Instruction
Manual

YVP110
Advanced Valve Positioner

IM 21B04C01-01E

YOKOGAWA
Yokogawa Electric Corporation

IM 21B04C01-01E
1st Edition

CONTENTS

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INTRODUCTION

The YVP110 Advanced valve positioner is fully factory-tested according to the specifications indicated upon the order.

This Instruction Manual consists of two parts: 'Hardware' and 'Functions'. 'Hardware' part gives instructions on handling, wiring set-up and maintenance of YVP110, and 'Functions' part describe the software functions of YVP110.

In order for the YVP110 to be fully functional and to operate in an efficient manner, both parts in this instruction manual must be carefully read , so that users become familiar with the functions, operation, and handling of the YVP110.

■ Notes on the Instruction 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 notice.
- In no case does this manual guarantee the merchantability of the transmitter or its adaptability to a specific client need.
- Should any doubt or error be found in this manual, submit inquiries to your local dealer.
- No special specifications are contained in this manual.
- 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 transmitter.

■ Notes on Safety and Modifications

- Before handling the YVP110, it is absolutely imperative that users of this equipment read and observe the safety instructions mentioned in each section of the manual in order to ensure the protection and safety of operators, the YVP110 itself and the system containing the transmitter. We are not liable for any accidents arising out of handling that does not adhere to the guidelines established in the safety instructions.
- No maintenance should be performed on explosion-proof type temperature transmitters while the equipment is energized. If maintenance is required with the cover open, always first use a gas detector to check that no explosive gases are present.
- If the user attempts to repair or modify an explosion-proof type transmitter and is unable to restore it to its original condition, damage to the explosion-proof features result, leading to dangerous conditions. Contact your authorized Yokogawa Electric Corporation representative for repairs or modifications of an explosion-proof type transmitter.
- The YVP110 advanced valve positioner and this manual use the following safety related symbols and signals.

●Symbols used in this Instruction Manual

WARNING

Contains precautions to protect against the chance of explosion or electric shock which, if not observed, could lead to death or serious injury.

CAUTION

Contains precautions to protect against danger, which, if not observed, could lead to personal injury or damage to the instrument.

IMPORTANT

Contains precautions to be observed to protect against adverse conditions that may lead to damage to the instrument or a system failure.

NOTE

Contains precautions to be observed with regard to understanding operation and functions.

Some of the diagrams in this instruction manual are partially omitted, described in writing, or simplified for ease of explanation. The drawings contained in the instruction manual may have a position or characters (upper/lower case) that differ slightly from the what are actually seen to an extent that does not hinder the understanding of functions or monitoring of operation.

■ Warranty

- The warranty period of the instrument is written on the estimate sheet that is included with your purchase. Any trouble arising during the warranty period shall be repaired free of charge.
- Inquiries with regard to problems with the instrument shall be accepted by the sales outlet or our local dealer representative.
- Should the instrument be found to be defective, inform us of the model name and the serial number of the instrument together with a detailed description of nonconformance and a progress report. Outline drawings or related data will also be helpful for repair.
- Whether or not the defective instrument is repaired free of charge depends on the result of our inspection.

● The following conditions shall not be eligible for charge-exempt repair.

- Problems caused by improper or insufficient maintenance on the part of the customer.
- Trouble or damage caused by mishandling, misusage, or storage that exceeds the design or specification requirements.
- Problems caused by improper installation location or by maintenance conducted in a non-conforming location.
- Trouble or damage was caused by modification or repair that was handled by a party or parties other than our consigned agent.
- Trouble or damage was caused by inappropriate relocation following delivery.
- Trouble or damage was caused by fire, earthquake, wind or flood damage, lightning strikes or other acts of God that are not directly a result of problems with this instrument.

■ Trade Mark

- FOUNDATION Fieldbus is a trademark of the Fieldbus Foundation.
- Registered trademarks or trademarks appearing in this manual are not designated by a TM or ® symbol.
- Other company names and product names used in this manual are the registered trademarks or trademarks of their respective owners.

[HARDWARE]

CONTENTS

1. NOTES ON HANDLING

The VP110 advanced valve positioner is fully factory-tested upon shipment. When the YVP110 is delivered, visually check that no damage occured during the shipment.

1.1 Nameplate

The model name and configuration are indicated on the nameplate. Verify that the configuration indicated in the “Model and Suffix Code” in Chapter 7 is in compliance with the specifications written on the order sheet.

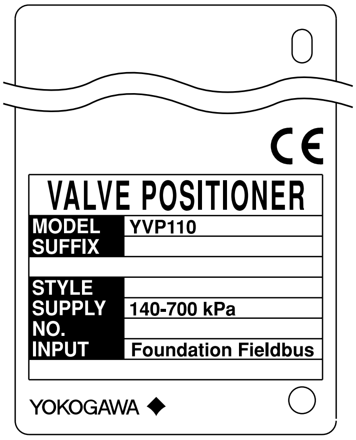


Figure 1.1 Nameplate

1.2 Transport

To prevent damage while in transit, leave the positioner in the original shipping container until it reaches the installation site.

1.3 Storage

When an extended storage period is expected, observe the following precautions:

(1) If at all possible, store the positioner in factory-shipped condition, that is, in the original shipping container.

(2) Choose a storage location that satisfies the following requirements.

- A location that is not exposed to rain or water.
- A location subject to a minimum of vibration or impact.
- The following temperature and humidity range is recommended. Ordinary temperature and humidity (25°C, 65%) are preferable.
  Temperature: –40 to 85°C
  Humidity: 5 to 100% RH (at 40°C)

(3) The performance of the positioner may be impaired if stored in an area exposed to direct rain and water.
To avoid damage to the positioner, install it immediately after removal from the shipping container. Follow wiring instructions in this manual.

1.4 Choosing the Installation Location

Although the advanced valve positioner is designed to operate in a vigorous environment, to maintain stability and accuracy, the following is recommended:

(1) Ambient Temperature

It is preferable not to expose the instrument to extreme temperatures or temperature fluctuations. If the instrument is exposed to radiation heat a thermal protection system and appropriate ventilation is recommended.

(2) Environmental Requirements

Do not allow the positioner to be installed in a location that is exposed to corrosive atmospheric conditions. When using the positioner in a corrosive environment, ensure the location is well ventilated. The unit and its wiring should be protected from exposure to rainwater.

(3) Impact and Vibration

It is recommended that the positioner is installed in a location that is subject to a minimum amount of impact and vibration.

1.5 Use of a Transceiver

Although the positioner is designed to resist influence from high frequency noise, use of a transceiver in the vicinity of installation may cause problems. Installing the transmitter in an area free from high frequency noise (RFI) is recommended.

1.6 Insulation Resistance Test and Withstand Voltage Test

⚠ **CAUTION**

(1) Overvoltage of the test voltage that is so small that it does not cause an dielectric breakdown may in fact deteriorate insulation and lower the safety performance; to prevent this it is recommended that the amount of testing be kept to a minimum.
(2) The voltage for the insulation resistance test must be 500V DC or lower, and the voltage for the withstand voltage test must be 500V AC or lower. Failure to heed these guidelines may cause faulty operation.
(3) Where a built-in arrester is provided (suffix code: /A), the voltage for the insulation resistance test must be 100V DC or lower, and the voltage for the withstand voltage test must be 100V AC or lower. Failure to heed these guidelines may cause faulty operation.

Follow the steps below to perform the test, the wiring of the communication line must be removed before initiating testing.

■ Insulation resistance test procedure

1. Lay transition wiring between the + terminal and the - terminal.
2. Connect the insulation resistance meter (with the power turned OFF) between the transition wiring of Step 1 above and ground terminal. The polarity of the input terminals must be positive and that of the ground must be negative.
3. Turn the power of the insulation resistance meter ON and measure the insulation resistance. The duration of the applied voltage must be the period during which 100 MΩ or more is confirmed (or 20 MΩ if the unit is equipped with a built-in arrester).
4. Upon completion of the test, remove the insulation resistance meter, connect a 100 KΩ resistor between the transition wiring, and allow the electricity to discharge. Do not touch the terminal with your bare hands while the electricity is discharging for more than one second.

■ Withstand voltage test procedure

Testing between the input terminals and the grounding terminal

1. Lay the transition wiring between the + terminal and the - terminal, and connect the withstand voltage tester (with the power turned OFF) between the transition wiring and the grounding terminal. Connect the grounding side of the withstand voltage tester to the grounding terminal.
2. After setting the current limit value of the withstand voltage tester to 10 mA, turn the power ON, and gradually increase the impressed voltage from 0 V to the specified value.
3. The voltage at the specified value must remain for a duration of one minute.
4. Upon completion of the test, carefully reduce the voltage so that no voltage surge occurs.

1.7 Notes for Saftey

⚠ **CAUTION**

When air is supplied to a valve, do not touch the moving part(a stem of the valve), as it may suddently move.

⚠ **CAUTION**

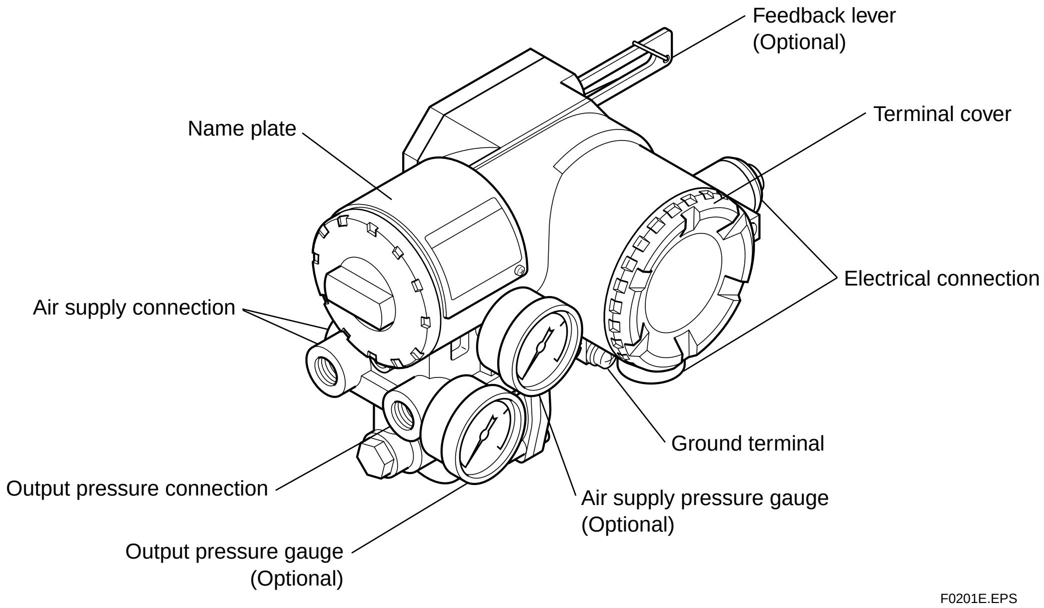
- While A/M selection switch is set to manual side (M), the pressure set in the regulator for air supply will be directly output to the actuator regardless of the control signal. Before changing the mode from auto to manual, check and confirm thoroughly that there will be no effect which may cause a danger in process or personal injury by changing the mode.
- Do not change the mode by using auto/ manual switch during the operation. If the mode is changed from auto to manual or manual to auto, the valve stem will happnen to move to the position which is different from the control signal (the input signal to the positioner), and thus dangerous.
- As soon as the manual operation is finished, make it sure to change the mode to auto by moving the A/M selection switch to Auto(A) side.

1.8 EMC Conformity Standards

For EMI(Emission) : EN 55011
For EMS(Immunity) : EN 50082-2

2. PART NAMES

2.1 Appearance and Part Names



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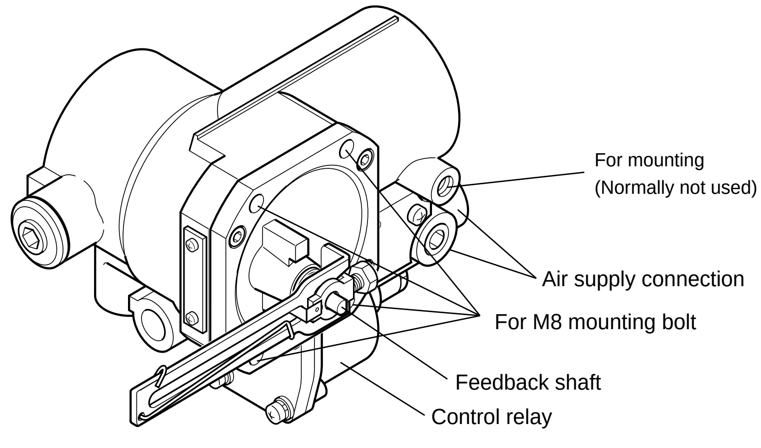

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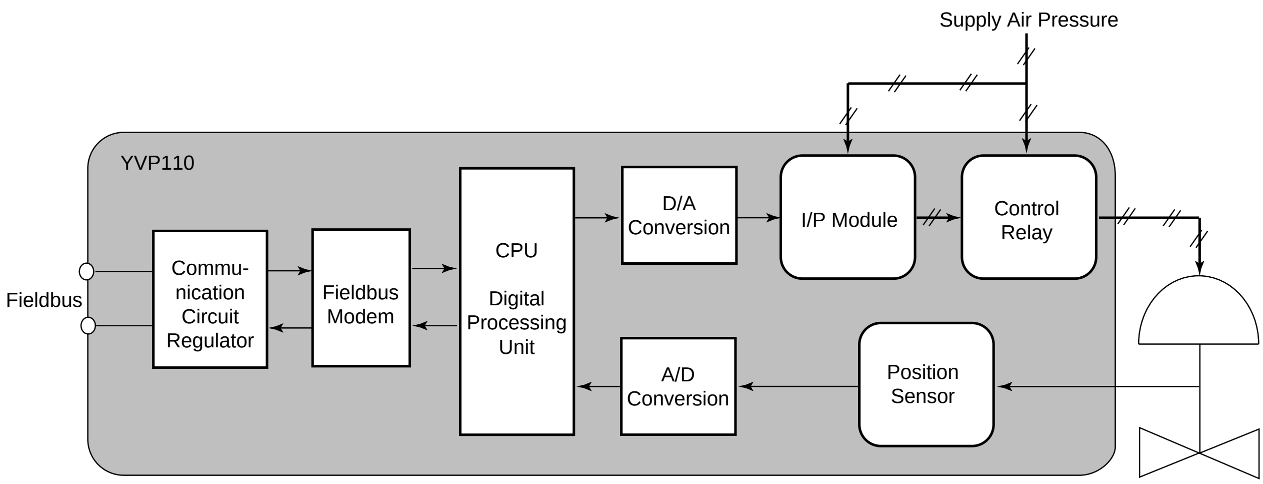
2.2 Block Diagram



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3. INSTALLING YVP110 ON ACTUATOR

3.1 General

For installation of a YVP110, see Section 1.4, "Choosing the Installation Location." For the ambient, environmental conditions required for installation, see Chapter 7, "General Specifications."

WARNING

To avoid injury or the process being affected when installing or replacing a positioner on a control valve, ensure that:

- All inputs to the valve actuator and other accessories of the valve and actuator, including the air supply and electric signal, are cut off.
- The process has been shut down or the control valve is isolated from the process by using bypass valves or the like.
- No pressure remains in the valve actuator.

3.2 Installing YVP110 on Actuator

A YVP110 can be installed on a valve actuator with a mounting bracket. Prepare the bracket and clamp which are necessary to install the valve, according to the valve. In general, the installation method is determined by the combination of the control valve and positioner as well as by the valve manufacturer who performs the adjustment. For details, consult the control valve manufacturer.

Required Tools: To install a YVP110, you need to prepare:

- Nominal 13-mm open end or box end wrench for M8 bolts used to fix the mounting bracket to the positioner.
- Nominal 10-mm open end or box end wrench for M6 bolt used to fix the feedback lever to the shaft.

3.2.1 Installing YVP110 on Linear-motion Control Valve

The following shows the general installation procedure when assembling a YVP110 with a linear-motion control valve (e.g., a globe valve) combined with a diaphragm actuator or single-acting cylinder actuator. Note that the most suitable procedure may differ depending on the shapes of the bracket and valve actuator, and the structure of the mounting position.

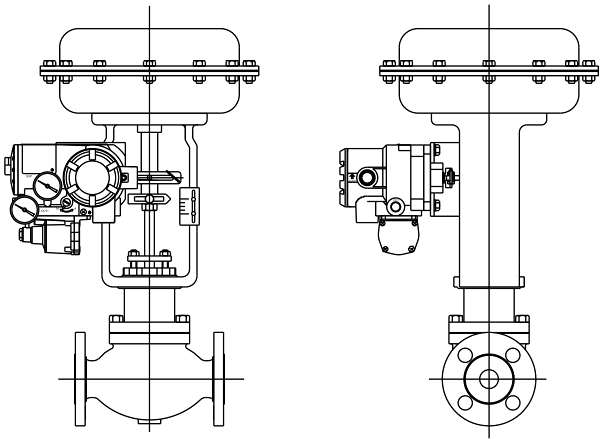

Figure 3.1 YVP Installed on Linear-motion Valve/Actuator

(1) Fixing Bracket to YVP110

Use the four M8 bolts that come with the YVP110 to tightly fix the mounting bracket to the YVP110. (See "Part Names" on page 2.1) The installation method is determined by the combination of the control valve and positioner as well as by the valve manufacturer who performs the adjustment. For details, consult the control valve manufacturer.

(2) Fixing the YVP110 to Actuator with Bracket

After fixing the bracket to the YVP110, attach it to the actuator with the specified bolts.
Depending on the shapes of the bracket and actuator, the working space at the rear of the YVP110 where the feedback shaft is positioned may be quite narrow, making installation work tricky. In such a case, the entire procedure may be made much easier by attaching the feedback lever to the feedback shaft as described in step (3), prior to carrying out step (2). Check the space behind the YVP110 beforehand.

(3) Attaching Feedback Lever

The YVP110 with option code /LV comes with the two different feedback levers shown below. Check the specifications of the levers shown in Table 3.1 and Figure 3.2 and choose the lever most suitable for the control valve used.

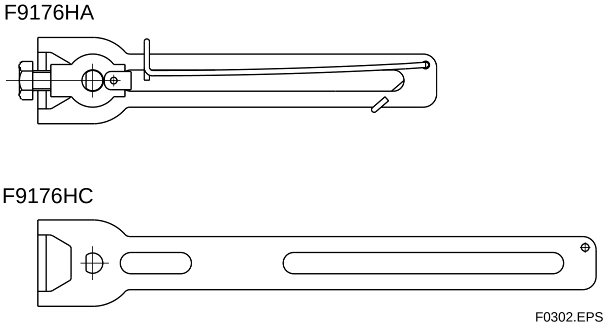

Figure 3.2 Feedback Levers

Table 3.1 Specifications of Levers

Lever Model	Stroke (X)	Pin-to-shaft Distance (L)	Allowable Range of Rotation Angle of Feedback Shaft(θ)
F9176HA	10 to 60mm	25 to 75mm	±10 to 25 degrees
F9176HB	30 to 100mm	75 to 115mm	

Note: When assembling a YVP110 with a linear-motion actuator, ensure that the rotation angle of the YVP110's feedback shaft does not exceed the allowable range (10 to 25 degrees shown above. Only if the range of the rotation angle is within this specification, it is guaranteed that the specified accuracy can be obtained by linearity correction (see the description for travel calibration in Section 5.3, "Carrying out Auto Tuning").

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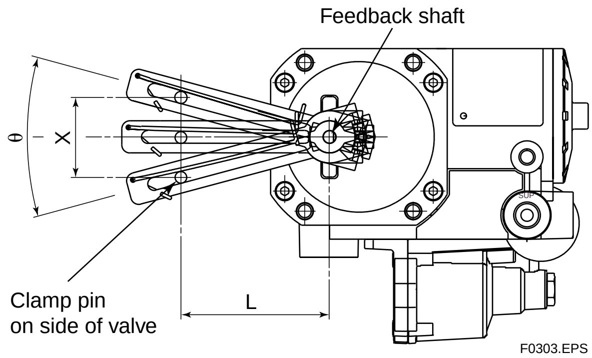

Figure 3.3 Stroke of Lever

The hardware for attaching the lever to the feedback shaft and the spring for fixing the clamp pin are attached to the F9176HA, the smaller feedback lever for generally used mid-capacity actuators. Thus, when using the F9176HC, the feedback lever for high-capacity actuators, detach and use the hardware and spring from the F9176HA. See Figure 3.4. To do so, first detach the spring <4>. Then, detach the clip <1> and remove the hardware <2> and <3>. Attach <1> to <4> to the F9176HC feedback lever for high-capacity actuators in the reverse order.

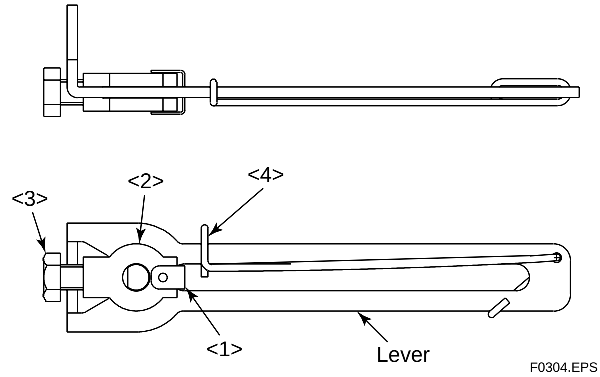

Figure 3.4 Disassembling a Lever Assembly

When determining which lever to use, follow the procedure below to make a linkage between the YVP110 positioner and control valve's stem via the clamp and lever. The adjustment of this linkage is a decisive factor for determining the characteristics of the control valve combined with the YVP110 positioner.

(1) Insert the YVP110's feedback shaft into the small hole on the stopper side of the lever as shown in Figure 3.5.

⚠ CAUTION

It is extremely likely that attaching the lever in the wrong orientation will cause the feedback shaft to rotate at an angle exceeding its mechanical limits of ±55 degrees, resulting in the YVP110 being seriously damaged.

Next, fix the lock screw.

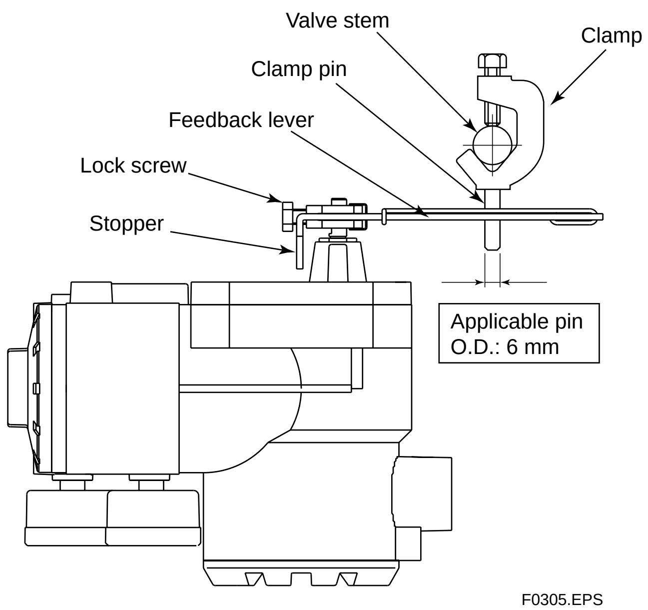

Figure 3.5 Attaching Lever and Clamp

(2) Attach the clamp to the stem in reference with Figure 3.5. It is necessary to set the clamp of the YVP110 in a position that allows the feedback lever to be at an angle within ±15 degrees from the horizontal level when the valve stem is at the 50% position (see Figure 3.6). Installing the YVP110 at a carefully determined position, where the feedback lever is at the horizontal level when the valve stem is at the 50% position, will make the consequent installation work easier.

Note that only if the YVP110 is installed at a position meeting the specification above, it is guaranteed that the specified accuracy can be obtained by linearity correction (see also Section 13.5, “Travel Calibration”).

⚠ WARNING

Procedures (3) through (6) require supplying air to the actuator. Piping must be carried out by following the instructions shown in Chapter 4. "Wiring and Piping".

(3) Using a flat-headed screwdriver, turn the A/M selector switch on the YVP110 clockwise to change the selector position to M (manual). Be sure to turn the switch until it stops (see also Section 3.2.3, “A/M Switching”).

⚠ WARNING

Changing the A/M selector switch position to M (manual) causes air at the pressure setting of the pressure regulator for air supply to be supplied to the valve actuator regardless of the input signal. Therefore, prior to switching to manual mode, make sure that doing so will neither cause an injury nor affect the process.

(4) Next, supply air to the valve actuator. Doing so causes the valve stem to move; be extremely careful about safety. Adjust the pressure regulator to set the stroke of the stem to 50%.

⚠ WARNING

Do not supply air at a pressure exceeding the maximum rated air supply pressure of the actuator or the YVP110 (700 kPa). Doing so may result in a high risk of damage to the equipment or lead to an accident.

(5) Check that the feedback lever is at around the horizontal level. If its incline deviates from the horizontal level by 15 degrees or more, shut off the air supply for safety. Then, after confirming that the air has been completely exhausted out of the actuator, readjust the clamp position.

(6) After the incline from the horizontal level has been adjusted to within ±15 degrees, shut off the air supply and turn the A/M selector switch counterclockwise until it stops, to change the selector position to A (automatic). (See also Section 3.2.3, “A/M Switching”).

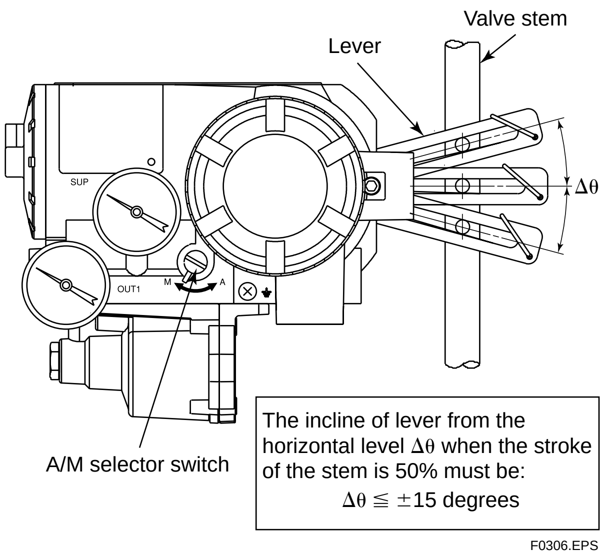

Figure 3.6 Checking Position at Which Clamp Should Be Fixed

3.2.2 Installing YVP110 on Rotary-motion Control Valve

The following shows the general installation procedure when assembling a YVP110 with a rotary-motion control valve combined with a diaphragm actuator or single-acting cylinder actuator. Note that the most suitable procedure may differ depending on the shapes of the bracket and valve actuator, and the structure of the actuator.

