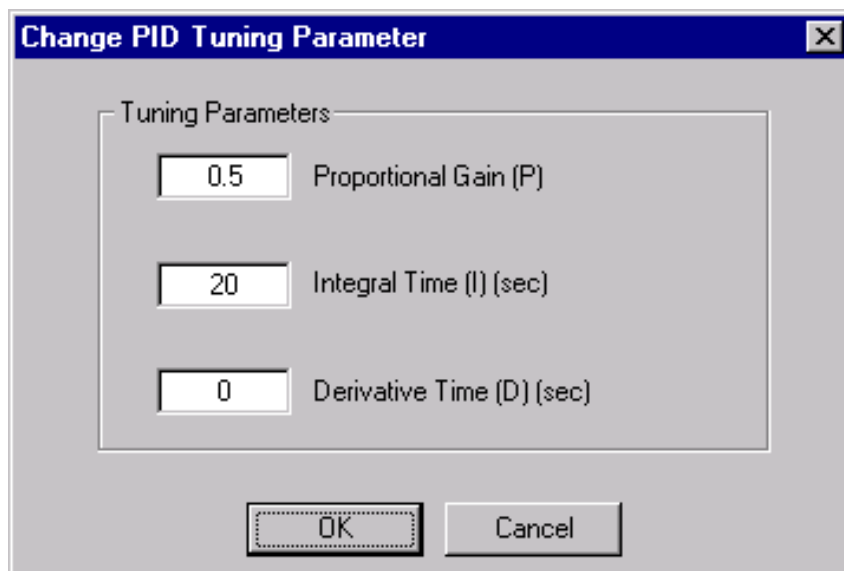


Figure 11.2 Change PID Tuning Parameters



WARNING

Changing tuning parameters to incorrect values can result in dangerous process upsets. Only trained control experts should make these changes.

● Use Trending to assist tuning

While adjusting PID process tuning parameters, it is helpful to use the trend service (See Chapter 12) to visualize the process dynamics. After opening the trend window from the PID dialog, Click View>Trend Selection, and check the boxes for Process variable, Process setpoint, and Target Pos.

11.3 Simulation Function

The simulation state is allowed only for the users of privilege level 8.

ValveNavi provides a special function for testing and training. The user can connect the valve position to the input of the PID with lag of 5 seconds to allow demonstration of closed loop control.



WARNING

The simulation state must not be used if the valve is connected in a control loop or the if the valve is controlling process flow.

The simulation state will permanently remove important control loop configuration information from the YVP valve positioner. The soft-wired connection between the PID functions block and its input function block must be restored after simulation is used.

Reconfigure function block links after using simulate.

11.3.1 Simulation State

This is a special state provided for training use only when the control valve is not operating a process. In this state, the control valve position readback signal is fed back into the PID input with a 5 second filter time. This will form a closed loop to simulate a process loop. The PID block is in AUTO mode. (This is not the same as the Foundation fieldbus SIMULATE parameter).

To enter this state the user must be logged onto ValveNavi with permission level 8. If there is a configured link to a process input signal (PID.IN), SIM state will permanently remove the link. For security, after using SIM state, the input signal link must be restored using function block configuration tools.

To Use Simulation Function, the function block application (linkage between function blocks) is necessary to be defined. By using Fieldbus Configuration Tool, define the linkage between AO and PID blocks.

In PID Process Controller dialog box, clicking [SIM] button in the [Select] frame will show the message to warn the entry to the Simulation mode. Confirm that the positioner and the valve are isolated from the control loop and there will be no effect on the system, and then click Yes. The connection of the closed loop mentioned as above will be done, and Simulation mode will be started.

By changing the value of Process setpoint, you can see that the valve follows.

With using Trending function, the change in the process setpoint and the Valve target position /actual position can be viewed in trend graph. (See Chapter 12)

After finishing the Simulation, check and re-define the function block application again, by using Fieldbus Configuration Tool.

12. TRENDING SERVICE

The trend service may be used to observe the dynamic behavior of both the control valve and its associated process variable. It is particularly useful for tuning the PID process loop and may be used to alter the response of the positioner control algorithm after auto-tuning.

Each device is provided with one trend window (ValveNavi supports up to 30 trend windows open simultaneously).

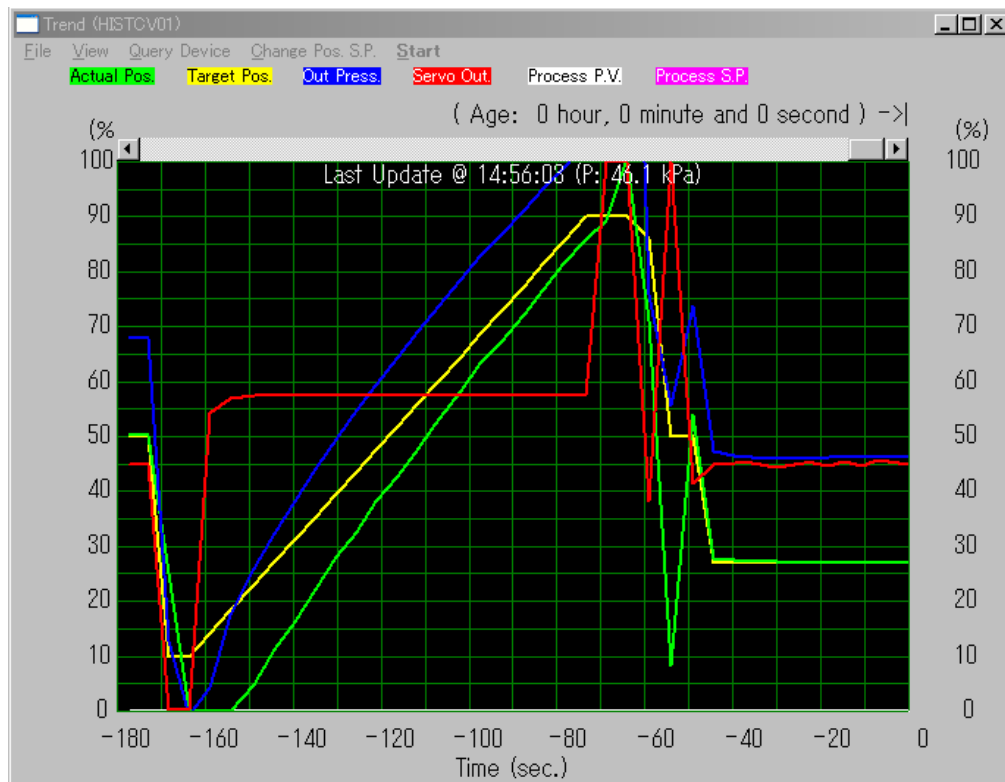


Figure 12.1 Trend with Pressure Loop

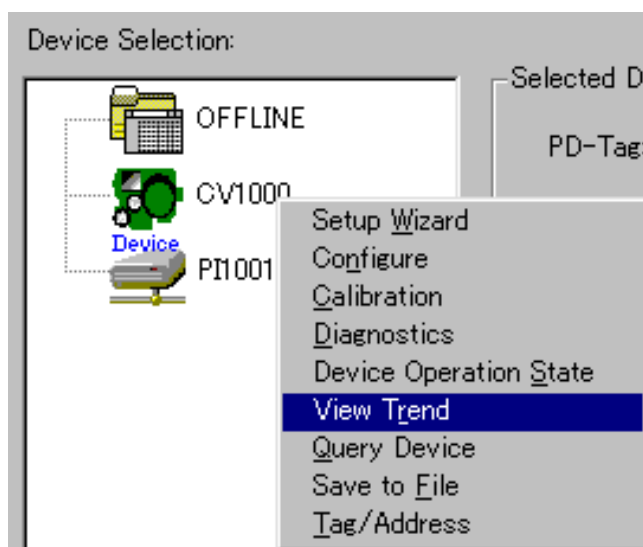


Figure 12.2 Open Trend from Device Selection Frame

The Trend Window is opened by right clicking on a device in the Device Tree, or by selecting View>Trend in the IVI or PID dialogs. The trend window can display selected historical data for up to 12 hours. The selected parameters may be actual valve position, target valve position, PID process variable, and PID process setpoint. Click the Start menu button to start trending and click Stop to stop trend. While the trend is stopped the time axis continues to increase. When trend is restarted, the time that it had been stopped will appear as a blank. The vertical axis of the graph area can be zoomed by dragging a rectangle around the area of the interest. A right mouse click returns the display to full scale.

Use the View menu to customize the trend.

Select which parameters are to be trended with Trend Selection. Set the duration of the trend (up to 12 hours), and the time scale (45, 90, or 180 seconds) in scope settings (Figure12.4).

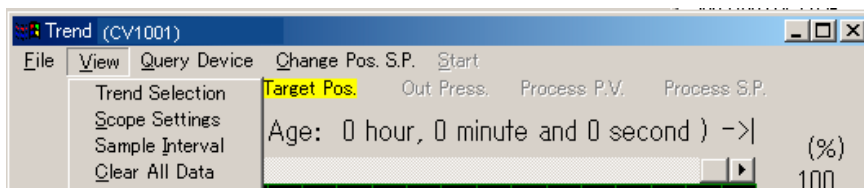


Figure 12.3 Trend selection from View Menu

12.1 Trend Selection

The Trend Data Selection dialog lets you select which parameters to trend: actual valve position, target valve position, servo output signal, PID process variable, and PID process setpoint.



WARNING

Do not alter schedules or links of operating process control segments.

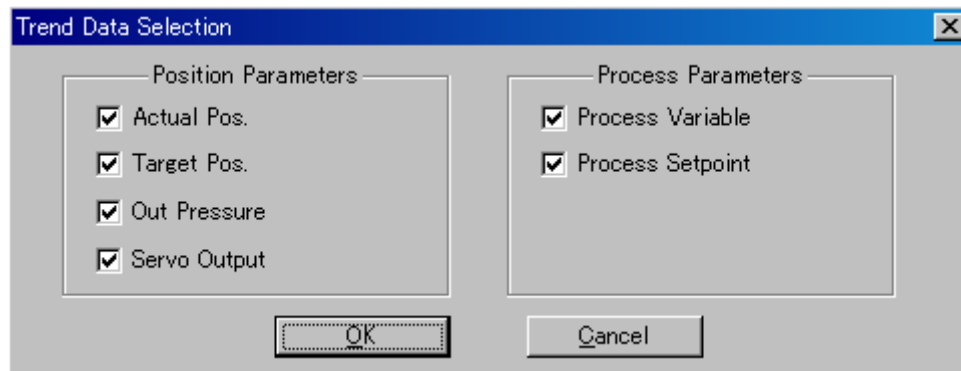


Figure 12.4 Trend selection

12.2 Scope Settings

- **Display Window**

The vertical axis in the trend graphical display can be scaled by entering values in the High/Low text boxes for vertical range. The horizontal (time) axis is adjusted by entering the trend time in the Wide text box.

- **Max. Record Length**

The maximum length for logging the trend data is 12 hours. The default is 1 hour. Any data older than the specified Max. Record Length will be discarded, dynamically.

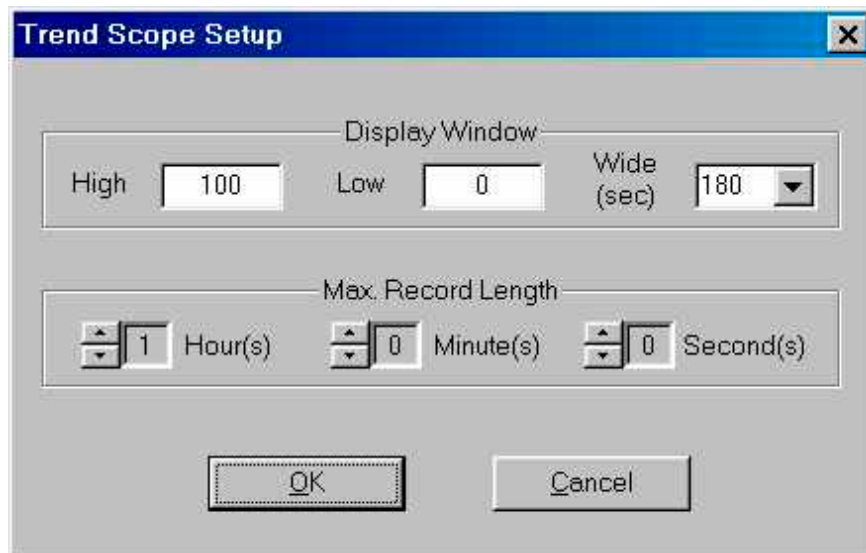


Figure 12.5 Trend Scope Setup

12.3 Saving and Opening Trend Files

Use the File menu to save the trend data or load saved data for playback. For each device, there is a trend window available and it is possible to open multiple trend windows for multiple positioner devices at the same time. The trend window can be run while other windows are active. Saving a trend does not discard current trend data, but you must temporarily stop trending while performing the save.

To display a trend that has been saved, stop the current trend (save it if necessary) and click File>Open. Then select the desired trend from the Open trend dialog. Click open. A warning appears that all current trend data will be lost. Click yes to proceed or click no to go back to save the current data.

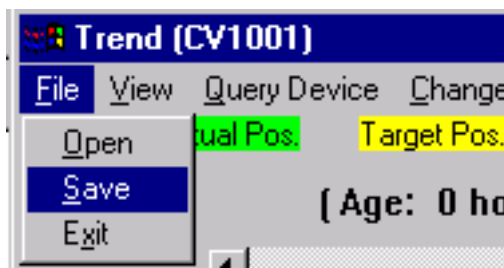


Figure 12.6 Save a Trend

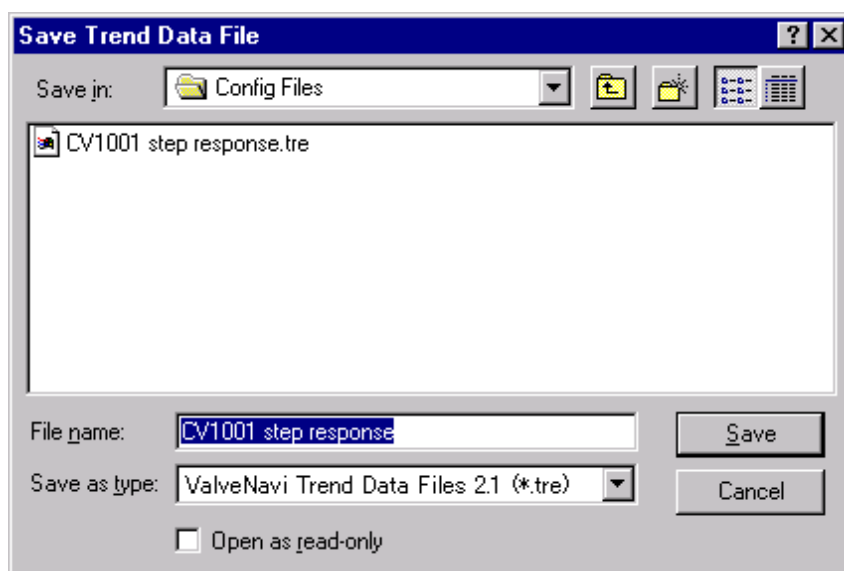


Figure 12.7 Select a Trend Filename

12.4 Changing Valve Position while Trending

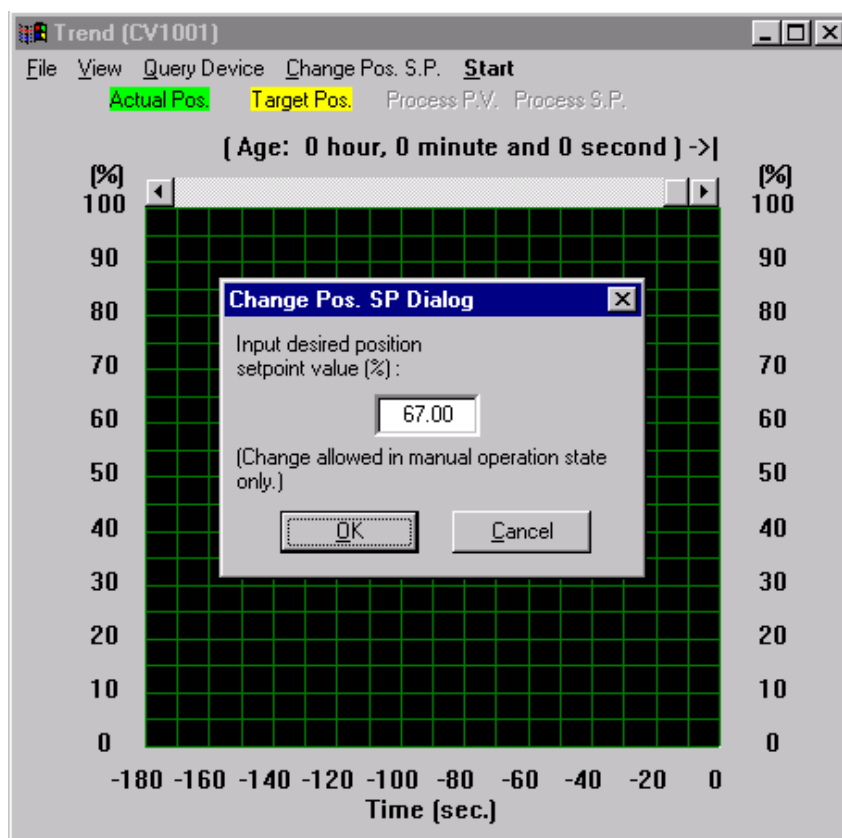


Figure 12.8 Change the Trend Position

To observe the positioner dynamic response, select Change Pos from the menu bar. The positioner must be in Manual Operating state. Enter the desired value in the text box, Figure 12.8

12.5 Closing the Trend Service

To close the trend click File>Exit. All unsaved trend data will be discarded.



NOTE

You will be prompted to close the trend service before switching to the PID Controller Dialog.

13. SAVING, DOWNLOADING, AND CLONING A CONFIGURATION

ValveNavi provides tools to retrieve, copy, or save YVP configuration data that can be used for offline configuration. Use them for copying a configuration from a device to its replacement, or to configure a series of similar positioners.



WARNING

This download may cause valve motion.

Keep away from the valve and actuator or any moving parts while carrying out the download.

Do not download a configuration to a positioner if the valve is controlling a process. Always isolate the valve from the process before a download. Test the configuration before reconnecting the valve to the process.

13.1 Open File

This service is available only while offline. From the main screen(IVI), click OFFLINE icon in the Device Selection frame. Select the open icon, click File>Open File menu item, or right click the Offline icon in Device tree. Choose a file from the popup dialog and click Open. Choose a file (extension .dmp) from the Open Device Configuration File dialog and click Open.

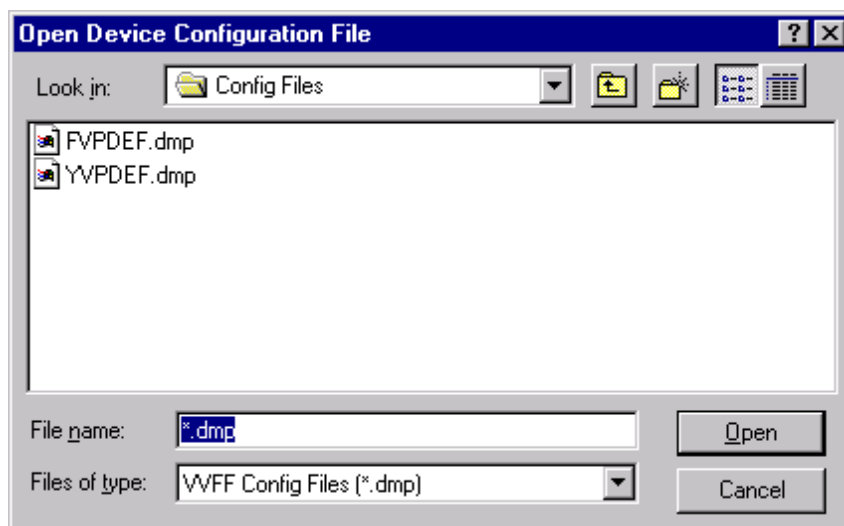


Figure 13.1 Open Configuration File Dialog

13.2 Save to File

This service is to save a current configuration on the ValveNavi and available either while online with a YVP or when offline. Select the open icon, click File>Save File menu item, or right click the currently selected device or the Offline icon in Device tree. Choose a file from the popup dialog and click Open.

