User's Manual

YPK110
Fieldbus-to-Pneumatic Converter

IM 21B04D01-01E

YOKOGAWA ◆
Yokogawa Electric Corporation

IM 21B04D01-01E
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CONTENTS

INTRODUCTION

The YPK110 fieldbus-to-pneumatic converter is fully factory-tested according to the specifications indicated upon the order.

This User's Manual consists of two parts: Hardware and Functions. The Hardware part gives instructions on handling, wiring set-up and maintenance of YPK110, and the Functions part describes the software functions of YPK110.

In order for the YPK110 to be fully functional and to operate in an efficient manner, both parts in this manual must be carefully read, so that users become familiar with the functions, operation, and handling of the YPK110.

■ Notes on the User's 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 instrument 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 instrument.
- 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.

● Symbols used in this 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.

■ For Safe Use of Product

For the protection and safety of the operator and the instrument or the system including the instrument, please be sure to follow the instructions on safety described in this manual when handling this instrument. In case the instrument is handled in contradiction to these instructions, Yokogawa does not guarantee safety. Please give your highest attention to the followings.

(a) Installation

- The instrument must be installed by an expert engineer or skilled personnel. The procedures described about INSTALLATION are not permitted for operators.
- Some of the operations will stroke the valve. Keep clear of the valve while the positioner is pneumatically or electrically supplied, so as not to be hit by unexpected movements of the valve.

- In case where ambient temperature is high, care should be taken not to burn yourself, because the surface of the body of the instrument reaches a high temperature.
- All installation shall comply with local installation requirement and local electrical codes.
- Do not supply air at a pressure exceeding the maximum rated air supply pressure. Doing so may result in a high risk of damage or cause an accident.
- To avoid injury or the process being affected when installing or replacing a positioner on a control valve, ensure that;
  1) All inputs to the valve actuator and other accessories of the valve and actuator, including air supply and electrical signal, are cut off;
  2) The process has been shut down or the control valve is isolated from the process by using bypass valves or the like; and
  3) No pressure remains in the valve actuator.
- Auto-Manual switch must not be moved by anyone except for the authorized engineer.

(b) Wiring

- The instrument must be installed by an expert engineer or skilled personnel. The procedures described about WIRING are not permitted for operators.
- Please confirm voltages between the power supply and the instrument before connecting the power cables and that the cables are not powered before connecting.

(c) Operation

- Wait three minutes after power is turned off, before opening the covers.

(d) Maintenance

- Only the procedures written in maintenance descriptions are allowed for users. When further maintenance is needed, please contact nearest YOKOGAWA office.
- Care should be taken to prevent the build up of drift, dust or other material on the data plate. In case of its maintenance, use clean, soft and dry cloth.
- The instrument modification or parts replacement for explosion-protected type instruments by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void the approval.

■ 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.

1. NOTES ON HANDLING

The YPK110 fieldbus-to-pneumatic converter is fully factory-tested upon shipment. When the YPK110 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.

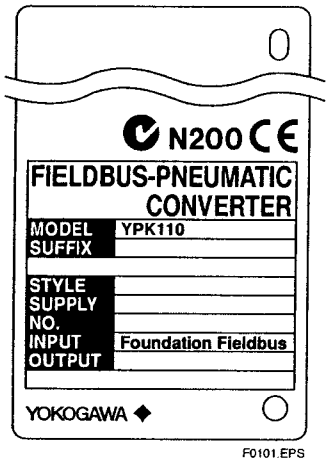


Figure 1.1 Nameplate

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. 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.
- 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

EN61326, AS/NZS2064

1.9 Installation of Explosion Protected Type

CAUTION

To preserve the safety of explosionproof equipment requires great care during mounting, wiring and piping. Safety requirements also place restrictions on maintenance and repair activities. Please read the following section very carefully.

1.9.1 FM Explosionproof Type

Caution for FM explosionproof type.

Note 1. Model YPK110 fieldbus-to-pneumatic converter with optional code /FF1 are applicable for use in hazardous locations.

- Explosionproof for Class I, Division 1, Groups A, B, C and D
- Dust-ignitionproof for Class II/III, Division 1, Groups E, F and G
- Enclosure Rating: NEMA 4X
- Temperature Class: T6
- Ambient Temperature: –40 to 80°C

Note 2. Wiring

- All wiring shall comply with National Electrical Code ANSI/NEPA70 and Local Electrical Codes.
- "FACTORY SEALED, CONDUIT SEAL NOT REQUIRED."

Note 3. Operation

- Note a warning label worded as follows; WARNING: OPEN CIRCUIT BEFORE REMOVING COVER.
- Take care not to generate mechanical spark when accessing to the instrument and peripheral devices in hazardous locations.

Note 4. Maintenance and Repair

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void the approval of Factory Mutual Research Corporation.

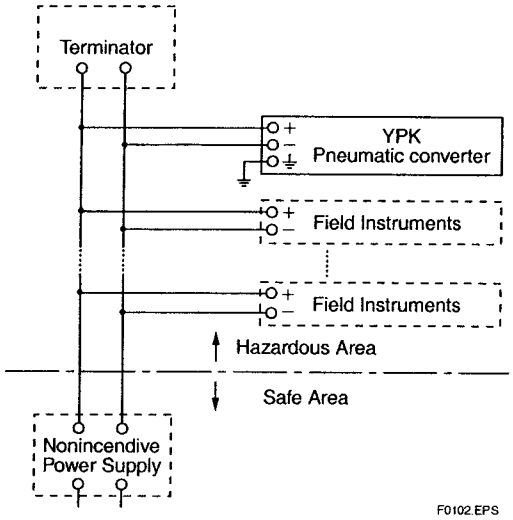
1.9.2 FM Nonincendive approval

Model YPK110 fieldbus-to-newmatic converter with optional code /FN15.

- Nonincendive Approval
  Class I, Division 2, Groups A, B, C and D
  Class II, Division 2, Groups F and G
  Class III, Division 1 and
  Class I, Zone 2, Group IIC in Hazardous (Classified) Locations.
  Temperature Class: T4
  Ambient Temperature: –40 to 60°C
  Ambient Humidity: 0 to 100%R.H. (No condensation) Enclosure: NEMA Type4X
- Electrical Parameters:
  Vmax = 32 Vdc
  Ci = 1.76 nF
  Li = 0 μH
- Caution for FM Nonincendive type. (Following contents refer to "DOC. No. NFM010-A12 p.1 and p.2")

■ NFM011-A12

Installation Diagram:

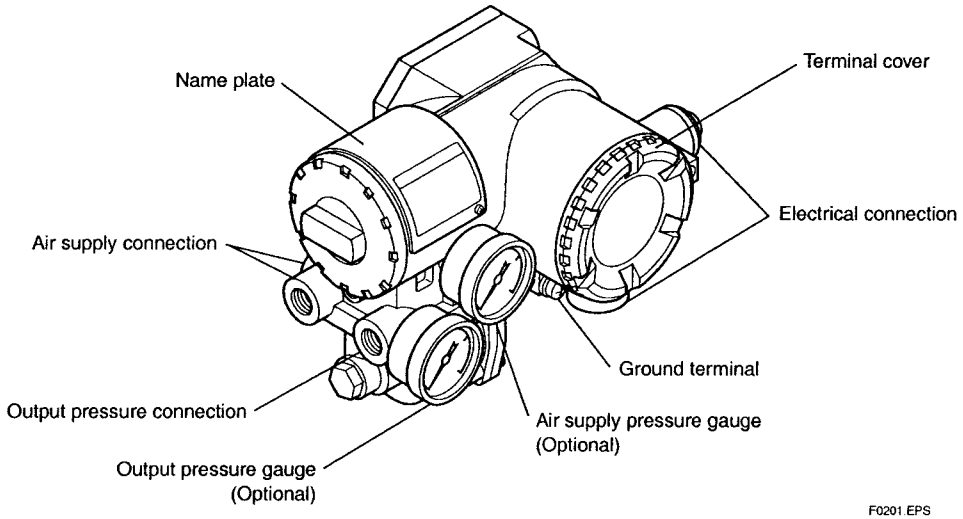


Note:

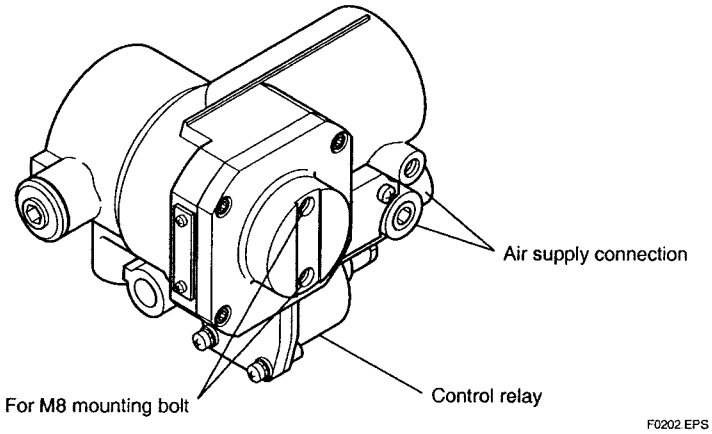
1: Dust-tight conduit seal must be used when installed in Class II and Class III environments.
2: Installation should be in accordance with National Electrical Code (ANSI/NFPA 70) Sections 504, 505 and Local Electrical Code.
3: The configuration of Associated Apparatus must be Factory Mutual Research Approved.
4: Associated Apparatus manufacturer's installation drawing must be followed when installing this equipment.
5: No revision to drawing without prior Factory Mutual Research Approval.
6: Terminator and supply unit must be FM approved.
7: Installation requirements;
   Vmax ≧ Voc or Vt
   Ca ≧ Ci + Ccable
   La ≧ Li + Lcable

2. PART NAMES

2.1 Appearance and Part Names

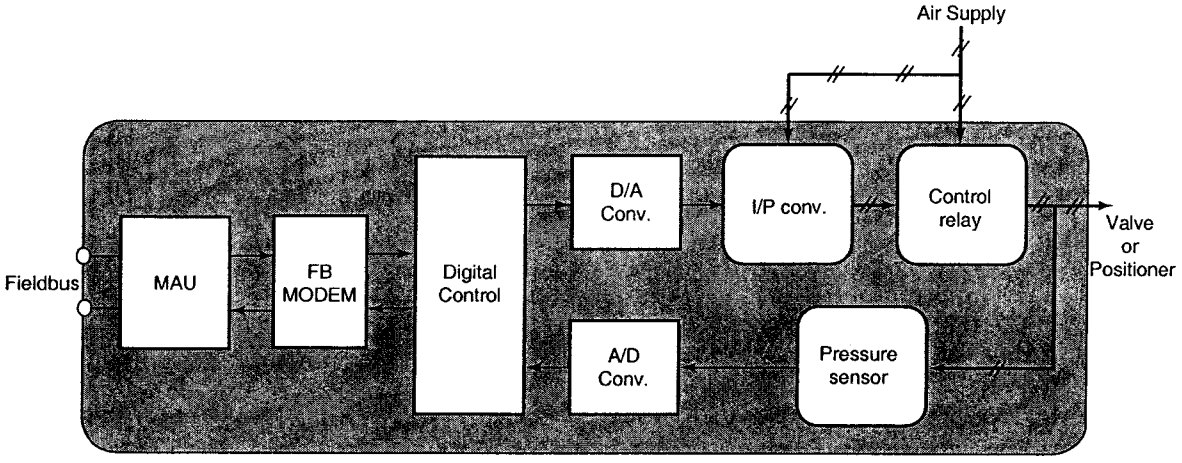


F0201.EPS



F0202.EPS

2.2 Block Diagram



F0203.EPS

3. INSTALLATION

3.1 Overview

When installing the YPK110 fieldbus-to-newmatic converter, see section 1.4 "Choosing the Installation Location." For the ambient environmental conditions of an installation place, see Chapter 7 "Standard Specifications."

3.2 Installation

YPK110 can be installed on a pipe using a mounting bracket provided or directly installed on the wall. Select either method, taking into account the installation space and service method.

3.2.1 Pipe Mounting

When this instrument is mounted on a pipe, use the mounting bracket and U-bolt provided. The pipe dia. available is 50mm (2-INCH) and the instrument can be installed on either a horizontal or vertical pipe.

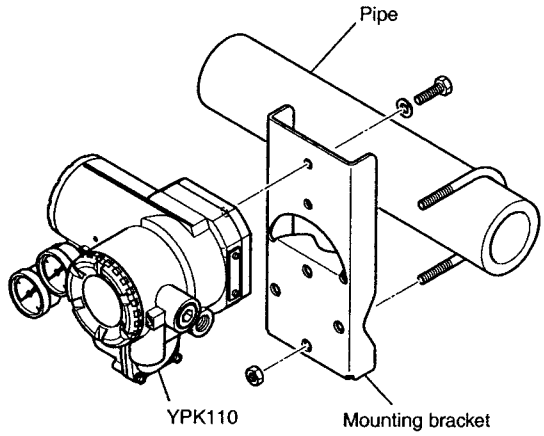


Figure 3.1 Pipe Mounting

3.2.2 Wall Mounting

When the instrument is installed on the wall, use the two M8 screws provided.

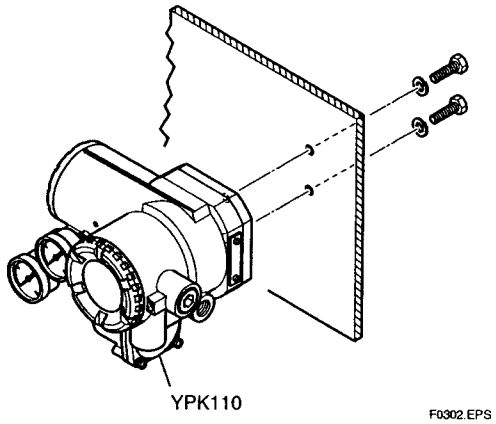


Figure 3.2 Wall Mounting

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.

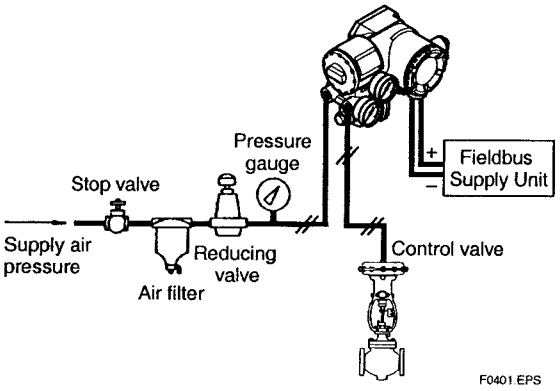


Figure 4.1 Example for general-use wiring and piping

4.2 Piping

4.2.1 Air Supply

For stable operation of the YPK110 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 YPK110 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 YPK110 requires an air supply of folowing table.

Table 4.1

Unit	Standard output	Doubled output
Pa	130 to 150 kPa	230 to 260 kPa
bar	1.3 to 1.5 bar	2.3 to 2.6 bar
psi	19 to 22 psi	34 to 37 psi

T0401.EPS

WARNING

Do not supply air at a pressure exceeding 400 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 YPK110, 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 YPK110 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 4.2 shows the pneumatic piping ports. The port specification can be chosen when ordering the YPK110.

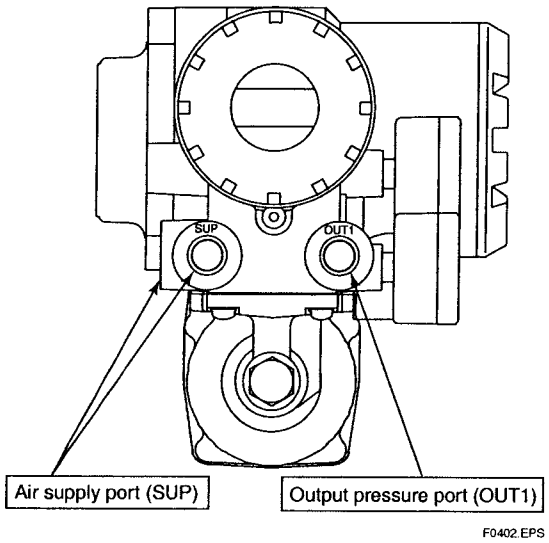


Figure 4.2 Pneumatic Piping Ports

CAUTION

- To obtain the maximum air processing flow rate of the YPK110, the inner diameter of the piping tube needs to be at least 6 mm. When the YPK110 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 A/M Switching

To perform manual operation of the valve using the A/M (automatic/manual) mode switching mechanism of the YPK110, 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 by changing the regulator output pressure regardless of the input signal of the YPK110. For a YPK110 equipped with pressure gauges, you can read the output pressure.

(3) After you have finished manual operation, turn the A/M selector switch counterclockwise until the stopper pin touches the side of the YPK110'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 output 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.
- If the pressure larger than the allowable range of pressure gauge is applied, the pressure gauge may possibly be damaged.

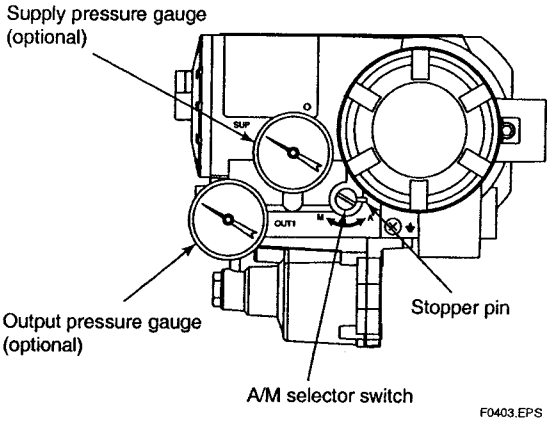


Figure 4.3 A/M Selector Switch

4.4 Wiring

CAUTION

For the intrinsically safe equipment, nonincendive and flameproof equipment, wiring materials and wiring work for these equipment including peripherals are strictly restricted. Users absolutely must wired in accordance with specific requirements (and, in certain countries, legal reguration) in order to preserve the effectiveness of their explosionprotected features.

4.4.1 Recommended Cables

For wiring for a YPK110, 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.

4.4.2 Precautions on Wiring

IMPORTANT

- Prevent the cables from being affected by noise induced from a high-capacity transformer or power supply to a motor.
- As shown in Figure 4.4, 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.
- 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.

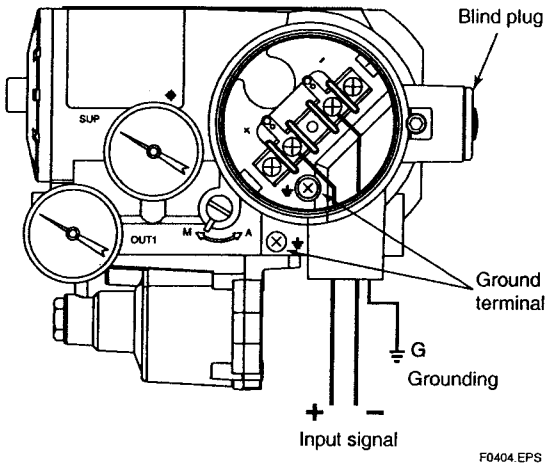


Figure 4.4 Wiring

(1) General-use Type and Nonincendive Type

Make cable wiring using metallic conduit or waterproof glands.–

- Apply a non-hardening sealant to the terminal box connection port and to the threads on the flexible metal conduit for waterproofing.

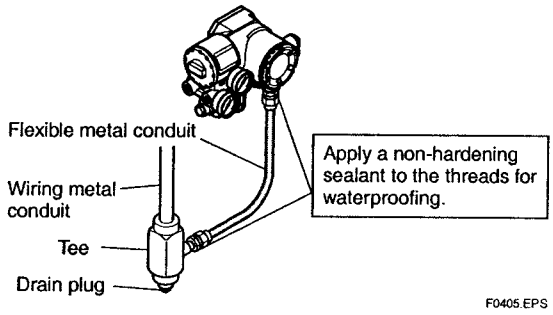


Figure 4.5 Typical Wiring Using Flexible Metal Conduit

(2) Flameproof Type

Wire cables through a flameproof packing adapter, or using a flameproof metal conduit.

■ Wiring cable through flameproof packing adapter (see Figure 4.6).

- Apply a nonhardening sealant to the terminal box connection port and to the threads on the flameproof packing adapter for waterproofing.

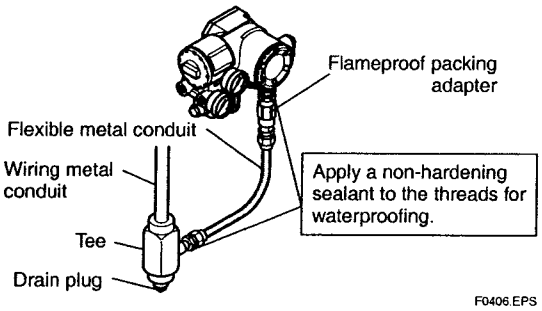


Figure 4.6 Typical Cable Wiring Using Flameproof Packing Adapter

■ Flameproof metal conduit wiring

- A seal fitting must be installed near the terminal box connection port for a sealed construction.
- Apply a non-hardening sealant to the threads of the terminal box connection port, flexible metal conduit and seal fitting for waterproofing.

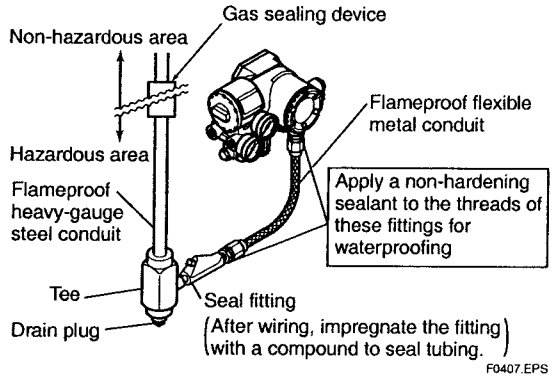


Figure 4.7 Typical Wiring Using Flameproof Metal Conduit

4.5 Grounding

Grounding is always required for the proper operation of transmitters. Follow the domestic electrical requirements as regulated in each country.

Ground terminals are located on the inside and outside of the terminal box. Either of these terminals may be used. See Figure 4.4.

⚠ WARNING

For flameproof type and Nonincendive type, grounding should be required.

5. SETUP

CAUTION

During the setup especially when calibration is being executed, the output air pressure may happen to move suddenly to an unexpected direction. Before starting the setup, check and confirm that the output air pressure is not affect to the plant operation.