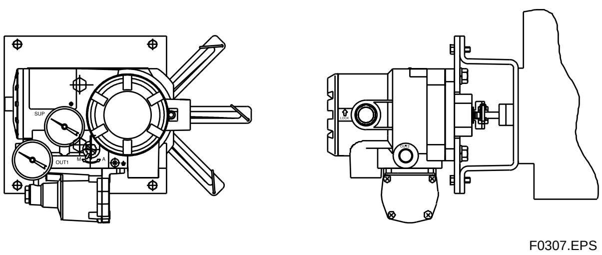

Figure 3.7 YVP Installed on Rotary-motion Valve/Actuator

(1) Allowable Range of Rotation Angle of Feedback Shaft

When combining a YVP110 with a rotary-motion actuator, ensure that the rotation of the feedback shaft by the position feedback meets the following specifications:

- Range of rotation angle of shaft:
  Within ±45 degrees from horizontal level
- Minimum span: 20 degrees
- Maximum span: 90 degrees
- Mechanically allowable rotation angle:
  ±55 degrees

If any one or more of the specifications above are not met, the specified accuracy may not be guaranteed, resulting in the YVP110 positioner being damaged. An advance check is essential.

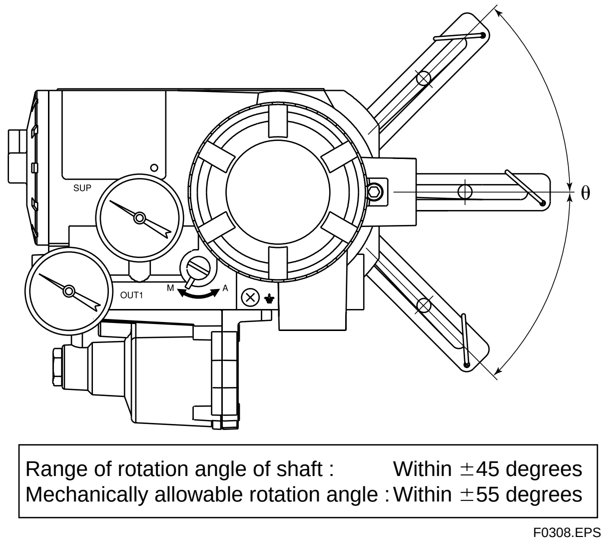

Figure 3.8 Allowable Range of Rotation Angle of Feedback Shaft When Assembling with Rotary-motion Actuator

(2) Fixing Bracket to YVP110

Use the four M8 bolts that come with the YVP110 to tightly fix the mounting bracket to the YVP110. (See “Part Names” on page 2.1) The installation method is determined by the combination of the control valve and positioner as well as by the valve manufacturer who performs the adjustment. For details, consult the control valve manufacturer.

(3) Attaching Feedback Lever

For a rotary-motion actuator, since it is often difficult to secure sufficient working space between the positioner and actuator, attach the feedback lever before fixing the YVP110 to the actuator. Make sure that the stopper is located on the side of the YVP110 as shown in Figure 3.9.

CAUTION

It is extremely likely that attaching the lever in the wrong orientation will cause the feedback shaft to rotate at an angle exceeding its mechanical limits of ±55 degrees, resulting in the YVP110 being seriously damaged.

Next, fix the lock screw.

(4) Fixing the YVP110 to Actuator with Bracket

Insert the pin attached to the valve spindle, into the long hole of the feedback shaft of the YVP110 positioner.
Before fixing the bracket to the actuator, carefully position it so that the center of the rotation axis of the valve plug and that of the YVP110 poistioner's feedback shaft are aligned both horizontally and vertically. After the alignment has been checked, tightly fix the bracket to the actuator with the specified bolts. Misalignment of these rotation axes decreases the level of accuracy.

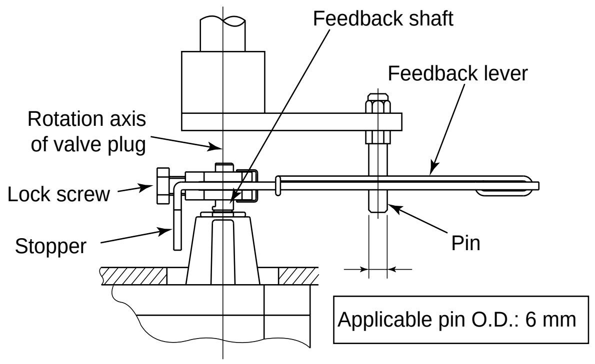

Figure 3.9 Inserting Pin into Hole of Feedback Lever

3.2.3 A/M Switching

To perform manual operation of the valve using the A/M (automatic/manual) mode switching mechanism of the YVP110, there needs to be a pressure regulator for the air supply. To perform manual operation, follow the procedure below.

(1) Turn the A/M selector switch clockwise to change the switch position to M until it stops.

(2) In manual mode, you can vary the pneumatic pressure output to the valve actuator by changing the regulator output pressure regardless of the input signal of the YVP110. For a YVP110 equipped with pressure gauges, you can read the output pressure to the actuator.

(3) After you have finished manual operation, turn the A/M selector switch counterclockwise until the stopper pin touches the side of the YVP110's casing in order to ensure the switch position changes to A.

⚠ **WARNING**

- Changing the A/M selector switch position to M (manual) causes air at the pressure setting of the pressure regulator for air supply to be supplied to the valve actuator regardless of the input signal. Therefore, prior to switching to manual mode, make sure that doing so will neither cause an injury nor affect the process.
- Do not change the A/M selector switch position from M (manual) to A (automatic) or A(automatic) to M(manual) during operation. Doing so will cause the valve stem to temporarily move to a position different from the position determined by the level of the input signal to the positioner.
- If the pressure larger than the allowable range of pressure gauge is applied, the pressure gauge may possibly be damaged.

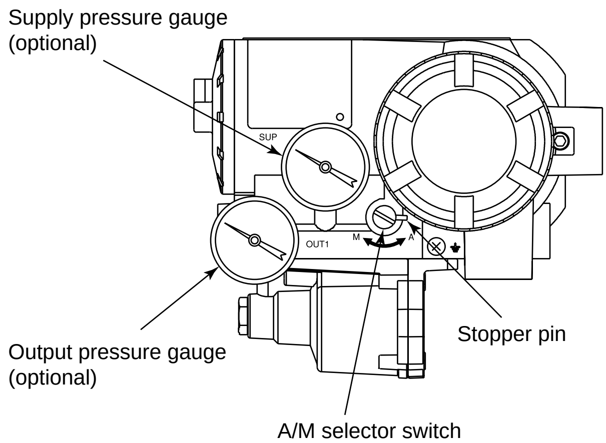

Figure 3.10 A/M Selector Switch

4. WIRING AND PIPING

4.1 General

This chapter describes the air piping and electric wiring connections.

WARNING

- Be sure to cut off all inputs to the valve actuator and other accessories of the valve and actuator, including the air supply and electric signal before making or modifying the piping and wiring connections.
- The process must be shut down or the control valve isolated from the process by using bypass valves or the like when making or modifying the piping and wiring connections.
- Always cap the unused wiring ports with blind plugs.

4.2 Piping

4.2.1 Air Supply

For stable operation of the YVP110 over a long term, a clean and dry supply of air needs to be maintained. Therefore, be careful about the following:

(1) To prevent moisture, oil, and dust from being led into the YVP110 through pipes, give careful consideration to the choice of the air supply system and supply air suction point as well as installation of the air supply header and air supply piping.

(2) The desired supply air must:
- Be dry air whose dew point is at least 10°C lower than that of the ambient temperature.
- Be free from solid particles as a result of being passed through a 5-μm or finer filter.
- Not contain oil at a concentration higher than 1 ppm in weight or volume.
- Not be contaminated by a corrosive, explosive, flammable, or toxic gas.
- Comply with ANSI/ISA-57.3 1975 (R1981) or ISA-S7.3-1975 (R1981).

(3) The YVP110 requires an air supply of 140 to 700 kPa. Within this range, regulate the air supply pressure at a level within ±10% of the air supply pressure specified for the actuator, and at 10% of the actuator's spring range or higher.

WARNING

Do not supply air at a pressure exceeding the maximum rated air supply pressure of the actuator or the YVP110 (700 kPa). Doing so may result in a high risk of damage to the equipment or lead to an accident.

4.2.2 Pneumatic Piping

Connect the air supply pipe to the SUP port of the YVP110, and the output pressure pipe to the OUT1 port. Use O.D. 6-mm/I.D. 4-mm or O.D. 8-mm/I.D. 6-mm copper tubes for piping, and pneumatic pipe fittings for joints. After finishing the piping, check that there is no leakage from the joints.

Note that a YVP110 has two air supply ports (SUP): one at the rear and the other on the side. When delivered, the rear SUP port is capped with a blind plug. Thus, to use the rear SUP port, remove the blind plug and cap the side SUP port with it. At this time, be very careful that no foreign matter or dust caught in the sealing tape is allowed to enter inside the pipe.

Figure 4.1 shows the pneumatic piping ports. The port specification can be chosen when ordering the YVP110.

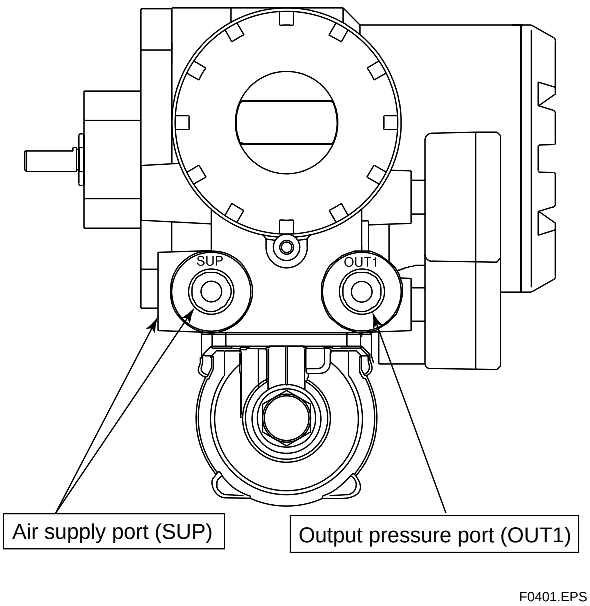

Figure 4.1 Pneumatic Piping Ports

CAUTION

- To obtain the maximum air processing flow rate of the YVP110, the inner diameter of the piping tube needs to be at least 6 mm. When the YVP110 is combined with a high-capacity actuator and a minimum response speed is required, use a tube whose inner diameter is 6 mm or larger.
- Do not use an unnecessarily long tube or piping as it will decrease the air flow rate, thus leading to a decrease in response speed.
- Perform sufficient flushing of the piping tubes and fittings before use to ensure that no foreign matter such as metal refuse may enter the piping.
- When performing the piping connection, be sufficiently careful that a piece of sealing tape or other solid or fluid sealing material does not enter the piping.

4.3 Wiring

4.3.1 Recommended Cables

For wiring for a YVP110, use a cable for H1 fieldbus segments specified by the Fieldbus FOUNDATION™. A shielded cable is recommended. For the details of cables required for H1 fieldbus segments, see "Fieldbus Technical Information"(TI 38K3A01-01).

Choose cables suitable for the respective ambient temperature ranges, especially when they are to be laid in a hot or cold place.

When laying cables in or through a place where the atmosphere may include a toxic gas or liquid, or oil or solvent, choose wires and cables made of materials that have sufficient durability.

4.3.2 Precautions on Wiring

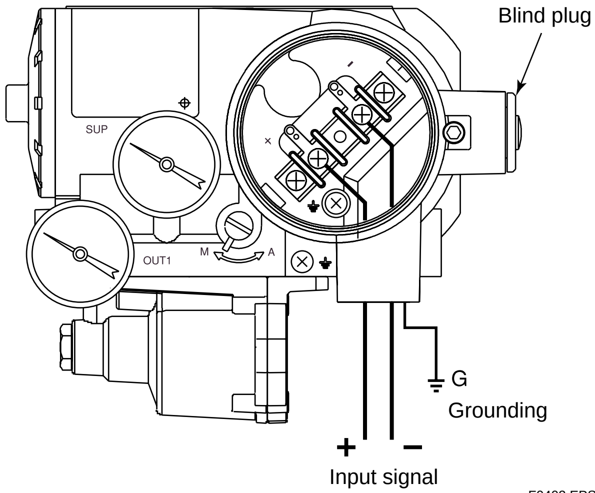

Figure 4.2 Wiring

(1) Prevent the cables from being affected by noise induced from a high-capacity transformer or power supply to a motor.

(2) As shown in Figure 4.2, remove the terminal box cover and dust proofing plug when performing a wiring connection. Be sure to securely seal the unused wiring port with a blind plug.

(3) To make the cables watertight and to prevent them from being damaged, it is recommended to use a cable conduit and duct. Also for the same reasons, be sure to use a watertight adapter for the connection of the conduit to the port.

(4) Ground the YVP110 to a pole with a grounding resistance of 100 Ω or less. There are two grounding terminals: one inside and another outside the terminal box. Use either terminal.

5. SETUP

⚠ CAUTION

During the setup especially when autotuning is being executed, the valve stem may happen to move suddenly to an unexpected direction. Before starting the setup, check and confirm that the process has been shut down or the control valve is isolated from the process. During the setup, keep away from the movable parts to avoid injury.

5.1 General

After mechanically attaching the YVP110 to an actuator and finishing the wiring and piping, connect the YVP110 to a fieldbus and make settings, such as carrying out auto tuning and setting the tight-shut option, using a parameter setting tool or the like.

IMPORTANT

For the operation of a parameter setting tool, read the manual of each tool. Also, read the Chapters 8 through 10 and 12 of this manual to become familiar with the configuration of the fieldbus instrument and the function of the transducer block before starting adjustment.

Check that the piping and wiring connections are all correct, and then supply the specified input voltage and air pressure. For the connection to the fieldbus, see the chapters 4.3 'Wiring' and 8.4 'System Configuration'.

Parameter settings for the actuator and valve are to be made in the parameters in the transducer block inside the YVP110 positioner. For details of each parameter, refer to the parameters list in Appendix 1. Follow the procedure below.

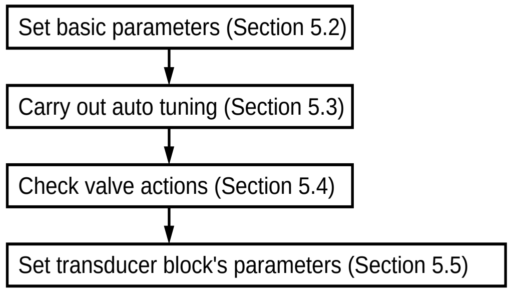

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Figure 5.1 Setup Procedure

5.2 Setting Basic Parameters

First, set the target mode's in the parameters MODE_BLK of the transducer block and AO function block to O/S (Out of Service). When either one or both of the transducer block and AO function block are in the O/S mode, the transducer block's parameters that determine the valve actions are write-locked.

(1) Selecting the Acting Direction of Valve

In the parameter ACT_FAIL_ACTION, set the value, 1 or 2, corresponding to the acting direction of the valve, whether the valve opens or closes due to an increase of the pneumatic pressure. The setting in ACT_FAIL_ACTION determines the relationship between the pneumatic input signal and 0-100% of the valve position, where the 0% position means complete closure.

1 = self-closing (air to open)

2 = self-opening (air to close)

IMPORTANT

For the transducer block, the 0% output always means complete closure of the valve. Set ACT_FAIL_ACTION correctly in accordance with the acting direction of the valve used. Nonetheless, the 0-100% of the transducer block's output can be logically reversed by setting IO_OPTS in the AO block to true.

Independently of the above setting, YVP110 always acts identical upon power off and cut-off of the air supply.

(2) Selecting the Actuator Type

For the parameter VALVE_TYPE, set the value, 1 or 2, in accordance with the actuator type.

1 = linear-motion actuator

2 = rotary-motion actuator

Choosing the linear-motion type automatically corrects a linearity error that is inherently caused between the linearly acting actuator and the rotating displacement sensor inside the YVP110 actuator.

5.3 Carrying out Auto Tuning

CAUTION

This function strokes the valve over its full range. Do not execute while valve is controlling the process. Keep away from the movable parts to avoid injury.

After selecting the acting direction of the valve and the actuator type, carry out auto tuning. The auto tuning program automatically:

- Adjusts the zero-point and span.
- Adjusts the parameter settings for controlling the valve.

IMPORTANT

Auto Tuning in YVP110 sets the 0% point at the position where the valve is fully closed and 100% point
at the position where the valve stem stops against the mechanical stopper(fully open). If it is necessary to adjust the zero point and span precisely to the rated stroke of the valve, carry out travel calibration which is described later in this chapter after the Auto Tuning.

To carry out auto tuning, write a value to the parameter AUTO_TUNE_EXEC according to the following procedure.

CAUTION

For the first time after installing the YVP110 on the actuator or anytime after detaching the YVP110 and installing it again on the actuator, be sure to perform step (1) below, or (2) and (3) to carry out all adjustments. Otherwise, the adjustments cannot be carried out correctly. From the next and any time thereafter, perform only step (2) or (3) independently.

(1) To sequentially adjust the zero-point and span, and then control parameter settings for the first time after installing the YVP110 on a valve actuator, write:

4 (= travel calibration at stop point and control parameter tuning).

(2) To leave the control parameter settings unchanged and only perform zero-point and span adjustments such as after detaching the YVP110 from the valve actuator and restoring it, write:

2 (= travel calibration at stop point).

(3) To leave zero-point and span settings unchanged and only adjust control parameter settings, such as after the hysteresis of the valve actions has greatly changed, write:

3 (= control parameter tuning).

The time needed to complete the adjustments, which varies with the actuator size and the hysteresis of the actions, is roughly 4 minutes for a mid-capacity (capacity of around 3 liters) actuator.

If you want to abort auto tuning for some reason such as when you have started it while leaving the air supply shut off, write:

5 (= cancel execution).

The tuning result will be written to AUTO_TUNE_RESULT. The value of AUTO_TUNE_RESULT is 255 and is displayed as “In operation” while auto tuning is running, and will change to 1 which is displayed as “Succeeded” when auto tuning has finished successfully. In the event of a warning or error, a value other than those below will be displayed. For details, see the specifications for the transducer block.

1 = succeeded
2 = canceled
255 = in operation

The values of the hysteresis of valve actions and the air supply pressure measured during auto tuning are stored in parameters of the transducer block inside the YVP110. Note that pressure data such as air supply pressure data are available only for a YVP110 with an optional pressure sensor.

CAUTION

Ensure that the pressure of the air supply to the YVP110 positioner is regulated within the specified range. If it differs from the pressure during actual operation, or if it is unstable, optimum tuning results may not be obtained.

The following parameters are tuned by carrying out auto tuning:

SERVO_GAIN
(static loop gain of internal valve control loop)
SERVO_RESET (integral time)
SERVO_RATE (derivative time)
SERVO_RATE_GAIN (derivative gain)
SERVO_DEADBAND
(dead band of integral action)
SERVO_OFFSET (offset of integral action)
BOOST_ON_THRESHOLD
(threshold to switch on the boost action)
BOOST_OFF_THRESHOLD
(threshold to switch off the boost action)
BOOST_VALUE
SERVO_I_SLEEP_LMT
(timer setting for integral action)
SERVO_P_ALPHA
(multiplication coefficient for the square of proportional factor)
INTERNAL_GAIN
(total gain of I/P module,control relay and the valve)

Normally, control parameters need not be readjusted after auto tuning. (Should there be a problem, see Chapter 16, "Troubleshooting.")

If you want to carry out fine adjustments of the zero-point and span settings, perform the travel calibration as follows.

● **Travel Calibration**

If the full stroke of the valve is too large for the maximum required flow rate, you can change the span of the travel by carrying out a travel calibration.

(1) First, vary the value of FINAL_VALUE.value (see caution) to move the stem and adjust the stem to the desired point that you want to set as the 100% position.

(2) Next, write 3 to TRAVEL_CALIB_EXEC. This changes the span while leaving the zero point unchanged.

TRAVEL_CALIB_EXEC:
1 = off
2 = 0%-point calibration (no change to span)
3 = span calibration (no change to 0% point)
4 = 50%- point calibration (no change to either span or 0% point)

CAUTION

Only when the target mode's in both the AO and transducer blocks are O/S, can FINAL_VALUE.value be written.

The result of the travel calibration will be written to TRAVEL_CALIB_RESULT.

5.4 Checking Valve Actions

After carrying out auto tuning, check step responses by changing the value of the transducer block's final valve position setpoint, FINAL_VALUE.value. Also, check whether the valve acts correctly over the 0-100% position range.

CAUTION

Only when the target mode's in MODE_BLK parameters in both the AO and transducer blocks are O/S, can FINAL_VALUE.value be written.

5.5 Setting Parameters of Transducer Block

Set the following parameters as necessary. For the settings made as default when shipped, see the parameter lists in Appendix 1.

(1) Position-to-flow Rate Characteristic Type

The parameter POSITION_CHAR_TYPE defines the characteristics between the valve position and flow rate, and is set to linear by default. Write the appropriate value:

1 = linear
2 = equal percent (50:1)
3 = equal percent (30:1)
4 = quick open (reversal of equal % - 50:1)
255 = user-defined

Writing the value 255 allows you to define the desired characteristics by 10 line segments for evenly divided input levels. The coordinates (0,0) and (100,100) are fixed; set the values corresponding to OUT(Output of AO block) = 10%, 20%, 30%..., 80%, 90%. Note that a set value must be greater than the preceding set value; the output must increase as the input increases.

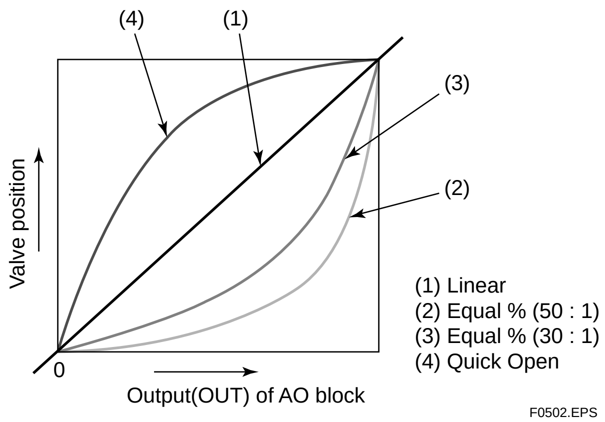

Figure 5.2 Position-to-flow Rate Characteristic Type

(2) Final-value Limits

Eu_100 and Eu_0 in the parameter FINAL_VALUE_RANGE define the upper and lower limits of FINAL_VALUE.value of the transducer block.

⚠ CAUTION

Even if the range of FINAL_VALUE.value is limited by FINAL_VALUE_RANGE, the actual valve position is set to outside the FINAL_VALUE_RANGE setting when the tight-shut or full-open action described below is activated.

(3) Tight-shut and Full-open Actions

The tight-shut action is an action to decrease the output pressure to a level much lower than the 0% pressure level (or to increase it much higher than the 0% pressure level for an air-to-close valve) when FINAL_VALUE.value is less than FINAL_VALUE_CUTOFF_LO in order to ensure that the valve is tightly shut off. Conversely, the full-open action is an action to increase the output pressure to a level much higher than the 100% pressure level (or decrease it much lower than the 100% pressure level for an air-to-close valve) when FINAL_VALUE.value is larger than FINAL_VALUE_CUTOFF_HI in order to ensure that the valve is fully open.

A hysteresis of 1% is applied to the thresholds, FINAL_VALUE_CUTOFF_LO and FINAL_VALUE_CUTOFF_HI.

(4) Thresholds for Limit Switches

Just like hardware limit switches for a valve, on/off status signals can be generated when the valve position read-back signal FINAL_POSITION_VALUE.value reaches specified levels. These on/off statuses can be transferred to a DI function block.

Write the threshold for the upper limit switch to LIMSW_HI_LIM, and the threshold for the lower limit switch to LIMSW_LO_LIM.

A hysteresis of 1% is applied to the thresholds, LIMSW_HI_LIM and LIMSW_LO_LIM.

⚠ CAUTION

To make a DI block read the on/off statuses of a limit switch, set CHANNEL of the DI block to:

- 2, for reading the on/off status of the upper limit switch.
- 3, for reading the on/off status of the lower limit switch.

(5) Thresholds for Operation Result Integration Alarms

The YVP110 has a function to integrate the following operation result quantities individually:

- TOTAL_CYCLE_COUNT (incremented by 1 at each change in the direction of the action)
- TOTAL_TRAVEL (in % where full stroke = 100%)
- TOTAL_OPEN_TIME (in hours)

- TOTAL_CLOSE_TIME (in hours)
- TOTAL_NEAR_CLOSE_TIM (total at nearly closed time in hours)

When these values exceed the respective thresholds below, corresponding alarms are output. Set the thresholds as necessary.

- CYCLE_COUNT_LIM
- TRAVEL_LIM
- OPEN_TIME_LIM
- CLOSE_TIME_LIM
- NEAR_CLOSE_TIME_LIM

Also, set NEAR_CLOSE_THRESHOLD, which defines the threshold of the valve position for counting NEAR_CLOSE_TIME, as necessary.

For other alarms and self-diagnostic functions, see "12.6 Online Diagnostics".

6. MAINTENANCE

6.1 General

The modular structure of the YVP110 increases the ease of maintenance work. This chapter describes cleaning and part replacement procedures that should be done for maintenance of the YVP110.

The YVP110 is a precision instrument; read the following carefully when carrying out maintenance.

For calibrations, see Chapter 5.

6.2 Periodic Inspections

To maintain problem-free plant operation, periodic inspections are essential. At each periodic inspection, be especially careful when ensuring that:

- No external damage can be seen.
- No leakage from the YVP110 or the piping around it can be detected.
- No build up in the drain, or dust or oil adhering to the air supply line has occurred.

