

YVP110 Advanced Valve Positioner

IM 21B04C01-01E

vigilantplant.[®]

YVP110

Advanced Valve Positioner

IM 21B04C01-01E 10th Edition

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Introduction

The YVP110 advanced valve positioner 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 YVP110, and the Functions part describes the software functions of YVP110.

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

■ 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. Yokogawa will not be liable for malfunctions or damage resulting from any modification made to this instrument by the customer. 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, misuse, 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.

■ ATEX Documentation

This procedure is only applicable to the countries in European Union.

<p>GB All instruction manuals for ATEX Ex related products are available in English, German and French. Should you require Ex related instructions in your local language, you are to contact your nearest Yokogawa office or representative.</p>	<p>SK Všetky návody na obsluhu pre prístroje s ATEX Ex sú k dispozícii v jazyku anglickom, nemeckom a francúzskom. V prípade potreby návodu pre Ex-prístroje vo Vašom národnom jazyku, skontaktujte prosím miestnu kanceláriu firmy Yokogawa.</p>
<p>DK Alle brugervejledninger for produkter relateret til ATEX Ex er tilgængelige på engelsk, tysk og fransk. Skulle De ønske yderligere oplysninger om håndtering af Ex produkter på eget sprog, kan De rette henvendelse herom til den nærmeste Yokogawa afdeling eller forhandler.</p>	<p>CZ Všechny uživatelské příručky pro výrobky, na něž se vztahuje nevýbušné schválení ATEX Ex, jsou dostupné v angličtině, němčině a francouzštině. Požadujete-li pokyny týkající se výrobků s nevýbušným schválením ve vašem lokálním jazyku, kontaktujte prosím vaši nejbližší reprezentační kancelář Yokogawa.</p>
<p>I Tutti i manuali operativi di prodotti ATEX contrassegnati con Ex sono disponibili in inglese, tedesco e francese. Se si desidera ricevere i manuali operativi di prodotti Ex in lingua locale, mettersi in contatto con l'ufficio Yokogawa più vicino o con un rappresentante.</p>	<p>LT Visos gaminių ATEX Ex kategorijos Eksploatavimo instrukcijos teikiami anglų, vokiečių ir prancūzų kalbomis. Norėdami gauti prietaisų Ex dokumentaciją kitomis kalbomis susisiekite su artimiausiu bendrovės "Yokogawa" biuru arba atstovu.</p>
<p>E Todos los manuales de instrucciones para los productos antiexplosivos de ATEX están disponibles en inglés, alemán y francés. Si desea solicitar las instrucciones de estos artículos antiexplosivos en su idioma local, deberá ponerse en contacto con la oficina o el representante de Yokogawa más cercano.</p>	<p>LV Visas ATEX Ex kategorijas izstrādājumu Lietošanas instrukcijas tiek piegādātas angļu, vācu un franču valodās. Ja vēlaties saņemt Ex ierīšu dokumentāciju citā valodā, Jums ir jāsazinās ar firmas Jokogava (Yokogawa) tuvāko ofisu vai pārstāvi.</p>
<p>NL Alle handleidingen voor producten die te maken hebben met ATEX explosiebeveiliging (Ex) zijn verkrijgbaar in het Engels, Duits en Frans. Neem, indien u aanwijzingen op het gebied van explosiebeveiliging nodig hebt in uw eigen taal, contact op met de dichtstbijzijnde vestiging van Yokogawa of met een vertegenwoordiger.</p>	<p>EST Kõik ATEX Ex toodete kasutamishendid on esitatud inglise, saksa ja prantsuse keeles. Ex seadmete muukeelse dokumentatsiooni saamiseks pöörduge lähima lokagava (Yokogawa) kontori või esindaja poole.</p>
<p>SF Kaikkien ATEX Ex -tyyppisten tuotteiden käyttöohjeet ovat saatavilla englannin-, saksan- ja ranskankielisinä. Mikäli tarvitsette Ex -tyyppisten tuotteiden ohjeita omalla paikallisella kielellänne, ottakaa yhteyttä lähimpään Yokogawa-toimistoon tai -edustajaan.</p>	<p>PL Wszystkie instrukcje obsługi dla urządzeń w wykonaniu przeciwwybuchowym Ex, zgodnych z wymaganiami ATEX, dostępne są w języku angielskim, niemieckim i francuskim. Jeżeli wymagana jest instrukcja obsługi w Państwa lokalnym języku, prosimy o kontakt z najbliższym biurem Yokogawy.</p>
<p>P Todos os manuais de instruções referentes aos produtos Ex da ATEX estão disponíveis em Inglês, Alemão e Francês. Se necessitar de instruções na sua língua relacionadas com produtos Ex, deverá entrar em contacto com a delegação mais próxima ou com um representante da Yokogawa.</p>	<p>SLO Vsi predpisi in navodila za ATEX Ex sorodni pridelki so pri roki v angleščini, nemščini ter francoščini. Če so Ex sorodna navodila potrebna v vašem tujejnem jeziku, kontaktirajte vaš najbliži Yokogawa office ili predstavnika.</p>
<p>F Tous les manuels d'instruction des produits ATEX Ex sont disponibles en langue anglaise, allemande et française. Si vous nécessitez des instructions relatives aux produits Ex dans votre langue, veuillez bien contacter votre représentant Yokogawa le plus proche.</p>	<p>H Az ATEX Ex műszerek gépkönyveit angol, német és francia nyelven adjuk ki. Amennyiben helyi nyelven kéri az Ex eszközök leírásait, kérjük keressék fel a legközelebbi Yokogawa irodát, vagy képviselőt.</p>
<p>D Alle Betriebsanleitungen für ATEX Ex bezogene Produkte stehen in den Sprachen Englisch, Deutsch und Französisch zur Verfügung. Sollten Sie die Betriebsanleitungen für Ex-Produkte in Ihrer Landessprache benötigen, setzen Sie sich bitte mit Ihrem örtlichen Yokogawa-Vertreter in Verbindung.</p>	<p>BG Всички упътвания за продукти от серията ATEX Ex се предлагат на английски, немски и френски език. Ако се нуждаете от упътвания за продукти от серията Ex на родния ви език, се свържете с най-близкия офис или представителство на фирма Yokogawa.</p>
<p>S Alla instruktionsböcker för ATEX Ex (explosionssäkra) produkter är tillgängliga på engelska, tyska och franska. Om Ni behöver instruktioner för dessa explosionssäkra produkter på annat språk, skall Ni kontakta närmaste Yokogawakontor eller representant.</p>	<p>RO Toate manualele de instructiuni pentru produsele ATEX Ex sunt in limba engleza, germana si franceza. In cazul in care doriti instructiunile in limba locala, trebuie sa contactati cel mai apropiat birou sau reprezentant Yokogawa.</p>
<p>GR Όλα τα εγχειρίδια λειτουργίας των προϊόντων με ATEX Ex διατίθενται στα Αγγλικά, Γερμανικά και Γαλλικά. Σε περίπτωση που χρειάζεστε οδηγίες σχετικά με Ex στην τοπική γλώσσα παρακαλούμε επικοινωνήστε με το πλησιέστερο γραφείο της Yokogawa ή αντιπρόσωπο της.</p>	<p>M Il-manwali kollha ta' l-istruzzjonijiet għal prodotti marbuta ma' ATEX Ex huma disponibbli bi-Ingliż, bi-Germaniż u bi-Franċiż. Jekk tkun tehtieg struzzjonijiet marbuta ma' Ex fil-lingwa lokali tieghek, għandek tikkuntattja lill-eqreb rappreżentant jew ufficċju ta' Yokogawa.</p>

1. Notes on Handling

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

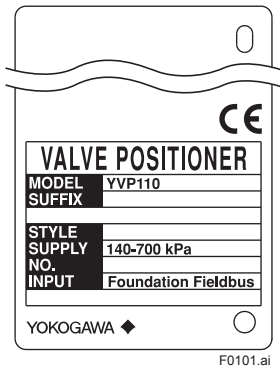


Figure 1.1 Nameplate

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 Safety



CAUTION

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



CAUTION

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

1.8 EMC Conformity Standards

EN61326-1 Class A, Table 2 (For use in industrial locations)



CAUTION

This instrument is a Class A product, and it is designed for use in the industrial environment. Please use this instrument in the industrial environment only.

1.9 Installation of Explosion Protected Type Positioner



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 Certification

A) FM Intrinsically Safe Type

Cautions for FM Intrinsically safe type. (Following cotents refer "Doc No. IFM017-A12 P.1, 1-1, 2, 2-1, and 2-2.")

Note 1. Model YVP110 Advanced Valve Positioner with optional code /FS15 are applicable for use in hazardous locations.

- Applicable standard: FM3600, FM3610, FM3611, FM3810, ANSI/NEMA250
- Intrinsically safe, with FISCO parameters, for use in Class I, II, III, Division 1, Groups A, B, C, D, E, F, G and Class I, Zone 0, AEx ia IIC
- Non-incendive for Class I, Division 2, Groups A, B, C, D and Class I, Zone 2, Group IIC
- Indoor/Outdoor hazardous locations, NEMA 4X
- Ambient Temperature: -40 to 60°C

Note 2. Electrical Data

Rating 1

For Groups A, B, C, D, E, F and G or Group IIC

Maximum Input Voltage V_{max} : 24 V

Maximum Input Current I_{max} : 250 mA

Maximum Input Power P_{max} : 1.2 W

Maximum Internal Capacitance C_i : 1.76 nF

Maximum Internal Inductance L_i : 0 μ H

or

Rating 2

For Groups A, B, C, D, E, F and G or Group IIC

Maximum Input Voltage V_{max} : 17.5 V

Maximum Input Current I_{max} : 360 mA

Maximum Input Power P_{max} : 2.52 W

Maximum Internal Capacitance C_i : 1.76 nF

Maximum Internal Inductance L_i : 0 μ H

or

Rating 3

For Groups C, D, E, F and G or Group IIB

Maximum Input Voltage V_{max} : 17.5 V

Maximum Input Current I_{max} : 380 mA

Maximum Input Power P_{max} : 5.32 W

Maximum Internal Capacitance C_i : 1.76 nF

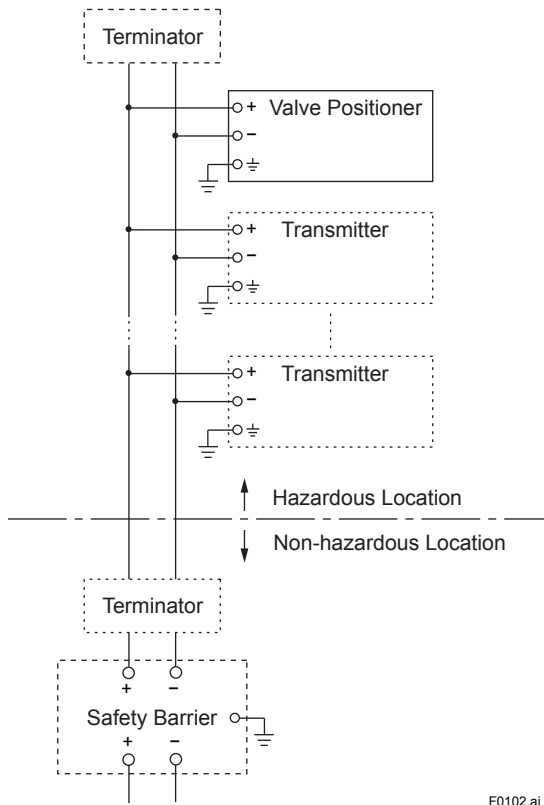
Maximum Internal Inductance L_i : 0 μ H

- In the rating 1, the output current of the barrier must be limited by a resistor "Ra" such that
 $I_o = U_o/R_a$.
- In the rating 2 or 3, the output characteristics of the barrier must be the type of trapezoid which are certified as the FISCO model.
- The safety barrier may include a terminator.
- More than one field instruments may be connected to the power supply line.

Note 3. Installation

- Dust-tight conduit seal must be used when installed in Class II and Class III environments.
- Control equipment connected to the Associated Apparatus must not use or generate more than 250 Vrms or Vdc.
- Installation should be in accordance with ANSI/ISA RP12.6 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code (ANSI/NFPA 70) Sections 504 and 505.
- The configuration of Associated Apparatus must be Factory Mutual Research Approved under FISCO Concept.
- Associated Apparatus manufacturer's installation drawing must be followed when installing this equipment.
- The YVP series are approved for Class I, Zone 0, applications. If connecting AEx[ib] associated Apparatus or AEx ib I.S. Apparatus to the YVP series the I.S. circuit is only suitable for Class I, Zone 1, or Class I, Zone 2, and is not suitable for Class I, Zone 0, or Class I, Division 1, Hazardous (Classified) Locations.

● **Installation Diagram (Intrinsically safe, Division 1 Installation)**



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Note 4. FISCO rules

The FISCO concept allows the interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criterion for such interconnection is that the voltage (U_i), the current (I_i) and the power (P_i) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (U_o , V_{oc} , V_t), the current (I_o) and the power (P_o) which can be provided by the associated apparatus (supply unit). In addition, the maximum unprotected residual capacitance (C_i) and inductance (L_i) of each apparatus (other than the terminators) connected to the fieldbus must be less than or equal to 5 nF and 10 μ H respectively.

In each I.S. fieldbus segment only one active source, normally the associated apparatus, is allowed to provide the necessary power for the fieldbus system. The allowed voltage U_o of the associated apparatus used to supply the bus is limited to the range of 14 V d.c. to 24 V d.c. All other equipment connected to the bus cable has to be passive, meaning that the apparatus

is not allowed to provide energy to the system, except to a leakage current of 50 μ A for each connected device.

Supply unit

trapezoidal or rectangular output characteristic only

$U_o = 14$ to 24 V (I.S. maximum value)

I_o according to spark test result or other assessment,

e.g. 133 mA for $U_o = 15$ V (Group IIC, rectangular characteristic)

No specification of L_o and C_o in the certificate and on the label.

Cable

The cable used to interconnect the devices needs to comply with the following parameters:

loop resistance R' : 15 to 150 Ω /km

inductance per unit length L' : 0.4 to 1 mH/km

capacitance per unit length C' : 80 to 200 nF/km

$C' = C'$ line/line + 0.5 C' line/screen, if both lines are floating

or

$C' = C'$ line/line + C' line/screen, if the screen is connected to one line

length of spur cable: max. 30 m (Group IIC) or 120 m (Group IIB)

length of trunk cable: max. 1 km (Group IIC) or 1.9 km (Group IIB)

Terminators

At each end of the trunk cable an approved line terminator with the following parameters is suitable:

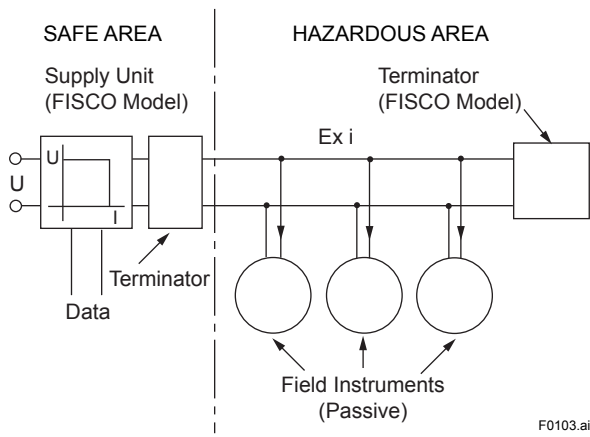
$R = 90$ to 100 Ω

$C = 0$ to 2.2 μ F

The resistor must be infallible according to IEC 60079-11. One of the two allowed terminators might already be integrated in the associated apparatus (bus supply unit).

System evaluation

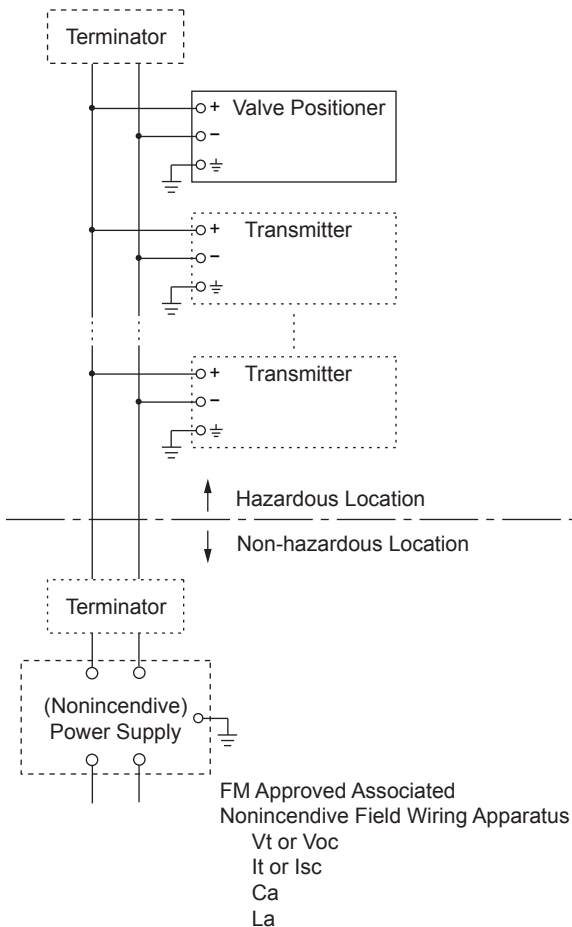
The number of passive devices like transmitters, actuators, hand held terminals connected to a single bus segment is not limited due to I.S. reasons. Furthermore, if the above rules are respected, the inductance and capacitance of the cable need not to be considered and will not impair the intrinsic safety of the installation.



Note 5. Maintenance and Repair

The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void Factory Mutual Intrinsically Safe and Non-incendive Approval.

● Installation Diagram (Nonincendive, Division 2 Installation)



- *1: Dust-tight conduit seal must be used when installed in Class II and Class III environments.
- *2: Installation should be in accordance with the National Electrical Code® (ANSI/NFPA 70) Sections 504 and 505.
- *3: The configuration of Associated Nonincendive Field Wiring Apparatus must be FM Approved.
- *4: Associated Nonincendive Field Wiring Apparatus manufacturer's installation drawing must be followed when installing this equipment.
- *5: No revision to drawing without prior FM Approvals.
- *6: Terminator and supply unit must be FM Approved.
- *7: If use ordinary wirings, the general purpose equipment must have nonincendive field wiring terminal approved by FM Approvals.
- *8: The nonincendive field wiring circuit concept allows interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus, using any of the wiring methods permitted for unclassified locations.
- *9: Installation requirements;
 $V_{max} \geq V_{oc}$ or V_t
 $I_{max} =$ see note 10.
 $C_a \geq C_i + C_{cable}$
 $L_a \geq L_i + L_{cable}$
- *10: For this current controlled circuit, the parameter (I_{max}) is not required and need not be aligned with parameter (I_{sc} or I_t) of the barrier or associated nonincendive field wiring apparatus.

Electrical Data:

Maximum Input Voltage V_{max} : 32 V
 Maximum Internal Capacitance C_i : 1.76 nF
 Maximum Internal Inductance L_i : 0 μ H

B) FM Explosionproof Type

Caution for FM explosionproof type.

Note 1. Model YVP110 Valve Positioner with optional code /FF1 are applicable for use in hazardous locations.

- Applicable standard: FM3600, FM3615, FM3810, ANSI/NEMA250
- 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.

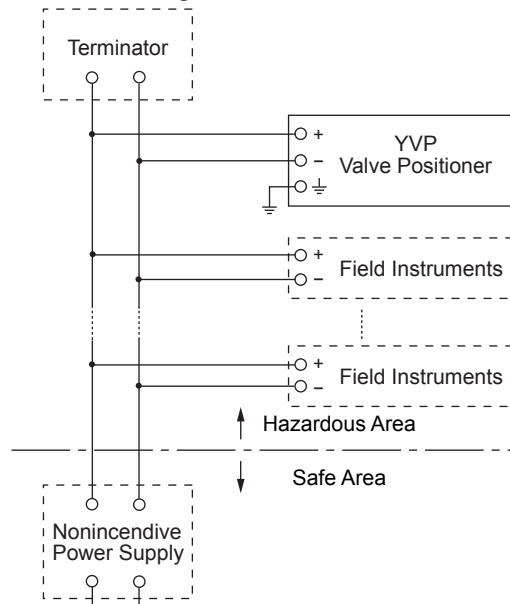
C) FM Nonincendive approval

Model YVP110 Advanced Valve Positioner with optional code /FN15.

- Applicable standard: FM3600, FM3611, FM3810
- 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
Enclosure: NEMA Type4X
- Electrical Parameters:
Vmax = 32 Vdc
Ci = 1.76 nF
Li = 0 μ H
- Caution for FM Nonincendive type.
(Following contents refer to “DOC. No. NFM010-A12 p.1 and p.2”)

■ NFM010-A12

Installation Diagram:



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Note 1.

Dust-tight conduit seal must be used when installed in Class II and Class III environments.

Note 2.

Installation should be in accordance with National Electrical Code (ANSI/NFPA 70) Sections 504, 505 and Local Electrical Code.

Note 3.

The configuration of Associated Apparatus must be Factory Mutual Research Approved.

Note 4.

Associated Apparatus manufacturer's installation drawing must be followed when installing this equipment.

Note 5.

No revision to drawing without prior Factory Mutual Research Approval.

Note 6.

Terminator and supply unit must be FM approved.

Note 7.

Installation requirements;
 $V_{max} \geq V_{oc} \text{ or } V_t$
 $C_a \geq C_i + C_{cable}$
 $L_a \geq L_i + L_{cable}$

1.9.2 ATEX Certification



WARNING

- Do not open the cover when energized.
- When the ambient temp. $\geq 70^{\circ}\text{C}$,
Use the heat-resisting cable $\geq 90^{\circ}\text{C}$
- Take care not to generate mechanical sparking when access to the instrument and peripheral devices in hazardous locations.
- Electrostatic charge may cause an explosion hazard.

Avoid any actions that cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating face of product.

(1) Technical Data

A) ATEX Intrinsically Safe Type (Ex ia)

Caution for ATEX Intrinsically Safe Type.



NOTE

Keep the safety use conditions for both 1G and 1D when used in the hazardous gas and dust area.

Note 1. Model YVP110 Advanced Valve Positioner with optional code /KS25 for potentially explosive atmospheres:

- Applicable standard: EN60079-0:2006, EN60079-11:2007, EN60079-26:2007, EN60079-27:2006, EN61241-0:2006, EN61241-1:2004, EN61241-11:2006 and EN60529
- Certificate: KEMA 08ATEX0114 X

Note 2. Ratings

Type of Protection:

II 1G Ex ia IIB/IIC T4

II 1D Ex iaD 20 IP65 T100°C

II 1D Ex tD A20 IP65 T100°C

Maximum Surface Temperature for dust proof.:
T100°C

Ambient Temperature Ex ia or Ex iaD:

-40°C to +60°C

Ambient Temperature Ex tD: -40°C to +80°C

Ambient Humidity: 0 to 100%RH

(No condensation)

Degree of Protection of the Enclosure: IP65

Electrical Parameters:

For Ex ia IIC or Ex iaD

$U_i = 24.0\text{ V}$, $I_i = 250\text{ mA}$, $P_i = 1.2\text{ W}$,

$C_{int} = 1.76\text{ nF}$, $L_{int} = 0\text{ }\mu\text{H}$

or

For Ex ia IIB/ IIC or Ex iaD (FISCO model)

$U_i = 17.5\text{ V}$, $I_i = 380\text{ mA}$, $P_i = 5.32\text{ W}$,

$C_{int} = 1.76\text{ nF}$, $L_{int} = 0\text{ }\mu\text{H}$

For II 1D Ex tD

Input signal: 32 Vdc,

Output current: 17 mA

Note 3. Installation

All wiring shall comply with local installation requirements.

(Refer to the installation diagram)

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 KEMA Intrinsically safe Certification.

Note 5. Special Conditions for Safe Use

Because the enclosure of the Valve Positioner is made of aluminium, if it is mounted in an area where the use of category 1G apparatus is required, it must be installed such, that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded. Once used as apparatus of equipment category 1D in type of protection Ex tD, the valve positioner is no longer suitable as apparatus of equipment category 1G or 1D in type of protection Ex ia or Ex iaD.

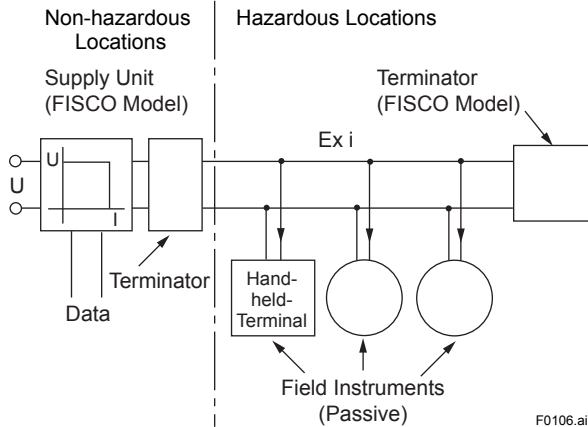
Note 6. Installation Instructions

When used in a potentially explosive atmosphere, requiring the use of apparatus of equipment category 1D, suitable certified cable entry devices or certified blanking elements with a degree of ingress protection of at least IP6X according to EN 60529 shall be used and correctly installed.

Note 7. Installation

When used in potentially explosive atmosphere for category 1D, need not use safety barrier.

■ **FISCO Model**



I.S. fieldbus system complying with FISCO

The criterion for such interconnection is that the voltage (U_i), the current (I_i) and the power (P_i), which intrinsically safe apparatus can receive, must be equal or greater than the voltage (U_o), the current (I_o) and the power (P_o) which can be provided by the associated apparatus (supply unit). In addition, the maximum unprotected residual capacitance (C_i) and inductance (L_i) of each apparatus (other than the terminators) connected to the fieldbus line must be equal or less than 5 nF and 10 μ H respectively.

Supply unit

The supply unit must be certified by a notified body as FISCO model and following trapezoidal output characteristic is used.

$U_o = 14$ to 24 V (I.S. maximum value)

I_o based on spark test result or other assessment, ex. 133 mA for $U_o = 15$ V (Group IIC)

The maximum allowed C_o and L_o are determined by the combinations as specified below.

Cable

The cable used to interconnect the devices needs to comply with the following parameters:

- loop resistance R' : 15 to 150 Ω /km
- inductance per unit length L' : 0.4 to 1 mH/km
- capacitance per unit length C' : 80 to 200 nF/km
- $C' = C'$ line/line + 0.5 C' line/screen, if both lines are floating

or

- $C' = C'$ line/line + C' line/screen, if the screen is connected to one line
- length of spur cable: max. 30 m (Ex ia IIC T4) or 120 m (Ex ia IIB T4)
- length of trunk cable: max. 1 km (Ex ia IIC T4) or 1.9 km (Ex ia IIB T4)

Terminators

The terminator must be certified by a notified body as FISCO model and at each end of the trunk cable an approved line terminator with the following parameters is suitable:

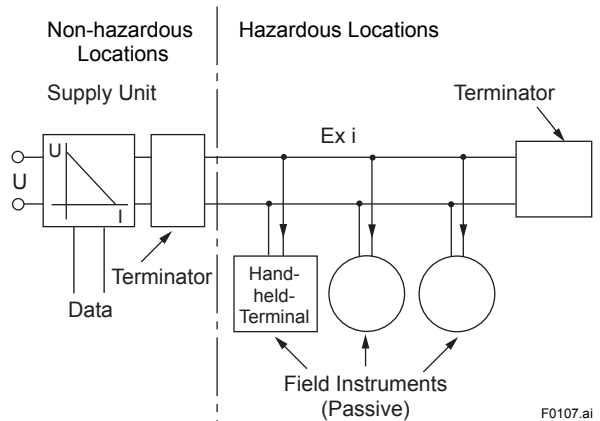
- $R = 90$ to 100 Ω
- $C = 0$ to 2.2 μ F

The resistor must be infallible according to EN 50020. One of the two allowed terminators might already be integrated in the associated apparatus (bus supply unit).

Number of Devices

The number of devices (max. 32) possible on a fieldbus link depends on factors such as the power consumption of each device, the type of cable used, use of repeaters, etc.

■ **Entity Model**



I.S. fieldbus system complying with Entity model

I.S. values Power supply-field device:

$$P_o \leq P_i, U_o \leq U_i, I_o \leq I_i$$

Calculation of max. allowed cable length:

$$C_{cable} \leq C_o - \sum c_i - \sum c_i \text{ (Terminator)}$$

$$L_{cable} \leq L_o - \sum L_i$$

Number of Devices

The number of devices (max. 32) possible on a fieldbus link depends on factors such as the power consumption of each device, the type of cable used, use of repeaters, etc.

B) ATEX Flameproof Type

Caution for ATEX flameproof type.

Note 1. Model YVP110 Valve Positioner with optional code /KF2 is applicable for potentially explosive atmospheres:

- Applicable standard: EN60079-0:2009, EN60079-1:2007
- Certificate: KEMA 10ATEX0023 X
- Group: II
- Category: 2G
- Type of Protection and Marking Code: Ex d IIC, T6 or T5 Gb
- Ambient Temperature: T6; -40 to 65°C
T5; -40 to 80°C

Note 2. Electrical Data

- Supply voltage: 32 V DC max.
- Output signal: 17 mA DC

Note 3. Installation Instructions

- The cable glands and blanking elements shall be certified in type of protection flameproof enclosure "d" suitable for the conditions of use and correctly installed.
- With the use of conduit entries a sealing device shall be provided either in the flameproof enclosure or immediately on the entrance thereto.
- To maintain the degree of ingress protection IP65 according to EN 60529 special care must be taken to avoid water entering the breathing and draining device when the valve positioner is mounted with the feedback shaft in the upright position.

Note 4. Operation

- Keep strictly the WARNING on the label on the positioner.
AFTER DE-ENERGIZING, DELAY 5 MINUTES BEFORE OPENING.
WHEN THE AMBIENT TEMP. $\geq 70^\circ\text{C}$,
USE HEAT-RESISTING CABLE & CABLE GLAND $\geq 90^\circ\text{C}$.

Note 5. Maintenance and Repair

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void KEMA Flameproof Certification.

C) ATEX Intrinsically safe (Ex ic)/Type n (Ex nA)

Note 1. Model YVP110 Advanced Valve Positioner with optional code /KN25

- Applicable standard: EN60079-0:2009/EN60079-0:2012(Ex ic/Ex nA), EN60079-11:2012(Ex ic) EN60079-15:2010(Ex nA)
- Ex ic: II 3G Ex ic IIC T4 Gc (Intrinsically safe)
- Ex nA: II 3G Ex nA IIC T4 Gc (Non-sparking)
- Ambient Temperature: -30 to 75°C
- Ambient Humidity: 0 to 100%RH (No condensation)
- Enclosure: IP65
- Installation category: I

Note 2. Electrical Data

- Ex ic: $U_i = 32 \text{ V}$, $C_i = 3.52 \text{ nF}$, $L_i = 0 \text{ } \mu\text{H}$
- Ex nA: 32 V DC MAX

Note 3. For the installation of this positioner, once a particular declared type of protection is selected, the other type of protection cannot be used. The installation must be in accordance with the description about type of protection in this instruction manual.

Note 4. In order to avoid confusion, unnecessary marking is crossed out on the label other than the selected type of protection when positioner is installed.

Note 5. Installation Instructions

- Cable glands, adapters and/or blanking elements shall be of Ex "n", EX "e" or Ex "d" and shall be installed so as to maintain the specified degree of protection (IP Code) of the equipment.
- To maintain the degree of protection IP65 according to IEC 60529, special care must be taken to avoid water.

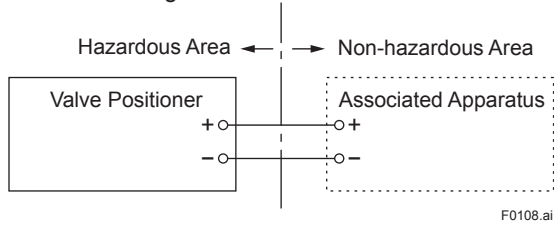
Note 6. Maintenance and Repair

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void ATEX Ex ic and Ex nA.

Note 7. Ex ic Installation

- All wiring shall comply with local installation requirements (refer to the installation diagram)

Installation Diagram



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Electrical Data: $U_i = 32\text{ V}$
 $C_i = 3.52\text{ nF}$
 $L_i = 0\text{ }\mu\text{H}$

Note 8. Ex ic Specific Conditions of Use

! WARNING

- Electrostatic charge may cause an explosion hazard. Avoid any actions that cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating face of product.
- When the lightning protector option is specified (/A), the apparatus is not capable of withstanding the 500V insulation test required by EN60079-11. This must be taken into account when installing the apparatus.
- WHEN THE AMBIENT TEMP. $\geq 70^\circ\text{C}$, USE THE HEAT-RESISTING CABLE AND CABLE GRAND $\geq 90^\circ\text{C}$
- POTENTIAL ELECTROSTATIC CHARGING HAZARD – SEE USER'S MANUAL

Note 9. Ex nA Installation

- Screws of terminals for field wiring connections shall be tightened with specified torque values: 1.2 N·m

! WARNING

When using a power supply not having a nonincendive circuit, please pay attention not to ignite in the surrounding flammable atmosphere. In such a case, we recommend using wiring metal conduit in order to prevent the ignition.

Note 10. Ex nA Specific Conditions of Use

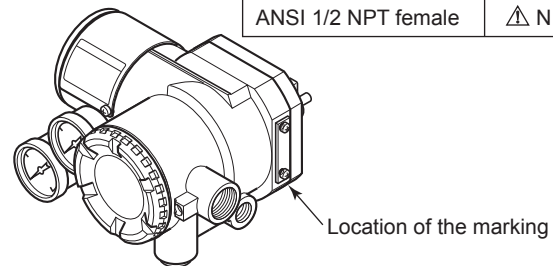
! WARNING

- Electrostatic charge may cause an explosion hazard. Avoid any actions that cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating face of product.
- WHEN THE AMBIENT TEMP. $\geq 70^\circ\text{C}$, USE THE HEAT-RESISTING CABLE AND CABLE GRAND $\geq 90^\circ\text{C}$
- POTENTIAL ELECTROSTATIC CHARGING HAZARD – SEE USER'S MANUAL
- DO NOT OPEN IN AN EXPLOSIVE ATMOSPHERE WHEN ENERGIZED

(2) Electrical Connection

The type of electrical connection is stamped near the electrical connection port according to the following marking.

Screw Size	Marking
ISO M20 × 1.5 female	$\triangle M$
ANSI 1/2 NPT female	$\triangle N$



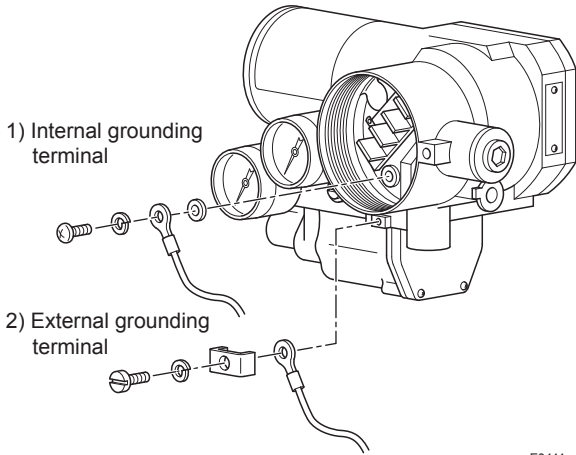
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(3) Installation

! WARNING

All wiring shall comply with local installation requirement and local electrical code.

The grounding terminals are located on the inside and outside of the terminal area.
Connect the cable to grounding terminal in accordance with wiring procedure 1) or 2).



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Wiring Procedure for Grounding Terminals

(4) Operation



- OPEN CIRCUIT BEFORE REMOVING COVER. INSTALL IN ACCORDANCE WITH THIS USER'S MANUAL
- Take care not to generate mechanical sparking when access to the instrument and peripheral devices in hazardous locations.
- Electrostatic charge may cause an explosion hazard.
Avoid any actions that cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating face of product.
- Carbon disulphide is excluded for enclosures under gas atmosphere.

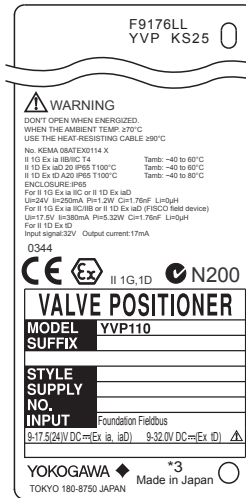
(5) Maintenance and Repair



The instrument modification or parts replacement by other than authorized Representative of Yokogawa Electric Corporation is prohibited and will void the certification.

(6) Name Plate

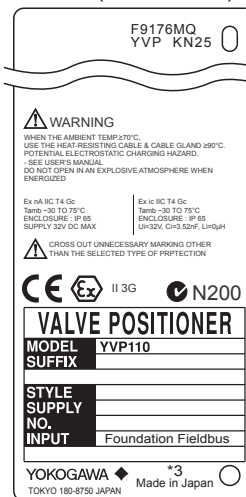
• Name plate for intrinsically safe type



• Name plate for flameproof type



• Name plate for /KN25 (Ex ic, Ex nA)



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MODEL: Specified model code.
SUFFIX: Specified suffix code.
STYLE: Style code.
SUPPLY: Air supply pressure.
NO.: Serial number and year of production*1.
INPUT: Type of electrical input (FOUNDATION FIELDBUS).

YOKOGAWA ◆ TOKYO 180-8750 JAPAN:
The manufacturer name and the address*2.

*1: The third figure from the last of the serial number shows the year of production. For example, the production year of the product engraved in "NO." column on the name plate as follows is 2001.

12A220566 108
 ↑
 The year 2001

*2: "180-8750" is a zip code which represents the following address.
2-9-32 Nakacho, Musashino-shi, Tokyo Japan

*3: The production year is shown on the place of *3 (for example "2013.02").

1.9.3 CSA Certification

A) CSA Explosionproof Type

Cautions for CSA Explosionproof type.

Note 1. Model YVP110 Advanced Valve Positioner with optional code /CF1 are applicable for use in hazardous locations:

- Applicable standard: C22.2 No. 0, No. 0.4, No. 0.5, No. 25, No. 30, No. 94, No. 1010.1
- Certificate: 1186507
- Explosionproof for Class I, Groups B, C and D; Class II, Groups E, F and G; Class III.
- Enclosure Rating: Type 4X
- Temperature Code: T6 and T5
- Ambient Temperature: -40 to 75°C for T6, -40 to 82°C for T5

Note 2. Wiring

- All wiring shall comply with National Electrical Code ANSI/NFPA 70 and Local Electrical Codes.
- "FACTORY SEALED, CONDUIT SEAL NOT REQUIRED."
- When the ambient temperature is 60°C or more, use an external cable having a maximum allowable heat-resistance of at least 90°C.

Note 3. Maintenance and Repair

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void CSA Certification.

1.9.4 TIIS Certification

A) TIIS Flameproof Type

The model YVP110 Valve Positioner with optional code /JF3, which has obtained certification according to technical criteria for explosion-protected construction of electric machinery and equipment (Standards Notification No. 556 from the Japanese Ministry of Labor) conforming to IEC standards, is designed for hazardous areas where inflammable gases or vapors may be present. (This allows installation in Division 1 and 2 areas)

To preserve the safety of flameproof equipment requires great care during mounting, wiring, and piping. Safety requirements also place restrictions on maintenance and repair activities. Users absolutely must read "Installation and Operating Precautions for JIS Flameproof Equipment" at the end of this manual.