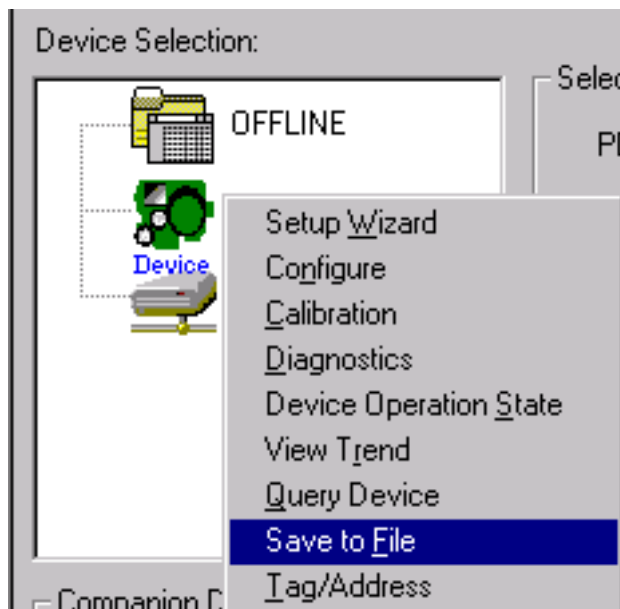


Figure 13.2 Save to File

13.3 Download

While a device is selected, configuration changes are downloaded to the device as the changes are made (when you click OK in the configuration dialog).

To download configuration data from a file, you must be in OFFLINE state.

In OFFLINE state, open the designated file by clicking the open file icon.

Then open the Download Select Dialog by selection download either by the Tool menu, by clicking the download icon or by right-clicking the OFFLINE icon.

Select a device as a target from the list box, and then press OK to confirm the selection. Downloading will put the device into the Out of Service operation state. The user will be prompted for permission. The downloading process will start and last approximately one minute.



Figure 13.3 Download Select Popup

The first steps to download will be tagname change and node address change.

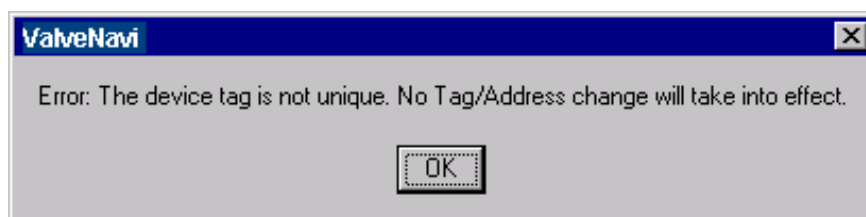


Figure 13.4 Duplicate a Tag Dialog

You will be warned that the address will be changed and asked

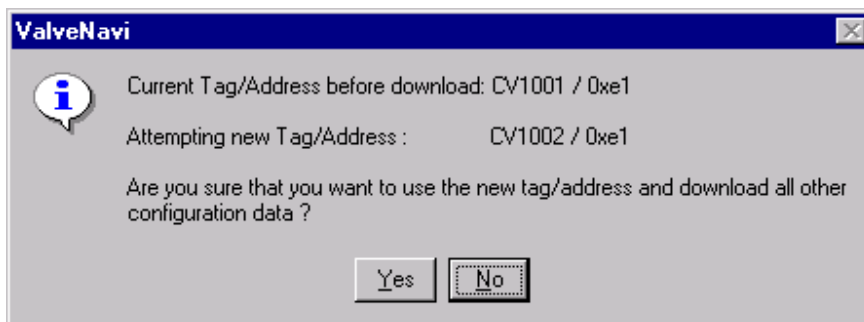


Figure 13.5 Download Device Warning



WARNING

Do not change tag or address of a positioner unless the valve is isolated from the process.



CAUTION

Changing tag or address will alter control linkages between function blocks. After changing these parameters, the control configuration must be tested and corrected.

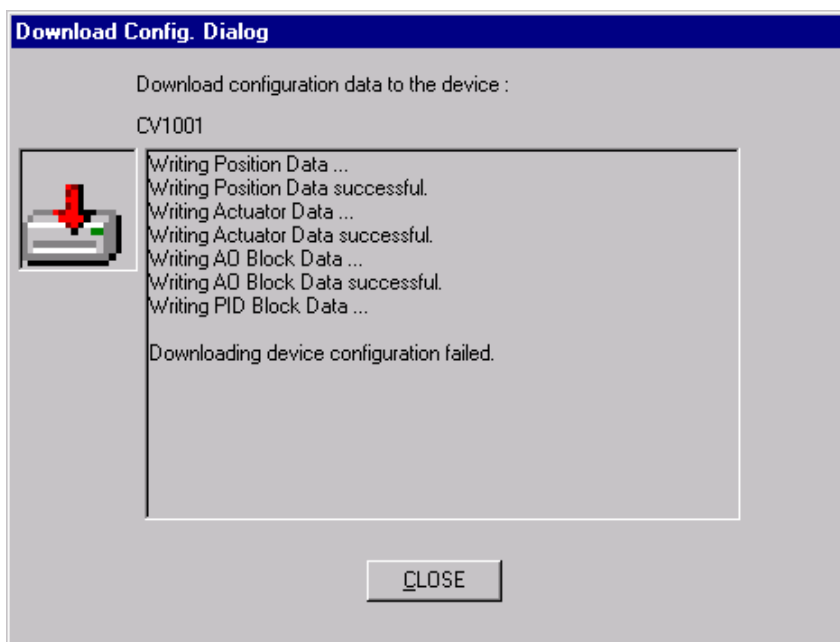


Figure 13.6 Configuration Download Progress



WARNING

If you try to perform a download for a different revision device, the following dialog box appears, and some parameters cannot be downloaded.

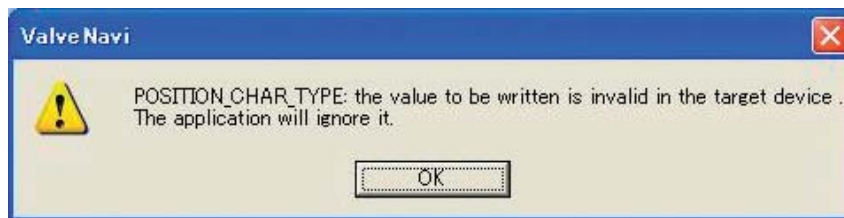


Figure 13.7 Download Warning Dialog



IMPORTANT

After the download is complete, the device must remain powered for at least 60 seconds to transfer the data to permanent memory.

13.4 Copy a Configuration to a New Positioner

To copy a configuration from a positioner to another positioner without file saving, select a source device in the device selection frame and wait until ValveNavi completes reading the configuration from the device. Then, select the OFFLINE icon but do not open a .dmp file. The configuration of the previously selected device remains open in ValveNavi. You may wish to disconnect the source device from the fieldbus segment to prevent accidentally altering its configuration. While in OFFLINE state, open Configuration Services and type in the correct Tag and Node Address. Then, right click on Offline or use the download icon to open the Download Selection dialog (Figure 13.3).

After configuration it is necessary to create the control function block linkages in a third party fieldbus configurator.



WARNING

The download of this data will overwrite all device configuration data.

14. DIAGNOSTIC SERVICES

14.1 General

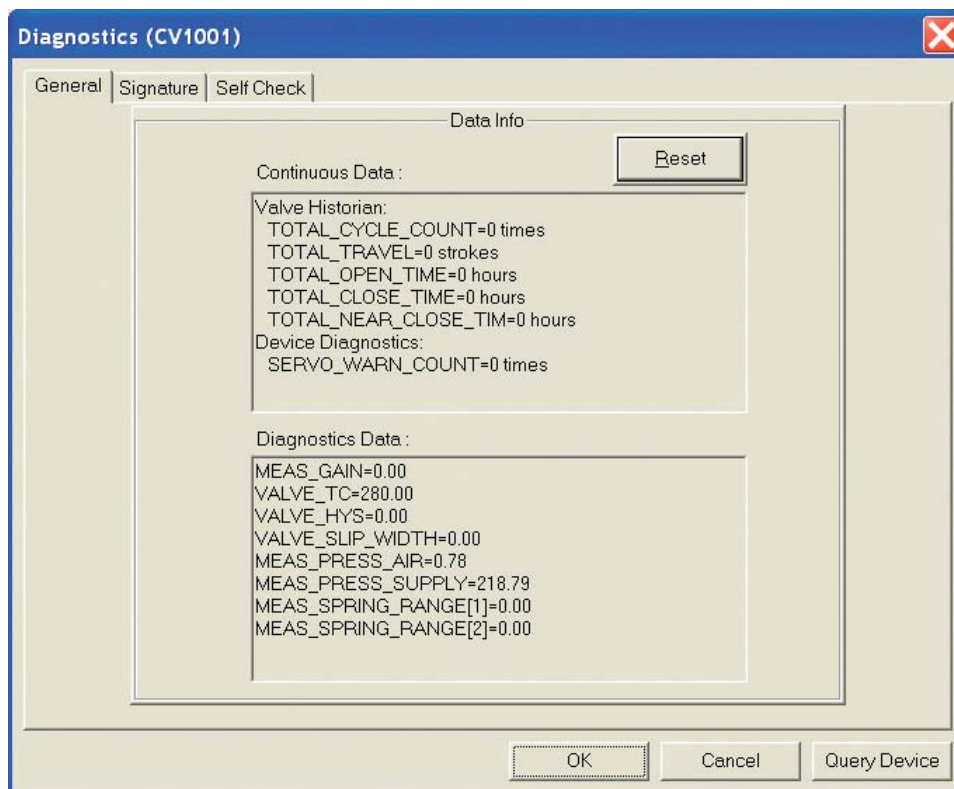


Figure 14.1 General Tab of Diagnostics

This general tab of diagnostics displays the service history for continuous data. The continuous data are compared with the limits set in Actuator setup. See the Actuator page for a detailed description.

To reset the continuous data to zero, first make a record of current values, then press the Reset button. All Continuous Data will be lost and cannot be recovered.

Data can be copied as a text.

To reset Valve Historian data and Device Diagnostic data to zero can be performed individually. Click reset button and carry out according to the figure 14.2. When you want the Device Diagnostics data to zero, you need to change the mode to OOS.

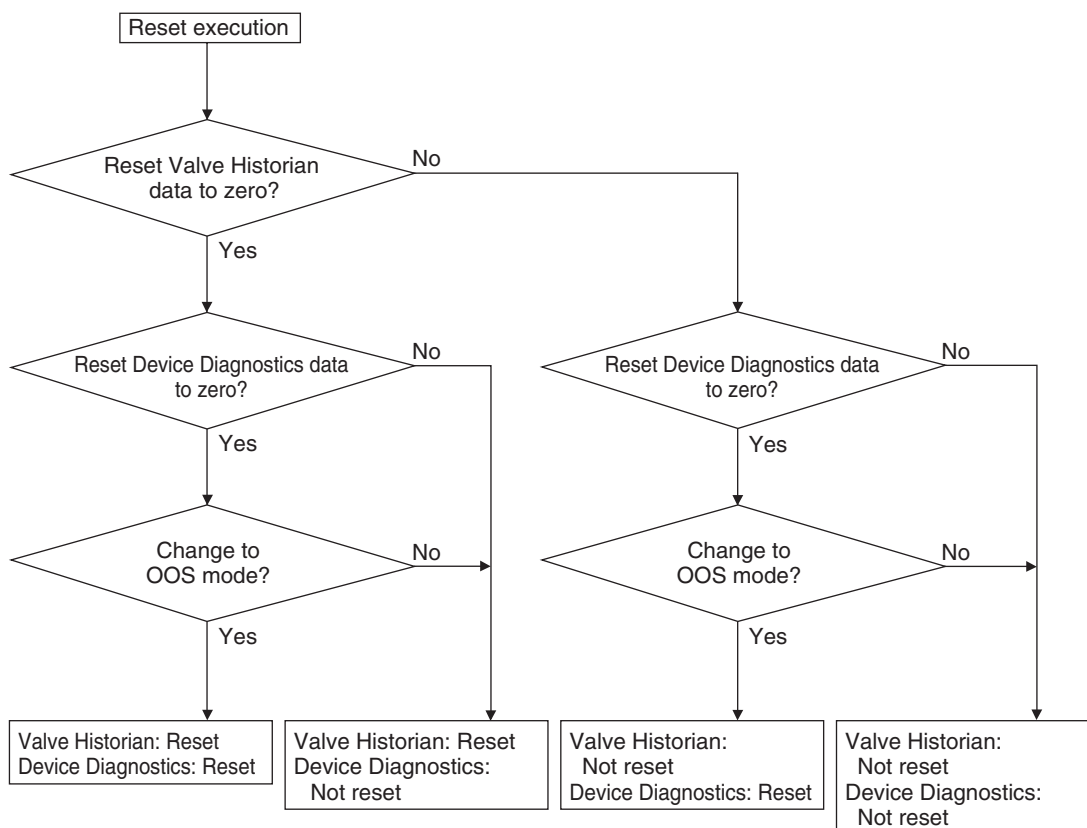


Figure 14.2 Data Reset Flow Chart

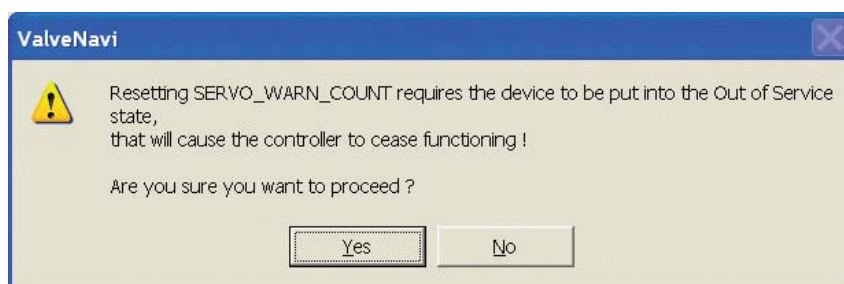


Figure 14.3 Changing OOS mode Warning Dialog

14.2 Self Check



WARNING

Performing Self Check will stroke the valve. Do not perform while the valve is controlling the process. Keep clear of moving valve parts.

The Self Check page of the diagnostics tests the performance parameters that are used to determine the position control parameters. The test will run autotune but will not change any parameters. The parameters display provides two views for comparison, the left half is the original data before performing this test, while the right half shows the result of the Self Check test.

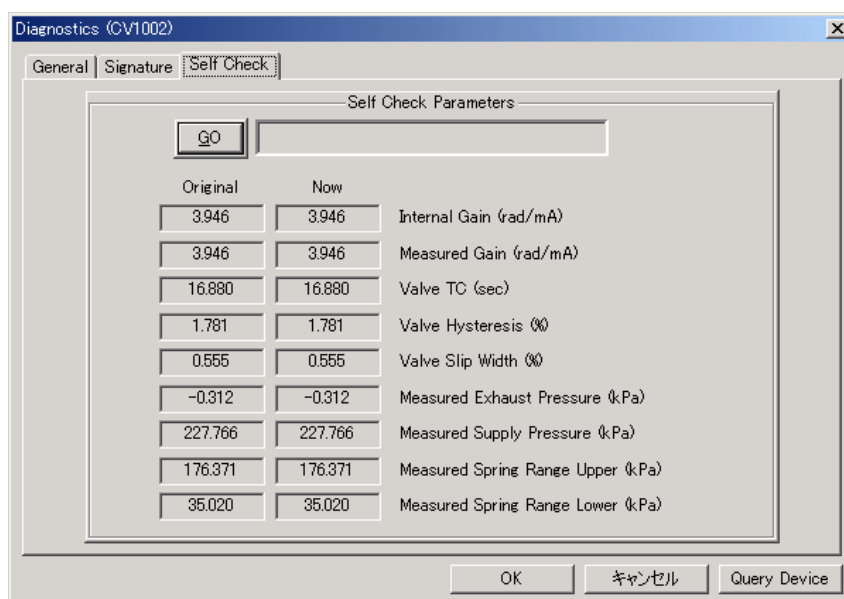


Figure 14.4 Self Check

Press **GO** to start the test.



WARNING

The control valve will move and must be isolated from the process. Keep clear of moving parts.

The result of the self check will be displayed in the box next to the GO button. Note any error messages.

(1) Internal Gain

This parameter describes the forward gain of control valve system. The forward gain is the gain of the I/P, Control relay, Valve Actuator (Spring range), and Linkage combined. The unit for this parameter is rad/mA. (The input signal of I/P is mA, the output signal of linkage is rad.)

The Internal Gain is based upon the Measured Gain.

(2) Measured Gain

The Measured Gain is measured by the Auto tuning function. The unit for this parameter is rad/mA.

(3) Valve TC

This parameter describes the response speed of control valve system. The units for this parameter are seconds. This parameter is measured by the Auto Tuning function. The parameter indicates how fast the control relay can drive the air actuator.

(4) Valve Hysteresis

This parameter describes the hysteresis of the control valve. The unit for this parameter is %. This parameter is measured by the Auto Tuning function.

(5) Valve Slip Width

This parameter describes the slip width of control valve. The unit for this parameter is %. The stem of the control valve will make an abrupt movement when the pneumatic actuator breaks the friction of the valve packing. Slip width is the value of abrupt movement of the stem.

(6) Measured Exhaust Pressure

This parameter describes air pressure. This parameter is available only in the AP option (with pressure sensor). The units for this parameter are determined by unit index of Spring Range. The Measured Exhaust Pressure is measured by the Auto tuning function. It is the value of actuator pressure when the valve is at the 0% mechanical stop.

The parameter is used for diagnostics only. It is not used for tuning or control.

(7) Measured Supply Pressure

This parameter describes supply pressure. The units for this parameter are determined by unit index of Spring Range. This parameter is available only in the AP option. The Measured Supply Pressure is measured by the Auto tuning function. It is the value of actuator pressure when the valve is at the 100% mechanical stop.

The parameter is used for diagnostic only. It is not used for tuning or control.

(8) Measured Spring Range- Upper

This parameter describes upper range value of the control valve spring range. The units for this parameter are determined by unit index of Spring Range. This parameter is available only in the AP option. The Measured Spring Range Upper is measured by the Auto tuning function.

The parameter is used for diagnostic only. It is not used for tuning or control.

(9) Measured Spring Range- Lower

This parameter is lower range value of the control valve spring range. The units for this parameter are determined by unit index of Spring Range. This parameter is available only in the AP option. The Measured Spring Range Lower is measured by the Auto tuning function.

This parameter is used for diagnostics only. It is not used for tuning or control.

14.3 Signature

Signature function is one of the functions in diagnostic function. The aim of this function is to detect the degradation failure and to grasp the condition of the control valve or the positioner by comparing the history of signature characterization. To accomplish the aim, the positioner must have the function to measure and retain the measured data of the characteristics of the control valve and the positioner itself.