6.2.1 Cleaning the Fixed Nozzle

The fixed nozzle of the YVP110 is attached to the control relay's surface that engages the YVP110's main structure (see Figure 6.1). Detach the control relay from the main structure of YVP110 by following the instruction shown in 6.3.2. Thread a wire with a 0.25-mm diameter through the nozzle to clean it. After cleaning the nozzle, place the nozzle and O-ring at the original position and attach the control relay again.

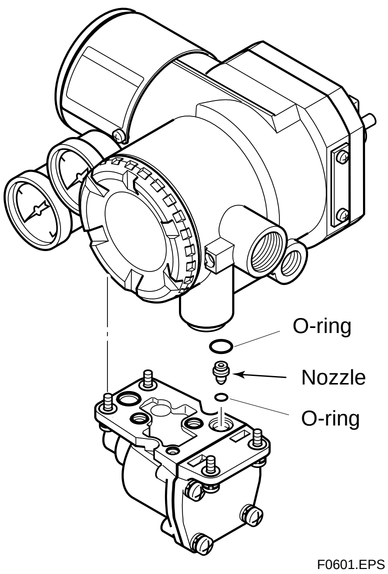

Figure 6.1 Cleaning the Nozzle

⚠ **CAUTION**

All the O-rings used for the sealing of pneumatic signal circuits are made of silicon rubber. The sealing capability is degraded if general silicon grease is applied. When applying grease to a sealing part, use a type of grease compatible with silicon rubber, such as fluoride grease and grease for silicon rubber.

6.3 Part Replacement

6.3.1 Replacing the Screen Filters

When the screen filters installed deep in the air supply port and output pneumatic signal port become clogged, replace them with new filters using a tool with pointed tips such as a set of tweezers.

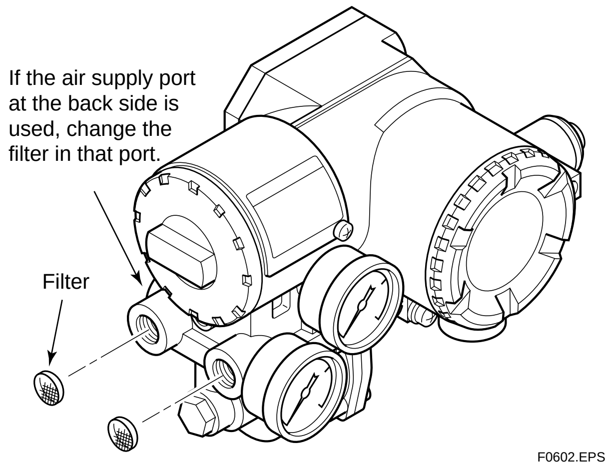

Figure 6.2 Replacing the Screen Filters

6.3.2 Replacing the Control Relay Assembly

(1) Decrease the air supply pressure to zero.

(2) Using a Philips screwdriver, unscrew the four mounting screws on the bottom face.

(3) Pull the relay assembly downwards to detach it.

(4) To mount a new relay assembly, remove the mounting screws and washers from the old assembly and use them to mount the new assembly in place by tightening them from below.

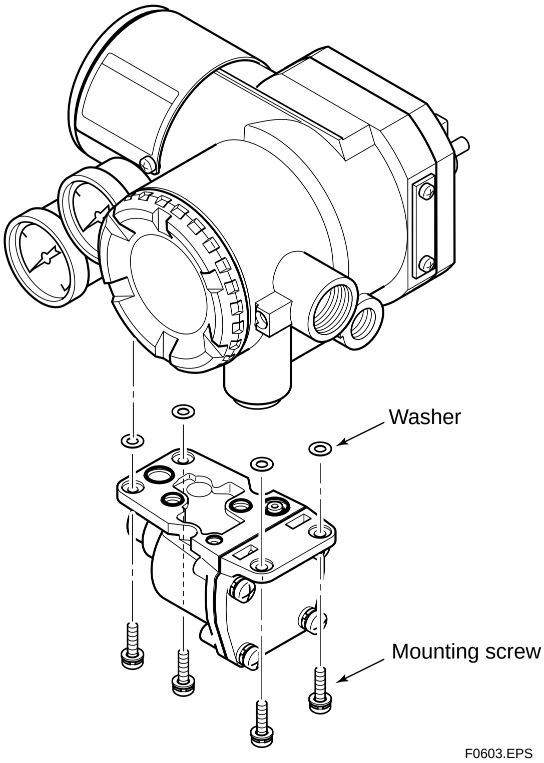

Figure 6.3 Replacing the Control Relay Assembly

6.3.3 Replacing the Internal Air Filter

An air filter is provided at the opening to the internal pneumatic circuits. Follow the procedure below to replace it.

(1) Decrease the air supply pressure to zero.

(2) Remove the relay assembly (in reference with Section 6.3.2).

(3) Remove the pneumatic circuit holding plate and gasket.

(4) Remove the air filter and O-ring.

(5) Set the new filter in place.

(6) Perform steps (3), then (2) to restore the YVP110 to its original state.

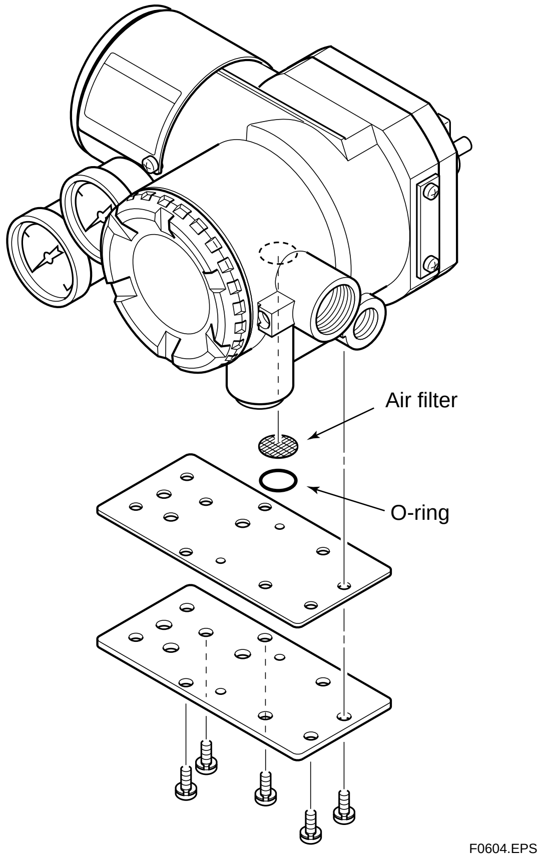

Figure 6.4 Replacing the Internal Air Filter

7. STANDARD SPECIFICATIONS

■ STANDARD SPECIFICATIONS

Applicable Control Valve:

Linear or Rotary Motion Control Valve
(Diaphragm Actuator and Single Acting Cylinder)
Note: Double Acting Actator can be applicable with using reversing relay.

Functions:

Function Blocks:
- AO: One Analog Output
- DI: Two Discrete Inputs
- PID: One PID Control Function (Optional)

Pressure Sensor(optional)
Flow Characterization Feature:
- Linear
- Equal Percentage(50 : 1)
- Equal Percentage(30 : 1)
- Quick Opening
- Customer Characterization (10 segments)

Auto Tuning Function
Valve Position Detecting Function
Contiuous Diagnostics Function:
- Total Travel
- Number of Cycles
- Time Open/Time Close/Time Near Close

Housing Materials:

Case: Aluminum die-cast
Paint: Polyurethane resin-baked finish
Color: Deep-sea moss-green (Munsell 0.6GY3.l/2.0 or equivalent)

Output signals and pressure gauge scale:

No gauge in standard. Pressure gauge can be selected as option. The supply pressure unit on the name plate for non-gauge model is Pa.

Diaphragm, Single acting Cylinder			
Calibration unit	Supply Air Pressure	Pressure Gauge Scale	
		Supply Air	Output Signal
Pa	140 to 400 kPa	400 kPa	400 kPa
kgf/cm^2	1.4 to 4 kgf/cm^2	4 kgf/cm^2	4 kgf/cm^2
bar	1.4 to 4 bar	4 bar	4 bar
psi	20 to 60 psi	60 psi	60 psi

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Pressure Gauge Case:

Stainless steel JIS SUS 304

Communication:

Digital: FOUNDATION fieldbus

Conditions of Communication Line

Supply Voltage: 9 to 32V DC
Supply Current: 17 mA(max)

Normal Operating conditions:

Air Supply pressure: 20 to 100 psi (140 to 700 kPa)
Vibration Limit: 4 mm at 5 to 15 Hz; 2G at 15 to 2000 Hz
Shock limik: 10G

Manual Operation:

Available using Auto/Manual(A/M) transfer switch

Zero Adjustment Range:

–15 to 85% of span

Span Adjustment Range:

Within 300% of span

Valve-stem travel Range:

Linear Motion:
5 to 150 mm(0.2 to 6.0 inch)
(Rotation Range: ±10 to ±25 deg)
Rotary Motion:
2 to 90 deg

Air Consumption and Output Capacity:

	Diaphragm, Single Acting Cylinder
Air Supply Pressure	20 psi (140 kPa)
Maximum Air Consumption	0.178 SCFM (0.32 Nm^3/h)
Maximum Output Capacity	4.1 SCFM (6.6 Nm^3/h)

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Ambient temperature Limits:

–40 to 85°C(–40 to 185°F)

Ambient Humidity Limits:

5 to 95% RH at 40°C(104°F)

EMC Conformity

For EMI (Emission): EN55011, EN55022A
For EMS (Immunity): EN50082-2

Waterproof:

NEMA 4X: IP65

Explosion-Proof Construction:

Explosion-proof Construction: Dual compartment
Ambient Temperature: –20 to 60°C

Connections:

Air Connection: Rc 1/4 or 1/4 NPT female
Electrical Connection: G 1/2, 1/2 NPT, M20 and Pg13.5 female
Pressure Gauge Connection:
Without pressure gauge(Standard Specification)

		Pressure gauge connection
Connections Codes	1,5 and 6	Rc 1/8 female
	3	1/8 NPT female

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With pressure gauge(Optional)

		Pressure gauge connection	
		Optional codes /GP, /GM, and /GB	Optional code /GE
Connections Codes	1,5 and 6	Rc 1/8 female	1/8 NPT female
	3		

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Mounting:

Front of Actuator with bracket.
Direct Connection for rotary valve.

Weight:

2.3 kg (4.41 lb)

■ PERFORMANCE SPECIFICATIONS

Linearity:

±0.5% of Span (including linkages)

Hysteresis:

0.3% of Span

Ambient temperature Effect:

±0.08% of Span/°C

Position Effect:

±0.3% of Span/90 deg

Vibration Effect:

±2% of Span at 15 to 2000 Hz

■ MODEL AND SUFFIX CODES

Model	Suffix Codes	Description
YVP110	························	Valve positioner
Input Signal	**-F** ·····················	Digital communication (FOUNDATION Fieldbus protocol)
Applicable Control Valve	**1** ··················	Single Acting Actuator
—————	**A**················	Always A
Connections	**1** ············	Electrical Connection: G 1/2, Pneumatic Connection: Rc 1/4
	3 ············	Electrical Connection: 1/2 NPT, Pneumatic Connection: Rc 1/4 NPT
	5 ············	Electrical Connection: DIN Pg 13.5, Pneumatic Connection: Rc 1/4
	6 ············	Electrical Connection: M20, Pneumatic Connection: Rc 1/4
—————	**N** ·········	Always N
Optional Codes	**/□** ·····	Optional Specifications

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■ OPTIONAL SPECIFICATIONS

Item		Description		Code
Lightning protection		Power supply 10.5 to 32V DC Allowable current Max. 6000 A(1× 40 µs), repeating 1000 A(1× 40 µs), 100 times		**A**
Painting	Coating change	Epoxy resin coating		**X1**
	Color Change	Terminal Cover only	Munsell notation code: NI1.5 Black	**P1**
			Munsell notation code: 7.5BG4/1.5, jade green	**P2**
			Metallic silver	**P7**
PID Function Block		PID control function		**LC1**
Output Monitor		Built-in pressure sensor for output		**AP**
With Pressure Gauge		Scale and calibration unit: Pa		**GP**
		Scale and calibration unit: kgf/cm^2		**GM**
		Scale and calibration unit: bar		**GB**
		Scale and calibration unit: psi		**GE**
Valve Linkage		Two levers: stroke limit of 10 to 100 mm		**LV1**

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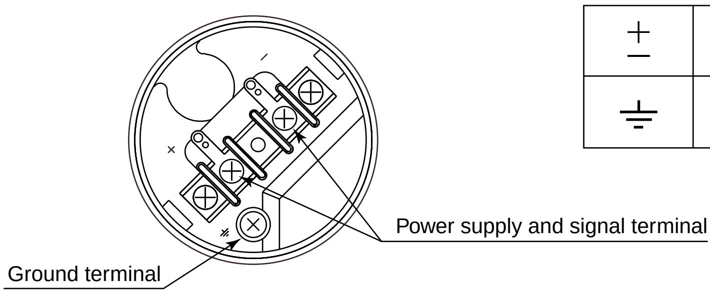
● Terminal Configuration



● Terminal Wiring

$+$ $-$	Power supply and signal terminal
⏚	Ground terminal

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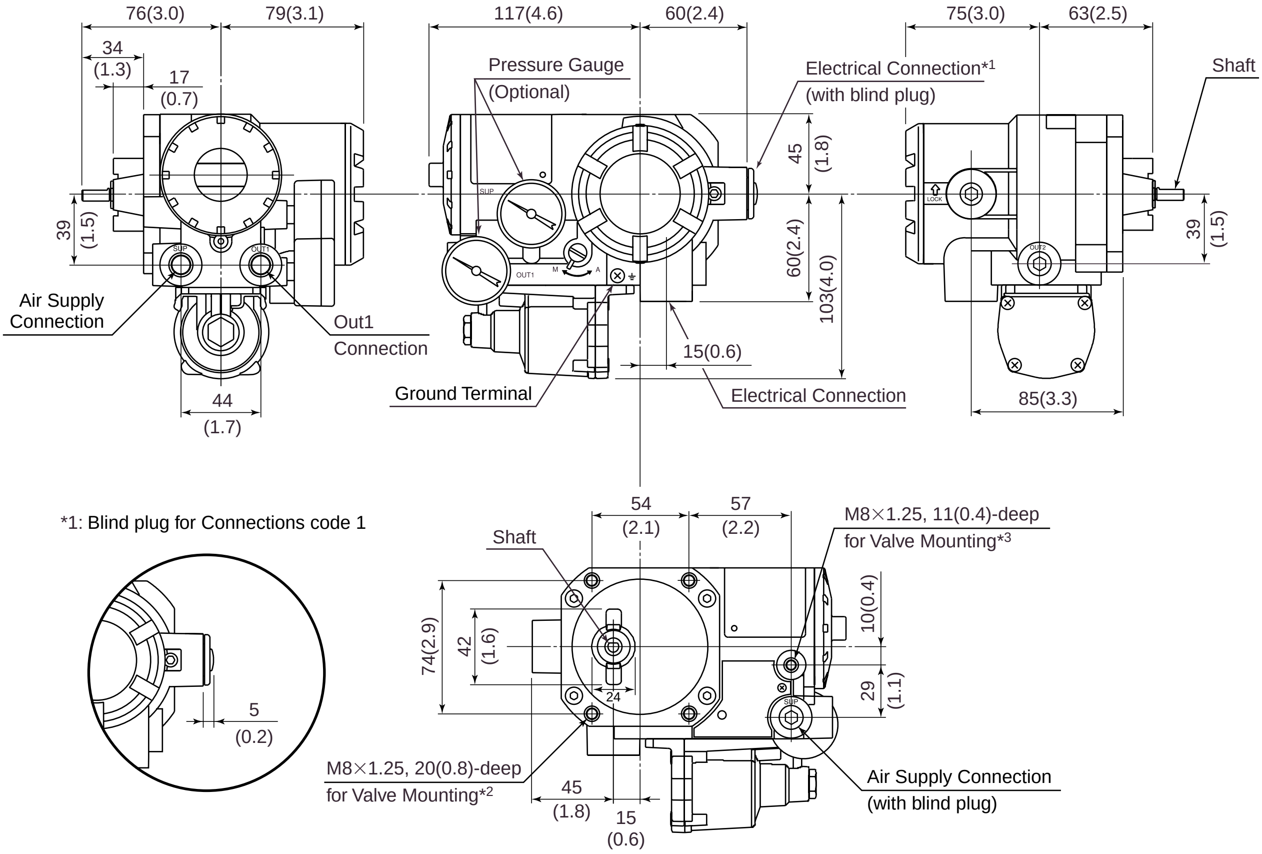
■ DIMENSIONS

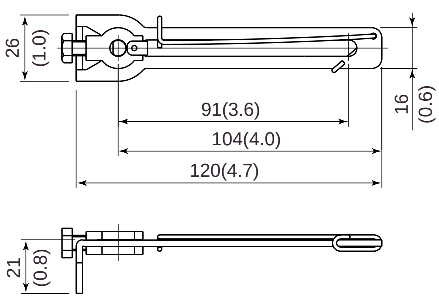
Unit: mm(approx. inch)



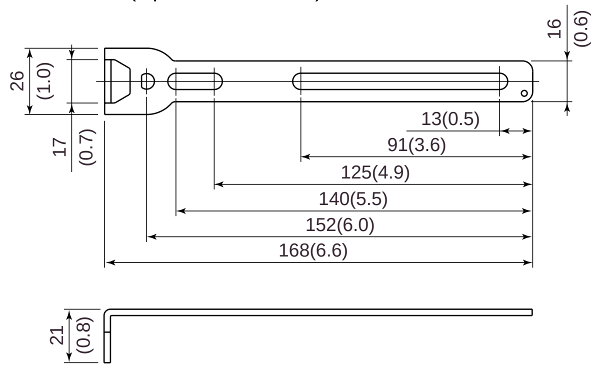
*2: Attached with 4 mounting bolts (M8, 25 mm) and spring washers (Applicable bracket thickness: 3 to 6 mm)

*3: Available when unable to mount securely with the 4 bolts in *2.

◆ Lever 1 (Optional code /LV1)



◆ Lever 2 (Optional code /LV1)



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[FUNCTIONS]

CONTENTS

8. ABOUT FIELDBUS

8.1 Outline

Fieldbus is a bi-directional digital communication protocol for field devices, which offers an advancement in implementation technologies for process control systems and is widely employed by numerous field devices.

YVP110 employs the specification standardized by The Fieldbus Foundation, and provides interoperability between Yokogawa devices and those produced by other manufacturers. Fieldbus comes with software consisting of AO function block, two DI function blocks and optional PID function block, providing the means to implement a flexible instrumentation system.

For information on other features, engineering, design, construction work, startup and maintenance of Fieldbus, refer to "Fieldbus Technical Information" (TI 38K3A01-01E).

8.2 Internal Structure of YVP110

The YVP110 contains two virtual field devices (VFD) that share the following functions.

8.2.1 System/network Management VFD

- Sets node addresses and Physical Device tags (PD Tag) necessary for communication.
- Controls the execution of function blocks.
- Manages operation parameters and communication resources (Virtual Communication Relationship: VCR).

8.2.2 Function Block VFD

(1) Resource block

- Manages the information common to each FB VFD in YVP110.

(2) Transducer block

- Located between Hardware I/O(actuator, sensor) and AO/DI function blocks, pass the control signal from AO function block to I/P module to control the valve position.

(3) AO function block

- Accepts a control signal from an upstream block and pass the signal to Transducer block.
- Accept a valve position signal from Transducer block and feedback it to an upstream block.

(4) DI function block

- Receives the discrete signal from Transcducer blcok and output them.

(5) PID function block(optional)

- Offers PID control function.

8.3 Logical Structure of Each Block

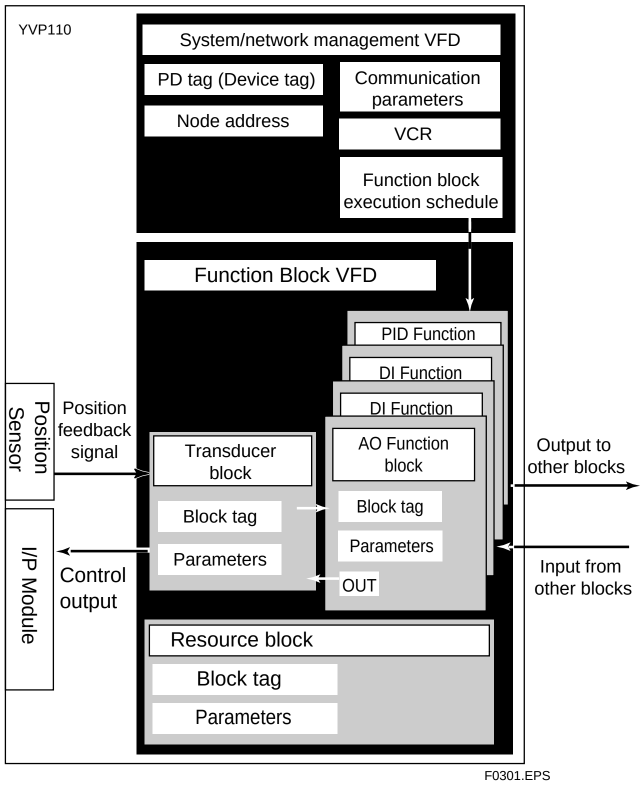

Figure 8.1 Logical Structure of Each Block

Setting of various parameters, node addresses, and PD Tags shown in Figure 8.1 is required before starting operation.

8.4 System Configuration

The following instruments are required for use with Fieldbus devices:

- **Power supply:**
  Fieldbus requires a dedicated power supply. It is recommended that current capacity be well over the total value of the maximum current consumed by all devices (including the host). Conventional DC current cannot be used as is.
- **Terminator:**
  Fieldbus requires two terminators. Refer to the supplier for details of terminators that are attached to the host.
- **Field devices:**
  Connect the field devices necessary for instrumentation. YVP110 has passed the interoperability test conducted by The Fieldbus Foundation. In order to properly start Fieldbus, it is recommended that the devices used satisfy the requirements of the above test.
- **Host:**
  Used for accessing field devices. A dedicated host (such as DCS) is used for an instrumentation line while dedicated communication tools are used for experimental purposes.
- **Cable:**
  Used for connecting devices. Refer to “Fieldbus Technical Information” (TI 38K3A01-01E) for details of instrumentation cabling. Provide a cable sufficiently long to connect all devices. For field branch cabling, use terminal boards or a connection box as required. If the total length of the cable is in a range of 2 to 3 meters for laboratory or other experimental use, the following simplified cable (a twisted pair wire with a cross section of 0.9 mm^2 or more (AWG #xx) and cycle period of within 5 cm (2 inches) may be used. Termination processing depends on the type of device being deployed. For YVP110, use an M4 screw terminal claw. Some hosts require a connector.

Refer to Yokogawa when making arrangements to purchase the recommended equipment.

The number of devices that can be connected to a single bus and the cable length vary depending on system design. When constructing systems, both the basic and overall design must be carefully considered to allow device performance to be fully exhibited.

8.4.1 Connection of Devices

Connect the devices as shown in Figure 9.1. Connect the terminators at both ends of the trunk, with a minimum length of the spur laid for connection.

The polarity of signal and power must be maintained.

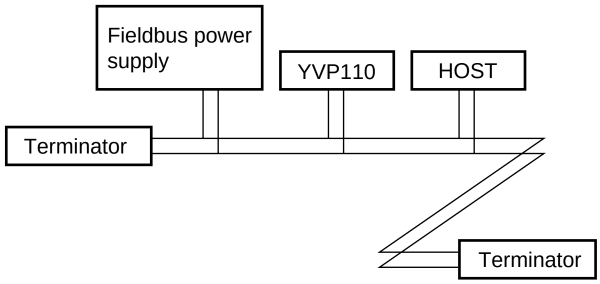

Figure 8.2 Cabling

Before using a Fieldbus configuration tool other than the existing host, confirm it does not affect the loop functionality in which all devices are already installed in operation. Disconnect the relevant control loop from the bus if necessary.

8.5 Integration of DD

If the host supports DD (Device Description), the DD of the YVP110 needs to be installed. Check if host has the following directory under its default DD directory.

594543/0001
  (594543 is the manufacturer number of Yokogawa Electric Corporation, and 0001 is the YVP110 device number, respectively.)

If this directory is not found, DD of YVP110 has not been included. Create the above directory and copy the DD file (0m0n.ffo,0m0n.sym) (m, n is a numeral) (to be supplied separately) into the directory.

Once the DD is installed in the directory, the name and attribute of all parameters of the YVP110 are displayed.

Off-line configuration is allowed by using the Capability file(CFF) which is also to be supplied seperately.

IMPORTANT

For offline configuration, use the CFF which matches the specification of the instrument to be configured. For YVP110, there are two types of CFF file; one for standard type instruments and the other for the instruments with /LC1 option in which PID function block is available. Using unmatched CFF will cause an error upon downloads, etc.

9. CONFIGURATION

This chapter contains information on how to adapt the function and performance of the YVP110 to suit specific applications. Because two or more devices are connected to Fieldbus, settings including the requirements of all devices need to be determined. Practically, the following steps must be taken.

(1) Network design
Determines the devices to be connected to Fieldbus and checks the capacity of the power supply.

(2) Network definition
Determines the tag and node addresses for all devices.

(3) Definition of combining function blocks
Determines the method for combination between each function block.

(4) Setting tags and addresses
Sets the PD Tag and node addresses one by one for each device.

(5) Communication setting
Sets the link between communication parameters and function blocks.

(6) Block setting
Sets the parameters for function blocks.

The following section describes each step of the procedure in the order given. Using a dedicated configuration tool allows the procedure to be significantly simplified. This section describes the procedure to be assigned for a host which has relatively simple functions. For operation of the host, refer to the instruction manual for each host. No details of the host are explained in the rest of this material.

IMPORTANT

Connecting a Fieldbus configuration tool to a loop with its existing host may cause communication data scrambles resulting in a functional disorder or a system failure.

IMPORTANT

Do not turn off the power immediately after setting. If the power is turned off within 40 seconds after setting is made, the modified parameters are not saved and the settings return to the original values.

9.1 Network Design

Select the devices to be connected to the Fieldbus network. (Refer to 8.4 'System Configuration' for selection of the devices.)