5.1 General

After finishing the wiring and piping to YPK110, connect the YPK110 to a fieldbus and make settings, such as carrying out output range, low cut and so on, 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 4.4 '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 YPK110. For details of each parameter, refer to the parameters list in Appendix 1. Follow the procedure below.

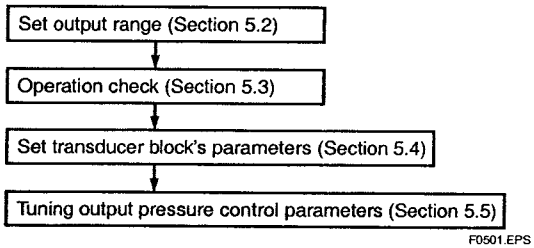


Figure 5.1 Setup Procedure

5.2 Setting Output Range

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 output air pressure are write-locked.

According to the input pressure range of the pneumatic positioner (pneumatic-to-pneumatic positioner) or valve to be used, set PRESSURE_LO and PRESSURE_HI. In PRESSURE_LO, which is the output pressure value when FINAL_VALUE.value is 0%, set a value within −10% to +10% of its rated span. Likewise in PRESSURE_HI, which is the output pressure value when FINAL_VALUE.value is 100%, set a value within +0% to +25% of its rated span plus the PRESSURE_LO value set above. Table 5.1 shows the setting ranges of PRESSURE_LO and PRESSURE_HI. Setting values exceeding the limits of their respective ranges shown in this table are excluded from the scope of guarantee for accuracy and performance provided in the product specifications. In addition, the converter indicates a warning message in XD_ERROR. This warning message can be prevented from displaying using MASK_XD_ERROR. See Chapter 12 "TRANSDUCER BLOCK", for more information.

Table 5.1

Rated Output Pressure	Range of 0% Point Setting Values [PRESSURE_LO]	Range of 100% Point Setting Values [PRESSURE_HI]
20 to 100 kPa	12 to 28	(80 to 100) + PRESSURE_LO
40 to 200 kPa	24 to 56	(160 to 200) + PRESSURE_LO
3 to 15 psi	1.8 to 4.2	(12 to 15) + PRESSURE_LO
6 to 30 psi	3.6 to 8.4	(24 to 30) + PRESSURE_LO
0.2 to 1.0 bar	0.12 to 0.28	(0.8 to 1.0) + PRESSURE_LO
0.4 to 2.0 bar	0.24 to 0.56	(1.6 to 2.0) + PRESSURE_LO

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Note that the upper and lower limits of these PRESSURE_LO and PRESSURE_HI setting ranges can only be entered when they satisfy the following conditions:

- 0 to supply pressure
- PRESSURE_LO < PRESSURE_HI

IMPORTANT

For the transducer block, the 0% output always means complete low pressure. Nonetheless, the 0-100% of the transducer block's output can be logically reversed by setting IO_OPTS in the AO block to "Increase to close."

Independently of the above setting, YPK110 always acts identical upon power off and cut-off of the air supply.

When a power failure or serious hardware damage is detected, the YPK110 cuts the current signal being fed to the I/P module to zero, changing the output pressure to min. side. The action of the YPK110 upon occurrence of a communication error can be predefined by AO block's parameters; see Section 13.3.1, "Fault State."

5.3 Operation Check

After setting the output range, rewrite FINAL_VALUE.value to check step responses. Also check that the converter outputs correct pressure across the 0-100% range.

Note that the converter enables the user to precisely adjust the 0%, 50% and 100% point output pneumatic pressure values using the user calibration function. This function is not needed during normal operation but can be executed using a high-precision pressure-measuring instrument. See Section 12.4 "User Calibration", for more information.

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.

5.4 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) Low-cutoff and High-cutoff Function

The Low-cutoff function is an action to decrease the output pressure to a level much lower than the 0% pressure level when FINAL_VALUE.value is less than FINAL_VALUE_CUTOFF_LO. Conversely, the High-cutoff function is an action to increase the output pressure to a level much higher than the 100% pressure level when FINAL_VALUE.value is larger than FINAL_VALUE_CUTOFF_HI.

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

(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, output pressure is set to outside the FINAL_VALUE_RANGE setting when the Low-cutoff and High-cutoff action described adove is activated.

(3) Output pressure Characteristic Type

The parameter OUTPUT_CHAR_TYPE defines the characteristics between output of AO block and output pressure 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.

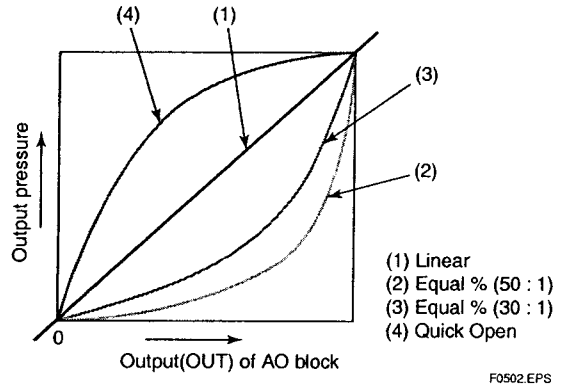
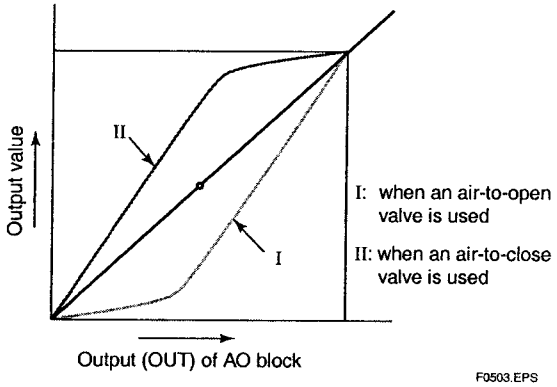


Figure 5.2 Output pressure Characteristic Type

CAUTION

Invert the output characteristics curve, depending on the setting of ACT_FAIL_ACTION which is the parameter for selecting the direction of valve action. The output characteristics curve is inverted symmetrically around the 50% point of the "Linear" output characteristics graph. This direction of action is also true with cases where the "User define" option is set for the output characteristics. The following figure illustrates the relationship between the output characteristics and the direction of valve action.



(4) Thresholds for Limit Switches

Just like hardware limit switches for a valve, on/off status signals can be generated when the output pressure read-back signal FINAL_PRESSURE_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 YPK110 has a function to integrate the following operation result quantities individually:

- PRESS_VERTICAL_FEED_COUNT (incremented by 1 at each change in the direction of the action)
- TOTAL_PRESS_VARIATION (incremented by pressure output variation in ×100%)
- TOTAL_PRESS_OUT_TIME (incremented by time in hours when pressure output is in normak state.)
- TOTAL_CUTOFF_LO_TIME (incremented by time in hours when pressure output is in Low cutt-off state.)

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

- PRESS_VERTICAL_FEED_COUNT_LIM
- TOTAL_PRESS_VARIATION_LIM
- TOTAL_PRESS_OUT_TIME_LIM
- TOTAL_CUTOFF_LO_TIME_LIM

For other alarms and self-diagnostic functions, see Chapter 12 "Transducer Block".

5.5 Tuning Control Parameters

In the YPK110, the pneumatic control parameters are changed automatically, depending on the capacity of the pneumatic positioner or valve connected to the output pressure port and on the length of piping. The control parameters therefore need not be tuned in most cases. Tune the parameters as instructed below, however, if for example the load capacity significantly differs from the assumed condition and therefore excess overshoots are present or pneumatic control is oscillatory.

(If the problem still persists even after tuning, see Chapter 17 "TROUBLESHOOTING.")

(1) Fixing the Control Parameters

Write a number into SERVO_GAIN_SELECTION according to the option numbers listed below. The rule-of-thumb capacity values including 3 m or shorter pipe lengths are 100 to 500 cc for "Small capacity", 500 to 1000 cc for "Middle capacity", and 1000 to 3000 cc for "Large capacity".

Automatic = 1
(automatic parameter set selection [default])
Small capacity = 2
(parameter set for small-capacity valves)
Middle capacity = 3
(parameter set for medium-capacity valves)
Large capacity = 4
(parameter set for large-capacity valves)
Pneumatic positioner = 5
(parameter set for pneumatic positioners)

Sorting the magnitudes of control gain by the option number results in "4 > 3 > 2 > 5." For longer pipe lengths (3 m or greater, as a rule), decrease the gain of the parameter set one or two steps further. This strategy will provide better controllability.

After selecting SERVO_GAIN_SELECTION, determine the following control parameter set. See Section 5.3 "Operation Check" to verify step responses, stability, etc.

SERVO_ADV_GAIN (proportional gain)
SERVO_ADV_RESET (integral time)
SERVO_ADV_RATE (derivative time)
SERVO_ADV_GAM1
(reciprocal of derivative gain)
SERVO_ADV_TD2
(derivative time of phase compensator)
SERVO_ADV_GAM2
(reciprocal of derivative gain of phase compensator)

(2) Tuning the Control Parameters

Should adequate controllability or response characteristics fail to be obtained even if the control parameters have been configured as instructed in the previous step, increase or decrease the value of SERVO_ADV_GAIN. If the converter reacts with oscillatory responses, decrease the value in units of 20 to 30% as a rule. If the converter is too slow in response, increase the value in units of 20 to 30%. If the overshoot is intolerably large on the air intake side in particular, increase the value of SERVO_ADV_RATE in increments of approximately 0.1 (to a maximum of 0.6). This strategy may sometimes improve the response characteristics.

If the overshoot is intolerably large when a medium-capacity valve is used, increase the value of SERVO_ADV_TD2 in increments of approximately 0.05 (to a maximum of 0.3). This strategy sometimes improves the response characteristics.

6. MAINTENANCE

6.1 General

The modular structure of the YPK110 increases the ease of maintenance work. This chapter describes cleaning and part replacement procedures that should be done for maintenance of the YPK110.

The YPK110 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 YPK110 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 YPK110 is attached to the control relay's surface that engages the YPK110's main structure (see Figure 6.1). Detach the control relay from the main structure of YPK110 by following the instruction shown in 6.3.1. 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.

After attaching check that pressure output correctly according to chapter 5.3 "Operation Check".

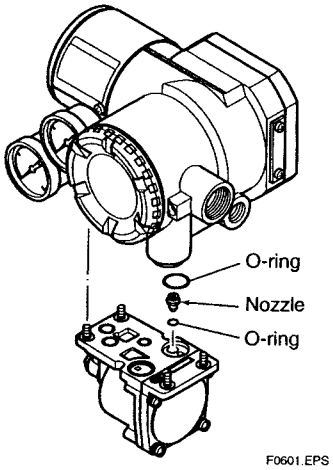


Figure 6.1 Cleaning the Nozzle

⚠ 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 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.

After attaching check that pressure output correctly according to chapter 5.3 "Operation Check".

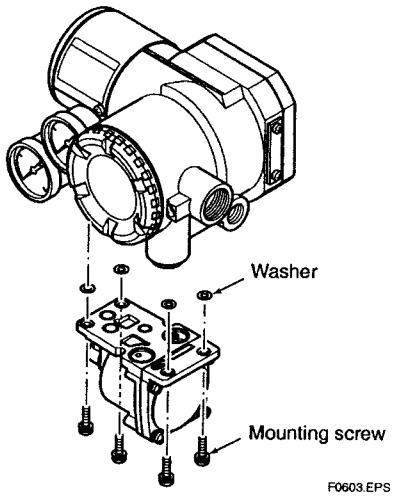


Figure 6.2 Replacing the Control Relay Assembly

6.3.2 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.

After attaching check that pressure output correctly according to chapter 5.3 "Operation Check".

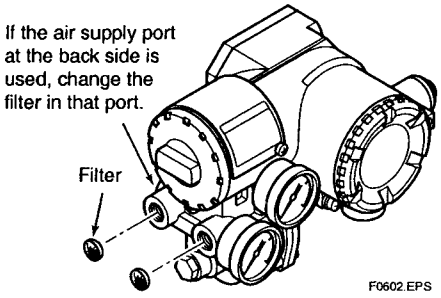


Figure 6.3 Replacing the Screen Filters

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 6.3.1).

(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 YPK110 to its original state.

After attaching check that pressure output correctly according to chapter 5.3 "Operation Check".

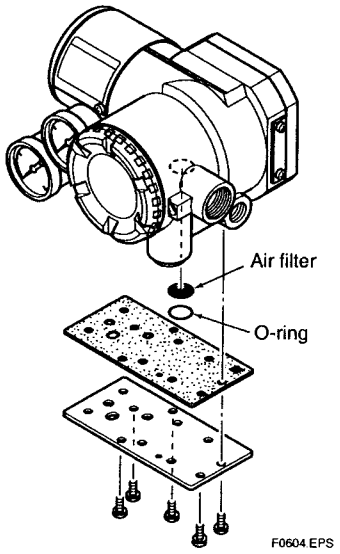


Figure 6.4 Replacing the Internal Air Filter

7. STANDARD SPECIFICATIONS

■ STANDARD SPECIFICATIONS

Functions:

Function blocks:
- AO: One analog output
- DI: Two discrete inputs
- PID: One PID control function (optional)
- OS: One output splitter

Output pressure characterization feature:
- Linear
- Equal percentage (50:1)
- Equal percentage (30:1)
- Quick opening
- Customer characterization (10 segments)

Limit switch function:
- Output pressure of high and low

Diagnostic function:
- A/D converter error, pressure sensor failure, temperature sensor failure, etc.
- Operation result integrate function

Communication:

FOUNDATION Fieldbus

Supply Voltage:

9 to 32 V DC

Steady-state current:

16 mA DC typical (17 mA max.)

Software Download (optional):

Current during Flash ROM blanking time;
Max. 24 mA additional to steady-state current

Fieldbus Foundation download class;
Class 1

Output signal, Supply Air and Pressure Gauge Scale:

No gauge in standard. Pressure gauge can be selected as option.

Output signal	Standard output			
	Output signal	Pressure gauge scale	Air supply pressure	Air supply pressure gauge
Pa	20 to 100kPa	0 to 200kPa	130 to 150kPa	0 to 200kPa
bar	0.2 to 1.0bar	0 to 2.0bar	1.3 to 1.5bar	0 to 2.0bar
psi	3 to 15psi	0 to 30psi	19 to 22psi	0 to 30psi

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Output signal	Doubled output			
	Output signal	Pressure gauge scale	Air supply pressure	Air supply pressure gauge
Pa	40 to 200kPa	0 to 400kPa	230 to 260kPa	0 to 400kPa
bar	0.4 to 2.0bar	0 to 4.0bar	2.3 to 2.6bar	0 to 4.0bar
psi	6 to 30psi	0 to 60psi	34 to 37psi	0 to 60 psi

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The maximum output pressure will be up to 90% of supply pressure

Auto/Manual(A/M) Transfer Switch:

Mounted on front of housing, in manual mode, output signal varied by adjusting the external supply pressure regulator

Zero Adjustment:

Adjustable range; ±10% of span

Span Adjustment:

Adjustable range; 100 to 125% of span
The maximum output pressure will be up to 90% of supply pressure

Air Consumption:

Max. 5.4 Nl/min. or 0.32 Nm3/hr at 140 kPa (20 psi) air supply pressure

Output Air Capacity:

Max. 110 Nl/min. or 6.6 Nm3/hr at 140 kPa (20 psi) air supply pressure

Ambient Temperature Limits:

–40 to 85°C (–40 to 185°F) (Standard model)
–40 to 60°C (–40 to 140°F) (FM Nonincendive)
–40 to 80°C (–40 to 176°F) (Explosion proof model)

Storage Temperature Limits:

–40 to 85°C (–40 to 185°F)

Waterproof and Dust proof Construction:

Complies with NEMA type 4X and IEC IP65

FM Nonincendive:

Class I II, Division 2, Group A, B, C, D, F & G
Class III, Division 1
Class I, Zone 2, Group II C

FM Explosionproof Approval:

Class I, Division 1, Group A, B, C and D

■ PERFORMANCE SPECIFICATIONS

Linearity:

±0.2% of Span

Hysteresis:

0.2% of Span

Repeatability:

0.1% of Span

■ PHYSICAL SPECIFICATIONS

Housing and Cover Material:

Cast aluminum alloy, finished with polyurethane paint.
Deep-sea moss-green (Munsell 0.6GY3.1/2.0)

Pressure Gauge Case: (Optional)

Stainless steel JIS SUS 304

Supply Air, Output Signal, Output Gauge Connections:

1/4 NPT female or Rc 1/4

Electrical Connection:

1/2 NPT female or G1/2, M20

Mounting:

Surface or 2-inch pipe.

Weight:

2.4 kg (5.3 lb) without gauge
2.5 kg (5.5 lb) with gauge

■ MODEL AND SUFFIX CODES

Model	Suffix codes		Description
YPK110	·····		Foundation Fieldbus-to-Pneumatic Converter
Input signal	**-F**·····		Foundation Fieldbus
Output signal	**1**·····		Output signal: 20 to 100 kPa, (Gauge scale: 0 to 200 kPa *3)
	2·····		Output signal: 40 to 200 kPa, (Gauge scale: 0 to 400 kPa *3)
	5·····		Output signal: 0.2 to 1.0 bar, (Gauge scale: 0 to 2 bar *3)
	6·····		Output signal: 0.4 to 2.0 bar, (Gauge scale: 0 to 4 bar *3)
	7·····		Output signal: 3 to 15 psi, (Gauge scale: 0 to 30 psi *3)
	8·····		Output signal: 6 to 30 psi, (Gauge scale: 0 to 60 psi *3)
Connections		**1**·····*1	Air connection: Rc 1/4 female, Electric connection: G 1/2 female
		3·····*2	Air connection: 1/4 NPT female, Electric connection: 1/2 NPT female
		6·····*1	Air connection: Rc 1/4 female, Electric connection: M20 female
————		**N**·····	Always N
Option codes	/□		Optional specification

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*1: Applicable for Output signal 1, 2, 5 and 6.

*2: Applicable for Output signal 5, 6, 7 and 8.

*3: No gauge in standard. Pressure gauge can be selected as option.

■ OPTIONAL SPECIFICATIONS

Item	Description	Code
Lightning protection	Power supply 9 to 32V DC Allowable current Max. 6000 A(1× 40 μs), repeating 1000 A(1× 40 μs), 100 times	**A**
Painting	Epoxy resin coating	**X1**
PID Function	PID control function	**LC1**
With pressure gauge	Scale unit: Pa *1	**GP**
	Scale unit: bar *2	**GB**
	Scale unit: psi *3	**GE**
Explosionproof type	FM Explosionproof Approval	**FF1**
	FM Nonincendive Approval	**FN15**
Software download	Software download for FOUNDATION Fieldbus Download class: Class 1	**EE**

T0704.EPS

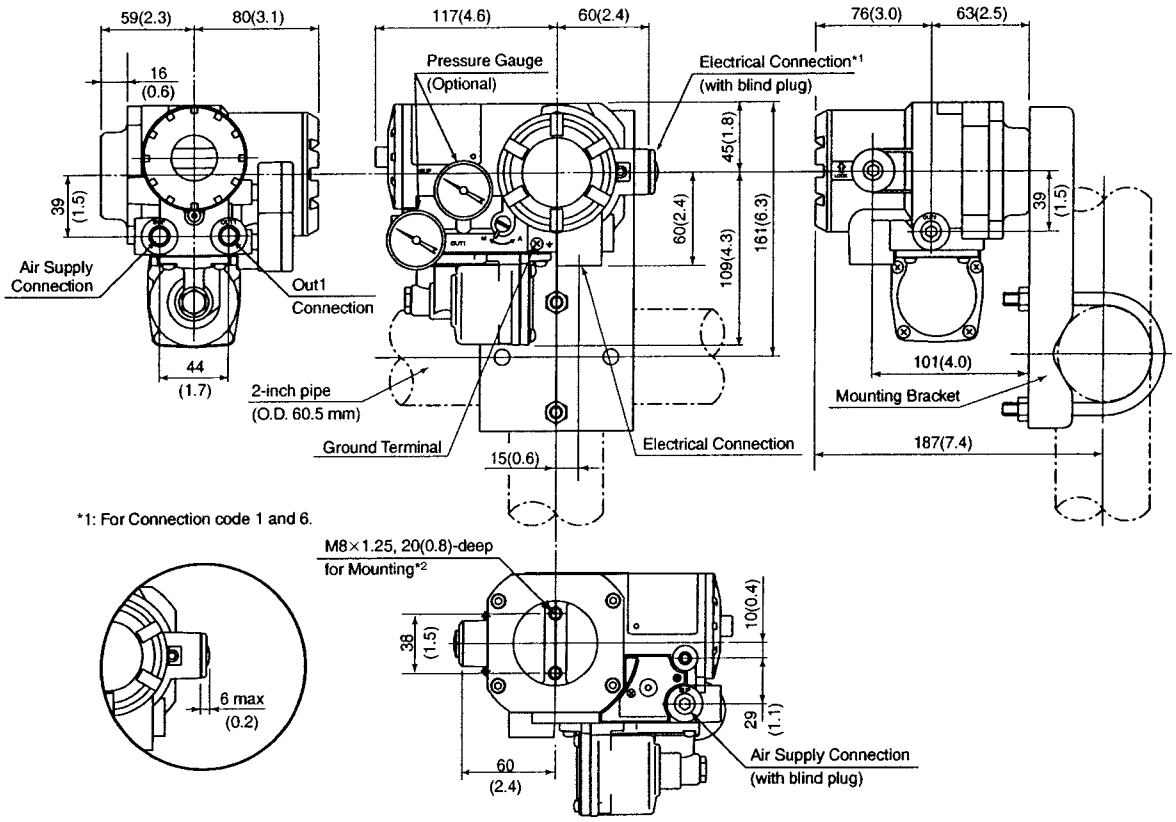
*1: Applicable for Output signal 1 and 2.

*2: Applicable for Output signal 5 and 6.

*3: Applicable for Output signal 7 and 8.

■ DIMENSIONS

Unit: mm (approx. inch)



*2: Attached with 2 mounting bolts (M8, 25 mm) and spring washers (applicable 3 to 6 mm thick brackets).

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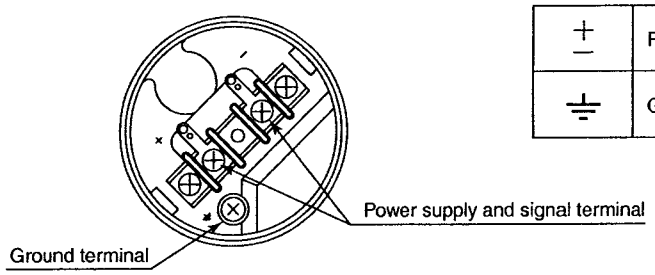
● Terminal Configuration



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● Terminal Wiring

+ / −	Power supply and signal terminal
⏚	Ground terminal

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.