Measuring procedures of signature of the control valve and the positioner will force the control valve to move the stem position; thus the measuring procedures must be performed while the process is in off line condition and the device is in Out of Service state.

YVP with /BP option for single acting actuator type has the ability to store locally the standard actuator signature data. In case the user is connected to a YVP in the Diagnostics window, the above valve signatures can be retrieved from YVP's non-volatile memory and compared to the current valve position, output pressure and other process information with valve signatures to determine if there is a shift in system performance.

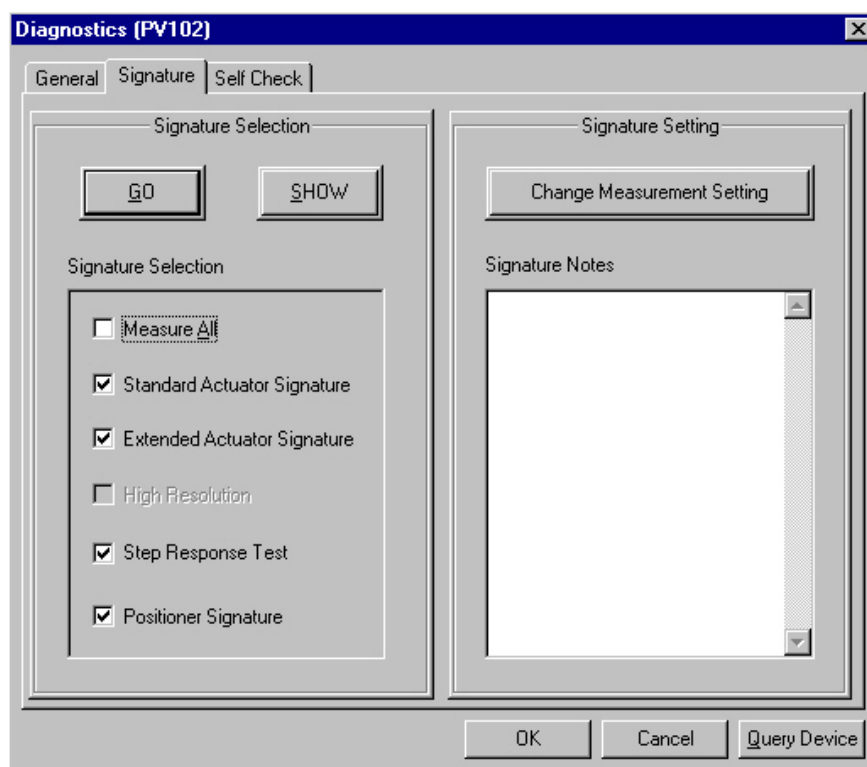


Figure 14.5 Signature Tab

The YVP with /BP option for single acting actuator type supports 5 types of user signature functions:

- Double acting actuator type and single acting actuator type without / BP option support only Step response Test and Positioner Signature.
- Actuator Signature: Static characteristic of the control valve.
- Extended Actuator Signature: Extended Static characteristic of the control valve.
- High Resolution Actuator Signature: High resolution Static characteristic of the control valve.
- Step Response Test: Step response characteristic of the control valve system.
- Positioner Signature: Static characteristic of the control valve system.

14.3.1 Actuator Signature

Actuator signature will measure and save the data of static characteristic of the control valve.

- **Measurement Parameters**

The input parameter is output pressure (Equal to **MEAS_PRESS_AIR**); and the output parameter is the feedback signal (Equal to **FINAL_POSITION_VALUE.Value**)

In measuring the signature, YVP will obtain 18 data set. (Pressure data and Position data is one set.) The measuring point is the round trip of 10, 20, 30, 40, 50, 60, 70, 80, and 90% of span.

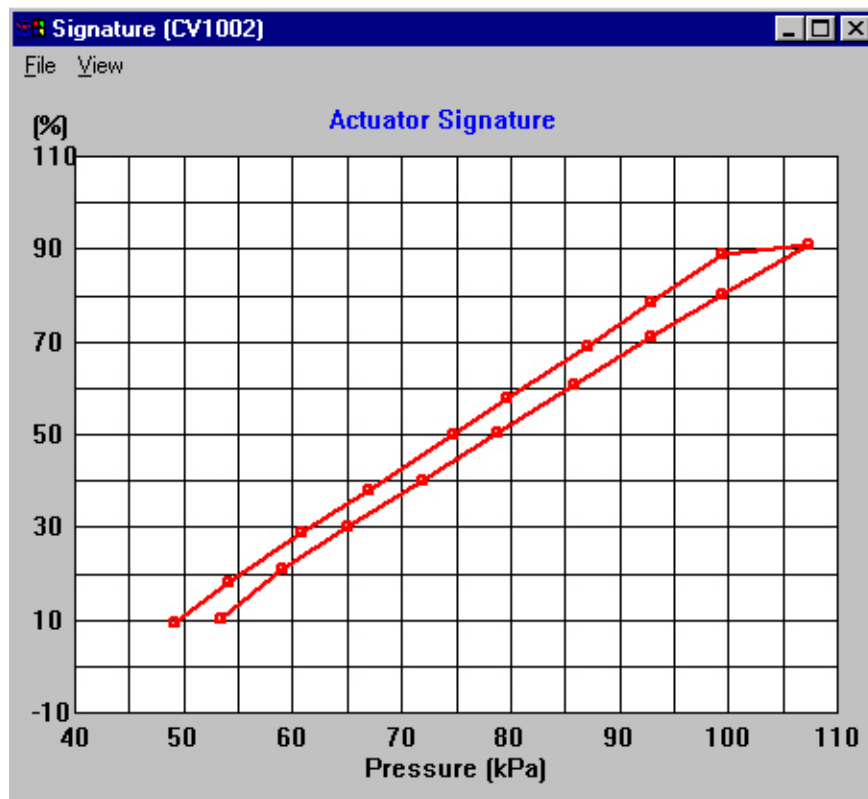


Figure 14.6 Actuator Signature Graph

- **Measurement Setting Parameters**

There are three measurement setting parameters: **Recommended Scan Time**, **Scan Time** and **Deviation margin**.

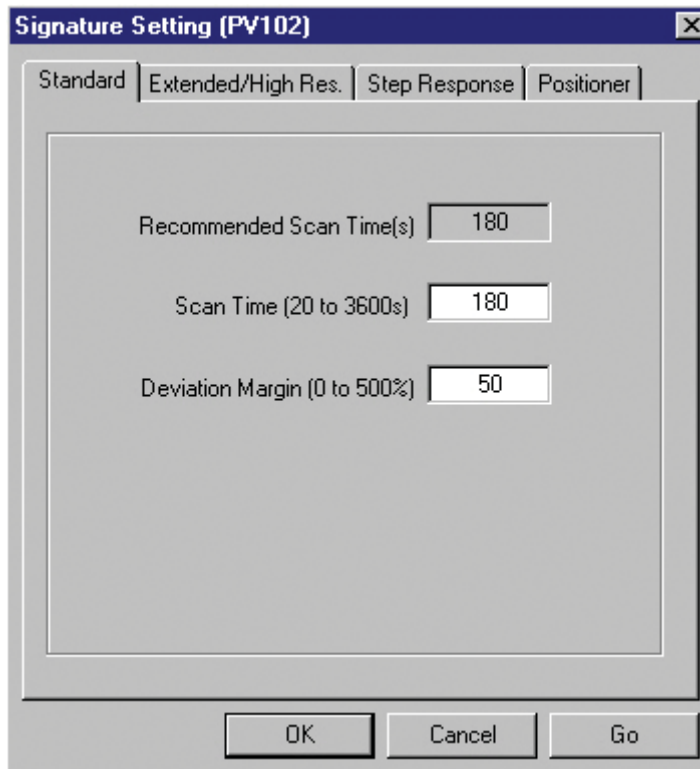


Figure 14.7 Standard Signature Setting

Recommended Scan Time (sec): The value is read only and does not affect the measurement. The value is calculated from the tuning parameters. It is used as a guide for setting **Scan Time** (in second).

Scan Time (sec): It determines the time for round trip of the measurement. User can set any value within the valid range. User can refer the **Recommended Scan Time**. The valid range is 20 to 3600 sec.

Deviation margin (%): The measurement is performed in Proportional control algorithm. In this reason, deviation between the set point value and the position value may occur due to the non-linear characteristic existing in the control system. (Mainly valve hysteresis) Basically, this value dose not need to be changed from the default value. However, in case if stem position did not reach the desirable point, then increase this value; or if stem position far exceeds the desirable point, then decrease this value to make the measurement correctly. The valid range is 0 to 500%.

- **Offset measurement**

Before measuring the actuator signature, YVP will perform Offset measurement (The same procedure in Auto Tuning) in order to prepare for the measurement.

- **Measurement of Spring Range and Valve Friction**

To view the results, click Edit on the menu bar and select the signature graph type, and then a pop-up menu will be shown. Also, you can move the cursor to the area of signature graph and make a right click for editing operation in a pop-up menu. Select and click Result Analysis to see the measured spring range and valve friction. The valve friction means the half of valve hysteresis.

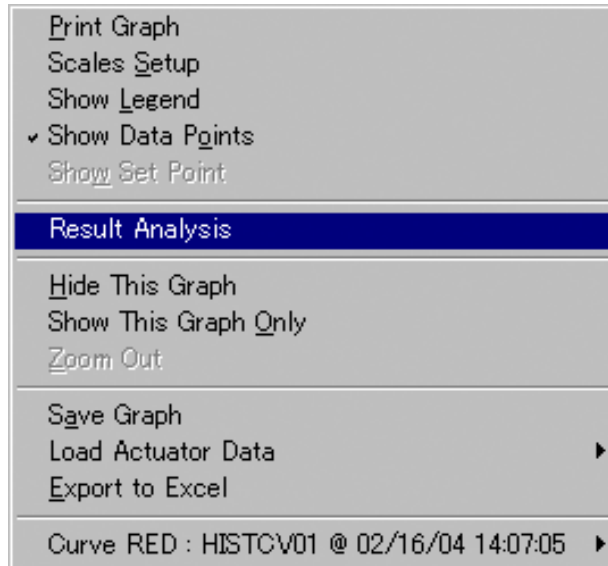


Figure 14.8 Pop-up menu for editing graph

Standard Signature Result Analysis									
PD_TAG	TimeStamp	Spring Range		Max Friction		Mean Friction		Min Friction	
		High	Low	kPa	%	kPa	%	kPa	%
HISTCV01	02/16/04 14:07:05	110.82	20.57	5.31	5.88	3.98	4.41	2.66	2.94

OK

Figure 14.9 Measurement of Spring Range and Valve Friction

14.3.2 Extended Actuator Signature

Extended actuator signature will measure the In-Out characteristics of the control valve in the range defined by users. The total number of data is 100 points.

- **Measurement Parameters**

The input parameter is output pressure (Equal to **MEAS_PRESS_AIR**); and the output parameter is the feedback signal (Equal to **FINAL_POSITION_VALUE.Value**)

- **Measurement Setting Parameters**

The measurement setting parameters determine the condition of measurement. The parameters consist of six float arrays. This group of parameters is shared with High Resolution Actuator signature.

Figure14.10 Extended Signature Setting

Lower Set Point[%]: lower measuring range, The valid range is -10 to 110%.

Higher Set Point[%]: higher measuring range, The valid range is -10 to 110%.

Recommended Scan Time [s]: Recommended Scanning Time.

Scan Time[s]: Scanning time. It determines the measuring time. User can use Recommended Scan Time value as a guide to set the scanning time. The valid range is 20 to 3600 sec.

Deviation margin[%]: Allowable deviation. The measurement is performed in Proportional control algorithm. In this reason, deviation between the set point value and the position value may occur due to the non-linear characteristic existing in the control system. (Mainly valve hysteresis) Basically, this value dose not need to be changed from the default value. But in case if stem position did not reach the desirable point then increase this value or if stem position far exceeds the desirable point then decrease this value to make the measurement correctly. The valid range is 0 to 500%.

Sampling rate[ms]: Sampling rate. This parameter is used for High Resolution Signature only. The valid range is 200 to 1000 ms.

- **Data to Obtain**

In measuring the extended actuator signature, YVP will obtain 100 data set. (Position data and Pressure data is one set.)

There are two data acquisition mode. **Position related data** acquisition and **time sampling related data** acquisition. Normally, data will be acquired according to the addressed measuring position point. When the valve is saturated and can not reach the measurement point, then data acquisition mode is switched to time sampling.

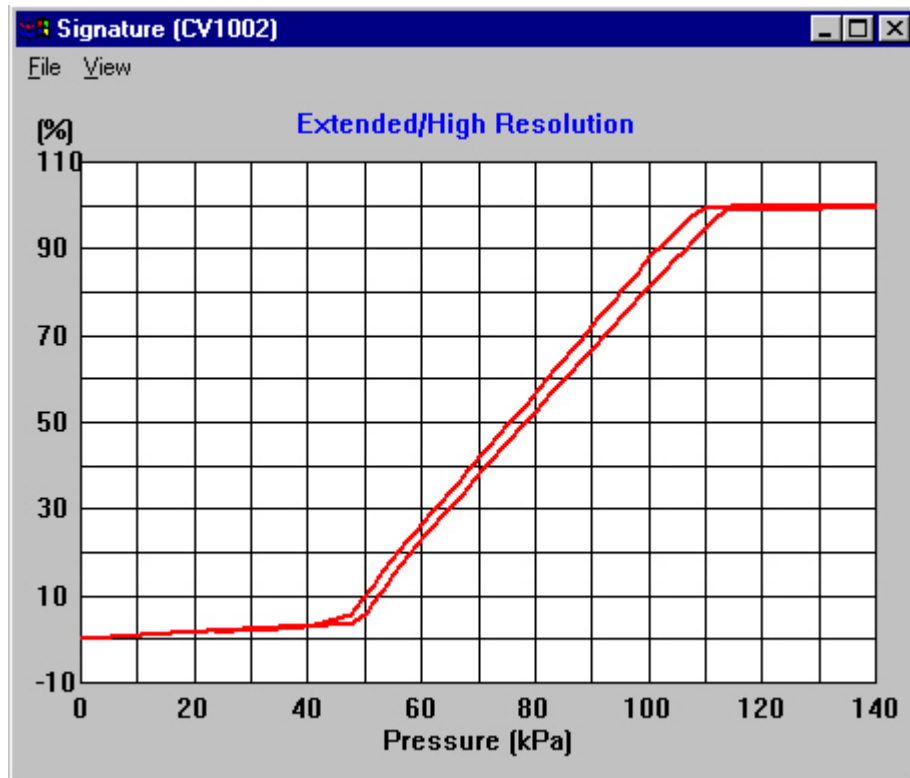


Figure 14.11 Extended Signature Graph

- **Offset measurement**

Before measuring the extended actuator signature, YVP will perform Offset measurement (The same procedure in Auto Tuning.) in order to prepare for the measurement if selected measuring mode is not **Measure All**.

- **Measurement of Spring Range and Valve Friction**

You can view the results of spring range and valve friction as in the same way at the Standard Actuator Signature.

14.3.3 High Resolution Actuator Signature

This function is used for measuring actuator signature in high resolution. This function will measure the In-Out characteristic of the control valve in time sampling mode. The number of measuring sample is dependent on the time of round-trip, and can be obtained by the following Calculation: $\text{Scan Time} / \text{Sampling rate} \times 1000$ [point].

Before measuring the signature, YVP110 will perform Offset measurement (The same procedure in Auto Tuning) in order to prepare for the measurement.

For details, refer to '14.3.2 Extended Actuator Signature'.

14.3.4 Step Response Test

This signature function will measure the step response characteristic of the control valve system. There are two types of step response test: single step response test and multiple step response test.

The multiple step response test consists of a series of single step response test, with a new set point for each following test incremented by the step size, executed consecutively in the overall range specified by the user. All individual single step tests use the same step size specified by the user except the very last one which uses the step size of the remaining portion.

There are four patterns of step response test: normal, cyclical, resolution and dead band test.

- **Measurement Parameter**

The step response test measures time-series changes in the valve position from the initial set point to the dest. set point. Valve position means FINAL_POSITION_VALUE.Value.

- **Measurement Setting Parameter**

The measurement condition defines as following parameters:

Signature Setting (FV-101)

Step Response

☐ Patterns

☒ Cyclical

☐ Dead Band Test

☐ Resolution

Initial Set Point (-10 to 110%)

Dest. Set Point (-10 to 110%)

Step Size (0 for Single Step)

Sampling Rate (20 to 1000ms)

Num of Samples (20 to 600) s Pause

Init Start Position Error limit (%)

Init Start Pos. Time Limit (sec)

2-Way Selection(round trip) ☐

OK Cancel Go

Figure 14.12 Step Response Setting

Initial Set Point (-10 to 110%): The base position for step test from which the set point will change by the amount of the step size. If the step test works as cyclical, resolution and dead band test, the value fixed at 50.

Dest. Set Point (-10 to 110%): The destination position. If it is in resolution patterns step test, the value should be over 50.

Step Size (0 for Single Step): The size of each step change. Used for multi step response test only. If the step size is 0, the multi-step test becomes the single step test in the range specified by the initial set point and the dest.set point. In pattern cyclically, the step size should be the range specified by the initial set point and the dest.set point if the step size is 0. In pattern resolution, the step size means the first step size (in the first cycle). In pattern resolution, the default value will be 5% if the step size is 0. In dead band test, the valid range is 0.1 to 2.0%.

Sampling rate (20 to 1000ms): Sampling rate of each step. The valid range is 20 to 1000ms.

Num of Samples (20 to 600): Sampling point of each step. The valid range is 20 to 600.

Init Start Position Error Limit (0.1 to 3%): The maximum error allowed between the actual position (FINAL_POSITION_VALUE) and the initial set point before starting the test. The valid range is 0.1% or more.

Init Start Position Time Limit (10 to 600sec): The maximum waiting time. If the actual position is not stabilizing within init start position error limit and within this time, step response test do not start.

2-way Selection (round trip): Selecting a round trip measurement Used for normal pattern test only. The values of the initial set point and the dest. set point determine the direction of the valve stem movement. When the value of the initial set point is more than that of the dest. set point, the valve steps down in one way trip, then steps up at return trip if 2-way selection specified.

Cycle: Number of cycles for cyclical response test.

Pause(s): Equal to Sampling rate * Number of Samples

- **Data to Obtain**

Position data before the step change is required in order to determine the starting point. The YVP110 will collect 10 samples of data before the each step input is applied.

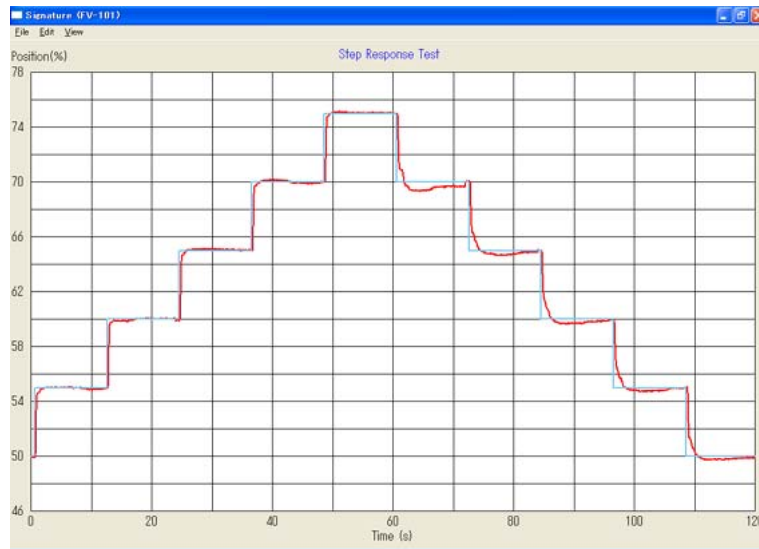


Figure 14.13 Step Response test Graph

- **View of Result Analysis**

To view the results, click edit on the menu bar and select the step response test graph, and then a pop-up menu will be shown. Also, you can move the cursor to the area of the step response test graph and make a right click for editing operation in a pop-up menu. Select and click result analysis to see the measured overshoot etc.