First, check the capacity of the power supply. The power supply capacity must be greater than the sum of the maximum current consumed by all devices to be connected to Fieldbus. The maximum current consumed (power supply voltage 9 V to 32 V) for YVP110 is 17 mA. The cable must have the spur in a minimum length with terminators installed at both ends of the trunk.

9.2 Network Definition

Before connection of devices with Fieldbus, define the Fieldbus network. Allocate PD Tag and node addresses to all devices (excluding such passive devices as terminators).

The PD Tag is the same as the conventional one used for the device. Up to 32 alphanumeric characters may be used for definition. Use a hyphen as a delimiter as required.

The node address is used to specify devices for communication purposes. Because data is too long for a PD Tag, the host uses the node address in place of the PD Tag for communication. A range of 16 to 247 (or hexadecimal 0x10 to 0xF7) can be set. Generally, the device (LM device) with bus control function (Link Master function) is allocated from a smaller address number (16) side, and other devices (BASIC device) without bus control function allocated from a larger address number (247) side respectively. Place YVP110 in the range of the BASIC device. Set the range of addresses to be used to the LM device. Set the following parameters.

Table 9.1 Parameters for Setting Address Range

Symbol	Parameters	Description
V (FUN)	First-Unpolled-Node	Indicates the address next to the address range used for the host or other LM device.
V (NUN)	Number-of-consecutive-Unpolled-Node	Unused address range

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The devices within the address range written as "Unused" in Figure 9.1 cannot be used on a Fieldbus. For other address ranges, the range is periodically checked to identify when a new device is mounted. Care must be taken not to allow the address range to become wider, which can lead to exhaustive consumption of Fieldbus communication performance.

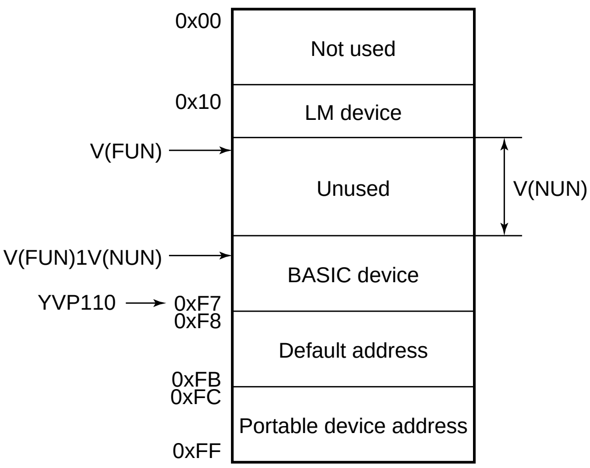

Figure 9.1 Available Range of Node Addresses

To ensure stable operation of Fieldbus, determine the operation parameters and set them to the LM devices. While the parameters in Table 9.2 are to be set, the worst-case value of all the devices to be connected to the same Fieldbus must be used. Refer to the specification of each device for details. Table 9.2 lists YVP110 specification values.

Table 9.2 Operation Parameter Values of the YVP110 to be Set to LM Devices

Symbol	Parameters	Description and Settings
V (ST)	Slot-Time	Indicates the time necessary for immediate reply of thje device. Unit of time is in octets (256 µs). Set maximum specification for all devices. For YVP, set a value of 4 or greater.
V (MID)	Minimum-Inter-PDU-Delay	Minimum value of communication data intervals. Unit of time is in octets (256 µs). Set the maximum specification for all devices. For YVP, set a value of 4 or greater.
V (MRD)	Maximum-Reply-Delay	The worst case time elapsed until a reply is recorded. The unit is Slot-time; set the value so that V (MRD) 3V (ST) is the maximum value of the specification for all devices. For YVP, the setting must be a value of 12 or greater.

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9.3 Definition of Combining Function Blocks

The input/output parameters for function blocks are combined. Practically, setting is written to the YVP110 link object with reference to "Block setting" in Section 9.6 for details.

For the YVP110, in order to minimize the delay in data transfer between Transducer block and AO function block, transducer block are designed to be executed in conjunction with the execution of AO function block. Therefore, in order to activate Transducer block, it is necessary that AO function block is always defined in the schedule.

The combined blocks need to be executed synchronously with other blocks on the communications schedule. In this case, change the YVP110 schedule according to the following table. Enclosed values in the table are factory-settings. YVP110 schedule is set as shown in the following. Change it as necessary.

Table 9.3 Execution Schedule of the YVP110 Function Blocks

Index	Parameters	Setting (Enclosed is factory-setting)
269 (SM)	MACROCYCLE_ DURATION	Cycle (MACROCYCLE) period of control or measurement. Unit is 1/32 ms. (32000 = 1 s)
276 (SM)	FB_START_ENTRY.1	AO block startup time. Elapsed time from the start of MACROCYCLE specified in 1/32 ms. (32000 = 1 s)

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A maximum of 120 ms is taken for execution of AO block, a maximum of 70 ms for execution of each DI block, and a maximum of 150 ms is taken for execution of PID block. For scheduling of communications for combination with the next function block, the execution is so arranged as to start after a lapse of longer than the time above mentioned. In no case should two function blocks of the YVP110 be executed at the same time (execution time is overlapped).

Figure 9.3 shows an example of schedule based on the loop shown in Figure 9.2.

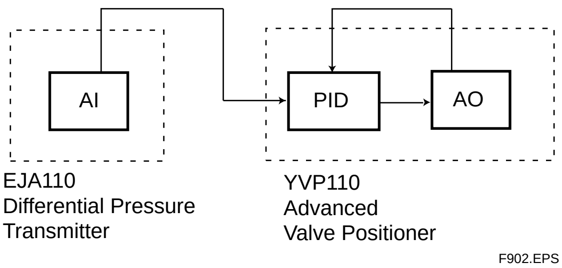

Figure 9.2 Example of Loop Connecting Function Block of YVP110 with other instruments

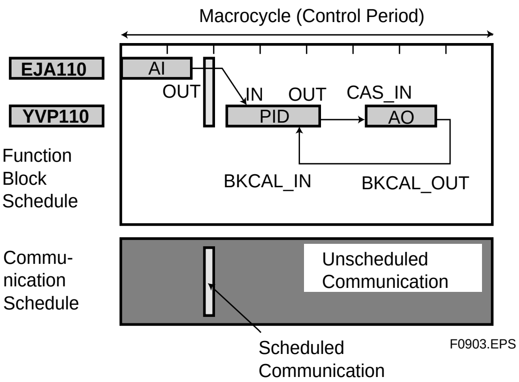

Figure 9.3 Function Block Schedule and Communication Schedule

For the case where the control period(macrocycle) is set to 4 seconds or longer, set the following interval larger than 1% of the macrocycle.

- The interval between 'the end of block execution' and 'the start of releasing CD from LAS'.
- The interval between 'the end of a block execution' and 'the start of the next block execution'.

9.4 Setting of Tags and Addresses

This section describes the steps in the procedure to set PD Tags and node addresses in the YVP110. Connect YVP110 with other network devices and turn on the power of the host and the bus.

There are three states of Fieldbus devices as shown in Figure 9.4, and if the state is other than the lowest SM_OPERATIONAL state, no function block is executed. YVP110 must be transferred to this state when a tag or address is changed.

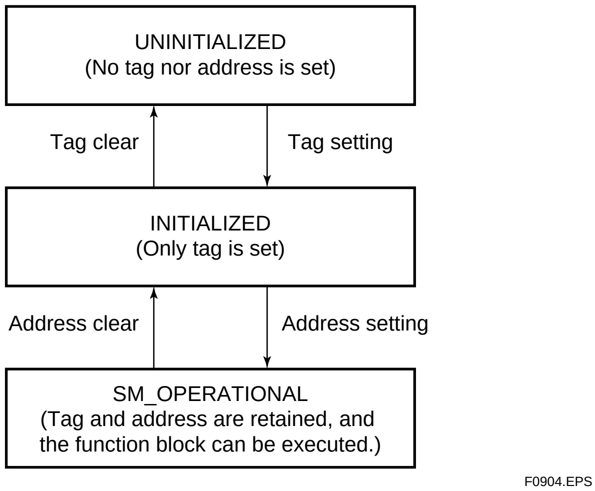

Figure 9.4 Status Transition by Setting PD Tag and Node Address

YVP110 has a PD Tag (CV1001) and node address (247, or hexadecimal 0xF7) that are set upon shipment from the factory unless otherwise specified. If two YVP110s are connected at a time, one YVP110 will keep the address upon shipment while the other will have a default address(See Figure 9.2). To change only the node address, clear the address once and then set a new node address. To set the PD Tag, first clear the node address and clear the PD Tag, then set the PD Tag and node address again.

Devices whose node address was cleared will await the default address (randomly chosen from a range of 248 to 251, or from hexadecimal 0xF8 to 0xFB). At the same time, it is necessary to specify the device ID in order to correctly specify the device. The device ID of the YVP110 is 5945430001xxxxxxxx. (The xxxxxxxx at the end of the above device ID is a total of 8 alphanumeric characters.)

9.5 Communication Setting

To set the communication function, it is necessary to change the database residing in SM-VFD.

9.5.1 VCR Setting

Set VCR (Virtual Communication Relationship), which specifies the called party for communication and resources. YVP110 has 19 VCRs whose application can be changed, except for the first VCR, which is used for management.

YVP110 has VCRs of four types:

Server(QUB) VCR
  A Server responds to requests from a host. This communication needs data exchange. This type of communication is called QUB (Queued User-triggered Bidirectional) VCR.
Source (QUU) VCR
  A Source multicasts alarms or trends to other devices. This type of communication is called QUU (Queued User-triggered Unidirectional) VCR.
Publisher (BNU) VCR
  A Publisher multicasts AI block output to another function block(s). This type of communication is called BNU (Buffered Network-triggered Unidirectional) VCR.
Subscriber (BNU) VCR
  A Subscriber receives the data from another function block(s). This type of communication is called BNU (Buffered Network-triggered Unidirectional) VCR.

A Server VCR is capable to respond to requests from a Client (QUB) VCR after the Client initiates connection to the Server successfully. A Source VCR transmits data without established connection. A Sink (QUU) VCR on another device can receive it if the Sink is configured so. A Publisher VCR transmits data when LAS requests so. An explicit connection is established from Subscriber (BNU) VCR(s) so that a Subscriber knows the format of published data.

Parameters must be changed together for each VCR because modification for each parameter may cause inconsistent operation.

9.5.2 Function Block Execution Control

According to the instructions given in Section 9.3, set the execution cycle of the function blocks and schedule of execution.

9.6 Block Setting

Set the parameter for function block VFD.

9.6.1 Link Object

Link object combines the data voluntarily sent by the function block with VCR. YVP110 has 15 link objects. A single link object specifies one combination. Each link object has the parameters listed in Table 9.4. Parameters must be changed together for each VCR because the modifications made to each parameter may cause inconsistent operation.

Table 9.4 Link Object Parameters

Sub-index	Parameters	Description
1	LocalIndex	Sets the index of function block parameters to be combined; set “0” for Trend and Alert.
2	VcrNumber	Sets the index of VCR to be combined. If set to “0”, this link object is not used.
3	RemoteIndex	Sets the index of remote object associated with this link object.
4	ServiceOperation	Set one of the following. Set only one each for link object for Alert or Trend. 0: Undefined 1: Local 2: Publisher 6: Alert 7: Trend
5	StaleCountLimit	Set the maximum number of consecutive stale input values which may be received before the input status is set to BAD. Setting of "2" or larger value is recommended to avoid unnecessary mode transfer which is caused when subscriber failed to receive data correctly.

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15 link objects are not factory-set.

9.6.2 Trend Object

It is possible to set the parameter so that the function block automatically transmits Trend. YVP110 has seven Trend objects, five of them are for analog data, and two of them are for discrete data. A single Trend object specifies the trend of one parameter.

Each Trend object has the parameters listed in Table 9.5. The first four parameters are the items to be set.

Table 9.5 Parameters for Trend Objects

Sub-index	Parameters	Description
1	Block Index	Sets the leading index of the function block that takes a trend.
2	Parameter Relative Index	Sets the index of parameters taking a trend by a value relative to the beginning of the function block.
3	Sample Type	Specifies how trends are taken. Choose one of the following 2 types: 1: Sampled upon execution of a function block. 2: The average value is sampled.
4	Sample Interval	Specifies sampling intervals in units of 1/32 ms. Set the integer multiple of the function block execution cycle.
5	Last Update	The last sampling time.
6 to 21	List of Status	Status part of a sampled parameter.
21 to 37	List of Samples	Data part of a sampled parameter.

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Seven objects are not factory-set.

9.6.3 View Object

This is the object to form groups of parameters in a block. One of advantage brought by forming groups of parameters is the reduction of load for data transaction. YVP110 has six View objects for Transducer block and four View objects for each Resource block, AO block and DI1 and DI2 function block, and each View object has the parameters listed in Table 9.7 to 9.11.

Table 9.6 Purpose of Each View Object

	Description
VIEW_1	Set of dynamic parameters required by operator for plant operation. (PV, SV, OUT, Mode etc.)
VIEW_2	Set of static parameters which need to be shown to plant operator at once. (Range etc.)
VIEW_3	Set of all the dynamic parameters.
VIEW_4	Set of static parameters for configuration or maintenance.

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Table 9.7 View Object for Transducer Block

Relative index	Parameters	VIEW 1	VIEW 2	VIEW 3	VIEW 4 1st	VIEW 4 2nd	VIEW 4 3rd
1	ST_REV	2	2	2	2		
2	TAG_DESC						
3	STRATEGY				2		
4	ALERT_KEY				1		
5	MODE_BLK	4		4			
6	BLOCK_ERR	2		2			
7	UPDATE_EVT						
8	BLOCK_ALM						
9	TRANSDUCER_DIRECTORY						
10	TRANSDUCER_TYPE	2	2	2	2		
11	XD_ERROR	1		1			
12	CORRECTION_DIRCTORY						
13	FINAL_VALUE	5		5			
14	FINAL_VALUE_RANGE		11				
15	FINAL_VALUE_CUTOFF_HI				4		
16	FINAL_VALUE_CUTOFF_LO				4		
17	FINAL_POSITION_VALUE	5		5			
18	SERVO_GAIN				4		
19	SERVO_RESET				4		
20	SERVO_RATE				4		
21	ACT_FAIL_ACTION				1		
22	ACT_MAN_ID				4		
23	ACT_MODEL_NUM				32		
24	ACT_SN				32		
25	VALVE_MAN_ID					4	
26	VALVE_MODEL_NUM					32	
27	VALVE_SN					32	
28	VALVE_TYPE					1	
29	XD_CAL_LOC						32
30	XD_CAL_DATE						7
31	XD_CAL_WHO						32
32	ALARM_SUM			8			
33	POSITION_CHAR_TYPE		1				
34	POSITION_CHAR						
35	LIMSW_HI_LIM		4				
36	LIMSW_LO_LIM		4				
37	ELECT_TEMP			4			
38	TEMPERATURE_UNIT						
39	SUPPLY_PRESSURE		4				
40	SPRING_RANGE		11				
41	OUT_PRESSURE			4			
42	SERVO_OUTPUT_SIGNAL			4			
43	SERVO_RATE_GAIN						
44	SERVO_DEADBAND						
45	SERVO_OFFSET						
46	BOOST_ON_THRESHOLD						
47	BOOST_OFF_THRESHOLD						
48	BOOST_VALUE						

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Relative index	Parameters	VIEW 1	VIEW 2	VIEW 3	VIEW 4 1st	VIEW 4 2nd	VIEW 4 3rd
49	SERVO_I_SLEEP_LMT						
50	SERVO_P_ALPHA						
51	SERVO_RET_TO_DFLT						
52	MEAS_GAIN						
53	VALVE_TC						
54	VALVE_HYS						
55	VALVE_SLIP_WIDTH						
56	MEAS_PRESS_AIR						
57	MEAS_PRESS_SUPPLY						
58	MEAS_SPRING_RANGE						
59	CONTROL_DIR						
60	THETA_HI						
61	THETA_LO						
62	THETA_P						
63	TRAVEL_CALIB_EXEC						
64	TRAVEL_CALIB_RESULT						
65	OPEN_STOP_ADJ						
66	AUTO_TUNE_EXEC						
67	AUTO_TUNE_RESULT						
68	AUTO_TUNE_STATE						
69	SERVO_RET_TO_DEFAULT						
70	ADVAL_FW						
71	ADVAL_BW						
72	ADVAL_PRESS						
73	ADVAL_T						
74	TOTAL_CYCLE_COUNT						
75	CYCLE_DEADBAND						
76	CYCLE_COUNT_LIM						
77	TOTAL_TRAVEL						
78	TRAVEL_DEADBAND						
79	TRAVEL_LIM						
80	TOTAL_OPEN_TIME						
81	TOTAL_CLOSE_TIME						
82	OPEN_CLOSE_THRESHOLD						
83	OPEN_TIME_LIM						
84	CLOSE_TIME_LIM						
85	TOTAL_NEAR_CLOSE_TIM						
86	NEAR_CLOSE_THRESHOLD						
87	NEAR_CLOSE_TIME_LIM						
88	DEVIATION_LIM						
89	DEVIATION_TIME_TH						
90	RELAEASE_FAILSAFE						
91	MODEL						
92	DEV_OPTIONS						
93	PRESS_SENS_INSTALLED						
94	ACTUATOR_TYPE						
95	RELAY_TYPE						
	Total (in bytes)	21	39	41	96	71	73

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Table 9.8 View Object for AO Function Block

Relative index	Parameters	VIEW 1	VIEW 2	VIEW 3	VIEW 4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV	5		5	
8	SP	5		5	
9	OUT	5		5	
10	SIMULATE				
11	PV_SCALE		11		
12	XD_SCALE		11		
13	GRANT_DENY		2		
14	IO_OPTS				2
15	STATUS_OPTS				2
16	READBACK	5		5	
17	CAS_IN	5		5	
18	SP_RATE_DN				4
19	SP_RATE_UP				4
20	SP_HI_LIM		4		
21	SP_LO_LIM		4		
22	CHANNEL				2
23	FSAFE_TIME				4
24	FSAFE_VAL				4
25	BKCAL_OUT			5	
26	RCAS_IN			5	
27	SHED_OPT				1
28	RCAS_OUT			5	
29	UPDATE_EVT				
30	BLOCK_ALM				
	Total (in bytes)	33	34	48	28

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Table 9.9 View Object for DI1, DI2 Function Block

Relative index	Parameters	VIEW 1	VIEW 2	VIEW 3	VIEW 4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV_D	2		2	
8	OUT_D	2		2	
9	SIMULATE_D				
10	XD_STATE		2		
11	OUT_STATE		2		
12	GRANT_DENY		2		
13	IO_OPTS				2
14	STATUS_OPTS				2
15	CHANNEL				2
16	PV_FTIME				4
17	FIELD_VAL_D	2		2	
18	UPDATE_EVT				
19	BLOCK_ALM				
20	ALARM_SUM	8		8	
21	ACK_OPTION				2
22	DISC_PRI				1
23	DISC_LIM				1
24	DISC_ALM				
	Total (in bytes)	22	8	22	19

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Table 9.10 View Object for PID Function Block

Relative index	Parameters	VIEW 1	VIEW 2	VIEW 3	VIEW 4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV	5		5	
8	SP	5		5	
9	OUT	5		5	
10	PV_SCALE		11		
11	OUT_SCALE		11		
12	GRANT_DENY		2		
13	CONTROL_OPTS				2
14	STATUS_OPTS				2
15	IN			5	
16	PV_FTIME				4
17	BYPASS		1		
18	CAS_IN	5		5	
19	SP_RATE_DN				4
20	SP_RATE_UP				4
21	SP_HI_LIM		4		
22	SP_LO_LIM		4		
23	GAIN				4
24	RESET				4
25	BAL_TIME				4
26	RATE				4
27	BKCAL_IN			5	
28	OUT_HI_LIM		4		
29	OUT_LO_LIM		4		
30	BKCAL_HYS				4
31	BKCAL_OUT			5	
32	RCAS_IN			5	
33	ROUT_IN			5	
34	SHED_OPT				1
35	RCAS_OUT			5	
36	ROUT_OUT			5	
37	TRK_SCALE				11
38	TRK_IN_D	2		2	
39	TRK_VAL	5		5	
40	FF_VAL			5	
41	FF_SCALE				11
42	FF_GAIN				4
43	UPDATE_EVT				
44	BLOCK_ALM				
45	ALARM_SUM	8		8	
46	ACK_OPTION				2
47	ALARM_HYS				4
48	HI_HI_PRI				1
49	HI_HI_LIM				4
50	HI_PRI				1
51	HI_LIM				4
52	LO_PRI				1
53	LO_LIM				4
54	LO_LO_PRI				1
55	LO_LO_LIM				4
56	DV_HI_PRI				1
57	DV_HI_LIM				4
58	DV_LO_PRI				1
59	DV_LO_LIM				4
60	HI_HI_ALM				
61	HI_ALM				
62	LO_ALM				
63	LO_LO_ALM				
64	DV_HI_ALM				
65	DV_LO_ALM				
	Total (in bytes)	43	43	83	104

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Table 9.11 View Object for Resource Block

Relative index	Parameters	VIEW 1	VIEW 2	VIEW 3	VIEW 4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	RS_STATE	1		1	
8	TEST_RW				
9	DD_RESOURCE				
10	MANUFAC_ID				4
11	DEV_TYPE				2
12	DEV_REV				1
13	DD_REV				1
14	GRANT_DENY		2		
15	HARD_TYPES				2
16	RESTART				
17	FEATURES				2
18	FEATURE_SEL		2		
19	CYCLE_TYPE				2
20	CYCLE_SEL		2		
21	MIN_CYCLE_T				4
22	MEMORY_SIZE				2
23	NV_CYCLE_T		4		
24	FREE_SPACE		4		
25	FREE_TIME	4		4	
26	SHED_RCAS		4		
27	SHED_ROUT		4		
28	FAIL_SAFE	1		1	
29	SET_FSAFE				
30	CLR_FSAFE				
31	MAX_NOTIFY				1
32	LIM_NOTIFY		1		
33	CONFIRM_TIME		4		
34	WRITE_LOCK		1		
35	UPDATE_EVT				
36	BLOCK_ALM				
37	ALARM_SUM	8		8	
38	ACK_OPTION				2
39	WRITE_PRI				1
40	WRITE_ALM				
41	ITK_VER				2
42	SOFT_REV				
43	SOFT_DESC				
44	SIM_ENABLE_MSG				
45	DEVICE_STATUS_1			4	2
46	DEVICE_STATUS_2			4	
47	DEVICE_STATUS_3			4	2
48	DEVICE_STATUS_4			4	1
49	DEVICE_STATUS_5			4	
50	DEVICE_STATUS_6			4	
51	DEVICE_STATUS_7			4	
52	DEVICE_STATUS_8			4	
	Total (in bytes)	22	30	54	31

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Table 9.12 Indexes of View for Each Block

	VIEW_1	VIEW_2	VIEW_3	VIEW_4
Resourse Block	40100	40101	40102	40103
Transducer Block	40200	40201	40202	40203 through 40205
AO Function Block	40500	40501	40502	40503
DI1 Function Block	40600	40601	40602	40603
DI2 Function Block	40610	40611	40612	40613
PID Function Block	40800	40801	40802	40803

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9.6.4 Function Block Parameters

Function block parameters can be read from the host or can be set. For a list and details of the parameters of blocks held by the YVP110, refer to the chapter for each function block and the list of parameters in the latter part of this manual.

10. ACTIONS OF YVP110 DURING OPERATION

10.1 Block Modes

All function blocks have modes. All blocks have their mode, expressed by MODE_BLK parameter. It is a structure of four components; Target, Actual, Permitted and Normal. Target is the mode into which an operator wants to bring this block. This component is writable. Actual shows the actual mode of the block and is read-only. When necessary condition is satisfied, actual mode becomes same to target. There is a chance that actual mode says different from target by some reason. Permitted mode shows which mode is allowed in this Function Block. Normal mode is a memo for operator to record mode that an operator expects in normal conditions.

The table below shows the modes supported by each function block contained in a YVP110.

Table 10.1 Block Modes

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

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Modes marked with ( ) in the above table cannot be specified as “target”.

The following are outlines of each mode.

O/S mode

Means Out of Service mode, in which the block does not run, and its output and setpoint maintain their previous values.

IMan mode

Means Initialization Manual mode. Only the AO and PID blocks in the YVP110 support this mode. When one of these blocks detects a loss of a correct path to the downstream block (such as when the downstream block is in the O/S, Man, Auto or LO mode), it enters IMan mode. For example, when the data status of BKCAL_IN in a PID block is “bad” or “good: not invited”, the PID block enters IMan mode.

LO mode

Means Local Override mode. If the PID block enters LO mode, the block output follows the tracking value (TRK_VAL). In AO block, the block enters LO mode when the block detects the fault status. In this case, the block holds the output or outputs the pre-configured value (FSTATE_VALUE) according to the setting of options.

Man mode

Means Manual mode. If the data status of a function block’s input is bad or its target mode is Man, the block enters Man mode. In Man mode, the function block does not update its OUT value. If the target is also Man, it allows the user to write a desired value to it.

Auto mode

In Auto mode, the function block performs the specified calculations based on the setpoint and outputs the result, independently without interlocking with another function block. The user can write the setpoint of a function block in this mode if the target is Auto. If the target mode of a function block is Auto, or if both of the following conditions are met for a function bock, the block enters Auto mode:

- The target mode is Cas or RCas.
- There is an error in communication with the upstream function block.

Cas mode

Means Cascade mode. In Cas mode, the function block performs the specified calculations based on the setpoint that is input from a different function block via the cascade input parameter and outputs the result.

ROut mode

Means Remote Output mode. In ROut mode, the output of the function block is set to the value of the remote output parameter that is written by a host computer or others. To prevent a sudden change in output, the block’s calculations are initialized when a change in mode occurs.

RCas mode

Means Remote Cascade mode. In RCas mode, the function block performs the specified calculations based on the setpoint that is input from host computer or others via the remote cascade parameter, and outputs the result.