YPK110 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 YPK110

The YPK110 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 YPK110.

(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

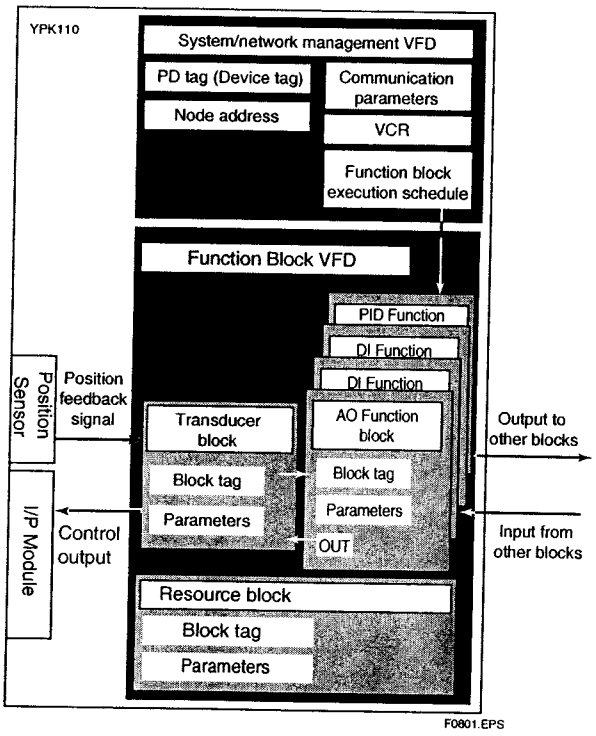

Figure 8.1 Logical Structure of Each Block

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. YPK110 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 #18) and cycle period of within 5 cm (2 inches) may be used. Termination processing depends on the type of device being deployed. For YPK110, use an M4 screw terminal claw. Some hosts require a connector.

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

8.4.1 Connection of Devices

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.

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.

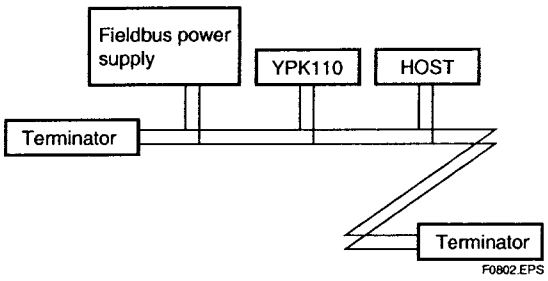

Figure 8.2 Cabling

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 YPK110 needs to be installed. Check if host has the following directory under its default DD directory.

594543/000A
(594543 is the manufacturer number of Yokogawa Electric Corporation, and 000A is the YPK110 device number, respectively.)

If this directory is not found, DD of YPK110 has not been included. Create the above directory and copy the DD file (0m0n.ffo,0m0n.sym) (m, n is a numeral) into the directory.

Once the DD is installed in the directory, the name and attribute of all parameters of the YPK110 are displayed.

Off-line configuration is allowed by using the capability file (CFF). If you do not have the DD or capability file for the YPK110, you can download it from following address.

www.yokogawa.com/fi/fieldbus/download.htm

IMPORTANT

For offline configuration, use the CFF which matches the specification of the instrument to be configured. For YPK110, 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 YPK110 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 60 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 YPK110 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 20 to 247 (or hexadecimal 0x14 to 0xF7) can be set. Generally, the device (LM device) with bus control function (Link Master function) is allocated from a smaller address number (20) side, and other devices (BASIC device) without bus control function allocated from a larger address number (247) side respectively. Set the range of addresses to be used to the LM device, Unused, and BASIC 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.

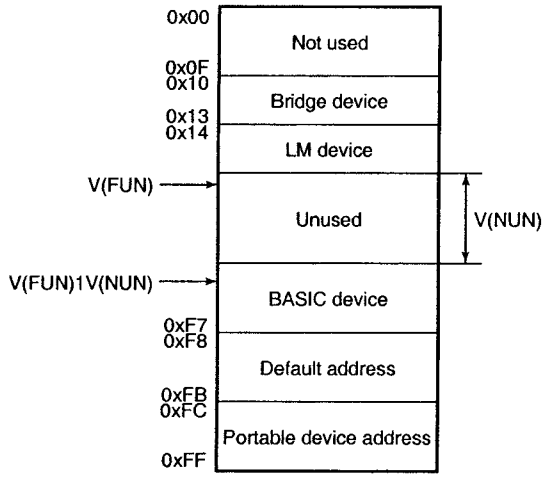

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Figure 9.1 Available Range of Node Addresses

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 YPK110 specification values.

Table 9.2 Operation Parameter Values of the YPK110 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 YPK, 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 YPK, 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 YPK, 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 YPK110 link object with reference to "Block setting" in Section 9.6 for details.

For the YPK110, 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 YPK110 schedule according to the following table. Enclosed values in the table are factory-settings. YPK110 schedule is set as shown in the following. Change it as necessary.

Table 9.3 Execution Schedule of the YPK110 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)
278 (SM)	FB_START_ENTRY.2	—
	⋮	
289 (SM)	FB_START_ENTRY.14	—

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A maximum of 105 ms is taken for execution of an AO block, a maximum of 40 ms for execution of each DI block a maximum of 95 ms for an OS block, and a maximum of 120 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 YPK110 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.

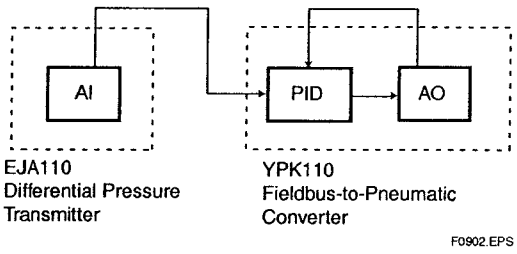

Figure 9.2 Example of Loop Connecting Function Block of YPK110 with other instruments

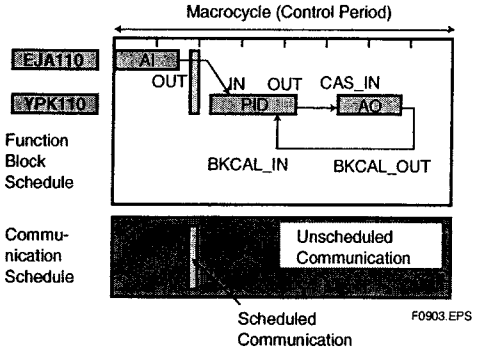

Figure 9.3 Function Block Schedule and Communication Schedule

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 YPK110. Connect YPK110 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. YPK110 must be transferred to this state when a tag or address is changed.

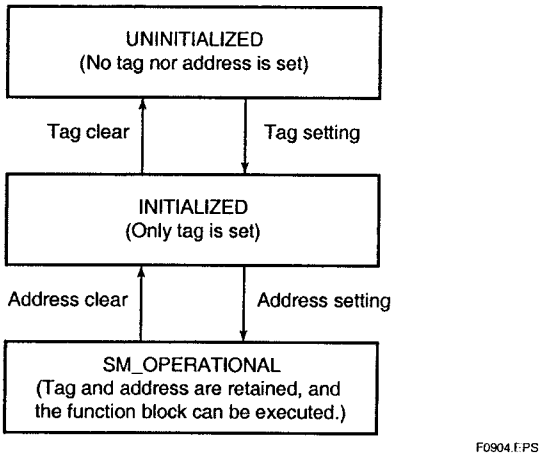

Figure 9.4 Status Transition by Setting PD Tag and Node Address

YPK110 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 YPK110s are connected at a time, one YPK110 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 YPK110 is 594543000Axxxxxxxx. (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. YPK110 has 29 VCRs whose application can be changed, except for the first VCR, which is used for management.

YPK110 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. YPK110 has 25 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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25 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. YPK110 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. YPK110 has 10 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 9.12.

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

Idx.	Parameter Mnemonic	VIEW 1	VIEW 2	VIEW 3 1st	VIEW 3 2nd	VIEW 4 1st	VIEW 4 2nd	VIEW 4 3rd	VIEW 4 4th	VIEW 4 5th	VIEW 4 6th
1	ST_REV	2	2	2	2	2	2	2	2	2	2
2	TAG_DESC										
3	STRATEGY					2					
4	ALERT_KEY					1					
5	MODE_BLK	4		4							
6	BLOCK_ERR	2		2							
7	UPDATE_EVT										
8	BLOCK_ALM										
9	TRANSDUCER_DIRECTORY										
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_PRESSURE_VALUE	5		5							
18	ACT_FAIL_ACTION					1					
19	ACT_MAN_ID					4					
20	ACT_MODEL_NUM					32					
21	ACT_SN					32					
22	VALVE_MAN_ID						4				
23	VALVE_MODEL_NUM						32				
24	VALVE_SN						32				
25	VALVE_TYPE						1				
26	XD_CAL_LOC							32			
27	XD_CAL_DATE							7			
28	XD_CAL_WHO							32			
29	ALARM_SUM	8		8							
30	FINAL_PRESS_HI		4								
31	FINAL_PRESS_LO		4								
32	SUPPLY_PRESSURE		4								
33	PRESSURE_UNIT		2								
34	OUT_PRESSURE	4		4							
35	PRESSURE_HI		4								
36	PRESSURE_LO		4								
37	CAL_PRESS_HI		4								
38	CAL_PRESS _LO		4								
39	CAL_PRESS_P		4								
40	OUTPUT_CHAR_TYPE		1								
41	OUTPUT_CHAR										
42	LIMSW_HI_LIM		4								
43	LIMSW_LO_LIM		4								
44	TEMPERATURE_UNIT		2								
45	ELECT_TEMP	4		4							
46	USER_CAL_EXEC			1							
47	USER_CAL_RESET			1							
48	USER_CAL_RESULT			1							

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Idx.	Parameter Mnemonic	VIEW 1	VIEW 2	VIEW 3 1st	VIEW 3 2nd	VIEW 4 1st	VIEW 4 2nd	VIEW 4 3rd	VIEW 4 4th	VIEW 4 5th	VIEW 4 6th
49	CAL_PRESSURE			4							
50	ADVAL_FW			2							
51	ADVAL_BW			2							
52	ADVAL_T			2							
53	PRESS_VERTICAL_FEED_COUNT			4							
54	TOTAL_PRESS_VARIATION			4							
55	TOTAL_PRESS_OUT_TIME			4							
56	TOTAL_CUTOFF_LO_TIME			4							
57	PRESSURE_VARIATION_DEADBAND						4				
58	PRESS_VERTICAL_FEED_COUNT_LIM						4				
59	TOTAL_PRESS_VARIATION_LIM						4				
60	TOTAL_PRESS_OUT_TIME_LIM						4				
61	TOTAL_CUTOFF_LO_TIME_LIM						4				
62	DEVIATION_LIM							4			
63	DEVIATION_TIME_TH							8			
64	RELEASE_FAILSAFE			1							
65	MODEL								32		
66	DEV_OPTIONS							2			
67	RATING_OUTPUT_TYPE							1			
68	RELAY_TYPE							1			
69	MASK_XD_ERROR							2			
70	CURRENT_GAIN_NUM				1						
71	SERVO_OUTPUT_SIGNAL	4		4							
72	SERVO_DEADBAND								4		
73	SERVO_OFFSET								4		
74	SERVO_GAIN_SELECTION		1								
75	SERVO_ADV_GAIN								4		
76	SERVO_ADV_RESET								4		
77	SERVO_ADV_RATE								4		
78	SERVO_ADV_GAM1								4		
79	SERVO_ADV_TD2								4		
80	SERVO_ADV_GAM2								4		
81	SERVO_RESERVE1								4		
82	SERVO_RESERVE2								4		
83	SERVO_RESERVE3								4		
84	SERVO_RESERVE4								4		
85 to 132	TEST_1 to TEST_48	0	0	29	97	0	0	0	5	88	47
	Total (in bytes)	41	61	100	100	84	91	91	87	90	49

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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 OS 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	SP	5		5	
8	OUT_1	5		5	
9	OUT_2	5		5	
10	OUT_1_RANGE		11		
11	OUT_2_RANGE		11		
12	GRANT_DENY		2		
13	STATUS_OPTS				2
14	CAS_IN	5		5	
15	BKCAL_OUT			5	
16	IN_ARRAY				16
17	OUT_ARRAY				16
18	LOCKVAL				1
19	BKCAL_IN_1			5	
20	BKCAL_IN_2			5	
21	BAL_TIME				4
22	HYSTVAL				4
23	UPDATE_EVT				
24	BLOCK_ALM				
	Total (in bytes)	28	26	43	48

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Table 9.11 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 9.12 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	FAULT_STATE	1		1	
29	SET_FSTATE				
30	CLR_FSTATE				
31	MAX_NOTIFY				1
32	LIM_NOTIFY		1		
33	CONFIRM_TIME		4		
34	WRITE_LOCK		1		
35	UPDATE_EVT				
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				

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Relative index	Parameters	VIEW 1	VIEW 2	VIEW 3	VIEW 4
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	
53	SOFTDWN_PROTECT				1
54	SOFTDWN_FORMAT				1
55	SOFTDWN_COUNT				2
56	SOFTDWN_ACT_AREA			1	
57	SOFTDWN_MOD_REV			16	
58	SOFTDWN_ERROR			2	
	Total (in bytes)	22	30	73	35

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Table 9.13 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 through 40203	40204 through 40209
AO Function Block	40500	40501	40502	40503
DI1 Function Block	40600	40601	40602	40603
DI2 Function Block	40610	40611	40612	40613
OS Function Block	41400	41401	41402	41403
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 YPK110, refer to the chapter for each function block and the list of parameters in the latter part of this manual.

10. ACTIONS OF YPK110 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 YPK110.

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
OS	Auto, Cas, (IMan), 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 YPK110 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 YPK110 (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 YPK110 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 YPK110 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

T1003.EPS

10.3 Simulation Function

The YPK110 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 YPK110'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 YPK110 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.

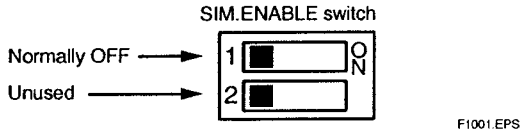

Figure 10.1 SIM.ENABLE Switch

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.
9	Memory Failure	When an unusual file is downloaded
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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11.3 Device Status

When fault occurs, the corresponding bits in the parameters DEVICE_STATUS_1 to _3 of the resource block are set on. Table 11.2 to 11.4 show the codes and indication corresponding to the individual bits in DEVICE_STATUS_1 to _3 as well as the meanings represented.

Table 11.2 DEVICE_STATUS_1

Hexadecimal Indication	Indication when Device Description is installed.	Meaning
0x80000000		
0x40000000		
0x20000000		
0x10000000		
0x08000000		
0x04000000		
0x02000000		
0x01000000		
0x00800000	Sim.enable Jmpr On	The SIM.ENABLE switch on the amplifier is set to ON.
0x00400000	RB is in O/S mode	The Resource block is in O/S mode.
0x00200000		
0x00100000		
0x00080000	EEPROM Failure	EEPROM failure
0x00040000		
0x00020000		
0x00010000		
0x00008000	Link Obj.1/17 not open	The VCR*1 to which link object 1 or 17 is specified to be linked is not open.
0x00004000	Link Obj.2/18 not open	The VCR*1 to which link object 2 or 18 is specified to be linked is not open.
0x00002000	Link Obj.3/19 not open	The VCR*1 to which link object 3 or 19 is specified to be linked is not open.
0x00001000	Link Obj.4/20 not open	The VCR*1 to which link object 4 or 20 is specified to be linked is not open.
0x00000800	Link Obj.5/21 not open	The VCR*1 to which link object 5 or 21 is specified to be linked is not open.
0x00000400	Link Obj.6/22 not open	The VCR*1 to which link object 6 or 22 is specified to be linked is not open.
0x00000200	Link Obj.7/23 not open	The VCR*1 to which link object 7 or 23 is specified to be linked is not open
0x00000100	Link Obj.8/24 not open	The VCR*1 to which link object 8 or 24 is specified to be linked is not open.
0x00000080	Link Obj.9/25 not open	The VCR*1 to which link object 9 or 25 is specified to be linked is not open.
0x00000040	Link Obj.10 not open	The VCR*1 to which link object 10 is specified to be linked is not open.
0x00000020	Link Obj.11 not open	The VCR*1 to which link object 11 is specified to be linked is not open.
0x00000010	Link Obj.12 not open	The VCR*1 to which link object 12 is specified to be linked is not open.
0x00000008	Link Obj.13 not open	The VCR*1 to which link object 13 is specified to be linked is not open.
0x00000004	Link Obj.14 not open	The VCR*1 to which link object 14 is specified to be linked is not open.
0x00000002	Link Obj.15 not open	The VCR*1 to which link object 15 is specified to be linked is not open.
0x00000001	Link Obj.16 not open	The VCR*1 to which link object 16 is specified to be linked is not open.

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*1: VCR: Virtual Coummunications Relationship

Table 11.3 DEVICE_STATUS_2

Hexadecimal Indication	Indication when Device Description is installed.	Meaning
0x80000000		
0x40000000		
0x20000000		
0x10000000		
0x08000000		
0x04000000		
0x02000000		
0x01000000	TB USER_CAL _RESULT not Succeeded	User Calibration has not been succeeded.
0x00800000		
0x00400000		
0x00200000	OS BLOCK_ERR not Zero	Block Error has occurred in the OS block.
0x00100000	PID BLOCK_ERR not Zero	Block Error has occurred in the PID block.
0x00080000	DI2 BLOCK_ERR not Zero	Block Error has occurred in the DI2 block.
0x00040000	DI1 BLOCK_ERR not Zero	Block Error has occurred in the DI1 block.
0x00020000	AO BLOCK_ERR not Zero	Block Error has occurred in the AO block.
0x00010000	TB XD_ERROR not Zero	XD Error has occurred in the Transducer block.
0x00008000		
0x00004000		
0x00002000		
0x00001000	PID in Bypass active	Bypass is activated in PID block.
0x00000800	DI2 in Simulate active	SIMULATE is activated in DI2 block.
0x00000400	DI1 in Simulate active	SIMULATE is activated in DI1 block.
0x00000200	AO in Simulate active	SIMULATE is activated in AO block.
0x00000100		
0x00000080		
0x00000040		
0x00000020	OS in O/S mode	OS block is in O/S mode.
0x00000010	PID in O/S mode	PID block is in O/S mode.
0x00000008	DI2 in O/S mode	DI2 block is in O/S mode.
0x00000004	DI1 in O/S mode	DI1 block is in O/S mode.
0x00000002	AO in O/S mode	AO block is in O/S mode.
0x00000001	TB in O/S mode	TB block is in O/S mode.

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Table 11.4 DEVICE_STATUS_3

Hexadecimal Indication	Indication when Device Description is installed.	Meaning
0x80000000		
0x40000000		
0x20000000		
0x10000000		
0x08000000		
0x04000000		
0x02000000		
0x01000000		
0x00800000		
0x00400000		
0x00200000		
0x00100000		
0x00080000		
0x00040000		
0x00020000		
0x00010000		
0x00008000		
0x00004000		
0x00002000	A/D Converter failure	Shows the contents of the XD_ERROR in the transducer block. Refer to 12.5.1 XD_ERROR for details.
0x00001000	Deviation error	
0x00000800	Operation point drift warning	
0x00000400	Pressure sensor failure	
0x00000200	Temperature sensor failure	
0x00000100	Deviation warning	
0x00000080	Pressure sensor out of range	
0x00000040	Temperature sensor out of range	
0x00000020	Span value out of range	
0x00000010	Zero value out of range	
0x00000008	Total cutoff lower limit exceeded	
0x00000004	Total pressure out limit exceeded	
0x00000002	Pressure variation limit exceeded	
0x00000001	Pressure vertical feed limit exceeded	

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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 YPK110 as a Fieldbus-to-Pneumatic Converter are packed in the transducer block. Major functions of the transducer blocks include:

- Transmission and reception of setpoint and readback signals for output pressure
- Setpoint high/low limiters
- Low cut-off and High cut-off function
- Output pressure characteristics conversion
- Fail safe

The transducer block in a YPK110 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 output pressure characteristics conversion;
- Limits the setpoint within a specified range; and
- Performs Low cut-off and High cut-off action as necessary.

The input from the AO block is always a percentage value where the transducer block always regards 0% to be the low pressure output. Make the correct settings at initial setup according to the specifications of the valve (in reference with Chapter 5, "Setup").

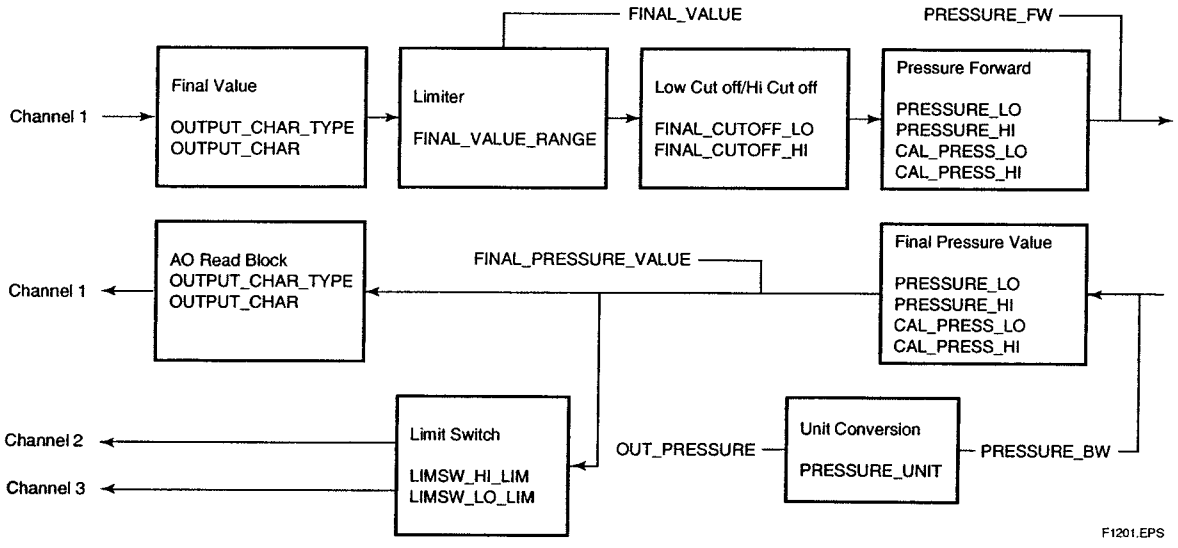


Figure 12.1 Function Diagram of Transducer Block

12.2.2 Output pressure Characteristic Conversion

The parameter OUTPUT_CHAR_TYPE defines the characteristics between the output of AO block and output pressure, 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 characteristic conversion is applied to the signal in the backword path as well.