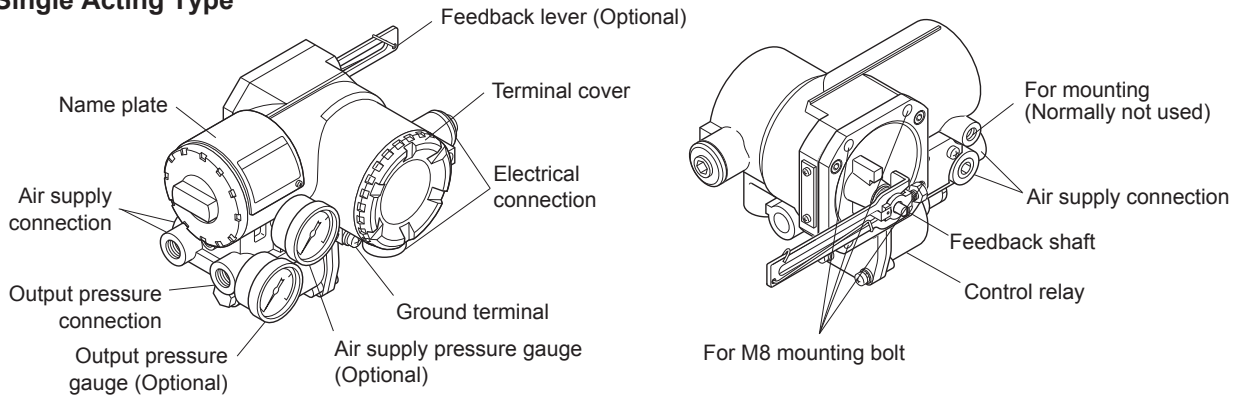
CAUTION

When selecting cables for TIIS flameproof type positioners, use cables having a maximum allowable heat resistance of at least 70°C.

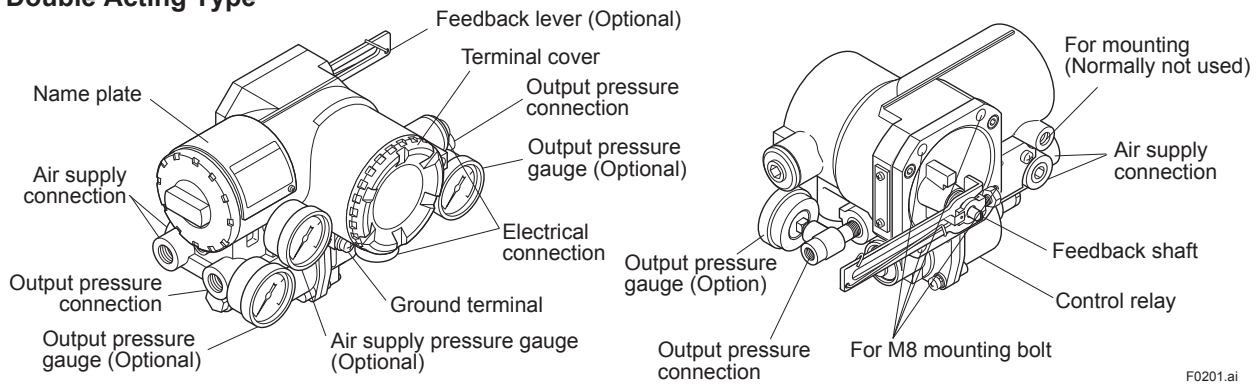
2. Part Names

2.1 Appearance and Part Names

Single Acting Type

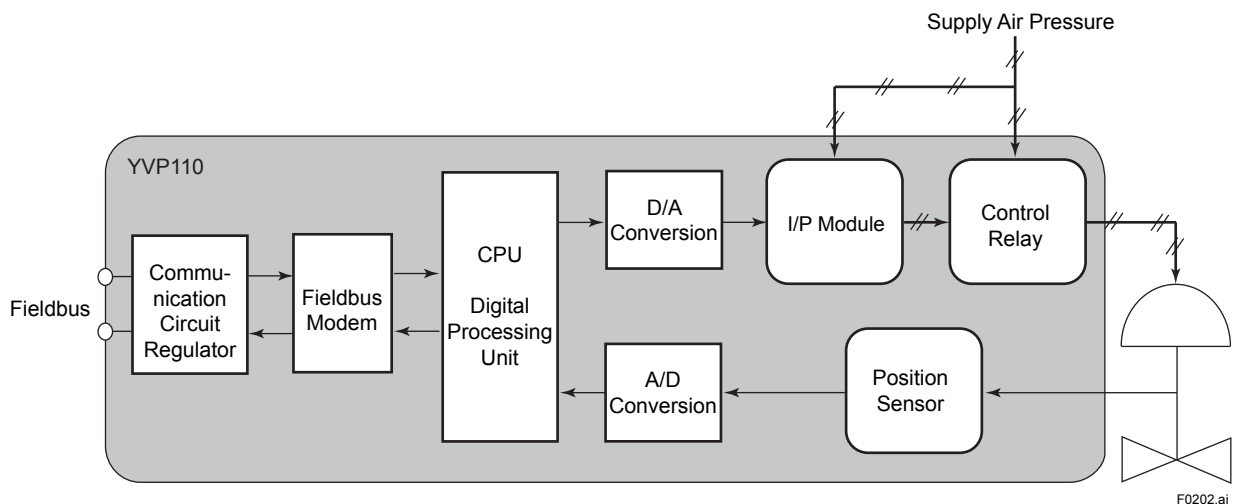


Double Acting Type



F0201.ai

2.2 Block Diagram



F0202.ai

3. Installing YVP110 on Actuator

3.1 General

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



WARNING

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

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

3.2 Installing YVP110 on Actuator

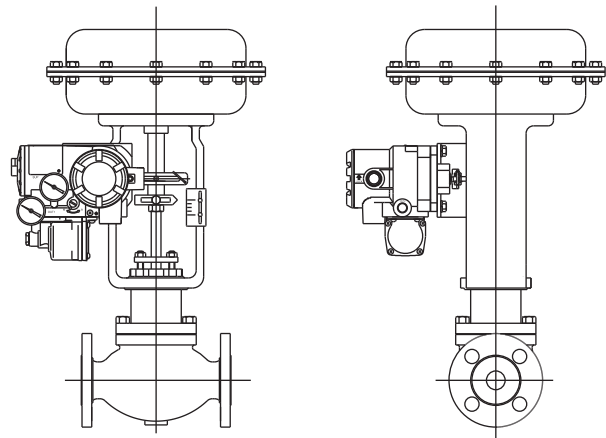
A YVP110 can be installed on a valve actuator with a mounting bracket. Prepare the bracket and clamp which are necessary to install the valve, according to the valve. In general, the installation method is determined by the combination of the control valve and positioner as well as by the valve manufacturer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

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

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

3.2.1 Installing YVP110 on Linear-motion Control Valve

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



F0301.ai

Figure 3.1 YVP Installed on Linear-motion Valve/ Actuator

(1) Fixing Bracket to YVP110

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

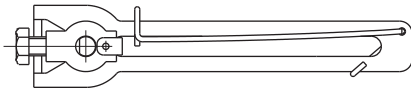
(2) Fixing the YVP110 to Actuator with Bracket

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

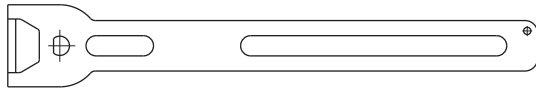
(3) Attaching Feedback Lever

The YVP110 with option code /LV1 comes with two different feedback levers, (1) and (2) shown below, and the one with option code /LV2 comes with lever (3). Check the specifications of the levers shown in Table 3.1 and Figure 3.2 and choose the lever most suitable for the control valve used.

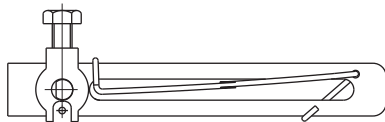
(1) F9176HA



(2) F9176HC



(3) F9176HD



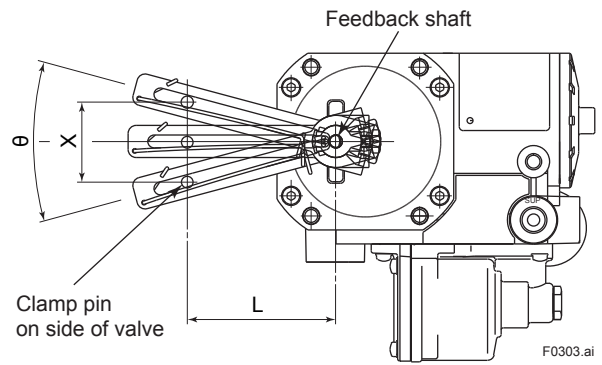
F0302.ai

Figure 3.2 Feedback Levers

Table 3.1 Specifications of Levers

Lever Model	Stroke (X)	Pin-to-shaft Distance (L)	Allowable Range of Rotation Angle of Feedback Shaft(θ)
F9176HA	10 to 60 mm	25 to 75 mm	±10 to 25 degrees
F9176HC	30 to 100 mm	75 to 115 mm	
F9176HD	5 to 20 mm	14 to 20 mm	

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

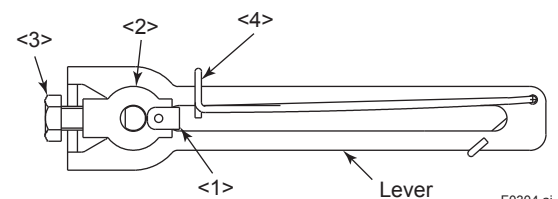


F0303.ai

Figure 3.3 Stroke of Lever

When /LV1 is specified, the hardware for attaching the lever to the feedback shaft and the spring for fixing the clamp pin are attached to the F9176HA, the smaller feedback lever for generally used mid-capacity actuators. Thus, when using the F9176HC, the feedback lever for high-capacity actuators, detach and use the hardware and spring from the F9176HA. See Figure 3.4. To do so, first detach the spring <4>. Then, detach the clip <1> and remove the hardware <2> and <3>. Attach <1> to <4> to the F9176HC feedback lever for high-capacity actuators in the reverse order.

The hardware and the spring attached to the /LV2 lever is not compatible with those for the /LV1 lever.



F0304.ai

Figure 3.4 Disassembling a Lever Assembly

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

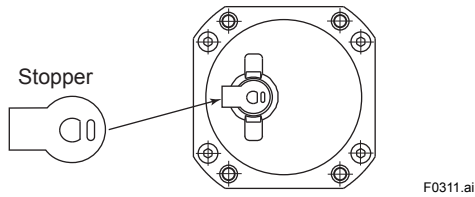
- (1) Insert the YVP110's feedback shaft into the small hole on the stopper side of the lever as shown in Figure 3.5.

CAUTION

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

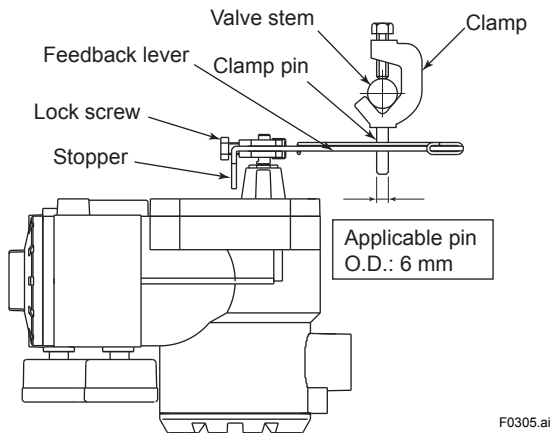
IMPORTANT

A stopper is attached to the feedback shaft to prevent an over-rotation of the shaft as shown below. When installing the lever, make sure that you install it on the stopper.



F0311.ai

Next, fix the lock screw.



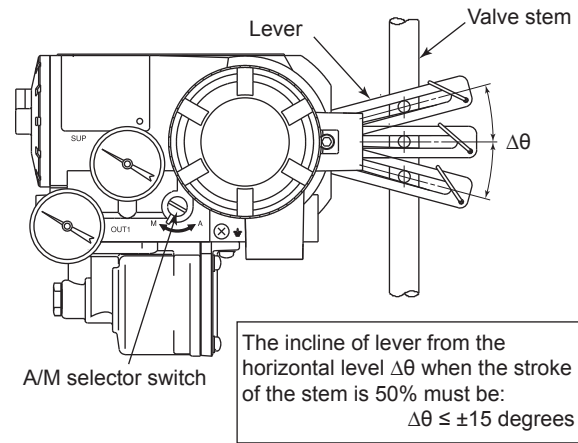
F0305.ai

Figure 3.5 Attaching Lever and Clamp

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

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

When using the Single Acting Type, it is possible to adjust the position of the feedback lever while air is being supplied to the actuator. See Appendix 5. "POSITION ADJUSTMENT OF FEEDBACK LEVER".



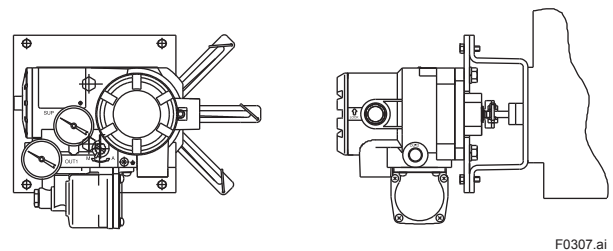
The incline of lever from the horizontal level $\Delta\theta$ when the stroke of the stem is 50% must be:
 $\Delta\theta \leq \pm 15$ degrees

F0306.ai

Figure 3.6 Checking Position at Which Clamp Should Be Fixed

3.2.2 Installing YVP110 on Rotary-motion Control Valve

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



F0307.ai

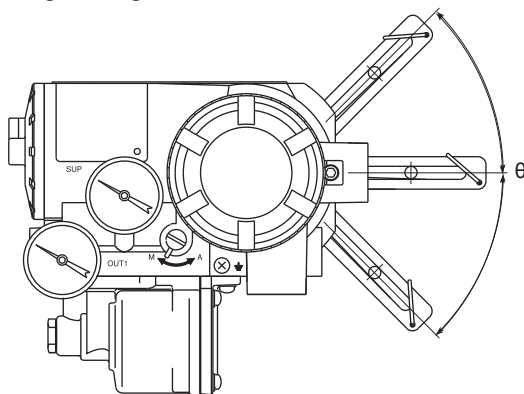
Figure 3.7 YVP Installed on Rotary-motion Valve/Actuator

(1) Allowable Range of Rotation Angle of Feedback Shaft

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

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

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



Range of rotation angle of shaft:	Within ±45 degrees
Mechanically allowable rotation angle:	Within ±55 degrees

F0308.ai

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

(2) Fixing Bracket to YVP110

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

(3) Attaching Feedback Lever

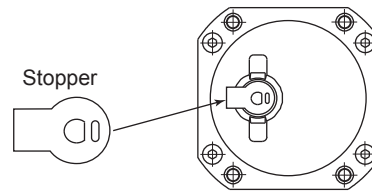
For a rotary-motion actuator, since it is often difficult to secure sufficient working space between the positioner and actuator, attach the feedback lever before fixing the YVP110 to the actuator. Make sure that the stopper is located on the side of the YVP110 as shown in Figure 3.9.

 **CAUTION**

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

 **IMPORTANT**

A stopper is attached to the feedback shaft to prevent an over-rotation of the shaft as shown below. When installing the lever, make sure that you install it on the stopper.



F0311.ai

Next, fix the lock screw.

(4) Fixing the YVP110 to Actuator with Bracket

Insert the pin attached to the valve spindle, into the long hole of the feedback shaft of the YVP110 positioner.

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

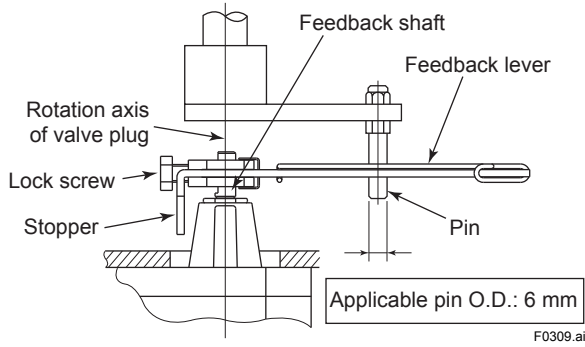


Figure 3.9 Inserting Pin into Hole of Feedback Lever (In case of using F9176HA)

3.2.3 A/M Switching

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

- (1) Turn the A/M selector switch clockwise to change the switch position to M until it stops.
- (2) In manual mode, the pneumatic pressure output to the valve actuator can be varied by changing the regulator output pressure by more than 70 kPa (approximately), regardless of the input signal of the YVP110. For a YVP110 equipped with pressure gauges, you can read the output pressure to the actuator. When using the Double Acting Type, the pneumatic pressure can only be varied from OUT1 to the valve actuator. The pressure is always 0% from OUT2 to the valve actuator. Note that the valve position is not always in accord with the regulator pressure.
- (3) After you have finished manual operation, turn the A/M selector switch counterclockwise until the stopper pin touches the side of the YVP110's casing in order to ensure the switch position changes to A.



WARNING

- Prior to changing the A/M selector switch position, make sure that doing so will neither cause an injury nor affect the process.
- Changing the A/M selector switch position from M (manual) to A (automatic) or A(automatic) to M(manual) during operation will cause the valve stem to temporarily move to a position different from the position determined by the level of the input signal to the positioner.
- If the pressure larger than the allowable range of pressure gauge is applied, the pressure gauge may possibly be damaged.

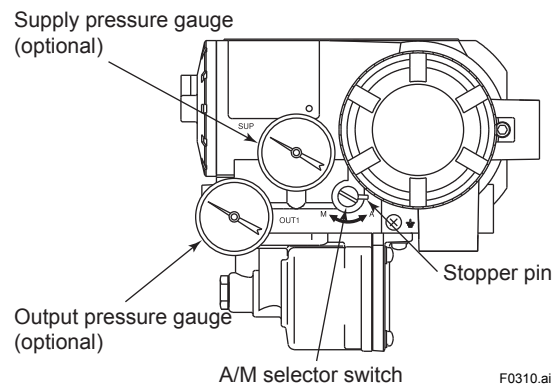


Figure 3.10 A/M Selector Switch

4. Wiring and Piping

4.1 General

This chapter describes the air piping and electric wiring connections.



WARNING

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

- (3) The YVP110 requires an air supply of 140 to 400 kPa. Within this range, regulate the air supply pressure at a level within $\pm 10\%$ of the air supply pressure specified for the actuator, and at 10% of the actuator's spring range or higher.



WARNING

Do not supply air at a pressure exceeding the maximum rated air supply pressure of the actuator or the YVP110 (400 kPa). Doing so may result in a high risk of damage to the equipment or lead to an accident. Supplying air to the valve actuator may cause the valve stem to move. Exercise extreme caution with regard to safety.

4.2 Piping

4.2.1 Air Supply

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

- (1) To prevent moisture, oil, and dust from being led into the YVP110 through pipes, give careful consideration to the choice of the air supply system and supply air suction point as well as installation of the air supply header and air supply piping.
- (2) The desired supply air must:
 - Be dry air whose dew point is at least 10°C lower than that of the ambient temperature.
 - Be free from solid particles as a result of being passed through a 5- μm or finer filter.
 - Not contain oil at a concentration higher than 1 ppm in weight or volume.
 - Not be contaminated by a corrosive, explosive, flammable, or toxic gas.
 - Comply with ANSI/ISA-57.3 1975 (R1981) or ISA-S7.3-1975 (R1981).

4.2.2 Pneumatic Piping

Connect the air supply pipe to the SUP port of the YVP110, and the output pressure pipe to the OUT1 port. When using the Double Acting Type, connect the output pressure pipe to the OUT2 port of the YVP110. A power failure will result in the fail-safe action; OUT1=0% and OUT2=100%. Use O.D. 6-mm/I.D. 4-mm or O.D. 8-mm/I.D. 6-mm copper tubes for piping, and pneumatic pipe fittings for joints. After finishing the piping, check that there is no leakage from the joints.

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

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

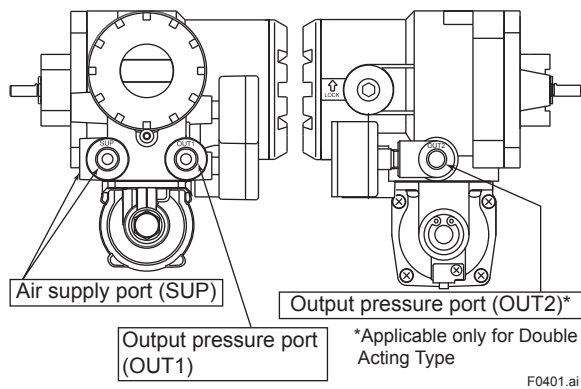


Figure 4.1 Pneumatic Piping Ports

CAUTION

- To obtain the maximum air processing flow rate of the YVP110, the inner diameter of the piping tube needs to be at least 6 mm. When the YVP110 is combined with a high-capacity actuator and a minimum response speed is required, use a tube whose inner diameter is 6 mm or larger.
- Do not use an unnecessarily long tube or piping as it will decrease the air flow rate, thus leading to a decrease in response speed.
- Perform sufficient flushing of the piping tubes and fittings before use to ensure that no foreign matter such as metal refuse may enter the piping.
- When performing the piping connection, be sufficiently careful that a piece of sealing tape or other solid or fluid sealing material does not enter the piping.
- When using the Double Acting Type and piping to the OUT2 port, ensure that the plug for the OUT2 Pressure Gauge does not get turned around.
- When using the Double Acting Type, adjust the pressure balance of the control relay as required (in reference to Section 6.3.4).

4.3 Wiring

CAUTION

For flameproof equipment, wiring materials and wiring work for these equipment including peripherals are strictly restricted. Users absolutely must read "Installation and Operating Precautions for JIS Flameproof Equipment" at the end of this manual prior to the work.

4.3.1 Recommended Cables

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

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

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

4.3.2 Precautions on Wiring

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 4.2, remove the terminal box cover and dust proofing plug when performing a wiring connection. Be sure to securely seal the unused wiring port with a blind plug.
- 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.

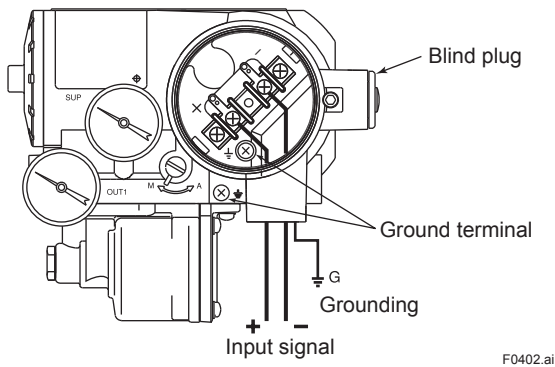


Figure 4.2 Wiring

(1) General-use Type and Intrinsically Safe 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.

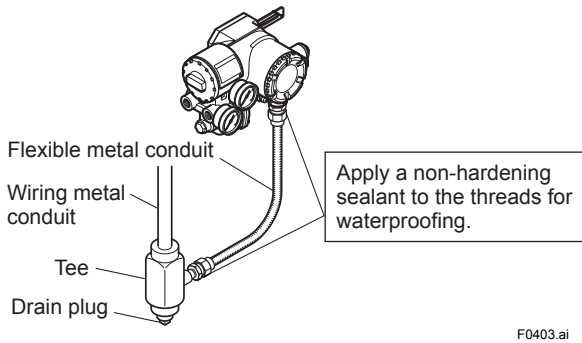


Figure 4.3 Typical Wiring Using Flexible Metal Conduit

(2) Flameproof Type (JIS)

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

- Wiring cable through flameproof packing adapter for only JIS flameproof type (see Figure 4.4).
 - Use only flameproof packing adapters approved by Yokogawa.
 - Apply a nonhardening sealant to the terminal box connection port and to the threads on the flameproof packing adapter for waterproofing.

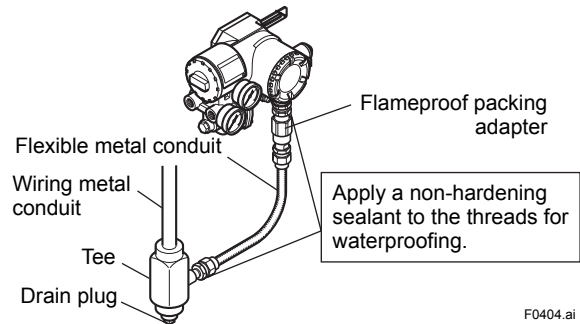


Figure 4.4 Typical Cable Wiring Using Flameproof Packing Adapter

- Measure the cable outer diameter in two directions to within 1 mm.
- Calculate the average of the two diameters, and use packing with an internal diameter nearest to this value (see Table 4.1).

Table 4.1 Flameproof Packings and Applicable Cable Outer Diameters

Optional Code	Wiring Port thread Diameter	Applicable Cable OD (mm)	Identifying Mark	Part Number
G11	G 1/2	8 to 10 10.1 to 12	16 8-10 16 10-12	G9601AM

- Mounting flameproof packing adapter body to conduit connection (see Figure 4.5)

- 1) Screw the flameproof packing adapter into the terminal box until the O-ring touches the wiring port (at least 6 full turns), and firmly tighten the lock nut.
- 2) Insert the cable through the union cover, the union coupling, the clamp nut, the clamp ring, the gland, the washer, the rubber packing, and the packing box, in that order.
- 3) Insert the end of the cable into the terminal box.
- 4) Tighten the union cover to grip the cable. When tightening the union cover, tighten approximately one turn past the point where the cable will no longer move up and down.



IMPORTANT

Proper tightening is important. If it is too tight, a circuit break in the cable may occur; if not tight enough, the flameproof effectiveness will be compromised.

- 5) Fasten the cable by tightening the clamp nut.
- 6) Tighten the lock nut on the union cover.
- 7) Connect the cable wires to each terminal.

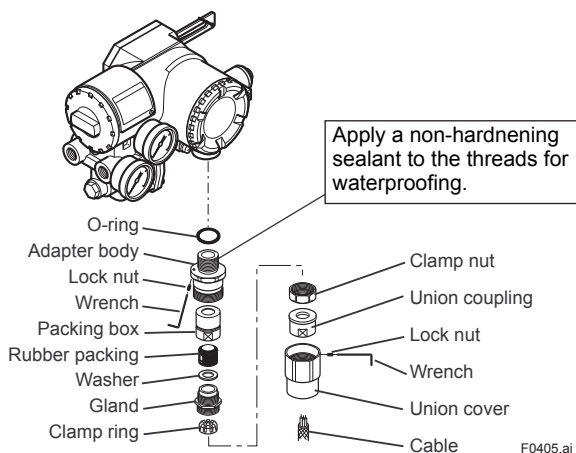


Figure 4.5 Installing Flameproof Packing Adapter

- 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.

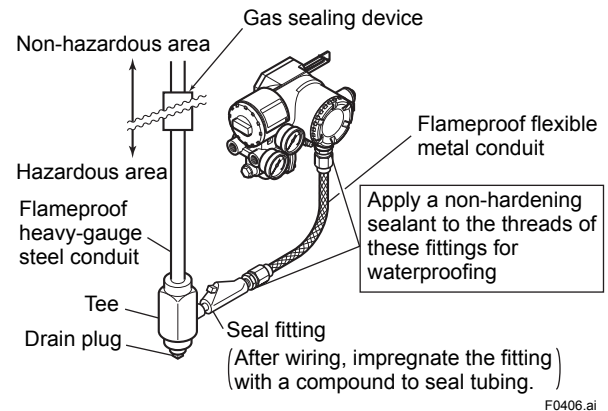


Figure 4.6 Typical Wiring Using Flameproof Metal Conduit

4.4 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 4.2.



WARNING

For JIS flameproof type and intrinsically safe type, grounding should satisfy Class D requirements (grounding resistance, 100 Ω or less).

5. Setup



CAUTION

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

5.1 General

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

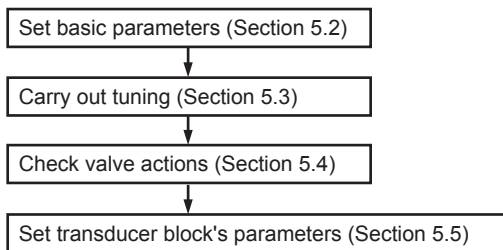


IMPORTANT

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

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

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



F0501.ai

Figure 5.1 Setup Procedure

5.2 Setting Basic Parameters

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

(1) Selecting the Acting Direction of Valve

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

- 1 = air to open
- 2 = air to close



IMPORTANT

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

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

When a power failure or serious hardware damage is detected, the YVP110 cuts the current signal being fed to the I/P module to zero, moving the valve to the safe side. The action of the YVP110 upon occurrence of a communication error can be predefined by AO block's parameters; see Section 13.3.1, "Fault State."

(2) Selecting the Actuator Type

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

- 1 = linear-motion actuator
- 2 = rotary-motion actuator

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

5.3 Carrying out Tuning



CAUTION

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

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

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



IMPORTANT

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

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



CAUTION

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

- (1) To sequentially adjust the zero-point and span, and then control parameter settings for the first time after installing the YVP110 on a valve actuator, write:
 - 4 (= travel calibration at stop point and control parameter tuning).
- (2) To leave the control parameter settings unchanged and only perform zero-point and span adjustments such as after detaching the YVP110 from the valve actuator and restoring it, write:
 - 2 (= travel calibration at stop point).
- (3) To leave zero-point and span settings unchanged and only adjust control parameter settings, such as after the hysteresis of the valve actions has greatly changed, write:
 - 3 (= control parameter tuning).

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

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

- 5 (= cancel execution).

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

- 1 = succeeded
- 2 = canceled
- 255 = in operation

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

 **CAUTION**

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

The following parameters are tuned by carrying out auto tuning: (For details, see section A6.4)

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

- X_BST_ON_THRESHOLD *
(the addition value to threshold for switching on boost action for exhaust.)
- X_BST_OFF_THRESHOLD *
(the addition value to threshold for switching off boost action for exhaust)
- X_BOOST_VALUE *
(the addition boost value for exhaust)

*Applicable only for Double Acting Type

Normally, control parameters need not be readjusted after auto tuning. (Should there be a problem, see Chapter 16, "Troubleshooting.") If you want to carry out fine adjustments of the zero-point and span settings, perform the travel calibration as follows.

● **Travel Calibration**

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

- (1) First, vary the value of FINAL_VALUE.value (see caution) to move the stem and adjust the stem to the desired point that you want to set as the 100% position.
- (2) Next, write 3 to TRAVEL_CALIB_EXEC. This changes the span while leaving the zero point unchanged.

TRAVEL_CALIB_EXEC:

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

 **CAUTION**

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

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

5.4 Checking Valve Actions

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



NOTE

Only when the target mode is in MODE_BLK parameters in both the AO and transducer blocks are O/S, can FINAL_VALUE.value be written. It is not usually necessary to readjust the control parameters after auto tuning. However, when using the Double Acting Type or if the expected response characteristics cannot be obtained using auto tuning, either conduct manual tuning in reference to APPENDIX 6 or refer to Section 18.5 Troubleshooting Auto Tuning.

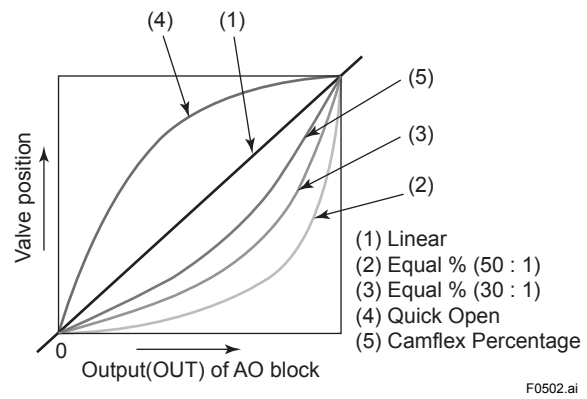


Figure 5.2 Position-to-flow Rate Characteristic Type

(2) Final-value Limits

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



CAUTION

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

5.5 Setting Parameters of Transducer Block

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

(1) Position-to-flow Rate Characteristic Type

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

- 1 = linear
- 2 = equal percent (50:1)
- 3 = equal percent (30:1)
- 4 = quick open (reversal of equal % - 50:1)
- 5 = Camflex Percentage
- 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.

(3) Tight-shut and Full-open Actions

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

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

(4) Thresholds for Limit Switches

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

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

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



CAUTION

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

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

(5) Thresholds for Operation Result Integration Alarms

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

- TOTAL_CYCLE_COUNT (incremented by 1 at each change in the direction of the action)
- TOTAL_TRAVEL (in % where full stroke = 100%)
- TOTAL_OPEN_TIME (in hours)
- TOTAL_CLOSE_TIME (in hours)
- TOTAL_NEAR_CLOSE_TIM (total at nearly closed time in hours)
- SERVO_WARN_COUNT (Total number of times of Servo output drift warning)

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

- CYCLE_COUNT_LIM
- TRAVEL_LIM
- OPEN_TIME_LIM
- CLOSE_TIME_LIM
- NEAR_CLOSE_TIME_LIM

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

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

6. Maintenance

6.1 General

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

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

For calibrations, see Chapter 5.



Precautions for ATEX flameproof type and type nA instruments

- Flameproof type and type nA instruments must be, as a rule, removed to a non-hazardous area for maintenance and be disassembled and reassembled to the original state.
- On the flameproof type and type nA instruments the terminal cover is locked by an Allen head bolt (shrouding bolt). When a shrouding bolt is driven clockwise by an Allen wrench, it is going in and cover lock is released, and then the cover can be opened. When a cover is closed it should be locked by a shrouding bolt without fail. Tighten the shrouding bolt to a torque of 0.7 N·m.

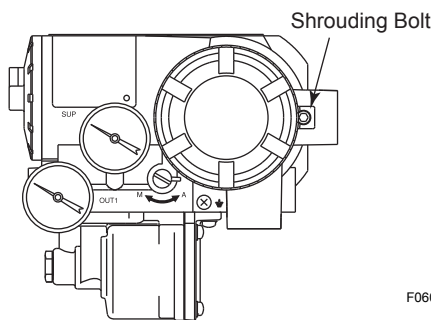


Figure 6.1 Shrouding Bolts

F0601.ai

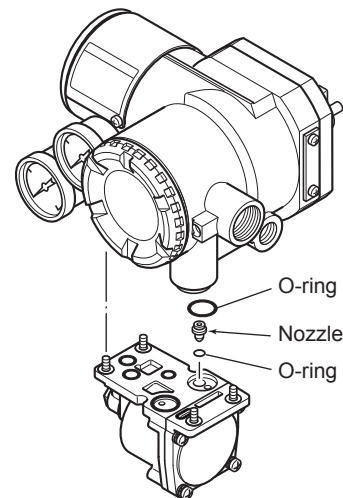
6.2 Periodic Inspections

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

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

6.2.1 Cleaning the Fixed Nozzle

The fixed nozzle of the YVP110 is attached to the control relay's surface that engages the YVP110's main structure (see Figure 6.2). Detach the control relay from the main structure of YVP110 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.



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Figure 6.2 Cleaning the Nozzle

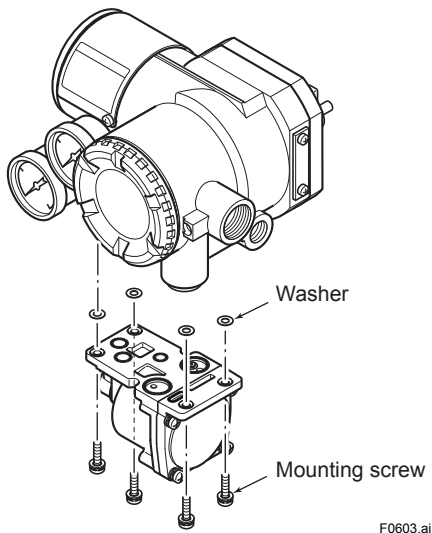


All the O-rings used for the sealing of pneumatic signal circuits are made of silicon rubber. The sealing capability is degraded if general silicon grease is applied. When applying grease to a sealing part, use a type of grease compatible with silicon rubber, such as fluoride grease and grease for silicon 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.
- (5) When using the Double Acting Type, adjust the pressure balance of the control relay as required (in reference to Section 6.3.4). After completing the replacement of the control relay assembly, carry out tuning and check the valve's actions (in reference to Sections 5.3 and 5.4).



F0603.ai

Figure 6.3 Replacing the Control Relay Assembly

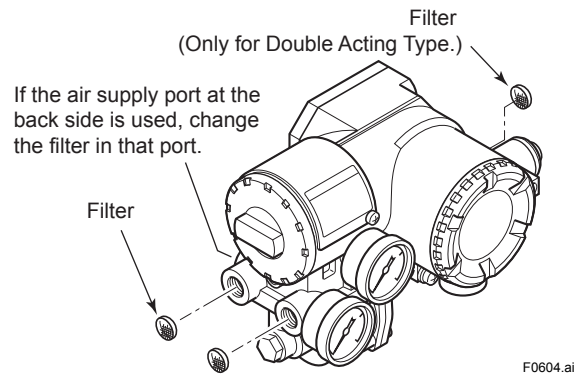


CAUTION

For the Double Acting Type, the recommended replacement cycle for the control relay is either when the actual repeat cycle exceeds 500,000 times, or after the control relay has been in use for 6 years.

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.



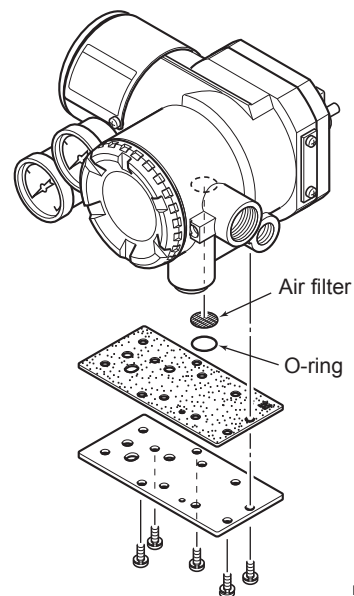
F0604.ai

Figure 6.4 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*. (*two gaskets for Double Acting Type)
- (4) Remove the air filter and O-ring.
- (5) Set the new filter in place.
- (6) Perform steps (3), then (2) to restore the YVP110 to its original state.



F0605.ai

Figure 6.5 Replacing the Internal Air Filter

6.3.4 Tuning the Pressure Balance of Control Relay

When you use a double-acting cylinder actuator, adjust the pressure balance of the control relay, if necessary.

The optimal point of pressure balance slightly differs depending on the packing and load characteristics of the cylinders used, but in general, approx. 50 to 90% of the supply air pressure is said to be appropriate.

The pressure balance of the YVP110 is set to approx. 75% at the time of shipment.

It is possible to reduce the hunting phenomenon and air consumption by adjusting the balance pressure.

However, if the pneumatic piping is connected to the valve actuator, the pressure of a cylinder on one side becomes higher, and the balance cannot be maintained.

If you want to increase the balance pressure, turn the screw for adjusting the balance pressure (shown in Figure 6.6) counterclockwise. If you want to decrease the balance pressure, turn the screw clockwise. At this time, you do must not to loosen the screw beside the adjustment screw.