Table 10.2 Examples of Block Mode Combinations and Operation Statuses

Operation Statuses	AI	PID	AO	TB
Transducer Initial setup, valve setup (when carrying out auto tuning, travel calibration, etc.)	—	—	O/S	O/S
Modification of parameter settings in transducer block (modification of control parameter settings, etc.)	—	—	O/S	O/S
Constant valve position control	—	—	Auto	Auto
PID single-loop control	Auto	Auto	Cas	Auto
PID cascade-loop control	Auto	Primary PID: Auto Secondary PID: Cas	Cas	Auto

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Table 10.2 shows examples of block mode combinations in a YVP110 (however, it does not show all patterns). When a block changes mode or the data status of a signal changes for some reason, the other blocks connected to that block identify the change by detecting the change in status of an input signal, and change their modes, too. For example, when the data status of BKCAL_IN in a PID block changes to bad, the PID block automatically change mode to IMan to initialize the control of its downstream block.

The respective modes to which each block should enter upon occurrence of a communication error and at a restart, and the handling of signals in each mode may be defined in the block's option parameters such as IO_OPTS and STATUS_OPTS. For details, see the detailed descriptions of each function block.

10.2 Alarm Generation

When the YVP110 detects an abnormality in the device itself by the self-diagnostic function, a device alarm is issued from the resource or transducer block. An abnormality in a function block or in a process value is issued from the corresponding block as a block error or process alarm.

A YVP110 can report the following alarms and events.

Analog alerts: A type of alarm generated when a process value or a deviation value exceeds a specified limit in the following blocks:

PID block : HI, HI_HI, LO, LO_LO, DV_HI, DV_LO

Discrete alerts: A type of alarm generated when an abnormal status is detected. For the resource block, a discrete alert is generated as a block alarm or write-error alarm. For the DI block, a discrete alert is generated as a block alarm or DISC alarm. For the Transducer block, AO block and PID block, a discrete alert is only generated as a block alarm.

Update alerts: Generated whenever a change is made to the settings of the certain parameters.

Table 10.3 shows the elements composing an alert object.

Table 10.3 Alert Objects

Subindex			Parameter Name	Description
Analog Alert	Discrete Alert	Update Alert		
1	1	1	Block Index	Leading Index to the block in which the alert has occurred
2	2	2	Alert Key	Copy of ALERT_KEY
3	3	3	Standard Type	Type of the alert that occurred
4	4	4	Mfr Type	The name of the alert defined in the device description (DD) file written by the device manufacturer.
5	5	5	Message Type	Cause of the alert
6	6	6	Priority	Priority level of the alert
7	7	7	Time Stamp	Time when the alert occurred first
8	8		Subcode	Subcode that indicates the cause of the alert
9	9		Value	Value of the related data
10	10		Relative Index	Relative Index to the related data
		8	Static Revision	Value of ST_REV in the block
11	11	9	Unit Index	Unit code of the related data

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10.3 Simulation Function

The YVP110 has a function to simulate input signals to its internal function blocks and makes the blocks to carry out the specified actions with the simulated input signals in order to allow for testing applications in the host computer or alarm handling processes. Each function block has a parameter to switch on/off the simulation function. To prevent this parameter setting from being modified during plant operation by mistake, a hardware switch labeled SIM.ENABLE is provided on the YVP110's amplifier assembly. Sliding this switch position to ON enables the simulation function to run. Remotely writing “REMOTE LOOP TEST SWITCH” to SIM_ENABLE_MSG also causes the same effect as turning ON the SIM.ENABLE switch; however, the value of SIM_ENABLE_MSG will be lost when the power to the YVP110 is turned off. In short, simulation can be carried out if the hardware SIM.ENABLE switch is ON or if the value of SIM_ENABLE_MSG is “REMOTE LOOP TEST SWITCH”.

When the simulation can be carried out, alarms generated from the resource blocks mask the other device alarms. Hence, simulation must be disabled immediately after it has finished.

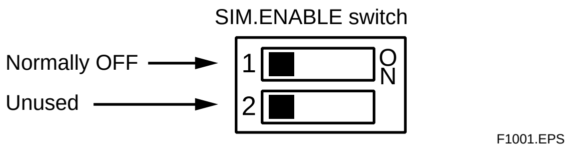

Figure 10.1 SIM.ENABLE Switch

11. RESOURCE BLOCK

11.1 General

The resource block stores device hardware information related to all function blocks in the same device, such as the memory size, and controls the device hardware and internal function blocks. Regardless of the execution schedule of the function blocks, the resource block runs at a certain interval.

11.2 Alarm Processing

The resource block generates a block alarm in the following cases:

- An error represented by a bit in BLOCK_ERROR, shown in the table below, has occurred (identified as a Block alarm).
- A static parameter has been written (identified as an update event).
- The value of a write-locked parameter has been modified (identified as Write alarm).

Table 11.1 BLOCK_ERROR in Resource Block

Bit	Name of Error Represented	Cause
3	Simulate Active	SIMULATE is active.
5	Device Fail Safe Set	Fail safe function is set.
10	Lost Static Data	
11	Lost NV Data	
13	Device Needs Maintenance Now	Needs servicing urgently.
15	Out-of-Service	The target mode is O/S.

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12. TRANSDUCER BLOCK

12.1 General

The transducer block works as an interface between the hardware I/O (actuator, sensor) and internal function blocks. Most functions of the YVP110 as a valve positioner are packed in the transducer block. Major functions of the transducer blocks include:

- Transmission and reception of setpoint and readback signals for valve position
- Setpoint high/low limiters
- Auto tuning
- Valve tight-shut and full-open actions
- Valve position-to-flow rate characteristics conversion
- Travel calibration
- Diagnostics of valve and positioner
- Valve position limit switches
- Pressure and temperature measurement (pressure measurement requires the optional sensor)
- Fail safe

The transducer block in a YVP110 is connected to an AO function block and two DI blocks via its channels as shown below.

Table 12.1 Correspondence between Channels and I/O Signals

Channel	Signal	Description
1	Analog input/output	Setpoint and readback signals
2	Discrete output	High limit switch status
3	Discrete output	Low limit switch status

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12.2 Forward Path

The following describes the signal input from the AO block to the transducer block and then passed to the device hardware side.

12.2.1 Input from AO Block

The OUT value of the AO block is input to the transducer block. This input action is halted when:

- The channel number of the AO block is not set as 1; or
- The AO block is in O/S mode.

Based on the input value from the AO block, transducer block:

- Performs the flow rate-to-valve position conversion;
- Limits the setpoint within a specified range; and
- Performs tight-shut or full-open action as necessary.

The input from the AO block is always a percentage value where the transducer block always regards 0% to be the shut-off position. Make the correct settings at initial setup according to the specifications of the valve (in reference with Chapter 5, “Setup”).

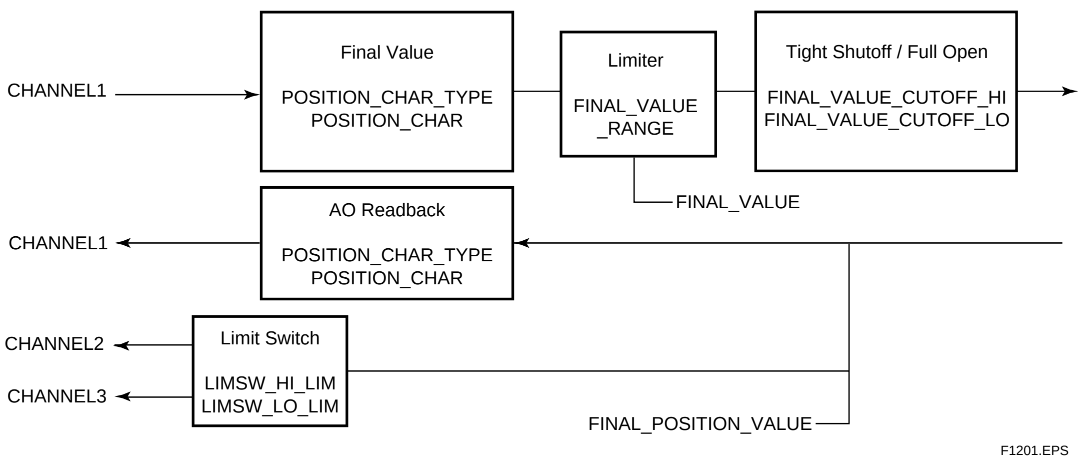

Figure 12.1 Function Diagram of Transducer Block

12.2.2 Position-to-flow Rate Characteristic Conversion

The parameter POSITION_CHAR_TYPE defines the characteristics between the valve position and flow rate, and can be set to one the following:

1 = linear

2 = equal percent (50:1)

3 = equal percent (30:1)

4 = quick open (reversal of equal percent 50:1)

255 = user-defined

Writing the value 255 allows you to define the desired characteristics by 10 line segments for evenly divided input levels. The coordinates (0,0) and (100,100) are fixed; set the values corresponding to OUT(Output of AO block) = 10%, 20%, 30%..., 80%, 90%. Note that a set value must be greater than the preceding set value; the output must increase as the input increases.

This flow rate conversion is applied to the signal in the backword path as well.

12.2.3 FINAL_VALUE and Range

The parameter FINAL_VALUE contains the valve position setpoint for valve control, and its value is always a percent value where 0% is the shut-off position as is the case for the input signal. High and low limits for the value of FINAL_VALUE.value can be set in FINAL_VALUE_RANGE.

12.2.4 Tight-shut and Full-open Actions

The tight-shut action is an action to decrease the output pressure to a level much lower than the 0% pressure level for an air-to-open valve (or increase it to a level much higher than the 0% pressure level for an air-to-close valve) when FINAL_VALUE.value is less than FINAL_VALUE_CUTOFF_LO in order to ensure that the valve is tightly shut off. After the tight-shut action is activated, when FINAL_VALUE.value becomes greater than FINAL_VALUE_CUTOFF_LO by 1% or more, the tight-shut action will turn off.

Conversely, the full-open action is an action to increase the output pressure to a level much higher than the 100% pressure level for an air-to-open valve (or decrease it to a level much lower than the 100% pressure level for an air-to-close valve) when FINAL_VALUE.value is larger than FINAL_VALUE_CUTOFF_HI in order to ensure that the valve is fully open. After the full-open action is activated, when FINAL_VALUE.value becomes less than FINAL_VALUE_CUTOFF_HI by 1% or more, the full-open action will turn off.

Although the actual output signal level is changed to a level outside the range during the period when the tight-shut or full-open action is on, the value of FINAL_VALUE.value remains as computed and is not affected by these actions.

12.3 Backward Path

The following describes the signal input from the device hardware to the transducer block and then passed to other function blocks.

12.3.1 FINAL_POSITION_VALUE

The parameter FINAL_POSITION_VALUE contains a percentage value of the valve position sent from the position sensor where 0% is the shut-off position as is the case for FINAL_VALUE.value. When one or more of the following conditions become true, the data status of FINAL_POSITION_VALUE becomes Bad, which is notified to the connected AO block and upstream function blocks:

- Bad - Out of service: The block is in the O/S mode.
- Bad - Sensor failure: The position sensor has failed.
- Bad - Device failure: The A/D converter has failed.
- Bad - Non specific: The deviation exceeds the limit.

12.3.2 Limit Switches

Limit switches monitor whether the valve position has reached a specified high or low limit position and send the high limit switch status to channel 2 and the low limit switch status to channel 3. The thresholds (settings) for the high and low limit switches should be set in LIMSW_HI_LIM and LIMSW_LO_LIM. The switch statuses sent to channels 2 and 3 mean:

0 = off (inactive)

1 = on (active)

Hysteresis of 1% is applied for both High and Low limit switch. While the limit switch of high side stays ON, it turns to OFF again only when the value of FINAL_POSITION_VALUE becomes smaller by 1% or less than the value of LIMSW_HI_LIM. Also, while limit switch of low side stays ON, it turns to OFF again only when the value of FINAL_POSITION_VALUE becomes greater by 1 % or more than the value of LIMSW_LO_LIM.

12.4 Auto Tuning

CAUTION

This function strokes the valve over its full range. Do not execute while valve is controlling the process. Keep away from the movable parts to avoid injury.

Auto tuning checks the valve responses and automatically tunes control parameter settings. The actions to be performed can be chosen as shown in the table below (for how to carry out auto tuning, see Chapter 5, “Setup”). Before carrying out auto tuning, change the modes of the AO function block and transducer block to O/S.

Table 12.2 Types of Auto Tuning

value	Comment	Description
1	Off	————
2	Travel calibration tuning at stop point	Travel calibration at the tight-shut and full-open positions
3	Control parameter tuning	Tuning of control parameters
4	Travel calibration at stop point & Control parameter tuning	Sequential execution of travel calibration and control parameter tuning
5	Cancel execution	Cancellation of auto tuning execution
6	Travel calibration at stop point without time out (for very large valve)	Zero-point and span calibration at the tight-shut and full-open positions without time out
7	Travel calibration with step by step (for very large valve)	Step-by-step travel calibration at the tight-shut and full-open positions
255	Self-check only	Execution of self-diagnostics only (without parameter tuning)

T1202.EPS

IMPORTANT

Auto Tuning in YVP110 sets the 0 % point at the position where the valve is fully closed and 100% point at the position where the valve stem stops against the mechanical stopper(fully open). If it is necessary to adjust the zero point and span precisely to the rated stroke of the valve, carry out travel calibration which is described later in this chapter after the Auto Tuning.

The result of auto tuning, which is written to AUTO_TUNE_RESULT, may be an error or warning. An error invalidates the tuning and does not update the parameter settings.

Table 12.3 AUTO_TUNE_RESULT & TRAVEL_CALIB_RESULT

Value (*1)	Comment	Error /Warning (*2)	Description
1	Succeeded	–	Auto tuning/Travel calibration has succeeded.
2	Canceld	–	Auto tuning has been canceled.
21	Exhaust air pressure warning	W	The measured exhaust pressure exceeds ±60 Kpa.
22	Small supply air pressure warning	W	The measured supply air pressure is less than 100 kPa.
23	Large supply air pressure warning	W	The measured supply air pressure is greater than 800 kPa.
40	Offset drift warning	W	The offset falls outside the normal operation range.
42	Large Response speed warning	W	Waiting time for measuring time > 40 seconds
43	Large hysteresis warning	W	Hysteresis > 30%
44	Large slip width warning	W	Slip width > 5%
60	Small angle span warning	W	Rotation-angle span < 15 degrees
61	Large angle span warning	W	VALVE_TYPE is linear and the rotation-angle span exceeds 55 degrees; or VALVE_TYPE is rotary and the rotation-angle span exceeds 95 degrees.
62	50% angle warning	W	VALVE_TYPE is linear and the rotation angle at the 50% position exceeds ±20 degrees.
100	Small angle span error	W	Rotation-angle span < 5 degrees
101	Large angle span error	E	VALVE_TYPE is linear and the rotation-angle span exceeds 60 degrees; or VALVE_TYPE is rotary and the rotation-angle span exceeds 100 degrees.
102	50% angle error	E	VALVE_TYPE is linear and the rotation angle at the 50% position exceeds ±25 degrees.
103	Linear adjust error	E	FINAL_VALUE.value falls outside 50 ±10% at 50% position.
120	Offset measurement failed error	E	Offset measurement has failed.
121	Gain measurement failed error	E	Gain measurement has failed.
122	Response speed measurement failed error	E	Response speed measurement has failed.
123	Hysteresis measurement failed error	E	Hysteresis measurement has failed.
255	In operation	–	Auto tuning is being executed.

(*1) Number 103 is not shown for AUTO_TUNE_RESULT. Number 1 through 44 and 120 through 123 are not shown for TRAVEL_CALIB_RESULT.
(*2) E stands for ‘Error’, and W stands for ‘Warning’.

T1203.EPS

12.5 Travel Calibration

CAUTION

This function strokes the valve over its full range. Do not execute while valve is controlling the process. Keep away from the movable parts to avoid injury.

Calibrate the travel of the valve stem, i.e., the stroke of the valve, as follows. First, set the valve stem to the desired position by changing the value of FINAL_VALUE.value. Next, write the value from the following choices according to your purpose of calibration. At this time, the AO block and the transducer block need to be in the O/S mode.

1 = off

2 = 0% point calibration (calibrates only the 0% point and shifts the 100% point by the resulting amount of the change in 0% point while leaving the span unchanged).

3 = span calibration (calibrates only the 100 % point while leaving the 0% point unchanged).

4 = 50% point calibration (calibrates at the 50% point while leaving the 0% point and 100 % point unchanged).

The 50%-point calibration (in other words, linearity calibration) is intended to minimize the linearity error at the 50% point. Also, if the feedback lever is slightly deviates from a horizontal level due to careless installation of the YVP110 positioner, an error caused by this shift can be corrected by the 50%-point calibration. Note that carrying out auto tuning of Index 2 or 4 clears the 50% calibration result. If you want to carry out the 50%-point calibration, do it after other tuning has finished.

The result of Travel calibration, which is written to TRAVEL_CALIB_RESULT as shown in Table 12.3, may be an error or warning. An error invalidates the tuning and does not update the parameter settings.

12.6 Online Diagnostics

The YVP110 features functions to diagnose the YVP110 itself and valve actions during online. The following describes the self-diagnostics function related to the transducer block.

12.6.1 XD_ERROR

The transducer block performs self-diagnostics and writes the results to the parameter XD_ERROR. Table 12.4 shows the meanings of these results in XD_ERROR.

When the content of XD_ERROR or BLOCK_ERROR becomes a nonzero value, an alarm is output to the parameter BLOCK_ALM.

Table 12.4 XD_ERROR

value	Message	Description
100	Cycle count limit exceed	TOTAL_CYCLE_COUNT has reached CYCLE_COUNT_LIM.
101	Travel limit exceed	TOTAL_TRAVEL has reached TRAVEL_LIM.
102	Total open limit exceed	TOTAL_OPEN_TIME has reached OPEN_TIME_LIM.
103	Total close limit exceed	TOTAL_CLOSE_TIME has reached CLOSE_TIME_LIM.
104	Total near close limit exceed	TOTAL_NEAR_CLOSE_TIM has reached NEAR_CLOSE_TIME_LIM.
110	Temperature out of range	The measured temperature is out of range.
111	Pressure sensor out of range	The measured pressure is out of range.
112	Position sensor out of range	The measured valve position is out of range.
113	Deviation warning	The deviation between the setpoint and measured valve position has exceeded DEVIATION_LIM continuously for the period specified by DEVIATION_TIME_TH [1].
120	Temperature sensor failure	Temperature sensor failed
121	Pressure sensor failure	Pressure sensor failed
122	Operation point drift warning	Operation point drifts.
123	Deviation error	The deviation between the setpoint and measured valve position has exceeded DEVIATION_LIM continuously for the period specified by DEVIATION_TIME_TH [2].
124	Position sensor failure	Position sensor failed
125	A/D converter failure	A/D converter failed

T1204.EPS

12.6.2 Fail-safe Action

If the “A/D converter failure,” “position sensor failure,” or “deviation error” event occurs in the XD_ERROR described above, the transducer block activates the specified fail-safe action by cutting the current signal to I/P module to zero. In addition, in the event of “position sensor failure” or “deviation error,” the fail-safe action will not be deactivated even when the cause of the failure/error is cleared. Writing “Clear non-latch” to the parameter RELEASE_FAILSAFE will finally deactivate the fail-safe action in this case. The fail-safe action activated in the event of “A/D converter failure” will be deactivated automatically when the cause of the failure is cleared.

12.6.3 Operation Result Integration

The YVP110 has a function to integrate the following operation result quantities individually. To reset an integrated quantity, write 0 to the corresponding parameter.

- **TOTAL_CYCLE_COUNT:**
  Incremented by 1 at each change in the direction of the valve action and indicates the total number of times of changes in direction of valve actions.

- **TOTAL_TRAVEL:**
  Total travel distance of the stem position shown as a percentage of the valve position span.

- **TOTAL_OPEN_TIME and TOTAL_CLOSE_TIME:**
  TOTAL_CLOSE_TIME contains the integrated time periods (in hours) when the valve position is equal to or less than the thresholds previously set in OPEN_CLOSE_THRESHOLD.
  TOTAL_OPEN_TIME is the integrated time periods (in hours) other than TOTAL_CLOSE_TIME.

- **TOTAL_NEAR_CLOSE_TIM:**
  Total time period (in hours) when the valve position is within the threshold set in NEAR_CLOSE_THRESHOLD.

12.6.4 Recording of Revisions

When the user makes a change to the setting of a static parameter, the change is counted-up in the parameter ST_REV and update event is generated.

12.7 Control Parameters

The following control parameters in a YVP110 can be set up by auto tuning:

SERVO_GAIN

SERVO_RESET

SERVO_RATE

SERVO_RATE_GAIN

SERVO_DEADBAND

SERVO_OFFSET

BOOST_ON_ THRESHOLD

BOOST_OFF_THRESHOLD

BOOST_VALUE

SERVO_I_SLEEP_LMT

SERVO_P_ALPHA

INTERNAL_GAIN

12.8 Temperature and Pressure Measurement

The YVP110 measures the surface temperature of the amplifier and sets it in the parameter ELECT_TEMP in the transducer block. The unit of temperature is defined by TEMPERATURE_UNIT and can be selected from:

1101 = °C

1102 = °F

A YVP110 with an optional pressure sensor can measure the output air pressure to the valve actuator and sets it in the parameter OUTPUT_PRESSURE. The unit of pressure is defined by Unit Code in SPRING_RANGE and can be selected from:

1133 = kPa

1137 = bar

1141 = psi

1145 = kgf/cm^2

13. AO FUNCTION BLOCK

13.1 General

The AO function block receives the control signal from the transducer block and outputs it to the actuator. The major functions of the AO function block include:

- Scaling
- Setpoint limiters - for both the value and rate of change
- Simulation
- Valve position feedback
- Actions upon abnormality of upstream block
- Signal inversion

The AO function block performs bi-directional signal handling: transfer of the valve control signal to the transducer block (forward path) and feedback of the valve position signal from the transducer block to the upstream block (backward path).

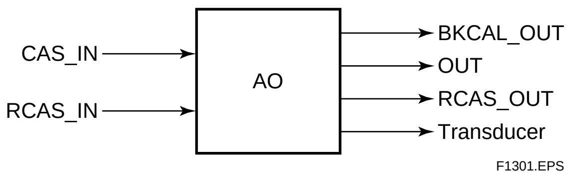

Figure 13.1 Inputs/Outputs of AO Function Block

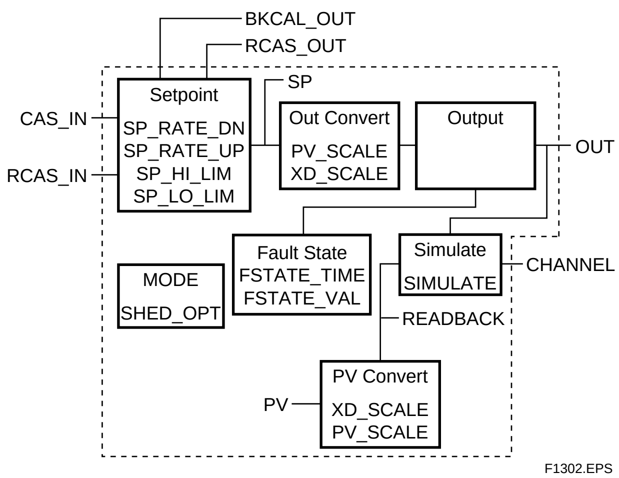

Figure 13.2 Function Diagram of AO Function Block

13.2 Modes

The target mode for the AO function block can be set from five block modes: RCas, Cas, Auto, Man, and O/S. Regardless of the target mode, the AO block automatically enters the IMan or LO mode when a specified condition is met (such as when another function block enters a specific status) depending on the parameter settings.

13.3 Forward Path

The following describes the signal input from the upstream block to the AO block and then passed to the transducer block. The upstream block is typically the PID controller block, and the control signal from the PID block is input as the source of computing the setpoint SP for the AO block.

The path for computing the SP differs depending on the mode. In Cas mode, CAS_IN is used for SP. In RCas mode, RCAS_IN is used for SP. If the value of CAS_IN or RCAS_IN, whichever is used, is greater than SP_HI_LIM (high limit) or less than SP_LO_LIM (low limit), the internal SP is set to the respective limits. Also, if the rate of change in the value of CAS_IN or RCAS_IN, whichever is used, is greater than SP_RATE_UP (rate-of-increase limit) in the increasing direction, or than SP_RATE_DN (rate-of-decrease limit) in the decreasing direction, the change in internal SP is limited by the corresponding rate-of-change limit setting.

In RCas, Cas or Auto mode, the SP value is used for the AO block's output OUT, whose value is then passed to the transducer block via channel 1.

13.3.1 Fault state

When any of the following status keeps for the moment of time specified in FSTATE_TIME, the block goes to the fault state and the mode changes to LO mode.

1. Target mode is Cas, and the status of CAS_IN is 'Bad: No Comm'
2. Target mode is Cas, and the status of CAS_IN is 'Good: IFS'
3. Target mode is RCas, and the status of RCAS_IN is 'Good: IFS'

In LO mode, the block holds the output (OUT) or outputs FSTATE_VAL, according to the setting of IO_OPTS.

13.4 Backward Path

The valve position signal from the transducer block is written to the parameter READBACK in the AO block, then scaled based on XD_SCALE and PV_SCALE to be converted to the process variable PV. The value of PV is fed back to the PID block or an upper-level system as the valve position signal via the parameter BKCAL_OUT and RCAS_OUT.

If SIMULATE is set to 'Enable', the value of SIMULATE.Simulate_Value is always set in READBACK.

SIMULATE contains the following data:

Simulate Status: Status to be set in simulation mode
Simulate Value: Value to be set in simulation mode
Transducer Status: Status of input from transducer
Transducer Value: Value of input from transducer
Enable/Disable: Whether to enable (2) or disable (1) simulation

13.5 IO_OPTS and STATUS_OPTS

IO_OPTS and STATUS_OPTS are parameters that stipulate options about block's signal processing and mode transitions. The settings of these options are made by setting or resetting the respective bits: on = true, off = false. Table 13.1 shows the options available in IO_OPTS of the AO block.

Table 13.1 IO_OPTS of AO Block

Bit	Meaning	Description
1	SP tracks PV if Man	Equalizes SP to PV when target is MAN mode.
3	SP tracks PV if LO	Equalizes SP to PV in LO mode.
4	SP tracks RCas or Cas if LO or Man (SP track retained target)	In LO mode, Equalizes SP to RCAS_IN if target mode is RCas and to CAS_IN if target mode is Cas.
5	Increase to close	Inverts the signal while it goes from SP through OUT.
6	Faultstate Type (Faultstate to value)	Uses a FSTATE_VALUE in LO mode.
7	Faultstate Type (Use Faultstate value on restart)	Uses a value preset for fault state also at a restart.
8	Target to Man	Sets the target mode to Man upon activation of the fault state.
9	PV for BKCAL_OUT	Sets the value of PV in BKCAL_OUT and RCAS_OUT.