PD_TAG	TimeStamp	Overshoot (%)	T86 (sec)
FV-101	07/27/09 13:49:57	1.84	0.45

Figure 14.14 Result Analysis

- **Step Response Patterns**

- a) Normal Step Response Test

Signature Setting (FV-101)

Step Response

☐ Patterns ☒ Cyclical ☐ Dead Band Test

☐ Resolution

Initial Set Point (-10 to 110%)

Dest. Set Point (-10 to 110%)

Step Size (0 for Single Step)

Sampling Rate (20 to 1000ms)

Num of Samples (20 to 600) 12 s Pause

Init Start Position Error limit (%)

Init Start Pos. Time Limit (sec)

2-Way Selection(round trip) ☐

OK Cancel Go

Figure 14.15.1a Normal Response Test Setting

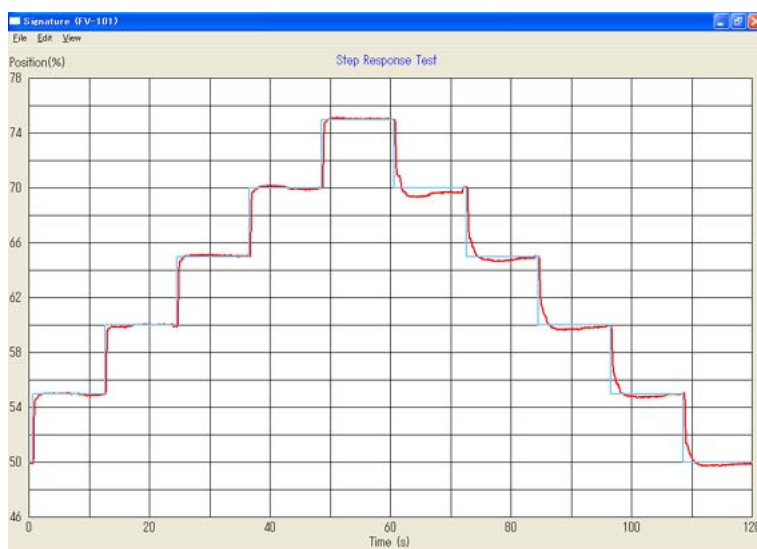
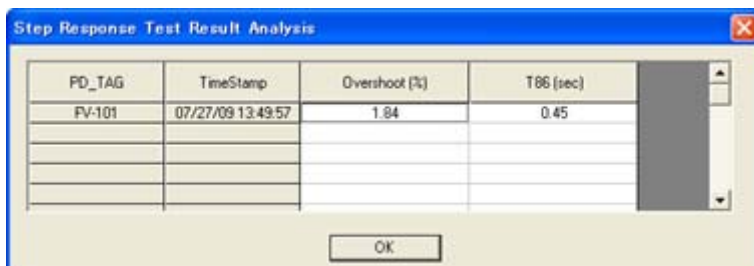


Figure 14.15.1b Normal Response Test Graph

The measured overshoot and 86% response time are displayed in the result analysis.

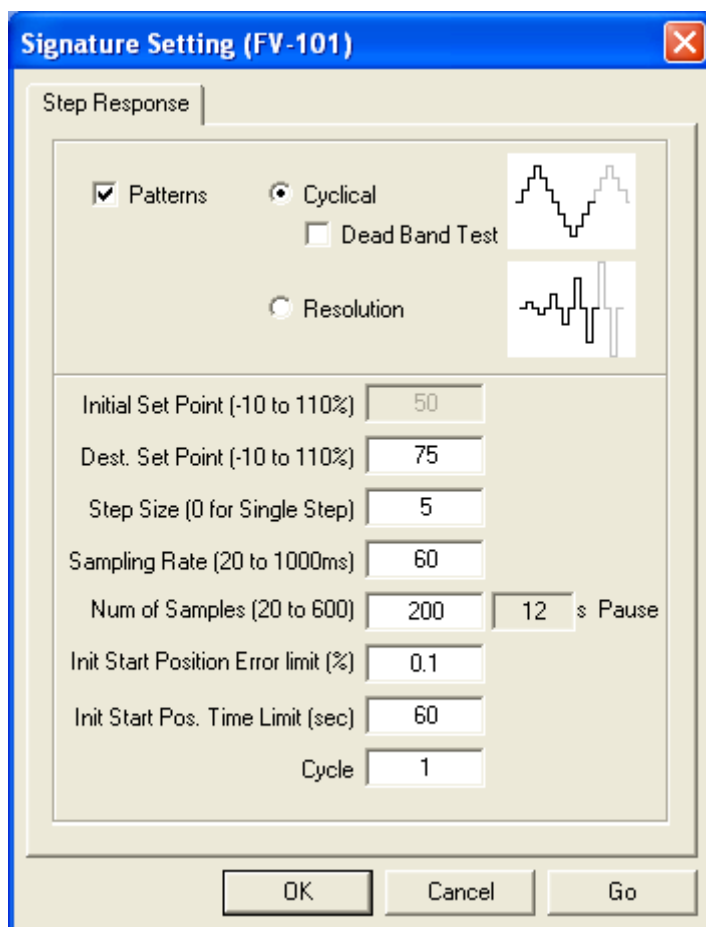


The image shows a dialog box titled "Step Response Test Result Analysis". It contains a table with four columns: PD_TAG, TimeStamp, Overshoot (%), and T86 (sec). The first row of data shows PD_TAG as FV-101, TimeStamp as 07/27/09 13:49:57, Overshoot (%) as 1.84, and T86 (sec) as 0.45. There are three empty rows below. An OK button is at the bottom.

PD_TAG	TimeStamp	Overshoot (%)	T86 (sec)
FV-101	07/27/09 13:49:57	1.84	0.45

Figure 14.15.1c Normal response Test Result Analysis

b) Cyclical



The image shows a dialog box titled "Signature Setting (FV-101)". It has a "Step Response" tab. Under "Patterns", the "Cyclical" radio button is selected. There are checkboxes for "Dead Band Test" (unchecked) and "Resolution" (unchecked). To the right are two waveform icons. Below are input fields for: Initial Set Point (-10 to 110%) = 50, Dest. Set Point (-10 to 110%) = 75, Step Size (0 for Single Step) = 5, Sampling Rate (20 to 1000ms) = 60, Num of Samples (20 to 600) = 200, 12 s Pause, Init Start Position Error limit (%) = 0.1, Init Start Pos. Time Limit (sec) = 60, and Cycle = 1. At the bottom are OK, Cancel, and Go buttons.

Step Response

☒ Patterns ☒ Cyclical ☐ Dead Band Test ☐ Resolution

Initial Set Point (-10 to 110%) 50

Dest. Set Point (-10 to 110%) 75

Step Size (0 for Single Step) 5

Sampling Rate (20 to 1000ms) 60

Num of Samples (20 to 600) 200 12 s Pause

Init Start Position Error limit (%) 0.1

Init Start Pos. Time Limit (sec) 60

Cycle 1

OK Cancel Go

Figure 14.15.2a Cyclical Response Test Setting

Start at initial set point (50%) to dest.set point by step size changing. Then move to set point which is 100 minus dest. set point. Then back to the initial set point (50%).

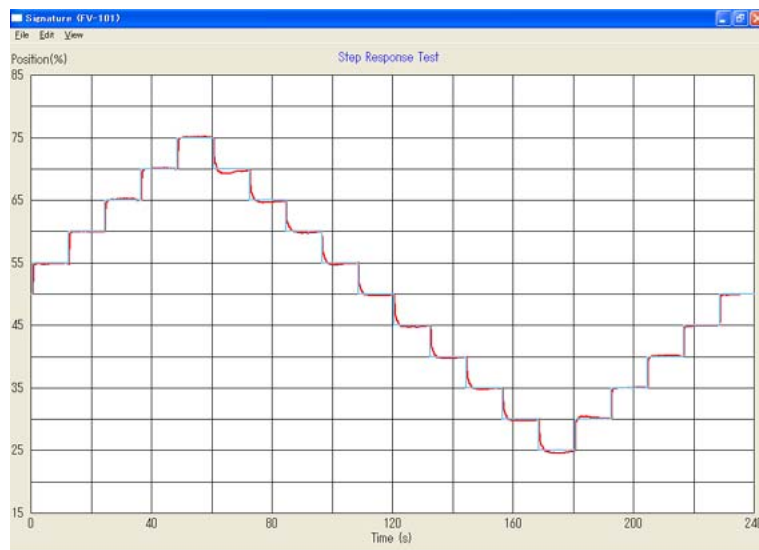
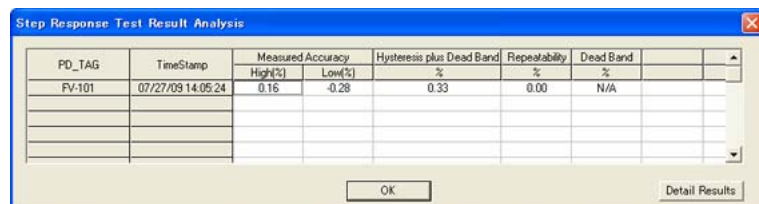


Figure 14.15.2b Cyclical Response Test Graph

The measured accuracy, hysteresis plus dead band and repeatability are displayed in the result analysis.



PD_TAG	TimeStamp	Measured Accuracy		Hysteresis plus Dead Band	Repeatability	Dead Band
		High(%)	Low(%)			
FV-101	07/27/09 14:05:24	0.16	-0.28	0.33	0.00	N/A

Figure 14.15.2c Cyclical Response Test Result Analysis

c) Cyclical / Dead Band Test

This test is used to determine the maximum value of marginal changes in the input level that does not move the control valve.

Signature Setting (FV-101)

Step Response

☒ Patterns ☒ Cyclical ☒ Dead Band Test

☐ Resolution

Initial Set Point (-10 to 110%)

Dest. Set Point (-10 to 110%)

Step Size (0 for Single Step)

Sampling Rate (20 to 1000ms)

Num of Samples (20 to 600) s Pause

Init Start Position Error limit (%)

Init Start Pos. Time Limit (sec)

Cycle

OK Cancel Go

Figure14.15.3a Dead Band Test Setting

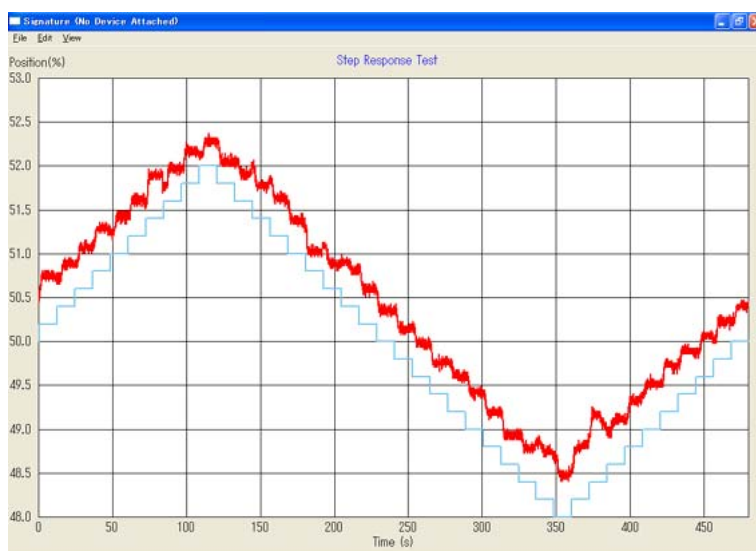
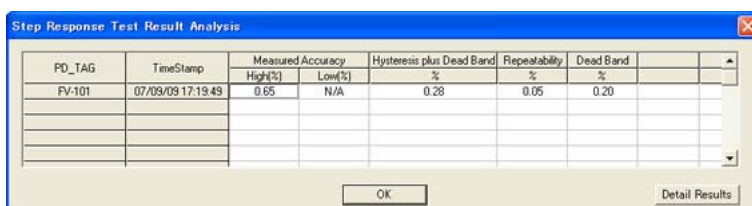


Figure 14.15.3b Dead Band Test Graph

Note: YVP110 stops integral function at the Dead Band Test. Therefore, the responding actual position has deviation from Set Point.

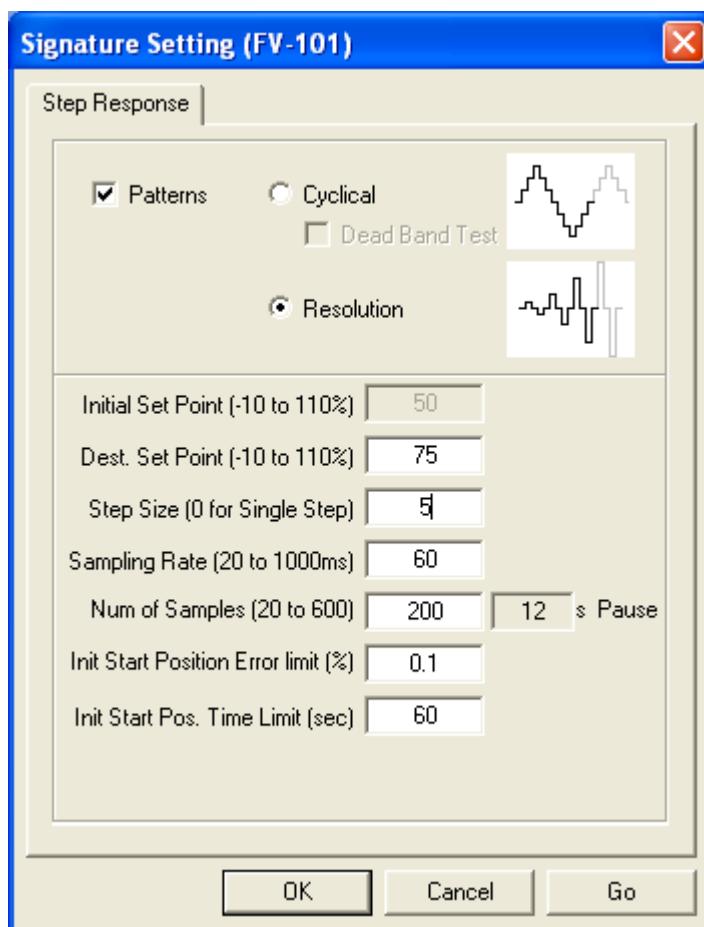
The measured accuracy, hysteresis plus dead band, repeatability and dead band are displayed in the result analysis.



PD_TAG	TimeStamp	Measured Accuracy		Hysteresis plus Dead Band	Repeatability	Dead Band
		High(%)	Low(%)	%	%	%
FV-101	07/09/09 17:19:49	0.65	N/A	0.28	0.05	0.20

Figure 14.15.3c Cyclical Response Test Result Analysis

d) Resolution



Signature Setting (FV-101)

Step Response

☒ Patterns ☐ Cyclical ☐ Dead Band Test

☒ Resolution

Initial Set Point (-10 to 110%)

Dest. Set Point (-10 to 110%)

Step Size (0 for Single Step)

Sampling Rate (20 to 1000ms)

Num of Samples (20 to 600) 12 s Pause

Init Start Position Error limit (%)

Init Start Pos. Time Limit (sec)

OK Cancel Go

Figure 14.15.4a Resolution Response Test Setting

Always start at initial set point (50%). Up to 1* step size, down to 1* step size, then up to 2* step size, down to 2* step size until the destination set point.

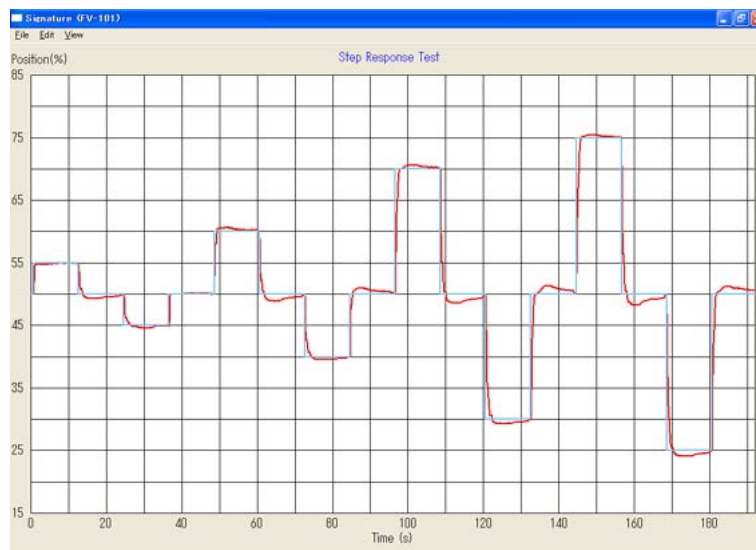


Figure 14.15.4b Resolution Response Test Graph

The measured overshoot and 86% response time are displayed in the result analysis.

The window title is 'Step Response Test Result Analysis'. It contains a table with the following data:

PD_TAG	TimeStamp	Overshoot (%)	T86 (sec)
FV-101	07/27/09 14:40:57	-0.23	0.43

At the bottom of the window is an 'OK' button.

Figure 14.15.4c Resolution Response Test Result Analysis

14.3.5 Positioner Signature

This signature function measures the static characteristics of the control valve system.

eter

Input signal of the control valve system: Input signal of YVP110 (Equal to **AO Block OUT.Value**)

Output signal of control valve system: Feedback signal of YVP110 (Equal to **FINAL_POSITION_VALUE.Value**)

The Low Cut, High Cut, Position Characterization and other functions related to Positioning in Transducer block are reflected in measuring Positioner signature. This helps the user to check the setting of YVP110 visually.

- **Measurement Setting Parameters**

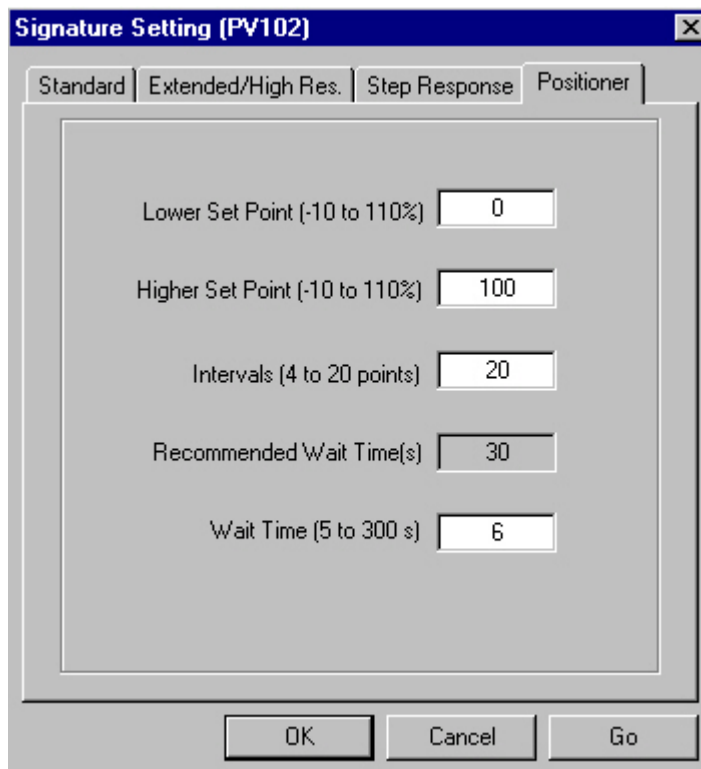


Figure 14.16 Poitioner Signature Setting

The measurement setting parameters consist of five float arrays.