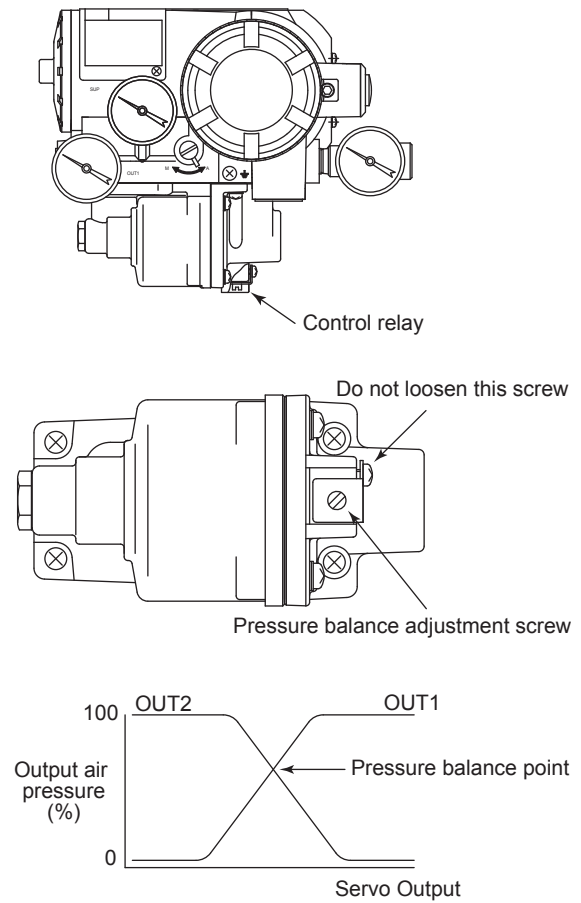


Figure 6.6 Tuning the Pressure Balance of Control Relay

F0606.ai

7. Standard Specifications

■ Standard Specifications

Applicable Control Valve:

Linear or Rotary Motion Control Valve
(Diaphragm Actuator and Cylinder)

Functions:

Function Blocks:
 AO: One Analog Output
 DI: Two Discrete Inputs
 OS: One Splitter Block
 IS: One Input Selector
 AR: One Arithmetic
 PID: One or Two PID Control Functions
 (Optional)



NOTE

IS, AR and PID (2 blocks) function blocks are applicable for only software download function (/EE).

Link Master Function
 Pressure Sensor (Optional)
 Flow Characterization Feature:
 Linear
 Equal Percentage (50 : 1)
 Equal Percentage (30 : 1)
 Quick Opening
 Camflex Percentage
 Customer Characterization (10 segments)
 Auto Tuning Function
 Valve Position Detecting Function
 Continuous Diagnostics Function:
 Total Travel
 Number of Cycles
 Time Open/Time Close/Time Near Close

Housing Materials:

Case: Aluminum die-cast
 Paint: Polyurethane resin-baked finish
 Color: Deep-sea moss-green
 (Munsell 0.6GY3.1/2.0 or equivalent)

Communication:

Digital: FOUNDATION fieldbus

Supply Voltage:

9 to 32V DC for general use and flameproof type
 9 to 24V DC for intrinsically safe type Entity model
 9 to 17.5V DC for intrinsically safe type FISCO model

Conditions of Communication Line

Supply Voltage: 9 to 32V DC
 Current Draw:
 Steady state: 17 mA max.
 Software download state: 41 mA max.

Output Signals and Pressure Gauge Scale:

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

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

Double acting Cylinder			
Calibration unit	Supply Air Pressure	Pressure Gauge Scale	
		Supply Air	Output Signal
Pa	200 to 700 kPa	1 MPa	1 MPa
kgf/cm ²	2 to 7 kgf/cm ²	10 kgf/cm ²	10 kgf/cm ²
bar	2 to 7 bar	10 bar	10 bar
psi	30 to 105 psi	150 psi	150 psi

Pressure Gauge Case:

Stainless steel JIS SUS 304

Normal Operating Conditions:

Air Supply pressure:
 Single Acting Actuator:
 20 to 60 psi (140 to 400 kPa)
 Double Acting Actuator:
 30 to 100 psi (200 to 700 kPa)
 Vibration Limit: 4 mm at 5 to 15 Hz;
 2G at 15 to 2000 Hz
 Shock limit: 10G

Manual Operation:

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

Zero Adjustment Range:

-15 to 85% of span

Span Adjustment Range:

Within 300% of span

Valve-stem Travel Range:

Linear Motion:

10 to 100 mm (0.4 to 4.0 inch)

(Rotation Range: ±10 to ±25 deg)

Rotary Motion:

20 to 90 deg

Air Consumption and Output Capacity:

	Diaphragm, Single Acting Cylinder
Maximum Air Consumption	0.20 SCFM (0.32 Nm ³ /h) at 140 kPa
Maximum Output Capacity	4.1 SCFM (6.6 Nm ³ /h) at 140 kPa

	Double Acting Cylinder
Maximum Air Consumption	0.62 SCFM (1.0 Nm ³ /h) at 400 kPa
Maximum Output Capacity	8.5 SCFM (13.7 Nm ³ /h) at 400 kPa

Ambient Temperature Limits:

Single Acting Actuator:

-40 to 85°C (-40 to 185°F)

Double Acting Actuator:

-40 to 60°C (-40 to 140°F) for standard

-10 to 85°C (14 to 185°F) for high

temperature use with option code /HT

Ambient Humidity Limits:

5 to 95% RH at 40°C (104°F)

EMC Conformity Standards: CE , N200

EN61326-1 Class A, Table 2 (For use in industrial locations)

Degrees of Protection:

IP65, NEMA4X

Connections:

Air Connection: Rc 1/4 or 1/4 NPT female

Electrical Connection: G 1/2, 1/2 NPT, M20 and Pg13.5 female

Pressure Gauge Connection:

		Pressure gauge connection	With pressure gauge (Optional)
Connections Codes	1,5 and 6	Rc 1/8 female	/GP, /GM, and /GB
	3	1/8 NPT female	/GE

Mounting:

Front of Actuator with bracket.

Direct Connection for rotary valve.

Weight:

Single Acting Actuator: 2.4 kg (5.3 lb)

Double Acting Actuator: 2.8 kg (6.2 lb)

Performance Specifications

Linearity:

Single Acting Actuator:

±0.5% of Span (including linkages)

Double Acting Actuator:

±1.0% of Span (including linkages)

Hysteresis:

Single Acting Actuator: 0.3% of Span

Double Acting Actuator: 0.5% of Span

Ambient Temperature Effect:

±0.08% of Span/°C

Position Effect:

±0.3% of Span/90 deg

Vibration Effect:

±2% of Span at 2G (15 to 2000 Hz)

■ Model and Suffix Codes

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

■ 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	Coating change	Epoxy resin coating	X1	
	Color change	Terminal Cover only	Munsell notation code: N1.5 Black	P1
			Munsell notation code: 7.5BG4/1.5, jade green	P2
			Metallic silver	P7
PID function	PID control function (one block)	LC1		
	PID control function (two blocks) *7	LC2		
Output monitor	Built-in output pressure sensor *3 and signature function *4	BP		
With pressure gauge	Scale and calibration unit: Pa *1	GP		
	Scale and calibration unit: kgf/cm ² *1	GM		
	Scale and calibration unit: bar *1	GB		
	Scale and calibration unit: psi *2	GE		
Valve linkage	Two levers: stroke limit of 10 to 100 mm	LV1		
	One lever: stroke limit of 5 to 10 mm When using this lever set, following performance specifications shall be applied; Linearity: Single Acting Actuator: ±1.0% of span, Double Acting Actuator: ±2.0% of span Hysteresis: Single Acting Actuator: 0.6% of span, Double Acting Actuator: 1.0% of span	LV2		
High temperature use *5	Ambient temperature limits: -10 to 85°C(14 to 185°F)	HT		
Software download function *6	Based on Foundation Fieldbus Specification(FF-883) Download class: Class1	EE		

- *1: Applicable for Connections code 1, 5 and 6.
- *2: Applicable for Connections code 3.
- *3: For double acting actuator, OUT1 connection is available.
- *4: Single acting actuator type with /BP supports 5 types of signature functions.
- *5: Applicable for double acting actuator.
- *6: Not applicable for Option code FS15 and KS25.
- *7: Applicable for option code EE.

■ **Optional Specifications (For Explosion Protected types)**

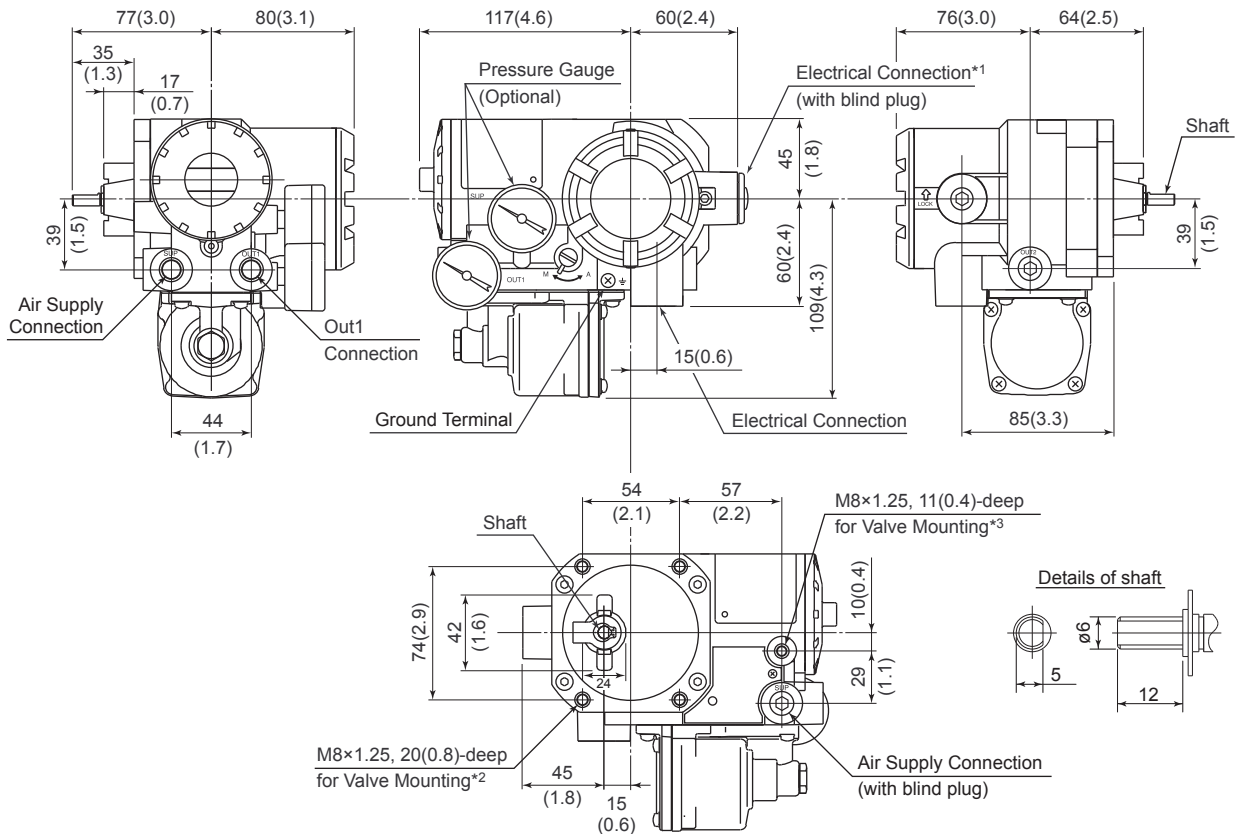
Item	Description	Code
Explosionproof type	CSA Explosionproof Approval*1 Applicable standard: C22.2 No. 0, No. 0.4, No. 0.5, No. 25, No. 30, No. 94, No. 1010.1 Certificate: 1186507 Explosionproof for Class I, Division 1, Class B, C & D; Class II, Groups E, F & G., Class III. Enclosure Type: NEMA4X Temp. Class: T5/T6 Amb.Temp.: -40 to 82°C(-40 to 180°F) for T5, -40 to 75°C(-40 to 167°F) for T6	CF1
	FM Explosionproof Approval*1 Applicable standard: FM3600, FM3615, FM3810, ANSI/NEMA250 Explosion proof for Class 1, Division 1, Groups A, B, C and D; Dust-ignitionproof for Class II/III, Division 1, Groups E, F and G Enclosure Type: NEMA 4X Temp. Class: T6 Amb. Temp.: -40 to 80°C (-40 to 176°F)	FF1
	FM Intrinsically Safe, Nonincendive Approval*1 Applicable standard: FM3600, FM3610, FM3611, FM3810, ANSI/NEMA250 IS/ I, II, III/1/ABCDEF/G/T4 Ta=60°C; Type 4X I/0/AEx ia/IIC/T4 Ta=60°C; Type 4X, NI/1/2/ABCD/T4 Ta=60°C; Type 4X, I/2/IIC/T4 Ta=60°C; Type 4X, S/II/2/FG/T4 Ta=60°C; Type 4X, S/III/2/T4 Ta=60°C; Type 4X Entity Parameters: Groups A, B, C, D, E, F, and G and Group IIC Vmax=24 V, Imax=250 mA, Pi=1.2 W, Ci=1.76 nF, Li=0 mH FISCO Parameters: Groups A, B, C, D, E, F, and G and Group IIC Vmax=17.5 V, Imax=360 mA, Pi=2.52 W, Ci=1.76 nF, Li=0 mH Groups C, D, E, F, and G and Group IIB Vmax=17.5 V, Imax=380 mA, Pi=5.32 W, Ci=1.76 nF, Li=0 mH Nonincendive Field Wiring Parameters: Groups A, B, C, D, E, F, and G and Group IIC: Vmax=32 V, Ci=1.76 nF, Li=0 mH	FS15
	FM Nonincendive Approval for /EE Software download *5 Applicable standard: FM3600, FM3611, FM3810 Class I, Division 2, Group A, B, C, & D Class II, Division 2, Group F & G and Class III, Division 1 Class I, Zone 2, Group IIC in Hazardous (Classified) locations Enclosure: "NEMA4X", Temp. Cl.: T4, Amb. Temp. -40 to 60°C (-40 to 140°F) Vmax.=32V, Ci=3.52 nF, Li=0µH	FN15
	ATEX Flameproof Approval*2 Applicable standard: EN60079-0:2009, EN60079-1:2007 Certificate: KEMA 10ATEX0023 X II 2G Ex d IIC T6 or T5 Gb Amb. Temp.: -40 to 65°C (-40 to 149°F) for T6, -40 to 80°C (-40 to 176°F) for T5 Special fastener: Class A2-50 or more	KF2
	ATEX Intrinsically Safe Approval*2 Applicable standard: EN60079-0:2006, EN60079-11:2007, EN60079-26:2007, EN60079-27:2006, EN61241-0:2006, EN61241-1:2004, EN61241-11:2006 and EN60529 Certificate: KEMA 08ATEX0114 X II 1G Ex ia IIB/IIC T4 II 1D Ex iaD 20 IP65 T100°C II 1D Ex tD A20 IP65 T100°C Maximum Surface Temperature for dust proof: T100°C Ambient Temperature for Ex ia/Ex iaD: -40 to 60°C (-40 to 140°F) Ambient Temperature for Ex tD: -40 to 80°C (-40 to 176°F) Enclosure: IP65 For Ex ia IIC or Ex iaD: Ui=24.0 V, li=250 mA, Pi=1.2 W, Ci=1.76 nF, Li=0 µH For Ex ia IIB/ IIC or Ex iaD (FISCO model): Ui=17.5 V, li=380 mA, Pi=5.32 W, Ci=1.76 nF, Li=0 µH For II 1D Ex tD: Input signal: 32 Vdc, Output current: 17 mA	KS25
	ATEX Intrinsically safe (Ex ic) / Type n (Ex nA)*2*5 Applicable standard: EN60079-0:2009/EN60079-0:2012(Ex ic/Ex nA), EN60079-11:2012(Ex ic), EN60079-15:2010(Ex nA) Amb. Temp: -30 to 75°C (-22 to 167°F), Enclosure: IP65 Ex ic: II 3G Ex ic IIC T4 Gc (Intrinsically safe) Ui=32 V, Ci=3.52 nF, Li=0 µH Ex nA: II 3G Ex nA IIC T4 Gc (Non-sparking) 32 V DC MAX.	KN25
	TIIS Flameproof Approval*3 Certificate: TC15453, TC15452 for option code /BP Ex d IIC T6 Amb. Temp.: -20 to 60°C	JF3
	Attached flameproof packing adapter*4	Electrical connection: G1/2 female Applicable cable: O.D. 8 to 12 mm

- *1: Applicable for Connections code 3.
- *2: Applicable for Connections code 3 and 6.
- *3: Applicable for Connections code 1, 3 and 6.
- *4: If cable wiring is to be used to a TIS flameproof type transmitter, do not fail to add the YOKOGAWA assured flameproof packing adapter.
- *5: Applicable for Option code EE.

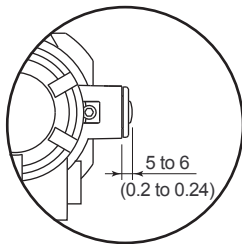
■ Dimensions

● For Single Acting Actuator

Unit: mm(approx. inch)



*1: Blind plug for Connection code 1, 5, and 6.



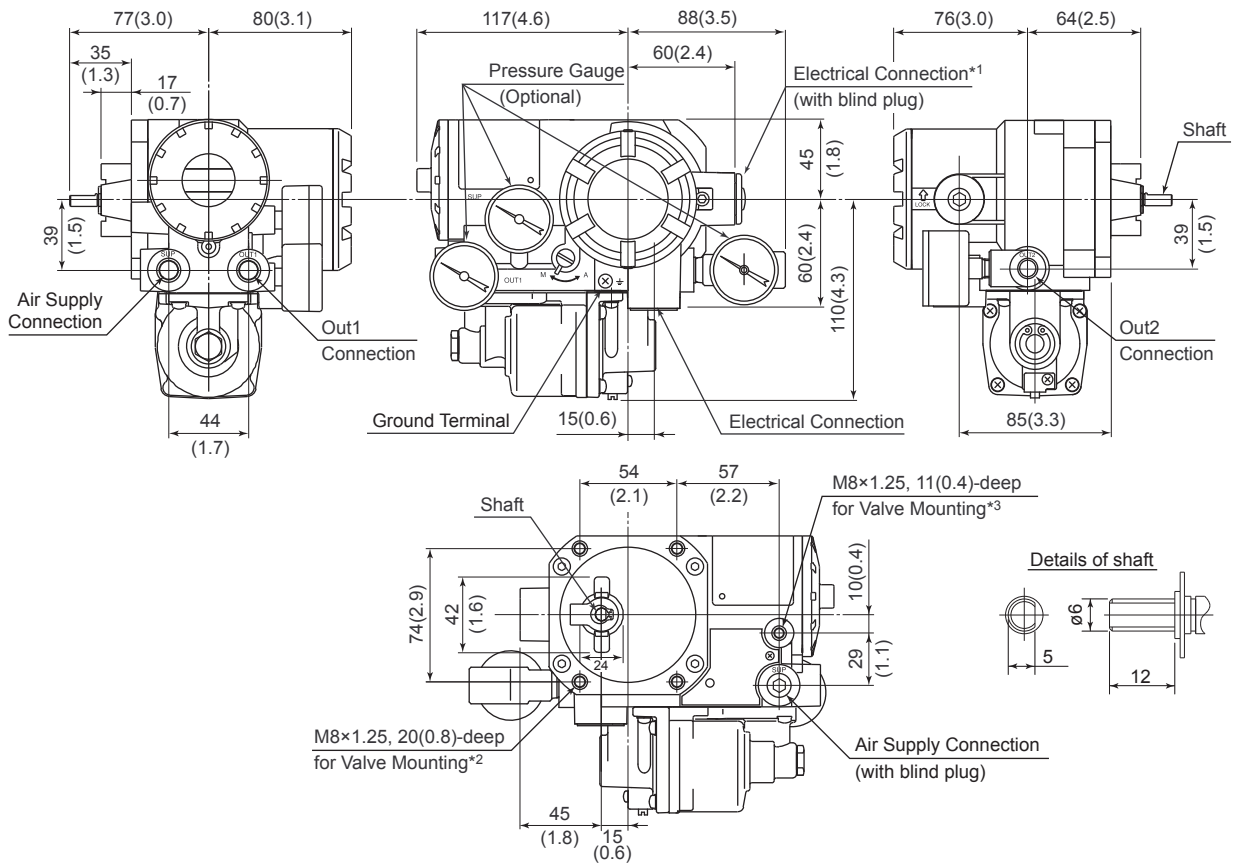
*2: Attached with 4 mounting bolts (M8, 25 mm) and spring washers (applicable 3 to 6 mm thick brackets).

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

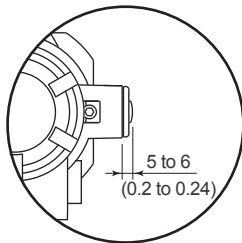
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● For Double Acting Actuator

Unit: mm(approx. inch)



*1: Blind plug for Connection code 1, 5, and 6.



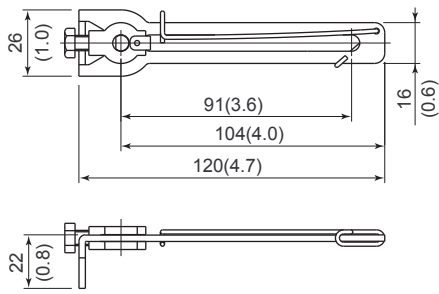
*2: Attached with 4 mounting bolts (M8, 25 mm) and spring washers (applicable 3 to 6 mm thick brackets).

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

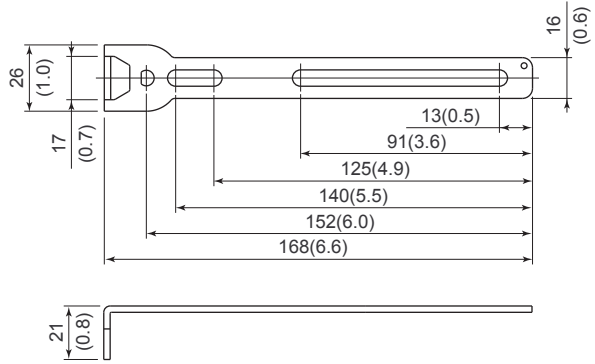
F0702.ai

Unit: mm(approx. inch)

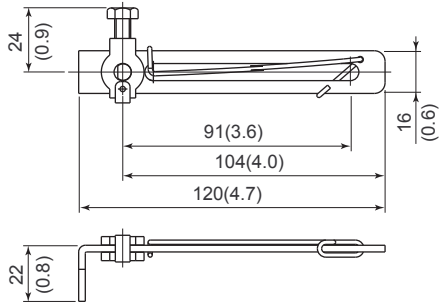
◆ Lever 1 (Option code /LV1)



◆ Lever 2 (Option code /LV1)

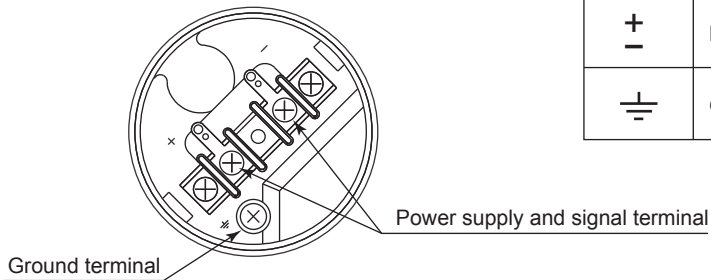


◆ Lever 3 (Option code /LV2)



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● Terminal Configuration



● Terminal Wiring

+	Power supply and signal terminal
-	
⊥	Ground terminal

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8. About Fieldbus

8.1 Outline

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

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

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

8.2 Internal Structure of YVP110

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

8.2.1 System/network Management VFD

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

8.2.2 Function Block VFD

(1) Resource block

Manages the information common to each FB VFD in YVP110.

(2) Transducer block

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

(3) AO function block

- Accepts a control signal from an upstream block and pass the signal to Transducer block.

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

(4) DI function block

Receives the discrete signal from Transducer block and output them.

(5) PID function block(optional)

Offers PID control function.

8.3 Logical Structure of Each Block

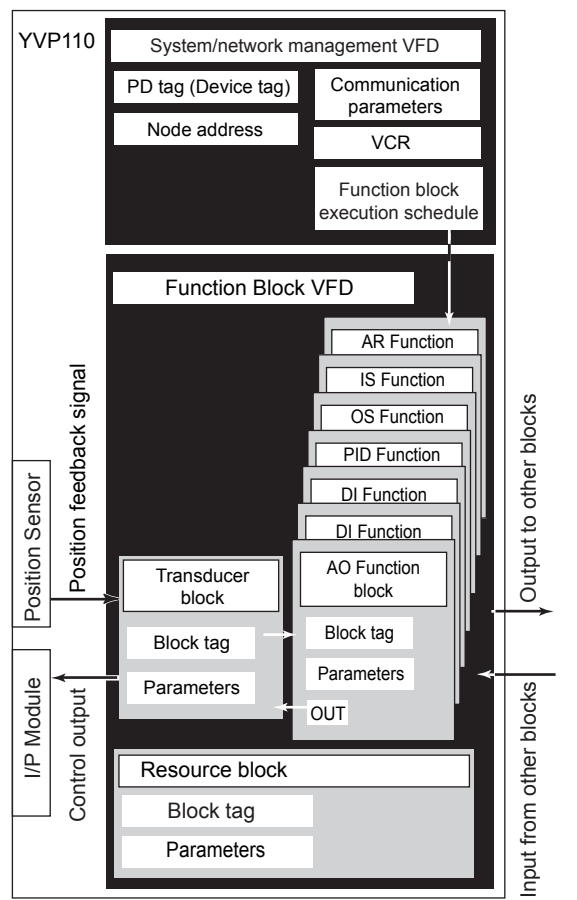


Figure 8.1 Logical Structure of Each Block

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

8.4 System Configuration

The following instruments are required for use with Fieldbus devices:

- Power supply:**
 Fieldbus requires a dedicated power supply. It is recommended that current capacity be well over the total value of the maximum current consumed by all devices (including the host). Conventional DC current cannot be used as is.
- Terminator:**
 Fieldbus requires two terminators. Refer to the supplier for details of terminators that are attached to the host.
- Field devices:**
 Connect the field devices necessary for instrumentation. YVP110 has passed the interoperability test conducted by The Fieldbus Foundation. In order to properly start Fieldbus, it is recommended that the devices used satisfy the requirements of the above test.
- Host:**
 Used for accessing field devices. A dedicated host (such as DCS) is used for an instrumentation line while dedicated communication tools are used for experimental purposes.
- Cable:**
 Used for connecting devices. Refer to “Fieldbus Technical Information” (TI 38K3A01-01E) for details of instrumentation cabling. Provide a cable sufficiently long to connect all devices. For field branch cabling, use terminal boards or a connection box as required. If the total length of the cable is in a range of 2 to 3 meters for laboratory or other experimental use, the following simplified cable (a twisted pair wire with a cross section of 0.9 mm² 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 YVP110, use an M4 screw terminal claw. Some hosts require a connector.

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

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

8.4.1 Connection of Devices

Connect the devices as shown in Figure 9.1.

Connect the terminators at both ends of the trunk, with a minimum length of the spur laid for connection.

The polarity of signal and power must be maintained.

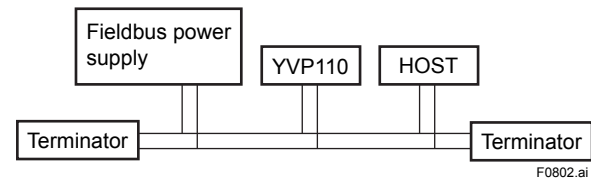


Figure 8.2 Cabling

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

8.5 Integration of DD

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

```
594543/0001
594543/0007 (/EE)
    (594543 is the manufacturer number of
    Yokogawa Electric Corporation, and 0001
    or 0007 is the YVP110 device number,
    respectively.)
```

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

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

Off-line configuration is allowed by using the capability file (CFF). If you do not have the DD or capability file for the YVP110, you can download it from www.yokogawa.com/fld/



IMPORTANT

For offline configuration, use the CFF which matches the specification of the instrument to be configured. For YVP110, there are three types of CFF file; one for standard type instruments, second for the instruments with one or two PID function blocks are available and the other can be selected between former two types using capability level description. Using unmatched CFF will cause an error upon downloads, etc.

9. Configuration

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

(1) Network design

Determines the devices to be connected to Fieldbus and checks the capacity of the power supply.

(2) Network definition

Determines the tag and node addresses for all devices.

(3) Definition of combining function blocks

Determines the method for combination between each function block.

(4) Setting tags and addresses

Sets the PD Tag and node addresses one by one for each device.

(5) Communication setting

Sets the link between communication parameters and function blocks.

(6) Block setting

Sets the parameters for function blocks.

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



IMPORTANT

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



IMPORTANT

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

9.1 Network Design

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

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

9.2 Network Definition

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

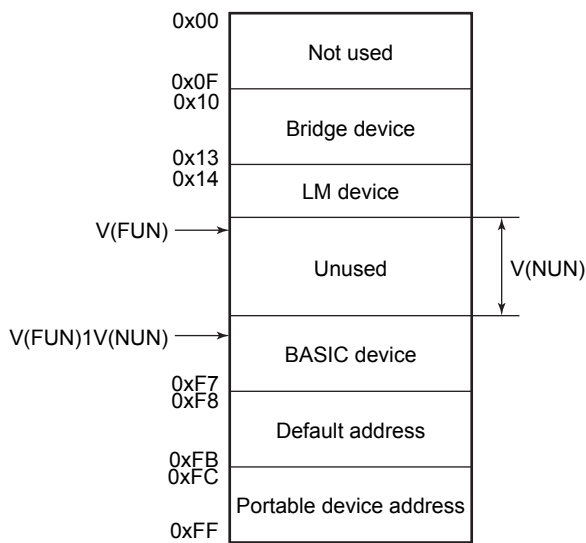
The PD Tag is the same as the conventional one used for the device. Up to 32 alphanumeric characters may be used for definition. Use a hyphen as a delimiter as required.

The node address is used to specify devices for communication purposes. Because data is too long for a PD Tag, the host uses the node address in place of the PD Tag for communication. A range of 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.

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.

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 YVP110 specification values.

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

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

9.3 Definition of Combining Function Blocks

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

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

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

Table 9.3 Execution Schedule of the YVP110 Function Blocks

Index	Parameters	Setting (Enclosed is factory-setting)
269 (SM)	MACROCYCLE_DURATION	Cycle (MACROCYCLE) period of control or measurement. Unit is 1/32 ms. (32000 = 1 s)
276 (SM)	FB_START_ENTRY.1	AO block startup time. Elapsed time from the start of MACROCYCLE specified in 1/32 ms. (32000 = 1 s)
278 (SM)	FB_START_ENTRY.2	—
	⋮	
289 (SM)	FB_START_ENTRY.14	—

Table 9.4 shows maximum execution time of YVP function blocks.

Table 9.4 Execution Time of YVP Function Blocks

Block Name	Execution time (ms)	Remarks
AO	95	
DI	40	
PID	120	Available for option /LC1 or /LC2
OS	95	
IS	140	Available for option /EE
AR	120	Available for option /EE

For scheduling of communications for combination with the next function block, the execution is so arranged as to start after a lapse of longer than the time above mentioned. In no case should two function blocks of the YVP110 be executed at the same time (execution time is overlapped).

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

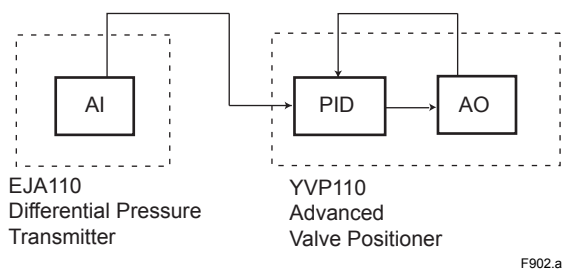


Figure 9.2 Example of Loop Connecting Function Block of YVP110 with other instruments

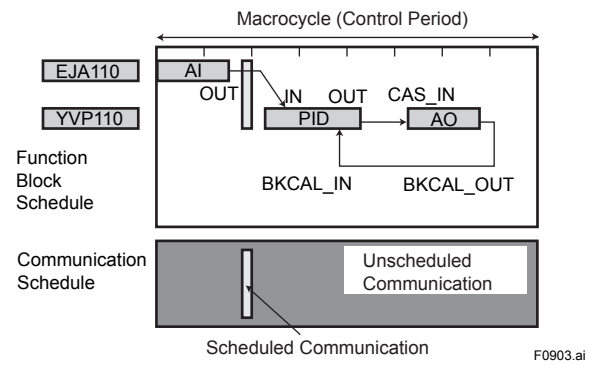


Figure 9.3 Function Block Schedule and Communication Schedule

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

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

9.4 Setting of Tags and Addresses

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

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

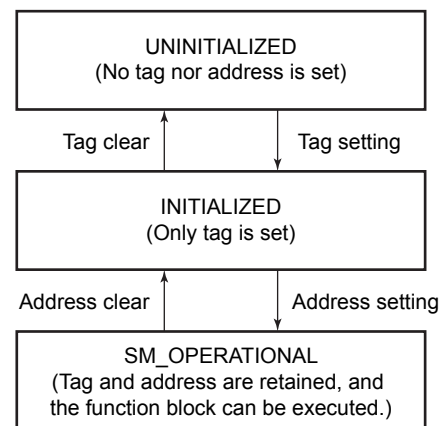


Figure 9.4 Status Transition by Setting PD Tag and Node Address

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

Devices whose node address was cleared will await the default address (randomly chosen from a range of 248 to 251, or from hexadecimal 0xF8 to 0xFB). At the same time, it is necessary to specify the device ID in order to correctly specify the device. The device ID of the YVP110 is 5945430001xxxxxxx or 5945430007xxxxxxx. (The xxxxxxxx at the end of the above device ID is a total of 8 alphanumeric characters.)

9.5 Communication Setting

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

9.5.1 VCR Setting

Set VCR (Virtual Communication Relationship), which specifies the called party for communication and resources. YVP110 has 29 or 33 VCRs (with /EE) whose application can be changed, except for the first VCR, which is used for management.

YVP110 has VCRs of four types:

Server(QUB) VCR

A Server responds to requests from a host. This communication needs data exchange. This type of communication is called QUB (Queued User-triggered Bidirectional) VCR.

Source (QUU) VCR

A Source multicasts alarms or trends to other devices. This type of communication is called QUU (Queued User-triggered Unidirectional) VCR.

Publisher (BNU) VCR

A Publisher multicasts AI block output to another function block(s). This type of communication is called BNU (Buffered Network-triggered Unidirectional) VCR.

Subscriber (BNU) VCR

A Subscriber receives the data from another function block(s). This type of communication is called BNU (Buffered Network-triggered Unidirectional) VCR.

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

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

9.5.2 Function Block Execution Control

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

9.6 Block Setting

Set the parameter for function block VFD.

9.6.1 Link Object

Link object combines the data voluntarily sent by the function block with VCR. YVP110 has 25 or 50 (with /EE) link objects. A single link object specifies one combination. Each link object has the parameters listed in Table 9.5. Parameters must be changed together for each VCR because the modifications made to each parameter may cause inconsistent operation.

Table 9.5 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	RemotelIndex	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.

Link objects are not factory-set.

9.6.2 Trend Object

It is possible to set the parameter so that the function block automatically transmits Trend. YVP110 has seven or twelve (with /EE) Trend objects, five or ten (with /EE) 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 9.6. The first four parameters are the items to be set.

Table 9.6 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.

Objects are not factory-set.

9.6.3 View Object

This is the object to form groups of parameters in a block. One of advantage brought by forming groups of parameters is the reduction of load for data transaction. YVP110 has 12 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 9.8 to 9.15.

Table 9.7 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.

Table 9.8 View Object for Transducer Block

Relative index	Parameters	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	VIEW 4 7th	VIEW 4 8th
1	ST_REV	2	2	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_DIRECTORY												
13	FINAL_VALUE	5		5									
14	FINAL_VALUE_RANGE		11										
15	FINAL_VALUE_CUTOFF_HI					4							
16	FINAL_VALUE_CUTOFF_LO					4							
17	FINAL_POSITION_VALUE	5		5									
18	SERVO_GAIN					4							
19	SERVO_RESET					4							
20	SERVO_RATE					4							
21	ACT_FAIL_ACTION					1							
22	ACT_MAN_ID					4							
23	ACT_MODEL_NUM					32							
24	ACT_SN					32							
25	VALVE_MAN_ID						4						
26	VALVE_MODEL_NUM						32						
27	VALVE_SN						32						
28	VALVE_TYPE						1						
29	XD_CAL_LOC							32					
30	XD_CAL_DATE							7					
31	XD_CAL_WHO							32					
32	ALARM_SUM	8		8									
33	POSITION_CHAR_TYPE		1										
34	POSITION_CHAR												
35	LIMSW_HI_LIM		4										
36	LIMSW_LO_LIM		4										
37	ELECT_TEMP	4		4									
38	TEMPERATURE_UNIT		2										
39	SUPPLY_PRESSURE		4										
40	SPRING_RANGE		11										
41	OUT_PRESSURE	4		4									
42	SERVO_OUTPUT_SIGNAL	4		4									
43	SERVO_RATE_GAIN						4						
44	SERVO_DEADBAND						4						
45	SERVO_OFFSET						4						
46	BOOST_ON_THRESHOLD							8					
47	BOOST_OFF_THRESHOLD							8					
48	BOOST_VALUE							8					
49	SERVO_I_SLEEP_LMT						4						
50	SERVO_P_ALPHA						4						

Relative index	Parameters	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	VIEW 4 7th	VIEW 4 8th
51	INTERNAL_GAIN						4						
52	MEAS_GAIN								4				
53	VALVE_TC								4				
54	VALVE_HYS								4				
55	VALVE_SLIP_WIDTH								4				
56	MEAS_PRESS_AIR								4				
57	MEAS_PRESS_SUPPLY								4				
58	MEAS_SPRING_RANGE								8				
59	CONTROL_DIR								1				
60	THETA_HI		4										
61	THETA_LO		4										
62	THETA_P		4										
63	TRAVEL_CALIB_EXEC			1									
64	TRAVEL_CALIB_RESULT		1										
65	OPEN_STOP_ADJ		4										
66	AUTO_TUNE_EXEC			1									
67	AUTO_TUNE_RESULT		1										
68	AUTO_TUNE_STATE			1									
69	SERVO_RET_TO_DEFAULT			1									
70	ADVAL_FW			2									
71	ADVAL_BW			2									
72	ADVAL_PRESS			2									
73	ADVAL_T			2									
74	TOTAL_CYCLE_COUNT			4									
75	CYCLE_DEADBAND								4				
76	CYCLE_COUNT_LIM								4				
77	TOTAL_TRAVEL			4									
78	TRAVEL_DEADBAND								4				
79	TRAVEL_LIM								4				
80	TOTAL_OPEN_TIME			4									
81	TOTAL_CLOSE_TIME			4									
82	OPEN_CLOSE_THRESHOLD								4				
83	OPEN_TIME_LIM								4				
84	CLOSE_TIME_LIM								4				
85	TOTAL_NEAR_CLOSE_TIM			4									
86	NEAR_CLOSE_THRESHOLD								4				
87	NEAR_CLOSE_TIME_LIM								4				
88	DEVIATION_LIM									4			
89	DEVIATION_TIME_TH									8			
90	RELEASE_FAILSAFE			1									
91	MODEL								32				
92	DEV_OPTIONS									2			
93	PRESS_SENS_INSTALLED									1			
94	ACTUATOR_TYPE									1			
95	RELAY_TYPE									1			
96	SIGN_MEAS_EXEC			1									
97	SIGN_MEAS_RESULT									1			
98	SIGN_MEAS_STATE			1									
99	SIGN_MEAS_COUNTER			2									
100	SIGN_DATA_SAVE				1								

Relative index	Parameters	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	VIEW 4 7th	VIEW 4 8th
101	SIGN_UPLOAD_DATABASE									1			
102	SIGN_UPLOAD_POINTER									2			
103	SIGN_DATA_X												
104	SIGN_DATA_Y												
105	SIGN_MEAS_DATE			7									
106	SIGN_HEADER_DATA				28								
107	STD_ACT_SIGN_SET									12			
108	EXT_ACT_SIGN_SET									24			
109	STEP_RESP_SET									16			
110	POSITIONER_SIGN_SET									20			
111	SERVO_WARN_HI_LIM											4	
112	SERVO_WARN_LO_LIM											4	
113	SERVO_TIME_TH											4	
114	SERVO_WARN_COUNT				4								
115	X_BST_ON_THRESHOLD												8
116	X_BST_OFF_THRESHOLD												8
117	X_BOOST_VALUE												8
118 to 165	TEST_1 to TEST_47 *1			14	69						87	76	
	Total (in bytes)	41	59	99	104	96	95	97	103	95	89	90	26

*1: These parameters are not usually used.
 "TEST_48 (Relative index 165)" applies to option code EE.