In addition, the output pressure characteristics curve is inverted by selecting ACT_FAIL_ACTION which is the parameter for determining the direction of valve action. The output pressure characteristics curve is inverted symmetrically around the 50% point of the "Linear" output characteristics graph. This direction of action is also true with cases where the "User define" option is set for the output characteristics.

ACT_FAIL_ACTION

1 = Self-closing (Air to Open)

2 = Self-opening (Air to Close)

12.2.3 FINAL_VALUE and Range

The parameter FINAL_VALUE contains the output pressure setpoint for pressure control, and its value is always a percent value where 0% is the low pressure output 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 Low cut-off and High cut-off function

Low cut-off function is an action to decrease the output pressure to a level much lower than the 0% pressure level when FINAL_VALUE.value is less than FINAL_VALUE_CUTOFF_LO. After the Low cut-off action is activated, when FINAL_VALUE.value becomes greater than FINAL_VALUE_CUTOFF_LO by 1% or more, the Low cut-off action will turn off.

Conversely, the High cut-off function is an action to increase the output pressure to a level much higher than the 100% pressure level when FINAL_VALUE.value is larger than FINAL_VALUE_CUTOFF_HI. After the High cut-off action is activated, when FINAL_VALUE.value becomes less than FINAL_VALUE_CUTOFF_HI by 1% or more, the High cut-off action will turn off.

Although the actual output signal level is changed to a level outside the range during the period when the Low cut-off and High cut-off 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_PRESSURE_VALUE

The parameter FINAL_PRESSURE_VALUE contains a percentage value of the output pressure sent from the pressure sensor where 0% is the low pressure position as is the case for FINAL_VALUE.value. When one or more of the following conditions become true, the data status of FINAL_PRESSRE_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 pressure sensor has failed.
- Bad - Device failure: The A/D converter has failed.
- Bad - Non specific: The deviation exceeds the limit.

The OUT_PRESSURE parameter enables the output pressure to be shown in a user-defined system of pressure units. To select a pressure unit system, use the PRESSURE_UNIT parameter. The pressure unit systems that can be selected are:

1133: kPa

1137: bar

1141: psi

1145: kgf/cm^2

12.3.2 Limit Switches

Limit switches monitor whether the output pressure has reached a specified high or low limit value 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_PRESSURE_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_PRESSURE_VALUE becomes greater by 1 % or more than the value of LIMSW_LO_LIM.

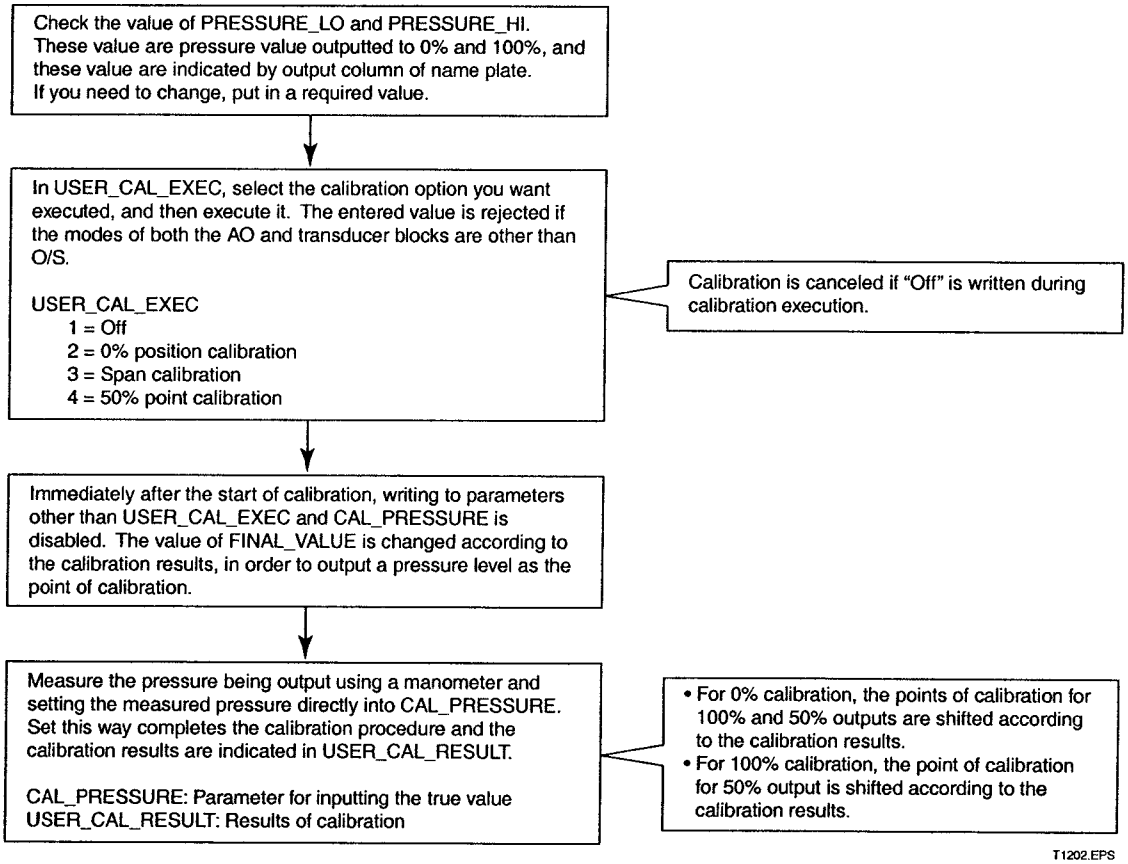
12.4 User Calibration

User calibration is a feature with which you can measure output pressure at a desired point (0%, 100% or 50% point) using a manometer to calibrate the converter to determine its output pressure.

Start user calibration by writing a value into USER_CAL_EXEC. At this point, the modes of the AO function block and the transducer block must be set to O/S. During user calibration, writing to parameters other than USER_CAL_EXEC and CAL_PRESSURE is disabled.

Follow the procedure below.

Table 12.2 User Calibration Procedure



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Any value that can be written into CAL_PRESSURE has its own adjustable range. This parameter only accepts values which fall within the ranges shown in Table 12.3. Enter values using the unit system selected in PRESSURE_UNIT. The adjustable ranges are based on the rated spans.

Table 12.3 Adjustable Ranges

	Adjustable Range
Zero point	–15 to +15%
100% point	–15 to +15%
50% point	–10 to +10%

T1203.EPS

The results of user calibration are written into USER_CAL_RESULT. Should any error occur, user calibration is invalidated and the parameters will not be updated.

Table 12.4 USER_CAL_RESULT Parameter

Code	Status	Description	Criteria
1	Success	Calibration success	Calbration has been completed.
2	Warning	Calibration cancel	The execution of calibration has been canceled.
20	Error	Zero adjust range over error	The difference between PRESSURE_LO and CAL_PRESSURE exceeds ±15% of the rated span.
21	Error	Span adjust range over error	The difference between PRESSURE_HI and CAL_PRESSURE exceeds ±15% of the rated span.
22	Error	Linear input over error	The difference between (PRESSURE_LO and PRESSURE_HI)/2 and CAL_PRESSURE exceeds ±10% of the rated span.

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12.5 Online Diagnostics

The YPK110 features functions to diagnose the YPK110 itself during online. The following describes the self-diagnostics function related to the transducer block.

12.5.1 XD_ERROR

The transducer block performs self-diagnostics and writes the results to the parameter XD_ERROR. Table 12.5 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.

Note that "104: Zero value out of range" and "105: Span value out of range" among the XD_ERROR items can be masked by entering a bit code in MASK_XD_ERROR, in order to prevent them from being provided as error outputs. To do so, use a bit code to activate the bit in the position for prohibiting error code output. Sum up the bits of bit codes when selecting two error codes. The bit codes are found in Table 12.6.

Table 12.5 XD_ERROR Parameter

Index			Mask
100	Pressure vertical feed limit exceeded	If PRESS_VERTICAL_FEED _COUNT is greater than PRESS_VERTICAL_FEED_COUNT _LIM	
101	Pressure Variation limit exceeded	If TOTAL_PRESS_VARIATION is greater than TOTAL_PRESS _VARIATION_LIM	
102	Total pressure out limit exceeded	If TOTAL_PRESS_OUT_TIME is greater than TOTAL_PRESS_OUT _TIME_LIM	
103	Total cutoff lower limit exceeded	If TOTAL_CUTOFF_LO_TIME is greater than TOTAL_CUTOFF_LO _TIME_LIM	
104	Zero value out of range	PRESSURE_LO is outside –10 to +10% (rated span) of the rated zero point.	bit: 4
105	Span value out of range	(PRESSURE_HI – PRESSURE_LO) is outside +0 to +25% (rated span).	bit: 5
110	Temperature out of range	The measured temperature value is outside –45°C to +90°C.	
111	Pressure out of range	The measured pressure value is outside –10 to 500 kPa.	
112	Deviation warning	The absolute deviation value remains at a value greater than DEVIATION_LIM for a period of DEVIATION_TIME_TH[1] hours.	
121	Temperature sensor failure	The temperature sensor is defective; the measured value is outside –65°C to +110°C.	
122	Operation point drift warning	A large shift in the operating point; the steady-state operating point remains outside the range from OFFSET_LO_LIM to OFFSET_HI_LIM for at least 10 seconds.	
123	Deviation error	The absolute deviation value remains at a value greater than DEVIATION_LIM for a period of DEVIATION_TIME_TH[2] hours.	
124	Pressure sensor failure	The output pressure sensor is defective; the measured value is outside –100 to 600 kPa.	
125	A/D Converter failure	A/D converter failure; this message is given if conversion does not end within the normal period.	

T1205.EPS

Table 12.6 XD_ERROR Parameter Bit Codes

Pressure verticalMasked XD_ERROR Items	Bitstring															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
104: Zero value out of range	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
105: Span value out of range	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0

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12.5.2 Fail-safe Action

If the "A/D converter failure," "pressure 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 "pressure 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.

12.5.3 Operation Result Integration

The YPK110 has a function to integrate the following operation result quantities individually.

Table 12.7 Integration Parameters

Item	Parameter (Upper line = total sum; lower line = alarm threshold)	Access Means
Air pressure rise/fall frequency (times)	PRESSURE_VERTICAL_FEED_COUNT	Each change in the direction of pressure output is counted as one time. Dead bands can be set using PRESSURE_VARIATION_DEADBAND.
	PRESSURE_VERTICAL_FEED_COUNT_LIM	
Total air pressure [×100%]	TOTAL_PRESS_VARIATION	The amounts of change in relation to the span of output pressure, which is defined as 100%, are totaled irrespective of the direction of air pressure chainges. Dead bands can be set using PRESSURE_VARIATION_DEADBAND.
	TOTAL_PRESS_VARIATION_LIM	
Air pressure output time [hours]	TOTAL_PRESS_OUT_TIME	The periods of time when the converter is not in a low-cutoff state are totaled.
	TOTAL_PRESS_OUT_TIME_LIM	
Air pressure low-cutoff time [hours]	TOTAL_CUTOFF_LO_TIME	The periods of time when the converter is in a low-cutoff state are totaled.
	TOTAL_CUTOFF_LO_TIME_LIM	

T1207.EPS

Parameters for setting thresholds are available for the respective total values. If the setpoint of any of these threshold parameters exceeds its total value, a block alarm is issued.

The integration parameters listed above can be reset by writing 0 into them. Care must be taken since the integration information that has been obtained to date is cleared if the parameters are reset.

12.5.4 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.

12.6 Temperature Measurement

The YPK110 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:

1001 = °C

1002 = °F

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).

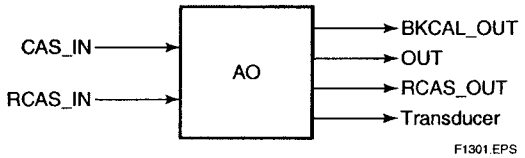


Figure 13.1 Inputs/Outputs of AO Function Block

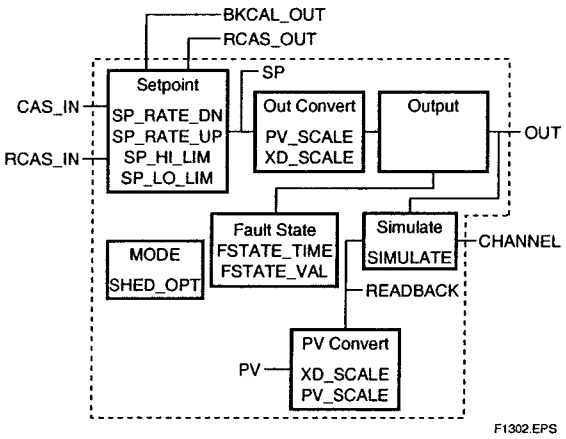


Figure 13.2 Function Diagram of AO Function Block

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

As for Fieldbus-enabled positioners including the YPK110, not only a power failure but also other errors (such as a communication error) can cause the fail-safe action. For example, when the status of the CAS_IN input of the AO block from its upstream block indicates a specific status, such as a communication error, the case is regarded as an abnormality and fault state actions including a mode change are enacted.

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. The factory setting is to hold the output.

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

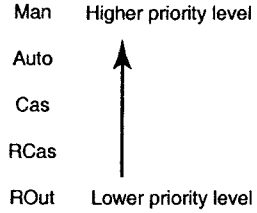
When the data status of RCAS_IN falls to Bad while the block in question is running in RCas (remote cascade) mode, mode shedding occurs in accordance with the setting in SHED_OPT. Table 13.3 shows the available selections for SHED_OPT setting for the AO block.

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.

T1303.EPS

(*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 YPK110 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

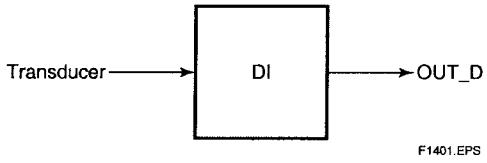

Figure 14.1 Inputs/Outputs of DI Function Block

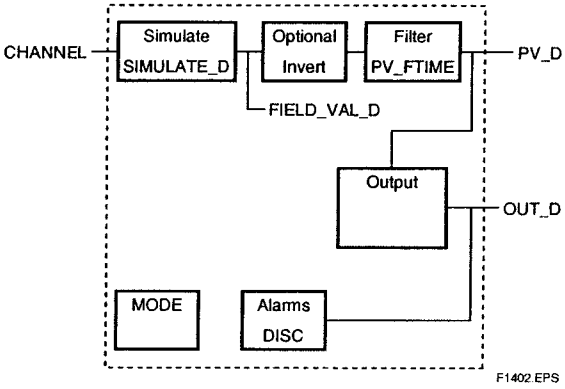

Figure 14.2 Function Diagram of DI Function Block

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.

T1402.EPS

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.

T1403.EPS

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.

T1404.EPS

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. OS FUNCTION BLOCK

15.1 General

The OS (output splitter) function block is used to split a single control signal into two parts for coordinating the actions of two or more valves, such as for split-range control or sequencing control of a large and a small valves. The OS block receives a control signal and converts it into two signals in accordance with the predefined relationships. The major functions of the OS block include:

- Conversion of the setpoint (SP) value into two output values (OUT_1 and OUT_2) in accordance with the user-specified characteristics (set in IN_ARRAY and OUT_ARRAY)
- Generation of the output value to be fed back to the upstream block (BKCAL_OUT)

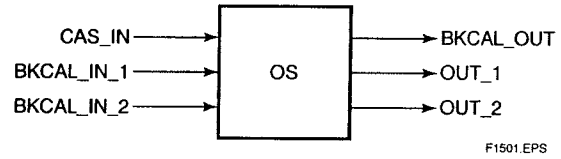

Figure 15.1 Inputs/Outputs of OS Function Block

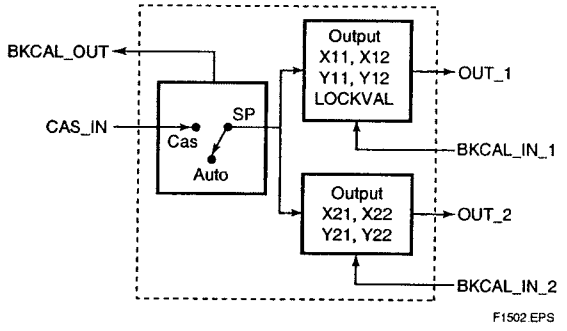

Figure 15.2 Function Diagram of OS Function Block

15.2 Modes

The target mode for the OS function block can be set from three block modes: Cas, Auto, and O/S. Regardless of the target mode, the OS block automatically enters the IMan mode when a specified condition is met.

15.3 Output Processing

The values of OUT_1 and OUT_2 with respect to the value of SP, which is the value of the input from the upstream block (CAS_IN) in the Cas mode or the local setpoint value in the Auto mode, are determined as shown in the following graphs.

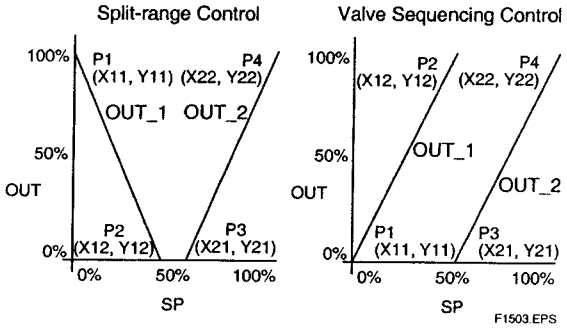

Figure 15.3 Examples of Valve Operation Characteristics

These characteristics are determined by the array element values in parameters IN_ARRAY and OUT_ARRAY.

IN_ARRAY: [X11, X12, X21, X22]
OUT_ARRAY: [Y11, Y12, Y21, Y22]

Coordinates P1 (X11, Y11) and P2 (X12, Y12) define the start and stop points of the characteristics for OUT_1, and P3 (X21, Y21) and P4 (X22, Y22) define those for OUT_2. These two operation characteristics may overlap each other, or start from the same point and have different slopes; however, all the following conditions must be met at all times. Settings of IN_ARRAY that do not meet one or more of these conditions cause a BLOCK_ERR, disabling the block from exiting the O/S mode.

$X21 \geq X11$
$X12 > X11$
$X22 > X21$

In areas outside the endpoints (i.e., start and stop points) of each operation characteristic, the output is retained at the Y value at the nearer end point. For OUT_1, however, depending on the setting of LOCKVAL, it is possible to:

Set the value of OUT_1 to Y11 in the areas outside the endpoints if SP is greater than X12 and if LOCKVAL is false.

When this action is enabled, the value set in HYSTVAL serves as hysteresis, which affects the output as follows:

When SP has increased beyond X12, OUT_1 is set to Y11.
Then, after SP has decreased below X12 minus HYSTVAL, OUT_1 returns to follow the set characteristic.

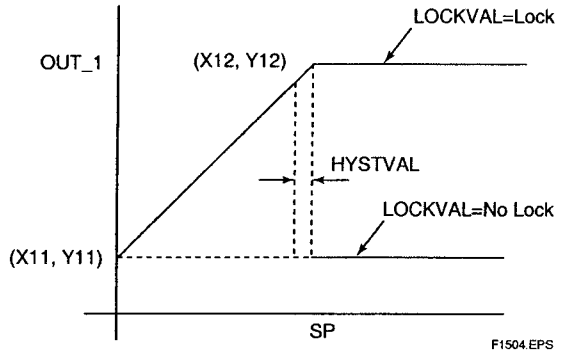

Figure 15.4 LOCKVAL and HYSTVAL

When both downstream blocks of the OS block are ready for cascade connection, the OS block connects the block on the side of OUT_1 first. For bumpless mode change on the side of OUT_2, the balancing time for connection can be set in BAL_TIME. When either downstream block alone is ready for cascade connection, the OS block connects it and enters the Cas mode. When neither downstream block is ready for cascade connection, the mode of the OS block is set to IMan.

15.4 Backward Path (BKCAL_OUT)

The value of SP or a value calculated from the value of either BKCAL_IN_1 or BKCAL_IN_2, depending on the handshake status with the downstream blocks, is output through BKCAL_OUT. In normal operating conditions (i.e., BLK_MODE.actual is Cas or Auto), BKCAL_OUT is set to the value of SP.

15.5 STATUS_OPTS

STATUS_OPTS is a parameter that stipulates options about the block's signal processing and mode transitions. Table 15.1 shows the options available in STATUS_OPTS of the OS block.

Table 15.1 STATUS_OPTS of OS Block

Bit	Meaning	Description
1	IFS if BAD CAS_IN	If this option is True, then: Set the sub-status components of OUT_1.status and OUT_2.status to Initial Fault State (IFS) if CAS_IN.status is Bad.
4	Propagate Fault Backward	If this option is True, then: Set the status of BKCAL_OUT to device failure if the quality and sub-status components of both BKCAL_IN_1 and BKCAL_IN_2 are Bad-Sensor Failure and Device Failure, respectively. If this option is False, then: Set the status of BKCAL_OUT to device failure if the quality and sub-status components of either or both BKCAL_IN_1 and BKCAL_IN_2 are Bad-Sensor Failure and Device Failure, respectively.

T1501.EPS

15.6 Alarm Processing

When the condition shown in the table below is met in the OS block, the OS block changes the bit statuses of BLOCK_ERR accordingly and generates a block alarm (BLOCK_ALM).

Table 15.2BLOCK_ERR in OS Block

Bit	Name of Error Represented	Description
1	Block Configuration Error	The settings of IN_ARRAY and OUT_ARRAY satisfy one or more of the following conditions: X21 < X11, X12 ≤ X11, X22 ≤ X21
15	Out of Service	The target mode (MODE_BLK.target) is OS.