Lower Set point signal (%): It determines input signal to start the measurement

Higher Set point signal (%): It determines the highest input signal in the measurement.

Intervals (points): Intervals determine the measurement points of this signature function. Width of measurement point is determined in equation below. The valid range is 4 to 20 points.

Width = (Higher Set point signal – Lower Set point signal)/Intervals

Total Sample points (collected in round trip)=2*Intervals+1

Recommended wait time (sec): It can be used as a guide for setting wait time (read only).

Wait time (sec): It determines the data acquisition queuing time for each measurement. The valid range is 5 to 300 seconds.

- **Data to Obtain**

The application will apply the Input signal to the YVP110 and wait until the valve stem settles then obtain the position data. The measurement will be proceeded in round trip.

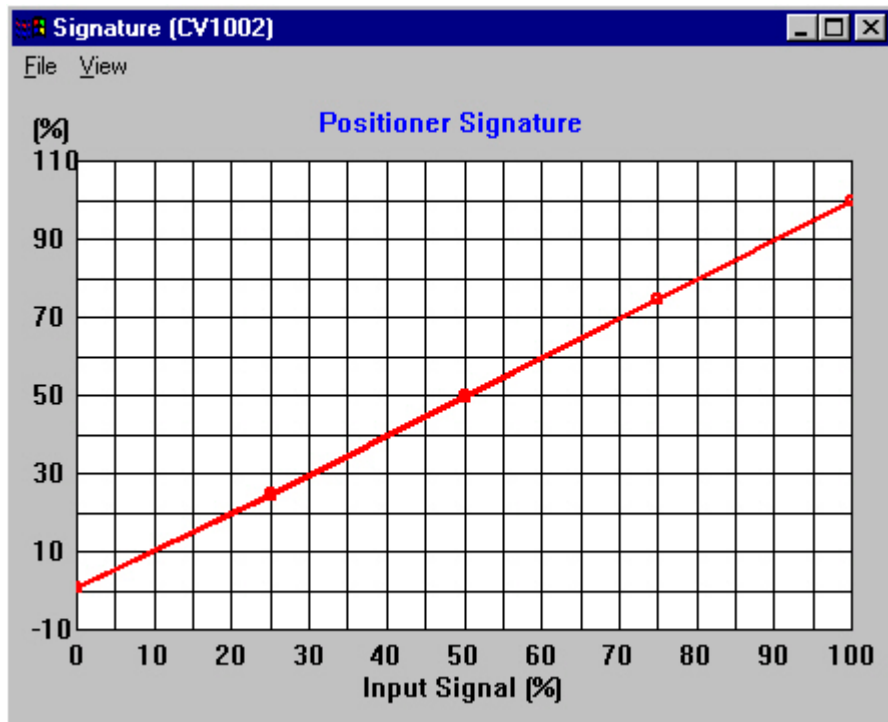


Figure 14.17 Positioner Signature Graph

14.3.6 Signature Selection

The general page of Diagnostics includes the interface to measure signatures.

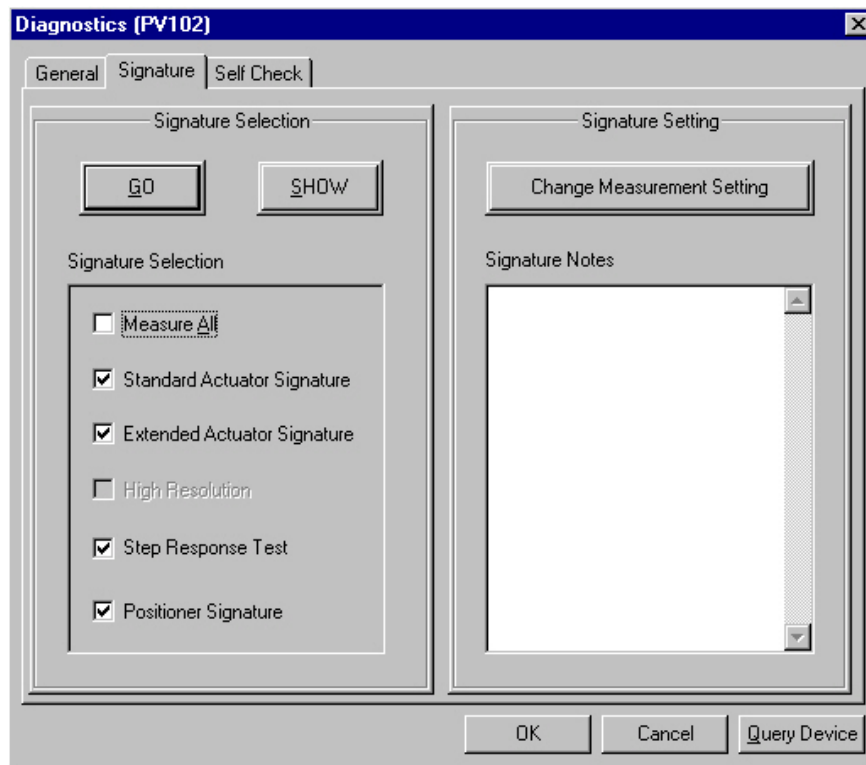


Figure 14.18 Selecting Signatures

The system allows user to be able to select **Measure All** or any combination of signatures set in either execution or data display.

When selecting **Measure All**, YVP will perform signature measurement in the following order.

- Actuator Signature
- Extended Actuator Signature
- Step Response Test (single step)
- Positioner Signature

Measure All does not support High Resolution Actuator Signature and only support Single Step Response Test.

For non-**Measure All** selection (any combination of signatures set), YVP may execute more than one command. It supports Multiple Step Response Test and High Resolution Actuator Signature.

- Clicking **Go** will start measuring signature. Refer to Signature Measurement for details.
- Clicking **Show** will display signature result. Refer to Signature Graphs for details.
- Clicking **Change Measurement Setting** will open Signature Measurement Setting dialog to modify the selected signatures measurement condition (setting parameters).
- The field of Signature Notes is used for entering notes. This information will automatically attach to the signature data after selected signatures measurement are performed.

14.3.7 Signature Setting

This dialog is used for setting signature conditions. The parameters allowed to modify will differ according to the selected signature.

The setting parameters are grouped by signature type. Each type of signature has its own parameters page (Extended Actuator Signature and High Resolution Signature share one page).

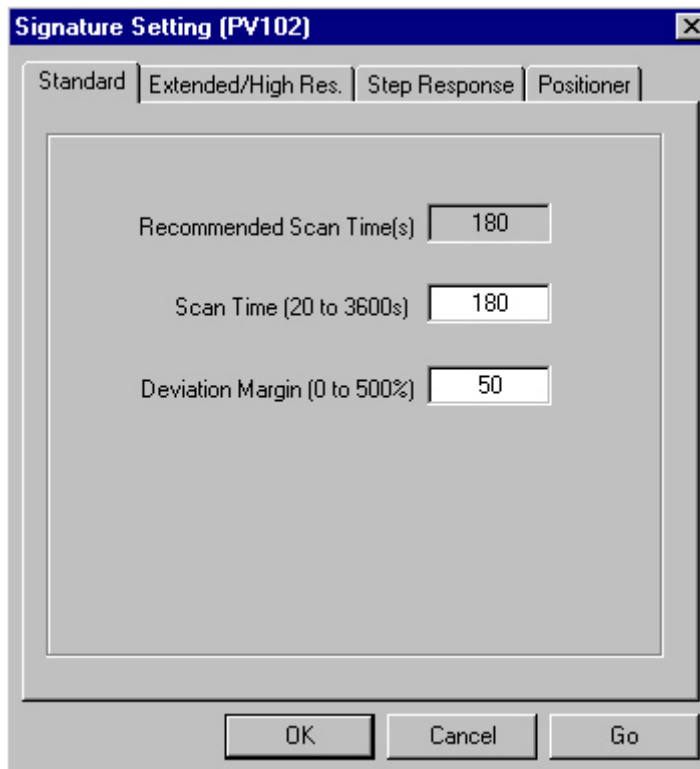


Figure 14.19 Standard Signature Setting

- **OK:** Clicking this button will validate the parameters value, and make them available for measurement.
- **Cancel:** Clicking this button will discard all modified value and close this window.
- **Go:** This button is only visible for YVP with /BP option. Clicking this button will validate the parameters value, and then start the signature process. At mean time, the dialog will be closed.

For parameters and their meaning, please refer to Actuator Signature, Extended Actuator Signature, Step Response Test or Positioner Signature for details.

14.3.8 Signature Measurement

During the signature procedure, the current measuring signature, measurement setting, real time data, real time curves, status and progress are displayed.

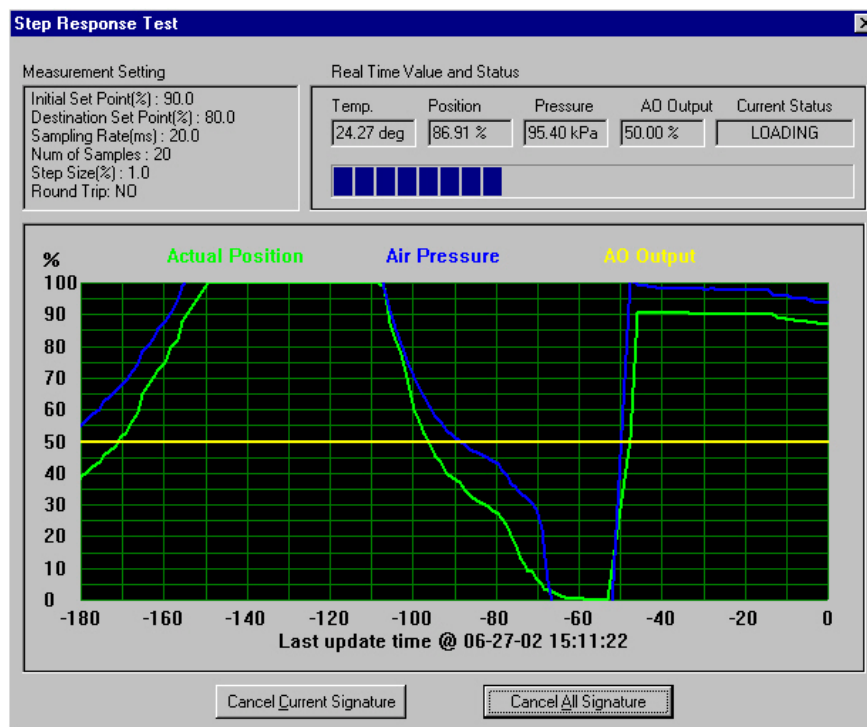


Figure 14.20 Signature Measurement

Window Title: the current execution signature.

Measurement Setting: the measurement condition of the signature in progress or other message before signature starts.

Temp.: Temperature, the value of TB parameter ELECT_TEMP

Position: Value of the feedback signal of YVP110, FINAL_POSITION_VALUE.VALUE

Pressure: Value of output pressure of YVP110, MEAS_PRE_AIR

AO output: Value of input signal of YVP110. AO block OUT.VALUE

Actual Position (red): The curve of feedback signal of YVP 110, FINAL_POSITION_VALUE.VALUE

Air Pressure (yellow): The curve of output pressure of YVP110, MEAS_PRE_AIR

AO output (blue): The curve of input signal of YVP110. AO block OUT.VALUE

Progress Bar: the current progress of the signature measurement.

Current Status: indicates current operation, or the measurement result.

Cancel Current Signature: Clicking this button will cancel the current executing signature, and measure the next signature. For **Measure All**, it will terminate all the signatures.

Cancel All Signature: Clicking this button will cancel all the selected signatures.

Zoom In/Zoom out: In the curve displaying area, user can select a rectangle area to zoom, and double click mouse to restore.

14.3.9 Signature Graphs

After signature measurement completes, the signature graphs dialog will be shown. Based on the user's selection, the signature graphs dialog can display up to four types of signature graphs. Because extended actuator signature and high resolution actuator are share database, their graphs are displayed in the same graph window.

Even when current selected device is OFFLINE or YVP whose device revision is 2, the application can show graphs which are stored in PC. At Signature Selection screen, make selections and then click **Show**. The graph window will open.

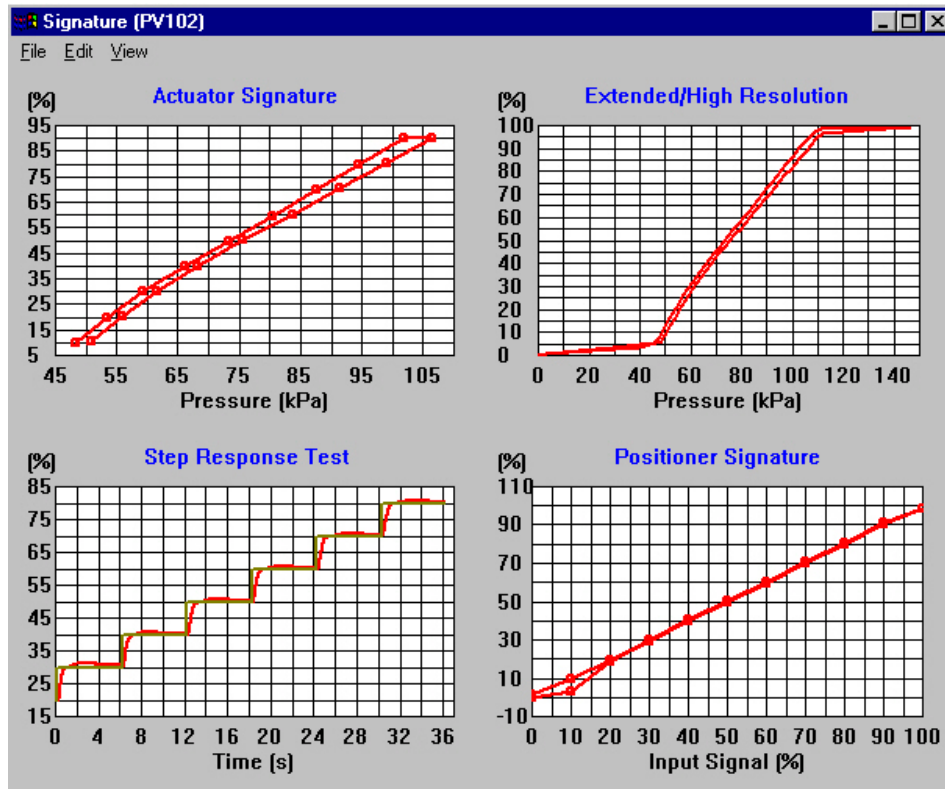


Figure 14.21 Signature Graphs

To edit a signature graph, click **Edit** on the menu bar, and then select signature graph type to be edited. A Pop-up menu will be shown at the center of selected graph area. Or move the cursor to the area of signature graph to be edited and make a right click of the mouse. A pop-up menu will be shown for editing operation.

- **Load Signature Graph(s)**

To load a group of graphs select **Load** from **File** menu and select a signature file to open. If current graph window is not empty, user will be prompted to clear old graph or not. By loading data into an existing graph, comparing curves will be shown in the graph.

To Load a specified type of graph, move the cursor to this graph, right-click, select **Load ... Data** from a pop-up menu and then select the data to be loaded. The data can be loaded from the **current** data base in YVP or **File**. **Record** or **Baseline** can also be selected if signature type is standard actuator signature.

The following lists extensions of data file for signature function.

- STD: Standard Actuator Signature
- EXT: Extended Actuator Signature and High Resolution Actuator Signature
- STP: Step Response Test
- POS: Positioner Signature
- SIG: Multiple Graphs or Legacy Files

- **Save Signature Graph(s)**

To save a group of graphs, select **Save** from menu **File**.

To save one specified graph, move mouse cursor to that graph, right click, and select **Save Graph** from **Pop-up menu**.

To save data of **current** data base in YVP to a file, select the curve from a pop-up menu, and then select **Save to File**. If signature type is standard actuator signature, **Save to Record** or **Save to Baseline** can also be selected.

- **Print Signature Graph(s)**

To print a group of graphs, select **Print All** from menu **File**.

To print one specified graph, select **Print Graph** from a pop-up menu.

- **Export Signature Data**

Signature data can be exported to Excel or Notepad. If Excel system is not installed, data will be exported to notepad.

To export all data in one graph window, select **Export to Excel** from a pop-up menu.

To export one signature measurement data in one graph window, select a curve to export from a pop-up menu, then select **Export to Excel**.

- **Hide graph/show graph**

Selecting **Hide this Graph** from a pop-up menu or unchecking related menu item from **View** menu will hide specified graph from a window. To **show this graph** again, **check** related menu item from **View** menu.

- **Show This Graph Only/Show All Selected Graphs**

Selecting **Show This Graph Only** from a pop-up menu will enlarge the graph in full window and hide other graphs.

Selecting **Show All Selected Graphs** from a pop-up menu will restore the full window graph to a previous size and show other selected graphs again.

- **Graph Scale Setup**

Double clicking X-Axis or Y-Axis area of a graph or selecting **Scales Setup** from a pop-up menu will open Graph Scale Setup dialog. Refer to '14. 3. 10 Graph Scale Setup' for details.

- **Graph Legend**

Selecting **Show Legend** from a pop-up menu will show the legend which includes the data source and its measurement time stamp. The legend box is movable. By Clicking one of the items listed in the legend box will show the summary information of the measurement.

- **Show Data Points**

By checking/unchecking **Show Data Points** from a pop-up menu, graph window will show the signature curve with/without data dots. In default mode, Actuator Signature and Positioner Signature graph show with dots, Extended Signature/High Resolution and Step Response Test show without dots.

- **Show Set Points**

For Step Response Test only. Checking/Unchecking **Show Set Points** from a pop-up menu will display or hide the set points curve in step response graph. The default mode shows set points curve.

- **Grid Line**

Select a grid line figure from solid, dot, and none by clicking **Grid Line** from a pop-up menu.

- **Zoom in/Zoom out**

Zoom in: In the curve area of a graph window, a selected rectangle area by mouse will be zoom in.

Zoom out: double clicking a mouse or select **Zoom Out** from pop-up menu will restore current displaying scale setting to default.

- **Signature Summary**

Selecting a curve and clicking **Measurement Summary** from Pop-up menu will open Signature Summary, Dialog to show signature measurement information. Refer to '14. 3. 12 Signature Summary' for details.

- **Signature Notes**

Selecting a curve and clicking **Signature Notes** from Pop-up menu will display User's notes. This information is editable. Refer Signature Notes for details.

- **Remove Curve**

Selecting a curve and clicking **Remove Curve** from pop-up menu will delete the curve from the graph.

14.3.10 Graph Scale Setup

This dialog is used for setup signature graph windows display area.

X-Axis: display range of input parameter.

Y-Axis: display range of output parameter.