T1301.EPS

Only the Propagate Fault Backward option is available in STATUS_OPTS of the AO block.

Table 13.2 STATUS_OPTS of AO Block

Bit	Meaning	Description
4	Propagate Fault Backward	Stipulates the handling of the value, data status and related alarm of BKCAL_OUT and RCAS_OUT to be performed. If this option is true, then: - Set the quality and sub-status components of the status of BKCAL_OUT to Bad and sensor failure, respectively. - Do nothing special for the BKCAL_OUT value. If this option is false, then: - Set the quality and sub-status components of the status of BKCAL_OUT to Bad and non specific, respectively. - Generates a block alarm.

T1302.EPS

13.6 Mode Shedding upon Computer Failure

When the data status of RCAS_IN, which is the setting received from a computer or other upstream system as the setpoint, falls to Bad while the block in question is running in RCas (remote cascade) mode for the time specified in SHED_RCAS parameter in the resource block, mode shedding occurs in accordance with the setting in SHED_OPT. Table 13.3 shows the available selections for SHED_OPT setting for the AO block.

Table 13.3 SHED_OPT of AO Block

bit	Available Setting for SHED_OPT	Actions upon Computer Failure
1	Normal shed, normal return	Sets MODE_BLK.actual to Cas(*1), and leaves MODE_BLK.target unchanged.
2	Normal shed, no return	Sets both MODE_BLK.actual and MODE_BLK.target to Cas(*1).
3	Shed to Auto, normal return	Sets MODE_BLK.actual to Auto(*2), and leaves MODE_BLK.target unchanged.
4	Shed to Auto, no return	Sets both MODE_BLK.actual and MODE_BLK.target to Auto(*2).
5	Shed to Manual, normal return	Sets MODE_BLK.actual to Man, and leaves MODE_BLK.target unchanged.
6	Shed to Manual, no return	Sets both MODE_BLK.actual and MODE_BLK.target to Man.
7	Shed to retained target, Normal return	If Cas is set in MODE_BLK.target, - sets MODE_BLK.actual to Cas and - leaves MODE_BLK.target unchanged. If Cas is not set in MODE_BLK.target, - sets MODE_BLK.actual to Auto(*2) and - leaves MODE_BLK.target unchanged.
8	Shed to retained target, No return	If Cas is set in MODE_BLK.target, sets: - MODE_BLK.actual to Cas, and - MODE_BLK.target to Cas, too. If Cas is not set in MODE_BLK.target, sets: - MODE_BLK.actual to Auto(*2), and - MODE_BLK.target to Cas.

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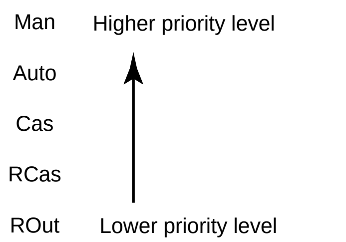
(*1)The modes to which the AO block can transfer are limited to those set in MODE_BLK.permitted, and the priority levels of modes are as shown below. In fact, if Normal shed, normal return is set for SHED_OPT, the detection of a computer failure causes MODE_BLK.actual to change to Cas, Auto, or Man, whichever is set in MODE_BLK.permitted and has the lowest priority level.



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(*2) Only when Auto is set as permitted mode.

NOTE: If a control block is connected as a cascade primary block of the AO block, a mode transition of the AO block to Cas occurs in the following sequence due to initialization of the cascade connection: RCas —> Auto —> Cas.

13.7 Initialization at Start

To prevent a sudden change in output when the AO block carries out the specified actions for the first time after the power is turned on, it:

1) Equalizes SP to PV if the Faultstate Type option (bit no. 7) in IO_OPTS is false.
2) Equalizes OUT to READBACK.

If the Faultstate Type option (bit no. 7) in IO_OPTS is true, it restores FSTATE_VAL in SP.

13.8 Alarm Processing

When a condition shown in the table below is met, the AO block changes the bit statuses of BLOCK_ERROR accordingly and generates a block alarm.

Table 13.4 BLOCK_ERROR in AO Block

Bit	Name of Error Represented	Condition
3	Simulate Active	SIMULATE is active.
4	Local Override	Fault state is on, and Propagate Fault Backward is false.
7	Input Failure / process variable has BAD status	Propagate Fault Backward in STATUS_OPTS is false, and the sub-status component of the status of READBACK is sensor failure or device failure.
15	Out-of-Service	The target mode is O/S.

T1304.EPS

14. DI FUNCTION BLOCK

14.1 General

A YVP110 contains two DI function blocks, which individually transfer the valve-position high and low limit switch signals generated by the transducer block.

The major functions of a DI function block include:

- Signal inversion (I/O processing option)
- Simulation
- Filtering (time delay)
- Alarm generation

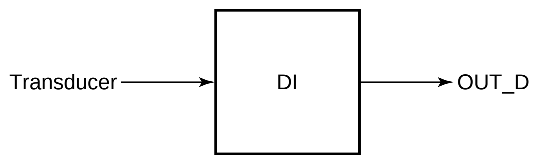

Figure 14.1 Inputs/Outputs of DI Function Block

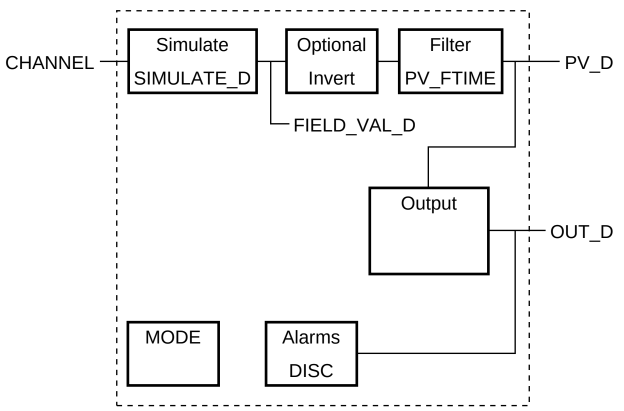

Figure 14.2 Function Diagram of DI Function Block

14.2 Modes

The target mode for a DI function block can be set from three block modes: O/S, Auto, and Man.

14.3 PV Value (PV_D)

A limit switch signal is transferred from the transducer block via a channel. Normally, the Transducer Value and Transducer Status values in SIMULATE_D are copied to FIELD_VAL_D, indicating the on/off status of the corresponding limit switch. If SIMULATE_D is set to 'Enable', the Simulate Value and Simulate Status values in SIMULATE_D are copied to FIELD_VAL_D.

SIMULATE_D contains the following data:

Simulate Status:	Status to be set in simulation mode
Simulate Value:	Value to be set in simulation mode
Transducer Status:	Status of input from transducer
Transducer Value:	Value of input from transducer
Enable/Disable:	Whether to enable (2) or disable (1) simulation

The value of FIELD_VAL_D is copied to the process value PV_D. At this time, if the Invert option (bit 0) is specified as true, the on/off status is inverted.

Table 14.1 FIELD_VAL_D

Value of FIELD_VAL_D	Value of PV_D	
	Invert = False	Invert = True
0	0 (off)	1
≥1	1 (on)	0

T1401.EPS

14.4 Filtering

Transfer of a change in the value of FIELD_VAL_D to the value of PV_D can be delayed for a desired time period set in the parameter PV_FTIME (in seconds).

14.5 Output

The value of the output OUT_D is generated based on the value of PV_D.

14.6 IO_OPTS and STATUS_OPTS

IO_OPTS and STATUS_OPTS are parameters that stipulate options about block's signal processing and mode transitions. The settings of these options are made by setting or resetting the respective bits: on = true, off = false. Table 14.2 shows the options available in IO_OPTS of a DI block.

Table 14.2 IO_OPTS of DI Block

Bit Position	Meaning	Description
0	Invert	Inverts the on/off status.

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The table below shows the options available in STATUS_OPTS of the AO block.

Table 14.3 STATUS_OPTS of DI Block

Bit Position	Meaning	Description
3	Propagate Fault Forward	Stipulates the handling of the value and data status of OUT_D when the quality component of the data status of SIMULATE_D falls to Bad and the sub-status component falls to device failure or sensor failure. If this option is true, then it: - Does not generate a block alarm. - Sets the status and value of SIMULATE_D in OUT_D. If this option is false, then it: - Generates the "input failure" block alarm. - Set the quality and sub-status components of the status of OUT_D to Bad and non specific, respectively.
8	Uncertain if Man mode	Sets the status of OUT_D to uncertain when in Man mode.

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14.7 Alarm Processing

14.7.1 Block Alarms

When a condition shown in the table below is met in a DI block, the DI block changes the bit statuses of BLOCK_ERROR accordingly and generates a block alarm.

Table 14.4 BLOCK_ERROR in AO Block

Bit	Name of Error Represented	Condition
3	Simulate Active	SIMULATE_D is active.
7	Input Failure / process variable has BAD status	Propagate Fault Backward in STATUS_OPTS is false, and the sub-status component of the status of READBACK is sensor failure or device failure.
15	Out of Service	The target mode is O/S.

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14.7.2 Discrete Alarm

The parameter DISC_ALM is a discrete alarm of the parameter OUT_D.

When the value of OUT_D agrees with the value of DISC_LIM, the alarm state of DISC_ALM is set to active and an alert is generated.

15. PID FUNCTION BLOCK

15.1 General

The PID function block receives an input signal, performs PID control computation, and outputs the control signal, like a single-loop controller. In practice, it performs PID computation based on the deviation between the setpoint set in the actual mode and the PV, and generates a value of its output OUT so as to decrease the deviation. The PID block works with other function blocks such as the AI and AO blocks connected to it. The major functions of the PID block include:

- Filtering
- Setpoint limiters - both for the value and rate of change
- Scaling of Process Variables(PV), setpoint(SP) and output (OUT)
- PID control computation
- Control action bypass
- Feed-forward
- External-output tracking
- Measured-value tracking
- Output limiters
- Mode shedding upon computer failure
- Alarm generation

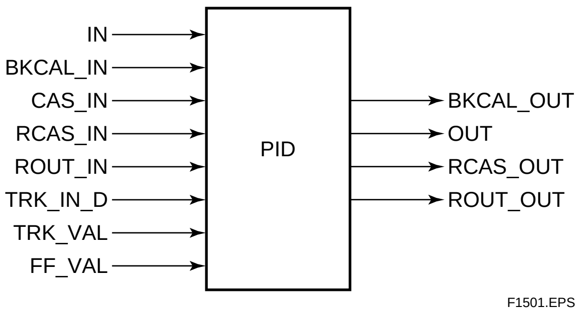

Figure 15.1 Inputs/Outputs of PID Function Block

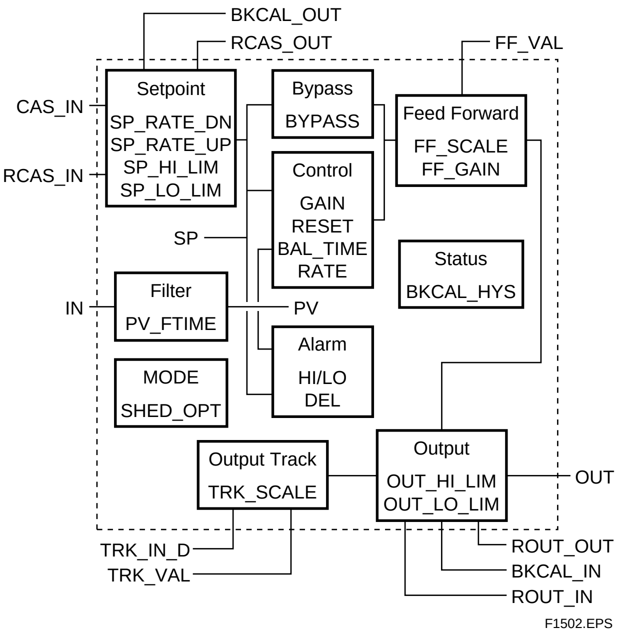

Figure 15.2 Function Diagram of PID Function Block

15.2 Modes

The target mode for the PID function block can be set from five block modes: ROut, RCas, Cas, Auto, Man, and O/S. Regardless of the target mode, the PID block automatically enters the IMan or LO mode when a specified condition is met (such as when another function block enters a specific status), depending on the parameter settings.

15.3 Input Processing

The input signal to IN is filtered through a lag filter whose time constant is set in PV_FTIME, and then set as the process variable (PV).

15.4 Setpoint (SP) Limiters

The path for computing the SP differs depending on the mode. In Cas mode, CAS_IN is used for SP. In RCas mode, RCAS_IN is used for SP. If the value of CAS_IN or RCAS_IN, whichever is used, is greater than SP_HI_LIM (high limit) or less than SP_LO_LIM (low limit), the internal SP is set to the respective limits. When the target mode is Auto or Man, and when SP-PV tracking is not specified at the same time, the rate of change in the setpoint is also limited (by the values of SP_RATE_UP and SP_RATE_DN).

15.5 PID Computation

For PID control, the PID block in a YVP110 employs the PV-proportional and PV-derivative type PID control algorithm (referred to as the I-PD control algorithm). This algorithm, whose basic form is expressed in the equation below, ensures control stability against sudden changes in the setpoint, such as when the user enters a new setpoint value. At the same time, the I-PD algorithm ensures excellent controllability by performing proportional, integral, and derivative control actions in response to changes of characteristics in the controlled process, changes in load, and occurrences of disturbances.

Where,

$$\Delta MVn = K\left\{ \Delta PVn + \frac{\Delta T}{Ti}(PVn - SPn) + \frac{Td}{\Delta T}\Delta(\Delta PVn) \right\}$$

ΔMVn = change in control output

ΔPVn = change in measured (controlled) value = $PVn - PVn-1$

ΔT = control period = period_of_execution in block header

K = proportional gain = GAIN (= 100/proportional band)

TI = integral time = RESET

TD = derivative time = RATE

The subscripts, n and n−1, represent the sampling time and thus PVn and PVn_{-1} denote the PV value sampled most recently and the PV value sampled at the preceding control period respectively.

The table below shows the PID control parameters.

Table 15.1 PID Control Parameters

Parameter	Description	Valid Range
GAIN	Proportional gain	0.05 to 20
RESET	Integral time	0.1 to 10,000 (seconds)
RATE	Derivative time	0 to infinity

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15.6 Control Output

The final control output value, OUT, is computed based on the change in control output ΔMVn, which is calculated at each control period in accordance with the aforementioned algorithm. The PID block in a YVP110 performs the velocity type output action for the control output. This means that the PID block determines the value of the new control output(OUT) by adding the change in control output calculated in the current control period, ΔMVn, to the current read-back value of the MV(OUT), MV_{RB} (BKCAL_IN). This action can be expressed as:

$$OUT = BKCAL\_IN - \Delta MVn$$

15.7 Direction of Control Action

The direction of the control action is determined by the Direct Acting setting in CONTROL_OPTS.

Table 15.2 Direction of Control Action

Value of Direct Acting	Resulting Action
True	The output increases when the input PV is greater than the setpoint SP.
False	The output decreases when the input PV is greater than the setpoint SP.

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15.8 Control Action Bypass

The PID control computation can be bypassed so as to set the SP value in the control output OUT as shown below. Setting BYPASS to on bypasses the PID control computation.

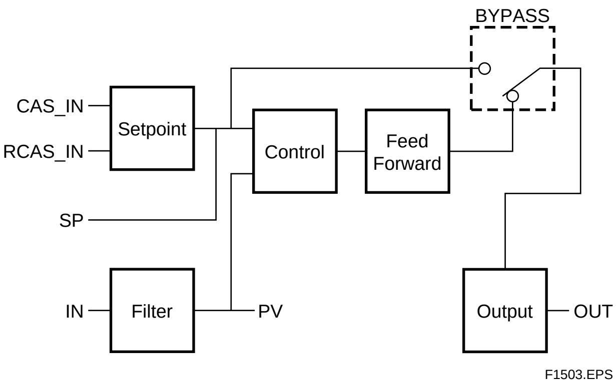

Figure 15.3 Control Action Bypass

15.9 Feed-forward

Feed-forward is an action to add a compensation input signal FF_VAL to the output of the PID control computation and is typically used for feed-forward control. In practice, the value of FF_VAL is scaled to the range of the OUT, multiplied by the value of FF_GAIN, and then added to the PID control computation result, as illustrated by Figure 15.4.

When the status of FF_VAL is Bad, the value of LUV(Lust usable value) is used instead of FF_VAL. If LUV contains no value, the feed-forward action is not carried out.

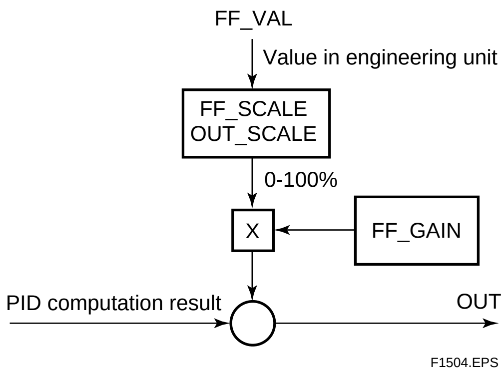

Figure 15.4 Feed-forward

15.10 External-output Tracking (LO)

External-output tracking is an action of outputting the value of the remote output TRK_VAL set from outside the PID block, as illustrated in the figure below. External tracking is performed when the block mode is LO.

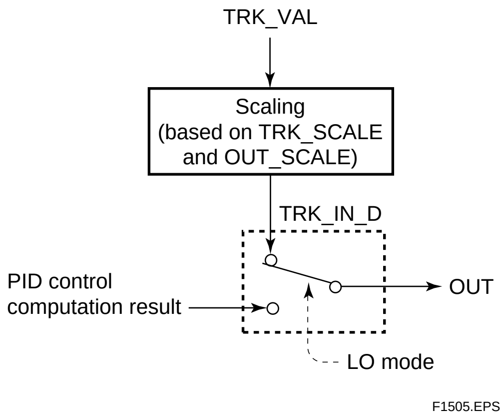

Figure 15.5 External-value Tracking

To change the block mode to LO:

(1) Set Track Enable in CONTROL_OPTS (see Section 15.12) to true.

(2) Set TRK_IN_D to true.

However, to change the block mode from Man to LO, Track in Manual must also be set as true in CONTROL_OPTS.

15.11 Measured-value Tracking

Measured-value tracking, also referred to as SP-PV tracking, is the action of equalizing the setpoint SP to the measured value PV when the block mode (MODE_BLK.actual) is Man in order to prevent a sudden change in control output from being caused by a mode change to Auto.

While a cascade primary control block is performing automatic control in Auto or Cas mode, when the mode of its secondary control block is changed from Cas to Auto, the cascade connection is opened and the control action of the primary block stops. The SP of the primary controller can also be equalized to its cascade input signal CAS_IN in this case.

The settings for measured-value tracking are made in the parameter CONTROL_OPTS, as shown in Table 15.3.

15.12 CONTROL_OPTS

CONTROL_OPTS is a parameter that stipulates control options as shown below.

Table 15.3 CONTROL_OPTS of PID Block

Bit	Options in CONTROL_OPTS	Description
0	Bypass Enable	Switch for activating the control action bypass
1	SP-PV Track in Man	Equalizes SP to PV when MODE_BLK.target is set to Man.
2	SP-PV Track in Rout	Equalizes SP to PV when MODE_BLK.target is set to ROut.
3	SP-PV Track in LO or IMan	Equalizes SP to PV when MODE_BLK.actual is set to LO or IMan.
4	SP Track retained Target	Equalizes SP to RCAS_IN or CAS_IN when MODE_BLK.target is either in IMan, LO, Man or ROut and MODE_BLK.actual is set to RCas or Cas.
5	Direct Acting	Set the PID block to be a direct acting controller.
7	Track Enable	While this option is set, if the value of TRK_IN_D becomes '0', the mode transfers to LO.
8	Track in Manual	Set this option when the mode should be transfered to LO even when MODE_BLK.target is set to Man. This option is invalid when Track Enable option is not set.
9	Use PV for BKCAL_OUT	Sets the value of PV in BKCAL_OUT and RCAS_OUT, instead of the value of SP.
12	Obey SP limits if Cas or RCas	Puts the setpoint high/low limits in force in the Cas or RCas mode.
13	No OUT limits in Manual	Disables the high/low limits for OUT in the Man mode.

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15.13 Initialization and Manual Fallback (IMan)

Initialization and manual fallback denotes a set of abnormality handling actions in which a PID block changes mode to IMan (initialization manual) and suspends the control action. Initialization and manual fallback takes place only when the following condition is met:

- The quality component of BKCAL_IN.status (data status of BKCAL_IN) is Bad.
  - OR -
- The quality component of BKCAL_IN.status is Good (c)
  - AND -
  The sub-status component of BKCAL_IN.status is FSA, LO, NI, or IR.

15.14 Manual Fallback

Manual fallback denotes an abnormality handling action in which a PID block changes mode to Man (manual) and suspends the control action. The manual fallback action is enabled to take place if the Target to Manual if BAD IN option in STATUS_OPTS is set as true, and it takes place when the following condition is met:

- IN.status (data status of IN) is Bad except when the control action bypass is on.

15.14.1 STATUS_OPTS

The table below shows the options in STATUS_OPTS.

Table 15.4 STATUS_OPTS of PID Block

Bit	Options in STATUS_OPTS	Description
0	IFS if BAD IN	Sets the sub-status component of OUT.status to IFS if IN.status is Bad except when PID control bypass is on.
1	IFS if BAD CAS IN	Sets the sub-status component of OUT.status to IFS if CAS_IN.status is Bad.
2	Use Uncertain as Good	Does not regard IN as being in Bad status when IN.status is Uncertain (to prevent mode transitions from being affected when it is Uncertain).
5	Target to Manual if BAD IN	Automatically changes the value of MODE_BLK.target to Man when IN falls to Bad status.
9	Target to next permitted mode if BAD CAS IN	Automatically changes the value of MODE_BLK.target to Auto (or to Man if Auto is not set in Permitted) when CAS_IN falls to Bad status.

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15.15 Auto Fallback

Auto fallback denotes an action in which a PID block changes mode from Cas to Auto and continues automatic PID control with the user-set setpoint. To enable the auto fallback action to take place:

- The Target to next permitted mode if BAD CAS IN option must be preset to true in STATUS_OPTS.
  - AND -
- Auto must be preset in MODE_BLK.permitted.

If the above settings are made, auto fallback takes place automatically when the following condition is met:

- CAS_IN.status (data status of cascade setpoint) is Bad except when the control action bypass is on.

15.16 Mode Shedding upon Computer Failure

When (1) the data status of RCAS_IN, which is the setting received from a computer as the setpoint SP, falls to Bad while the PID block is running in the RCas (remote cascade) mode, or when (2) the data status of ROUT_IN, which is the setting received from a computer as the remote output signal, falls to Bad while the PID block is running in the ROut (remote output) mode; mode shedding occurs in accordance with the SHED_OPT setting.

Table 16.5 SHED_OPT of PID Block

Available Setting for SHED_OPT	Actions upon Computer Failure
Normal shed, normal return	Sets MODE_BLK.actual to Cas(*1), and leaves MODE_BLK.target unchanged.
Normal shed, no return	Sets both MODE_BLK.actual and MODE_BLK.target to Cas(*1).
Shed to Auto, normal return	Sets MODE_BLK.actual to Auto(*2), and leaves MODE_BLK.target unchanged.
Shed to Auto, no return	Sets both MODE_BLK.actual and MODE_BLK.target to Auto(*2).
Shed to Manual, normal return	Sets MODE_BLK.actual to Man, and leaves MODE_BLK.target unchanged.
Shed to Manual, no return	Sets both MODE_BLK.actual and MODE_BLK.target to Man.
Shed to retained target, normal return	If Cas is set in MODE_BLK.target, - sets MODE_BLK.actual to Cas(*1) and - leaves MODE_BLK.target unchanged. If Cas is not set in MODE_BLK.target, - sets MODE_BLK.actual to Auto(*2) and - leaves MODE_BLK.target unchanged.
Shed to retained target, no return	If Cas is set in MODE_BLK.target, sets: - MODE_BLK.actual to Cas, and - MODE_BLK.target to Cas(*1), too. If Cas is not set in MODE_BLK.target, sets: - MODE_BLK.actual to Auto(*2), and - MODE_BLK.target to Cas.

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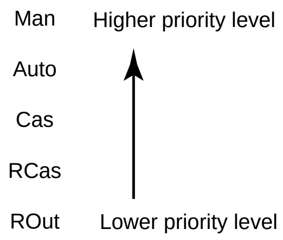
(*1)The modes to which the PID block can transfer are limited to those set in MODE_BLK.permitted, and the priority levels of modes are as shown below.

In fact, if Normal shed, normal return is set for SHED_OPT, detection of a computer failure causes MODE_BLK.actual to change to Cas, Auto, or Man, whichever is set in MODE_BLK.permitted and has the lowest priority level.



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(*2) Only when Auto is set as permitted mode.

NOTE: If a control block is connected as a cascade primary block of the PID block in question, a mode transition of the PID block to Cas occurs in the following sequence due to initialization of the cascade connection: RCas or ROut —> Auto —> Cas.

15.17 Alarms

There are two kinds of alarms generated by a PID block: block and process alarms.

15.17.1 Block Alarm (BLOCK_ALM)

The block alarm BLOCK_ALM is generated upon occurrence of either of the following errors (values set in BLOCK_ERR) and notifies the content of BLOCK_ERR.

Value of BLOCK_ERR	Condition
Input Failure	IN.status of the PID block is either of the following: • Bad-Device Failure • Bad-Sensor Failure
Out of Service	MODE_BLK.target of the PID block is O/S.

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15.17.2 Process Alarms

There are six types of process alarms. Only one process alarm can be generated at a time, and the process alarm having the highest priority level from among those occurring at the same time is generated. The priority level is set for each process alarm type.