T1502.EPS

16. PID FUNCTION BLOCK

16.1 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 variable (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

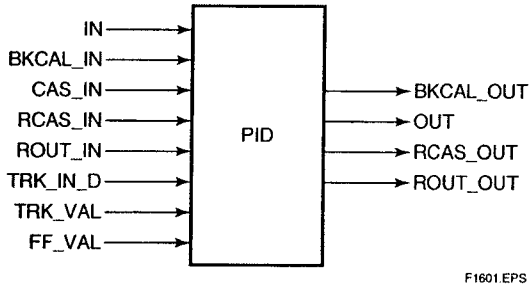

Figure 16.1 Inputs/Outputs of PID Function Block

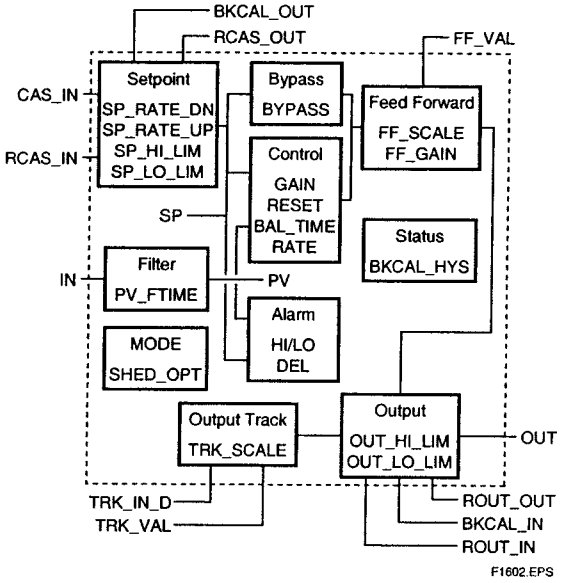

Figure 16.2 Function Diagram of PID Function Block

16.2 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.

16.3 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).

16.4 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).

16.5 PID Computation

For PID control, the PID block in a YPK110 employs the PV-proportional and PV-derivative type PID control algorithm (referred to as the I-PD control algorithm) for Auto and RCas mode. This algorithm mensures 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.

For Cas mode, PV-derivative type PID control algorithm (referred to as the PI-D control algorithm) is employed in order to obtain better performance against the changes in the setpoint.

The algorithm is automatically changed by the block according to the mode. A basic form of each algorithm is expressed in the equation below.

In Auto / RCas mode

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

In Cas mode

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

Where ;

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 16.1 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

T1601.EPS

16.6 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 YPK110 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 readback value of the MV(OUT), MV_{RB} (BKCAL_IN). This action can be expressed as:

OUT = BKCAL_IN − ΔMVn'

ΔMVn' = ΔMVn which is scaled by PV_SCALE and OUT_SCALE

16.7 Direction of Control Action

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

Table 16.2 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.

T1602.EPS

16.8 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.

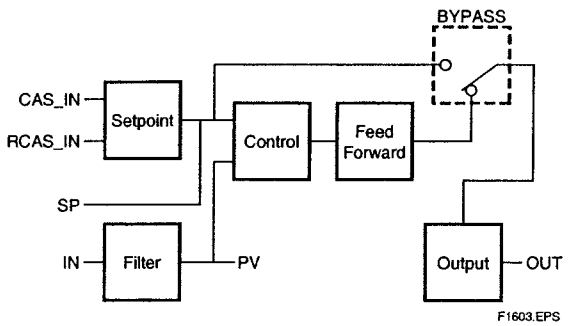

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Figure 16.3 Control Action Bypass

16.9 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 the change in 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 16.4.

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.

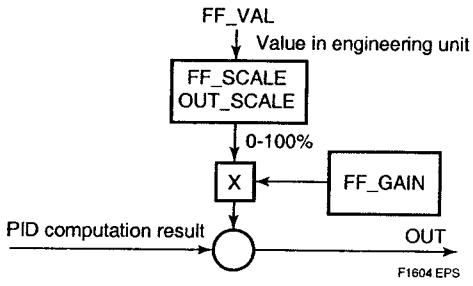

Figure 16.4 Feed-forward

16.10 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.

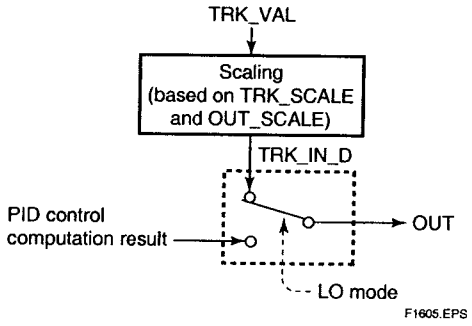

Figure 16.5 External-value Tracking

To change the block mode to LO:

(1) Set Track Enable in CONTROL_OPTS (see Section 16.12) 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.

16.11 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 16.3.

16.12 CONTROL_OPTS

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

Table 16.3 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 '1', 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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16.13 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.

16.14 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.

16.14.1 STATUS_OPTS

The table below shows the options in STATUS_OPTS.

Table 16.4 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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16.15 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.

16.16 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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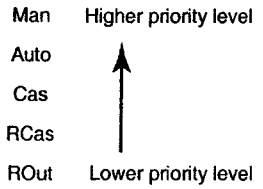
(*1) The modes to which the PID block can transfer are limited to those set in MODE_BLK.permitted, and the priority levels of modes are as shown below. In fact, if Normal shed, normal return is set for SHED_OPT, detection of a computer failure causes MODE_BLK.actual to change to Cas, Auto, or Man, whichever 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.

16.17 Alarms

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

16.17.1 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
Local Override	MODE_BLK.actual of the PID block is LO.
Out of Service	MODE_BLK.target of the PID block is O/S.

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16.17.2 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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17. TROUBLESHOOTING

17.1 What to Do First

When a problem occurs, check the following first.

Mounting of YPK110

- Is the YPK110 mounted correctly using brackets or the like?

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 or pneumatic positioner?
- Is the A/M selector on the positioner set to A (automatic)?

Wiring

- Is the YPK110 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?

Self-diagnosis

- Was any problem discovered using the self-diagnosis function of the YPK110?
  (See Sections 12.5.1 "XD_ERROR" and 11.3 "Device Status".)

17.2 Troubleshooting Communications

Problem	Presumed Cause	Remedy	Ref. Section
Communication with the YPK110 cannot be performed.	Wiring is incorrect.	Correct wiring.	4.4, 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 YPK110 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 YPK110 can be detected, but neither function blocks nor transducer block can be seen.	The node address of the YPK110 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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17.3 Troubleshooting Function Block Parameters

Problem	Presumed Cause	Remedy	Ref. Section
A value cannot be written to a parameter in the YPK110.	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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17.4 Troubleshooting pressure output 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
	Air supply is not being fed.	Supply proper air pressure	4.2
	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 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.	12.2.3 13.3
The deviation between the setpoint and readback signal remains.	The supply pressure is insufficient to provide pressure output.	Check the supply pressure and supply the correct pressure.	4.2
	The High cut-off and Low cut-off action is active.	Check the values of FINAL_VALUE_CUTOFF_HI and FINAL_VALUE_CUTOFF_LO.	5.4 12.2.4
The output pressure is unstable or oscillatory.	The control gain is too high for the existing piping or load.	Fix the parameter set and tune the control parameters.	5.5, Appendix1.2
	The supply pressure is unstable.	Check the supply pressure.	4.2
	Air leakage is present on the output pressure piping side.	Check the piping.	4.2
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 123 occurs in XD_ERROR in steady states. If it does occur, contact the nearest service station or representative office.	12.5.1
	The control relay's nozzle has become blocked from dirt contained in the air supply or the like.	Check whether or not error 123 occurs in XD_ERROR in steady states.	12.5.1
	The control gain is insufficient.	Increase the SERVO_GAIN_OPE_SET	5.5, Appendix1.2
	There's air leak from the pipe of output pressure.	Check the piping.	4.2

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17.5 Troubleshooting Pressure and Temperature Sensors

Problem	Presumed Cause	Remedy	Ref. Section
The pressure sensor signal is unstable, or XD_ERROR indicates error 122.	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 121.	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	1		Universal parameter used by an upper-level system to classify the function blocks.
4	1004	ALERT_KEY	1		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 YPK110.
8	1008	TEST_RW	Null		Parameter used to test read and write access to the YPK110
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 YPK110.
12	1012	DEV_REV	2	–	Revision number of the YPK110
13	1013	DD_REV	1	–	Revision number of the device description (DD) applied to this YPK110
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 YPK110 in the selected way. 1: Running 2: Restart Resource 3: Restart with the default settings defined in FF specifications.*1 4: Restart CPU

*1: FF-891 "Foundation™ Specification Function Block Application Process Part 2"

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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 YPK110.
23	1023	NV_CYCLE_T	0	–	Cycle of saving the settings of non-volatile attribute parameters to the EEPROM. 0 is set with the YPK110, and saving is not cyclically done.
24	1024	FREE_SPACE	0	–	Shows the free space memory for configurations as a percent value. YPK110 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 YPK110.
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 YPK110, 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 (YPK110).
32	1032	LIM_NOTIFY	3		Maximum number of alerts to be held by the device (YPK110); 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	20000 (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 (YPK110).
38	1038	ACK_OPTION	0XFFFF		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 YPK110.
49	1049	DEVICE_STATUS_5	0	–	Not used in the YPK110.
50	1050	DEVICE_STATUS_6	0	–	Not used in the YPK110.
51	1051	DEVICE_STATUS_7	0	–	Not used in the YPK110.
52	1052	DEVICE_STATUS_8	0	–	Not used in the YPK110.

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A1.2 Parameters of Transducer Block

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	1		Universal parameter used by an upper-level system to classify the function blocks.
4	2004	ALERT_KEY	1		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			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 YPK110
10	2010	TRANSDUCER_TYPE	65535	–	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 output pressure 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 YPK110 makes the output pressure increase to a maximum.
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 YPK110 makes the output pressure decrease to a minimum.
17	2017	FINAL_PRESSURE _VALUE		–	Stores the pressure data read by the pressure sensor.
18	2018	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
19	2019	ACT_MAN_ID	0		ID of actuator manufacturer
20	2020	ACT_MODEL_NUM	Null		Model number of actuator
21	2021	ACT_SN	0		Serial number of actuator
22	2022	VALVE_MAN_ID	0		ID of valve manufacturer
23	2023	VALVE_MODEL _NUM	Null		Model number of valve

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Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description [Setting range]
24	2024	VALVE_SN	0		Serial number of valve
25	2025	VALVE_TYPE	1	O/S	Valve type: 1 = linear-motion valve 2 = rotary-motion valve
26	2026	XD_CAL_LOC	Null		Shows and is used to record the location where the positioner was calibrated.
27	2027	XD_CAL_DATE	01/01/00		Shows and is used to record the date when the positioner was calibrated.
28	2028	XD_CAL_WHO	Null		Shows and is used to record the person who calibrated the positioner.
29	2029	ALARM_SUM			Shows the alarm summary (current alarm statuses, acknowledged/unacknowledged states, masking states) for the transducer block.
30	2030	FINAL_PRESS_HI	100	–	Shows the rated pressure for input when FINAL VALUE is 100%. (PRESSURE_UNIT)
31	2031	FINAL_PRESS_LO	20	–	Shows the rated pressure for input when FINAL VALUE is 0%. (PRESSURE_UNIT)
32	2032	SUPPLY_PRESSURE	140	–	Supplied air pressure (PRESSURE_UNIT)
33	2033	PRESSURE_UNIT	1133		Sets the pressure unit. 1133 = kPa 1137 = bar 1141 = psi 1145 = kgf/cm^2
34	2034	OUT_PRESSURE			Output pressure (PRESSURE_UNIT)
35	2035	PRESSURE_HI	100	O/S	Specifies the desired output pressure for input when FINAL VALUE is 100%. (PRESSURE_UNIT)
36	2036	PRESSURE_LO	20	O/S	Specifies the desired output pressure for input when FINAL VALUE is 0%. (PRESSURE_UNIT)
37	2037	CAL_PRESS_HI	100	–	Shows the calibrated pressure for a 100% point of user calibration. (PRESSURE_UNIT)
38	2038	CAL_PRESS_LO	20	–	Shows the calibrated pressure for a 0% point of user calibration. (PRESSURE_UNIT)
39	2039	CAL_PRESS_P	60	–	Shows the calibrated pressure for a 50% point of user calibration. (PRESSURE_UNIT)
40	2040	OUTPUT_CHAR _TYPE	1	O/S	Defines the output pressure 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
41	2041	OUTPUT_CHAR	10,20,30,40,50,60, 70,80,90	O/S	Defines the coordinates of the segment function when 255 is set for OUTPUT_CHAR_TYPE. [0 to 100, only simple decreasing can be allowed]
42	2042	LIMSW_HI_LIM	+110%		Setting of high limit switch
43	2043	LIMSW_LO_LIM	–10%		Setting of low limit switch
44	2044	TEMPERATURE _UNIT	1101(degC)		Defines the unit of temperature indication above: 1101 = degC 1102 = degF
45	2045	ELECT_TEMP			Indicates the temperature on amplifier board
46	2046	USER_CAL_EXEC	1	O/S	Executes user calibration. 1 = off 2 = 0% position calibration 3 = span calibration 4 = 50% point calibration
47	2047	USER_CAL_RESET	1	O/S	Reverts to the factory-set condition. 2 = Execute

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Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description [Setting range]
48	2048	USER_CAL_RESULT	1	–	Shows the results of user calibration. 1 = Succeeded
49	2049	CAL_PRESSURE	0	O/S	Set the value measured with a manometer during user calibration. (PRESSURE_UNIT)
50	2050	ADVAL_FW		–	Setpoint equivalent to pressure sensor A/D value
51	2051	ADVAL_BW		–	Pressure sensor A/D value
52	2052	ADVAL_T		–	Temperature sensor A/D value
53	2053	PRESS_VERTICAL _FEED_COUNT			Air pressure rise/fall frequency (times) Writing 0 resets the parameter.
54	2054	TOTAL_PRESS _VARIATION			Total air pressure change (×100%) Writing 0 resets the parameter.
55	2055	TOTAL_PRESS_OUT _TIME			Air pressure output time (h) Writing 0 resets the parameter.
56	2056	TOTAL_OUTOFF_LO _TIME			Air pressure low cut-off time (h) Writing 0 resets the parameter.
57	2057	PRESSURE _VARIATION _DEADBAND	0.25	–	Deadband when pressure changes are totaled (%)
58	2058	PRESS_VERTICAL _FEED_COUNT_LIM	2^32-1		Alarm threshold for air pressure rise/fall frequency (times)
59	2059	TOTAL_PRESS _VARIATION_LIM	2^32-1		Alarm threshold for total air pressure change (%)
60	2060	TOTAL_PRESS_OUT _TIME_LIM	2^32-1		Alarm threshold for air pressure output time (h)
61	2061	TOTAL_CUTOFF_LO _TIME_LIM	2^32-1		Alarm threshold for air pressure low cut-off time (h)
62	2062	DEVIATION_LIM	110	O/S	Deviation for fail-safe judgment (%)
63	2063	DEVIATION_TIME_TH	First value: 10 Second value: –1 (off)	O/S	Deviation time threshold for fail-safe judgment (sec) The YPK110 issues an alarm when the first value is exceeded, and goes into fail-safe action when the second value is exceeded. A negative number at the second value means prohibition of fail-safe action.
64	2064	RELEASE_FAILSAFE	1	O/S	Used to cancel the fail-safe status. By writing 1 into the parameter, when set to 3, the YPK110 can be recovered to the normal state. 1 = Clear, non-latch (normal state) 2 = Active latched (in fail-safe action) 3 = Clear latched (fail-safe action in progress, though the cause has been eliminated)
65	2065	MODEL	"YPK110"	–	Model number
66	2066	DEV_OPTIONS	0x0000	–	Shows whether the model has any software-related option. (PID block: 0x0001; software download function: 0x0004; sum of the values if the model has more than one option)
67	2067	RATING_OUTPUT _TYPE	1	–	Shows the classification of pressure ratings. 1 = Standard pressure output 2 = Double pressure output
68	2068	RELAY_TYPE	1		Control relay type 1 = Direct action
69	2069	MASK_XD_ERROR	0x0000	O/S	Selects the XD_ERROR item(s) to be masked. Activate the specified bit if an error need not be notified for the item.
70	2070	CURRENT_GAIN _NUM		–	Control parameter set number currently being used
71	2071	SERVO_OUTPUT _SIGNAL		–	Output current (%) to I/P module

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Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description [Setting range]
72	2072	SERVO_DEADBAND	0.5%	O/S	Derivative action dead band; a control parameter set by auto tuning [0 to 50%]
73	2073	SERVO_OFFSET	50% of MV	O/S	Derivative action offset; a control parameter set by auto tuning [0 to 100 % of MV]
74	2074	SERVO_GAIN _SELECTION	1	O/S	Selects the control algorithm to be used. Under normal conditions, select "Automatic". 1 = Automatic 2 = Small capacity 3 = Middle capacity 4 = Large capacity 5 = Pneumatic positioner
75	2075	SERVO_ADV_GAIN	0.21	O/S	Proportional gain [0.05–0.30] (This parameter is valid except when SERVO_GAIN_SELECTION = Automatic.)
76	2076	SERVO_ADV_RESET	0.045	O/S	Integral time (s) [0.003–0.06] (This parameter is valid except when SERVO_GAIN_SELECTION = Automatic.)
77	2077	SERVO_ADV_RATE	0.75	O/S	Derivative time (s) [0.1–1.5] (This parameter is valid except when SERVO_GAIN_SELECTION = Automatic.)
78	2078	SERVO_ADV_GAM1	0.15	O/S	Reciprocal of derivative gain [0.03–0.5] (This parameter is valid except when SERVO_GAIN_SELECTION = Automatic.)
79	2079	SERVO_ADV_TD2	0.05	O/S	Derivative time of phase compensator (s) [0.03–0.3] (This parameter is valid except when SERVO_GAIN_SELECTION = Automatic.)
80	2080	SERVO_ADV_GAM2	0.02	O/S	Reciprocal of derivative gain of phase compensator [0.1–0.2] (This parameter is valid except when SERVO_GAIN_SELECTION = Automatic.)
81	2081	SERVO_RESERVE1	0		Spare parameter
82	2082	SERVO_RESERVE2	0		Spare parameter
83	2083	SERVO_RESERVE3	0		Spare parameter
84	2084	SERVO_RESERVE4	0		Spare parameter

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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	1		Universal parameter used by an upper-level system to classify the function blocks.
4	5004	ALERT_KEY	1		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	0	Auto	Indicates the setpoint for the block.
9	5009	OUT	0	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 YPK110.
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		Parameter Name	Default (factory setting)	Write	Description
	DI1	DI2				
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	1		Universal parameter used by an upper-level system to classify the function blocks.
4	6004	6104	ALERT_KEY	1		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 YPK110.
11	6011	6111	OUT_STATE	0		Index to the text describing the states of a discrete output, but not supported by YPK110.
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 YPK110.
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	0XFFFF		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 OS Block

Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description
0	14000	Block Header		Block tag = O/S	Information about this block, including the block tag, DD revision, execution time
1	14001	ST_REV	0		Incremented when a change in made to the parameter settings for the OS block to indicate the revision level of the settings, and used to see whether or not there is a change in parameter settings.
2	14002	TAG_DESC	Spaces		Universal parameter storing the description of the tag
3	14003	STRATEGY	1		Universal parameter used by an upper-level system to classify the function blocks
4	14004	ALERT_KEY	1		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	14005	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	14006	BLOCK_ERR			Indicates the error statuses related to the block itself.
7	14007	SP		Auto	Indicates the setpoint for the block.
8	14008	OUT_1		O/S	Indicates the value and status of output 1.
9	14009	OUT_2		O/S	Indicates the value and status of output 2.
10	14010	OUT_1_RANGE	0-100%		Defines the range of OUT_1 (output 1).
11	14011	OUT_2_RANGE	0-100%		Defines the range of OUT_2 (output 2).
12	14012	GRANT_DENY	0		Option to control access from the host computer and local control panel to tuning and alarm parameters
13	14013	STATUS_OPTS	0	O/S	Defines block actions depending on block status conditions.
14	14014	CAS_IN			Cascade input
15	14015	BKCAL_OUT			Value returned to BLCAL_IN of the upstream block; used by the upstream block to prevent reset windup and perform bumpless transfer to closed-loop control.
16	14016	IN_ARRAY	(0, 0, 0, 0)	O/S	Settings used to convert SP to OUT_1
17	14017	OUT_ARRAY	(0, 0, 0, 0)	O/S	Settings used to convert SP to OUT_2
18	14018	LOCKVAL	2		Defines the value of OUT_1 outside the set endpoints of operation characteristic. 2 = Lock
19	14019	BKCAL_IN_1			Read-back value of OUT_1 returned from the downstream block
20	14020	BKCAL_IN_2			Read-back value of OUT_2 returned from the downstream block
21	14021	BAL_TIME	0		Defines the balancing time. After the cascade connection to one downstream block has already been established, the cascade connection to the other downstream block will be established over the time period defined by this parameter.
22	14022	HYSTVAL	0		Defines the hysteresis for LOCKVAL. When it is set to 'No Lock.'
23	14023	UPDATE_EVT			Shows the contents of an update event (a change to the setpoint) upon occurrence.
24	14024	BLOCK_ALM			Shows the contents of a block alarm upon occurrence.

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A1.6 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	1		Universal parameter used by an upper-level system to classify the function blocks.
4	8004	ALERT_KEY	1		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	0XFFFF		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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A1.7 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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A1.8 STATUS_OPTS - Availability of Options for Each Block

Bit	Contents	DI	AO	OS	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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A1.9 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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APPENDIX 2. LINK MASTER FUNCTIONS

A2.1 Link Active Scheduler

A link active scheduler (LAS) is a deterministic, centralized bus scheduler that can control communications on an H1 fieldbus segment. There is only one LAS on an H1 fieldbus segment.

A YPK supports the following LAS functions.

- PN transmission: Identifies a fieldbus device newly connected to the same fieldbus segment. PN is short for Probe Node.
- PT transmission: Passes a token governing the right to transmit, to a fieldbus device on the same segment. PT is short for Pass Token.
- CD transmission: Carry out a scheduled transmission to a fieldbus device on the same segment. CD is short for Compel Data.
- Time synchronization: Periodically transmits the time data to all fieldbus devices on the segment and returns the time data in response to a request from a device.
- Live list equalization: Sends the live list data to link masters on the same segment.
- LAS transfer: Transfers the right to be the LAS on the segment to another link master.

A2.2 Link Master

A link master (LM) is any device containing a link active scheduler. There must be at least one LM on a segment. When the LAS on a segment has failed, another LM on the same segment starts working as the LAS.