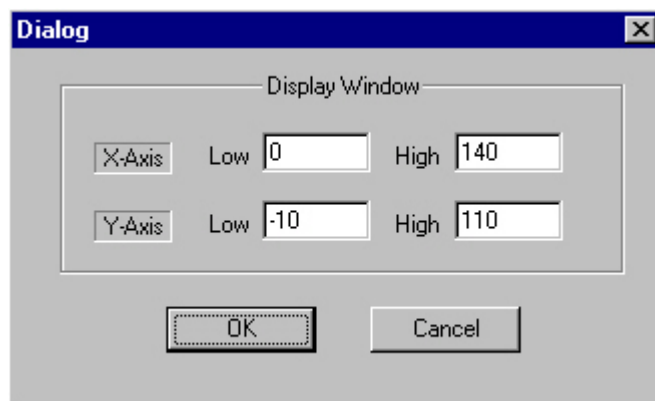


Figure 14.22 Scale setting

14.3.11 SignaAug. 01, 2004-00ture Summary

The Signature Summary shows measured temperature, signature setting, input/output parameters, time stamp, saved location, and user's free signature notes.

Measurement Setting: the signature's measuring condition.

Input/Output Parameters: signature input and output parameter's properties including engineering unit, range limits, maximum and minimum measured value.

Time Stamp: signature measured time. The time is based on published time on Fieldbus.

File Path: full path name if the data is loaded from a file.

Notes: signature notes written down by user to record memos such as valve or positioner conditions. The note can also be modified by clicking **Edit Notes** button.

Result Analysis: According to the result of standard actuator signature, system will perform data analysis automatically. The analysis items include spring range and friction. This feature apply to standard actuator signature only.

Signature Summary (PV103)

Measurement Setting		Input/Output Parameters	
Temperature	: 17.7		
Recommended Scan Time(s)	: 180.0		
Setting Scan Time(s)	: 180.0		
Deviation Margin(%)	: 50.0		
Time Stamp		01/11/04 15:11:30	
File Path		D:\Program Files\ValveNavi\Signature Data\Samples\PV103_01132004.sig	
Notes			
Edit Notes			
Spring Range		Friction	
Low	44.96 kPa	Max	1.52 kPa
High	111.93 kPa	Min	0.73 kPa
		Average	1.12 kPa
			2.26 %
			1.08 %
			1.67 %

Figure 14.23 Signature Summary

There are two ways to show Signature Summary:

- Right-click the mouse on a graph field. Select the curve to be shown (by selecting **Curve ...**), and then select **Measurement Summary**.
- Show **Graph Legend** on the graph field, and click the item listed in the legend box.

14.3.12 Signature Notes

Signature notes can be used for writing down the condition of the control valve or the positioner when performing the signature tests. Signature Notes can be entered either before signature starts or after it is performed. There are three ways to record signature notes.

- Write down notes before signature starts. In Signature Page, Signature Notes edit field is used for entering notes. See Signature Selection.
- At signature graph window, right-click the mouse on the graph area, select a Curve that you want to record signature notes, and then select Signature Notes. A Signature Notes dialog will be opened.

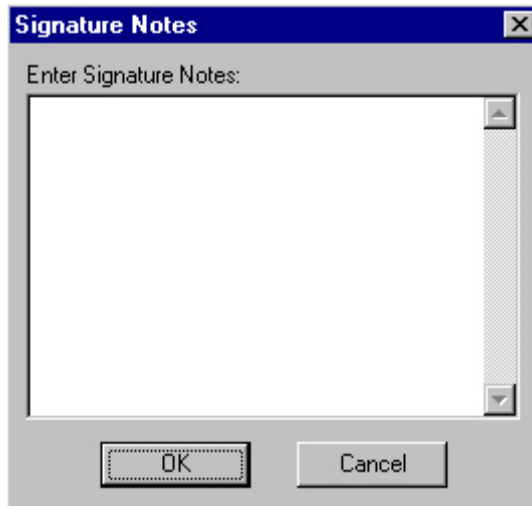


Figure 14.24 Signature Notes

- The note can be added or modified through Signature Summary dialog. Refer to Signature Summary for details.

15. QUERY SERVICES

Query services are useful for viewing every parameter in every YVP. It is accessible by several methods: from the Device Query icon in the tool bar, from the IVI, or PID dialogs and by right-clicking a selected device in the device tree. As many as 30 Query dialogs can be open simultaneously to examine parameters in the selected function blocks. Click Read to update. They are not refreshed. A query will remain active even when the device to which it is directed is no longer the selected device.

The General tab provides a selection from commonly used parameters. Use the scroll bar to select a parameter, then click Read.

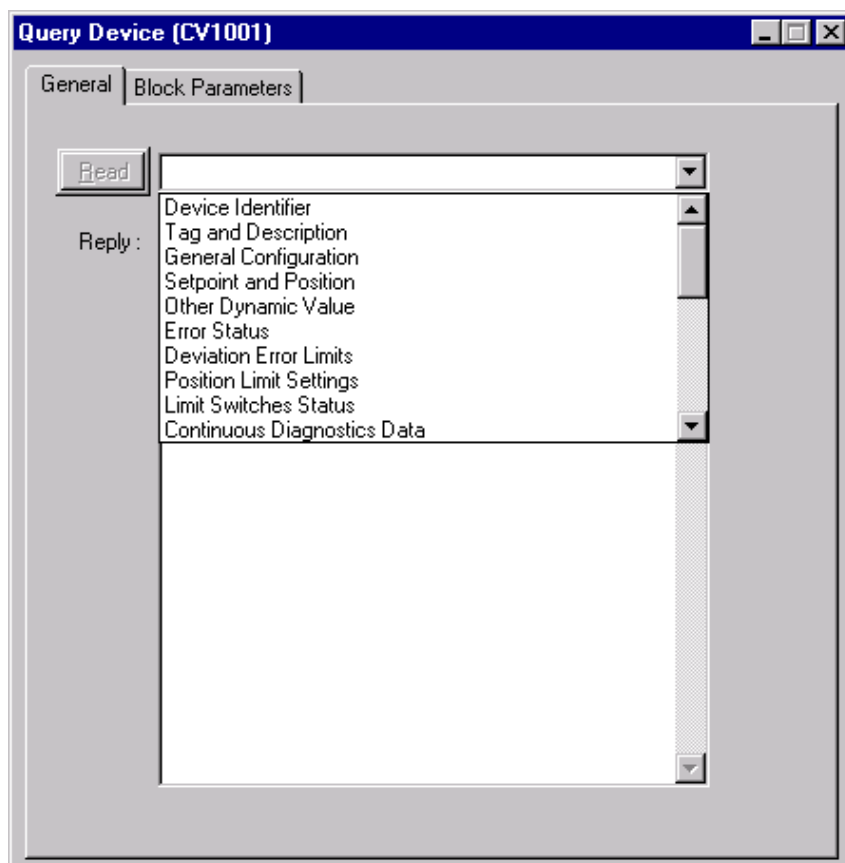


Figure 15.1 Query Device - General

The Block Parameters tab provides access to every parameter in each selected block. For the expert technician it provides detailed information that is not available in the configuration and tuning dialogs. For interpretation of the parameters, and their units and data structure, see the YVP user's manual. In the example shown in Figure 15.2, the parameter MODE_BLK reveals that the mode of the Transducer block is Set to OOS (out of service) now.

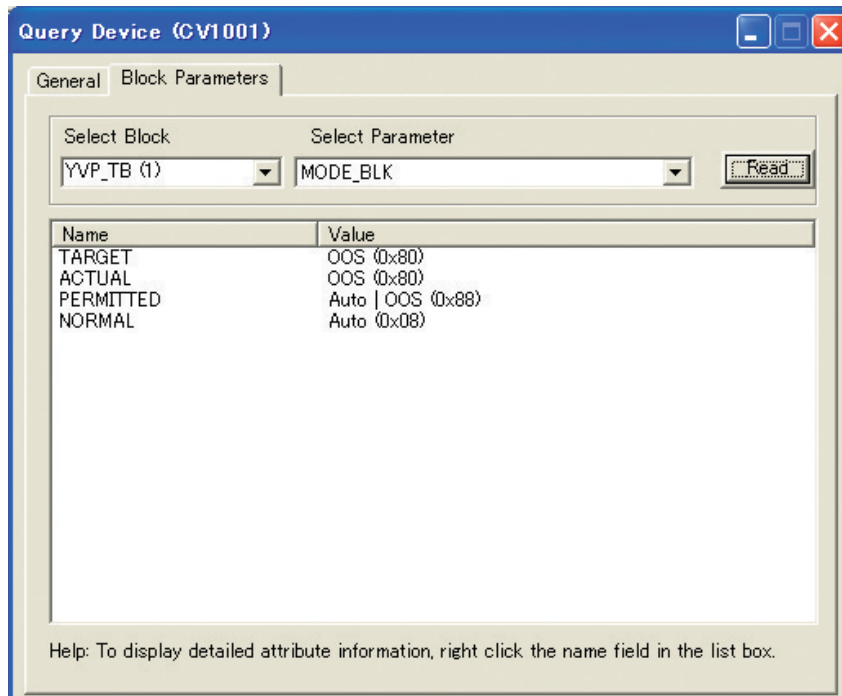


Figure 15.2 Query Transducer Block Valve Characteristic Parameter

As in the General tab, select a parameter from the pull-down list using the scroll bar. Then click read to see the parameter value.

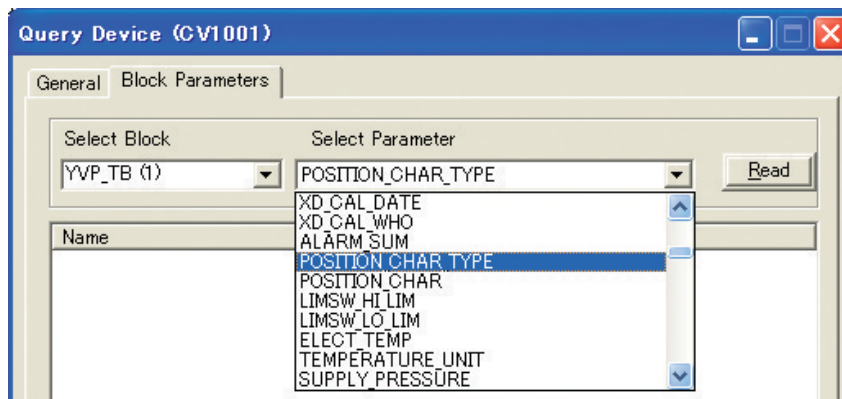


Figure 15.3 Parameter Pull-down List

The Parameter Attribute window can be accessed from the Block Parameters page of Query Device by right-clicking the parameter name field. It displays the attributes of the parameter described in the DD file.

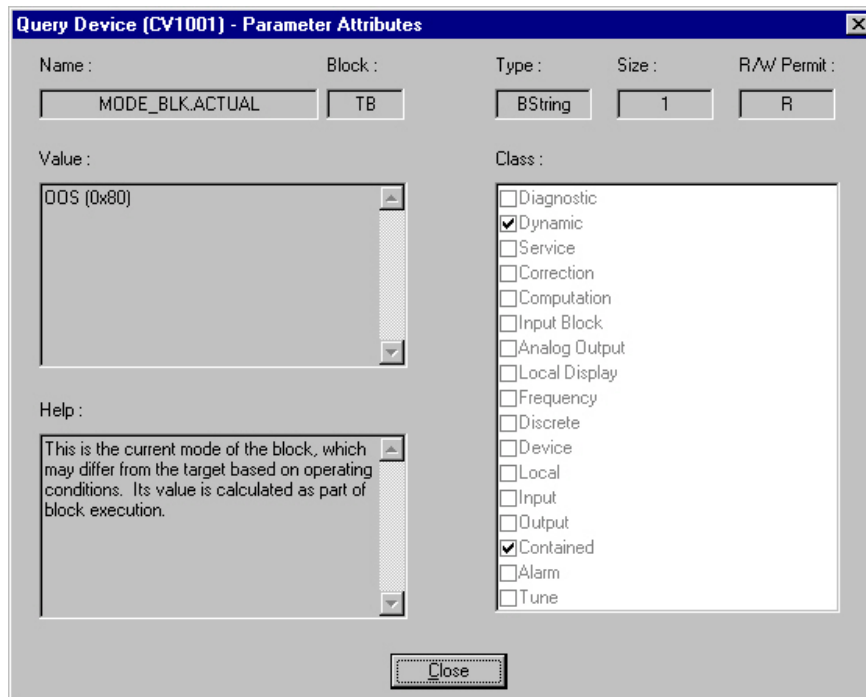


Figure 15.4 Parameter Attributes

16. REPORTING SERVICES

16.1 Configuration Report

This program provides a Configuration Report feature that captures a snapshot of all configuration data currently contained in and related to the selected device. The data are organized into groups that are consistent with the format of the configuration user interface. The report can be either HTML format or TEXT format. The HTML-based is browser independent. It is best viewed with the latest browser versions. Access the Generate Report menu item from the file menu. Then a HTML or TEXT format choice is needed.

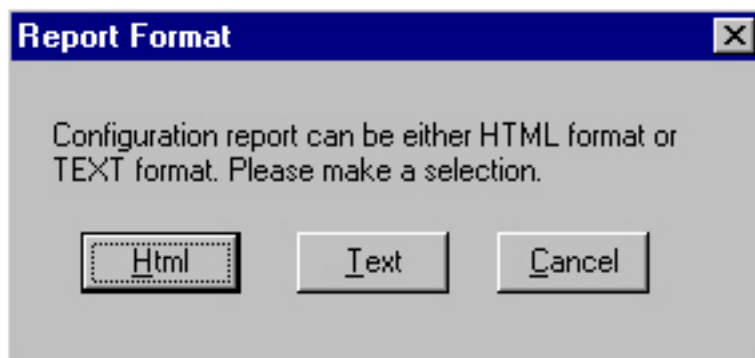


Figure 16.1 Report Format Selection

If you select HTML format, the default browser will open the YVP configuration report as a Web Page similar to that shown in Figure 16.2. The appearance will differ slightly between Internet Explorer to Netscape Navigator.

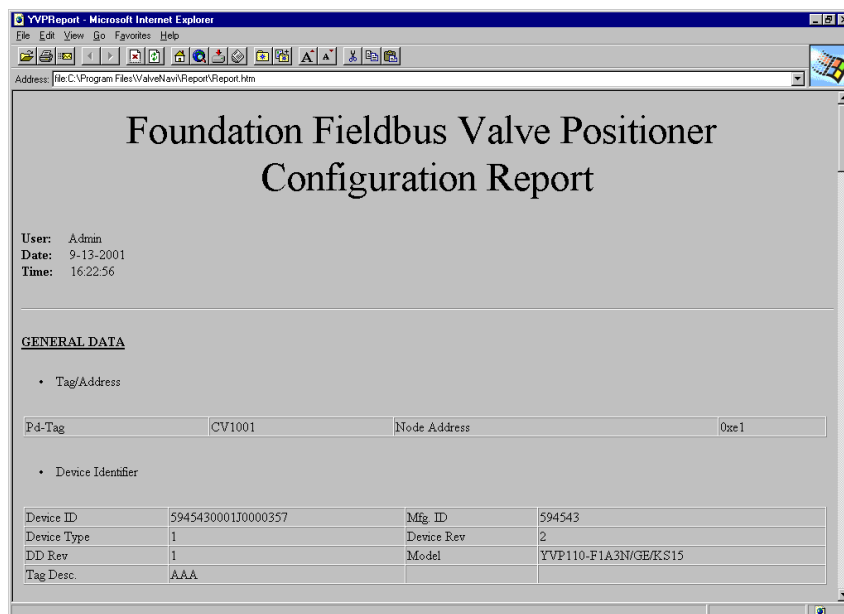


Figure 16.2 Configuration Report in Browser (IE5.0)

To save the report into a file, select File Save on the browser menu bar. To print a hard copy of the report, select File Print from the browser menu bar. Or use the browser's print and save toolbar icons.

● Use Report Generation to View Saved Configuration Files Services

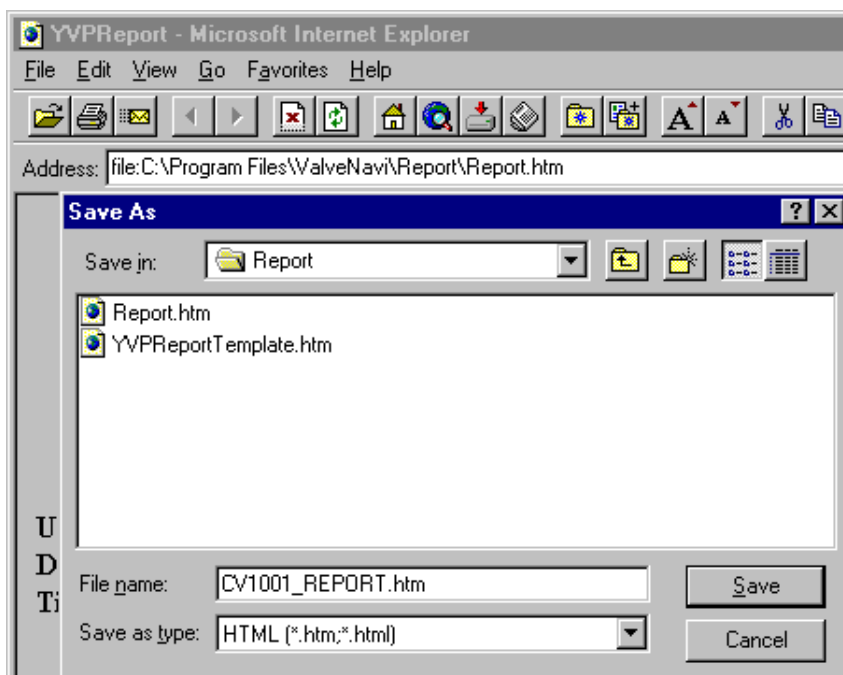


Figure 16.2 Save Configuration Web Page Dialog

Configurations that are saved for downloading (.dmp files) to devices may be viewed with the Report Generator in Offline State. Right click Offline and then click Open. Select the configuration file that has the desired data. When the Offline device loads the data, then click Generate Report to view and to print the data with your Web browser.

16.2 Communication Error Log

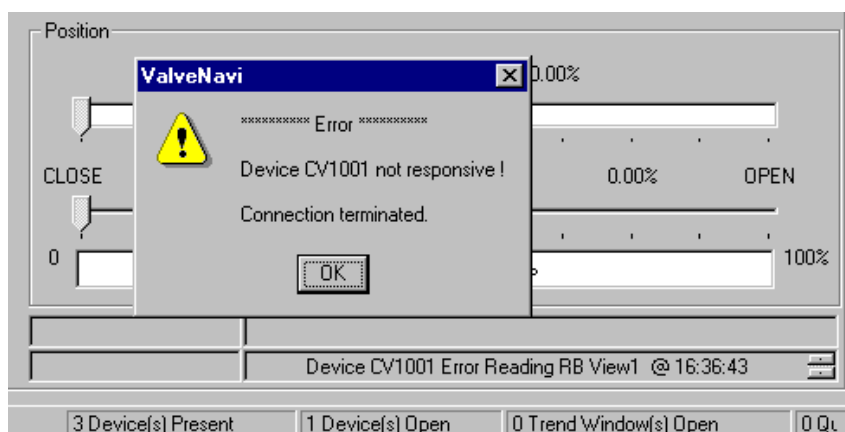


Figure 16.3 Communication Error Dialog

Occasionally, Foundation fieldbus will report communication errors. For example, if there is a loose or intermittent connection between the fieldbus segment the NI-FBUS card interface then communication errors may occur. ValveNavi pops up a warning dialog. The first error requires acknowledgement (click OK to close) and following errors are recorded in the communication errors text box shown in Figure 16.3. The error log can be saved to a text file using the following steps.