Process Alarm	Cause of Occurrence	Parameter Containing Priority Level Setting
HI_HI_ALM	Occurs when the PV increases above the HI_HI_LIM value.	HI_HI_PRI
HI_ALM	Occurs when the PV increases above HI_LIM value.	HI_PRI
LO_ALM	Occurs when the PV decreases below the LO_LIM value.	LO_PRI
LO_LO_ALM	Occurs when the PV decreases below the LO_LO_LIM value.	LO_LO_LIM
DV_HI_ALM	Occurs when the value of [PV - SP] increases above the DV_HI_LIM value.	DV_HI_PRI
DV_LO_ALM	Occurs when the value of [PV - SP] decreases below the DV_LO_LIM value.	DV_LO_PRI

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16. TROUBLESHOOTING

16.1 What to Do First

When a problem occurs, check the following first.

Mounting of YVP110 Positioner

- Is the linkage to the valve actuator correctly set up?
- Is the feedback lever correctly attached?
- Is the span of rotation angle of the position sensor against the valve stroke more than the minimum requirement?
- Has auto tuning been performed after installation?

Air Piping

- Are the air pipes correctly connected? Is there no leak of air?
- Is the air supply pressure high enough to drive the valve?
- Is the A/M selector on the positioner set to A (automatic)?

Wiring

- Is the YVP110 positioner correctly connected to the fieldbus?
- Are the conductors incorrectly connected, in other words, is the plus side connected to minus, and vice-versa?
- Has the power to the fieldbus been turned on? Is the terminal-to-terminal voltage equal to or greater than 9 V?
- Is the terminator correctly installed?
- Is a host system connected to the fieldbus?

16.2 Troubleshooting Communications

Problem	Presumed Cause	Remedy	Ref. Section
Communication with the YVP110 cannot be performed.	Wiring is incorrect.	Correct wiring.	4.3, 8.4
	The power is off or the power supply voltage is less than 9 V.	Supply proper voltage.	4.3, Chapter 7
	The address detection range is not correctly set.	Correct address detection range.	9.4
Communication with the YVP110 is frequently cut off.	The fieldbus is experiencing a large amount of noise.	Using an oscilloscope or the like, check the waveform on the fieldbus.	———
The YVP110 can be detected, but neither function blocks nor transducer block can be seen.	The node address of the YVP110 is left as the default (0xF8-0xFB).	Change it to an operable address. See the descriptions for address settings.	9.4

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16.3 Troubleshooting Function Block Parameters

Problem	Presumed Cause	Remedy	Ref. Section
A value cannot be written to a parameter in the YVP110.	You have attempted to write a value outside the valid range.	Check the setting range of parameters.	Appendix 1
	The target mode does not allow write access.	Change the target mode. See the parameter lists.	Appendix 1
The actual mode of a function block cannot be equalized to the target mode.	O/S is set for the target mode of the resource block.	Change the target mode of the resource block to Auto.	Appendix 1, 10.1
	The I/O of the function block in question is not connected to another function block.	Using a configuration tool, set the virtual communication relationship (VCR) and link object.	Chapter 9
	Schedules that define when function blocks execute are not set correctly.	Set the schedules using a configuration tool.	Chapter 9
	The transducer block is in O/S mode.	Change the target mode of the transducer block to Auto.	Appendix 1, 10.1
A block's dynamic parameters do not update.	The block in question is in O/S mode.	Change the target mode as necessary.	Appendix 1, 10.1
	O/S is set for the target mode of the resource block.	Change the target mode of the resource block to Auto.	Appendix 1, 10.1

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16.4 Troubleshooting Valve Control

Problem	Presumed Cause	Remedy	Ref. Section
A change in setpoint causes no action of the valve.	Air piping is incorrect.	Correct piping.	4.2
	The instrument is in FAILSAFE state.	Write 'Clear non-latch' to RELEASE_FAILSAFE parameter.	12.6.2
	Air supply is not being fed.	Supply proper air pressure	4.2
	The valve has failed.	Apply a pneumatic pressure directly to the valve actuator and check whether there is valve action.	3.2.3
	The I/P module or control relay has failed, or there is breakage in the cable between the I/P module and control relay.	If the output pressure does not increase even though the SERVO_OUTPUT_SIGNAL value is at maximum, contact the nearest service station or representative office.	———
The valve's full stroke is insufficient for the setpoint input.	The air supply pressure is not high enough to drive the valve actuator.	Check the air supply pressure rating for the valve actuator and supply air at the correct pressure, and write 4 or 2 to AUTO_TUNE_EXEC to redo autotning.	4.2, 5.3
	The range of the setpoint is limited by software.	Check the values of SP_HI_LIM and SP_LO_LIM in the AO block and FINAL_VALUE_RANGE in the transducer block.	13.3, Appendix 1
The deviation between the setpoint and readback signal remains.	The tight-shut or full-open action is active.	Check the values of FINAL_VALUE_CUTOFF_HI and FINAL_VALUE_CUTOFF_LO.	12.2.4, Appendix 1
	The travel calibration has not been performed correctly.	Write 2 to AUTO_TUNE_EXEC to perform 0 &100% point adjustment.	5.3
The valve oscillates cyclically (limit cycle).	The friction of grand packing is large.	1) Write 4 or 3 to AUTO_TUNE_EXEC to redo auto tuning.	5.3
		2) Use the actuator of proper size.	———
	The dead band of integral action is too little.	Write 4 or 3 to AUTO_TUNE_EXEC to redo auto tuning. Or, increase the SERVO_DEADBAND setting until the valve stops oscillating.	5.3 12.7, Appendix1
	There's air leak from the pipe of output pressure, or feedback lever is not correctly attached.	Check the piping and attachment of the lever, and write 4 or 3 to AUTO_TUNE_EXEC to redo autotuning.	Chapter 3, 5.3
Valve responses are too slow.	If only the responses that require air suction are slow, it means that the regulator's maximum capacity is large enough.	Replace the regulator.	———
	The I/P module's nozzle has become blocked from dirt contained in the air supply or the like.	Check whether or not error 122 occurs in XD_ERROR in steady states. If it does occur, contact the nearest service station or representative office.	12.6.1
	The control relay's nozzle has become blocked from dirt contained in the air supply or the like.	Check whether or not error 122 occurs in XD_ERROR in steady states.	12.6.1
	The control gain is insufficient.	Write 4 or 3 to AUTO_TUNE_EXEC to redo auto tuning. Or, increase the SERVO_GAIN setting.	5.3, 12.7, Appendix 1
	There's air leak from the pipe of output pressure, or feedback lever is not correctly attached.	Check the piping and attachment of the lever, and write 4 or 3 to AUTO_TUNE_EXEC to redo autotuning.	Chapter 3, 5.3

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16.5 Troubleshooting Auto Tuning

Problem	Presumed Cause	Remedy	Ref. Section
Auto tuning requests are rejected.	Either or both of the A/O block and transducer block are not in O/S mode.	Change the target modes of the AO and transducer block to O/S.	Appendix 1
When auto tuning has finished, AUTO_TUNE_RESULT changes value to an index from 21 to 24.	There is something wrong with the air supply pressure or spring range.	Check whether the measured pressure reading nearly equals the actual pressure. See the descriptions for auto tuning.	5.3 12.4
When auto tuning has finished, AUTO_TUNE_RESULT changes value to index 40 or 120.	There is something wrong with the operation point of the I/P module. SERVO_OFFSET could not be measured.	If there is nothing wrong with the air supply pressure and piping, contact the nearest service station or representative office.	———
When auto tuning has finished, AUTO_TUNE_RESULT changes value to an index from 42 to 44, or from 120 to 122.	The measured time delay constant, hysteresis, and/or slip width of the valve is excessively large.	Check whether they meet the characteristics specified for the valve. See the descriptions for auto tuning.	5.3 12.4
When auto tuning has finished, AUTO_TUNE_RESULT changes value to an index from 60 to 62, or from 100 to 103.	The span of rotation angle is incorrect or the 50% position deviation from the horizontal level is too large.	Correct the installation and try auto tuning again.	Chapter 3, 5.3

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16.6 Troubleshooting Position, Pressure, and Temperature Sensors

Problem	Presumed Cause	Remedy	Ref. Section
The position sensor signal remains unchanged.	The feedback lever is not properly attached.	See the descriptions for positioner installation.	Chapter 3
	The position sensor has failed or there is breakage in the cable between the sensor and amplifier.	If ADVAL_BW does not change value when the shaft rotates, it may be necessary to replace the position sensor. Contact our nearest representative or service station.	——
The positon sensor signal is unstable, or XD_ERROR indicates error 124.	The position sensor has failed or there is breakage in the cable between the sensor and amplifier.	It may be necessary to replace the position sensor. Contact the nearest representative or service station.	——
The pressure sensor signal is unstable, or XD_ERROR indicates error 121.	The pressure sensor has failed.	It may be necessary to replace the amplifier. Contact the nearest representative or service station.	——
The temperature sensor signal is unstable, or XD_ERROR indicates error 120.	The temperature sensor has failed.	It may be necessary to replace the amplifier. Contact the nearest representative or service station.	——

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Appendix 1. FUNCTION BLOCK PARAMETERS

NOTE: Throughout the following tables, the Write column shows the modes in which the respective parameters can be written. The legends of the entries are as follows:

O/S: Can be written when the corresponding block is in O/S mode.
Man: Can be written when the corresponding block is in Man mode.
Auto: Can be written when the corresponding block is in Auto, Man, or O/S mode.
—: Can be written in no mode of the corresponding block.
Blank: Can be written in all modes of the corresponding block.

A1.1 Parameters of Resource Block

Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description
0	1000	Block Header		Block Tag =O/S	Information about this block, including the block tag, DD revision, execution time
1	1001	ST_REV	0	–	Incremented when a change is made to the parameter settings for the resource block to indicate the revision level of the settings, and used to see whether or not there is a change in parameter settings.
2	1002	TAG_DESC	Null		Universal parameter storing the description of the tag
3	1003	STRATEGY	0		Universal parameter used by an upper-level system to classify the function blocks.
4	1004	ALERT_KEY	0		Universal parameter used as a key to identify the point from which an alert is issued; normally used by an upper-level system to select alerts to provide to a particular operator who covers a specific area of the plant.
5	1005	MODE_BLK	O/S	Auto	Universal parameter that indicates the block operation conditions and is composed of actual mode, target mode, permitted modes, and normal mode.
6	1006	BLOCK_ERR	–	–	Universal parameter indicating the hardware and software error statuses related to the block itself
7	1007	RS_STATE	–	–	Indicates the statuses of resource in the YVP110.
8	1008	TEST_RW	Null		Parameter used to test read and write access to the YVP110
9	1009	DD_RESOURCE	Null	–	Name of the device description (DD) containing the information of this resource block
10	1010	MANUFAC_ID	0x00594543	–	Manufacturer ID; 5850435 (= 0x594543) is assigned to Yokogawa Electric Corporation.
11	1011	DEV_TYPE	1	–	ID number of device; 1 is assigned to the YVP110.
12	1012	DEV_REV	2	–	Revision number of the YVP110
13	1013	DD_REV	1	–	Revision number of the device description (DD) applied to this YVP110
14	1014	GRANT_DENY	0		Option to control access from the host computer and local control panel to tuning and alarm parameters
15	1015	HARD_TYPES	Scalar input, Scalar output	–	Bit string indicating the hardware types Bit 0: Scalar input Bit 1: Scalar output Bit 2: Discrete input Bit 3: Discrete output
16	1016	RESTART	–		Restart the YVP110 in the selected way. 1: Running 2: Restart Resource 3: Restart with the default settings 4: Restart CPU

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Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description [Setting range]
17	1017	FEATURES	–	–	Shows supportable optional features of the block.
18	1018	FEATURE_SEL		–	Parameter used to select the optional features of the resource block
19	1019	CYCLE_TYPE	Scheduled	–	Bit string indicating cycle types executable for the resources Bit 0: Scheduled; to be scheduled Bit 1: Event driven; to be driven by an event Bit 2: Manufacturer specified; executable by a manufacturer-specified unique function
20	1020	CYCLE_SEL	Scheduled		Bit string used to select the cycle type
21	1021	MIN_CYCLE_T	3200 (100ms)	–	Minimum execution cycle
22	1022	MEMORY_SIZE	0	–	Memory size allowed for use of function block configurations in the device; checked before a download, but not supported by the YVP110.
23	1023	NV_CYCLE_T	0	–	Cycle of saving the settings of non-volatile attribute parameters to the EEPROM. 0 is set with the YVP110, and saving is not cyclically done.
24	1024	FREE_SPACE	0	–	Shows the free space memory for configurations as a percent value. YVP110 shows zero which means the pre-configured resource.
25	1025	FREE_TIME	0	–	Shows the free time that can be used for computations by resources but not supported by the YVP110.
26	1026	SHED_RCAS	640000		Communication time-out setting for communications with the device from which the remote cascade setpoint is sent.
27	1027	SHED_ROUT	640000		Communication time-out setting for communications with the device from which the remote output setting is sent; not used in the YVP110, however.
28	1028	FAULT_STATE	1	–	Indicates the fault-state.
29	1029	SET_FSTATE	1		Sets the fault-state.
30	1030	CLR_FSTATE	1		Clears the fault-state.
31	1031	MAX_NOTIFY	3	–	Maximum number of alerts retained in the device (YVP110).
32	1032	LIM_NOTIFY	3		Maximum number of alerts to be held by the device (YVP110); used by the user to restrict the number of alert notifications to the host to prevent overflow of alert receptions in the host.
33	1033	CONFIRM_TIM	5000 (ms)		Defines the time to wait for confirmation for an alert.
34	1034	WRITE_LOCK	Unlocked		Prohibits write access from outside the device to the settings.
35	1035	UPDATE_EVT	–	–	Shows the contents of an update event upon occurrence.
36	1036	BLOCK_ALM	–	–	Shows the contents of an alarm event upon occurrence.
37	1037	ALARM_SUM	Enable		Shows the alarm summary for all blocks within the device (YVP110).
38	1038	ACK_OPTION	0		Defines the acknowledgment action of each alarm type. By setting a bit to 1, the corresponding alarm will behave as acknowledged immediately when it occurs without receipt of acknowledgment from the host.
39	1039	WRITE_PRI	0		Defines the priority level of WRITE_ALM as well as allows for notification to be disabled and makes acknowledgment unnecessary for WRITE_ALM.
40	1040	WRITE_ALM	–	–	Alarm generated when WRITE_LOCK is set to unlocked

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Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description
41	1041	ITK_VER	4	–	Version number of the inter-operability test kit
42	1042	SOFT_REV	–	–	Revision number of software
43	1043	SOFT_DSC	–	–	Revision number of software for development purpose.
44	1044	SIM_ENABLE_MSG	Null	–	Used to determine whether to enable the simulation function to run. To enable, set "REMOTE LOOP TEST SWITCH".
45	1045	DEVICE_STATUS_1	0	–	Shows device statuses - mainly link object setting statuses.
46	1046	DEVICE_STATUS_2	0	–	Shows device statuses - mainly individual for each block status.
47	1047	DEVICE_STATUS_3	0	–	Shows device statuses - mainly the contents of XD_ERROR in each block.
48	1048	DEVICE_STATUS_4	0	–	Not used in the YVP110.
49	1049	DEVICE_STATUS_5	0	–	Not used in the YVP110.
50	1050	DEVICE_STATUS_6	0	–	Not used in the YVP110.
51	1051	DEVICE_STATUS_7	0	–	Not used in the YVP110.
52	1052	DEVICE_STATUS_8	0	–	Not used in the YVP110.

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A1.2 Parameters of Transducer Block

Parameters marked with (*1) are automatically set and changed by autotuning. Parameters marked with (*2) are automatically set and changed by Travel calibration.

Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description [Setting range]
0	2000	Block Header		Block tag = O/S	Information about this block, including the block tag, DD revision, execution time
1	2001	ST_REV	0	–	Incremented when a change is made to the parameter settings for the transducer block to indicate the revision level of the settings, and used to see whether or not there is a change in parameter settings.
2	2002	TAG_DESC	Spaces		Universal parameter storing the description of the tag
3	2003	STRATEGY	0		Universal parameter used by an upper-level system to classify the function blocks.
4	2004	ALERT_KEY	0		Universal parameter used as a key to identify the point from which an alert is issued; normally used by an upper-level system to select alerts to provide to a particular operator who covers a specific area of the plant.
5	2005	MODE_BLK	O/S		Universal parameter that indicates the block operation conditions and is composed of the actual mode, target mode, permitted modes, and normal mode.
6	2006	BLOCK_ERR	–	–	Indicates the error statuses related to the block itself.
7	2007	UPDATE_EVT	–	–	Shows the contents of an update event upon occurrence.
8	2008	BLOCK_ALM	–	–	Universal parameter indicating the hardware and software error statuses related to the block itself
9	2009	TRANSDUCER _DIRECTORY	1, 10	–	Index to the text describing the transducer contained in the YVP110 positioner
10	2010	TRANSDUCER_TYPE	106	–	Transducer type
11	2011	XD_ERROR	0	–	Stores the error prioritized at the highest level from among the errors that are currently occurring in the transducer block.
12	2012	CORRECTION _DIRCTORY	1, 13	–	Stores the number of data collection and the index number to be started with.
13	2013	FINAL_VALUE	–	O/S	Stores the valve control level and status written by the AO block.
14	2014	FINAL_VALUE _RANGE	-10%, 110%	O/S	Defines the upper and lower range limits of FINAL_VALUE, and the unit code and decimal point position for value indication of FINAL_VALUE.
15	2015	FINAL_VALUE _CUTOFF_HI	110%	O/S	If the value of FINAL_VALUE is greater than the value set in this parameter, the YVP110 moves the valve to the full-open position.
16	2016	FINAL_VALUE _CUTOFF_LO	-10%	O/S	If the value of FINAL_VALUE is less than the value set in this parameter, the YVP110 moves the valve to the shut-off position.
17	2017	FINAL_POSITION _VALUE	–	–	Stores the position data read by the valve position sensor.
18	2018	SERVO_GAIN (*1)	120	O/S	Static control loop gain set by auto tuning [0.5 to 1300]
19	2019	SERVO_RESET (*1)	15 sec	O/S	Integral time set by auto tuning
20	2020	SERVO_RATE (*1)	0. 22 sec	O/S	Derivative time set by auto tuning
21	2021	ACT_FAIL_ACTION	1	O/S	Specifies the actuator action direction in case of losing of air supply pressure: 1 = self-closing 2 = self-opening
22	2022	ACT_MAN_ID	0	–	ID of actuator manufacturer
23	2023	ACT_MODEL_NUM	Null	–	Model number of actuator
24	2024	ACT_SN	0	–	Serial number of actuator
25	2025	VALVE_MAN_ID	0	–	ID of valve manufacturer
26	2026	VALVE_MODEL _NUM	Null	–	Model number of valve

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Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description [Setting range]
27	2027	VALVE_SN	0		Serial number of valve
28	2028	VALVE_TYPE	1	O/S	Valve type: 1 = linear-motion valve 2 = rotary-motion valve
29	2029	XD_CAL_LOC	Null		Shows and is used to record the location where the positioner was calibrated.
30	2030	XD_CAL_DATE	01/01/00		Shows and is used to record the date when the positioner was calibrated.
31	2031	XD_CAL_WHO	Null		Shows and is used to record the person who calibrated the positioner.
32	2032	ALARM_SUM			Shows the alarm summary (current alarm statuses, acknowledged/unacknowledged states, masking states) for the transducer block.
33	2033	POSITION_CHAR _TYPE	1	O/S	Defines the valve position-to-flow characteristics: 1 = linear 2 = equal % (50:1) 3 = equal % (30:1) 4 = quick open (inverse of 50:1 equal %) 255 = user-defined 10-segment function
34	2034	POSITION_CHAR	10,20,30,40,50,60, 70,80,90	O/S	Defines the coordinates of the segment function when 255 is set for POSITION_CHAR_TYPE. [0 to 100, only simple decreasing can be allowed]
35	2035	LIMSW_HI_LIM	+110%		Setting of high limit switch
36	2036	LIMSW_LO_LIM	-10%		Setting of low limit switch
37	2037	ELECT_TEMP	–	–	Indicates the temperature on amplifier board
38	2038	TEMPERATURE _UNIT	1101(degC)	O/S	Defines the unit of temperature indication above: 1101 = degC 1102 = degF
39	2039	SUPPLY _PRESSURE	140kPa	O/S	Air supply pressure (irrespective of control)
40	2040	SPRING_RANGE	20kPa, 100kPa	O/S	Defines the pressure range and unit for valve operation (with no direct effect on control). The unit defined here also applies to OUT_PRESSURE. 1133 = kPa 1137 = bar 1141 = psi 1145 = kgf/cm^2
41	2041	OUT_PRESSURE	–	–	Output pressure to valve actuator
42	2042	SERVO_OUTPUT _SIGNAL	–	–	Output current (%) to I/P module
43	2043	SERVO_RATE _GAIN (*1)	5	O/S	Derivative gain; a control parameter set by auto tuning [2 to 20]
44	2044	SERVO _DEADBAND (*1)	0.5%	O/S	Derivative action dead band; a control parameter set by auto tuning [0 to 50%]
45	2045	SERVO_OFFSET (*1)	50% of MV	O/S	Derivative action offset; a control parameter set by auto tuning [0 to 100 % of MV]
46	2046	BOOST_ON _THRESHOLD (*1)	1.9, 2.9%	O/S	Threshold for switching on boost action; a control parameter set by auto tuning[0, 0.1 to 10 %]
47	2047	BOOST_OFF _THRESHOLD (*1)	1.0, 1.0%	O/S	Threshold for switching off boost action; a control parameter set by auto tuning [0.1 to 10%]
48	2048	BOOST_VALUE (*1)	8, 10% of MV	O/S	Boost value; a control parameter set by auto tuning [0 to 50 % of MV]
49	2049	SERVO_I_SLEEP _LMT (*1)	0 sec	O/S	Integral-action sleep timer setting; a control parameter set by auto tuning [0 to10 sec]

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Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description [Setting range]
50	2050	SERVO_P_ALPHA (*1)	0 %	O/S	Multiplication coefficient for the square of proportional factor; a control parameter set by auto tuning [0 to 100%]
51	2051	INTERNAL_GAIN (*1)(*2)	5 rad./mA	O/S	Gain for internal computation ; a control parameter set by auto tuning [0.5 to 50 rad./mA]
52	2052	MEAS_GAIN	0 rad./mA	–	Measurement gain of I/P module, control relay and valve; a parameter set by auto tuning
53	2053	VALVE_TC	0 sec	–	Proportional factor of response speed of valve; a parameter set by auto tuning
54	2054	VALVE_HYS	0 %	–	Hysteresis of valve actions (%); a parameter set by auto tuning
55	2055	VALVE_SLIP _WIDTH	0 %	–	Slip width of valve actions (%); a parameter set by auto tuning
56	2056	MEAS_PRESS_AIR	0kPa	–	Air pressure (%); a parameter set by auto tuning (Valid when an optional pressure sensor is specified.)
57	2057	MEAS_PRESS _SUPPLY	0kPa	–	Air supply pressure (%); a parameter set by auto tuning (Valid when an optional pressure sensor is specified.)
58	2058	MEAS_SPRING _RANGE	0kPa	–	Spring range of valve; a parameter set by auto tuning (Valid when an optional pressure sensor is specified.)
59	2059	CONTROL_DIR	2	–	Defines the acting direction of the feedback loop: 1 = direct 2 = reverse
60	2060	THETA_HI(*1)(*2)	+ 0.2 rad.	–	Upper angle signal limit of position sensor (in radians)
61	2061	THETA_LO(*1)(*2)	-0.2 rad.	–	Upper angle signal limit of position sensor (in radians)
62	2062	THETA_P(*1)(*2)	0 rad.	–	Angle signal equal to 50 % from position sensor (in radians)
63	2063	TRAVEL_CALIB _EXEC	1	O/S	Switch for starting a travel calibration.
64	2064	TRAVEL_CALIB _RESULT	1	–	Indicates the result of a travel calibration.
65	2065	OPEN_STOP _ADJ	–	–	Not used for YVP110.
66	2066	AUTO_TUNE _EXEC	1	O/S	Switch for starting auto tuning.
67	2067	AUTO_TUNE _RESULT	1	–	Indicates the result of auto tuning.
68	2068	AUTO_TUNE _STATE	0	–	Indicates auto tuning sequence number.
69	2069	SERVO_RET_TO _DFLT	1	O/S	Writing 2 to this parameter resets all control parameters to the defaults: 1 = off 2 = set (to the defaults)
70	2070	ADVAL_FW	–	–	Digital value of valve control signal, setpoint equivalent to A/D value of valve position signal.
71	2071	ADVAL_BW	–	–	A/D value of valve position signal
72	2072	ADVAL_PRESS	–	–	A/D value of pressure from sensor
73	2073	ADVAL_T	–	–	A/D value of temperature from sensor
74	2074	TOTAL_CYCLE _COUNT	0		Total number of cycles. To reset the count, write 0.
75	2075	CYCLE _DEADBAND	0.25%	–	Dead band of cycle counting
76	2076	CYCLE_COUNT _LIM	2^32-1		High-limit alarm setting for TOTAL_CYCLE_COUNT. When TOTAL_CYCLE_COUNT has reached this setting, a block alarm is generated.