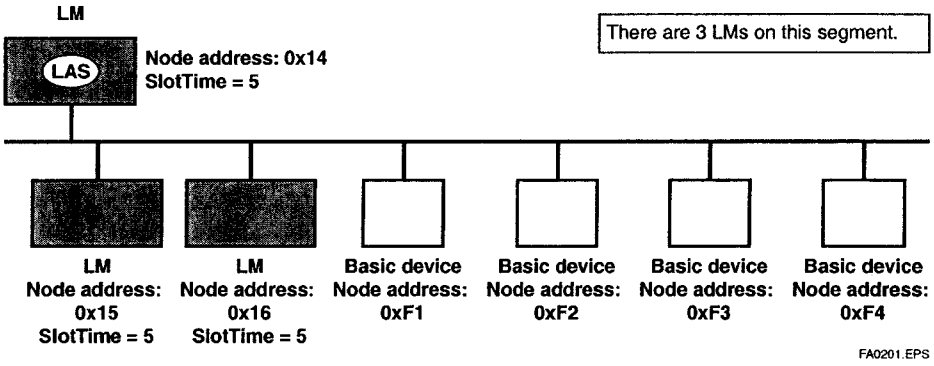

Figure 1. Example of Fieldbus configuration-3 LMs on Same Segment

A2.3 Transfer of LAS

There are two procedures for an LM to become the LAS:

- If the LM whose value of [V(ST)×V(TN)] is the smallest on a segment, with the exception of the current LAS, judges that there is no LAS on the segment, in such a case as when the segment has started up or when the current LAS has failed, the LM declares itself as the LAS, then becomes the LAS. (With this procedure, an LM backs up the LAS as shown in the following figure.)
- The LM whose value of [V(ST)×V(TN)] is the smallest on a segment, with the exception of the current LAS, requests the LAS on the same segment to transfer the right of being the LAS, then becomes the LAS.

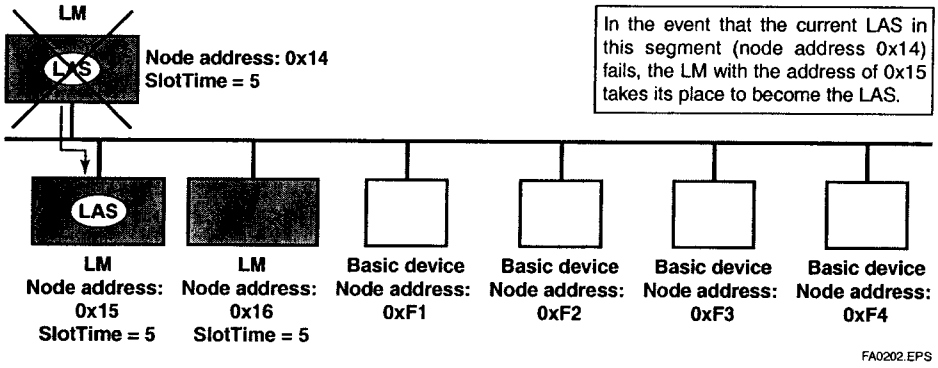

Figure 2. Backup of LAS

To set up a YPK as a device that is capable of backing up the LAS, follow the procedure below.

NOTE: When changing the settings in a YPK, add the YPK to the segment in which an LAS is running. After making changes to the settings, do not turn off the power to the YPK for at least 60 seconds.

(1) Set the node address of the YPK. In general, use an address from 0x10 to [V(FUN) - 1].

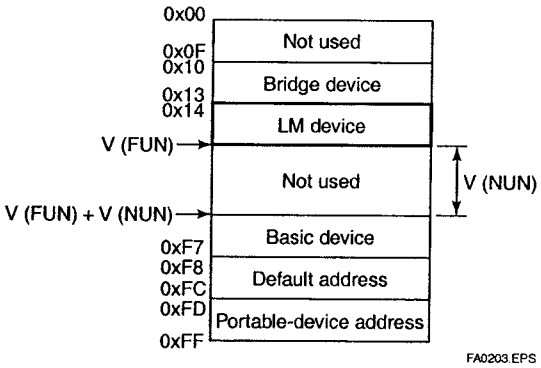

Figure 3. Node Address Ranges

(2) In the LAS settings of the YPK, set the values of V(ST), V(MRD), and V(MID) to the same as the respective lowest capability values in all the devices within the segment. An example is shown below.

DlmeBasicInfo (YPK Index 361 (SM))

Sub-index	Element	EJA	Device 1	Device 2	Device 3	Description
1	SlotTime	4	8	10	20	Capability value for V (ST)
3	MaxResponse Delay	3	6	3	5	Capability value for V (MRD)
6	MinInterPdu Delay	4	8	12	10	Capability value for V (MID)

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In this case, set SlotTime, MaxResponseTime, and MinInterPduDelay as follows:

ConfiguredLinkSettingsRecord (YPK Index 369 (SM))

Subindex	Element	Setting (Default)	Description
1	SlotTime	20 (4095)	V (ST)
3	MaxResponseDelay	6 (5)	V (MRD)
6	MinInterPduDelay	12 (12)	V (MID)

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(3) In the LAS settings of the YPK, set the values of V(FUN) and V(NUN) so that they include the node addresses of all nodes within the same segment. (See also Figure 3.)

ConfiguredLinkSettingsRecord (YPK Index 369 (SM))

Subindex	Element	Default Value	Description
4	FirstUnpolledNodeId	0x25	V (FUN)
7	NumConsecUnpolledNodeId	0xBA	V (NUN)

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A2.4 LM Functions

No.	Function	Description
1	LM initialization	When a fieldbus segment starts, the LM with the smallest [V(ST) × V(TN)] value within the segment becomes the LAS. At all times, each LM is checking whether or not a carrier is on the segment.
2	Startup of other nodes (PN and Node Activation SPDU transmissions)	Transmits a PN (Probe Node) message, and Node Activation SPDU message to devices which return a new PR (Probe Response) message.
3	PT transmission (including final bit monitoring)	Passes a PT (Pass Token) message to devices included in the live list sequentially, and monitors the RT (Return Token) and final bit returned in reply to the PT.
4	CD transmission	Transmits a CD (Compel Data) message at the scheduled times.
5	Time synchronization	Supports periodic TD (Time Distribution) transmissions and transmissions of a reply to a CT (Compel Time).
6	Domain download server	Sets the schedule data. The schedule data can be equalized only when the Domain Download command is carried out from outside the LM in question. (The version of the schedule is usually monitored, but no action takes place, even when it changes.)
7	Live list equalization	Transmits SPDU messages to LMs to equalize live lists.
8	LAS transfer	Transfers the right of being the LAS to another LM.
9	Reading/writing of NMIB for LM	See Section A2.5.
10	Round Trip Delay Reply (RR) Reply to DLPDU	Not yet supported in the current version.
11	Long address	Not yet supported in the current version.

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A2.5 LM Parameters

A2.5.1 LM Parameter List

The tables below show LM parameters of a YPK positioner.

Meanings of **Access** column entries: RW = read/write possible; R = read only

Index (SM)	Parameter Name	Sub-parameter Name (Sub Index)	Default Factory Setting	Access	Remarks
362	DLME_LINK_MASTER_CAPABILITIES_VARIABLE		0x04	RW	
363	DLME_LINK_MASTER_INFO_RECORD	0		RW	
		1 MaxSchedulingOverhead	0		
		2 DefMinTokenDelegTime	100		
		3 DefTokenHoldTime	300		
		4 TargetTokenRotTime	4096		
		5 LinkMaintTokHoldTime	400		
		6 TimeDistributionPeriod	5000		
		7 MaximumInactivityToClaimLasDelay	8		
		8 LasDatabaseStatusSpduDistributionPeriod	6000		
364	PRIMARY_LINK_MASTER_FLAG_VARIABLE		–	RW	LAS: True = 0xFF; non-LAS: False = 0x00
365	LIVE_LIST_STATUS_ARRAY_VARIABLE		–	R	
366	MAX_TOKEN_HOLD_TIME_ARRAY	0	0x0000×16, 0x012c×16	RW	
		1 Element1	0x012c×5, 0x0000×27		
		2 Element2	0x0000×32		
		3 Element3	0x0000×32		
		4 Element4	0x0000×32		
		5 Element5	0x0000×32		
		6 Element6	0x0000×31 ox012c		
		7 Element7	0x012c×32		
		8 Element8	0x02		
367	BOOT_OPERAT_FUNCTIONAL_CLASS		0x01	RW	0x01 (basic device); 0x02 (LM)
368	CURRENT_LINK_SETTING_RECORD	0		R	Settings for LAS
		1 SlotTime			
		2 PerDlpduPhlOverhead			
		3 MaxResponseDelay			
		4 FirstUnpolledNodeId			
		5 ThisLink			
		6 MinInterPduDelay			
		7 NumConseeUnpolledNodeId			
		8 PreambleExtension			
		9 PostTransGapExtension			
		10 MaxInterChanSignalSkew			
		11 TimeSyncClass			
369	CONFIGURED_LINK_SETTING_RECORD	0		RW	
		1 SlotTime	4095		
		2 PerDlpduPhlOverhead	4		
		3 MaxResponseDelay	5		
		4 FirstUnpolledNodeId	37		
		5 ThisLink	0		
		6 MinInterPduDelay	12		
		7 NumConseeUnpolledNodeId	186		
		8 PreambleExtension	2		
		9 PostTransGapExtension	1		
		10 MaxInterChanSignalSkew	0		
		11 TimeSyncClass	4		

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Index (SM)	Parameter Name	Sub-parameter Name (Sub Index)	Default Factory Setting	Access	Remarks
370	PLME_BASIC_ CHARACTERISTICS	0		R	
		1 ChannelStatisticsSupported	0x00		
		2 MediumAndDataRatesSupported	0x4900000000000000		
		3 IecVersion	1 (0x1)		
		4 NumOfChannels	1 (0x1)		
		5 PowerMode	0 (0x0)		
371	CHANNEL_STATES	0		R	
		1 channel-1	0 (0x0)		
		2 channel-2	128 (0x80)		
		3 channel-3	128 (0x80)		
		4 channel-4	128 (0x80)		
		5 channel-5	128 (0x80)		
		6 channel-6	128 (0x80)		
		7 channel-7	128 (0x80)		
		8 channel-8	128 (0x80)		
372	PLME_BASIC_INFO	0		R	
		1 InterfaceMode	0 (0x0)		
		2 LoopBackMode	0 (0x0)		
		3 XmitEnabled	1 (0x1)		
		4 RcvEnabled	1 (0x1)		
		5 PreferredReceiveChannel	1 (0x1)		
		6 MediaTypeSelected	73 (0x49)		
		7 ReceiveSelect	1 (0x1)		
373	LINK_SCHEDULE_ACTIVATION_VARIABLE			RW	
374	LINK_SCHEDULE_LIST_ CHARACTERISTICS_ RECORD	0		R	
		1 NumOfSchedules	0		
		2 NumOfSubSchedulesPerSchedule	1		
		3 ActiveScheduleVersion	0		
		4 ActiveSheduleOdIndex	0		
		5 ActiveScheduleStartingTime	0		
375	DLME_SCHEDULE_ DESCRIPTOR.1	0		R	
		1 Version	0		
		2 MacrocycleDuration	0		
		3 TimeResolution	0		
376	DLME_SCHEDULE_ DESCRIPTOR.2	0		R	
		1 Version	0		
		2 MacrocycleDuration	0		
		3 TimeResolution	0		
377	DOMAIN.1				Read/write impossible. Get-OD possible.
378	DOMAIN.2				Read/write impossible. Get-OD possible.

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A2.5.2 Descriptions for LM Parameters

The following describes LM parameters of a YPK.

IMPORTANT

Do not turn off the power to the YPK immediately after setting. When the parameters are saved to the EEPROM, the redundant processing is executed for the improvement of reliability. If the power is turned off within 60 seconds after setting is made, the modified parameters are not saved and the settings may return to the original value.

(1) DlmeLinkMasterCapabilitiesVariable

Bit Position	Meaning	Description	Value
B3: 0x04	LAS Schedule in Non-volatile Memory	Whether the LAS schedule can (= 1) or cannot (= 0) be saved to the non-volatile memory	1
B2: 0x02	Last Values Record Supported	Whether to support (= 1) or not to support (= 0) LastValuesRecord.	0
B1: 0x01	Link Master Statistics Record Supported	Whether to support (= 1) or not to support (= 0) DlmeLinkMasterStatisticsRecord.	0

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(2) DlmeLinkMasterInfoRecord

Sub-index	Element	Size [bytes]	Description
1	MaxSchedulingOverhead	1	V(MSO)
2	DefMinTokenDelegTime	2	V(DMDT)
3	DefTokenHoldTime	2	V(DTHT)
4	TargetTokenRotTime	2	V(TTRT)
5	LinkMaintTokHoldTime	2	V(LTHT)
6	TimeDistributionPeriod	4	V(TDP)
7	MaximumInactivityToClaimLasDelay	2	V(MICD)
8	LasDatabaseStatusSpduDistributionPeriod	2	V(LDDP)

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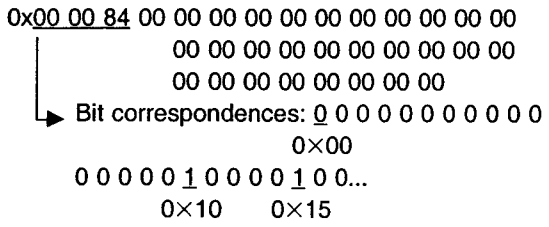
(3) PrimaryLinkMasterFlagVariable

Explicitly declares the LAS. Writing "true" (0xFF) to this parameter in a device causes that device to attempt to become the LAS. However, a request of writing "true" to this parameter in a device is rejected if the value of the same parameter in any other device that has a smaller node address within the same segment is true.

(4) LiveListStatusArrayVariable

A 32-byte variable, in which each bit represents the status of whether a device on the same segment is live or not. The leading bit corresponds to the device address 0x00, and final bit to 0xFF. The value of LiveListStatusArrayVariable in the case where devices having the addresses 0x10 and 0x15 in the fieldbus segment is shown below.



(5) MaxTokenHoldTimeArray

An 8(64 byte array variable, in which each set of 2 bytes represents the delegation time (set as an octet time) assigned to a device. The delegation time denotes a time period that is given to a device by means of a PT message sent from the LAS within each token circulation cycle.

The leading 2 bytes correspond to the device address 0x00, and the final 2 bytes to the device address 0xFF. Specify the subindex to access this parameter.

(6) BootOperatFunctionalClass

Writing 1 to this parameter in a device and restarting the device causes the device to start as a basic device. On the contrary, writing 2 to this parameter and restarting the device causes the device to start as an LM.

(7) CurrentLinkSettingRecord and ConfiguredLinkSettingsRecord

CurrentLinkSettingRecord indicates the bus parameter settings currently used. ConfiguredLinkSettingsRecord indicates the bus parameter settings to be used when the device becomes the LAS. Thus, when a device is the LAS, its CurrentLinkSettingRecord and ConfiguredLinkSettingsRecord have the same values.

Sub-index	Element	Size [bytes]	Description
1	SlotTime	2	V(ST)
2	PerDlpduPhlOverhead	1	V(PhLO)
3	MaxResponseDelay	1	V(MRD)
4	FirstUnpolledNodeId	1	V(FUN)
5	ThisLink	2	V(TL)
6	MinInterPduDelay	1	V(MID)
7	NumConsecUnpolledNodeId	1	V(NUN)
8	PreambleExtension	1	V(PhPE)
9	PostTransGapExtension	1	V(PhGE)
10	MaxInterChanSignalSkew	1	V(PhIS)
11	TimeSyncClass	1	V(TSC)

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(8) DlmeBasicInfo

Sub-index	Element	Size [bytes]	Description
1	SlotTime	2	Indicates the capability value for V(ST) of the device.
2	PerDlpduPhlOverhead	1	V(PhLO)
3	MaxResponseDelay	1	Indicates the capability value for V(MRD) of the device.
4	ThisNode	1	V(TN), node address
5	ThisLink	2	V(TL), link-id
6	MinInterPduDelay	1	Indicates the capability value for V(MID) of the device.
7	TimeSyncClass	1	Indicates the capability value for V(TSC) of the device.
8	PreambleExtension	1	V(PhPE)
9	PostTransGapExtension	1	V(PhGE)
10	MaxInterChanSignalSkew	1	V(PhIS)

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(9) PlmeBasicCharacteristics

Sub-index	Element	Size [bytes]	Value	Description
1	Channel Statistics Supported	1	0	Statistics data are not supported.
2	Medium AndData Rates Supported	8	0x4900000000000000	Wire medium, voltage mode, and 31.25 kbps are supported.
3	IceVersion	2	0x0403	IEC 4.3 is supported.
4	NumOf Channels	1	1	
5	Power Mode	1	0	0: Bus-powered; 1: Self-powered

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(10) ChannelStates

Sub-index	Element	Size [bytes]	Value	Description
1	Channel 1	1	0x00	In Use, No Bad since last read, No Silent since last read, No Jabber since last read, Tx Good, Rx Good
2	Channel 2	1	0x80	Unused
3	Channel 3	1	0x80	Unused
4	Channel 4	1	0x80	Unused
5	Channel 5	1	0x80	Unused
6	Channel 6	1	0x80	Unused
7	Channel 7	1	0x80	Unused
8	Channel 8	1	0x80	Unused

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(11) PlmeBasicInfo

Sub-index	Element	Size [bytes]	Value	Description
1	InterfaceMode	1	0	0: Half duplex; 1: Full duplex
2	LoopBackMode	1	0	0: Disabled; 1: MAU; 2: MDS
3	XmitEnabled	1	0x01	Channel 1 is enabled.
4	RcvEnebled	1	0x01	Channel 1 is enabled.
5	PreferredReceive Channel	1	0x01	Channel 1 is used for reception.
6	MediaType Selected	1	0x49	Wire medium, voltage mode, and 31.25 kbps are selected.
7	ReceiveSelect	1	0x01	Channel 1 is used for reception.

TA0212.EPS

(12) LinkScheduleActivationVariable

Writing the version number of an LAS schedule, which has already been downloaded to the domain, to this parameter causes the corresponding schedule to be executed. On the other hand, writing 0 to this parameter stops execution of the active schedule.

(13) LinkScheduleListCharacteristicsRecord

Sub-index	Element	Size [bytes]	Description
1	NumOf Schedules	1	Indicates the total number of LAS schedules that have been downloaded to the domain.
2	NumOfSub SchedulesPer Schedule	1	Indicates the maximum number of sub-schedules an LAS schedule can contain. (This is fixed to 1 in the Yokogawa communication stacks.)
3	ActiveSchedule Version	2	Indicates the version number of the schedule currently executed.
4	ActiveSchedule OdIndex	2	Indicates the index number of the domain that stores the schedule currently executed.
5	ActiveSchedule StaringTime	6	Indicates the time when the current schedule began being executed.

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(14) DlmeScheduleDescriptor

This parameter exists for the same number as the total number of domains, and each describes the LAS schedule downloaded to the corresponding domain. For the domain to which a schedule has not yet been downloaded, the values in this parameter are all zeros.

Sub-index	Element	Size [bytes]	Description
1	Version	2	Indicates the version number of the LAS schedule downloaded to the corresponding domain.
2	Macrocycle Duration	4	Indicates the macro cycle of the LAS schedule downloaded to the corresponding domain.
3	TimeResolution	2	Indicates the time resolution that is required to execute the LAS schedule downloaded to the corresponding domain.

TA0214.EPS

(15) Domain

Read/write: impossible; get-OD: possible

Carrying out the GenericDomainDownload command from a host writes an LAS schedule to Domain.

A2.6 FAQs

Q1. When the LAS stops, a YPK does not back it up by becoming the LAS. Why?

A1-1. Is that YPK running as an LM? Check that the value of BootOperatFunctionalClass (index 367) is 2 (indicating that it is an LM).

A1-2. Check the values of V(ST) and V(TN) in all LMs on the segment and confirm that the following condition is met:

YPK		Other LMs
V(ST)×V(TN)	<	V(ST)×V(TN)

Q2. How can I make a YPK become the LAS?

A2-1. Check that the version numbers of the active schedules in the current LAS and the YPK are the same by reading:

LinkScheduleListCharacteristicsRecord (index 374 for a YPK)

- ActiveScheduleVersion (subindex 3)

A2-2. Make the YPK declare itself as and become the LAS by writing:

- 0x00 (false) to PrimaryLinkMasterFlagVariable in the current LAS; and
- 0xFF (true) to PrimaryLinkMasterFlagVariable (index 364) in the YPK.

Q3. On a segment where a YPK works as the LAS, another device cannot be connected. How come?

A3-1. Check the following bus parameters that indicate the bus parameter as being the LAS for the YPK and the capabilities of being the LAS for the device that cannot be connected:

- V(ST), V(MID), V(MRD) of YPK: ConfiguredLinkSettingsRecord (index 369)
- V(ST), V(MID), V(MRD) of problematic device: DlmeBasicInfo

Then, confirm that the following conditions are met:

YPK		Problematic Device
V(ST)	>	V(ST)
V(MID)	>	V(MID)
V(MRD)	>	V(MRD)

A3-2. Check the node address of the problematic device is not included in the V(FUN)+V(NUN) of the YPK.

APPENDIX 3. DD METHODS AND DD MENU

A3.1 Overview

Fieldbus technology has enabled a broad range of functions to be covered by a field device alone. Conversely, it has resulted in increased parameters to support these increased functions. To alleviate intricate operations due to the multiplied parameters and to provide easier-to-use user interfaces, fieldbus technology offers a menu facility and interactive guidance facility called methods, to be incorporated in device descriptions (DDs). With a field device whose DD contains a pre-embedded menu and methods, users can easily and intuitively access desired parameters and perform a series of setup operations.

A DD menu and DD methods are features embedded in a DD file for a field device, therefore, software supporting them needs to be used on the host computer for fieldbus system configuration. Make an inquiry to the software supplier about whether and how the software you use supports DD menus and DD methods. This User's Manual describes only the DD menu and DD methods of the YPK110.

A3.2 DD Methods

DD methods guide you in setting parameter procedures properly. Simply following instructions given by DD methods will accomplish the intended parameter setting without accessing a wrong parameter or failing to follow the correct setting procedure. Note that in principle, accessing the individual parameters can also make the settings that can be made using DD methods.

A3.2.1 Transducer Block

1) Output Range Scaling

This method sets PRESSURE_LO and PRESSURE_HI according to the input pressure range of the pneumatic positioner (pneumatic-to-pneumatic positioner) or valve to be used. For more information on the parameter content and work included in this method, see Chapter 5 "SETUP."