- Step 1 Right click on the error log text box. A menu box appears (Figure 16.4).
- Step 2 Click Select All. There may be many lines of errors although only one shows in the text box.
- Step 3 Click Copy.
- Step 4 Open a text document with any text editor and paste the log.

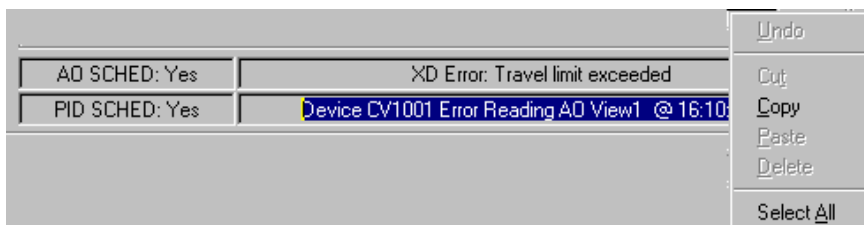


Figure 16.4 Copy the Error Log

```

Device FV 101 DI View2 Aborted @ 15:10:19
Device FV 101 DI View2 Aborted @ 15:10:19
Device FV 101 PID View3 Aborted @ 15:10:21
Device FV 101 PID View3 Aborted @ 15:10:21
Device FV 101Error (-5): E_BAD_ARGUMENT @ 15:10:21
Device FV 101 DI View2 Aborted @ 15:10:21
Device FV 101 DI View2 Aborted @ 15:10:21
Device FV 101Error (-5): E_BAD_ARGUMENT @ 15:10:27
Device FV 101Error (-5): E_BAD_ARGUMENT @ 15:10:34
Device FV 101 Comm Error (-11): E_COMM_ERROR @ 15:11:14
Device FV 101 Comm Error (-14): E_OBSOLETE_DEVICE @ 15:14:35
Device FV 101 Comm Error (-14): E_OBSOLETE_DEVICE @ 15:14:35
Device FV 101 DI View2 Aborted @ 15:14:35
Device FV 101 DI View2 Aborted @ 15:14:35
Device FV 101 Comm Error (-11): E_COMM_ERROR @ 15:14:52

```

Figure 16.5 Paste the Error Log into a Text File

The error log in Figure 16.5 was created when the connection to the segment was repeatedly disconnected.

17. FAILSAFE HANDLING

17.1 Introduction

For the selected positioner, ValveNavi will constantly monitor the status of the actual valve position parameter FINAL POSITION VALUE in Transducer (TB) block to report and manage Failsafe events. The actual status of Failsafe is determined by the parameter RELEASE FAILSAFE in TB. To configure the Time 2 parameter to force Failsafe because of sustained deviation, refer to Position setup configuration. If the IVI is open, the Fail Safe Status window automatically opens to display a Failsafe status. The window can also be opened manually from the View menu in the Main screen. Once the Fail Safe Status window is displayed, it will remain open until closed by the user. Failsafe can interact with other configuration settings in ways which make it very difficult to recover from failsafe.

17.2 Failsafe Active Latched

The following Fail Safe Status window will pop up when the selected device is in Failsafe Active Latched condition.

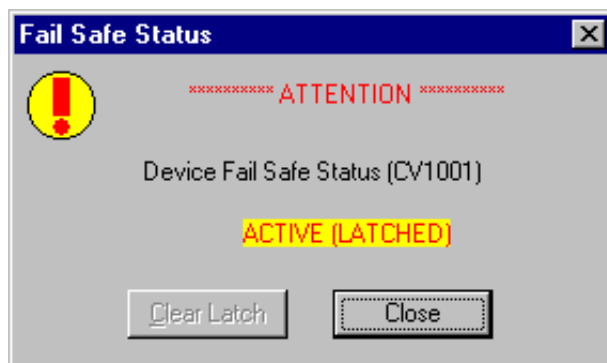


Figure 17.1 Failsafe Active Latched Dialog

17.3 Failsafe Clear Latched

The Fail Safe Status window will be updated with the Failsafe Clear Latched condition when the active condition has been cleared. The Clear Latch button will be enabled for the user to clear the latch. If the positioner is not in out of service (OOS) operation state, required for clearing the latched state, the user will be prompted to switch to OOS state.



Figure 17.2 Failsafe -Clear Latched

17.4 Failsafe Clear Non-Latch

The Fail Safe Status window will be updated to the Failsafe Clear Non-Latch condition when the latch has been cleared.

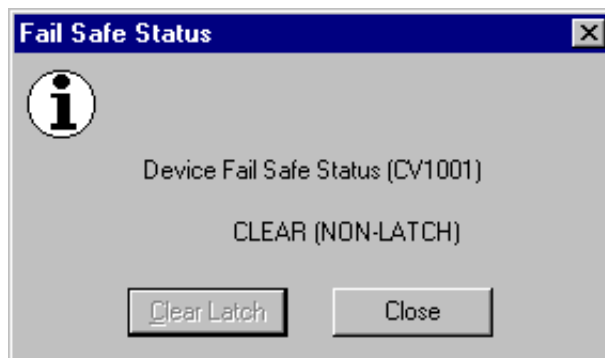


Figure 17.3 Failsafe - Clear Non-Latch

17.5 To Exit Failsafe

Failsafe cannot be cleared until the original cause is corrected. Determine the cause of failure and correct it.

After the cause of the problem has been corrected, the Failsafe Dialog may show Clear (Latched). Click the Clear latch button and close the Clear (Non-latch) button.

17.5.1 If the Deviation Error Failsafe is set

If the duration in which a deviation is out of the Error Band (%) exceeds the value of Time 2, the failsafe action is activated.

Certain combinations of configuration parameters can complicate exiting failsafe. Typically non-standard travel calibration coupled with tight shutoff, full open, and/or position limits may need to be cleared before exiting failsafe. If the Time 2 (T2) Deviation parameters are set the following four cases might be found for failsafe. Follow the steps as shown in below for these cases.

● Deviation Error, Air to open, Low or high actuator pressure (Cases 1 and 3)

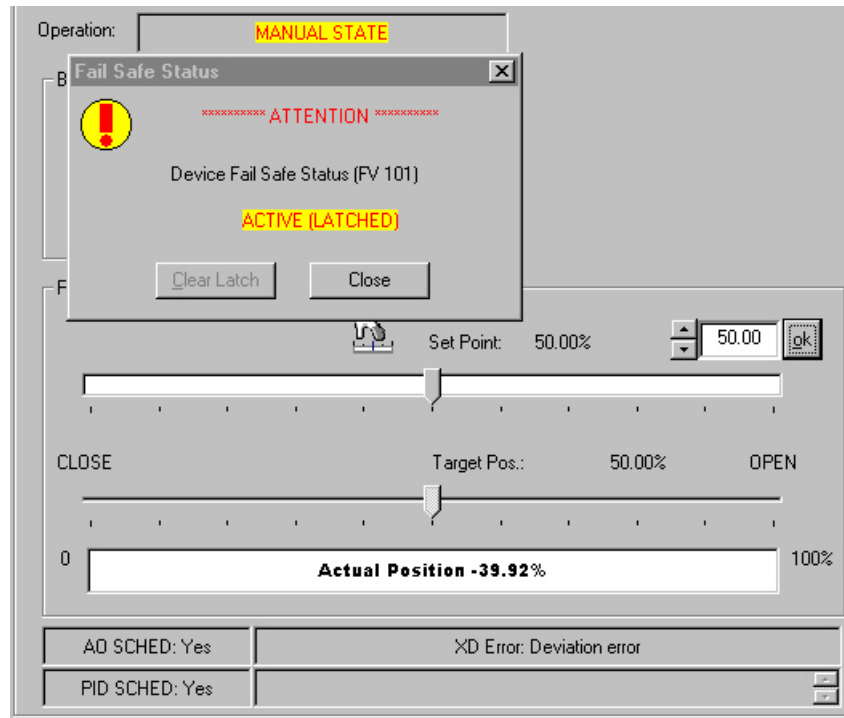
Table 17.1 Failsafe- Cases 1 and 3

Case 1	Failsafe type	Actuator Action	Cause of Failure
	Deviation Error	Air to Open Fail Close	Loss of supply or low actuator pressure
Observable behavior	Valve fails closed with low actuator pressure. After the pressure problem is corrected, the valve is closed in failsafe.		
	XD Error: Deviation error appears in the Error status. The Failsafe Status dialog appears and shows Active (Latched).		
Case 3	Failsafe type	Actuator Action	Cause of Failure
	Deviation Error	Air to Open Fail Close	High actuator pressure
Observable behavior	Valve fails open with high actuator pressure. After the pressure problem is corrected, the valve is closed in failsafe.		
	XD Error: Deviation error appears in the Error status. The Failsafe Status dialog appears and shows Active (Latched).		

T17.1eps

To exit Failsafe for Case 1 and 3

- Step 1 Restore the air supply or correct actuator problem.
Check that the pneumatics are working correctly.
- Step2 Move the Failsafe dialog to one side of the screen to uncover the IVI display. (If the PID dialog is open, close it.)
- Step3 Record the Actual Position. (Shown as -39.92% in Figure 17.4) In this extreme example, the valve calibration allows for large travel between closed stop and 0% position.

**Figure 17.4 Failsafe Steps 1 and 2.**

- Step4 This step requires privilege level 3, 4, 8 or 9.
Open the Operation State dialog, and select Manual, then click OK. In the setpoint text box, enter the same value as the Actual Position, recorded in step 3. Click OK. If the Failsafe dialog changes to Clear (Latched), then click the Clear Latch button. When the dialog request a change to OOS, click Yes. If the Failsafe dialog remains in Active (Latched) proceed to the next step.
- Step5 This step requires privilege level 3, 4, 8 or 9
Open the Configuration dialog. Select the Position tab. Set the Tight Shutoff and Position Low Limit parameters to -10 lower than the Actual Position recorded in step 3. Set the Time 2 parameter to -1. See Figure 17.5. Click OK to accept the changes, and then click Yes when a dialog warns of a change to OOS state. The Failsafe dialog should change to Clear (Latched). Click the Clear Latch button. When the dialog requests a change to OOS, click Yes.
- Step6 This step requires privilege level 2, 3, 4, 8 or 9.
Open the Operation State dialog and select Manual, then click OK. In the setpoint text box, enter the same value as the Actual Position, recorded in step 3. Click OK.

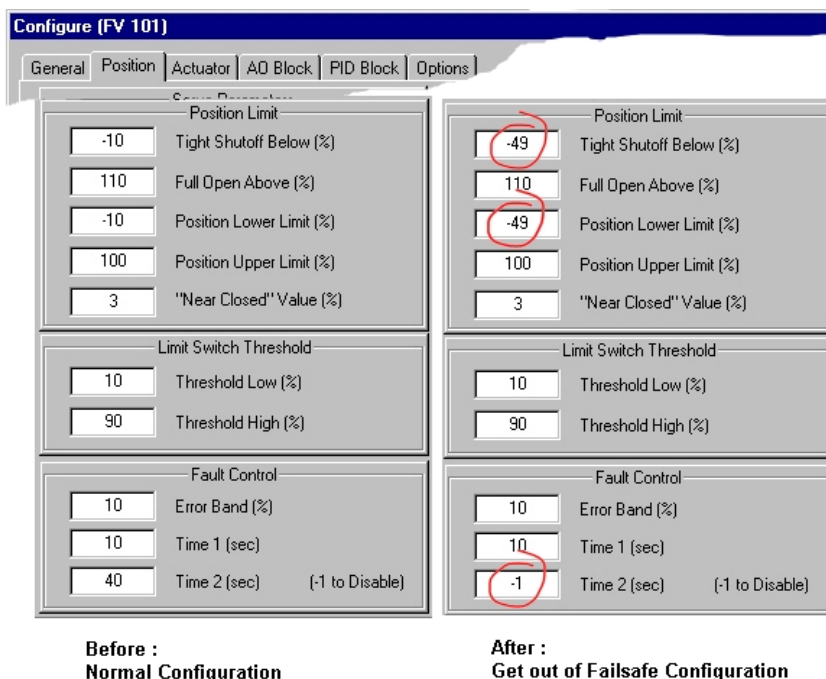


Figure 17.5 Set the Parameters to Values that Allow Return from Failsafe.

Click Clear Latch. Click yes to the switch to OOS to Release Failsafe. Then return to Manual operation state to resume manual operation of the valve. Then follow plant procedure to return to automatic control. The Deviation Error Failsafe configuration can later be restored by resetting the T2 parameter in Configuration>Position.

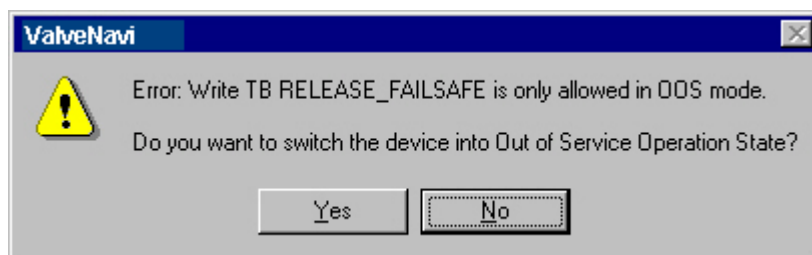


Figure 17.6 Clear Latch Dialog



Figure 17.7 Change Mode to OOS Warning



WARNING

Setting the T2 Parameter, to cause failsafe after a sustained position error, can cause unwanted process shutdowns. The T2 setting should be used cautiously. Care must be taken to avoid interaction with other configuration parameters, particularly High and Low Position limits.

● Deviation Error, Air to close, High or low actuator pressure (Cases 2 and 4)

Table 17.2 Failsafe- Cases 2 and 4

Case 2	Failsafe type	Actuator Action	Cause of Failure
	Deviation Error	Air to close Fail Open	High actuator pressure
Observable behavior	Valve fails closed with high actuator pressure.		
	After pressure problem is corrected, the valve is open in failsafe. - As the problem is corrected the valve may move past setpoint and go to clear latch briefly.		
	XD Error: Deviation error appears in the Error status. The Failsafe Status dialog appears and shows Active (Latched).		
Case 4	Failsafe type	Actuator Action	Cause of Failure
	Deviation Error	Air to close Fail Open	Supply pressure failure or low actuator pressure
Observable behavior	Valve fails open with low actuator pressure.		
	After the pressure problem is corrected, the valve remains open in failsafe.		
	XD Error: Deviation error appears in the Error status. The Failsafe Status dialog appears and shows Active (Latched).		

T17.2eps

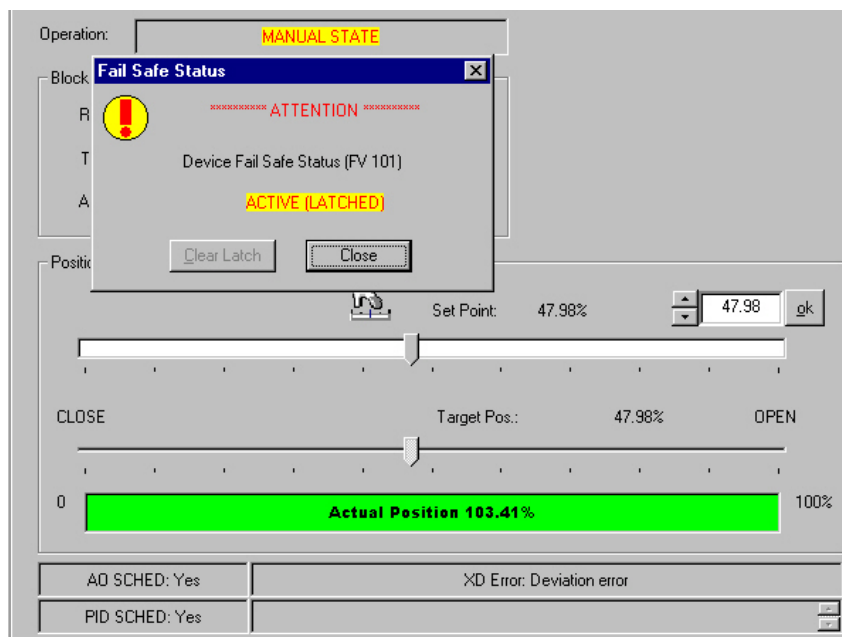
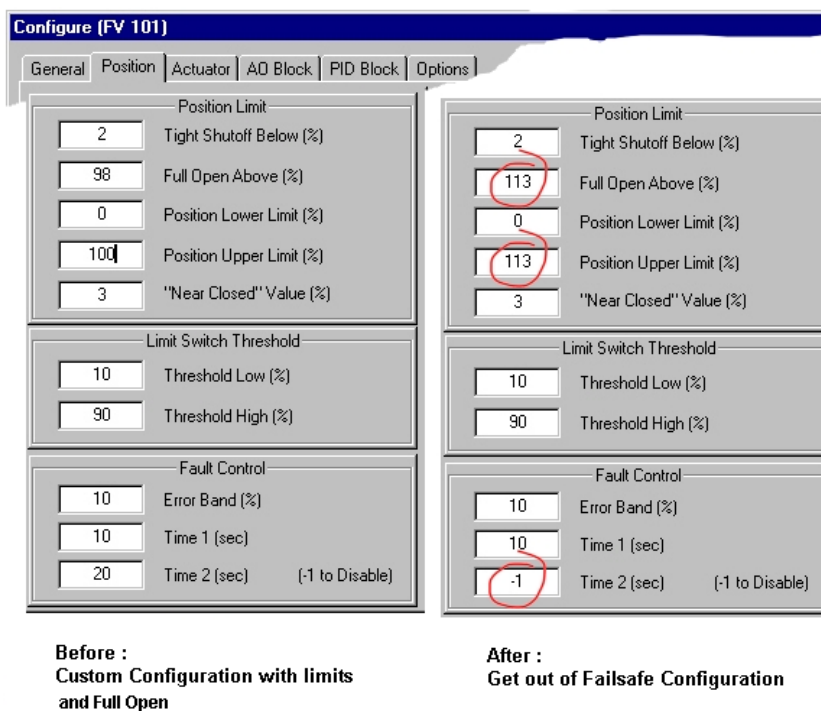


Figure 17.8 Failsafe Case 4 Steps 1 and 2

To exit Failsafe for Cases 2 and 4

- Step1 Restore the air supply or correct actuator problem. Check that the pneumatics are working correctly.
- Step2 Move the Failsafe dialog to one side of the screen to uncover the IVI display. (If the PID dialog is open, close it.)
- Step3 Record the Actual Position. (Shown as 103.41% in Figure 17.8.) In this extreme example, the valve calibration allows for large over-travel between the open stop and 100% position.
- Step4 This step requires privilege level 3, 4, 8 or 9.
- Open the Operation State dialog and select Manual, then click OK. In the setpoint text box, enter the same value as the Actual Position, recorded in step 3. Click OK. If the Failsafe dialog changes to Clear (Latched), then click the Clear Latch button. When the dialog request a change to OOS, click Yes.
- If the Failsafe dialog remains in Active,(Latched), proceed to the next step.

**Figure 17.9 Set the Parameters to Values that Allow Return from Failsafe.**

- Step5 This step requires privilege level 3, 4, 8 or 9.
- Open the Configuration dialog. Select the Position tab. Set the Full Open Above (FAO) and Position Low Limit parameters to +10 higher than the Actual Position recorded in step 3. Set the Time 2 parameter to -1. See Figure 17.9. Click OK to accept the changes, and then click Yes when a dialog warns of a change to OOS state. The Failsafe dialog should change to Clear (Latched). Click the Clear Latch button. Then close the failsafe dialog.
- Step6 This step requires privilege level 2, 3, 4, 8 or 9.
- Open the Operation State dialog and select Manual, then click OK. In the setpoint text box, enter the desired valve position.