Table 9.9 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	

Relative index	Parameters	VIEW 1	VIEW 2	VIEW 3	VIEW 4
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

Table 9.10 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

Table 9.11 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

Table 9.12 View Object for IS 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	OUT	5		5	
8	OUT_RANGE		11		
9	GRANT_DENY		2		
10	STATUS_OPTS				2
11	IN_1	5		5	
12	IN_2	5		5	
13	IN_3	5		5	
14	IN_4	5		5	
15	DISABLE_1	2		2	
16	DISABLE_2	2		2	
17	DISABLE_3	2		2	
18	DISABLE_4	2		2	
19	SELECT_TYPE				1
20	MIN_GOOD				1
21	SELECTED	2		2	
22	OP_SELECT	2		2	
23	UPDATE_EVT				
24	BLOCK_ALM				
25	IN_5	5		5	
26	IN_6	5		5	
27	IN_7	5		5	
28	IN_8	5		5	
29	DISABLE_5	2		2	
30	DISABLE_6	2		2	
31	DISABLE_7	2		2	
32	DISABLE_8	2		2	
	Total (in bytes)	73	15	73	9

Table 9.13 View Objects of AR 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	OUT	5		5	
9	PRE_OUT	5		5	
10	PV_SCALE		11		
11	OUT_RANGE		11		
12	GRANT_DENY		2		
13	INPUT_OPTS				2
14	IN			5	
15	IN_LO			5	
16	IN_1			5	
17	IN_2			5	
18	IN_3			5	
19	RANGE_HI				4
20	RANGE_LO				4
21	BIAS_IN_1				4
22	GAIN_IN_1				4
23	BIAS_IN_2				4
24	GAIN_IN_2				4
25	BIAS_IN_3				4
26	GAIN_IN_3				4
27	COMP_HI_LIM				4
28	CONP_LO_LIM				4
29	ARITH_TYPE				1
30	BAL_TIME				4
31	BIAS				4
32	GAIN				4
33	OUT_HI_LIM				4
34	OUT_LO_LIM				4
35	UPDATE_EVT				
36	BLOCK_ALM				
	Total (in bytes)	23	26	48	68

Table 9.15 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				
45	DEVICE_STATUS_1			4	2
46	DEVICE_STATUS_2			4	
47	DEVICE_STATUS_3			4	2
48	DEVICE_STATUS_4			4	1
49	DEVICE_STATUS_5			4	
50	DEVICE_STATUS_6			4	
51	DEVICE_STATUS_7			4	
52	DEVICE_STATUS_8			4	
	Total (in bytes)	22	30	54	31

Table 9.16 Indexes of View for Each Block

	VIEW_1	VIEW_2	VIEW_3	VIEW_4
Resource Block	40100	40101	40102	40103
Transducer Block	40200	40201	40202, 40203	40204 through 40211
AO Function Block	40500	40501	40502	40503
DI1 Function Block	40600	40601	40602	40603
DI2 Function Block	40610	40611	40612	40613
PID or PID1 (with /EE) Function Block	40800	40801	40802	40803
PID2 Function Block	40810	40811	40812	40813
OS Function Block	41400	41401	41402	41403
IS Function Block	41700	41701	41702	41703
AR Function Block	41750	41751	41752	41753

9.6.4 Function Block Parameters

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

10. Actions of YVP110 During Operation

10.1 Block Modes

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

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

Table 10.1 Block Modes

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

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

The following are outlines of each mode.

O/S mode

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

IMan mode

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

LO mode

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

Man mode

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

Auto mode

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

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

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

10.2 Alarm Generation

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

A YVP110 can report the following alarms and events.

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

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

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

10.3 Simulation Function

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

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

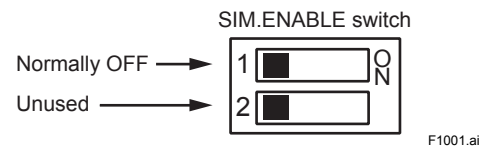


Figure 10.1 SIM.ENABLE Switch

11. Resource Block

11.1 General

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

11.2 Alarm Processing

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

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

Table 11.1 BLOCK_ERROR in Resource Block

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

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 (without /EE)

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 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.

Hexadecimal Indication	Indication when Device Description is installed.	Meaning
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.

*1: VCR: Virtual Coummunications Relationship

Table 11.3 DEVICE_STATUS_1 (with /EE)

Hexadecimal Indication	Indication when Device Description is installed.	Meaning
0x80000000		
0x40000000		
0x20000000		
0x10000000		
0x08000000		
0x04000000	Abnormal Boot Process	Abnormal boot process
0x02000000	Download fail	Download fail
0x01000000	Download incomplete	Download incomplete
0x00800000	Sim.enable Jmpr On	The SIM.ENABLE switch on the amplifier is set to ON.
0x00400000	RB 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.1/17/33/49 not open	The VCR*1 to which link object 1, 17, 33 or 49 is specified to be linked is not open.
0x00004000	Link Obj.2/18/34/50 not open	The VCR*1 to which link object 2, 18, 34 or 50 is specified to be linked is not open.
0x00002000	Link Obj.3/19/35 not open	The VCR*1 to which link object 3, 19, or 35 is specified to be linked is not open.
0x00001000	Link Obj.4/20/36 not open	The VCR*1 to which link object 4, 20, or 36 is specified to be linked is not open.
0x00000800	Link Obj.5/21/37 not open	The VCR*1 to which link object 5, 21, or 37 is specified to be linked is not open.
0x00000400	Link Obj.6/22/38 not open	The VCR*1 to which link object 6, 22, or 38 is specified to be linked is not open.
0x00000200	Link Obj.7/23/39 not open	The VCR*1 to which link object 7, 23, or 39 is specified to be linked is not open.
0x00000100	Link Obj.8/24/40 not open	The VCR*1 to which link object 8, 24, or 40 is specified to be linked is not open.
0x00000080	Link Obj.9/25/41 not open	The VCR*1 to which link object 9, 25, or 41 is specified to be linked is not open.
0x00000040	Link Obj.10/26/42 not open	The VCR*1 to which link object 3, 19, or 35 is specified to be linked is not open.
0x00000020	Link Obj.11/27/43 not open	The VCR*1 to which link object 11, 27, or 43 is specified to be linked is not open.
0x00000010	Link Obj.12/28/44 not open	The VCR*1 to which link object 12, 28, or 44 is specified to be linked is not open.

Hexadecimal Indication	Indication when Device Description is installed.	Meaning
0x00000008	Link Obj.13/29/45 not open	The VCR*1 to which link object 13, 29, or 45 is specified to be linked is not open.
0x00000004	Link Obj.14 /30/46 not open	The VCR*1 to which link object 14, 30, or 46 is specified to be linked is not open.
0x00000002	Link Obj.15/31/47 not open	The VCR*1 to which link object 15, 31, or 47 is specified to be linked is not open.
0x00000001	Link Obj.16/32/48 not open	The VCR*1 to which link object 16, 32, or 48 is specified to be linked is not open.

*1: VCR: Virtual Coummunications Relationship

Table 11.4 DEVICE_STATUS_2 (without /EE)

Hexadecimal Indication	Indication when Device Description is installed.	Meaning
0x80000000		
0x40000000		
0x20000000		
0x10000000		
0x08000000		
0x04000000		
0x02000000	TB TRAVEL_ CALIB_RESULT not Succeeded	Travel Calibration has not been succeeded.
0x01000000	TB AUTO_ TUNE_RESULT not Succeeded	Auto tuning 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	TB in Signature executing	Signature is proceeding.
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	TB in Auto tuning	Auto tuning is proceeding.
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.

Table 11.5 DEVICE_STATUS_2 (with /EE)

Hexadecimal Indication	Indication when Device Description is installed.	Meaning
0x80000000		
0x40000000		
0x20000000		
0x10000000	PID2 BLOCK_ERR not Zero	Block Error has occurred in the PID2 block.
0x08000000	PID2 in Bypass active	Bypass is activated in PID2 block.
0x04000000	PID2 O/S mode	PID2 block is in O/S mode.
0x02000000	TB TRAVEL_CALIB_RESULT not Succeeded	Travel Calibration has not been succeeded.
0x01000000	TB AUTO_TUNE_RESULT not Succeeded	Auto tuning has not been succeeded.
0x00800000	AR BLOCK_ERR not Zero	Block Error has occurred in the AR block.
0x00400000	IS BLOCK_ERR not Zero	Block Error has occurred in the IS block.
0x00200000	OS BLOCK_ERR not Zero	Block Error has occurred in the OS block.
0x00100000	PID1 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	TB in Signature executing	Signature is proceeding.
0x00004000		
0x00002000		
0x00001000	PID1 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	TB in Auto tuning	Auto tuning is proceeding.
0x00000080	AR in O/S mode	AR block is in O/S mode.
0x00000040	IS in O/S mode	IS block is in O/S mode.
0x00000020	OS in O/S mode	OS block is in O/S mode.
0x00000010	PID1 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.

Table 11.6 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	Servo output drift warning	Shows the contents of the XD_ERROR in the transducer block. Refer to 12.6.1 XD_ERROR for details.
0x00004000	A/D Converter failure	
0x00002000	Position sensor failure	
0x00001000	Deviation error	
0x00000800	Severe servo output drift	
0x00000400	Pressure sensor failure	
0x00000200	Temperature sensor failure	
0x00000100	Deviation warning	
0x00000080	Position sensor out of range	
0x00000040	Pressure sensor out of range	
0x00000020	Temperature sensor out of range	
0x00000010	Total near close limit exceed	
0x00000008	Total close limit exceed	
0x00000004	Total open limit exceed	
0x00000002	Travel limit exceed	
0x00000001	Cycle count limit exceed	

12.2.2 Position-to-flow Rate Characteristic Conversion

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

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

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

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

12.2.3 FINAL_VALUE and Range

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

12.2.4 Tight-shut and Full-open Actions

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

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

VALUE_CUTOFF_HI by 1% or more, the full-open action will turn off.

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

12.3 Backward Path

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

12.3.1 FINAL_POSITION_VALUE

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

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

12.3.2 Limit Switches

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

- 0 = off (inactive)
- 1 = on (active)

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

12.4 Auto Tuning



CAUTION

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

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

Table 12.2 Types of Auto Tuning

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



IMPORTANT

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

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

Table 12.3 AUTO_TUNE_RESULT & TRAVEL_CALIB_RESULT

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

*1: Number 103 is not shown for AUTO_TUNE_RESULT. Number 1 through 44 and 120 through 123 are not shown for TRAVEL_CALIB_RESULT.

*2: E stands for 'Error', and W stands for 'Warning'.

12.5 Travel Calibration



CAUTION

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

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

- 1 = off
- 2 = 0% point calibration (calibrates only the 0% point and shifts the 100% point by the resulting amount of the change in 0% point while leaving the span unchanged).
- 3 = span calibration (calibrates only the 100% point while leaving the 0% point unchanged).
- 4 = 50% point calibration (calibrates at the 50% point while leaving the 0% point and 100% point unchanged).

The 50%-point calibration (in other words, linearity calibration) is intended to minimize the linearity error at the 50% point. Also, if the feedback lever is slightly deviates from a horizontal level due to careless installation of the YVP110 positioner, an error caused by this shift can be corrected by the 50%-point calibration. Note that carrying out travel calibration of Index 2 or 3 clears the 50% calibration result. If you want to carry out the 50%-point calibration, do it after other tuning has finished.

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

12.6 Online Diagnostics

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

12.6.1 XD_ERROR

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

Table 12.4 shows the meanings of these results in XD_ERROR.

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

Table 12.4 XD_ERROR

value	Message	Description
100	Cycle count limit exceed	TOTAL_CYCLE_COUNT has reached CYCLE_COUNT_LIM.
101	Travel limit exceed	TOTAL_TRAVEL has reached TRAVEL_LIM.
102	Total open limit exceed	TOTAL_OPEN_TIME has reached OPEN_TIME_LIM.
103	Total close limit exceed	TOTAL_CLOSE_TIME has reached CLOSE_TIME_LIM.
104	Total near close limit exceed	TOTAL_NEAR_CLOSE_TIM has reached NEAR_CLOSE_TIME_LIM.
110	Temperature out of range	The measured temperature is out of range.
111	Pressure sensor out of range	The measured pressure is out of range.
112	Position sensor out of range	The measured valve position is out of range.
113	Deviation warning	The deviation between the setpoint and measured valve position has exceeded DEVIATION_LIM continuously for the period specified by DEVIATION_TIME_TH [1]. This is not applicable for tight-shut or full-open actions, or when the period specified by DEVIATION_TIME_TH [1] is less than 0.
114	Servo output drift warning	SERVO_OUTPUT_SIGNAL has reached SERVO_WARN_LO_LIM or SERVO_WARN_HI_LIM and has continued in excess of SERVO_TIME_TH. This is not applicable for tight-shut or full-open actions, or when the period specified by SERVO_TIME_TH is less than 0.
120	Temperature sensor failure	Temperature sensor failed
121	Pressure sensor failure	Pressure sensor failed
122	Severe servo output drift	SERVO_OUTPUT_SIGNAL has reached 10% or 90%, and has continued in excess of SERVO_TIME_TH. This is not applicable for tight-shut or full-open actions, or when the period specified by SERVO_TIME_TH is less than 0.
123	Deviation error	The deviation between the setpoint and measured valve position has exceeded DEVIATION_LIM continuously for the period specified by DEVIATION_TIME_TH [2]. This is not applicable for tight-shut or full-open actions, or when the period specified by DEVIATION_TIME_TH [2] is less than 0.
124	Position sensor failure	Position sensor failed
125	A/D converter failure	A/D converter failed

12.6.2 Fail-safe Action

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

12.6.3 Operation Result Integration

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

- **TOTAL_CYCLE_COUNT:**
Incremented by 1 at each change in the direction of the valve action and indicates the total number of times of changes in direction of valve actions.
- **TOTAL_TRAVEL:**
Total travel distance of the stem position shown as a percentage of the valve position span.
- **TOTAL_OPEN_TIME and TOTAL_CLOSE_TIME:**
TOTAL_CLOSE_TIME contains the integrated time periods (in hours) when the valve position is equal to or less than the thresholds previously set in OPEN_CLOSE_THRESHOLD. TOTAL_OPEN_TIME is the integrated time periods (in hours) other than TOTAL_CLOSE_TIME.
- **TOTAL_NEAR_CLOSE_TIM:**
Total time period (in hours) when the valve position is within the threshold set in NEAR_CLOSE_THRESHOLD.
- **SERVO_WARN_COUNT:**
Total number of times the servo output drift warning occurred.
Indicates the total number of times a drift warning occurred regarding the output current to the I/P module.

12.6.4 Recording of Revisions

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

12.7 Control Parameters

The following control parameters in a YVP110 can be set up by auto tuning: (For details, see section A6.4)

SERVO_GAIN
 SERVO_RESET
 SERVO_RATE
 SERVO_RATE_GAIN
 SERVO_DEADBAND
 SERVO_OFFSET
 BOOST_ON_THRESHOLD
 BOOST_OFF_THRESHOLD
 BOOST_VALUE
 SERVO_I_SLEEP_LMT
 SERVO_P_ALPHA
 INTERNAL_GAIN
 X_BOOST_ON_THRESHOLD *
 X_BOOST_OFF_THRESHOLD *
 X_BOOST_VALUE *

* Applicable only for Double Acting Type

12.8 Temperature and Pressure Measurement

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

1001 = °C
 1002 = °F

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

1133 = kPa
 1137 = bar
 1141 = psi
 1145 = kgf/cm²

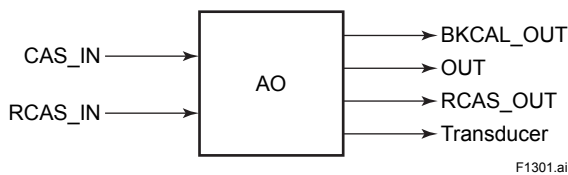
13. AO Function Block

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:

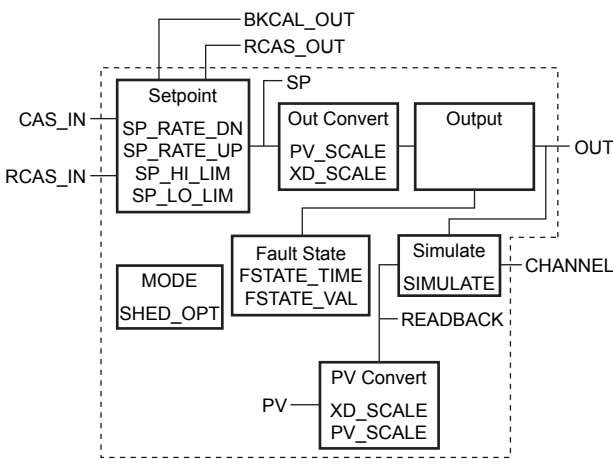
- Scaling
- Setpoint limiters - for both the value and rate of change
- Simulation
- Valve position feedback
- Actions upon abnormality of upstream block
- Signal inversion

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).



F1301.ai

Figure 13.1 Inputs/Outputs of AO Function Block



F1302.ai

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 YVP110, 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
0	Invert	Not available
1	SP-PV Track in Man	Equalizes SP to PV when target is MAN mode
2	Reserved	Not available
3	SP-PV Track in LO	Equalizes SP to PV in LO mode.
4	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	Fault State to value	Uses a FSTATE_VALUE in LO mode.
7	Use Fault State value on restart	Uses a value preset for fault state also at a restart.
8	Target to Man if Fault State activated	Sets the target mode to Man upon activation of the fault state.
9	Use PV for BKCAL_OUT	Sets the value of PV in BKCAL_OUT and RCAS_OUT.
10	Low cutoff	Not available
11	Reserved (SIS-Latch Fstate)	Not available
12	Units Conversion	Not available

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	<p>Stipulates the handling of the value, data status and related alarm of BKCAL_OUT and RCAS_OUT to be performed.</p> <p>If this option is true, then:</p> <ul style="list-style-type: none"> - 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. <p>If this option is false, then:</p> <ul style="list-style-type: none"> - Set the quality and sub-status components of the status of BKCAL_OUT to Bad and non specific, respectively. - Generates a block alarm.

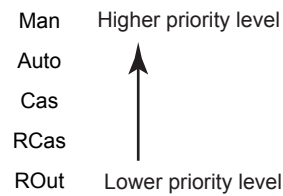
13.6 Mode Shedding upon Computer Failure

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.

*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.



*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.

14. DI Function Block

14.1 General

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

The major functions of a DI function block include:

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

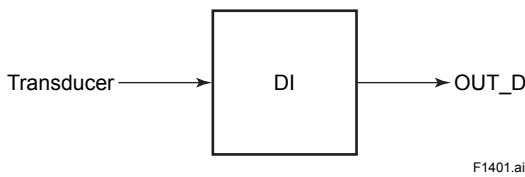


Figure 14.1 Inputs/Outputs of DI Function Block

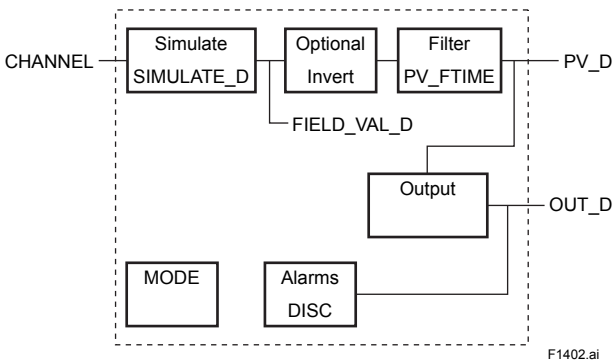


Figure 14.2 Function Diagram of DI Function Block

14.2 Modes

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

14.3 PV Value (PV_D)

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

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

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

Table 14.1 FIELD_VAL_D

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

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.

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	<p>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.</p> <p>If this option is true, then it:</p> <ul style="list-style-type: none"> - Does not generate a block alarm. - Sets the status and value of SIMULATE_D in OUT_D. <p>If this option is false, then it:</p> <ul style="list-style-type: none"> - 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.

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.

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)

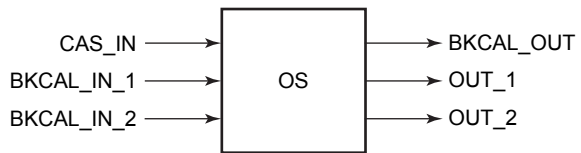


Figure 15.1 Inputs/Outputs of OS Function Block

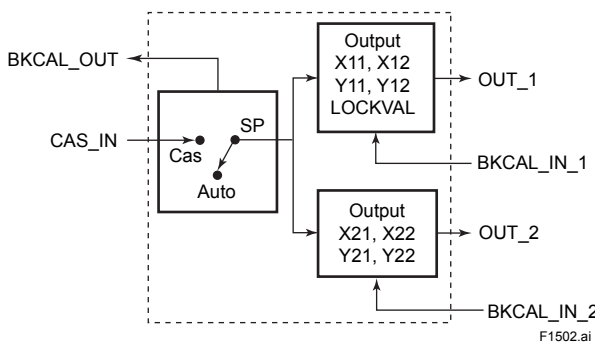


Figure 15.2 Function Diagram of OS Function Block

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.

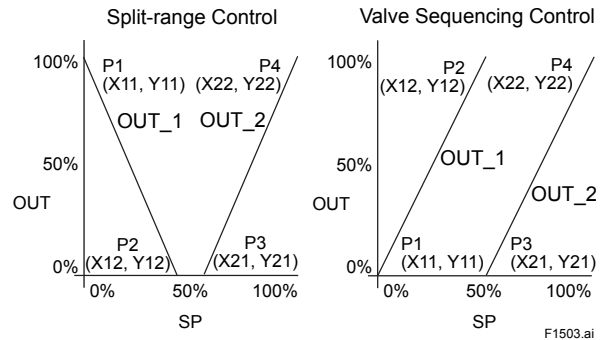


Figure 15.3 Examples of Valve Operation Characteristics

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 endpoint. 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.

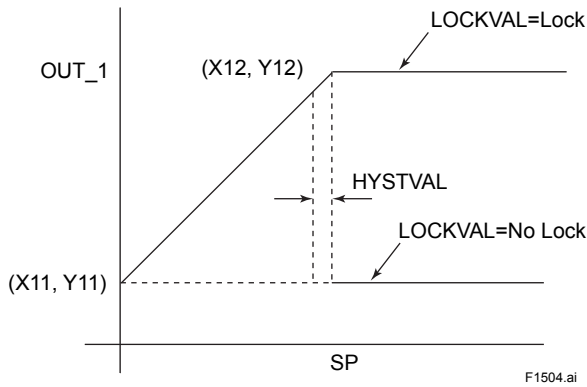


Figure 15.4 LOCKVAL and HYSTVAL

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 substatus 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 substatus components of either or both BKCAL_IN_1 and BKCAL_IN_2 are Bad-Sensor Failure and Device Failure, respectively.

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 15.2 BLOCK_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.

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

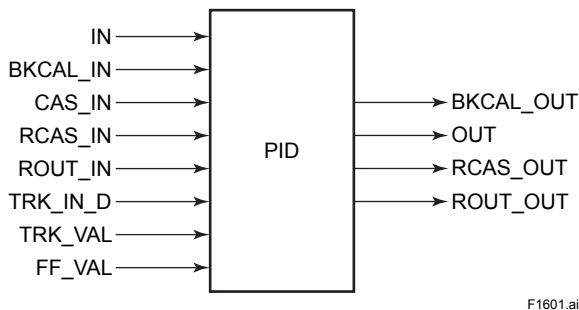


Figure 16.1 Inputs/Outputs of PID Function Block

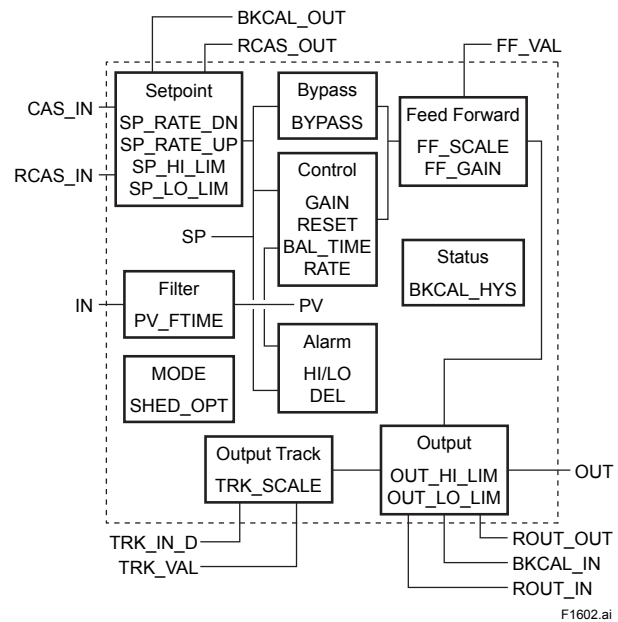


Figure 16.2 Function Diagram of PID Function Block

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 YVP110 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 measures 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

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

In Cas mode

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

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)
- T_i = integral time = RESET
- T_d = 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

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 YVP110 performs the velocity type output action for the control output. This means that the PID block determines the value of the new control output(OUT) by adding the change in control output calculated in the current control period, ΔMVn , to the current read-back value of the MV(OUT), MV_{RB} (BKCAL_IN). This action can be expressed as:

$$OUT = BKCAL_IN - \Delta MVn'$$

$$\Delta MVn' = \Delta MVn \text{ which is scaled by } PV_SCALE \text{ and } OUT_SCALE$$

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.

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.

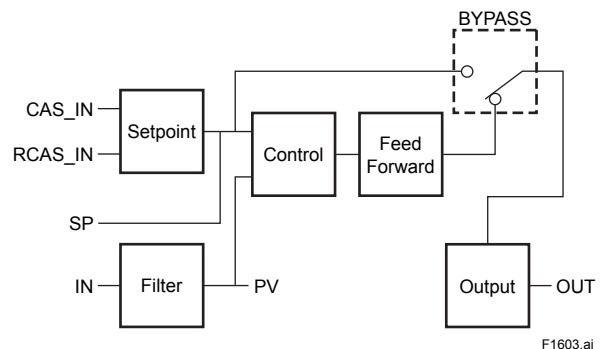


Figure 16.3 Control Action Bypass

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.

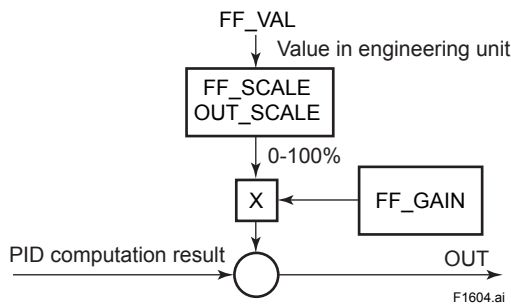


Figure 16.4 Feed-forward

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.

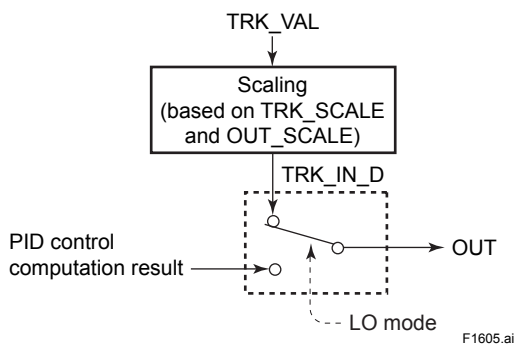


Figure 16.5 External-value Tracking

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 transferred 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.

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.

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.

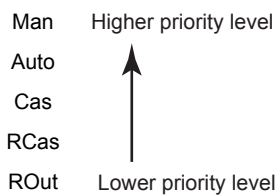
16.16 Mode Shedding upon Computer Failure

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.

*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.



*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.

Bit	Value of BLOCK_ERR	Condition
4	Local Override	MODE_BLK.actual of the PID block is LO.
7	Input Failure	The status of PV is Bad. (The status of IN is Bad, or the status of IN is Uncertain and "Use Uncertain as Good" is false in STATUS_OPTS).
15	Out of Service	MODE_BLK.target of the PID block is O/S.

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

17. IS Function Block

The function of the Input Selector (IS) block is to automatically select one signal from multiple input signals using a specified selection method.

The IS block is used for selective control in which one measured quantity is selected from multiple measured quantities to be transmitted to the controller as a controlled variable. This feature is primarily used for temperature control systems.

17.1 IS Function Block Schematic

The following shows the Input Selector function block schematic.

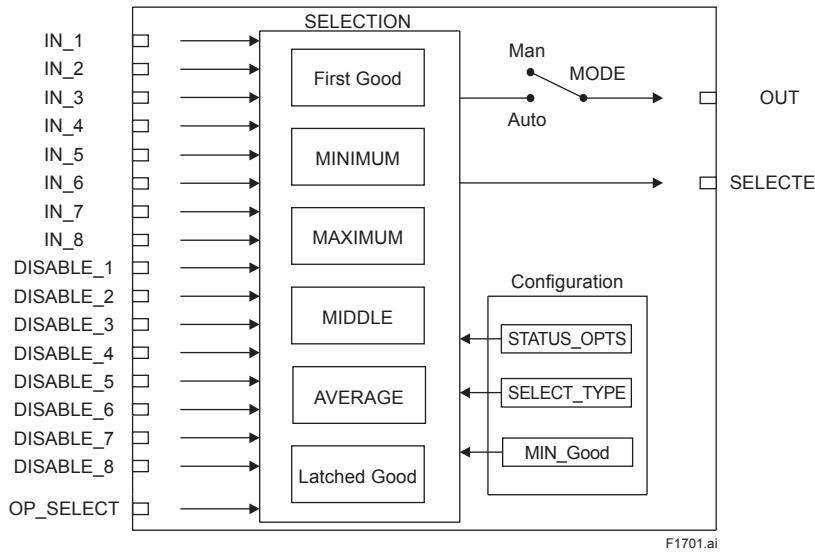


Figure 17.1 IS Block

Input Parameters (Input Terms)

- IN_1 : Block input 1
- IN_2 : Block input 2
- IN_3 : Block input 3
- IN_4 : Block input 4
- IN_5 : Block input 5
- IN_6 : Block input 6
- IN_7 : Block input 7
- IN_8 : Block input 8
- DISABLE_1 : Selector switch 1 to disable input 1 from being selected
- DISABLE_2 : Selector switch 2 to disable input 2 from being selected
- DISABLE_3 : Selector switch 3 to disable input 3 from being selected
- DISABLE_4 : Selector switch 4 to disable input 4 from being selected
- DISABLE_5 : Selector switch 5 to disable input 5 from being selected
- DISABLE_6 : Selector switch 6 to disable input 6 from being selected
- DISABLE_7 : Selector switch 7 to disable input 7 from being selected
- DISABLE_8 : Selector switch 8 to disable input 8 from being selected
- OP_SELECT : A parameter which can be set by an operator to forcibly employ the input of the selected number

Output Parameters (Computation or Selection Results)

OUT: Block output

SELECTED: Indicates the input number selected using the alternatives.

Other Parameters

OUT_RANGE : Sets the OUT range. This setting does not affect instrument action.

STATUS_OPTS : Option used to specify the handling of various statuses.

SELECT_TYPE : Determines the input selection algorithm.

MIN_GOOD : Parameter specifying the minimum required number of inputs with “good” status. If the number of inputs that are “good” is less than the value of MIN_GOOD, input selection is canceled.

Mode

O/S : Allows configuration change, but disables input value output.

Man : Allows internal processing, but the output value may vary depending on the definition of usage conditions.

Auto : Outputs the input value.

The Input Selector (IS) block offers a maximum of eight input alternatives and generates the output according to the configured action. This block generally receives inputs from the Analog Input (AI) function block. The function of the IS block is to select a maximum, minimum, middle, average, “first good,” or “latched good” signal. The block combines parameter configuration (DISABLE_n) and option (“first good”) to give priority to alternative(s) or to function as a rotary position switch. When used as a rotary position switch, the block can receive operator inputs or switch information from connected inputs.

The IS block supports the concept of middle selection. This function outputs the average of two middle signals if even multiple valid signals are configured or a middle signal if odd multiple valid signals are configured. Application of the block is to supply a selected control signal in the forward path.

The SELECTED parameter is the 2nd output indicating which input has been selected using the algorithm.

17.2 Input Section

17.2.1 Mode Handling

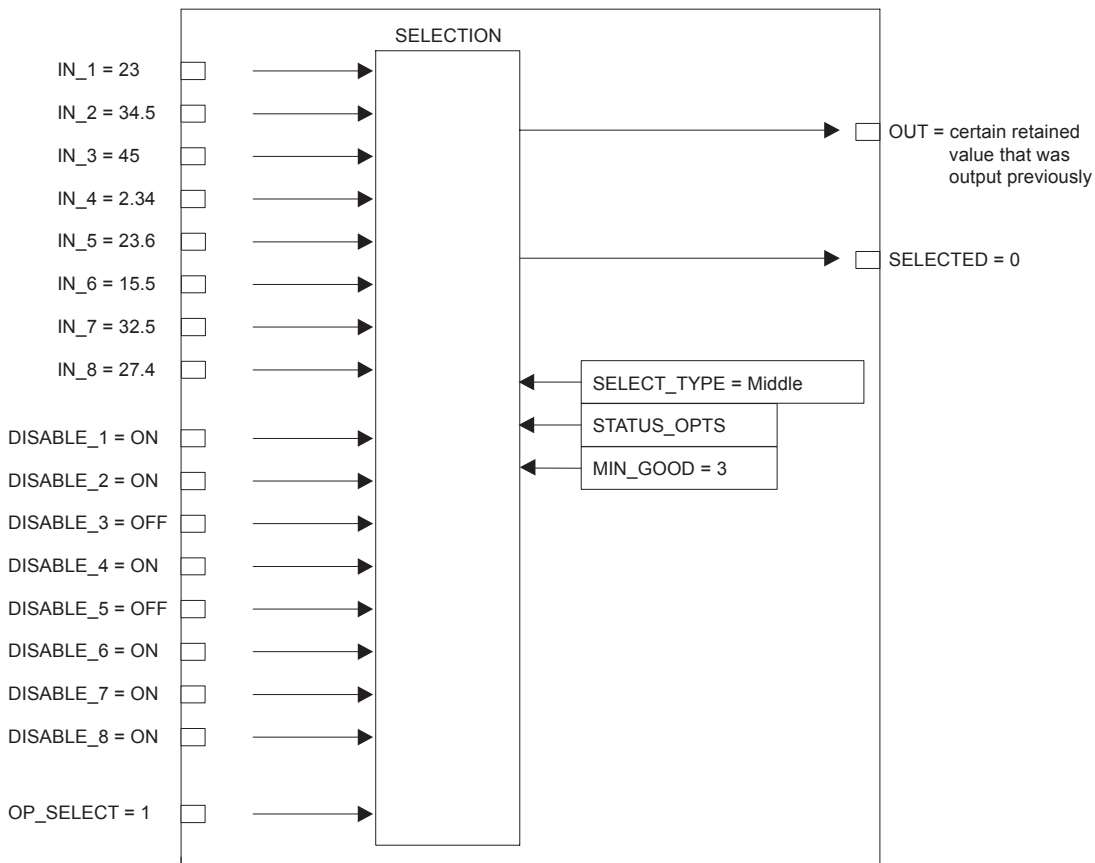
The Input Selector block's operations are determined by the mode (parameter name: MODE_BLK). The following describes operations in each mode.

Supported Mode	Role
O/S (Out of Service)	<ul style="list-style-type: none"> System-stopped status Allows you to make changes to configuration.
Man	<ul style="list-style-type: none"> If you do not want to output the value and status from IN or if the value or status thus output is not preferable, you can manually transmit the value to OUT.
Auto	<ul style="list-style-type: none"> Automatic system operation status

17.2.2 MIN_GOOD Handling

If there is no selectable input or if the number of selectable inputs is less than the value of MIN_GOOD, SELECTED becomes "0."

A case where the number of valid INs is less than the value of MIN_GOOD:



F1702.ai

Figure 17.2 Example (1)

This example restricts the valid inputs using DISABLE_n, and the inputs are enabled only at DISABLE_3 and DISABLE_5. Because the effective number of MIN_Good is 3, the input specified by OP_SELECT will not be output.

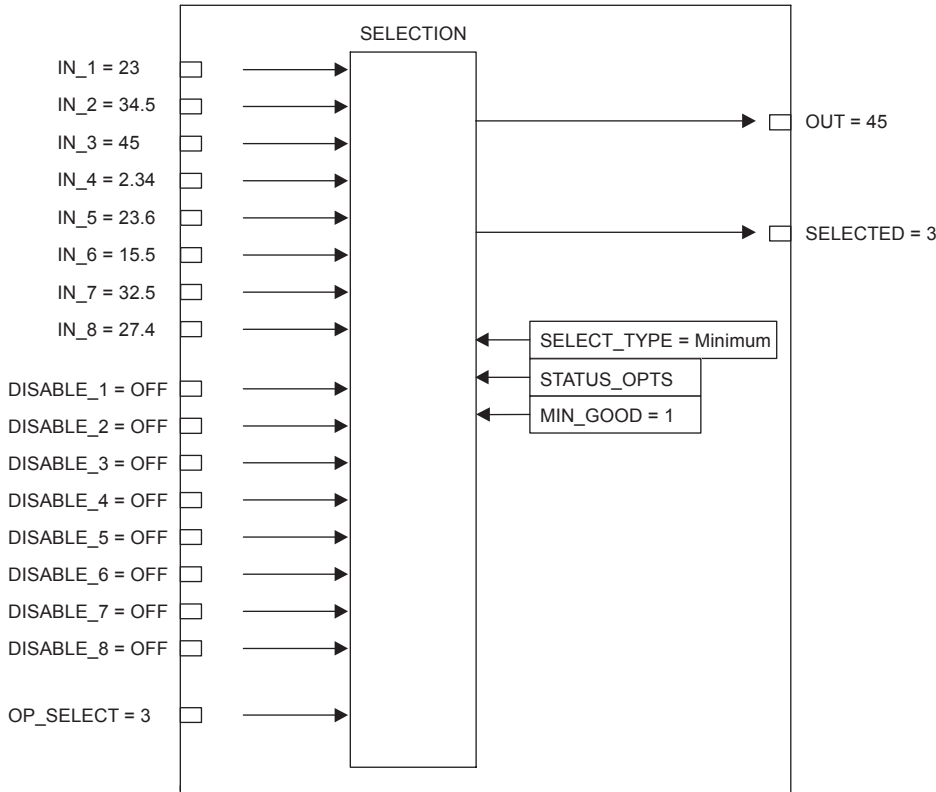
17.3 Selection

The following processing is performed after completing input processing. If the number of valid inputs is less than the value of MIN_Good, no input selection is made.