- Checking the modes of the AO/TB blocks
- Select either of the following two methods:
  (1) Teaching the desired valve position
  (2) Setting 0/100% pressure directly
- If (1) is selected, the YPK110 prompts you to change FINAL_VALUE.value and sets OUT_PRESSURE to PRESSURE_LO or PRESSURE_HI.
- If (2) is selected, the YPK110 directly sets PRESSURE_LO and PRESSURE_HI as output range parameters.

2) User Calibration

In this method, the user measures output pressure at a desired point (0%, 100% or 50% point) of calibration to calibrate the converter with regard to the output pressure. For more information on this calibration work, see "User Calibration" in Chapter 12

- Check the modes of the AO/TB blocks.
- Select the items to be tuned from 0%, 100%, 50% and Off options under USER_CAL_EXEC.
- Wait until the output pressure stabilizes.
- Store the manometer value in YPK110 by writing it to CAL_PRESSURE.
- The YPK110 prompts you to repeat selecting from the options of the USER_CAL_EXEC parameter mentioned above, and completes user calibration when the Off option is selected.

A3.2.2 AO Block

1) Simulation Enable

This is a method for causing the AO block to activate the simulation status. When a block is in the simulation status, you can apply simulated inputs to the block to let the block function with that input, and check the actions of the function block application and alarm processing. Since the simulation function is disabled to run normally in consideration of the nature of its functionality, when using this method, the simulation function needs to be rendered active by doing either of the following:

- Write "REMOTE LOOP TEST SWITCH" to SIM_ENABLE_MSG in the resource block.
- Turn on the SIM.ENABLE hardware switch on the YPK110's amplifier assembly (see Section 10.3, "Simulation Function").

Simulation enabling procedure

- Check that the simulation switch is ON (active).
- Check the AO block mode
- Change the value of SIMULATE.status to "Enable"
- Set the simulated input value in SIMULATE.value

2) Simulation Disable

This is a method for disabling the simulation function of the AO block.

Simulation disabling procedure

- Confirm whether the simulation function can be disabled.
- Change the value of SIMULATE.status to "Disable"
- The method displays a message announcing that block alarms will not be reset until both the hardware switch and software switch in the resource block for enabling execution of the simulation function are turned off.

A3.2.3 OS Block

1) X-Y Scaling

This is a method for setting the scales of the X- and Y-axes for defining the conversion characteristics for OUT_1 and OUT_2 (values of IN_ARRAY and OUT_ARRAY), by setting the coordinates of four endpoints: P1 as the start point of OUT_1, P2 as the end point of OUT_1, P3 as the start point of OUT_2, and P4 as the end point of OUT_2. (See also Section 15.3, "Output Processing.")

X-Y scaling procedure

- Set coordinates of P1 through P4
  - P1: IN_ARRAY, OUT_ARRAY
  - P2: IN_ARRAY, OUT_ARRAY
  - P3: IN_ARRAY, OUT_ARRAY
  - P4: IN_ARRAY, OUT_ARRAY
- Set LOCK_VAL

A3.3 DD Menu

The DD menu consists of layered menu trees that categorize the parameters and DD methods, and enables users to promptly access desired parameters.

A3.3.1 Resource Block Menu

Items marked with □ shows method.

Resource block (Top menu)

Block Info
- TAG_DESC
- STRATEGY
- ALERT_KEY

Mode Block
- MODE_BLK.TARGET
- MODE_BLK.ACTUAL
- MODE_BLK.PERMITTED
- MODE_BLK.NORMAL

Configuration
- CONFIRM_TIME
- WRITE_LOCK
- Feature Info
  - FEATURES
  - FEATURE_SEL
- Cycle Info
  - CYCLE_TYPE
  - CYCLE_SEL
  - MIN_CYCLE_T
- Notify Info
  - MAX_NOTIFY
  - LIM_NOTIFY
- Sheding
  - SHED_RCAS
  - SHED_ROUT

Diagnostics/Alerts
- Status
  - MODE_BLK.ACTUAL
  - BLOCK_ERR
  - RS_STATE
  - FAULT_STATE
  - Set/Clear FSTATE
  - Device Status
- Alert Parameters
  - BLOCK_ALM
  - ALARM_SUM
  - ACK_OPTION
  - WRITE_PRI
  - WRITE_ALM
  - UPDATE_EVT

Others
- RESTART
- GRANT_DENY
- SIM_ENABLE_MSG
- Hardware Info
  - HARD_TYPES
  - MEMORY_SIZE
  - NV_CYCLE_T
  - FREE_SPACE
  - FREE_TIME
- Identification
  - MANUFAC_ID
  - DEV_TYPE
  - DEV_REV
  - DD_REV
- Other Info
  - ITK_VER
  - SOFT_REV
  - SOFT_DESC

Query Device
- Standard parameters
- Enhanced parameters

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A3.3.2 Transducer Block Menu

Items marked with □ shows method.

Block Info
- TAG_DESC
- STRATEGY
- ALERT_KEY
- TRANSDUCER_DIRECTORY
- TRANSDUCER_TYPE

Mode Block

Dynamic variables
- FINAL_VALUE
- FINAL_POSITION_VALUE
- SERVO_OUTPUT_SIGNAL
- OUT_PRESSURE
- ELECT_TEMP

Configuration/Calibration
- □ Setup Wizard
- General
  - Device Info
    - MODEL
    - Device Options
      - DEV_OPTIONS
      - PRESS_SENS_INSTALLED
  - Actuator Info
    - ACT_MAN_ID
    - ACT_MODEL_NUM
    - ACT_SN
  - Valve Info
    - VALVE_MAN_ID
    - VALVE_MODEL_NUM
    - VALVE_SN
  - Transducer Calibration Info
    - XD_CAL_LOC
    - XD_CAL_DATE
    - XD_CAL_WHO
- Actuator set
  - ACT_FAIL_ACTION
  - ACTUATOR_TYPE
  - RELAY_TYPE
  - VALVE_TYPE
- Tuning/Calibration
  - □ Auto Tuning
  - Selective Tuning
    - □ Search stop points
    - □ Control parameter tuning
    - Servo Manual Tuning
    - FINAL_VALUE
    - Servo Parameters
      - SERVO_GAIN
      - SERVO_RESET
      - SERVO_RATE
      - SERVO_RATE_GAIN
      - SERVO_DEADBAND
      - SERVO_OFFSET
      - Advanced Paramaters
        - BOOST_ON_THRESHOLD
        - BOOST_OFF_THRESHOLD
        - BOOST_VALUE
        - SERVO_I_SLEEP_LMT
        - SERVO_P_ALPHA

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- □ Travel calibration
- Operational set
  - □ Operational configuration
  - Position Characterization
    - POSITION_CHAR_TYPE
    - POSITION_CHAR
  - Position Limits
    - FINAL_VALUE_CUTOFF_LO
    - FINAL_VALUE_CUTOFF_HI
    - FINAL_VALUE_RANGE
  - Limit Switch Threshold
    - LIMSW_LO_LIM
    - LIMSW_HI_LIM
  - Fault Control
    - DEVIATION_LIM
    - DEVIATION_TIME_TH
    - □ Release Fail Safe
  - Continuous Data Threshold
  - Sampling Threshold
    - CYCLE_DEADBAND
    - TRAVEL_DEADBAND
    - OPEN_CLOSE_THRESHOLD
    - NEAR_CLOSE_THRESHOLD
  - Alarming Threshold
    - CYCLE_COUNT_LIM
    - TRAVEL_LIM
    - OPEN_TIME_LIM
    - CLOSE_TIME_LIM
    - NEAR_CLOSE_TIME_LIM
- Pressure set
  - Pressure Units
    - SPRING_RANGE.UNITS_INDEX
  - SUPPLY_PRESSURE
  - SPRING_RANGE
- Temperature set
  - TEMPERATURE_UNIT

Diagnostics/Alerts
- □ Instant trouble shooting
- □ Self Check execution
- □ Release Fail Safe
- Block Status/Alerts
  - Block Status
    - MODE_BLK
    - BLOCK_ERR
    - XD_ERROR
  - Alert Parameters
    - BLOCK_ALM
    - ALARM_SUM
    - UPDATE_EVT
- Measured values
  - MEAS_GAIN
  - INTERNAL_GAIN
  - VALVE_TC
  - VALVE_HYS
  - VALVE_SLIP_WIDTH
  - MEAS_PRESS_AIR
  - MEAS_PRESS_SUPPLY
  - MEAS_SPRING_RANGE
  - Others
    - CONTROL_DIR
    - THETA_HI
    - THETA_LO
    - THETA_P

FA0302-2.EPS

- Continuous Data
  - TOTAL_CYCLE_COUNT
  - TOTAL_TRAVEL
  - TOTAL_OPEN_TIME
  - TOTAL_CLOSE_TIME
  - TOTAL_NEAR_CLOSE_TIM
- Signature functions
  - Signature execution
  - Upload Signature data
  - Upload Signature header data

Query Device

- TB profile parameters
- TB original parameters(part1)
- TB original parameters(part2)
- TB original parameters(part3)

FA0302-3.EPS

A3.3.3 AO Block Menu

Items marked with □ shows method.

AO FB (Top menu)

Block Info

- TAG_DESC
- STRATEGY
- ALERT_KEY

Mode Block

Dynamic variables

- CAS_IN
- RCAS_IN
- SP
- OUT
- READBACK
- PV
- BKCAL_OUT
- RCAS_OUT

Configuration

- CHANNEL
- Scaling/Limits
  - PV_SCALE
  - XD_SCALE
  - SP_RATE_DN
  - SP_RATE_UP
  - SP_HI_LIM
  - SP_LO_LIM
- Options
  - IO_OPTS
  - STATUS_OPTS
  - SHED_OPT
- Failsafe
  - FSTATE_TIME
  - FSTATE_VAL

Diagnostics/Alerts

- Block Status
  - MODE_BLK
  - BLOCK_ERR
- Alert Parameters
  - BLOCK_ALM
  - UPDATE_EVT
- Simulation Enable
- Simulation Disable

Others

- GRANT_DENY

Query Device

- Standard parameters

FA0303.EPS

A3.3.4 DI Block Menu

DI FB (Top menu)

Block Info
- TAG_DESC
- STRATEGY
- ALERT_KEY

Mode Block

Dynamic variables
- FIELD_VAL_D
- PV_D
- OUT_D

Configuration
- CHANNEL
- Filter
  - PV_FTIME
- Options
  - IO_OPTS
  - STATUS_OPTS

Diagnostics/Alerts
- Block Status
  - MODE_BLK
  - BLOCK_ERR
- Alert Parameters
  - BLOCK_ALM
  - ALARM_SUM
  - ACK_OPTION
  - DISC_PRI
  - DISC_LIM
  - DISC_ALM
  - UPDATE_EVT

Others
- SIMULATE_D
- GRANT_DENY

Query Device
- Standard parameters

FA0304.EPS

A3.3.5 OS Block Menu

Items marked with □ shows method.

OS FB (Top menu)

Block Info
- TAG_DESC
- STRATEGY
- ALERT_KEY

Mode Block

Dynamic variables
- CAS_IN
- SP
- OUT_1
- OUT_2
- BKCAL_IN_1
- BKCAL_IN_2
- BKCAL_OUT

Configuration
- **OS X-Y scaling**
- LOCKVAL
- BAL_TIME
- HYSTVAL
- Options
  - STATUS_OPTS

Diagnostics/Alerts
- Block Status
  - MODE_BLK
    - MODE_BLK.ACTUAL
  - BLOCK_ERR
- Alert Parameters
  - BLOCK_ALM
  - UPDATE_EVT

Others
- GRANT_DENY

Query Device
- Stndard parameters

FA0305.EPS

A3.3.6 PID Block Menu

Items marked with □ shows method.

PID FB (Top menu)

Block Info
- TAG_DESC
- STRATEGY
- ALERT_KEY

Mode Block

Dynamic variables
- CAS_IN
- RCAS_IN
- ROUT_IN
- SP
- IN
- PV
- OUT
- BKCAL_IN
- BKCAL_OUT
- RCAS_OUT
- ROUT_OUT
- Others
  - FF_VAL
  - TRK_VAL
  - TRK_IN_D

Configuration
- Scaling/Filter/Limits
  - PV_SCALE
  - OUT_SCALE
  - SP_RATE_DN
  - SP_RATE_UP
  - PV_FTIME
  - SP_HI_LIM
  - SP_LO_LIM
  - OUT_HI_LIM
  - OUT_LO_LIM
- Control Parameters
  - GAIN
  - RESET
  - RATE
  - BYPASS
  - BAL_TIME
- Feed Forward Control
  - FF_SCALE
  - FF_GAIN
- Tracking
  - TRK_SCALE
- Options
  - CONTROL_OPTS
  - STATUS_OPTS
  - SHED_OPT
  - BKCAL_HYS

Diagnostics/Alerts
- Block Status
  - MODE_BLK.ACTUAL
  - BLOCK_ERR
- Alert Parameters
  - BLOCK_ALM
- Common set
  - ALARM_SUM
  - ACK_OPTION
  - ALARM_HYS
- Hi Hi Alarm
  - HI_HI_PRI
  - HI_HI_LIM
  - HI_HI_ALM
- Hi Alarm
  - HI_PRI
  - HI_LIM
  - HI_ALM
- Lo Alarm
  - LO_PRI
  - LO_LIM
  - LO_ALM
- Lo Lo Alarm
  - LO_LO_PRI
  - LO_LO_LIM
  - LO_LO_ALM
- Deviation High Alarm
  - DV_HI_PRI
  - DV_HI_LIM
  - DV_HI_ALM
- Deviation Low Alarm
  - DV_LO_PRI
  - DV_LO_LIM
  - DV_LO_ALM
- UPDATE_EVT

Others
- GRANT_DENY

Query Device
- Standard parameters

FA0306-1.EPS

FA0306-2.EPS

APPENDIX 4. SOFTWARE DOWNLOAD

A4.1 Benefits of Software Download

This function enables you to download software to field devices via a FOUNDATION Fieldbus to update their software. Typical uses are to add new features such as function blocks and diagnostics to existing devices, and to optimize existing field devices for your plant.

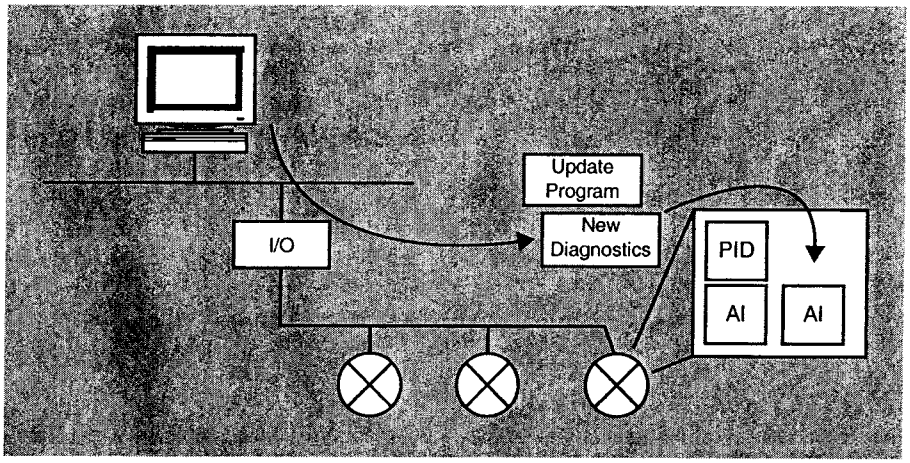


Figure 1. Concept of Software Downloading

A4.2 Specifications

Steady-state current:
Max. 17 mA

Current during FlashROM blanking time:
Max. 24 mA additional to steady-state current

Fieldbus Foundation download class:
Class 1

NOTE

Class 1 devices can continue the specified measurement and/or control actions even while software is being downloaded to them. Upon completion of a download, however, the devices will be reset internally to make the new, downloaded software take effect, and this will temporarily halt fieldbus communication and function block executions.

A4.3 Preparations for Software Downloading

For software downloading, you need to prepare the following:

- Software download tool
- Software binary file for each of the target field devices

For the software download tool, use only the specific program. For details, see the User's Manual of download tool. For information about updates of software binary files for field devices and how to obtain them, visit the following web site.

http://www.yokogawa.com/fi/fieldbus/download.htm

CAUTION

Avoid linking the software download tool to a fieldbus segment, as this may adversely affect the plant operation.

NOTE

The download tool can not execute downloading during other system connects to the system/ network management VFD of the device.

A4.4 Flow of Software Download

The flowchart below outlines the software download procedure. Although the time taken for the entire procedure varies depending on the size of the field bus device's software, it will take about 20 minutes for a one-to-one connection between a fieldbus device and download tool, and longer when multiple field devices are connected to the fieldbus.

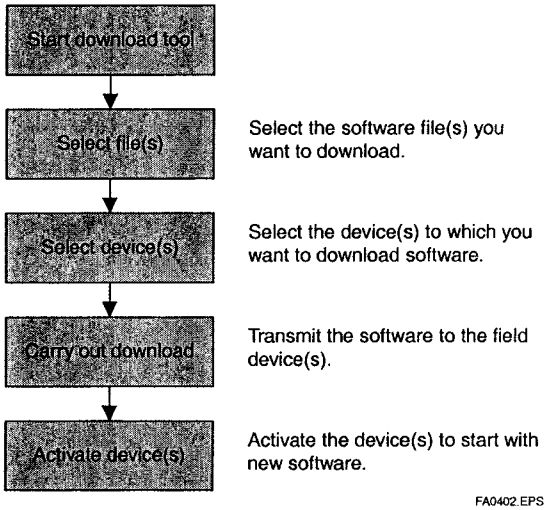


Figure 2. Flow of Software Download Procedure

CAUTION

Carrying out a software download leaves the PD tag, node address, and transducer block calibration parameters that are retained in the nonvolatile memory inside the target device, but may reset other parameters to the defaults (except a minor update that does not change the number of parameters). Hence, where necessary, save the parameters using an engineering tool, parameter setting utility, or the like before carrying out a software download, and then reconfigure the field device(s) after the download. For details, see Section A4.6.

CAUTION

The current dissipation of the target field device increases transitorily immediately after a download due to erasing of the FlashROM's contents. Use a fieldbus power supply which has sufficient capacity to cover such increases in feed current.

CAUTION

Upon completion of the activation, the target fieldbus device performs resetting internally, which temporarily halts fieldbus communication and function block executions. Be especially careful about a valve positioner; the output air pressure will fall to the minimum level (i.e., zero).

CAUTION

Do not turn off the power to a field device or disconnect the download tool during a download or activation. The device may fail as a result.

NOTE

Be careful about the noise on the fieldbus link. If the fieldbus is noisy, the downloading may take a very long time or fail.

A4.5 Download Files

Download files have the following filenames (with the filename extension of ".ffd"). Take care to choose the correct download file for the target field device:

"594543" + device family + "_" + device type + "_" + domain name + "_" + software name + "_" + software revision + ".ffd"

For example, the name of the download file may have the following name:

594543000A_000A_YPK-SD_ORIGINAL_R101.ffd

Refer to A4.11(3) DOMAIN_HEADER about each keyword of the file name.

The device type is "000A" for an YPK110 (with software download capability)

The software name is "ORIGINAL" or "UPDATE." The former indicates an original file and the latter an update file. Whenever performing a download to update the device revision, obtain the original file. In general, an addition to the parameters or blocks requires a device revision update.

A4.6 Steps after Activating a Field Device

When the communication with a field device has recovered after activating the device, check using the download tool that the software revision of the field device has been updated accordingly. The value of SOFT_REV of the resource block indicates the software revision.

The PD tag, node address, and transducer block calibration parameters that are retained in the nonvolatile memory inside the target device will remain unchanged after a software download. However, after a software update which causes an addition to the block parameters or blocks, or to the system/network management VFD parameters, some parameters may be reset to the defaults, thus requiring parameter setup and engineering again. For details, see the table below.

Also note that a change in the number of parameters or blocks requires the DD and capabilities files corresponding to the new software revision.

Table 1. Actions after Software Update

Contents of Software Update	Action
Does not change the number of parameters.	Re-setup of parameters not needed.
Adds a block parameter.	Setup of the added parameter needed.
Adds a block.	Reengineering and setup of the added block's parameters needed.
Changes the number of system/network management VFD parameters.	Reengineering needed.

TA0401.EPS

A4.7 Troubleshooting

For error messages appearing in the download tool, see also the User's Manual of download tool.

Table 2. Actions after Software Update

Symptom	Cause	Remedy
An error occurs before starting a download, disabling the download.	The selected download file is not for the selected field device.	Check SOFTDWN_ERROR in the resource block and obtain the correct file.
An error occurs after starting a download, disabling the download.	You attempted to update the device revision by downloading a file which is not an original file.	Check SOFTDWN_ERROR in the resource block and obtain the original file.
	The selected field device does not support software downloading.	Check whether the option code /EE is included in the model and suffix codes of the device.
	The voltage on the fieldbus segment falls below the specified limit (9 volts).	Check the capacity of the field bus power supply used and the voltage at the terminal.
	There was an error in a checksum or the number of transmission bytes.	Check SOFTDWN_ERROR in the resource block and obtain the correct file.
	The download tool does not allow download with same software revision.	Check the setting of the download tool.
The download takes far longer than expected or fails frequently.	The fieldbus segment is noisy.	Check the noise on the fieldbus segment.
An error occurs after activation.	Transient error caused by the internal resetting of the field device	Check whether communication with the field device has recovered after a while.
The new software does not take effect after the activation.	The file of the current revision was downloaded.	Obtain the correct file.
	Failure of the memory in field device, etc.	Check SOFTDWN_ERROR in the resource block, and re-try downloading. If fails, place a service call.

TA0402.EPS

A4.8 Resource Block's Parameters Relating to Software Download

Table 3. Additional Parameters of Resource Block

Relative Index	Index	Parameter Name	Default (Factory Set)	Write Mode	Description
53	1053	SOFTDWN_PROTECT	0x01		Defines whether to accept software downloads. 0x01: Unprotected 0x02: Protected
54	1054	SOFTDWN_FORMAT	0x01		Selects the software download method. 0x01: Standard
55	1055	SOFTDWN_COUNT	0	—	Indicates the number of times the internal FlashROM was erased.
56	1056	SOFTDWN_ACT_AREA	0	—	Indicates the ROM number of the currently working FlashROM. 0: FlashROM #0 working 1: FlashROM #1 working
57	1057	SOFTDWN_MOD_REV	1, 0, 0, 0, 0, 0, 0, 0, 0	—	Indicates the software module revision.
58	1058	SOFTDWN_ERROR	0	—	Indicates the error during a software download. See Table 4.