Step7 This step requires privilege level 3, 4, 8 or 9.

Open the Configuration dialog. Select the Position tab. The position limit changes made in Step 5 will prevent failsafe action from occurring and will disable FOA and Position High Limit. Unless there is an important control consideration, do not change these values.

Click Clear Latch.

Click yes to the switch to OOS to Release Failsafe. Then return to Manual operation state to resume manual operation of the valve. Then follow plant procedure to return to automatic control. The Deviation Error Failsafe configuration can later be restored by resetting the T2 parameter in Configuration>Position.

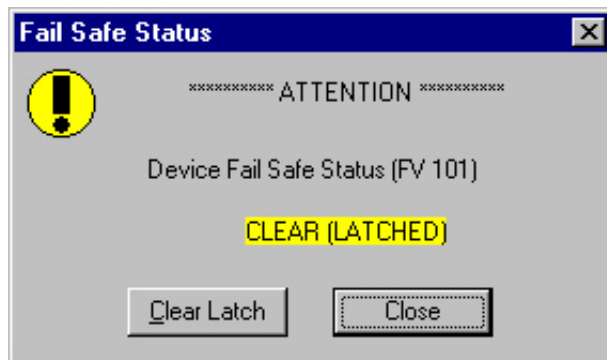


Figure 17.10 Clear Latched

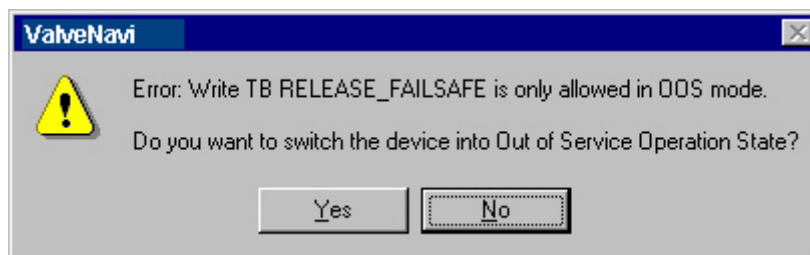


Figure 17.11 Change Mode to OOS Warning



WARNING

Setting the T2 Parameter, to cause failsafe after a sustained position error, can cause unwanted process shutdowns. The T2 setting should be used cautiously. Care must be taken to avoid interaction with other configuration parameters, particularly High and Low Position limits.

17.5.2 If the failsafe is caused by internal diagnostics

If an A/D Converter Failure or Position Sensor Failure of the XD_Errors occurs, the A/D converter or displacement sensor may be malfunctioning. Take appropriate action, such as placing a service call.

APPENDICES

Appendix A Glossary and Acronyms

FAS	Fieldbus Access Sublayer
FMS	Fieldbus Messaging Service
MIB	Management Information Base
SMIB	System Management Information Base
MAN	Manual mode
RCAS	Remote Cascade mode
LO	Local Override mode
IMan	Initialization manual mode
ROUT	Remote output mode
Cas	Cascade mode
AUTO	Automatic mode
OOS	Out of Service mode
0xf7	See hexadecimal. This is the number 247 represented in hexadecimal notation. The 0x preamble indicates hexadecimal notation.
1.#INF	This is the representation of infinity as expressed in IEEE 754 floating point arithmetic. It is used in fieldbus devices to set a parameter to a value that does not interfere with operation, such as for a limit, for example.
Algorithm	A set of rules that control the operation of an object through software.
AO	Analog Output block
ATC Air to close	The combination of a single acting actuator and the control valve where the valve is closed when air pressure is applied to the actuator. A spring opens the valve when air pressure is removed.
ATO Air to open	The combination of a single acting actuator and the control valve where the valve is open when air pressure is applied to the actuator. A spring closes the valve when air pressure is removed.
Basic Device	A Basic Device is any device not having the capability to control communications on an H1 fieldbus segment.
Capabilities File	A Capabilities File describes the communication objects in a fieldbus device. A configuration device can use Device Description (DD) Files and Capabilities Files to configure a fieldbus system without having the fieldbus devices online.
Characteristic	The positioner input setpoint command may be selectively modified to provide a desired relationship between setpoint and valve position. In the valve, the relationship between stroke and Cv is also called valve inherent characteristic. It is often adjusted by design, to equal percentage, for example. The positioner characteristic is applied to modify the setpoint to travel relationship of the actuator. The characteristic of the positioner should be chosen to compliment the valve. If the valve is equal percentage, the positioner should be set to linear. If a linear valve is installed the positioner may be set to an equal percentage characteristic to improve flow control. Local display can be used to select the custom characteristic, but cannot adjust the points.
Closed	The valve position in which the flow is minimum or zero. See tight shutoff.
Communications Stack	A Communications Stack is device communications software which provides encoding and decoding of User Layer messages, deterministic control of message transmission, and message transfer.
Compliance voltage	The voltage that must be available at the control system output in order to drive the control current through all the resistive devices in series with it.

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Condition Monitoring	A technology for measuring the performance of process equipment and valves over a period of time to predict the need for maintenance. The technology evolved to meet NRC requirements GL 89-10, and has proven valuable to other process industries. ValveNavi offer a suite of diagnostic tools to implement condition monitoring.
Connector	A Connector is a coupling device used to connect the wire medium to a fieldbus device or to another segment of wire.
Control Loop	A Control Loop is a group of Function Blocks (FBs) that execute at a specified rate within a fieldbus device or distributed across the fieldbus network.
Coupler	A Coupler is a physical interface between a Trunk and Spur, or a Trunk and a device.
D	Derivative time or rate time is the time constant of derivative control expressed in seconds. A value of zero disables derivative action.
Damping Coefficient	The valve response may be made slower for some applications. A value of 0 gives no damping, and a value of 9 gives maximum damping of valve motion.
Data Link Layer (DLL)	The Data Link Layer (DLL) controls transmission of messages onto the fieldbus, and manages access to the fieldbus through the Link Active Scheduler (LAS). The DLL used by FOUNDATION fieldbus is defined in IEC 61158 and ISA S50. It includes Publisher/Subscriber, Client/Server and Source/Sink services.
Dead Zone(%)	When the valve position is within the setpoint +/- the dead zone, no additional position control is performed. This value is normally 0%, however for high friction valves (e.g. valves with graphite packing) a higher dead zone will help avoid limit cycling due to the stick/slip action of the valve. In these cases the dead zone chosen might be 0.2% to 1%.
decimal	Notation for numbers to base 10. The number sequence is 0,1...9.
Device Description (DD)	A Device Description (DD) provides an extended description of each object in the Virtual Field Device (VFD), and includes information needed for a control system or host to understand the meaning of data in the VFD.
DI	Digital Input Block
Fieldbus	A Fieldbus is a digital, two-way, multi-drop communication link among intelligent measurement and control devices. It serves as a Local Area Network (LAN) for advanced process control, remote input/output and high speed factory automation applications.
Fieldbus Access Sublayer (FAS)	The Fieldbus Access Sublayer (FAS) maps the Fieldbus Message Specification (FMS) onto the Data Link Layer (DLL).
Fieldbus Messaging Specification (FMS)	The Fieldbus Messaging Specification (FMS) contains definitions of Application Layer services in FOUNDATION fieldbus. The FMS specifies services and message formats for accessing Function Block (FB) parameters, as well as Object Dictionary (OD) descriptions for those parameters defined in the Virtual Field Device (VFD).
Flash Memory	A computer memory which is not volatile. It stores all its data even when the power is off. It performs high speed reads and may be re-written many times. It is used to store programs and permanent parameters.
Flexible Function Block	A Flexible Function Block (FB) is similar to a Standard FB, except that the function of the block, the order and definition of the block parameters, and the time required to execute the block are determined by an application-specific algorithm created by a programming tool. Flexible Function Blocks (FBs) are typically used for control of discrete processes and for hybrid (batch) processes. A Programmable Logic Controller (PLC) can be modelled as a Flexible Function Block device.
H1	H1 is a term used to describe a fieldbus network operating at 31.25 kbit/second.
H1 Field Device	An H1 Field Device is a fieldbus device connected directly to an H1 fieldbus. Typical H1 Field Devices are valves and transmitters.
H1 Repeater	An H1 Repeater is an active, bus-powered or non-bus-powered device used to extend the range over which signals can be correctly transmitted and received for a given medium. A maximum of four Repeaters and/or active Couplers can be used between any two devices on an H1 fieldbus network.
Hazardous Area	The area of the plant where explosion hazards may be present, hazards such as propane gas in a refinery, or dust in a flour mill.
hexadecimal	Notation for numbers to base 16. The number sequence is 0,1...9, a, b, c, d, e, f to represent decimal 0 to 16. Customarily hexadecimal notation is identified with the preamble 0x.
High Speed Ethernet (HSE)	High Speed Ethernet (HSE) is the Fieldbus Foundation's backbone network running at 100 Mbit/second.
Hot swappable	The YVP in combination with ValveNavi enables a very brief Mean Time To Repair by the following process: Upload all configuration information from installed positioner to ValveNavi, then replace the positioner and download the configuration file. Run STOPS, and autoTUNE, and the repair is complete.

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HSE Field Device	An HSE Field Device is a fieldbus device connected directly to a High Speed Ethernet (HSE) fieldbus. Typical HSE Field Devices are HSE Linking Devices, HSE Field Devices running Function Blocks (FBs), and Host Computers.
HSE Linking Device	An HSE Linking Device is a device used to interconnect H1 fieldbus Segments to High Speed Ethernet (HSE) to create a larger network.
HSE Switch	An HSE Switch is standard Ethernet equipment used to interconnect multiple High Speed Ethernet (HSE) devices such as HSE Linking Devices and HSE Field Devices to form a larger HSE network.
I	Integral time or reset time, is the time constant of integral control. Higher values of I cause slower integral action. A value of zero disables integral action.
I/P Converter	The electro-magnetic device which converts low energy electrical current signal to a pressure which is then amplified by the pneumatic relay.
Input/Output (I/O) Subsystem Interface	An Input/Output (I/O) Subsystem Interface is a device used to connect other types of communications protocols to a fieldbus Segment or Segments.
Interchangeability	Interchangeability is the capability to substitute a device from one manufacturer with that of another manufacturer on a fieldbus network without loss of functionality or degree of integration.
Interoperability	Interoperability is the capability for a device from one manufacturer to interact with that of another manufacturer on a fieldbus network without loss of functionality.
ISA	The Instrument Society of America. ISA develops and publishes international standards for use in process control. See www.isi.org
Link	A Link is the logical medium by which H1 Fieldbus devices are interconnected. It is composed of one or more physical segments interconnected by bus Repeaters or Couplers. All of the devices on a link share a common schedule which is administered by that link's current LAS.
Link Active Scheduler (LAS)	A Link Active Scheduler (LAS) is a deterministic, centralized bus scheduler that maintains a list of transmission times for all data buffers in all devices that need to be cyclically transmitted. Only one Link Master (LM) device on an H1 fieldbus Link can be functioning as that link's LAS.
Link Master (LM)	A Link Master (LM) is any device containing Link Active Scheduler (LAS) functionality that can control communications on an H1 fieldbus Link. There must be at least one LM on an H1 Link; one of those LM devices will be elected to serve as LAS.
Link Object	A Link Object contains information to link Function Block (FB) Input/Output (I/O) parameters in the same device and between different devices. The Link Object links directly to a Virtual Communications Relationship (VCR).
Multidrop	A variation of the HART Communications Protocol which allows many smart field devices to draw power from, and to communicate over a single pair of wires.
NAMUR	NAMUR is a European user association of process control technology in chemical and pharmaceutical industries. "Recommendations and Worksheets are experience reports and working documents prepared by NAMUR for its members among process control users for facultative utilization". NAMUR issued a recommended accessory mounting for control valves (NE 14 Anschluß von Schwenkantrieben an Armaturen 06.08.96) which describes a method for mounting a positioner on an actuator. See more at www.namur.de
Network Management (NM)	Network Management (NM) permits FOUNDATION Network Manager (NMgr) entities to conduct management operations over the network by using Network Management Agents (NMAs). Each Network Management Agent (NMA) is responsible for managing the communications within a device. The NMgr and NMA communicate through use of the Fieldbus Messaging Specification (FMS) and Virtual Communications Relationship (VCR).
Non-Volatile memory	Computer memory which is not lost when power is turned off.
Normal State-	The normal set of target modes for the function blocks
Object Dictionary	An Object Dictionary (OD) contains all Function Block (FB), Resource Block (RB) and Transducer Block (TB) parameters used in a device. Through these parameters, the blocks may be accessed over the fieldbus network.
Out of Service State-	The YVP positioner transducer, resource and Analog Output, PID blocks are in Out of Service mode.
P	P is a dimensionless gain factor related to the proportioning action of the algorithm. It ranges from 0 to 5000. Common values for the positioner are 50 for small valves up to 4000 for large valves.
Parameter	The data objects in Foundation fieldbus are identified in the form of TAG.PARAMETER. Each data object is a parameter that may include many elements such as an array, or a value and a status. Elements of a parameter are referred to by sub-index.
PC	As used in this manual, a personal computer or laptop running under Windows 2000/XP, or later operating system.
Physical Layer	The Physical Layer receives messages from the Communications Stack and converts the messages into physical signals on the fieldbus transmission medium, and vice-versa.
PID	Proportion Integral Derivative Control Block

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Position	With a reciprocating valve, the position is the distance of the plug from its seat, normally measured as a linear motion of the valve or actuator stem. With a rotary valve, the position is the angle of rotation of the valve plug measured as angular rotation of the valve shaft.
Position limit	The Actuator can be mechanically set to stop at a predetermined position by setting an adjustment, sometimes with a handwheel or screw stop.
Position, valve	With a reciprocating valve, the position is the distance of the plug from its seat, normally measured as a linear motion of the valve or actuator stem. With a rotary valve, the position is the angle of rotation of the valve plug measured as angular rotation of the valve shaft.
Positioner Tuning Parameters	The positioner requires six integer parameters to determine the response of the positioner to a setpoint change. Internally, the positioner uses an improved PID control algorithm to control the valve's position.
Quick Opening	(see Characteristic)
RB	Resource Block
Relay, Pneumatic	The component which amplifies the pneumatic control signals to provide a wide range of actuation pressure and to supply and vent at high flow rates for responsive control.
Resource Block (RB)	A Resource Block (RB) describes characteristics of the fieldbus device such as the device name, manufacturer and serial number. There is only one Resource Block (RB) in a device.
Safe Area	The area of a plant where there never is an explosion hazard present, such as the control room or a wire marshalling rack area.
Schedules	Schedules define when Function Blocks (FBs) execute and when data and status is published on the bus.
Segment	A Segment is a section of an H1 fieldbus that is terminated in its characteristic impedance. Segments can be linked by Repeaters to form a longer H1 fieldbus. Each Segment can include up to 32 H1 devices.
Single Acting	The action of a position with a single pneumatic output for operation with a spring return actuator. (see double acting).
Splice	A Splice is an H1 Spur measuring less than 1 m (3.28 ft.) in length.
Split range	A control configuration in which a single control output is sent to two or more control valves. Each control valve positioner is calibrated to respond to a separate portion of the control signal. An example would be a steam valve and a cooling water valve arranged to be both closed at 50% and the steam valve to open
Spur	A Spur is an H1 branch line connecting to the Trunk that is a final circuit. A Spur can vary in length from 1 m (3.28 ft.) to 120 m (394 ft.).
Standard Function Block (FB)	Standard Function Blocks (FBs) are built into fieldbus devices as needed to achieve the desired control functionality. Automation functions provided by Standard FBs include Analog Input (AI), Analog Output (AO) and Proportional/Integral/Derivative (PID) control. The Fieldbus Foundation has released specifications for 21 types of Standard FBs. There can be many types of FBs in a device. The order and definition of Standard FB parameters are fixed and defined by the specifications.
Stroke	The total range of valve travel. Often used as a verb to describe the process of moving the valve.
System Management (SM)	System Management (SM) synchronizes execution of Function Blocks (FBs) and the communication of Function Block (FB) parameters on the fieldbus, and handles publication of the time of day to all devices, automatic assignment of device addresses, and searching for parameter names or "tags" on the fieldbus.
Tag	The formal designator the control valve used in control loop documentation.
TB	Transducer Block
Terminator	A Terminator is an impedance-matching module used at or near each end of a transmission line. Only two Terminators can be used on a single H1 segment.
Tight Shutoff (TS)	A positioner property that is selected and adjusted when it is desired to prevent operation of the valve at or near the closed position. The positioner will cause all available actuator force to be applied to the valve seat at a position set point equal to or less than the TS adjustable parameter. A dead band is applied to prevent cycling in and out of this behavior.
Transducer Block (TB)	A Transducer Block (TB) decouples Function Blocks (FBs) from the local Input/Output (I/O) functions required to read sensors and command output hardware. Transducer Blocks (TBs) contain information such as calibration date and sensor type. There is usually one TB channel for each input or output of a Function Block (FB).
Transmitter	A Transmitter is an active fieldbus device, usually sensing a physical variable, containing circuitry which applies a digital signal on the bus.
Trunk	A Trunk is the main communication highway between devices on an H1 fieldbus network. The Trunk acts as a source of main supply to Spurs on the network.

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User Application	The User Application is based on “blocks,” including Resource Blocks (RBs), Function Blocks (FBs) and Transducer Blocks (TBs), which represent different types of application functions.
User Layer	The User Layer provides scheduling of Function Blocks (FBs), as well as Device Descriptions (DDs) which allow the host system to communicate with devices without the need for custom programming.
ValveNavi	The full featured Yokogawa software for diagnostics, calibration, and configuration of Foundation fieldbus positioner, YVP.
VCR	See Virtual Communication Relationship
VDE/VDI 3845	A Standard common in Europe for mounting positioners and accessories on rotary valve actuators.
VFD	See Virtual Field Device
Virtual Communication Relationship (VCR)	Configured application layer channels that provide for the transfer of data between applications. FOUNDATION fieldbus describes three types of VCRs: Publisher/Subscriber, Client/Server, and Source/Sink.
Virtual Field Device (VFD)	A Virtual Field Device (VFD) is used to remotely view local device data described in the object dictionary. A typical device will have at least two Virtual Field Devices (VFDs).

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Appendix B Configuring DI Blocks to TB Channels

There are two DI (discrete input) blocks in YVP. They are used to communicate the state of internal (software) limit switches. The DI modes are displayed in IVI and the internal variables can be viewed with the Query service.

To activate the DI blocks, each block must be scheduled (though not necessarily linked) and each must be configured to the correct channel in the TB. In an FB configurator set the DI channel parameter. Channel 2 should be assigned to the High limit switch DI1, and channel 3 should be assigned to the low limit switch, DI2.

Appendix C Setting a Failsafe Strategy

The user must design a strategy for safe handling of fault conditions that will be safe and effective for each control valve. Several levels of failsafe action can be configured using YVP and ValveNavi to support the safety strategy.

As levels of safety are increased, more actions are required to restart a system that has gone into failsafe. The most secure level will cause the positioner to close the valve and cause it to remain closed until an operator manually reopens the valve. In the least secure level, the valve will close and will reopen as soon as the cause of the failsafe event has cleared.

On non-critical processes, the highest level of security may cause excessive nuisance shutdowns. In these cases, it may be preferable to allow the valve to restart after failsafe.

When a critical process that has the potential to release toxic substances or to result in an accident, it may be necessary to force full shutdown with manual restart.



WARNING

Do not set Position Lower Limit equal to or larger than the Deviation Error Band value. It will not be possible to clear the Failsafe condition.

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