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Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description
77	2077	TOTAL_TRAVEL	0	O/S	Total amount of travel. To reset the count, write 0.
78	2078	TRAVEL _DEADBAND	0.25%		Dead band of travel integration
79	2079	TRAVEL_LIM	2^32-1		High-limit alarm setting for TOTAL_TRAVEL. When TOTAL_TRAVEL has reached this setting, a block alarm is generated.
80	2080	TOTAL_OPEN _TIME	0 hour		Total time other than counted for TOTAL_CLOSE_TIME. To reset the count, write 0.
81	2081	TOTAL_CLOSE _TIME	0 hour		Total time where valve position is equal to or less than OPEN_CLOSE_THRESHOLD. To reset the count, write 0.
82	2082	OPEN_CLOSE _THRESHOLD	0.25%	–	Threshold value for TOTAL_OPEN_TIME and TOTAL_CLOSE_TIME.
83	2083	OPEN_TIME_LIM	2^32-1 hours		High-limit alarm setting for TOTAL_OPEN_TIME. When TOTAL_OPEN_TIME has reached this setting, a block alarm is generated.
84	2084	CLOSE_TIME_LIM	2^32-1 hours		High-limit alarm setting for TOTAL_CLOSE_TIME. When TOTAL_CLOSE_TIME has reached this setting, a block alarm is generated.
85	8085	TOTAL_NEAR _CLOSE_TIM	0		Total time period when the valve position is equal to or less than the value set in NEAR_CLOSE_THRESHOLD (judged as when the valve is nearly closed). To reset the count, write 0.
86	2086	NEAR_CLOSE _THRESHOLD	3.0 %		Threshold for judging that the valve is nearly closed
87	2087	NEAR_CLOSE _TIME_LIM	2^32-1 hours		High-limit alarm setting for TOTAL_NEAR_CLOSE_TIM. When TOTAL_NEAR_CLOSE_TIM has reached this setting, a block alarm is generated.
88	2088	DEVIATION_LIM	110%		Deviation high limit (%)
89	2089	DEVIATION_TIME _TH	10, -1 (off)		If the time period when the deviation is continuously equal to or greater than DEVIATION_LIM has reached the time set for the first value in this parameter, a block alarm is generated. If it has reached the time set for the second value, the instrument transfers to fault state. Negative value means “off”.
90	2090	RELEASE _FAILSAFE	1	O/S	Used to release the block from the fail-safe state. When the value of this parameter is 3, writing 1 will release the block from the fail-safe state. 1 = clear, non-latch (normal state) 2 = active, latched (during fail-safe state) 3 = clear, latched (cause has been cleared but fail-safe action is still on).
91	2091	MODEL	As specified upon ordering	–	Model code
92	2092	DEV_OPTIONS	0x000D (or 0X0001 if PID option is specified)	–	Indicates whether any software options are provided.
93	2093	PRESS_SENS _INSTALLED	1	–	Indicates whether a pressure sensor is equipped: 1 = equipped 2 = not equipped
94	2094	ACTUATOR_TYPE	1	–	Actuator type 1 = single acting
95	2095	RELAY_TYPE	1		Control relay type: 1 = direct acting

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A1.3 Parameters of AO Block

Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description
0	5000	BLOCK HEADER		Block tag = O/S	Information about this block, including the block tag, DD revision, execution time
1	5001	ST_REV	0	–	Incremented when a change is made to the parameter settings for the AO block to indicate the revision level of the settings, and used to see whether there is a change in parameter settings.
2	5002	TAG_DESC	Spaces		Universal parameter storing the description of the tag
3	5003	STRATEGY	0		Universal parameter used by an upper-level system to classify the function blocks.
4	5004	ALERT_KEY	0		Universal parameter used as a key to identify the point from which an alert is issued; normally used by an upper-level system to select alerts to provide to a particular operator who covers a specific area of the plant.
5	5005	MODE_BLK	O/S		Universal parameter that indicates the block operation conditions and is composed of actual mode, target mode, permitted modes, and normal mode.
6	5006	BLOCK_ERR	–	–	Indicates the error statuses related to the block itself.
7	5007	PV	–	–	Indicates the primary analog value (or the corresponding process value) used to execute the specified actions, and the status of that value.
8	5008	SP	–	Auto	Indicates the setpoint for the block.
9	5009	OUT	–	Man	Indicates the output value and its status.
10	5010	SIMULATE	disable		Used to simulate the output from the Transducer block; allows the user to set the value and status input from the specified channel.
11	5011	PV_SCALE	0-100%	O/S	High and low scale values when displaying the PV parameter and the parameters which have the same scaling as PV.
12	5012	XD_SCALE	0-100%	O/S	High and low scale values used with the value obtained from or sent to the transducer block for a specified channel.
13	5013	GRANT_DENY	0		Option to control access from the host computer and local control panel to tuning and alarm parameters
14	5014	IO_OPTS	0 x 000A	O/S	Settings for the I/O processing of the block
15	5015	STATUS_OPTS	0 x 0000	O/S	Defines block actions depending on block status conditions.
16	5016	READBACK	–	–	Readback signal of valve position from transducer block
17	5017	CAS_IN	–		Cascade input
18	5018	SP_RATE_DN	+INF		Rate-of-decrease limit for SP effective in AUTO, CAS, and RCAS modes. If this parameter is 0, no limit is applied to the rate of decrease.
19	5019	SP_RATE_UP	+INF		Rate-of-increase limit for SP effective in AUTO, CAS, and RCAS modes. If this parameter is 0, no limit is applied to the rate of increase.
20	5020	SP_HI_LIM	100		Upper limit for setpoint (SP)
21	5021	SP_LO_LIM	0		Lower limit for setpoint (SP)
22	5022	CHANNEL	1	O/S	Defines the channel number of the hardware channel connected to the transducer block. Always set to 1 for the AO block in a YVP110.
23	5023	FSTATE_TIME	0 second		Defines the time from when the fault state of the RCAS_IN or CAS_IN is detected to when the output should be set to the level preset in FSTATE_VAL (this action takes place only if Fault State to value is set as true in I/O_OPTS).

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Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description
24	5024	FSTATE_VAL	0		Preset output level for fault state. See above.
25	5025	BKCAL_OUT	–	–	Value to be input to BKCAL_IN of the downstream block; used by the downstream block to prevent reset windup and perform bumpless transfer to closed-loop control.
26	5026	RCAS_IN	–		Remote cascade setpoint set by the host computer, etc.
27	5027	SHED_OPT	1		Defines the mode shedding action to be taken upon occurrence of time-out of communication in a mode using the remote setpoint.
28	5028	RCAS_OUT	–	–	Remote setpoint sent to a host computer, etc.
29	5029	UPDATE_EVT	–	–	Shows the contents of an update event upon occurrence.
30	5030	BLOCK_ALM	–	–	Shows the contents of a block alarm upon occurrence.

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A1.4 Parameters of DI Block

Relative Index	Index DI1	Index DI2	Parameter Name	Default (factory setting)	Write	Description
0	6000	6100	BLOCK HEADER		Block tag = O/S	Information about this block, including the block tag, DD revision, execution time
1	6001	6101	ST_REV	0	–	Incremented when a change is made to the parameter settings for the DI block to indicate the revision level of the settings, and used to see whether there is a change in parameter settings.
2	6002	6102	TAG_DESC	Spaces		Universal parameter storing the description of the tag
3	6003	6103	STRATEGY	0		Universal parameter used by an upper-level system to classify the function blocks.
4	6004	6104	ALERT_KEY	0		Universal parameter used as a key to identify the point from which an alert is issued; normally used by an upper-level system to select alerts to provide to a particular operator who covers a specific area of the plant.
5	6005	6105	MODE_BLK	O/S		Universal parameter that indicates the block operation conditions and is composed of actual mode, target mode, permitted modes, and normal mode.
6	6006	6106	BLOCK_ERR	–	–	Indicates the error statuses related to the block itself.
7	6007	6107	PV_D	–	–	Indicates the primary discrete value (or the corresponding process value) used to execute the specified actions, and the status of that value.
8	6008	6108	OUT_D	–	Man	Indicates the output value and its status.
9	6009	6109	SIMULATE_D	disable	–	Used to determine whether to use the limit switch signal input from the transducer block or use the user-set value. When this parameter is set to disable, the block uses the actual input value and status.
10	6010	6110	XD_STATE	0		Index to the text describing the states of the discrete value obtained from the transducer, but not supported by YVP110.
11	6011	6111	OUT_STATE	0		Index to the text describing the states of a discrete output, but not supported by YVP110.
12	6012	6112	GRANT_DENY	0		Used to check whether various user operations can be put into effective. Before operations, in the GRANT parameter component, set the bits (to 1) corresponding to the intended operations. After the operations, check the DENY parameter component. If the corresponding bits are not set (to 1) in DENY, it proves that the corresponding operation has been put into effective.
13	6013	6113	IO_OPTS	0	O/S	Settings for the I/O processing of the block
14	6014	6114	STATUS_OPTS	0	O/S	Defines block actions depending on block status conditions.
15	6015	6115	CHANNEL	2 or 3	O/S	Defines the channel number of the hardware channel connected to the transducer block. Always set 2 for the DI1 block and 3 for DI2 in a YVP110.
16	6016	6116	PV_FTIME	0 second		Time constant of filter for PV_D.
17	6017	6117	FIELD_VAL_D	–	–	Status of limit switch signal obtained from the transducer block
18	6018	6118	UPDATE_EVT	–	–	Shows the contents of an update event upon occurrence.
19	6019	6119	BLOCK_ALM	–	–	Shows the contents of a block alarm upon occurrence.
20	6020	6120	ALARM_SUM	enable		Shows the alarm summary (current alarm statuses, acknowledged/unacknowledged states, masking states) for the DI block.
21	6021	6121	ACK_OPTION	unack		Defines the priority of WRITE_ALM as well as allows for notification to be disabled and makes acknowledement unnecessary for WRITE_ALM .
22	6022	6122	DISC_PRI	0	–	Priority order of discrete alarm
23	6023	6123	DISC_LIM	1		Input status of generating a discrete alarm
24	6024	6124	DISC_ALM	–		Status of discrete alarm

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A1.5 Parameters of PID Block (Optional)

Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description
0	8000	BLOCK HEADER		Block tag = O/S	Information about this block, including the block tag, DD revision, execution time
1	8001	ST_REV	0	–	Incremented when a change is made to the parameter settings for the PID block to indicate the revision level of the settings, and used to see whether there is a change in parameter settings.
2	8002	TAG_DESC	Spaces		Universal parameter storing the description of the tag
3	8003	STRATEGY	0		Universal parameter used by an upper-level system to classify the function blocks.
4	8004	ALERT_KEY	0		Universal parameter used as a key to identify the point from which an alert is issued; normally used by an upper-level system to select alerts to provide to a particular operator who covers a specific area of the plant.
5	8005	MODE_BLK	O/S		Universal parameter that indicates the block operation conditions and is composed of actual mode, target mode, permitted modes, and normal mode.
6	8006	BLOCK_ERR	–	–	Indicates the error statuses related to the block itself.
7	8007	PV	–	–	Indicates the primary analog value (or the corresponding process value) used to execute the specified actions, and the status of that value.
8	8008	SP	–	Auto	Setpoint of the block
9	8009	OUT	–	Man	Value and status of output
10	8010	PV_SCALE	0-100%	O/S	Upper and lower scale limit values used for scaling of the input (IN) value.
11	8011	OUT_SCALE	0-100%	O/S	Upper and lower scale limit values used for scaling of the control output (OUT) value to the values in the engineering unit
12	8012	GRANT_DENY	0		Option to control access from the host computer and local control panel to tuning and alarm parameters
13	8013	CONTROL_OPTS	0x0000	O/S	Defines block actions depending on block status conditions.
14	8014	STATUS_OPTS	0x0000	O/S	Defines options for control actions of block.
15	8015	IN	0		Controlled-value input
16	8016	PV_FTIME	0		Time constant (in seconds) of the first-order lag filter applied to IN
17	8017	BYPASS	1	Man	Determines whether to bypass control computation. 1 = off; do not bypass. 2 = on; bypass.
18	8018	CAS_IN	0		Cascade setpoint
19	8019	SP_RATE_DN	+INF		Rate-of-decrease limit for setpoint (SP)
20	8020	SP_RATE_UP	+INF		Rate-of-increase limit for setpoint (SP)
21	8021	SP_HI_LIM	100		Upper limit for setpoint (SP)
22	8022	SP_LO_LIM	0		Lower limit for setpoint (SP)
23	8023	GAIN	1		Proportional gain (= 100 / proportional band)
24	8024	RESET	10		Integration time (seconds)
25	8025	BAL_TIME	0		Unused
26	8026	RATE	0		Derivative time (seconds)
27	8027	BKCAL_IN	0		Readback of control output
28	8028	OUT_HI_LIM	100		Upper limit for control output (OUT)
29	8029	OUT_LO_LIM	0		Lower limit for control output (OUT)
30	8030	BKCAL_HYS	0		Hysteresis for release from a limit for OUT.status
31	8031	BKCAL_OUT	–	–	Read-back value to be sent to the BKCAL_IN of the downstream block
32	8032	RCAS_IN	0		Remote setpoint set from the host computer.

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Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description
33	8033	ROUT_IN	–		Remote control output value set from a computer, etc.
34	8034	SHED_OPT	1		Defines the mode shedding actions, namely, the changes to be made to MODE.BLK.target and MODE.BLK.actual when (1) the value of RCAS_IN.status becomes Bad if MODE_BLK.actual = RCAS, or when (2) the value of ROUT_IN.status becomes Bad if MODE_BLK.actual = ROUT.
35	8035	RCAS_OUT	–	–	Remote setpoint sent to a host computer, etc.
36	8036	ROUT_OUT	–	–	Remote control output value
37	8037	TRK_SCALE	0-100%	Man	Upper and lower scale limits used to convert the output tracking value (TRK_VAL) to non-dimensional.
38	8038	TRK_IN_D			Switch for output tracking
39	8039	TRK_VAL			Output tracking value. When MODE_BLK.actual = LO, the value scaled from the TRK_VAL value is set in OUT.
40	8010	FF_VAL			Feed-forward input value. The FF_VAL value is scaled to a value with the same scale as for OUT, multiplied by the FF_GAIN value, and then added to the output of the PID computation.
41	8041	FF_SCALE	0-100%	Man	Scale limits used for converting the FF_VAL value to a non-dimensional value
42	8042	FF_GAIN	0	Man	Gain for FF_VAL
43	8043	UPDATE_EVT	–	–	Shows the contents of an update event upon occurrence.
44	8044	BLOCK_ALM	–	–	Shows the contents of a block alarm upon occurrence.
45	8045	ALARM_SUM	Enable		Shows the alarm summary (current alarm statuses, acknowledged/unacknowledged states, masking states)
46	8046	ACK_OPTION	0		Selects whether or not the alarms related to the DI block are automatically self-acknowledged.
47	8047	ALARM_HYS	0.5%		Hysteresis for alarm detection and resetting to prevent each alarm from occurring and recovering repeatedly within a short time
48	8048	HI_HI_PRI	0		Priority order of HI_HI_ALM alarm
49	8049	HI_HI_LIM	+INF		Setting for HI_HI_ALM alarm
50	8050	HI_PRI	0		Priority order of HI_ALM alarm
51	8051	HI_LIM	+INF		Setting for HI_ALM alarm
52	8052	LO_LO_PRI	0		Priority order of LO_ALM alarm
53	8053	LO_LO_LIM	+INF		Setting for LO_ALM alarm
54	8054	LO_PRI	0		Priority order of LO_LO_ALM alarm
55	8055	LO_LIM	+INF		Setting for LO_LO_ALM alarm
56	8056	DV_HI_PRI	0		Priority order of DV_HI_ALM alarm
57	8057	DV_HI_LIM	+INF		Setting for DV_HI_ALM alarm
58	8058	DV_LO_PRI	0		Priority order of DV_LO_ALM alarm
59	8059	DV_LO_LIM	+INF		Setting for DV_LO_ALM alarm
60	8060	HI_HI_ALM	–	–	Alarm that is generated when the PV value has exceeded the HI_HI_LIM value and whose priority order* is defined in HI_HI_PRI. * Priority order: Only one alarm is generated at a time. When two or more alarms occur at the same time, the alarm having the highest priority order is generated. When the PV value has decreased below [HI_HI_LIM - ALM_HYS], HI_HI_ALM is reset.
61	87061	HI_ALM	–	–	As above
62	8062	LO_LO_ALM	–	–	As above Reset when the PV value has increased above [LO_LIM + ALM_HYS].
63	8063	LO_ALM	–	–	As above
64	8064	DV_HI_ALM	–	–	An alarm that is generated when the value of [PV - SP] has exceeded the DV_HI_LIM value. Other features are the same as HI_HI_ALM.
65	8065	DV_LO_ALM	–	–	Alarm that is generated when the value of [PV - SP] has decreased below the DV_LO_LIM value. Other features are the same as LO_LO_ALM.

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A1.6 IO_OPTS - Availability of Options for Each Block

Bit	Contents	DI	AO
0	Invert	×	
1	SP tracks PV if Man		×
2	Reserved		
3	SP tracks PV if LO		×
4	SP tracks RCas or Cas if LO or Man		×
5	Increase to close		×
6	Faultstate Type		×
7	Faultstate Type		×
8	Target to Man		×
9	PV for BKCal_Out		×
10	Reserved		

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A1.7 STATUS_OPTS - Availability of Options for Each Block

Bit	Contents	DI	AO	PID
0	IFS if BAD IN			×
1	IFS if BAD CAS_IN			×
2	Use Uncertain as Good			×
3	Propagate Fault Forward	×		
4	Propagate Fault Backward		×	
5	Target to Manual if BAD IN			×
6	Uncertain if Limited			
7	BAD if Limited			
8	Uncertain if Man mode	×		
9	Target to next permitted mode if Bad CAS_IN			×

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A1.8 CONTROL_OPTS - Availability of Options for Each Block

Bit	Contents	PID
0	Bypass Enable	×
1	SP-PV Track in Man	×
2	SP-PV Track in ROut	×
3	SP-PV Track in LO or IMan	×
4	SP Track retained target	×
5	Direct Acting	×
6	Reserved	
7	Track Enable	×
8	Track in Manual	×
9	Use PV for BKCAL_OUT	×
10	Act on IR	
11	Use BKCAL_OUT with IN_1	
12	Obey SP limits if Cas or RCas	×
13	No OUT limits in Manual	×
14	Reserved	
15	Reserved	

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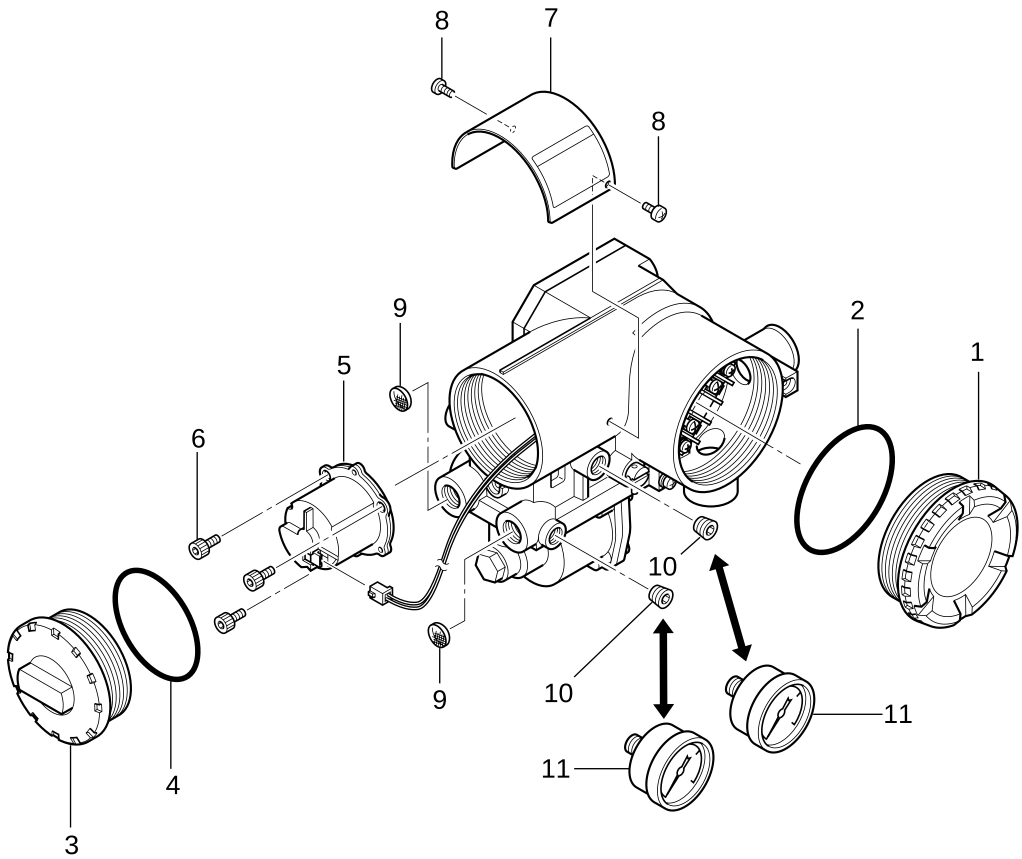
Customer Maintenance Parts List

YVP110
Advanced Valve Positioner



Item	Part No.	Qty	Description
1	F9341RA	1	Cover
2	F9341JP	1	O-Ring
3	—	1	IP Cover
4	—	1	O-Ring
5	—	1	IP Assembly
6	—	3	Bolt Hex. Socket
7	—	1	Name Plate
8	F9300AG	2	Screw
9	U0103FP	3	Screen
10	Bellow	2	Plug
	G9612EJ		For Connection code 1, 5, and 6
	G9612EL		For Connection code 3
11	See Table 1	2	Pressure Gauge

Table 1. Pressure Gauge Part Number (item 11).

Applicable Actuator code	Connection code	Optional code			
		/GP	/GM	/GB	/GE
1	1, 5, and 6	G9615ED	G9615AR	G9615EF	—
(Single Acting Actuator)	3	—	—	—	G9615EE

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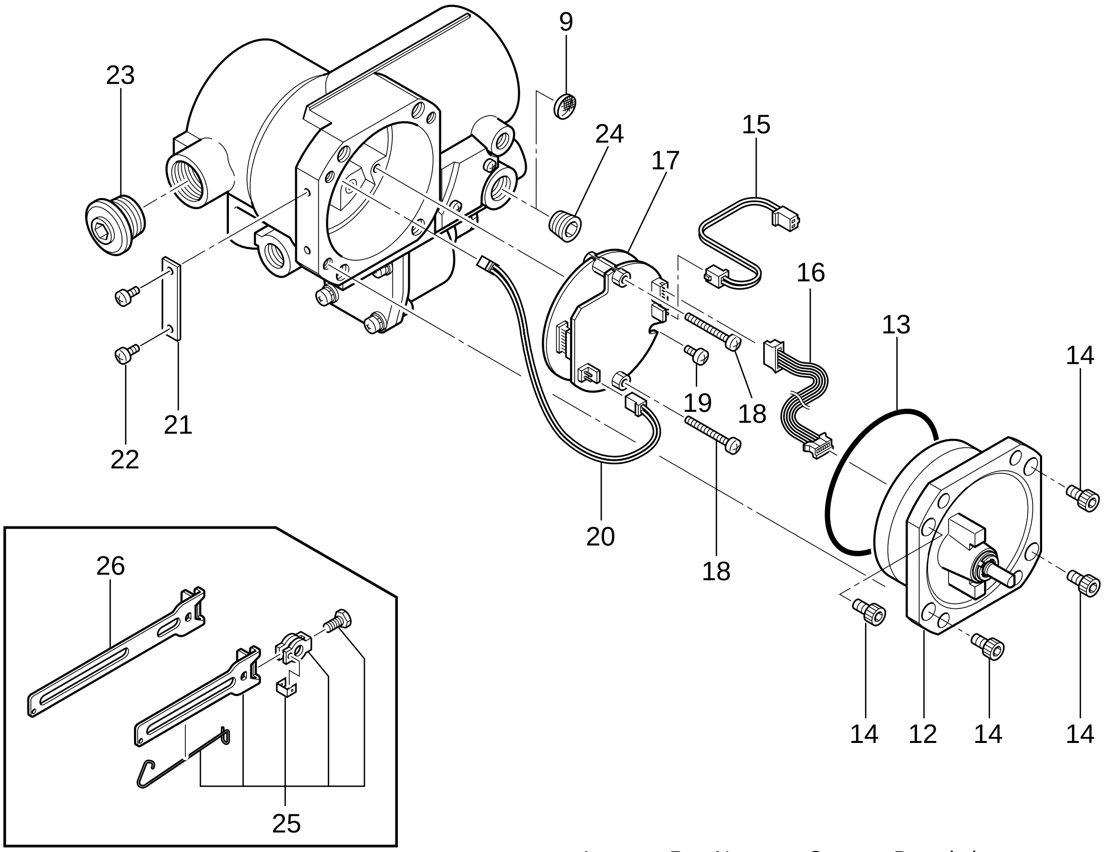

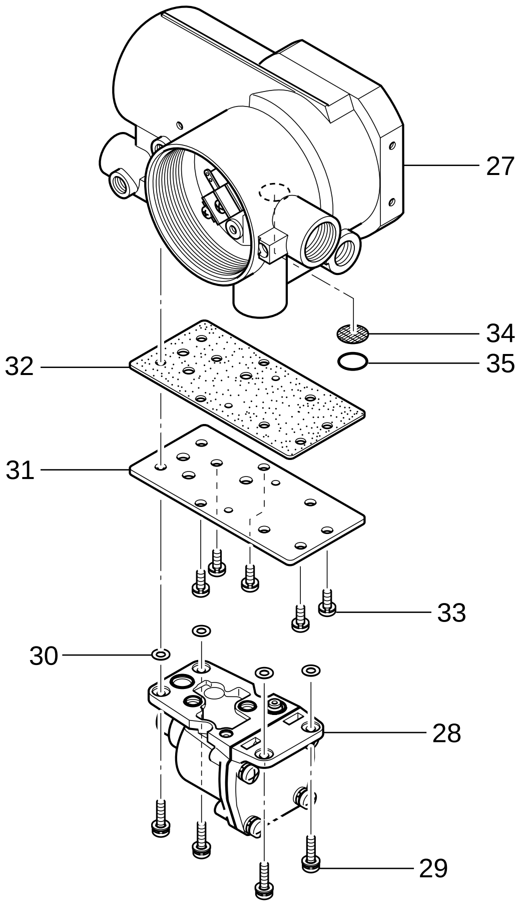

Item	Part No.	Qty	Description
12	—	1	Position Sensor Assembly
13	—	1	O-Ring
14	—	1	Bolt Hex. Socket
15	—	4	Connector Assembly
16	—	1	Connector Assembly
17	—	1	Amplifier Assembly
18	—	2	Screw Machine
19	—	1	Screw Machine
20	—	1	Connector Assembly
21	F9165DF	1	Tag Plate
22	F9300AG	2	Screw
23	Bellow	1	Plug
	G9330DP		G 1/2
	G9612EB		1/2 NPT
	F9340NW		Pg13.5
	F9340NX		M20
24	Bellow	1	Plug
	G9612EK		R 1/4
	G9612EM		1/4 NPT
25	F9176HA	1	Lever Assembly
26	F9176HC	1	Lever
27	—	1	Case Assembly
28	F9177HA	1	Pilot Relay(Control Relay) Assembly
29	Y9414JY	4	Screw
30	F9177GZ	4	Washer
31	F9176GA	1	Plate
32	F9176GB	1	Gasket
33	G9307MQ	5	Screw M4×8
34	F9176GC	1	Filter
35	F9176JZ	1	O-Ring

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