TA0103.EPS

Table 4. Error Codes of Errors during Download

Error Code	Detail
0	No error
32768	Unsupported header version
32769	Abnormal header size
32770	Abnormal manufacturer ID
32771	Abnormal device family
32772	Abnormal device revision
32773	Abnormal vendor specification version
32774	Abnormal number of modules
32775	Abnormal number of bytes in module 1
32776	Abnormal number of bytes in module 2
32777	Device error in module 1
32778	Checksum error in module 1
32779	Checksum error in file
32780	Unused
32781	Write-prohibited area in FlashROM
32782	Verification error during FlashROM writing
32783	Polling error during FlashROM erasing
32784	Polling time-out during FlashROM erasing
32785	Polling error during FlashROM writing
32786	Polling time-out during FlashROM writing
32787	FlashROM driver undefined number error
32788	File endcode error
32789	File type error (UPDATE, ORIGINAL)
32790	FlashROM driver undefined number error
32791	On-start state error (other than DWNLD_NOT_READY)
32792	Start segment error in module 1
32793	Binary file error
32794	Binary file error
32795	Device error in module 2
32796	Detection of EEPROM state other than backup after activation
32797	Checksum error in module 2
32798	Not in DWNLD_READY state when receiving GenericDomainInitiate
32799	Not in DWNLD_OK state when receiving GenericDomainTerminate
32800	Not in DOWNLOADING state when receiving GenericDomainSegment
32801	Firmware error
36863	Unused

TA0404.EPS

A4.9 View Objects Altered by Software Download

(1) Resource Block

Relative Index	Parameter Name	VIEW 1	VIEW 2	VIEW 3	VIEW 4
53	SOFTDWN_PROTECT				1
54	SOFTDWN_FORMAT				1
55	SOFTDWN_COUNT				2
56	SOFTDWN_ACT_AREA			1	
57	SOFTDWN_MOD_REV			16	
58	SOFTDWN_ERROR			2	
	Total bytes	22	30	73	35

TA0405.EPS

(2) Transducer Block

Relative Index	Parameter Name	VIEW 1	VIEW 2	VIEW 3		VIEW 4					
				1st	2nd	1st	2nd	3rd	4th	5th	6th
132	TEST_48				1						
	Total bytes	41	61	100	100	84	91	91	87	90	49

TA0406.EPS

A4.10 System/Network Management VFD Parameters Relating to Software Download

Table 5. System/Network Management VFD Parameters

Write Mode: R/W = read/write; R = read only

Index (SM)	Parameter Name	Sub Index	Sub-parameter Name	Default (Factory Set)	Write Mode	Remarks
400	DWNLD_PROPERTY	0			R	
		1	Download Class	1		
		2	Write Rsp Returned For ACTIVATE	1		
		3	Write Rsp Returned For PREPARE	1		
		4	Reserved	0		
		5	ReadyForDwnld Delay Secs	200		
		6	Activation Delay Secs	60		
410	DOMAIN_DESCRIPTOR	0			R/W	Read/write-permitted only for sub-index 1
		1	Command	3		
		2	State	1		
		3	Error Code	0		
		4	Download Domain Index	440		
		5	Download Domain Header Index	420		
		6	Activated Domain Header Index	430		
		7	Domain Name	(Device name)		
420	DOMAIN_HEADER.1	0				
		1	Header Version Number	0		
		2	Header Size	0		
		3	Manufacturer ID			
		4	Device Family			
		5	Device Type			
		6	Device Revision	0		
		7	DD Revision	0		
		8	Software Revision			
		9	Software Name			
		10	Domain Name			
430	DOMAIN_HEADER.2	0				
		1	Header Version Number	1		
		2	Header Size	44		
		3	Manufacturer ID	0x594543		
		4	Device Family	(DEV_TYPE of RB)		
		5	Device Type	(DEV_TYPE of RB)		
		6	Device Revision	(DEV_REV of RB)		
		7	DD Revision	(DD_REV of RB)		
		8	Software Revision	(SOFT_REV of RB)		
		9	Software Name	ORIGINAL		
		10	Domain Name	(Device name)		
440	DOMAIN					Read/write: prohibited Get-OD: permitted

TA0407 EPS

A4.11 Comments on System/Network Management VFD Parameters Relating to Software Download

IMPORTANT

Do not turn off the power to a field device immediately after changing parameter settings. Data writing actions to the EEPROM are made redundant to ensure reliability. If the power is turned off within 60 seconds after setup, the parameters may revert to the previous settings.

(1) DWNLD_PROPERTY

Sub Index	Element	Size (Bytes)	Description
1	Download Class	1	Indicates the download class. 1: Class 1
2	Write Rsp Returned For ACTIVATE	1	Indicates whether a write response is returned to the ACTIVATE command. 1: Write Response Returned
3	Write Rsp Returned For PREPARE	1	Indicates whether a write response is returned to the PREPARE command. 1: Write Response Returned
4	Reserved	1	(Reserved)
5	ReadyForDwnld Delay Secs	2	Indicates the maximum delay after receipt of the PREPARE_FOR_DWNLD command to proceed to transition from DWNLD_NOT_READY to DWNLD_READY.
6	Activation Delay Secs	2	Indicates the maximum delay after receipt of the ACTIVATE command to proceed to transition from DWNLD_OK to DWNLD_NOT_READY.

TA0408.EPS

(2) DOMAIN_DESCRIPTOR

Sub Index	Element	Size (Bytes)	Description
1	Command	1	Reads/writes software download commands. 1: PREPARE_FOR_DWNLD (instruction of download preparation) 2: ACTIVATE (activation instruction) 3: CANCEL_DWNLD (instruction of download cancellation)
2	State	1	Indicates the current download status. 1: DWNLD_NOT_READY (download not ready) 2: DWNLD_PREPARING (download under preparation) 3: DWNLD_READY (ready for download) 4: DWNLD_OK (download complete) 5: DOWNLOADING (download underway) 6: CHECKSUM_FAIL (not used in this product) 7: FMS_DOWNLOAD_FAIL (failure during download) 8: DWNLD_INCOMPLETE (download error detected at restart) 9: VCR_FAIL (not used in this product) 10: OTHER (download error other than 6 and 7 detected)
3	Error Code	2	Indicates the error during a download and activation. 0: success, configuration retained (download successfully completed) 32768 - 65535: Download error (See Table 4 for error codes.)
4	Download Domain Index	4	Indicates the index number of the domain for software downloading.
5	Download Domain Header Index	4	Indicates the index number of the domain header to which the download is performing.
6	Activated Domain Header Index	4	Indicates the index numbers of the domain header currently running.
7	Domain Name	8	Indicates the domain name. With this product, Domain Name indicates the field device name.

TA0409.EPS

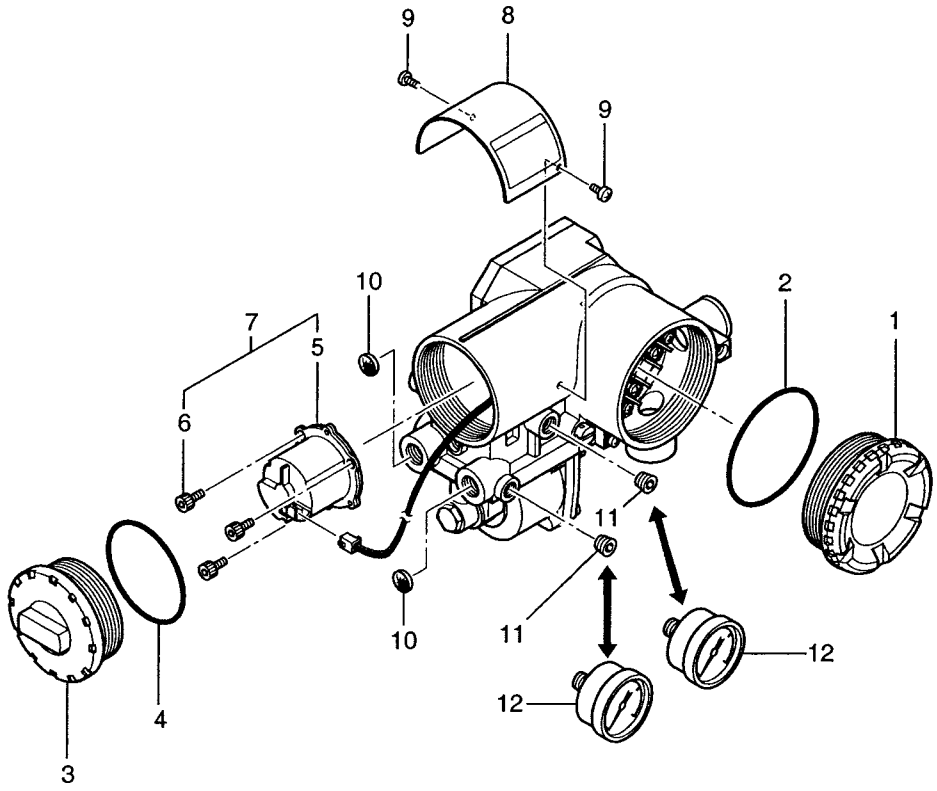
(3) DOMAIN_HEADER

Sub Index	Element	Size (Bytes)	Description
1	Header Version Number	2	Indicates the version number of the header.
2	Header Size	2	Indicates the header size.
3	Manufacturer ID	6	Indicates the value of resource block's MANUFAC_ID (manufacturer ID) as character string data.
4	Device Family	4	Indicates the device family. With this product, Device Family indicates the value of resource block's DEV_TYPE as character string data.
5	Device Type	4	Indicates the value of resource block's DEV_TYPE as character string data.
6	Device Revision	1	Indicates the value of resource block's DEV_REV.
7	DD Revision	1	Indicates the value of resource block's DD_REV.
8	Software Revision	8	Indicates the value of resource block's SOFT_REV.
9	Software Name	8	Indicates the attribute of the binary file. With this product, Software Name indicates either of the following: "ORIGINAL" followed by one space: Original file "UPDATE" followed by two spaces: Update file
10	Domain Name	8	Indicates the domain name. With this product, Domain Name indicates the field device name.

TA0410.EPS

Customer Maintenance Parts List

YPK110
Fieldbus-to-Pneumatic Converter



Item	Part No.	Qty	Description
1	F9341RA	1	Cover
2	F9341JP	1	O-Ring
3	—	1	IP Cover
4	G9303AG	1	O-Ring
5	—	1	IP Module
6	Y9408ZU	3	Bolt Hex. Socket
7	F9177BZ	1	IP Module Assembly
8	—	1	Name Plate
9	F9300AG	2	Screw
10	U0103FP	3	Screen
11	Below	2	Plug
	G9612EJ		For Connection code 1 and 6
	G9612EL		For Connection code 3
12	See Table 1	2	Pressure Gauge

Table 1. Pressure Gauge Part Number (item 12).

Output signal code	Option code		
	/GP	/GB	/GE
1, 5, and 7	G9615EA	G9615EC	G9615EB
2, 6, and 8	G9615ED	G9615EF	G9615EE

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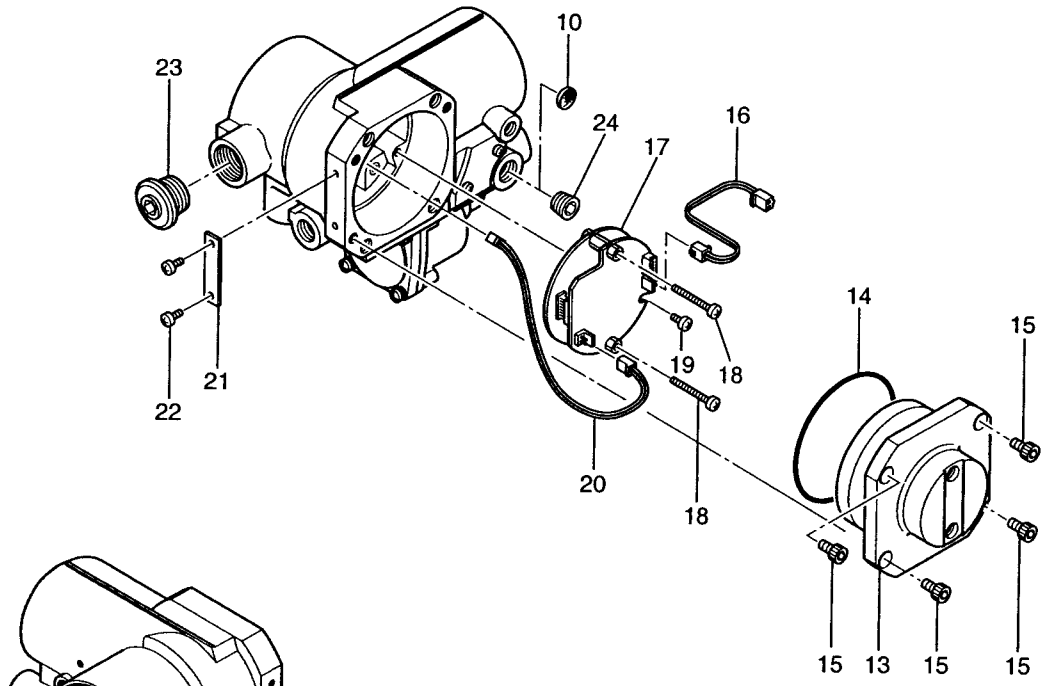
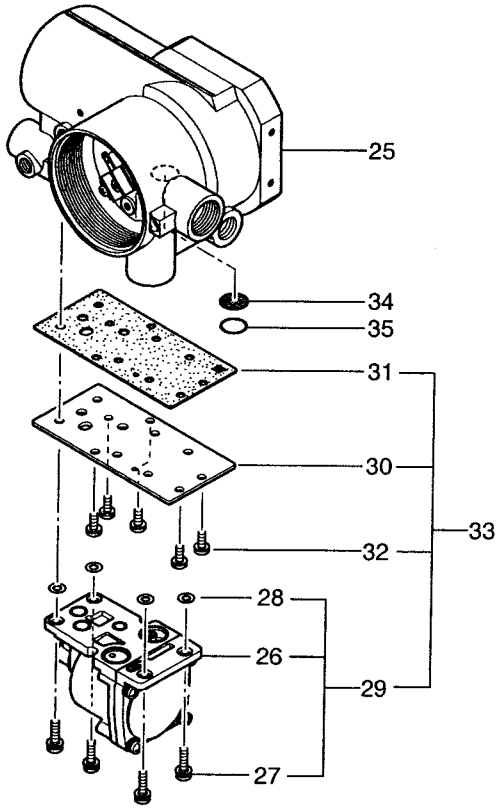
Yokogawa Electric Corporation

CMPL 21B04D01-01E
1st Edition: Mar. 2004(YG)





Item	Part No.	Qty	Description
13	—	1	Housing
14	—	1	O-Ring
15	—	4	Bolt Hex. Socket
16	—	1	Connector Assembly
17	—	1	Amplifier Assembly
18	—	2	Screw Machine
19	—	1	Screw Machine
20	F9177WC	1	Connector Assembly
21	F9165DF	1	Tag Plate
22	F9300AG	2	Screw
23	Below	1	Plug
	G9330DP		G 1/2
	G9612EB		1/2 NPT
	F9340NX		M20
24	Below	1	Plug
	G9612EK		R 1/4
	G9612EM		1/4 NPT
25	—	1	Case Assembly
26	—		Control Relay Assembly
27	Y9414JY	4	Screw
28	F9176GZ	4	Washer
29	Below	1	Control Relay Assembly with Screws
	F9186MJ	1	Standard output signal
	F9186NJ	1	Doubled output signal
30	F9176GD	1	Plate
31	F9176GE	1	Gasket
32	G9307MQ	5	Screw M4×8
33	Below	1	Control Relay Assembly with Plate and Gasket
	F9186ME	1	Standard output signal
	F9186NE	1	Doubled output signal
34	F9176GC	1	Filter
35	F9176JZ	1	O-Ring

REVISION RECORD

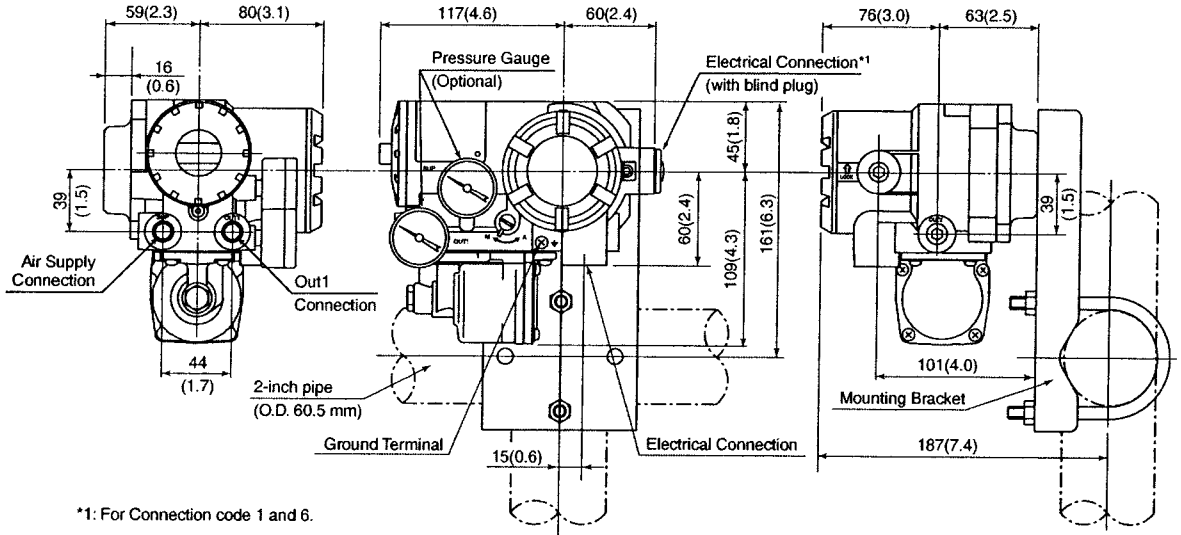
Title: Model YPK110 Fieldbus-to-Pneumatic Converter
Manual No.: IM 21B04D01-01E

Edition	Date	Page	Revised Item
1st	Mar. 2004	—	New publication

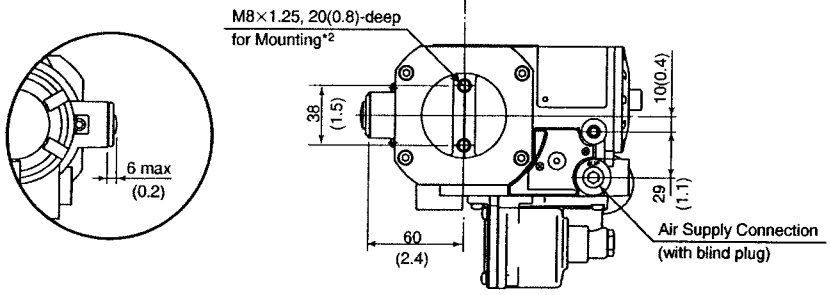
Drawings

Model YPK110
Fieldbus to Pneumatic Converter

Unit: mm(approx. inch)

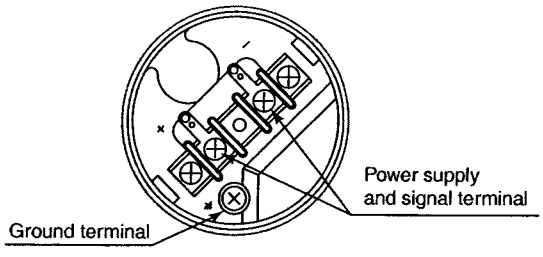


*1: For Connection code 1 and 6.



*2: Attached with 2 mounting bolts (M8, 25 mm) and spring washers (applicable 3 to 6 mm thick brackets).

● Terminal Configuration



● Terminal Wiring

+ / −	Power supply and signal terminal
⏚	Ground terminal

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Quality Inspection Standards

Model YPK110 Fieldbus-to-Pneumatic Converter

This inspection standard applies to Model YPK110 Fieldbus-to-Pneumatic Converter.

1. INSPECTION ITEMS

1.1 Insulation Resistance Test

1.2 Dielectric Strength Test

1.3 Input/Output Test

1.4 Operation Check of A/M Transfer Switch and Dial Pressure Gauge *

Note: The items marked with an asterisk (*) are subject to inspection by test certificate only.

2. INSPECTION METHODS, STANDARD, AND CONDITIONS

2.1 Insulation Resistance Test

Test the insulation resistance by applying 500V DC between the input terminal and the ground terminal (Using "+" and "–" terminals results in short-circuit). The insulation resistance must be 100 MΩ or greater. However, for the model with lightning protection (Optional code /A), apply 100V DC and the resistance must be 20 MΩ or greater.

2.2 Dielectric Strength Test

Test the dielectric strength by applying 500V AC (a substantially sinusoidal waveform) of 50 or 60 Hz between the input terminal and the ground terminal. The positioner must withstand this voltage for one minute. However, for the model with lightning protection (Optional code /A), apply 100V AC.

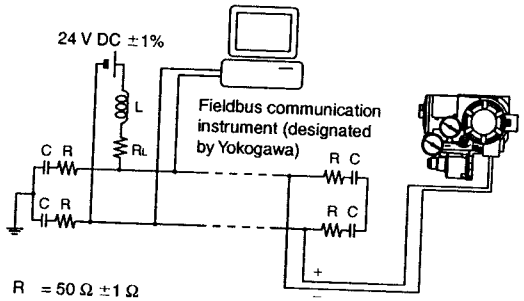
2.3 Input/Output Test

Connect the Fieldbus communication instrument (see Figure 1.), and a standard pressure gauge to the pneumatic output port. Then execute the Fieldbus communication instrument to apply the set point*1 of 0, 25, 50, 75, 100, 75, 50, 25, 0% to the YPK110, and measure the output pressure.
Tolerances at each check point must be ±0.2% of span.

*1: Set the AO function block and transducer block to "Out of Service (O/S)" mode, then enter the set point to "FINAL_VALUE" of transducer block.

2.4 Operation Check of A/M Transfer Switch and Dial Pressure Gauge

Set the Auto/Manual (A/M) transfer switch to M position (manual operation).
Vary the supply pneumatic pressure using a pressure tester. For the model with pressure gauges (Optional code /G□), check that the output dial pressure gauge pointer moves smoothly while applying pneumatic pressure from 0 kPa to maximal value of gauge.



R = 50 Ω ±1 Ω
C = 2 μF ±0.4 μF
L = 5 mH ±5%
RL = 50 Ω ±1%

F01E.EPS

Figure 1. Wiring

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