17.3.1 OP_SELECT Handling

When a value other than “0” (that is, 1 to 8) is selected for OP_SELECT:

The IS block selects the input of the number specified by OP_SELECT regardless of the setting of SELECT_TYPE, propagates the value of that input to OUT, and transmits the input number to SELECTED.



F1703.ai

Figure 17.3 Example (2)

In the above example, SELECT_TYPE is set to Minimum. However, because OP_SELECT specifies the value and number of IN_3, the value and number of this specified IN are transmitted to OUT and SELECTED.

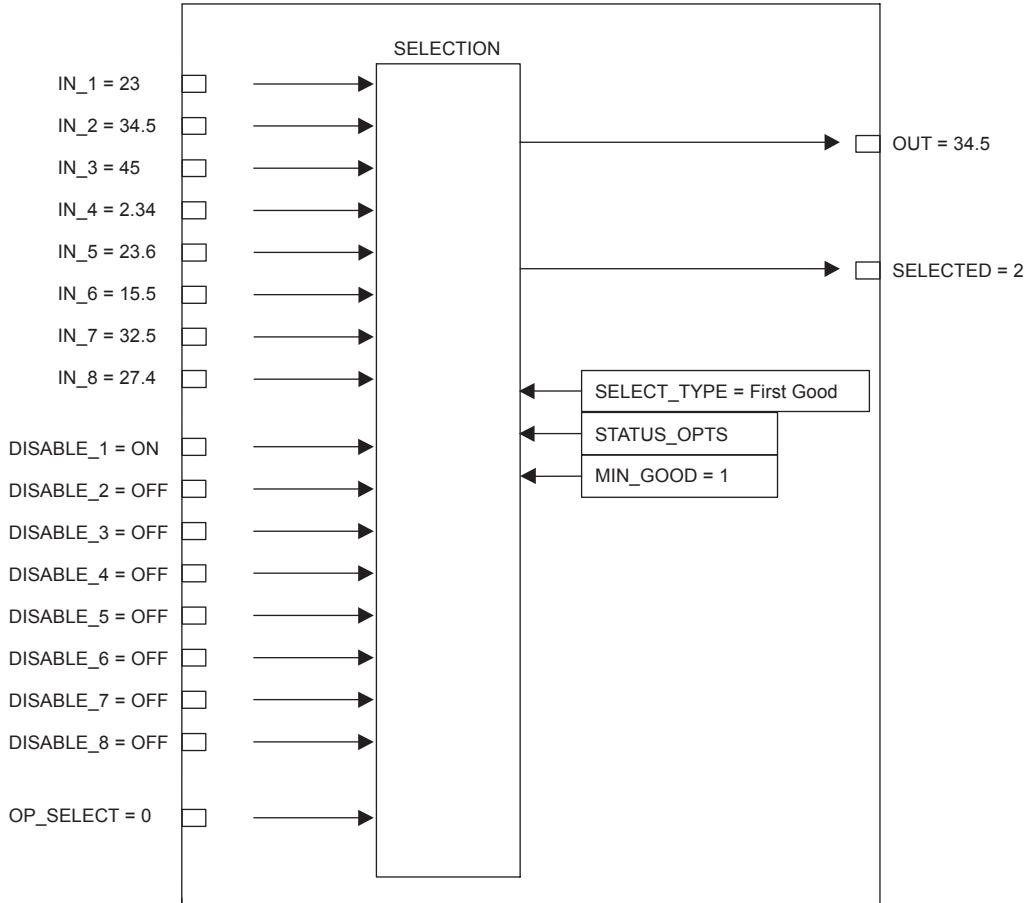
* Note: Even if the IN specified by OP_SELECT is an invalid input (the corresponding DISABLE parameter is ON or the IN's status is “bad”), the value and status of that IN are transmitted to OUT.

17.3.2 SELECTION Handling

If the value of OP_SELECT is "0," input selection using SELECT_TYPE is enabled.

When SELECT TYPE is "first good"

The IS block selects the input with the smallest input number among valid inputs and transmits the value of that input to OUT. The number of the selected input is transmitted to SELECTED.



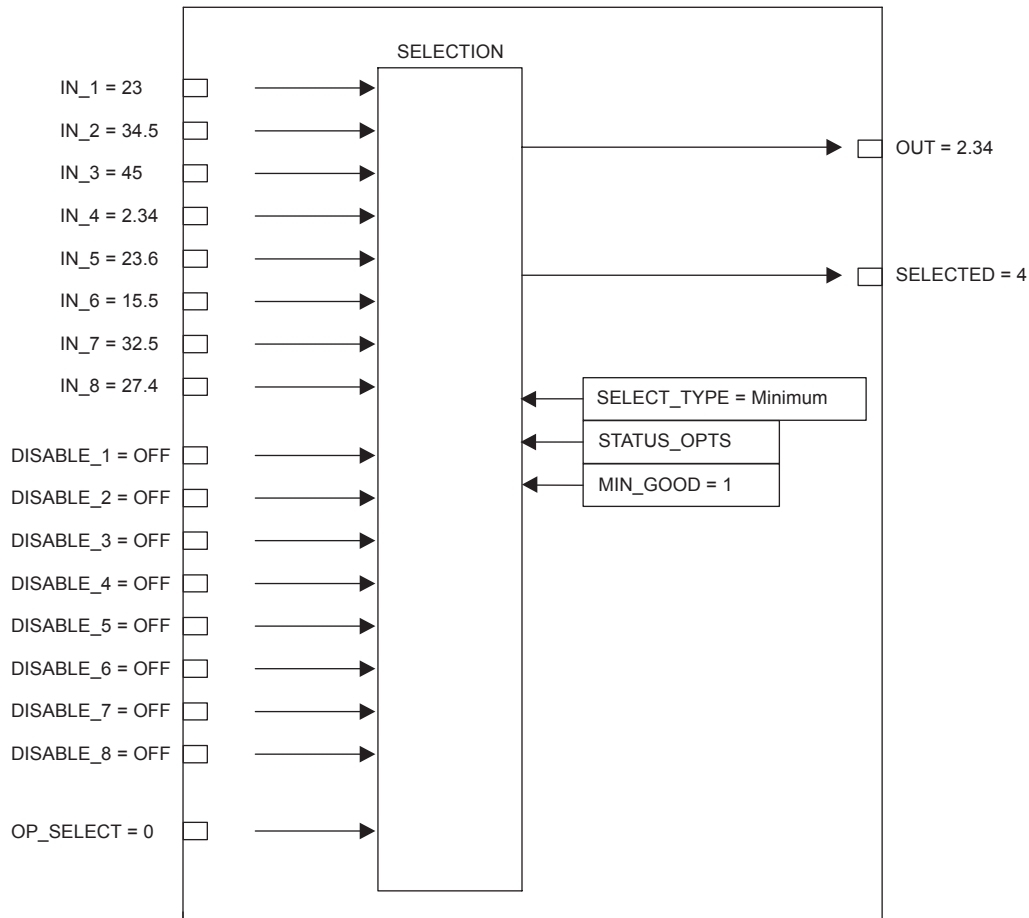
F1704.ai

Figure 17.4 Example (3)

Because DISABLE_1 is ON, IN_1 is disabled, and IN_2 is selected for output. If DISABLE_1 is turned OFF, the output changes from IN_2 to IN_1. That is, the valid IN with the smaller input number is always selected for output.

When SELECT TYPE is “Minimum”

The IS block selects the input with the minimum value among valid inputs and transmits the value of that input to OUT. The number of the selected input is transmitted to SELECTED.

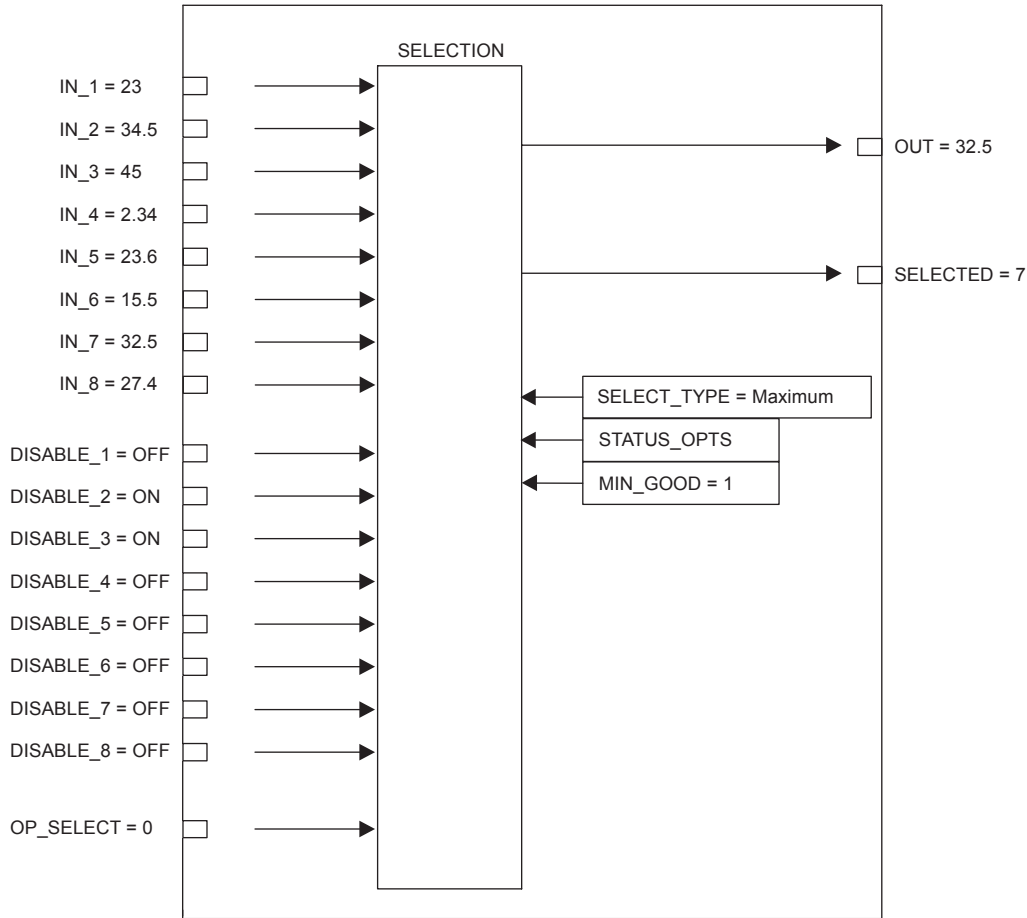


F1705.ai

Figure 17.5 Example (4)

When SELECT TYPE is “Maximum”

The IS block selects the input with the maximum value among valid inputs and transmits the value of that input to OUT. The number of the selected input is transmitted to SELECTED.



F1706.ai

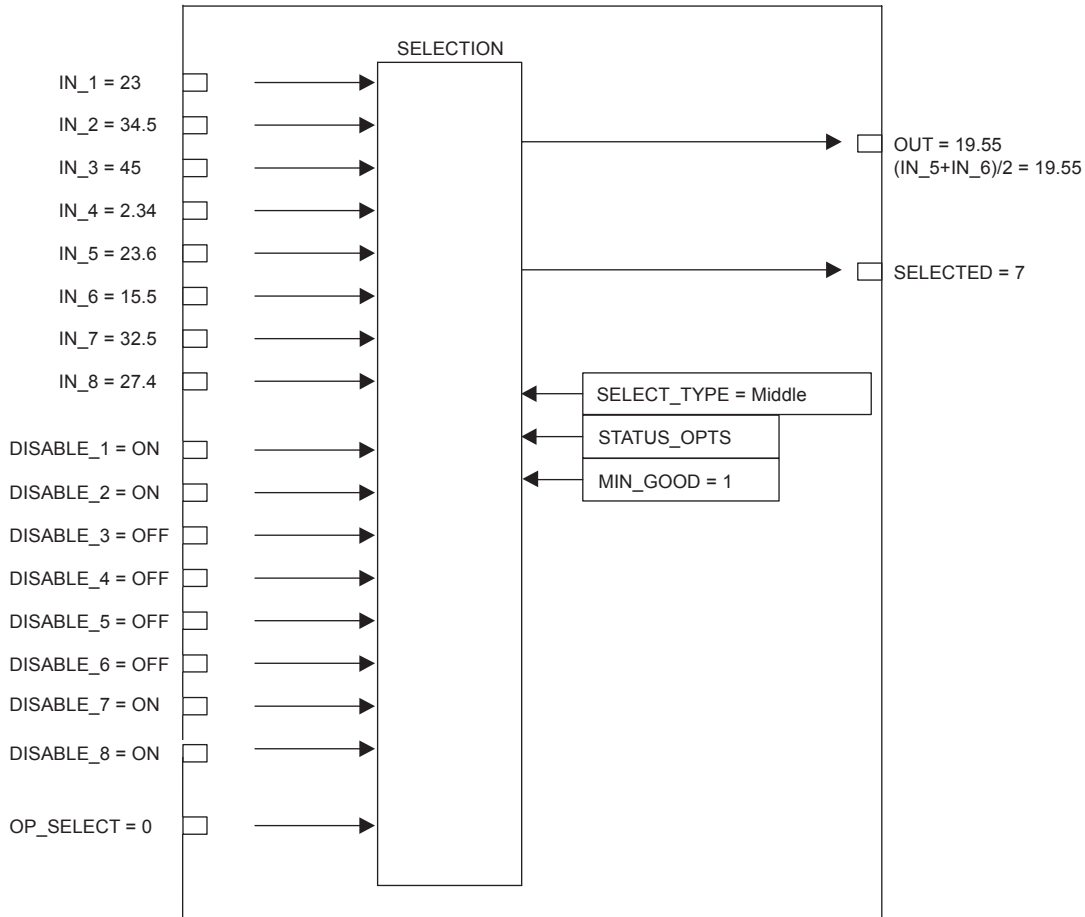
Figure 17.6 Example (5)

Because DISABLE_2 and DISABLE_3 are ON, IN_2 and IN_3 are disabled, and the IN with the maximum value among the remaining IN_n is selected for output. In the above example, since IN_7 has the maximum value among the remaining valid INs, it is output.

When SELECT TYPE is “Middle”

If there is more than one valid input and the number of such input is an odd number, the value of the middle input will be transmitted to OUT. If there is an even number of valid inputs, the average of the middle two inputs is transmitted to OUT. If the average is used for OUT, the block transmits “0” to SELECTED, while it transmits the number of the input used for the middle for other cases. If the number of valid inputs is 1, it is irrelevant to selection by “Middle” selector action. The following shows an example of selection by “Middle” selector action.

If there is an even number of valid inputs:

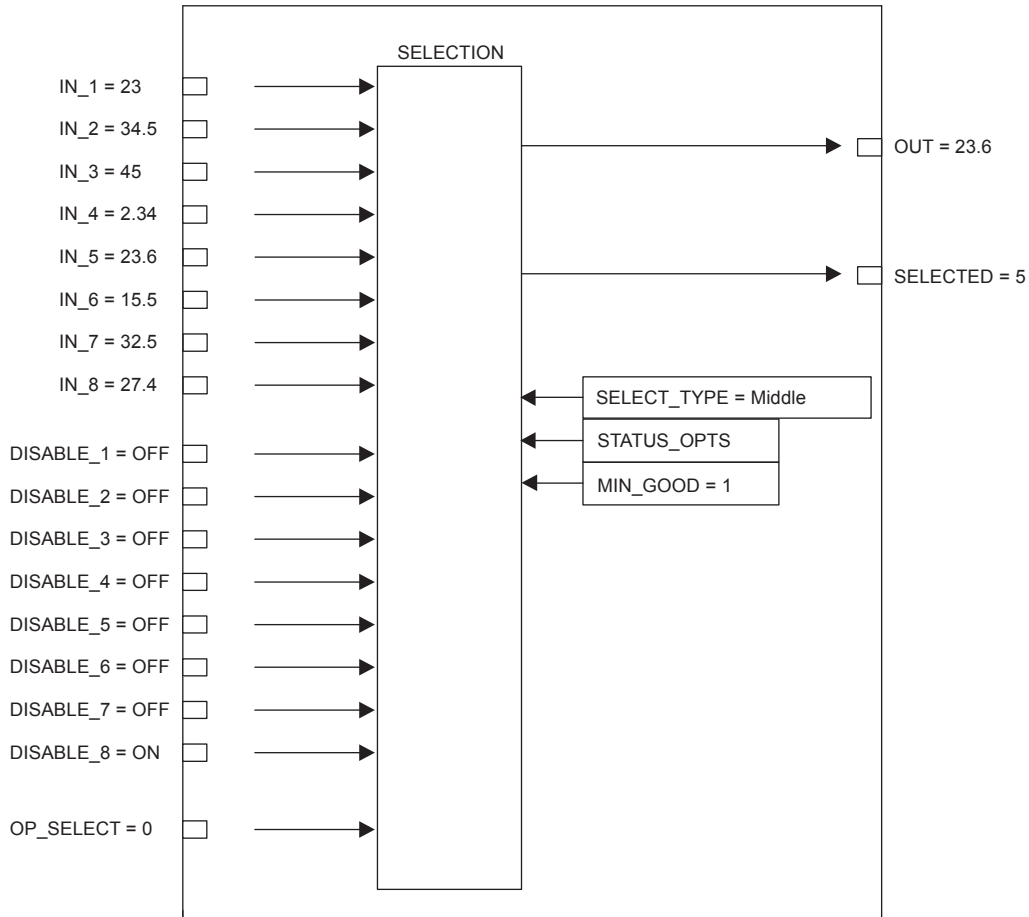


F1707.ai

Figure 17.7 Example (6)

Because DISABLE_1, DISABLE_2, DISABLE_7, and DISABLE_8 are ON, the corresponding IN_1, IN_2, IN_7, and IN_8 are disabled and the remaining four INs are enabled. Furthermore, because IN_3 has the maximum value and IN_4 has the minimum value among the valid INs, they are not selected and the average of IN_5 and IN_6 inputs is output. When the average is selected for OUT, SELECTED is set to “0.”

If there is an odd number of valid inputs:



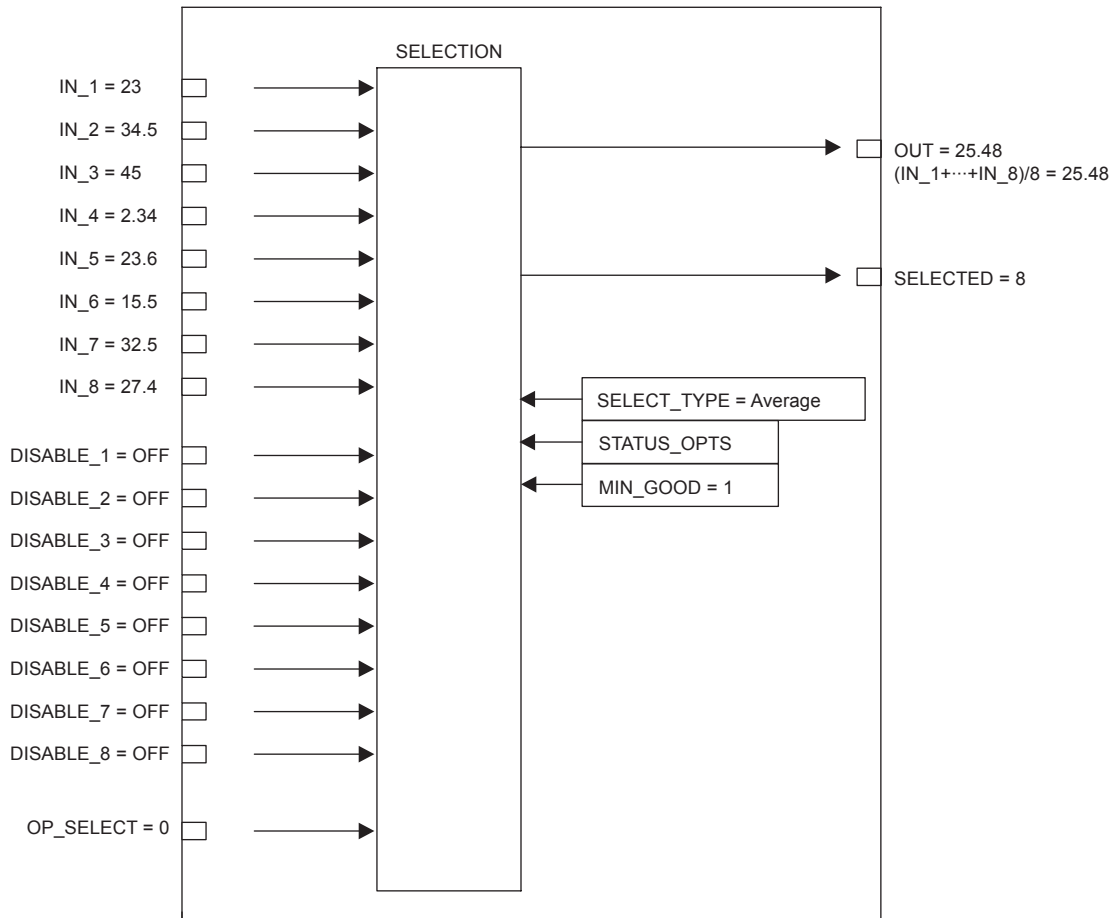
F1708.ai

Figure 17.8 Example (7)

If the number of valid INs is an odd multiple, the IN with the middle value will be output. In the above example, the IN_5 input having the middle value is output.

When SELECT TYPE is “Average”

The block calculates the average of the valid inputs and transmits it to OUT. The number of inputs used to calculate its value is indicated in SELECTED.



F1709.ai

Figure17.9 Example (8)

When SELECT TYPE is “Latched Good”

The valid input with the smaller input number is selected as an output and is held until it becomes invalid. When it becomes invalid, the next valid input will be selected as an output regardless of the magnitude of the value. Even if an input with the input number smaller than that of the currently selected input recovers, the current selection is held.

Assuming that IN_2 is the valid input with the smallest input number, the order of input selection is IN_2 → IN_3 → ... → IN_8 → IN_1 →

If the power is turned OFF and then ON with SELECT TYPE set to “Latched Good,” input selection starts with the IN that was selected before the power was turned OFF.

17.4 Output Processing

17.4.1 Handling of SELECTED

For the value output to SELECTED when OP_SELECT has been selected (that is, not “0”), the number specified by OP_SELECT will be stored as is.

However, “0” is stored in the SELECTED in the following cases:

1. If there is no valid input;
2. If the value of MIN_GOOD is greater than the number of valid inputs;
3. If the input status is “bad” or “uncertain” when the value of OP_SELECT is anything other than “0” (with the exception of the case where the “Uncertain as good” bit in STATUS_OPTS is set.);
4. If the value of OP_SELECT is greater than 8, which is the maximum number of inputs;
5. If the value is out of the SELECT_TYPE setting range when the value of OP_SELECT is zero.

As long as there is one valid input, even an invalid input can be selected for OP_SELECT.

If the number of valid inputs is greater than the value of MIN_GOOD, the number of the input (including an invalid input) specified by OP_SELECT will be stored in SELECTED. Therefore, even if an invalid input is selected, SELECTED does not become zero.

If no input is selected for OP_SELECT, the output of SELECTED will depend on SELECT_TYPE.

The Table 17.1 shows the value of SELECTED according to the number of valid inputs and SELECT_TYPE.

Table 17.1 Value of SELECTED According to Inputs

Valid Inputs	Value of SELECTED			
	SELECT_TYPE = First Good	SELECT_TYPE = MINIMUM, MAXIMUM, or Latched Good	SELECT_TYPE = MIDDLE	SELECT_TYPE = AVERAGE
None	0 (zero)	0 (zero)	0 (zero)	0 (zero)
1	# of IN with a smaller value	# of selected IN	# of selected IN	1
Multiple INs (Even # of INs)			0 (the average is taken)	# of valid INs (the average is taken)
Multiple INs (Odd # of INs)			# of IN with the middle value	

Table 17.2 Value of SELECTED According to the Mode

O/S	MAN	AUTO
0	0	0 to 8

17.4.2 OUT Processing

OUT is an output parameter used to send the value selected in the IS block to another function block.

The following describes OUT processing.

Table 17.3 Block Mode and Value

Mode		Value
O/S		<ul style="list-style-type: none"> The previous value is output. (At startup, the initial value is used). Writable (the operator may change the value.)
Man		
A u t o	Value specified by MIN_Good > the number of valid inputs	<ul style="list-style-type: none"> The previous value is output. Not writable
	If there is no valid input	
	If the input status is "bad" or "uncertain" when the value of OP_SELECT is anything other than "0" (with the exception of the case where the "Uncertain as good" bit in STATUS_OPTS is set)	
	If the value of OP_SELECT is greater than 8, which is the maximum number of inputs	<ul style="list-style-type: none"> Zero Not writable
	If OP_SELECT is enabled	<ul style="list-style-type: none"> The value of the selected input is output. Not writable
	If the value is out of the SELECT_TYPE setting range when the value of OP_SELECT is "0"	<ul style="list-style-type: none"> The previous value is output. Not writable
	If SELECT_TYPE is "First Good"	<ul style="list-style-type: none"> The value of a valid input with the smallest input number is output. Not writable
	If SELECT_TYPE is "MINIMUM"	<ul style="list-style-type: none"> The minimum value among the values of the valid inputs is output. Not writable
	If SELECT_TYPE is "MAXIMUM"	<ul style="list-style-type: none"> The maximum value among the values of the valid inputs is output. Not writable
	If SELECT_TYPE is "MIDDLE" (There is an even multiple number of valid inputs.)	<ul style="list-style-type: none"> Because two inputs are positioned in the middle of the values of even multiple valid inputs, the average of the values of these two inputs is output. Not writable
	If SELECT_TYPE is "MIDDLE" (There is an odd multiple number of valid inputs.)	<ul style="list-style-type: none"> The value of the input positioned in the middle of the values of odd multiple valid inputs is output. Not writable
If SELECT_TYPE is "AVERAGE"	<ul style="list-style-type: none"> The value obtained by dividing the added value of the values of valid inputs by the number of these inputs is output. Not writable 	
If SELECT_TYPE is "Latched Good"	<ul style="list-style-type: none"> The value of a valid input with the smallest input number is output. Not writable 	

Table 17.4 Condition and Mode

Condition (Listed in priority sequence)	Mode
If the Actual is in O/S	O/S
If the "Uncertain if Man mode" bit in STATUS_OPTS is set and the Actual is in Man	Man
If the "Uncertain if Man mode" bit in STATUS_OPTS is not set and the Actual is in Man	Man
Values specified by MIN_Good > the number of valid inputs	Auto
If there is no valid input	Auto
If the input status is "bad" or "uncertain" when the value of OP_SELECT is anything other than "0" (with the exception of the case where the "Uncertain as good" bit in STATUS_OPTS is set)	Auto
If the value of OP_SELECT is greater than 8, which is the maximum number of inputs	Auto
If OP_SELECT has selected IN whose status is "bad" or "uncertain" (See the item "Transition of Sub-status in the Case Where OP_SELECT is Selected.")	Auto
If the value is out of the SELECT_TYPE setting range when the value of OP_SELECT is "0"	Auto

17.4.3 STATUS_OPTS

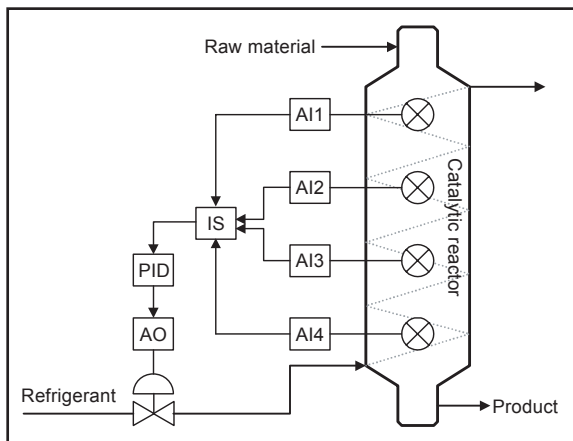
Bit	Description
Use Uncertain as Good	Causes all inputs (OP_SELECT, IN_n, and DISABLE_n) the status of which is "uncertain," to be handled as "good" (NC) status inputs and the others to be handled as "bad" status inputs.
Uncertain if Man mode	When the mode is Man, the status of OUT is interpreted as "uncertain." (This does not apply to SELECTED.)

Basic operations and work sequence:

1. The IS block obtains values and status information from AI.
2. The block selects the AI information using the alternatives.
3. The block displays and outputs the information selected by SELECTED.

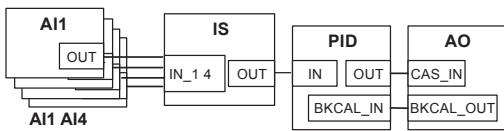
17.5 Application Example

The following describes the temperature control system of a fixed bed-type reactor. In this case, there are instances where the point showing the maximum temperature changes due to catalytic deterioration, raw material flow, etc. Therefore, a large number of measurement points are provided, and the maximum value obtained among these measurement points is input to the controller to control reactor temperature.



F1710.ai

Figure 17.10 Temperature Control System of a Fixed Bed-type Reactor



F1711.ai

Figure 17.11 Example of Scheduling

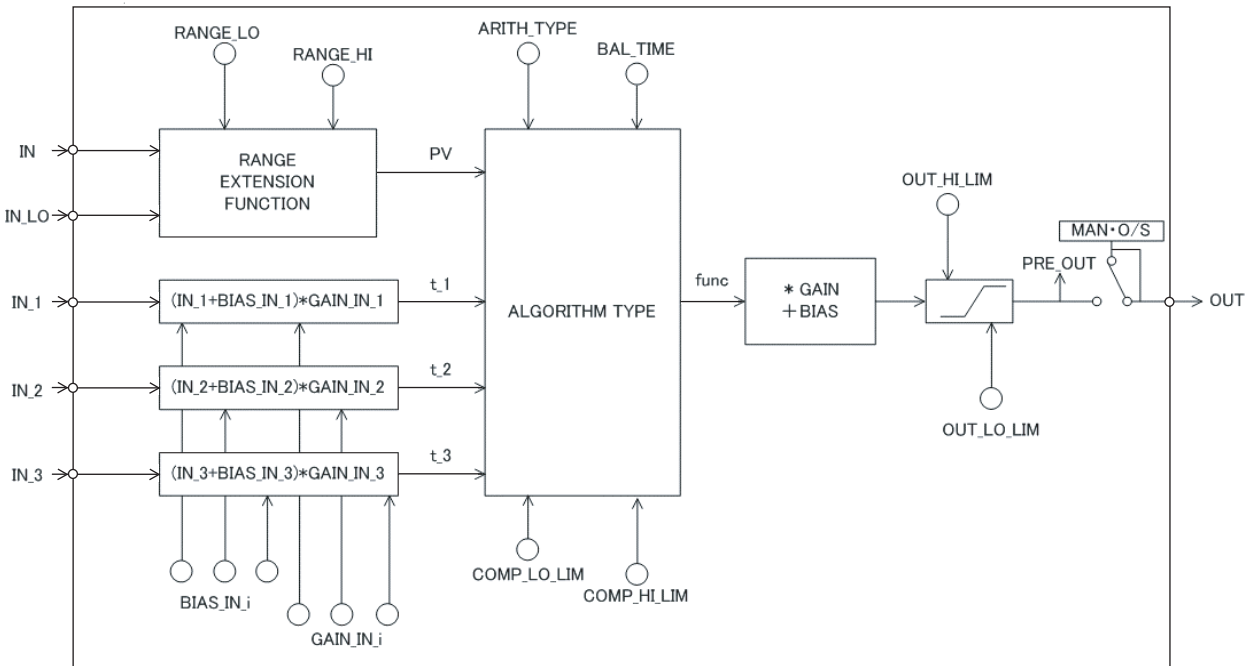
AI1: Temperature 1, AI2: Temperature 2,
 AI3: Temperature 3, AI4: Temperature 4
 IS: SELECT_TYPE = MAX

18. AR Function Block

The Arithmetic (AR) block switches two main inputs of different measurement ranges seamlessly and combines the result with three auxiliary inputs through the selected compensation function (10 types) to calculate the output.

18.1 AR Function Block Schematic

The diagram below shows the Arithmetic block schematic.



F1801.ai

Figure 18.1 AR Block

The Arithmetic block is divided into three sections:

- Input section: Makes a go/no-go decision on the use of an input value, switches the range, and determines the PV status.
- Computation section: Makes calculations through ARITH_TYPE.
- Output section: Applies gain multiplication and bias addition to the calculated result to perform limitation processing for output.

*The range extension function compensates the IN and IN_LO input values when two devices with different ranges are connected, to make smooth input switching.

18.2 Input Section

There are five inputs: IN and IN_LO main inputs and IN_1, IN_2, and IN_3 auxiliary inputs.

IN and IN_LO are intended to connect devices with different measurement ranges and allow the use of switching a measurement range by selecting the measuring device. However, because there are slight differences between IN and IN_LO values even when the same item is measured, instantaneous switching causes abrupt changes in the output.

To prevent this phenomenon, the Arithmetic block uses a function known as range extension to compensate the IN and IN_LO values between RANGE_HI and RANGE_LO. This enables the input to be switched smoothly. The result of the range extension function is substituted into PV to be used for calculations.

18.2.1 Main Inputs

The range extension function determines the PV value in the following order:

1. If $IN \geq RANGE_HI \rightarrow PV = IN$
2. If $IN \leq RANGE_LO \rightarrow PV = IN_LO$
3. If $RANGE_HI > IN > RANGE_LO \rightarrow PV = g \times IN + (1 - g) \times IN_LO$
 $g = (IN - RANGE_LO) / (RANGE_HI - RANGE_LO)$

RANGE_HI and RANGE_LO are threshold values for switching two main inputs seamlessly.

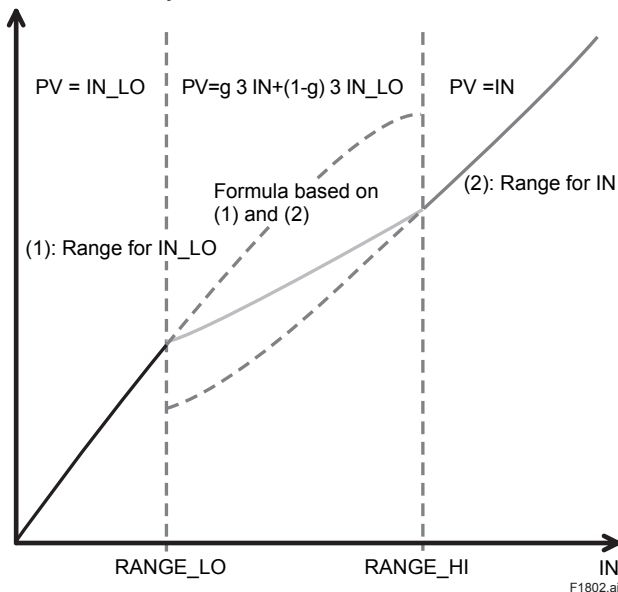


Figure 18.2 Range Extension Function and PV

PV is a parameter with status information, and PV status is determined by the value of “g.”

If “g” < 0.5 → The status of IN_LO is used.

If “g” ≥ 0.5 → The status of IN is used.

Determination of the status is made with a hysteresis of 10% provided for 0.5.

If $RANGE_LO > RANGE_HI$, the statuses of PV and OUT are “Bad. Configuration Error.” Then “Configuration Error” is output to BLOCK_ERR.

If there is only one main input, the input is incorporated into the computation section as is, not taking into account RANGE_HI and RANGE_LO.

Example:

Assuming that

RANGE_LO	20
RANGE_HI	300

the following are established:

$$IN = 310, IN_LO = 20 \rightarrow PV = 310$$

$$IN = 230, IN_LO = 20$$

$$\rightarrow g = (230 - 20) / (300 - 20) = 0.75$$

$$PV = 0.75 \times 230 + (1 - 0.75)$$

$$\times 20 = 177.5$$

$$IN = 90, IN_LO = 20$$

$$\rightarrow g = (90 - 20) / (300 - 20) = 0.25$$

$$PV = 0.25 \times 230 + (1 + 0.25)$$

$$\times 20 = 37.5$$

$$IN = 19, IN_LO = 10 \rightarrow PV = 10$$

18.2.2 Auxiliary Inputs

There are bias and gain parameters for the IN_1, IN_2, and IN_3 auxiliary inputs. The following shows the equation using them.

$$t_i = (IN_i + BIAS_IN_i) \times GAIN_IN_i$$

The bias parameter is used for calculating absolute temperature or absolute pressure, while the gain parameter is used for normalization of square root extraction.

18.2.3 INPUT_OPTS

INPUT_OPTS has an option that handles an input with “uncertain” or “bad” status as a “good” status input.

Bit	Function
0	Handles IN as a “good” status input if its status is “uncertain.”
1	Handles IN_LO as a “good” status input if its status is “uncertain.”
2	Handles IN_1 as a “good” status input if its status is “uncertain.”
3	Handles IN_1 as a “good” status input if its status is “bad.”
4	Handles IN_2 as a “good” status input if its status is “uncertain.”
5	Handles IN_2 as a “good” status input if its status is “bad.”
6	Handles IN_3 as a “good” status input if its status is “uncertain.”
7	Handles IN_3 as a “good” status input if its status is “bad.”
8 to 15	Reserved

There are options called “IN Use uncertain” and “IN_LO Use uncertain” for the IN and IN_LO inputs. When these options are valid, IN and IN_LO are internally interpreted as “good” IN and IN_LO even if their statuses are “uncertain.” (There is no option for “bad” status.)

For the IN_1, IN_2, and IN_3 auxiliary inputs, there are options known as “IN_i Use uncertain” and “IN_i Use bad.” If these options are valid, an IN_i with “uncertain” or “bad” status is internally interpreted as a “good” IN_i.

* The exception is that if the input status is “Bad. Not Connected,” INPUT_OPTS does not apply and the input is considered “bad” as is.

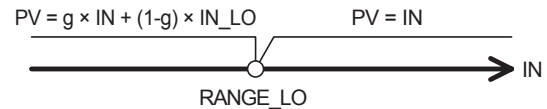
18.2.4 Relationship between the Main Inputs and PV

The value and PV status are determined by the statuses of two main inputs, INPUT_OPTS, and RANGE_LO and RANGE_HI.

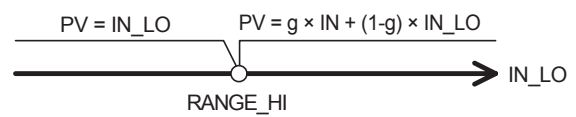
- If the statuses of two main inputs are both “good” or anything other than “good”
See 18.2.1, Main Inputs.
- If only one of two main inputs has “good” status after application of INPUT_OPTS, the PV value is determined as follows:
 - If the status of IN is “good” and that of “IN_LO” is anything other than “good”
 $IN > RANGE_LO \rightarrow PV = IN$
 $IN \leq RANGE_LO \rightarrow$ See 18.2.1.

- If the status of IN is anything other than “good” and that of “IN_LO” is “good”
 $IN_LO < RANGE_HI \rightarrow PV = IN_LO$
 $IN_LO \geq RANGE_HI \rightarrow$ See 18.2.1.

If the status of IN is “good” and that of “IN_LO” is anything other than “good”



If the status of IN is anything other than “good” and that of “IN_LO” is “good”



F1803.ai

18.3 Computation Section

18.3.1 Computing Equations

This subsection shows computing equations used in the computation section:

- 1) Flow compensation (linear)
 $func = PV \times f$
 $f = (t_1 / t_2)$
- 2) Flow compensation (square root)
 $func = PV \times f$
 $f = \text{sqrt}(t_1 / t_2 / t_3)$
- 3) Flow compensation (approximate expression)
 $func = PV \times f$
 $f = \text{sqrt}(t_1 \times t_2 \times t_3 \times t_3)$
- 4) Quantity of heat calculation
 $func = PV \times f$
 $f = (t_1 - t_2)$
- 5) Multiplication and division
 $func = PV \times f$
 $f = ((t_1 / t_2) + t_3)$
- 6) Average calculation
 $func = (PV + t_1 + t_2 + t_3) / N$
 where N: number of inputs
- 7) Summation
 $func = PV + t_1 + t_2 + t_3$

8) Polynomial computation

$$\text{func} = PV + t_1^2 + t_2^3 + t_3^4$$

9) HTG-level compensation

$$\text{func} = (PV - t_1) / (PV - t_2)$$

10) Polynomial computation

$$\text{func} = PV + t_1 \times PV^2 + t_2 \times PV^3 + t_3 \times PV^4$$

* Precaution for computation

Division by "0": If a value is divided by "0," the calculation result is interpreted as 10³⁷ and, depending with core, a plus sign is added to it.

Negative square root: The square root of an absolute value is extracted and a minus sign is added to it.

18.3.2 Compensated Values

In computing equations 1) to 5) in 18.3.1, the value "f" is restricted by the COMP_HI_LIM or COMP_LO_LIM parameter. In this case, the value "f" is treated as follows:

If "f" > COMP_HI_LIM,

$$f = \text{COMP_HI_LIM}$$

If "f" < COMP_LO_LIM,

$$f = \text{COMP_LO_LIM}$$

18.3.3 Average Calculation

In computing equation 6) in 18.3.1, the average of input value is calculated. Here, it is necessary to obtain the number of inputs, N. For this, determination is made to see if the sub-status of each input is "Not Connected." Note that the main inputs may be accepted if IN or IN_LO is not in "Not Connected" sub-status. In this case, the number of inputs that are not in "Not Connected" sub-status is regarded as "N."

18.4 Output Section

After executing the computing equation, the block applies a gain to the calculated result and then adds a bias to it.

It then substitutes the result into PRE_OUT and if the mode is in AUTO, the value of PRE_OUT is taken as OUT.

$$\text{PRE_OUT} = \text{func} \times \text{gain} + \text{bias}$$

where func: result of computing equation execution

$$\text{OUT} = \text{PRE_OUT} \text{ (when the mode is in AUTO)}$$

Next, the block performs limitation processing (OUT_HI_LIM, OUT_LO_LIM). This processing is described as follows with respect to the value of PRE_OUT.

If PRE_OUT > OUT_HI_LIM:

$$\text{PRE_OUT} = \text{OUT_HI_LIM}$$
 The "high limited" processing is applied to the status of PRE_OUT.

If PRE_OUT < OUT_LO_LIM:

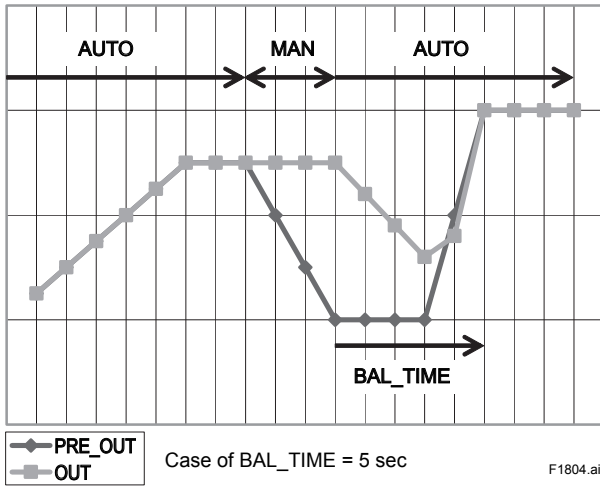
$$\text{PRE_OUT} = \text{OUT_LO_LIM}$$
 The "low limited" processing is applied to the status of PRE_OUT.

18.4.1 Mode Handling

Mode	Output
Auto	OUT = PRE_OUT
MAN	For OUT, the OUT value in the Auto mode just before change to MAN or O/S is retained.
O/S	

In the Manual mode (including O/S), the value of OUT in the Auto mode just before a change to the Manual mode is held or the value written to OUT is output.

If the mode is switched from Manual to Auto, the value of OUT that is linearly changed with respect to the value of PRE_OUT for time set by BAL_TIME is output. The PRE_OUT always indicates the results of calculation. After elapse of BAL_TIME, OUT = PRE_OUT is established. Note that if the value of BAL_TIME is changed during linear change of the OUT value, it is not reflected. The value of BAL_TIME will be reflected only after the mode is changed the next time.



The value of OUT is represented by the following equation.

$$y_n = y_{n-1} + (x_n - y_{n-1}) / (\alpha - n)$$

$$\alpha = (T / tc) + 1$$

*: The value of T/tc truncates digits to the right of the decimal point.

where y: OUT

- x: PRE_OUT
- tc: period of execution
- T: BAL_TIME
- n: period

18.4.2 Status Handling

The setting of INPUT_OPTS is applied to the input status. When INPUT_OPTS is applied, there are cases where the PV status becomes “good” even if the status of main inputs is “uncertain” or the status of auxiliary inputs is “uncertain” or “bad.”

The PV status is classified by the following:

- If the statuses of two main inputs are both “good” or anything other than “good”:
See 18.2.1, Main Inputs.
- If only one of the statuses of two main inputs is “good”:
 - If the status of IN is “good” and that of “IN_LO” is anything other than “good”
 - IN > RANGE_LO → The status of IN applies.
 - IN ≤ RANGE_LO → See 18.2.1, Main Inputs

- If the status of IN is anything other than “good” and that of “IN_LO” is “good”

IN_LO < RANGE_H → The status of IN_LO applies.

IN_LO ≥ RANGE_HI → See 18.2.1, Main Inputs

The exception is that if RANGE_LO > RANGE_HI, the PV status is made “Bad. Configuration Error.”

The input status irrelevant to the computing equation selected by ARITH_TYPE will be ignored and does not affect other statuses. The statuses of outputs (OUT.Status and PRE_OUT.Status) are interpreted as the status of the worst input among the statuses of PV and auxiliary inputs (IN_1, IN_2, and IN_3) to which INPUT_OPTS has been applied.

Example:

		Case 1	Case 2	Case 3
PV		Good		
IN_1		Uncertain		
IN_2		Bad		
IN_3		Bad		
INPUT_OPTS	IN_1	Handled as a “good” input if its status is “uncertain.”	No option	
	IN_2	Handled as a “good” input if its status is “bad.”	No option	
	IN_3	No option		
ARITH_TYPE		1) Flow compensation (linear) in 18.3.1, “Computing Equations”		
OUT.Status		Good	Uncertain	Bad

19. Diagnostics

19.1 Overview

A spotlighted benefit of fieldbus is the capability of gaining a wealth of information from the field via field devices. Particularly for a control valve, it is expected to become possible to determine the status of valves which have been difficult to identify without traveling to the field and physically examining them, to some extent from a distant control room through the information transmitted from the valve positioner. The YVP110 features diagnostics as shown below.

Table 19.1 Diagnostics of YVP110

Category	Diagnostic Details	Access Points
Positioner status diagnostics	Self-diagnostics: Detects positioner hardware failures, positioner software setting errors, and so on.	<ul style="list-style-type: none"> • XD_ERROR in Transducer block
Valve status diagnostics	Measures valve parameters such as the hysteresis and slip width.	<ul style="list-style-type: none"> • Transducer block's respective parameters that contain the values measured during the auto tuning and selfcheck
	Integration: Integrates the travel distance of the valve stem and counts the changes in direction of the valve action (total cycle count), and raises an alarm when each integrated value reaches a preset threshold.	<ul style="list-style-type: none"> • Transducer block's respective parameters • XD_ERROR in Transducer block
	Signature measurement (featured in a model with option code /BP): Measures the signatures of the valve and positioner.	<ul style="list-style-type: none"> • ValveNavi (Model YVP20S)

For self-diagnostics, see Section 12.6, "Online Diagnostics." For valve parameter measurement, see Section 5.3, "Carrying out Tuning" and Section A1.2, "Parameters of Transducer Block." The following describes the integration and signature measurement functions.

19.2 Integration Functions

The transducer block in the YVP110 has the following parameters containing an integrated operation result quantity.

Table 19.2 YVP110's Parameters Containing Integrated Operation Result Quantity

Item	Parameter (upper: integrated value; lower: threshold)	Description
Total number of times of changes in direction of valve actions	TOTAL_CYCLE_COUNT CYCLE_COUNT_LIM	Incremented by 1 at each change in the direction of the valve action. The dead band can be set in CYCLE_DEADBAND.
Total travel (%)	TOTAL_TRAVEL TRAVEL_LIM	Total travel distance of the stem position, regardless of the direction of the travel, represented as a percentage of the valve position span (full stroke). The dead band can be set in CYCLE_DEADBAND.
Total close time (hours)	TOTAL_CLOSE_TIME CLOSE_TIME_LIM	Integrated time periods when the valve position is equal to or less than the threshold set in OPEN_CLOSE_THRESHOLD.
Total open time (hours)	TOTAL_OPEN_TIME OPEN_TIME_LIM	Integrated time periods when the valve position is larger than the threshold set in OPEN_CLOSE_THRESHOLD
Total near close time (hours)	TOTAL_NEAR_CLOSE_TIM NEAR_CLOSE_TIME_LIM	Integrated time periods when the valve position is between a shutoff and the threshold set in NEAR_CLOSE_THRESHOLD. Useful to predict deterioration of valve body.
Total number of times of servo output drift warning.	SERVO_WARN_COUNT	Indicates the total number of times a drift warning occurred regarding the output current to the I/P module.

Each integrated value is associated with a parameter specifying a threshold. Setting the desired value for a threshold will raise a block alarm when that value is reached. The total travel is useful for various purposes such as for anticipating possible degradation of the valve and determining appropriate timing for maintenance. To reset these integrated values, write 0 to the respective parameters. Use caution as the previous value cannot be restored after being reset.

19.3 Signature Measurement Functions

Acquisition of detailed data is essential to ensure that changes in valve's characteristics are captured and on-target maintenance is performed. The signature functions measure the input-to-position characteristics of the valve, and the input-to-position characteristics and step response of the positioner while off-line. As for a valve's input-to-position characteristics, a function of performing in-detail measurement is provided to enable miniscule changes to be captured without fail.

Nevertheless, since a vast amount of measured data cannot be stored in the limited memory of the positioner and most of the data would be lost in the event of a power failure, measured data should be uploaded from a host as necessary. Further, the data thus uploaded needs to be processed for analyses. These requirements make it difficult to use a general-purpose tool or application for these tasks. ValveNavi (R2.20 or later) YVP management software, a YVP-specific tool is designed to perform these tasks with ease and offers dedicated functions. ValveNavi facilitates executions signature measurement, uploads of measured data, display of measured data in a graph, and comparisons of measured data with previously measured data.

This User's Manual outlines the contents of each type of signature and explains the signature-pertaining parameters in the transducer block. For instructions on performing signature measurement, see the User's Manual for ValveNavi (IM 21B04C50-01E, second edition or later), which explains its functions and operation procedures.

19.3.1 Signature Measurement Procedure

The fundamental procedure for measuring signatures is as follows.

Set the measurement conditions for the signature(s) you want to measure in reference with Section 19.3.2.

Set SIGN_MEAS_EXEC to select the signature(s) to be measured and carry out the measurement. At this time, the value of MODE_BLK target in both the transducer and AO blocks needs to be O/S.

- SIGN_MEAS_EXEC
- 1 Off
 - 2 Measure All (executing 3, 4, 6, 7)
 - 3 Measure Standard Actuator Signature
 - 4 Measure Extended Actuator Signature
 - 5 Measure High Resolution Actuator Signature
 - 6 Measure Step Response Test
 - 7 Measure Positioner Signature
 - 255 Cancel Execution

After the measurement has finished, set SIGN_UPLOAD_DATABASE to select the data you want to upload, and upload the values of SIGN_DATA_X and SIGN_DATA_Y.

- SIGN_UPLOAD_DATABASE
- 1 Current: Standard Actuator Signature
 - 2 Current: Extended/High Resolution Actuator Signature
 - 3 Current: Step Response Test
 - 4 Current: Positioner Signature
 - 5 Factory: Standard Actuator Signature (result stored in non-volatile memory)
 - 6 Record: Standard Actuator Signature (result stored in non-volatile memory)

If the number of the measured data is 20 or more, specify in SIGN_UPLOAD_POINTER the leading position of the data to be uploaded. For example, setting "21" in SIGN_UPLOAD_POINTER will upload the twenty-first through fortieth data. Refer to the value of SIGN_MEAS_COUNTER, which indicates the number of data actually measured.

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19.3.2 Signatures and Relevant Parameters

The following describes each signature and the relevant parameters.

(1) Standard Actuator Signature *1

The standard signature is the fundamental input-to-position characteristics of the valve, measured at 10% through 90% of the full stroke in 10% intervals over a round trip.

- The following can be set in a setting parameter `STD_ACT_SIGN_SET`:
 - Recommended Scan Time [seconds]
 - Scan Time [seconds]
 - Deviation Margin [%]
- Performing measurement sets the pressure data in `SIGN_DATA_X` and the position data (%) in `SIGN_DATA_Y`.
- This signature can be saved to non-volatile memory within the YVP110. To do so, Select "2" (Save as a Factory data) or "3" (Save as record data) in `SIGN_DATA_SAVE` and execute saving. The standard signature previously saved is then overwritten. It is recommended to save the signature data taken at the installation as a "Factory data" and that of the latest measurement as a "Record data."

(2) Extended Actuator Signature *1

The extended actuator signature is the input-to-position characteristics of the valve, measured at arbitrary positions within the full stroke of the valve. As the positions of measuring, 50 points can be specified for each direction of the valve actions, totaling 100 points.

- The following can be set in a setting parameter `EXT_ACT_SIGN_SET`:
 - Lower Setpoint [%]
(point to start the measurement)
 - Upper Setpoint [%]
(point to finish the measurement)
 - Recommended Scan Time [seconds]
 - Scan Time [seconds]
 - Deviation Margin [%]
 - Sampling Rate [milliseconds]
(not used in this function)
- Performing measurement sets the pressure data in `SIGN_DATA_X` and the position data (%) in `SIGN_DATA_Y`.

(3) High Resolution Actuator Signature *1

The high-resolution actuator signature is the input-to-position characteristics of the valve, measured with high resolution while sampling data at the specified time rate. Up to 100 data values can be stored in the memory of the YVP100. After this limit is reached during measurement, the stored data will be overwritten from the leading data in order. Using ValveNavi, users can continue measurement while uploading the measured data.

- The following can be set in a setting parameter `EXT_ACT_SIGN_SET`:
 - Lower Setpoint [%]
(point to start the measurement)
 - Upper Setpoint [%]
(point to finish the measurement)
 - Recommended Scan Time [seconds]
(not used in this function)
 - Scan Time [seconds]
 - Deviation Margin [%]
 - Sampling Rate [milliseconds]

The sampling rate can be set within the range of 200 through 1000 milliseconds. The total number of measured samples can be obtained by the following formula:

$$\text{Scan time} / \text{sampling rate} \times 1000 \text{ [points]}$$

- Performing measurement sets the pressure data in `SIGN_DATA_X` and the position data (%) in `SIGN_DATA_Y`.

(4) Step Response Test

The step response test measures time-series changes in the valve position in response to a sudden change (step) in the setpoint of the positioner from the preset initial setpoint to the destination setpoint.

- The following can be set in a setting parameter `STEP_RESP_SET`:
 - Initial Setpoint [%]
 - Destination Setpoint [%]
 - Sampling Rate [milliseconds]
 - Number of Samples [points]

The sampling rate can be set within the range of 20 through 1000 milliseconds (corresponding to the measurement period of 0.4 through 600 seconds). The number of samples can be set to up to 600.

- Performing measurement sets the positioner setpoints in `SIGN_DATA_X` and the position data (%) in `SIGN_DATA_Y`.

(5) Positioner Signature

The positioner signature is the setpoint (input)-to-position characteristics of the positioner, measured at points in equal intervals within a specified range over a round trip. The positioner signature reflects the positioner Cv characteristics, cutoff level, and limits, thus allowing the positioner setting conditions to be ascertained.

- The following can be set in a setting parameter POSITIONER_SIGN_SET:
 - Lower Setpoint [%]
 - Upper Setpoint [%]
 - Intervals [points]
 - Recommended Wait Time [seconds] (read-only)
 - Wait Time [seconds]

- Performing measurement sets the setpoint in SIGN_DATA_X and the position data (%) in SIGN_DATA_Y.
- For the intervals, set the number of points of measurement in the increasing direction within the range of 4 through 20. The total number of points of measurement in a round trip results in:
 - Intervals × 2 + 1.
 For the wait time, set the retention time at each point of measurement. For example, provided the lower setpoint is set to 0, the upper setpoint to 100, and the intervals to 10, the points of measurement are 0, 10, 20, ...90, 100, 90, 80, ...10, and 0, totaling 21 points.

*1: Applicable for Single Acting type with Code /BP.

19.3.3 Signature Measuring Result

The signature measuring result will be displayed to SIGN_MEAS_RESULT. While signature measuring is running, "In operation" is displayed.

Table 19.1 Signature Measuring Result

Code	Message	Description
1	Succeeded	Signature measuring has succeeded.
2	Canceled	Signature measuring has been canceled.
10	Measure Actuator warning	While Standard Actuator Signature is running or preprocessing of other Signature, warning has occurred.
20	Measure Extended Actuator warning	While Extended / High Resolution Actuator Signature is running, warning has occurred.
30	Measure Step Response Test warning	While Step Response Test is running, warning has occurred.
40	Measure Positioner warning	While Positioner Signature is running, warning has occurred.
100	Measure Actuator error	During Signature preprocessing, error has occurred.
255	In operation	Signature measuring is being executed.

20. Troubleshooting

20.1 What to Do First

When a problem occurs, check the following first.

Mounting of YVP110 Positioner

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

Air Piping

- Are the air pipes correctly connected? Is there no leak of air?

- Is the air supply pressure high enough to drive the valve?
- Is the A/M selector on the positioner set to A (automatic)?

Wiring

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

20.2 Troubleshooting Communications

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

20.3 Troubleshooting Function Block Parameters

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

20.4 Troubleshooting Valve Control

Problem	Presumed Cause	Remedy	Ref. Section
A change in setpoint causes no action of the valve.	Air piping is incorrect.	Correct piping.	4.2
	The instrument is in FAILSAFE state.	Write 'Clear non-latch' to RELEASE_FAILSAFE parameter.	12.6.2
	Air supply is not being fed.	Supply proper air pressure	4.2
	The valve has failed.	Apply a pneumatic pressure directly to the valve actuator and check whether there is valve action.	3.2.3
	The I/P module or control relay has failed, or there is breakage in the cable between the I/P module and control relay.	If the output pressure does not increase even though the SERVO_OUTPUT_SIGNAL value is at maximum, contact the nearest service station or representative office.	—
The valve's full stroke is insufficient for the setpoint input.	The air supply pressure is not high enough to drive the valve actuator.	Check the air supply pressure rating for the valve actuator and supply air at the correct pressure, and write 4 or 2 to AUTO_TUNE_EXEC to redo autotuning.	4.2, 5.3
	The range of the setpoint is limited by software.	Check the values of SP_HI_LIM and SP_LO_LIM in the AO block and FINAL_VALUE_RANGE in the transducer block.	13.3, Appendix 1
The deviation between the setpoint and readback signal remains.	The tight-shut or full-open action is active.	Check the values of FINAL_VALUE_CUTOFF_HI and FINAL_VALUE_CUTOFF_LO.	12.2.4, Appendix 1
	The travel calibration has not been performed correctly.	Write 2 to AUTO_TUNE_EXEC to perform 0 & 100% point adjustment.	5.3
The valve oscillates cyclically (limit cycle).	The friction of grand packing is large.	1) Write 4 or 3 to AUTO_TUNE_EXEC to redo auto tuning.	5.3
		2) Use the actuator of proper size.	—
	The dead band of integral action is too little.	Write 4 or 3 to AUTO_TUNE_EXEC to redo auto tuning. Or, increase the SERVO_DEADBAND setting until the valve stops oscillating.	5.3, 12.7, Appendix 1, Appendix 6
	There's air leak from the pipe of output pressure, or feedback lever is not correctly attached.	Check the piping and attachment of the lever, and write 4 or 3 to AUTO_TUNE_EXEC to redo autotuning.	Chapter 3, 5.3
Valve responses are too slow.	If only the responses that require air suction are slow, it means that the regulator's maximum capacity is large enough.	Replace the regulator.	—
	The I/P module's nozzle has become blocked from dirt contained in the air supply or the like.	Check whether or not error 114 or 122 occurs in XD_ERROR in steady states. If it does occur, contact the nearest service station or representative office.	12.6.1
	The control relay's nozzle has become blocked from dirt contained in the air supply or the like.	Check whether or not error 114 or 122 occurs in XD_ERROR in steady states.	12.6.1
	The control gain is insufficient.	Write 4 or 3 to AUTO_TUNE_EXEC to redo auto tuning. Or, increase the SERVO_GAIN setting.	5.3, 12.7, Appendix 1, Appendix 6
	There's air leak from the pipe of output pressure, or feedback lever is not correctly attached.	Check the piping and attachment of the lever, and write 4 or 3 to AUTO_TUNE_EXEC to redo autotuning.	Chapter 3, 5.3
	The pressure balance deviation is too large.	Adjust the pressure balance of control relay.	6.3.4

20.5 Troubleshooting Auto Tuning

Problem	Presumed Cause	Remedy	Ref. Section
Auto tuning requests are rejected.	Either or both of the A/O block and transducer block are not in O/S mode.	Change the target modes of the AO and transducer block to O/S.	Appendix 1
When auto tuning has finished, AUTO_TUNE_RESULT changes value to an index from 21 to 23.	There is something wrong with the air supply pressure or spring range.	Check whether the measured pressure reading nearly equals the actual pressure. See the descriptions for auto tuning.	5.3, 12.4
When auto tuning has finished, AUTO_TUNE_RESULT changes value to index 40 or 120.	There is something wrong with the operation point of the I/P module. SERVO_OFFSET could not be measured.	If there is nothing wrong with the air supply pressure and piping, contact the nearest service station or representative office.	—
When auto tuning has finished, AUTO_TUNE_RESULT changes value to an index from 42 to 44, or from 120 to 123.	The measured time delay constant, hysteresis, and/or slip width of the valve is excessively large.	Check whether they meet the characteristics specified for the valve. See the descriptions for auto tuning.	5.3, 12.4
When auto tuning has finished, AUTO_TUNE_RESULT changes value to an index from 60 to 62, or from 100 to 103.	The span of rotation angle is incorrect or the 50% position deviation from the horizontal level is too large.	Correct the installation and try auto tuning again.	Chapter 3, 5.3
When auto tuning has finished, AUTO_TUNE_RESULT changes value to an index from 60 to 62, or from 120 to 123.	The valve hysteresis is large.	Carry out manual tuning.	Appendix 6

20.6 Troubleshooting Position, Pressure, and Temperature Sensors

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

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 YVP110.
8	1008	TEST_RW	Null		Parameter used to test read and write access to the YVP110
9	1009	DD_RESOURCE	Null	—	Name of the device description (DD) containing the information of this resource block
10	1010	MANUFAC_ID	0x00594543	—	Manufacturer ID; 5850435 (= 0x594543) is assigned to Yokogawa Electric Corporation.
11	1011	DEV_TYPE		—	ID number of device; 1 or 7 (/EE) is assigned to the YVP110.
12	1012	DEV_REV		—	Revision number of the YVP110
13	1013	DD_REV		—	Revision number of the device description (DD) applied to this YVP110
14	1014	GRANT_DENY	0		Option to control access from the host computer and local control panel to tuning and alarm parameters
15	1015	HARD_TYPES	Scalar input, Scalar output Discrete input	—	Bit string indicating the hardware types Bit 0: Scalar input Bit 1: Scalar output Bit 2: Discrete input Bit 3: Discrete output

Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description
16	1016	RESTART	—		Restart the YVP110 in the selected way. 1: Running 2: Restart Resource 3: Restart with the default settings defined in FF specifications.*1 4: Restart CPU
17	1017	FEATURES	—	—	Shows supportable optional features of the block.
18	1018	FEATURE_SEL	.	—	Parameter used to select the optional features of the resource block
19	1019	CYCLE_TYPE	Scheduled	—	Bit string indicating cycle types executable for the resources Bit 0: Scheduled; to be scheduled Bit 1: Event driven; to be driven by an event Bit 2: Manufacturer specified; executable by a manufacturer-specified unique function
20	1020	CYCLE_SEL	Scheduled		Bit string used to select the cycle type
21	1021	MIN_CYCLE_T	3200 (100ms)	—	Minimum execution cycle
22	1022	MEMORY_SIZE	0	—	Memory size allowed for use of function block configurations in the device; checked before a download, but not supported by the YVP110.
23	1023	NV_CYCLE_T	0	—	Cycle of saving the settings of non-volatile attribute parameters to the EEPROM. 0 is set with the YVP110, and saving is not cyclically done.
24	1024	FREE_SPACE	0	—	Shows the free space memory for configurations as a percent value. YVP110 shows zero which means the pre-configured resource.
25	1025	FREE_TIME	0	—	Shows the free time that can be used for computations by resources but not supported by the YVP110.
26	1026	SHED_RCAS	640000		Communication time-out setting for communications with the device from which the remote cascade setpoint is sent.
27	1027	SHED_ROUT	640000		Communication time-out setting for communications with the device from which the remote output setting is sent; not used in the YVP110, however.
28	1028	FAULT_STATE	1	—	Indicates the fault-state.
29	1029	SET_FSTATE	1		Sets the fault-state.
30	1030	CLR_FSTATE	1		Clears the fault-state.
31	1031	MAX_NOTIFY	3	—	Maximum number of alerts retained in the device (YVP110).
32	1032	LIM_NOTIFY	3		Maximum number of alerts to be held by the device (YVP110); used by the user to restrict the number of alert notifications to the host to prevent overflow of alert receptions in the host.
33	1033	CONFIRM_TIM	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 (YVP110).
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.

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

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

A1.2 Parameters of Transducer Block

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

Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description [Setting range]
0	2000	Block Header		Block tag = O/S	Information about this block, including the block tag, DD revision, execution time
1	2001	ST_REV	0	—	Incremented when a change is made to the parameter settings for the transducer block to indicate the revision level of the settings, and used to see whether or not there is a change in parameter settings.
2	2002	TAG_DESC	Spaces		Universal parameter storing the description of the tag
3	2003	STRATEGY	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	O/S		Universal parameter that indicates the block operation conditions and is composed of the actual mode, target mode, permitted modes, and normal mode.
6	2006	BLOCK_ERR	—	—	Indicates the error statuses related to the block itself.
7	2007	UPDATE_EVT	—	—	Shows the contents of an update event upon occurrence.
8	2008	BLOCK_ALM	—	—	Universal parameter indicating the hardware and software error statuses related to the block itself

Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description [Setting range]
9	2009	TRANSDUCER_DIRECTORY	1, 10	—	Index to the text describing the transducer contained in the YVP110 positioner
10	2010	TRANSDUCER_TYPE	106	—	Transducer type
11	2011	XD_ERROR	0	—	Stores the error prioritized at the highest level from among the errors that are currently occurring in the transducer block.
12	2012	CORRECTION_DIRECTORY	1, 13	—	Stores the number of data collection and the index number to be started with.
13	2013	FINAL_VALUE	—	O/S	Stores the valve control level and status written by the AO block.
14	2014	FINAL_VALUE_RANGE	-10%, 110%	O/S	Defines the upper and lower range limits of FINAL_VALUE, and the unit code and decimal point position for value indication of FINAL_VALUE.
15	2015	FINAL_VALUE_CUTOFF_HI	110%	O/S	If the value of FINAL_VALUE is greater than the value set in this parameter, the YVP110 moves the valve to the full-open position. There is a hysteresis of 1% at the release time. If the value of FINAL_VALUE becomes 1% less than the value set in this parameter, this function is released.
16	2016	FINAL_VALUE_CUTOFF_LO	0%	O/S	If the value of FINAL_VALUE is less than the value set in this parameter, the YVP110 moves the valve to the shut-off position. There is a hysteresis of 1% at the release time. If the value of FINAL_VALUE becomes 1% greater than the value set in this parameter, this function is released.
17	2017	FINAL_POSITION_VALUE	—	—	Stores the position data read by the valve position sensor.
18	2018	SERVO_GAIN (*1)	120	O/S	Static control loop gain set by auto tuning [0.5 to 1300]
19	2019	SERVO_RESET (*1)	15 sec	O/S	Integral time set by auto tuning
20	2020	SERVO_RATE (*1)	0.22 sec	O/S	Derivative time set by auto tuning
21	2021	ACT_FAIL_ACTION	1	O/S	Specifies the actuator action direction (in case of losing of air supply pressure): 1 = Air to Open 2 = Air to Close
22	2022	ACT_MAN_ID	0	—	ID of actuator manufacturer
23	2023	ACT_MODEL_NUM	Null	—	Model number of actuator
24	2024	ACT_SN	0	—	Serial number of actuator
25	2025	VALVE_MAN_ID	0	—	ID of valve manufacturer
26	2026	VALVE_MODEL_NUM	Null	—	Model number of valve
27	2027	VALVE_SN	0	—	Serial number of valve
28	2028	VALVE_TYPE	1	O/S	Valve type: 1 = linear-motion valve 2 = rotary-motion valve
29	2029	XD_CAL_LOC	Null	—	Shows and is used to record the location where the positioner was calibrated.
30	2030	XD_CAL_DATE	01/01/00	—	Shows and is used to record the date when the positioner was calibrated.
31	2031	XD_CAL_WHO	Null	—	Shows and is used to record the person who calibrated the positioner.
32	2032	ALARM_SUM	—	—	Shows the alarm summary (current alarm statuses, acknowledged/unacknowledged states, masking states) for the transducer block.

Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description [Setting range]
33	2033	POSITION_CHAR_TYPE	1	O/S	Defines the valve position-to-flow characteristics: 1 = linear 2 = equal % (50:1) 3 = equal % (30:1) 4 = quick open (inverse of 50:1 equal %) 5 = Camflex Percentage 255 = user-defined 10-segment function
34	2034	POSITION_CHAR	10, 20, 30, 40, 50, 60, 70, 80, 90	O/S	Defines the coordinates of the segment function when 255 is set for POSITION_CHAR_TYPE. [0 to 100, only simple decreasing can be allowed]
35	2035	LIMSW_HI_LIM	+110%		Setting of high limit switch
36	2036	LIMSW_LO_LIM	-10%		Setting of low limit switch
37	2037	ELECT_TEMP	—	—	Indicates the temperature on amplifier board
38	2038	TEMPERATURE_UNIT	1001(degC)	O/S	Defines the unit of temperature indication above: 1001 = degC 1002 = degF
39	2039	SUPPLY_PRESSURE	140kPa	O/S	Air supply pressure (irrespective of control)
40	2040	SPRING_RANGE	20kPa, 100kPa	O/S	Defines the pressure range and unit for valve operation (with no direct effect on control). The unit defined here also applies to OUT_PRESSURE. 1133 = kPa 1137 = bar 1141 = psi 1145 = kgf/cm ²
41	2041	OUT_PRESSURE	—	—	Output pressure to valve actuator
42	2042	SERVO_OUTPUT_SIGNAL	—	—	Output current (%) to I/P module
43	2043	SERVO_RATE_GAIN (*1)	5	O/S	Derivative gain; a control parameter set by auto tuning [2 to 20]
44	2044	SERVO_DEADBAND (*1)	0.5%	O/S	Derivative action dead band; a control parameter set by auto tuning [0 to 50%]
45	2045	SERVO_OFFSET (*1)	55% of MV	O/S	Derivative action offset; a control parameter set by auto tuning [0 to 100 % of MV]
46	2046	BOOST_ON_THRESHOLD (*1)	1.9, 2.9%	O/S	Threshold for switching on boost action; a control parameter set by auto tuning [0, 0.1 to 10 %]
47	2047	BOOST_OFF_THRESHOLD (*1)	1.0, 1.0%	O/S	Threshold for switching off boost action; a control parameter set by auto tuning [0.1 to 10%]
48	2048	BOOST_VALUE (*1)	8, 10% of MV	O/S	Boost value; a control parameter set by auto tuning [0 to 50 % of MV]
49	2049	SERVO_I_SLEEP_LMT (*1)	0 sec	O/S	Integral-action sleep timer setting; a control parameter set by auto tuning [0 to 10 sec]
50	2050	SERVO_P_ALPHA (*1)	0 %	O/S	Multiplication coefficient for the square of proportional factor; a control parameter set by auto tuning [0 to 100%]
51	2051	INTERNAL_GAIN (*1)(*2)	5 rad./mA	O/S	Gain for internal computation; a control parameter set by auto tuning and travel calibration [0.5 to 50 rad./mA]
52	2052	MEAS_GAIN	0 rad./mA	—	Measurement gain of I/P module, control relay and valve; a parameter set by auto tuning
53	2053	VALVE_TC	0 sec	—	Proportional factor of response speed of valve; a parameter set by auto tuning
54	2054	VALVE_HYS	0 %	—	Hysteresis of valve actions (%); a parameter set by auto tuning
55	2055	VALVE_SLIP_WIDTH	0 %	—	Slip width of valve actions (%); a parameter set by auto tuning
56	2056	MEAS_PRESS_AIR	0kPa	—	Air pressure (%); a parameter set by auto tuning (Valid when an optional pressure sensor is specified.)

Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description [Setting range]
57	2057	MEAS_PRESS_SUPPLY	0kPa	—	Air supply pressure (%); a parameter set by auto tuning (Valid when an optional pressure sensor is specified.)
58	2058	MEAS_SPRING_RANGE	0kPa	—	Spring range of valve; a parameter set by auto tuning (Valid when an optional pressure sensor is specified.)
59	2059	CONTROL_DIR	2	—	Defines the acting direction of the feedback loop: 1 = direct 2 = reverse
60	2060	THETA_HI (*1)(*2)	+ 0.2 rad.	—	Upper angle signal limit of position sensor (in radians)
61	2061	THETA_LO (*1)(*2)	-0.2 rad.	—	Upper angle signal limit of position sensor (in radians)
62	2062	THETA_P (*1)(*2)	0 rad.	—	Angle signal equal to 50 % from position sensor (in radians)
63	2063	TRAVEL_CALIB_EXEC	1	O/S	Switch for starting a travel calibration.
64	2064	TRAVEL_CALIB_RESULT	1	—	Indicates the result of a travel calibration.
65	2065	OPEN_STOP_ADJ	—	—	Not used for YVP110.
66	2066	AUTO_TUNE_EXEC	1	O/S	Switch for starting auto tuning.
67	2067	AUTO_TUNE_RESULT	1	—	Indicates the result of auto tuning.
68	2068	AUTO_TUNE_STATE	0	—	Indicates auto tuning sequence number.
69	2069	SERVO_RET_TO_DFLT	1	O/S	Writing 2 to this parameter resets all control parameters to the defaults: 1 = off 2 = set (to the defaults)
70	2070	ADVAL_FW	—	—	Digital value of valve control signal, setpoint equivalent to A/D value of valve position signal.
71	2071	ADVAL_BW	—	—	A/D value of valve position signal
72	2072	ADVAL_PRESS	—	—	A/D value of pressure from sensor
73	2073	ADVAL_T	—	—	A/D value of temperature from sensor
74	2074	TOTAL_CYCLE_COUNT	0	O/S	Total number of cycles. To reset the count, write 0.
75	2075	CYCLE_DEADBAND	0.25%	—	Dead band of cycle counting
76	2076	CYCLE_COUNT_LIM	2 ³² -1	—	High-limit alarm setting for TOTAL_CYCLE_COUNT. When TOTAL_CYCLE_COUNT has reached this setting, a block alarm is generated.
77	2077	TOTAL_TRAVEL	0	O/S	Total amount of travel. To reset the count, write 0.
78	2078	TRAVEL_DEADBAND	0.25%	—	Dead band of travel integration
79	2079	TRAVEL_LIM	2 ³² -1	—	High-limit alarm setting for TOTAL_TRAVEL. When TOTAL_TRAVEL has reached this setting, a block alarm is generated.
80	2080	TOTAL_OPEN_TIME	0 hour	—	Total time other than counted for TOTAL_CLOSE_TIME. To reset the count, write 0.
81	2081	TOTAL_CLOSE_TIME	0 hour	—	Total time where valve position is equal to or less than OPEN_CLOSE_THRESHOLD. To reset the count, write 0.
82	2082	OPEN_CLOSE_THRESHOLD	0.25%	—	Threshold value for TOTAL_OPEN_TIME and TOTAL_CLOSE_TIME.
83	2083	OPEN_TIME_LIM	2 ³² -1 hours	—	High-limit alarm setting for TOTAL_OPEN_TIME. When TOTAL_OPEN_TIME has reached this setting, a block alarm is generated.
84	2084	CLOSE_TIME_LIM	2 ³² -1 hours	—	High-limit alarm setting for TOTAL_CLOSE_TIME. When TOTAL_CLOSE_TIME has reached this setting, a block alarm is generated.

Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description [Setting range]
85	8085	TOTAL_NEAR_CLOSE_TIM	0	O/S	Total time period when the valve position is equal to or less than the value set in NEAR_CLOSE_THRESHOLD (judged as when the valve is nearly closed). To reset the count, write 0.
86	2086	NEAR_CLOSE_THRESHOLD	3.0 %		Threshold for judging that the valve is nearly closed
87	2087	NEAR_CLOSE_TIME_LIM	2 [^] 32-1 hours		High-limit alarm setting for TOTAL_NEAR_CLOSE_TIM. When TOTAL_NEAR_CLOSE_TIM has reached this setting, a block alarm is generated.
88	2088	DEVIATION_LIM	110%		Deviation high limit (%)
89	2089	DEVIATION_TIME_TH	10, -1 (off)		If the time period when the deviation is continuously equal to or greater than DEVIATION_LIM has reached the time set for the first value in this parameter, a block alarm is generated. If it has reached the time set for the second value, the instrument transfers to fault state. Negative value means "off".
90	2090	RELEASE_FAILSAFE	As specified upon ordering	O/S	Used to release the block from the fail-safe state. When the value of this parameter is 3, writing 1 will release the block from the fail-safe state. 1 = clear, non-latch (normal state) 2 = active, latched (during fail-safe state) 3 = clear, latched (cause has been cleared but fail-safe action is still on).
91	2091	MODEL	As specified upon ordering	—	Model code
92	2092	DEV_OPTIONS	0x0000 (or 0x0001 if PID option is specified)	—	Indicates whether any software options are provided.
93	2093	PRESS_SENS_INSTALLED	1	—	Indicates whether a pressure sensor is equipped: 1 = equipped 2 = not equipped
94	2094	ACTUATOR_TYPE	As specified upon ordering	—	Actuator type 1 = single acting 2 = double acting
95	2095	RELAY_TYPE	1		Control relay type: 1 = direct acting
96	2096	SIGN_MEAS_EXEC	1	O/S	Carries out signature measurement. 1 = off
97	2097	SIGN_MEAS_RESULT	1	—	Indicates the signature measurement status and result. 1 = succeeded
98	2098	SIGN_MEAS_STATE	0	—	Indicates the progress of signature measurement.
99	2099	SIGN_MEAS_COUNTER	0	—	Indicates the number of measured data sets. The count is reset to zero when the power is turned off or measurement of a new signature is performed.
100	2100	SIGN_DATA_SAVE	1		Saves the measurements of the standard actuator signature to non-volatile memory as record data. 1 = off
101	2101	SIGN_UPLOAD_DATABASE	1		Parameter used to specify the measured data to be uploaded. Set this parameter, and the related parameters will be read.
102	2102	SIGN_UPLOAD_POINTER	0		Pointer that indicates the leading position of the data to be uploaded from SIGN_DATA_X or SIGN_DATA_Y, and used when there are 20 or more data values measured.
103	2103	SIGN_DATA_X	0	—	Parameter used to upload the measured signature data (input data).

Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description [Setting range]
104	2104	SIGN_DATA_Y	0	—	Parameter used to upload the measured signature data (output data).
105	2105	SIGN_MEAS_DATE	01/01/00 00:00:00.000	—	Parameter used to upload the date and time of signature measurement
106	2106	SIGN_HEADER_DATA	+inf	—	Parameter used to upload the ambient temperature and settings at signature measurement
107	2107	STD_ACT_SIGN_SET	180, 180, 50		Settings of the standard actuator signature
108	2108	EXT_ACT_SIGN_SET	0, 100, 180, 180, 50, 200		Settings of the extended actuator signature and high-resolution actuator signature
109	2109	STEP_RESP_SET	45, 55, 100, 600		Settings of step levels for step response test
110	2110	POSITIONER_SIGN_SET	0, 100, 10, 30, 30		Settings of the positioner signature
111	2111	SERVO_WARN_HI_LIM	80 % of MV		High-limit alarm setting for Servo Output Drift warning
112	2112	SERVO_WARN_LO_LIM	20 % of MV		Low-limit alarm setting for Servo Output Drift warning
113	2113	SERVO_TIME_TH	10 sec		High-limit alarm setting for total time of Servo Output Drift warning.
114	2114	SERVO_WARN_COUNT	0	O/S	Total number of times of Servo Output Drift warning. To reset the count, write 0.
115	2115	X_BST_ON_THRESHOLD	0, 0 %	O/S	The addition value to threshold for switching on boost action; a control parameter for exhaust [-10 to 10%] Applicable for Double Acting Type
116	2116	X_BST_OFF_THRESHOLD	0, 0 %	O/S	The addition value to threshold for switching off boost action; a control parameter for exhaust [-10 to 10%] Applicable for Double Acting Type
117	2117	X_BOOST_VALUE	0, 0 % of MV	O/S	The addition Boost value; a control parameter for exhaust [-50 to 50%] Applicable for Double Acting Type

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.

Relative Index	Index	Parameter Name	Default (factory setting)	Write	Description
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	0x000A	O/S	Settings for the I/O processing of the block
15	5015	STATUS_OPTS	0x0000	O/S	Defines block actions depending on block status conditions.
16	5016	READBACK	—	—	Readback signal of valve position from transducer block
17	5017	CAS_IN	—		Cascade input.
18	5018	SP_RATE_DN	+INF		Rate-of-decrease limit for SP effective in AUTO, CAS, and RCAS modes. If this parameter is 0, no limit is applied to the rate of decrease.
19	5019	SP_RATE_UP	+INF		Rate-of-increase limit for SP effective in AUTO, CAS, and RCAS modes. If this parameter is 0, no limit is applied to the rate of increase.
20	5020	SP_HI_LIM	100		Upper limit for setpoint (SP)
21	5021	SP_LO_LIM	0		Lower limit for setpoint (SP)
22	5022	CHANNEL	1	O/S	Defines the channel number of the hardware channel connected to the transducer block. Always set to 1 for the AO block in a YVP110.
23	5023	FSTATE_TIME	0 second		Defines the time from when the fault state of the RCAS_IN or CAS_IN is detected to when the output should be set to the level preset in FSTATE_VAL (this action takes place only if Fault State to value is set as true in I/O_OPTS).
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.

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 YVP110.
11	6011	6111	OUT_STATE	0		Index to the text describing the states of a discrete output, but not supported by YVP110.
12	6012	6112	GRANT_DENY	0		Used to check whether various user operations can be put into effective. Before operations, in the GRANT parameter component, set the bits (to 1) corresponding to the intended operations. After the operations, check the DENY parameter component. If the corresponding bits are not set (to 1) in DENY, it proves that the corresponding operation has been put into effective.
13	6013	6113	IO_OPTS	0	O/S	Settings for the I/O processing of the block.
14	6014	6114	STATUS_OPTS	0	O/S	Defines block actions depending on block status conditions.
15	6015	6115	CHANNEL	2 or 3	O/S	Defines the channel number of the hardware channel connected to the transducer block. Always set 2 for the DI1 block and 3 for DI2 in a YVP110.
16	6016	6116	PV_FTIME	0 second		Time constant of filter for PV_D.
17	6017	6117	FIELD_VAL_D	—	—	Status of limit switch signal obtained from the transducer block.
18	6018	6118	UPDATE_EVT	—	—	Shows the contents of an update event upon occurrence.
19	6019	6119	BLOCK_ALM	—	—	Shows the contents of a block alarm upon occurrence.
20	6020	6120	ALARM_SUM	enable		Shows the alarm summary (current alarm statuses, acknowledged/unacknowledged states, masking states) for the DI block.
21	6021	6121	ACK_OPTION	0xFFFF		Defines the priority of WRITE_ALM as well as allows for notification to be disabled and makes acknowledgement 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.

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 is 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.

A1.6 Parameters of PID Block (Optional)

Index: PID1: 8000 through 8065

PID2: 8100 through 8165

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.

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	8040	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_PRI	0		Priority order of LO_ALM alarm
53	8053	LO_LIM	+INF		Setting for LO_ALM alarm
54	8054	LO_LO_PRI	0		Priority order of LO_LO_ALM alarm
55	8055	LO_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	8061	HI_ALM	—	—	As above
62	8062	LO_ALM	—	—	As above Reset when the PV value has increased above [LO_LIM + ALM_HYS].
63	8063	LO_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.

A1.7 Parameters of IS Block

Relative Index	Index	Parameter Name	Valid Range	Default (factory setting)	Write	Description
0	17000	BLOCK_HEADER		TAG: "IS"	O/S	Information relating to this function block, such as block tag, DD revision, and execution time.
1	17001	ST_REV	—	—		Indicates the revision level of the set parameters associated with the IS block. If a setting is modified, this revision is updated. It is used to check for parameter changes, etc.
2	17002	TAG_DESC		Null		A universal parameter that stores comments describing tag information
3	17003	STRATEGY		1		A universal parameter intended for use by the high-level system to identify function blocks.
4	17004	ALERT_KEY	1-255	1		Key information used to identify the location where an alert has occurred. Generally, this parameter is used by the high-level system to identify specific areas in a plant that are under the control of specific operators, to distinguish necessary alarms only. This is one of the universal parameters.
5	17005	MODE_BLK				A universal parameter representing the operation status of the IS block. It consists of the actual, target, permit, and normal modes.
6	17006	BLOCK_ERR	—	—		Indicates the error status relating to the IS function block. The bit used by this function block is as follows; Bit 15: O/S mode
7	17007	OUT		0	MAN	Block output
8	17008	OUT_RANGE				Set the range of OUT
9	17009	GRANT_DENY		0		The parameter used to check if various operations have been executed. The bits in the GRANT parameter corresponding to various operations are set before any of them are executed. After the operations are complete, the DENY parameter is checked to find out if any bit corresponding to the relevant operation has been set. If no bit is set, it is evident that the operations have been executed successfully.
10	17010	STATUS_OPTS	"Use Uncertain as good" and "Uncertain if Manual" only	0	O/S	A user-selectable option available for status handling in the block.
11	17011	IN_1		0		Input 1
12	17012	IN_2		0		Input 2
13	17013	IN_3		0		Input 3
14	17014	IN_4		0		Input 4
15	17015	DISABLE_1	0, 1	0		Selector switch to disable input 1 from being selected
16	17016	DISABLE_2	0, 1	0		Selector switch to disable input 2 from being selected
17	17017	DISABLE_3	0, 1	0		Selector switch to disable input 3 from being selected
18	17018	DISABLE_4	0, 1	0		Selector switch to disable input 4 from being selected
19	17019	SELECT_TYPE	1-6	0		Specifies the input selection algorithm
20	17020	MIN_GOOD	0-8	0		Parameter specifying the minimum required number of inputs with "good" status. If the number of inputs with "good" status is less than the value of MIN_GOOD, input selection is canceled.
21	17021	SELECTED	0-8	0		Indicates the number of the selected input. However, it indicates the number of inputs used to calculate the average if SELECT_TYPE=Average. If no input is selectable or if there are multiple inputs, it became "0" (none).

Relative Index	Index	Parameter Name	Valid Range	Default (factory setting)	Write	Description
22	17022	OP_SELECT	0-8	0		A parameter to forcibly employ the input of a selected number (Operator-settable)
23	17023	UPDATE_EVT	—	—		Indicates event information if an update event (setting change) occurs.
24	17024	BLOCK_ALM	—	—		Indicates alarm information if a block alarm occurs.
25	17025	IN_5		0		Input 5
26	17026	IN_6		0		Input 6
27	17027	IN_7		0		Input 7
28	17028	IN_8		0		Input 8
29	17029	DISABLE_5	0, 1	0		Selector switch to disable input 5 from being selected
30	17030	DISABLE_6	0, 1	0		Selector switch to disable input 6 from being selected
31	17031	DISABLE_7	0, 1	0		Selector switch to disable input 7 from being selected
32	17032	DISABLE_8	0, 1	0		Selector switch to disable input 8 from being selected

A1.8 Parameters of AR Block

Relative Index	Index	Parameter Name	Valid Range	Default (factory setting)	Write	Description																				
0	17500	BLOCK_HEADER		TAG: "AR"	O/S	Information relating to this function block, such as block tag, DD revision, and execution time.																				
1	17501	ST_REV		0		Indicates the revision level of the set parameters associated with the AR block. If a setting is modified, this revision is updated. It is used to check for parameter changes, etc.																				
2	17502	TAG_DESC		Null		A universal parameter that stores comments describing tag information																				
3	17503	STRATEGY		1		A universal parameter intended for use by the high-level system to identify function blocks.																				
4	17504	ALERT_KEY	1-255	1		Key information used to identify the location where an alert has occurred. Generally, this parameter is used by the high-level system to identify specific areas in a plant that are under the control of specific operators, to distinguish necessary alarms only. This is one of the universal parameters.																				
5	17505	MODE_BLK		AUTO		A universal parameter representing the operation status of the AR block. It consists of the actual, target, permit, and normal modes.																				
6	17506	BLOCK_ERR		0		Indicates the error status relating to the AR function block. The bit used by this function block is as follows; Bit 1: Block Configuration Error Bit 15: O/S mode																				
7	17507	PV		0		The result of a range extension function is substituted into this. When viewed from the computing equation, PV is the main input.																				
8	17508	OUT		0	MAN	Block output																				
9	17509	PRE_OUT		0		Always indicates the calculation result. The value is substituted into OUT in auto mode.																				
10	17510	PV_SCALE			O/S	Indicates PV scaling (for making a memo).																				
11	17511	OUT_RANGE				Output scaling for the host (for making a memo).																				
12	17512	GRANT_DENY		0		The parameter used to check if various operations have been executed. The bits in the GRANT parameter corresponding to various operations are set before any of them are executed. After the operations are complete, the DENY parameter is checked to find out if any bit corresponding to the relevant operation has been set. If no bit is set, it is evident that the operations have been executed successfully.																				
13	17513	INPUT_OPTS		0		<p>Determines whether an input is used as a "good" input when the input status is "bad" or "uncertain."</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Handles IN as "good" input if its status is "uncertain."</td> </tr> <tr> <td>1</td> <td>Handles IN_LO as "good" input if its status is "uncertain."</td> </tr> <tr> <td>2</td> <td>Handles IN_1 as "good" input if its status is "uncertain."</td> </tr> <tr> <td>3</td> <td>Handles IN_1 as "good" input if its status is "bad."</td> </tr> <tr> <td>4</td> <td>Handles IN_2 as "good" input if its status is "uncertain."</td> </tr> <tr> <td>5</td> <td>Handles IN_2 as "good" input if its status is "bad."</td> </tr> <tr> <td>6</td> <td>Handles IN_3 as "good" input if its status is "uncertain."</td> </tr> <tr> <td>7</td> <td>Handles IN_3 as "good" input if its status is "bad."</td> </tr> <tr> <td>8 to 15</td> <td>Reserved</td> </tr> </tbody> </table>	Bit	Function	0	Handles IN as "good" input if its status is "uncertain."	1	Handles IN_LO as "good" input if its status is "uncertain."	2	Handles IN_1 as "good" input if its status is "uncertain."	3	Handles IN_1 as "good" input if its status is "bad."	4	Handles IN_2 as "good" input if its status is "uncertain."	5	Handles IN_2 as "good" input if its status is "bad."	6	Handles IN_3 as "good" input if its status is "uncertain."	7	Handles IN_3 as "good" input if its status is "bad."	8 to 15	Reserved
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7	Handles IN_3 as "good" input if its status is "bad."																									
8 to 15	Reserved																									

Relative Index	Index	Parameter Name	Valid Range	Default (factory setting)	Write	Description																																	
14	17514	IN		0		Input block																																	
15	17515	IN_LO		0		Input for a low-range transmitter. This is used for the range extension function.																																	
16	17516	IN_1		0		Auxiliary input 1																																	
17	17517	IN_2		0		Auxiliary input 2																																	
18	17518	IN_3		0		Auxiliary input 3																																	
19	17519	RANGE_HI		0		High limit for switching to a high-range transmitter by the range extension function.																																	
20	17520	RANGE_LO		0		Low limit for switching to a low-range transmitter by the range extension function.																																	
21	17521	BIAS_IN_1		0		IN_1 bias																																	
22	17522	GAIN_IN_1		0		IN_1 gain																																	
23	17523	BIAS_IN_2		0		IN_2 bias																																	
24	17524	GAIN_IN_2		0		IN_2 gain																																	
25	17525	BIAS_IN_3		0		IN_3 bias																																	
26	17526	GAIN_IN_3		0		IN_3 gain																																	
27	17527	COMP_HI_LIM		+INF		High limit of compensation factor f																																	
28	17528	COMP_LO_LIM		-INF		Low limit of compensation factor f																																	
29	17529	ARITH_TYPE	1 to 10	0x01		Computation algorithm identification number. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Value</th> <th>Selection Name</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Flow compensation, linear</td> <td>Flow compensation (linear)</td> </tr> <tr> <td>2</td> <td>Flow compensation, square root</td> <td>Flow compensation (square root)</td> </tr> <tr> <td>3</td> <td>Flow compensation, approximate</td> <td>Flow compensation (approximate expression)</td> </tr> <tr> <td>4</td> <td>BTU flow (*)</td> <td>Quantity of heat calculation</td> </tr> <tr> <td>5</td> <td>Traditional Multiply Divide</td> <td>Multiplication and division</td> </tr> <tr> <td>6</td> <td>Average</td> <td>Average calculation</td> </tr> <tr> <td>7</td> <td>Traditional summer</td> <td>Summation</td> </tr> <tr> <td>8</td> <td>Fourth order Polynomial, Type 1</td> <td>4th-order (auxiliary input) polynomial computation</td> </tr> <tr> <td>9</td> <td>HTG level compensation (*)</td> <td>HTG level compensation</td> </tr> <tr> <td>10</td> <td>Fourth order Polynomial, Type 2</td> <td>4th-order (main input) polynomial computation</td> </tr> </tbody> </table> * BTU stand for British thermal value HTG stands for hydrostatic tank gauging	Value	Selection Name	Description	1	Flow compensation, linear	Flow compensation (linear)	2	Flow compensation, square root	Flow compensation (square root)	3	Flow compensation, approximate	Flow compensation (approximate expression)	4	BTU flow (*)	Quantity of heat calculation	5	Traditional Multiply Divide	Multiplication and division	6	Average	Average calculation	7	Traditional summer	Summation	8	Fourth order Polynomial, Type 1	4th-order (auxiliary input) polynomial computation	9	HTG level compensation (*)	HTG level compensation	10	Fourth order Polynomial, Type 2	4th-order (main input) polynomial computation
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9	HTG level compensation (*)	HTG level compensation																																					
10	Fourth order Polynomial, Type 2	4th-order (main input) polynomial computation																																					
30	17530	BAL_TIME	More than 0	0		Time taken to return to the set value																																	
31	17531	BIAS		0		Bias value used to calculate the output																																	
32	17532	GAIN		1		Gain value used to calculate the output																																	
33	17533	OUT_HI_LIM		+INF		Maximum output value																																	
34	17534	OUT_LO_LIM		-INF		Minimum output value																																	
35	17535	UPDATE_EVT				Indicate event information if an update (setting change) occurs.																																	
36	17536	BLOCK_ALM				Indicates alarm information if a block alarm occurs.																																	

A1.9 IO_OPTS - Availability of Options for Each Block

Bit	Contents	DI	AO
0	Invert	x	
1	SP-PV Track in Man		x
2	Reserved		
3	SP-PV Track in LO		x
4	SP Track retained target		x
5	Increase to close		x
6	Fault State to value		x
7	Use Fault State value on restart		x
8	Target to Man if Fault State activated		x
9	Use PV for BKCAL_OUT		x
10	Low cutoff		
11	Reserved (SIS-Latch Fstate)		
12	Units Conversion		

A1.10 STATUS_OPTS - Availability of Options for Each Block

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

A1.11 CONTROL_OPTS - Availability of Options for Each Block

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

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 YVP 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.

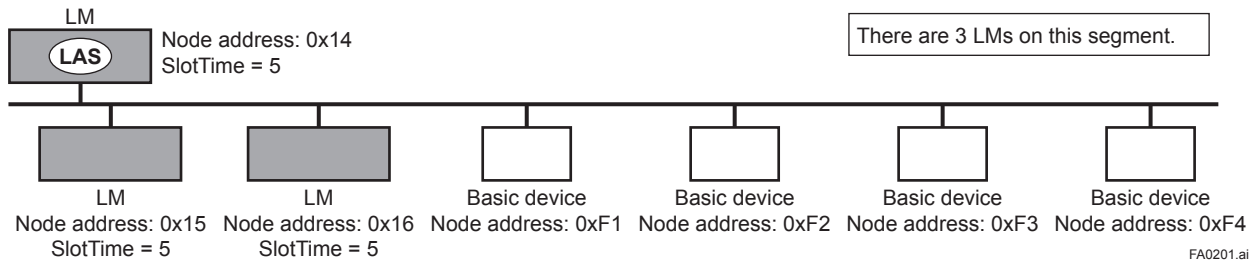


Figure 1. Example of Fieldbus configuration-3 LMs on Same Segment

A2.3 Transfer of LAS

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

- If the LM whose value of $[V(ST) \times V(TN)]$ 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 $[V(ST) \times V(TN)]$ 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.

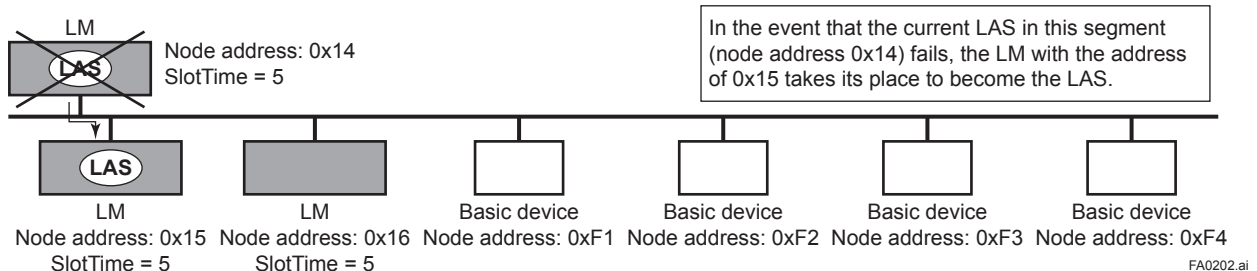


Figure 2. Backup of LAS

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

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

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

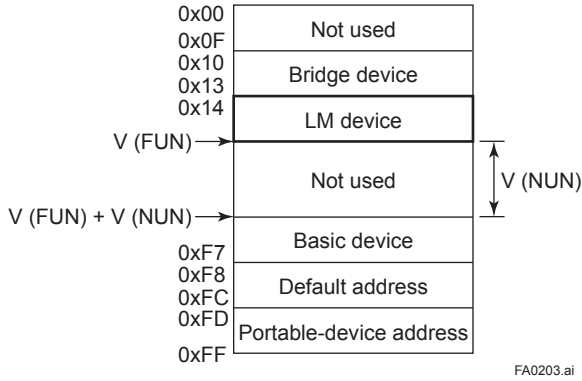


Figure 3. Node Address Ranges

- (2) In the LAS settings of the YVP, 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 (YVP 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	MaxResponseDelay	3	6	3	5	Capability value for V (MRD)
6	MinInterPduDelay	4	8	12	10	Capability value for V (MID)

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

ConfiguredLinkSettingsRecord (YVP 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)

- (3) In the LAS settings of the YVP, 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 (YVP Index 369 (SM))

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

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.

A2.5 LM Parameters

A2.5.1 LM Parameter List

The tables below show LM parameters of a YVP 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 0x012c		
		7 Element7	0x012c×32		
		8 Element8	0x02		
367	BOOT_OPERAT_FUNCTIONAL_CLASS		As specified upon ordering	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		

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)		
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		
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.

A2.5.2 Descriptions for LM Parameters

The following describes LM parameters of a YVP.



IMPORTANT

Do not turn off the power to the YVP 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) DImeLinkMasterCapabilitiesVariable

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) DImeLinkMasterStatisticsRecord.	0

(2) DlmeLinkMasterInfoRecord

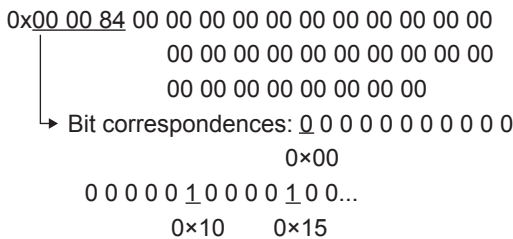
Sub-index	Element	Size [bytes]	Description
1	MaxSchedulingOverhead	1	V(MSO)
2	DefMinTokenDelegTime	2	V(DMDT)
3	DefTokenHoldTime	2	V(DTHT)
4	TargetTokenRotTime	2	V(TTRT)
5	LinkMaintTokHoldTime	2	V(LTHT)
6	TimeDistributionPeriod	4	V(TDP)
7	MaximumInactivityToClaimLasDelay	2	V(MICD)
8	LasDatabaseStatusSpduDistributionPeriod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

(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	PerDlpduPhiOverhead	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)

(8) DlmeBasicInfo

Sub-index	Element	Size [bytes]	Description
1	SlotTime	2	Indicates the capability value for V(ST) of the device.
2	PerDlpduPhiOverhead	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)

(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	0x49 00 00 00 00 00 00 00	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

(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

(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.

(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.

(14) DImeScheduleDescriptor

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.

(15) Domain

Read/write: impossible; get-OD: possible
Carrying out the GenericDomainDownload command from a host writes an LAS schedule to Domain.

Then, confirm that the following conditions are met:

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

A2.6 FAQs

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

- A1-1. Is that YVP 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:

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

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

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

- A2-1. Check that the version numbers of the active schedules in the current LAS and the YVP are the same by reading:
LinkScheduleListCharacteristicsRecord (index 374 for a YVP)
- ActiveScheduleVersion (subindex 3)
- A2-2. Make the YVP 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 YVP.

Q3. On a segment where a YVP 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 YVP and the capabilities of being the LAS for the device that cannot be connected:
 - V(ST), V(MID), V(MRD) of YVP: ConfiguredLinkSettingsRecord (index 369)
 - V(ST), V(MID), V(MRD) of problematic device: DlmeBasicInfo

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 YVP110.

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.

As for the YVP110, twelve DD methods for the transducer block, two for the AO block, and one for the OS block are provided. The following describes these methods for each block model.

A3.2.1 Transducer Block

1) Setup Wizard

This method guides you through each step of the most common setup procedure that always needs to be performed after installing the YVP110 on a valve. For the details of the setup and pertaining parameters, see Chapter 5, "Setup."

Setup procedure

- AO/TB block mode check
- ACT_FAIL_ACTION setting
- VALVE_TYPE setting
- Stop position search and automatic tuning
- Travel calibration
 - 0% calibration
 - Span calibration
 - 50% calibration
- Operational parameter setting
- ...

2) Auto Tuning Wizard

This method guides you through each step to search for the valve's mechanical stop positions and carry out auto tuning of control parameters. For details, see Section 5.3, "Carrying out Auto Tuning."

Auto tuning procedure

- AO/TB block mode check
- Auto tuning execution: AUTO_TUNE_EXEC

3) Search Stop Points

This method guides you through each step to search for the valve's mechanical stop positions (both on the closed and open sides) by maximizing and minimizing the output pressure to the positioner.

Setup procedure

- AO/TB block mode check
- Auto tuning execution: AUTO_TUNE_EXEC
 - Standard
 - Without timeout
 - Step by step
 - Exit

4) Control Parameter Tuning

This method helps perform control-parameter-specific tuning, from among the parameters that can be tuned by the auto tuning function. It does not contain a help utility for a stop point search (searching for the valve's mechanical stop positions).

- AO/TB block mode check
- Execution of control parameter tuning:
 - AUTO_TUNE_EXEC

5) Travel Calibration

This method guides you through each step to carry out travel calibration. See the respective descriptions in Section 5.3, "Carrying out Auto Tuning."

Travel calibration procedure

- AO/Transducer block mode check
- Execute travel calibration
 - 0% calibration:
 - Adjustment of FINAL_VALUE (by moving the valve position to the desired 0% position)
 - Execute 0% calibration:
TRAVEL_CALIB_EXEC
 - Span calibration:
 - Adjustment of FINAL_VALUE (by moving the valve position to the desired 100% position)
 - Execute span calibration:
TRAVEL_CALIB_EXEC
 - 50% calibration:
 - Adjustment of FINAL_VALUE (by moving the valve position to the desired 50% position)
 - Execute 50% calibration:
TRAVEL_CALIB_EXEC
- Exit

6) Operational Parameter Configuration

This method guides you through the setting of individual operational parameters excluding the selection of position-to-flow rate characteristic type.

Operational parameter configuration procedure

- AO/Transducer block mode check
- Operational parameter configuration
 - Position Limit setting:
 - FINAL_VALUE_CUTOFF_LO
 - FINAL_VALUE_CUTOFF_HI
 - FINAL_VALUE_RANGE
 - Limit Switch setting:
 - LIM_SW_LO_LIM
 - LIM_SW_HI_LIM
 - Fault Control:
 - DEVIATION_LIM
 - DEVIATION_TIME_TH(1)
 - DEVIATION_TIME_TH(2)
 - Others:
 - NEAR_CLOSE_THRESHOLD
- Exit

7) Release Fail Safe

This is a method for releasing the device latched by the fail-safe actions, restoring it to the normal state.

Procedure of releasing fail safe

- Check whether the device is in the latched state.
- Write "Clear-latched" to parameter RELEASE_FAIL_SAFE if the device is in the latched state, to release it from the latched state.

8) Instant Trouble Shooting

This is a help utility which provides troubleshooting instructions such as indicating the points and parameters to be checked for troubleshooting. This method does not contain a utility to change parameter settings. For troubleshooting of device statuses, see Chapter 18, "Troubleshooting."

Instant troubleshooting procedure

- Commanded to check DEVICE_STATUS in the resource block
- Check XD_ERROR and the remedy will be displayed if an error has been detected
- Check RELEASE_FAIL_SAFE
- Commanded to check the mechanical linkage, piping, and installation conditions
- Commanded to check the correct operation of the device hardware

9) Self Check Execution

The self-check measures the valve's characteristics in the same fashion as in auto tuning, and makes no changes to parameter settings.

Self Check Execution procedure

- AO/TB block mode check
- Self check execution: AUTO_TUNE_EXEC

10) Signature Execution

This method guides you through each step to perform signature measurement (see Chapter 17, "Diagnostics"). Signature measurement entails off-line diagnostics functions to measure characteristics of the valve and positioner. Comparing the current signature data with the previously measured data gives clues to identify the deterioration status and a possible need of maintenance.

Signature execution procedure

- AO/TB block mode check
- Signature measurement execution
 - Measure all:
 - Setting all signature measurement conditions
 - Executing signature measurement (SIGN_MEAS_EXEC)
 - Uploading data (see Item 11) below).
 - Measure actuator signature:
 - Setting STD_ACT_SIGN_SET
 - Executing signature measurement (SIGN_MEAS_EXEC)
 - Uploading data (see Item 11) below).
 - Measure extended actuator signature:
 - Setting EXT_ACT_SIGN_SET
 - Executing signature measurement (SIGN_MEAS_EXEC)
 - Uploading data (see Item 11) below).
 - Step response test:
 - Setting STEP_RESP_SET
 - Executing step response test (SIGN_MEAS_EXEC)
 - Uploading data (see Item 11) below).
 - Measure positioner signature:
 - Setting POSITIONER_SIGN_SET
 - Executing signature measurement (SIGN_MEAS_EXEC)
 - Uploading data (see Item 11) below).

Exit

11) Upload Signature Data

This method guides you through uploading the signature data that has been measured and stored in the positioner, from selecting the database you want to upload, to adjusting the data pointer to the leading position of the desired data and uploading it.

Signature data uploading procedure

- Select action from menu
 - Upload data:
 - Uploading data from SIGN_DATA_X and SIGN_DATA_Y
 - Select upload database (meaning, “select the database to be uploaded”)
 - Change data pointer

Exit

12) Upload Signature Header Data

This method guides you through uploading the header data of a signature measurement that has already been performed. The header data contains the measurement condition settings, the ambient temperature at the measurement, the date of the measurement, and so on. Users can select a database to access the desired header data.

Signature header data uploading procedure

- Selection of action from menu
 - Upload header data:
 - Select upload database (meaning, “select the database to be uploaded”)
- Exit

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 YPV110’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

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.

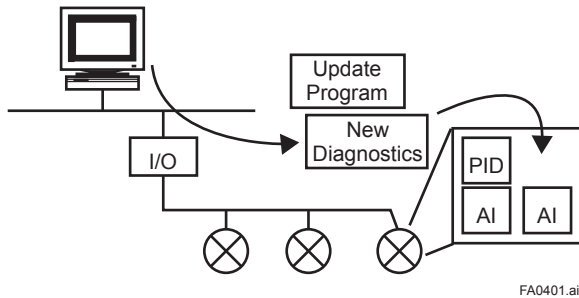


Figure A4.1 Concept of Software Downloading

A4.2 Specifications

Steady-state current: Max. 17 mA

Current Draw (Steady-state): 17 mA (max)

Current Draw (Software Download state):
41 mA (max)

Based on Fieldbus Foundation Specification
Download class: Class 1



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 halt fieldbus communication and function block executions for about one minute.

A4.3 Preparations for Software Downloading

For software downloading, you need to prepare the following:

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

For the software download tool, use only a program developed for that purpose. For details, see the software's User's Manual.



Do not hook up the software download tool to a fieldbus segment while the plant is in operation, as it may temporarily disturb the communication. Always connect the tool before starting operation.



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

A4.4 Software Download Sequence

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 generally take about 20 minutes where there is a one-to-one connection between a fieldbus device and download tool, and longer when multiple field devices are connected to the fieldbus.

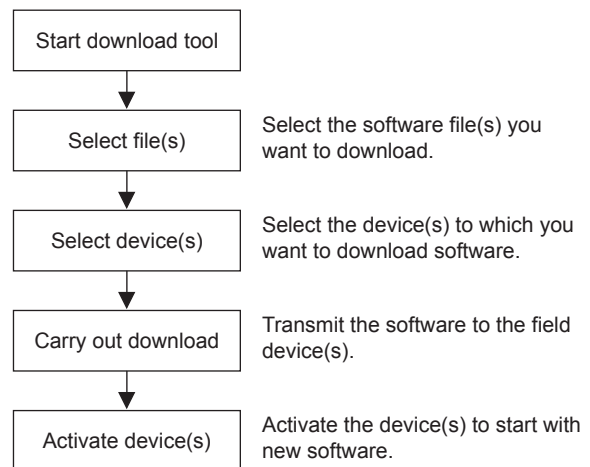


Figure A4.2 Flow of Software Download Procedure

FA0402.ai

**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 for an YVP may have the following name:

594543000C_0007_YVP_ORIGINAL_R101.ffd

Refer to A4.10(3) DOMAIN_HEADER about each keyword of the file name.

The device type is "0007" for an YVP transmitter .

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 A4.1 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.

A4.7 Troubleshooting

For information on the download tool's error messages, see also the software's User's Manual.

Table A4.2 Problems 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 level 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 work 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.

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

Table A4.3 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, 0	—	Indicates the software module revision.
58	1058	SOFTDWN_ERROR	0	—	Indicates an error during a software download. See Table 4.

Table A4.4 Download Error Codes

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

A4.9 System/Network Management VFD Parameters Relating to Software Download

Table A4.5 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	300		
		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

A4.10 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 dual 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.

(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.

(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.

Appendix 5. Position Adjustment of Feedback Lever

For Single Acting Type, it is possible to adjust the position of feedback lever while air is being supplied to the actuator.

WARNING

Procedures (1) through (4) require supplying air to the actuator. Piping must be carried out by following the instructions shown in Chapter 4. "Wiring and Piping".

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

WARNING

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

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

WARNING

Do not supply air at a pressure exceeding the maximum rated air supply pressure of the actuator or the YVP110 (400 kPa). Doing so may result in a high risk of damage to the equipment or lead to an accident.

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

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

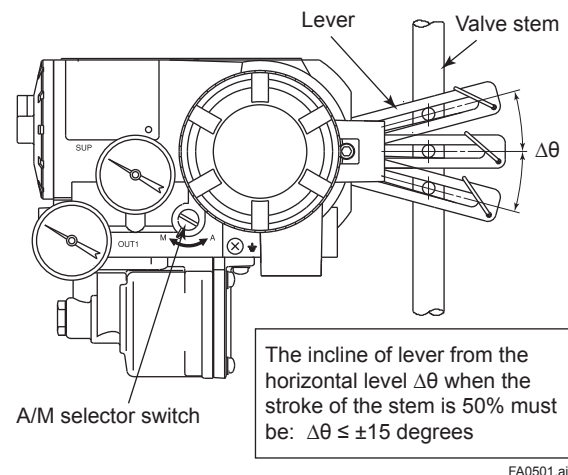


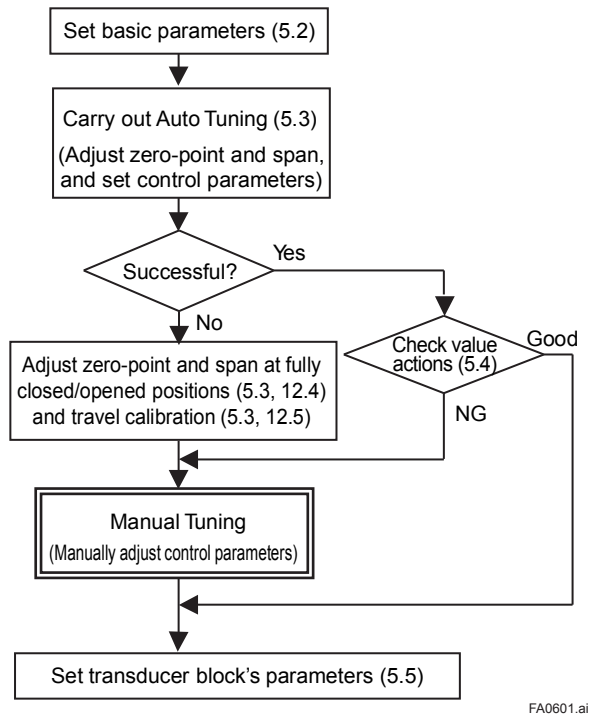
Figure A5.1 Checking Position at Which Clamp Should Be Fixed

Appendix 6. Manual Tuning Guideline

A6.1 General

The YVP110 can improve controllability by properly performing the manual tuning of control parameters for each valve and actuator.

The following shows the whole tuning procedure.



If you cannot obtain expected response characteristics by Auto Tuning, verify the 10% step response and compare your response waveform with three types of response waveforms shown in A6.2. Adjust parameters by referring to the procedure of a waveform that has characteristics similar to those of your waveform.

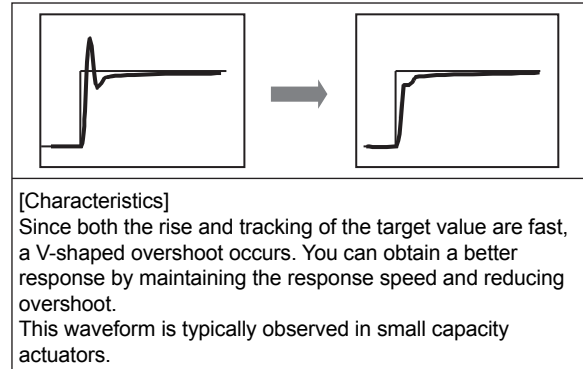
If Auto Tuning fails, adjust the zero-point and the span, then set the parameters by referring to the default settings (factory settings) or tuning examples in A6.3. Then verify the 10% step response and adjust the parameters according to the procedure described in A6.2.

(For detail about the control parameters, see section A6.4.)

Before carrying out parameter tuning, change the modes of the AO function block and transducer block to O/S.

A6.2 Control Parameter Tuning Procedure

[1] Fast response



[Characteristics]
 Since both the rise and tracking of the target value are fast, a V-shaped overshoot occurs. You can obtain a better response by maintaining the response speed and reducing overshoot.
 This waveform is typically observed in small capacity actuators.

(1) Modifying overshoot

- Increase the value for SERVO_RATE to reduce an excessively rapid response. Verify the 10% step response and increment the value by 0.2.
- If a significant improvement effect cannot be obtained by only incrementing the value for SERVO_RATE in small steps of approximately 5% or less, input the value in small steps in BOOST_ON_THRESHOLD [2] and decrement the value for BOOST_VALUE [1] by 2 to decrease the boost.
- The same boost value is set on both the air delivery and exhaust sides using Auto Tuning. If the overshoot on the exhaust side is larger than that on the air delivery side for a double-acting model, input a negative value in X_BOOST_VALUE[1][2], without changing the value of 0 in X_BST_ON_THRESHOLD[1][2] and X_BST_OFF_THRESHOLD[1][2]. First, try to input a negative value of half that of BOOST_VALUE [1] [2], and if necessary, increment or decrement the value by 1.
- If necessary, increment or decrement the value for SERVO_GAIN by 30.

(2) Improving the stabilization time

Decrease the value for SERVO_RESET to improve the capability of tracking the target value. Verify the 10% step response and decrement the value by 3.

(3) Improving the response time

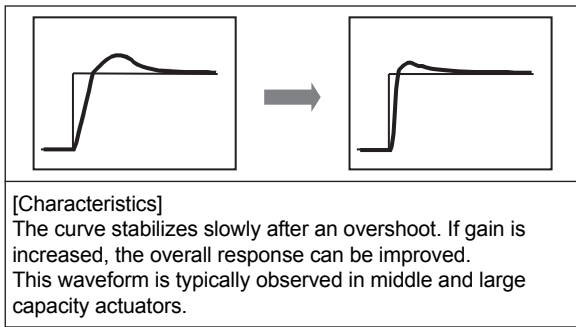
- If you input a value in a small step of 5% or less and response is slow, increment the value for SERVO_GAIN by 30.
- If necessary, increment or decrement the value for BOOST_VALUE [1] [2] and X_BOOST_VALUE [1] [2] by 1, respectively.

(4) Checking hunting operation

Input a value in a large step of approx. 80% to ensure the hunting operation does not occur. If the hunting operation does occur, decrease the value for SERVO_GAIN to 2/3 or 1/2 of the originally entered value.

(5) After tuning the control parameters, re-check each parameter if necessary.

[2] Moderate response



(1) Improving the stabilization time

Decrease the value for SERVO_RESET to improve the capability of tracking the target value. Verify the 10% step response and decrement the value by 3.

(2) Modifying overshoot

- Increment the value for SERVO_GAIN. Verify the 10% step response and increment the value by 1.5 times.
- If you input a value in a small step of approx. 5% or less, and you cannot obtain a significant improvement effect compared to the 10% step, increment the value for SERVO_RATE by 0.2 to reduce an excessively rapid response.
- The same boost value is set on both the air delivery and exhaust sides using Auto Tuning. If the overshoot on the exhaust side is larger than that on the air delivery side for a double-acting model, input a negative value in X_BOOST_VALUE [1] [2], without changing the value of 0 in X_BST_ON_THRESHOLD [1] [2] and X_BST_OFF_THRESHOLD [1] [2]. First, try to

input a negative value of half that of BOOST_VALUE [1] [2], and if necessary, increment or decrement the value by 1.

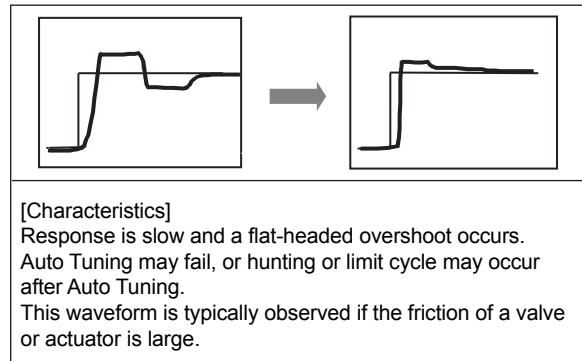
(3) Improving the response time

- If you input a value in a small step of 5% or less and the response is slow, increment or decrement the value for BOOST_VALUE [1] [2] and X_BOOST_VALUE [1] [2] by 1, respectively.
- If necessary, increment the value for SERVO_GAIN by 30.

(4) Checking hunting operation

Input a value in a large step of approx. 80% to ensure the hunting operation does not occur. If the hunting operation does occur, decrease the value for SERVO_GAIN to 2/3 or 1/2 of the originally entered value.

[3] Moderate response with a flat overshoot



(1) In the case of the occurrence of a limit cycle

- If you increase the value for SERVO_RESET, response slows down and a limit cycle can be prevented. Verify a large step response of 30% or more and increment the value by 5.
- If necessary, decrease the value for SERVO_GAIN to 2/3 or 1/2 of the originally entered value.
- If necessary, set the SERVO_DEADBAND. Set a value in approximately the range of a limit cycle (recommended upper limit is 2%).
- If the limit cycle is not eliminated, check the piping and feedback lever installation by referring to Section 20.4.

(2) Modifying overshoot

- Increase the value for SERVO_RATE to reduce an excessively rapid response. Verify the 10% step response and increment the value by 0.2.

- If necessary, increment the value for SERVO_RESET by 5.
- The same boost value is set on both the air delivery and exhaust sides by Auto Tuning. If the overshoot on the exhaust side is larger than that on the air delivery side for a double-acting model, input a negative value in X_BOOST_VALUE [1] [2], without changing the value of 0 in X_BST_ON_THRESHOLD [1] [2] and X_BST_OFF_THRESHOLD [1] [2]. First, try to input a negative value of half that of BOOST_VALUE [1] [2], and if necessary, increment or decrement the value by 1.

(3) Improving the stabilization time and slow overshoot

Decrease the value for SERVO_RESET to improve the capability of tracking the target value. However, if the value is too small, the hunting operation or limit cycle may occur. Verify the 10% step response and decrement the value by 2 to 3.

(4) Improving the response time

- Increment or decrement the value for BOOST_VALUE [1] [2] and X_BOOST_VALUE [1] [2] by 2, respectively.
- If necessary, increment the value for SERVO_GAIN by 30.

(5) Checking hunting operation

Input a value in a large step of approx. 80% to ensure the hunting operation does not occur. If the hunting operation does occur, decrease the value for SERVO_GAIN to 2/3 or 1/2 of the originally entered value. Then, increase the value for SERVO_RESET by approx. 1.5 times.

(6) After tuning the control parameters, re-check each parameter if necessary.

A6.3 Examples of Tuning Control Parameters

The following table shows examples of tuning parameters for double-acting actuators.

- [1] Valtek25sq.in. double-acting actuator, stroke = 0.75 in, capacity = approx. 300 cc, supply pressure = 400 kPa, hysteresis = 150N
- [2] Valtek25sq.in. double-acting actuator, stroke = 0.75 in, capacity = approx. 300 cc, supply pressure = 400 kPa, hysteresis = 380N
- [3] Valtek50sq.in. double-acting actuator, stroke = 2.5 in, capacity = approx. 2000 cc, supply pressure = 400 kPa, hysteresis = 300N
- [4] Valtek50sq.in. double-acting actuator, stroke = 2.5 in, capacity = approx. 2000 cc, supply pressure = 400 kPa, hysteresis = 1200N

Parameter Name (Figures in parentheses represent default values (factory settings))	Valtek25sq.in. Stroke = 0.75 in.		Valtek50sq.in. Stroke = 2.5 in.	
	Hysteresis = 150N	Hysteresis = 380N	Hysteresis = 300N	Hysteresis = 1200N
SERVO_GAIN (120)	140	120	350	300
SERVO_RESET (15)	8	8	9	24
SERVO_RATE (0.22)	0.4	0.4	0.6	0.5
SERVO_RATE_GAIN (5.0)	10.0	10.0	5.0	5.0
SERVO_DEADBAND (0.0)	0.0	0.0	0.0	0.0
SERVO_OFFSET (55.0)	(55.0) Default	(55.0) Default	(55.0) Default	(55.0) Default
BOOST_ON_THRESHOLD[1][2] (1.9, 2.9)	0.9, 1.9	0.9, 1.9	0.9, 5.1	0.9, 1.9
BOOST_OFF_THRESHOLD[1][2] (1.0, 1.0)	0.5, 0.5	0.5, 0.5	0.5, 0.5	0.5, 0.5
BOOST_VALUE[1][2] (8.0, 10.0)	8.0, 10.0	8.0, 10.0	6.0, 10.0	6.0, 8.0
SERVO_I_SLEEP_LMT (0.0)	1.4	1.4	1.8	1.7
SERVO_P_ALPHA (0.0)	0.0	0.0	0.0	0.0
INTERNAL_GAIN (5.0)	6.8	6.8	14.1	14.1
X_BST_ON_THRESHOLD[1][2] (0.0, 0.0)	0.0, 0.0	0.0, 0.0	0.0, 0.0	0.0, 0.0
X_BST_OFF_THRESHOLD[1][2] (0.0, 0.0)	0.0, 0.0	0.0, 0.0	0.0, 0.0	0.0, 0.0
X_BOOST_VALUE[1][2] (0.0, 0.0)	-4.0, -5.0	-8.0, -10.0	-3.0, -6.0	-3.0, -4.0

The above adjusted values are only for reference. Adjust parameters depending on the individual valve, actuator, and operating conditions. X_BST_ON_THRESHOLD, X_BST_OFF_THRESHOLD, and X_BOOST_VALUE are parameters that are only valid for double-acting models.

A6.4 Description of Control Parameters

The YVP110's basic method of controlling the valve position is PI-D control. This control is characterized by the fact that a rapid output change is prevented by the derivative term of D being added to the feedback.

In addition, YVP110 has a boost function that serves as an output acceleration function after an input change, because it compensates the nonlinearity caused by the structure of a valve or YVP.

When you set these parameters, change the mode of the transducer block and AO function block to O/S.

SERVO_GAIN

Tuning range: 0.1 to 1300 (Default: 120)

Set the loop gain of PI-D control.

The proportional gain of PI-D control increases in proportion to (SERVO_GAIN / INTERNAL_GAIN).

If you increase the value for SERVO_GAIN, tracking capability tends to increase, whereas control stability tends to decrease.

SERVO_RESET

Tuning range: 0, 2 to 50 sec (Default: 15 sec)

Set the integral time of PI-D control.

The pace of change in integral volume quickens in reverse proportion to the integral time and the volume changes repeatedly until the deviation disappears.

If you set a smaller value for the integral time, the deviation disappears more quickly, whereas fast accumulation of integral components may cause an overshoot.

If you set a larger value for the integral time, you can reduce the accumulation of excessive integral components when the deviation is large, but it takes longer for the deviation to disappear.

If 0 is set, this function is invalid.

SERVO_RATE

Tuning range: 0, 0.05 to 1.0 sec (Default: 0.22 sec)

Set the derivative time of PI-D control.

The derivative term relates to the feedback and prevents a rapid output change, and the preventive effect increases in proportion to the derivative time.

If a rapid response causes an overshoot, set a larger value for the derivative time to prevent a rapid change and reduce overshoot.

However, if the effect of this change is excessive, tracking capability during step response decreases.

If 0 is set, this function is invalid.

SERVO_RATE_GAIN

Tuning range: 2 to 20 (Default: 5)

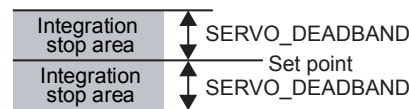
Set the gain in the derivative term of PI-D control.

As with SERVO_RATE, this parameter relates to the derivative term of control, and the preventive effect increases in proportion to an increase in the gain in the derivative term.

SERVO_DEADBAND

Tuning range: 0 to 50% (Default: 0%)

Setting this parameter stops an integral operation in the vicinity of the Set point.



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The range of SERVO_DEADBAND in relation to the set point is a dead band, in the area of which the integral operation stops.

If you set the parameter SERVO_DEADBAND when, for example, the friction of a valve is large, a limit cycle can be prevented. However, the value of the steady-state deviation could be as large as that of SERVO_DEADBAND.

SERVO_OFFSET

Tuning range: 0 to 100% of MV (Default: 55%)

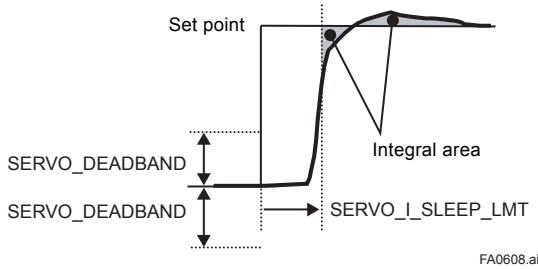
Set the initial value for the electric current that is output from the CPU to the I/P module after the power is turned on. The value simultaneously serves as the base point for an integration operation.

The unit of this parameter is % of the current output to the I/P module.

The value is usually determined by Auto Tuning, so you do not need to change the value.

If the hysteresis of a valve is large, the valve may not react for a while after an input change, and a delay in response may occur. This delay in response is accompanied by a large deviation, and the accumulation of excessive integral components can cause an overshoot. This parameter is effective in cases such as this.

If the deviation from the set point value exceeds the `SERVO_DEADBAND`, this function starts. If 0 is set to `SERVO_DEADBAND`, this function is invalid.



SERVO_P_ALPHA

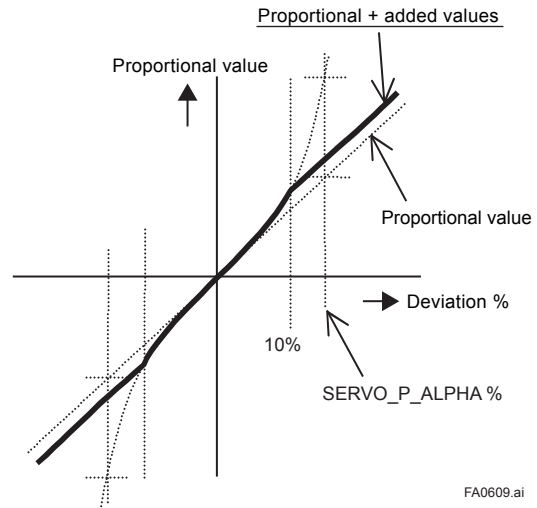
Tuning range: 0 to 100% (Default: 0%)

Setting this parameter adds more values to the proportional term for a large step compared to a small step. Use this parameter when a large value cannot be set to the proportional gain because of the large hysteresis of a value, and the response speed for a large step is insufficient.

A usual operation in the proportional term covers the deviation only; however, unless 0 is set for this parameter, a value calculated based on the following equation is added, in addition to the deviation. If 0 is set, this function is invalid.

$$(\text{Value added to the proportional term}) = \text{deviation} \times |\text{deviation}| / \text{SERVO_P_ALPHA}$$

You can obtain a quadratic curve in which the proportional term doubles when the deviation equals the `SERVO_P_ALPHA`, and the added value is in reverse proportion to an increase in the value of `SERVO_P_ALPHA`.



You can obtain an effect to increase the apparent gain for a large step without changing the response characteristics for a small step.

However, as long as the deviation is more than 10%, the added value is fixed to a value calculated when the deviation is 10%

INTERNAL_GAIN

Tuning range: 0.5 to 50 rad/mA (Default: 5 rad/mA)

`INTERNAL_GAIN` is the total gain of the I/P module, the control relay, the valve, the actuator, and the feedback lever.

`INTERNAL_GAIN` is part of the loop gain of PI-D control.

This value is usually determined by auto tuning and travel calibration, so you do not need to change the value.

Installation and Operating Precautions for TIS Flameproof Equipment

Apparatus Certified Under Technical Criteria (IEC-compatible Standards)

1. General

The following describes precautions on electrical apparatus of flameproof construction (hereinafter referred to as flameproof apparatus) in explosion-protected apparatus.

Following the Labour Safety and Health Laws of Japan, flameproof apparatus is subjected to type tests to meet either the technical criteria for explosionproof electrical machinery and equipment (standards notification no. 556 from the Japanese Ministry of Labour) (hereinafter referred to as technical criteria), in conformity with the IEC Standards, or the "Recommended Practice for Explosion-Protected Electrical Installations in General Industries," published in 1979. These certified apparatus can be used in hazardous locations where explosive or inflammable gases or vapours may be present.

Certified apparatus includes a certification label and an equipment nameplate with the specifications necessary for explosion requirements as well as precautions on explosion protection. Please confirm these precautionary items and use them to meet specification requirements.

For electrical wiring and maintenance servicing, please refer to "Internal Wiring Rules" in the Electrical Installation Technical Standards as well as "USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry," published in 1994.

To meet flameproof requirements, equipment that can be termed "flameproof" must:

- (1) Be certified by a Japanese public authority in accordance with the Labour Safety and Health Laws of Japan and have a certification label in an appropriate location on its case, and
- (2) Be used in compliance with the specifications marked on its certification label, equipment nameplate and precautionary information furnished.

2. Electrical Apparatus of Flameproof Type of Explosion-Protected Construction

Electrical apparatus which is of flameproof construction is subjected to a type test and certified by the Japanese Ministry of Labour aiming at preventing explosion caused by electrical apparatus in a factory or any location where inflammable gases or vapours may be present. The flameproof construction is of completely enclosed type and its enclosure shall endure explosive pressures in cases where explosive gases or vapours entering the enclosure cause explosion. In addition, the enclosure construction shall be such that flame caused by explosion does not ignite gases or vapours outside the enclosure.

In this manual, the word "flameproof" is applied to the flameproof equipment combined with the types of protection "e", "o", "i", and "d" as well as flameproof equipment.

3. Terminology

(1) Enclosure

An outer shell of an electrical apparatus, which encloses live parts and thus is needed to configure explosion-protected construction.

(2) Shroud

A component part which is so designed that the fastening of joint surfaces cannot be loosened unless a special tool is used.

(3) Enclosure internal volume

This is indicated by:— the total internal volume of the flameproof enclosure minus the volume of the internal components essential to equipment functions.

(4) Path length of joint surface

On a joint surface, the length of the shortest path through which flame flows from the inside to outside of the flameproof enclosure. This definition cannot be applied to threaded joints.

(5) Gaps between joint surfaces

The physical distance between two mating surfaces, or differences in diameters if the mating surfaces are cylindrical.

Note: The permissible sizes of gaps between joint surfaces, the path length of a joint surface and the number of joint threads are determined by such factors as the enclosure's internal volume, joint and mating surface construction, and the explosion classification of the specified gases and vapours.

4. Installation of Flameproof Apparatus

(1) Installation Area

Flameproof apparatus may be installed, in accordance with applicable gases, in a hazardous area in Zone 1 or 2, where the specified gases are present. Those apparatus shall not be installed in a hazardous area in Zone 0.

Note: Hazardous areas are classified in zones based upon the frequency of the appearance and the duration of an explosive gas atmosphere as follows:

- Zone 0: An area in which an explosive gas atmosphere is present continuously or is present for long periods.
- Zone 1: An area in which an explosive gas atmosphere is likely to occur in normal operation.
- Zone 2: An area in which an explosive gas atmosphere is not likely to occur in normal operation and if it does occur it will exist for a short period only.

(2) Environmental Conditions

The standard environmental condition for the installation of flameproof apparatus is limited to an ambient temperature range from -20°C to $+40^{\circ}\text{C}$ (for products certified under Technical Criteria). However, some field-mounted instruments may be certified at an ambient temperature up to $+60^{\circ}\text{C}$ as indicated on the instrument nameplates. If the flameproof apparatus are exposed to direct sunshine or radiant heat from plant facilities, appropriate thermal protection measures shall be taken.

5. External Wiring for Flameproof Apparatus

Flameproof apparatus require cable wiring or flameproof metal conduits for their electrical connections. For cable wiring, cable glands (cable entry devices for flameproof type) to wiring connections shall be attached. For metal conduits, attach sealing fittings as close to wiring connections as possible and completely seal the apparatus. All non-live metal parts such as the enclosure shall be securely grounded.

For details, see the "USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry," published in 1994.

(1) Cable Wiring

- For cable wiring, cable glands (cable entry devices for flameproof type) specified or supplied with the apparatus shall be directly attached to the wiring connections to complete sealing of the apparatus.
- Screws that connect cable glands to the apparatus are those for G-type parallel pipe threads (JIS B 0202) with no sealing property. To protect the apparatus from corrosive gases or moisture, apply non-hardening sealant such as liquid gaskets to those threads for waterproofing.

- Specific cables shall be used as recommended by the "USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry," published in 1994.
- In necessary, appropriate protective pipes (conduit or flexible pipes), ducts or trays shall be used for preventing the cable run (outside the cable glands) from damage.
- To prevent explosive atmosphere from being propagated from Zone 1 or 2 hazardous location to any different location or non-hazardous location through the protective pipe or duct, apply sealing of the protective pipes in the vicinity of individual boundaries, or fill the ducts with sand appropriately.
- When branch connections of cables, or cable connections with insulated cables inside the conduit pipes are made, a flameproof or increased-safety connection box shall be used. In this case, flameproof or increased-safety cable glands meeting the type of connection box must be used for cable connections to the box.

(2) Flameproof Metal Conduit Wiring

- For the flameproof metal conduit wiring or insulated wires shall be used as recommended by the USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry, published in 1994.
- For conduit pipes, heavy-gauge steel conduits conforming to JIS C 8305 Standard shall be used.
- Flameproof sealing fittings shall be used in the vicinity of the wiring connections, and those fittings shall be filled with sealing compounds to complete sealing of the apparatus. In addition, to prevent explosive gases, moisture, or flame caused by explosion from being propagated through the conduit, always provide sealing fittings to complete sealing of the conduit in the following locations:
 - (a) In the boundaries between the hazardous and non-hazardous locations.
 - (b) In the boundaries where there is a different classification of hazardous location.
- For the connections of the apparatus with a conduit pipe or its associated accessories, G-type parallel pipe threads (JIS B 0202) shall be used to provide a minimum of five-thread engagement to complete tightness. In addition, since these parallel threads do not have sealing property, non-hardening sealant such as liquid gaskets shall thus be applied to those threads for ensuring waterproofness.
- If metal conduits need flexibility, use flameproof flexible fittings.

6. Maintenance of Flameproof Apparatus

To maintain the flameproof apparatus, do the following. (For details, see Chapter 10 "MAINTENANCE OF EXPLOSION-PROTECTED ELECTRICAL INSTALLATION" in the USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry.)

(1) Maintenance servicing with the power on.

Flameproof apparatus shall not be maintenance-serviced with its power turned on. However, in cases where maintenance servicing is to be conducted with the power turned on, with the equipment cover removed, always use a gas detector to check that there is no explosive gas in that location. If it cannot be checked whether an explosive gas is present or not, maintenance servicing shall be limited to the following two items:

- (a) Visual inspection
Visually inspect the flameproof apparatus, metal conduits, and cables for damage or corrosion, and other mechanical and structural defects.
- (b) Zero and span adjustments
These adjustments should be made only to the extent that they can be conducted from the outside without opening the equipment cover. In doing this, great care must be taken not to cause mechanical sparks with tools.

(2) Repair

If the flameproof apparatus requires repair, turn off the power and transport it to a safety (non-hazardous) location. Observe the following points before attempting to repair the apparatus.

- (a) Make only such electrical and mechanical repairs as will restore the apparatus to its original condition. For the flameproof apparatus, the gaps and path lengths of joints and mating surfaces, and mechanical strength of enclosures are critical factors in explosion protection. Exercise great care not to damage the joints or shock the enclosure.
- (b) If any damage occurs in threads, joints or mating surfaces, inspection windows, connections between the transmitter and terminal box, shrouds or clamps, or external wiring connections which are essential in flameproofness, contact Yokogawa Electric Corporation.



CAUTION

Do not attempt to re-process threaded connections or refinish joints or mating surfaces.

- (c) Unless otherwise specified, the electrical circuitry and internal mechanisms may be repaired by component replacement, as this will not directly affect the requirements for flameproof apparatus (however, bear in mind that the apparatus must always be restored to its original condition). If you attempt to repair the flameproof apparatus, company-specified components shall be used.
- (d) Before starting to service the apparatus, be sure to check all parts necessary for retaining the requirements for flameproof apparatus. For this, check that all screws, bolts, nuts, and threaded connections have properly been tightened.

(3) Prohibition of specification changes and modifications

Do not attempt to change specifications or make modifications involving addition of or changes in external wiring connections.

7. Selection of Cable Entry Devices for Flameproof Type



IMPORTANT

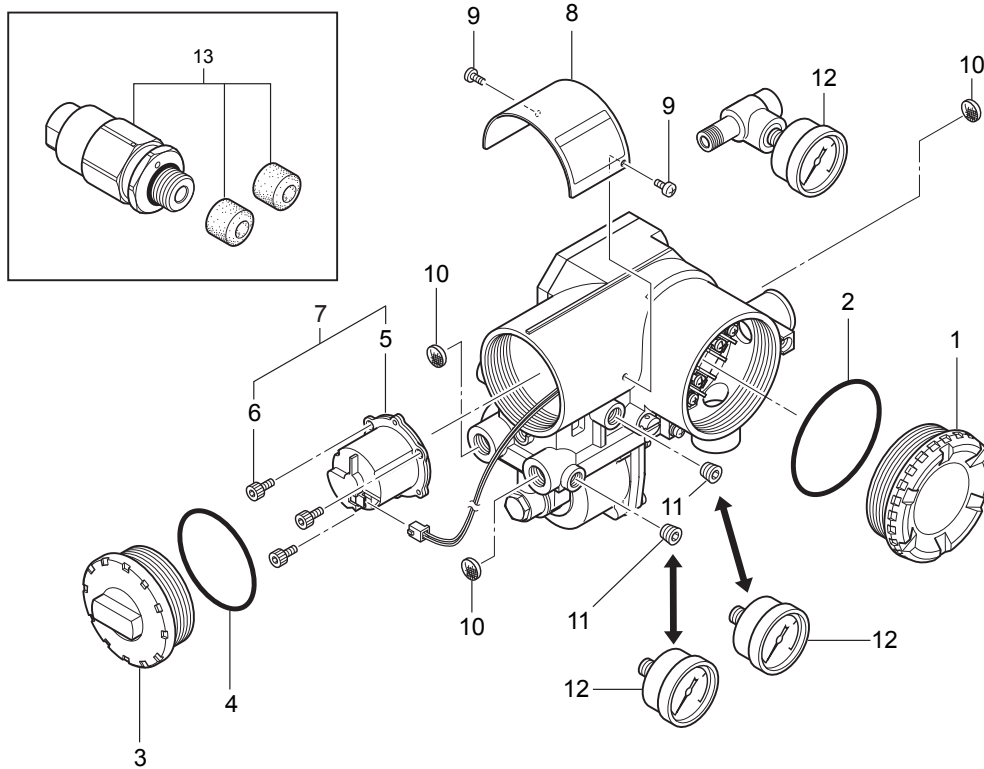
The cable glands (cable entry devices for flameproof type) conforming to IEC Standards are certified in combination with the flameproof apparatus. So, Yokogawa-specified cable entry devices for flameproof type shall be used to meet this demand.

References:

- (1) Type Certificate Guide for Explosion-Protected Construction Electrical Machinery and Equipment (relating to Technical Standards Conforming to International Standards), issued by the Technical Institution of Industrial Safety, Japan
- (2) USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry (1994), issued by the Japanese Ministry of Labour, the Research Institute of Industrial Safety.

Customer Maintenance Parts List

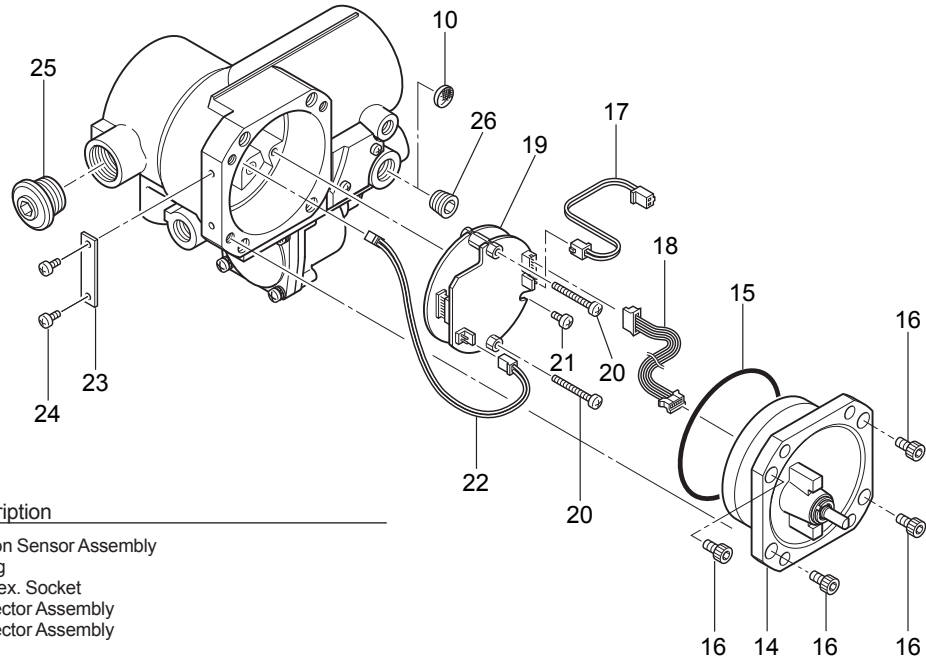
YVP110 Advanced Valve Positioner



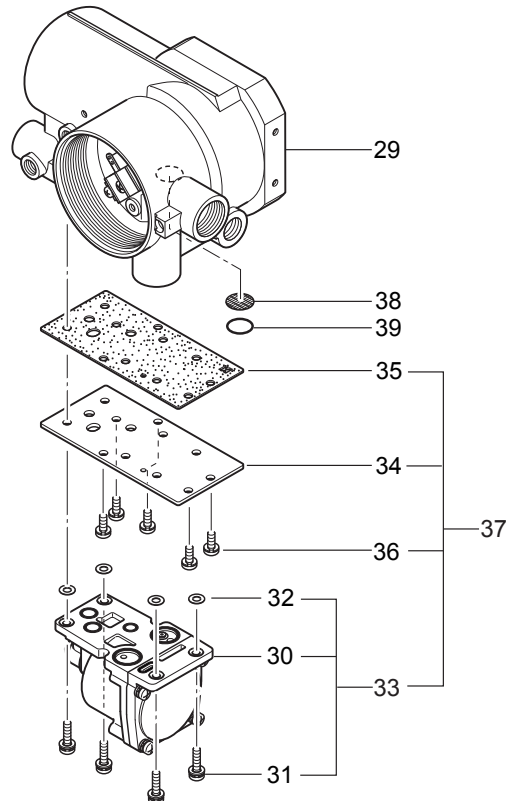
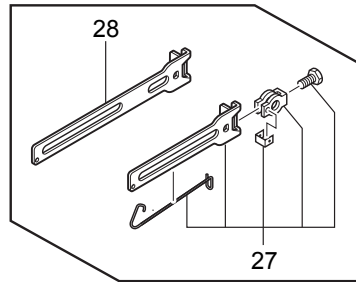
Item	Part No.	Qty	Description
1	F9341RA	1	Cover
2	F9341JP	1	O-Ring
3	—	1	I/P Cover
4	G9303AG	1	O-Ring
5	—	1	I/P Module
6	Y9408ZU	3	Bolt Hex. Socket
7	—	1	I/P Module Assembly
8	—	1	Name Plate
9	F9300AG	2	Screw
10	U0103FP	3	Screen (Single Acting Actuator)
		4	Screen (Double Acting Actuator)
11	Below	2	Plug
	G9612EJ		For Connection code 1, 5, and 6
	G9612EL		For Connection code 3
12	See Table 1	2	Pressure Gauge (Single Acting Actuator)
		3	Pressure Gauge (Double Acting Actuator)
13	G9601AM	1	Cable Gland Assy for TIIS Flameproof Type (Option code /G11)

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

Applicable Actuator code	Connection code	Option code			
		/GP	/GM	/GB	/GE
1 (Single Acting Actuator)	1, 5, and 6	G9615ED	G9615AR	G9615EF	—
	3	—	—	—	G9615EE
2 (Double Acting Actuator)	1, 5, and 6	G9615EG	G9615AS	G9615EH	—
	3	—	—	—	G9615EJ



Item	Part No.	Qty	Description
14	—	1	Position Sensor Assembly
15	—	1	O-Ring
16	—	4	Bolt Hex. Socket
17	—	1	Connector Assembly
18	—	1	Connector Assembly
19	—	1	Amplifier Assembly
20	—	2	Screw Machine
21	—	1	Screw Machine
22	F9177WA	1	Connector Assembly
23	F9165DF	1	Tag Plate
24	F9300AG	2	Screw
25	Below	1	Plug
	G9330DP		G 1/2
	G9612EB		1/2 NPT
	F9340NW		Pg13.5
	F9340NX		M20
26	Below	1	Plug
	G9612EK		R 1/4
	G9612EM		1/4 NPT
27	Below	1	Lever Assembly
	F9176HA		For Option code /LV1
	F9176HD		For Option code /LV2
28	F9176HC	1	Lever for Option code /LV1
29	—	1	Case Assembly
30	—	1	Control Relay Assembly
31	Y9414JY	4	Screw
32	F9176GZ	4	Washer
33	Below	1	Control Relay Assembly with Screws
	F9177MJ		For Single Acting Actuator
	F9177ML		For Single Acting Actuator and Option code /X1
	F9177PS		For Double Acting Actuator
	F9177PU		For Double Acting Actuator and Option code /X1
	F9177PW		For Double Acting Actuator and Option code /HT
	F9177PY		For Double Acting Actuator and Option code /X1/HT
34	Below	1	Plate
	F9176GD		For Single Acting Actuator
	F9176HG		For Double Acting Actuator
35	Below		Gasket
	F9176GE	1	For Single Acting Actuator
	F9176HH	2	For Double Acting Actuator
36	G9307MQ	5	Screw M4×8
37	Below	1	Control Relay Assembly
	F9177ME		For Single Acting Actuator
	F9177MG		For Single Acting Actuator and Option code /X1
	F9177PJ		For Double Acting Actuator
	F9177PL		For Double Acting Actuator and Option code /X1
	F9177PN		For Double Acting Actuator and Option code /HT
	F9177PQ		For Double Acting Actuator and Option code /X1/HT
38	F9176GC	1	Filter
39	F9176JZ	1	O-Ring



Revision Record

- Title : Model YVP110
Advanced Valve Positioner
- Manual No. : IM 21B04C01-01E

Edition	Date	Page	Revised Item																								
1st	July 2000	—	New Publication																								
2nd	Apr. 2001	1-2 1-3 15-2 15-5	“1.8 EMC Conformity Standard” Change standards #. Add “1.9 Installation of Explosion Protected Type Positioner.” Modify explanations for “15.5 PID Computation” and “15.6 Control Output.” Add “Local override” in “15.17.1 Block Alarm (BLK_ALM).”																								
3rd	July 2001	1-4 4-2 6-1 7-3 EX-B03E CMPL	Add “B) CENELEC(KEMA) Flameproof type.” Add “1.9.3 JIS Certification.” Add Wiring Instructions in “4.3.2. Precautions on Wiring.” Add “4.4 Grounding.” Add CAUTION for flameproof type. Add Optional Specifications /KF1, /JF3 and /G11. Add “Installation and Operating Precautions for JIS Flameproof Equipment.” CMPL 21B04C01-01E 1st → 2nd. Add Item 12, Cable Gland Assy.																								
4th	Sep. 2002	3-2 3-4 7-2 8-2 9-6 through 9-8 9-10 11-1 15-1 17-1 A-8 A-12 A16 A-24	Add Optional Specifications /LV2. Add notes for stopper. Add notes for stopper. Add Optional Specifications /LV2 and /BP. Website address for downloading DD. Add parameters. Add OS block. “11.3 Device Status” “15. OS Function Block” “17. OS Function Block” Add parameters. “A1.5 Parameters of OS Block” “A2. Link Master Function” “A3. DD Method and DD Menu”																								
5th	Apr. 2003	1-5 1-6 CMPL	Add Optional Specifications /KS25. (Manual Change) Add Optional Specifications /KF2. (Manual Change) CMPL 21B04C01-01E 2nd → 3rd Add Part No. <table border="0" style="margin-left: 20px;"> <tr><td>Item</td><td>Part No.</td></tr> <tr><td>4</td><td>G9303AG</td></tr> <tr><td>6</td><td>Y9408ZU</td></tr> <tr><td>7</td><td>F9177BZ</td></tr> <tr><td>22</td><td>F9177WA</td></tr> <tr><td>27</td><td>F9176HD</td></tr> <tr><td>33</td><td>F9177MJ</td></tr> <tr><td>37</td><td>F9177ME</td></tr> </table> Change Part No. <table border="0" style="margin-left: 20px;"> <tr><td>Item</td><td>Part No.</td></tr> <tr><td>32</td><td>F9177GZ → F9176GZ</td></tr> <tr><td>34</td><td>F9176GA → F9176GD</td></tr> <tr><td>35</td><td>F9176GB → F9176GE</td></tr> </table>	Item	Part No.	4	G9303AG	6	Y9408ZU	7	F9177BZ	22	F9177WA	27	F9176HD	33	F9177MJ	37	F9177ME	Item	Part No.	32	F9177GZ → F9176GZ	34	F9176GA → F9176GD	35	F9176GB → F9176GE
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6th	Jan. 2005	Viii 1-3 to 1-4 1-5 1-6 7-4 A-27 to A-31	Add ATEX Documentation Change Installation Diagram (Intrinsically safe, Division 1 Installation) Add Installation Diagram (Nonincendive, Division 2 Installation) Modify explanations for Technical Data of CENELEC ATEX (KEMA) Intrinsically Safe type Modify explanations for Description of FS15 and KS25 Delete DD Menu																								

Edition	Date	Page	Revised Item
7th	Aug. 2006	1-6 1-9 1-12 2-1 3-5 4-1 4-2 5-3 5-4 6-2 6-3 7-1 to 7-7 9-6 to 9-8 11-1 11-2 12-2 12-4 12-5 17-1 17-3 18-2 18-3 A-8 A-28 to A-35 A-36 A-37 to A-43 CMPL	Add "C) FM Nonincendive approval" Add "C) CENELEC ATEX Type of Protection n" Add "1.10 Low Voltage Directive" Add appearance and part names of Double Acting Type Add explanations of Double Acting Type to "3.2.3 A/M Switching" Add explanations of Double Acting Type to "4.2.2 Pneumatic Piping" Add explanations of Double Acting Type to "4.2.2 Pneumatic Piping CAUTION" Add control parameters for Double Acting Type Add notes for Double Acting Type Add Camflex Percentage Add SERVO_WARN_COUNT Add explanations of Double Acting Type to "6.3 Part Replacement" Add "6.3.4 Tuning the Pressure Balance of Control Relay" Add specifications of Double Acting Type Add VIEW_4 8th Add Relative index 111 to 165 Add items of download to DEVICE_STATUS_1 Modify explanations for Servo Output Drift in DEVICE_STATUS_3 Add Camflex Percentage Modify explanations for Servo Output Drift in XD_ERROR Add SERVO_WARN_COUNT Add control parameters for Double Acting Type Modify explanations for Servo Output Drift in "17.2 Integration Functions" Add notes of Code/BP Add explanations for the pressure balance of control relay Add explanations for manual tuning Add Relative index 111 to 117 Add "APPENDIX 4. SOFTWARE DOWNLOAD" Add "APPENDIX 5. POSITION ADJUSTMENT OF FEEDBACK LEVER" Add "APPENDIX 6. MANUAL TUNING GUIDELINE" Add parts of Double Acting Type
8th	Nov. 2008	— 1-9 7-1 7-3 7-4 8-1 8-2 9-3 9-4 9-5 9-10 9-12 10-1 10-2 11-1 11-2 11-3 11-4 17 18 A-12 A-14 A-16 A-18	Change format Add type nA to CENELEC ATEX Type of Protection "n" Add IS, AR, PID (2 blocks) to Functions Add option code /LC2 Add type nA to option code /KN25 Add OS, IS and AR function blocks in subsection 8.1 Change the IMPORTANT Add Table 9.4 Execution Time of YVP Function Blocks Add number of VCRs for /EE Add number of link objects for /EE and trend objects for /EE Add Table 9.12 View Object for IS Function Block Add Table 9.13 View Object for AR Function Block Add IS, AR and PID2 function blocks to Table 9.16 Add IS and AR function blocks to Table 10.1 Add OS, IS and AR function blocks to subsection 10.2 Change Table 11.2 DEVICE_STATUS_1 (without /EE) Add Table 11.3 DEVICE_STATUS_1 (with /EE) Change Table 11.4 DEVICE_STATUS_2 (without /EE) Add Table 11.5 DEVICE_STATUS_2 (with /EE) Add section 17 IS FUNCTION BLOCK Add section 18 AR FUNCTION BLOCK Add PID2 Index Add A1.7 Parameters of IS Block Add A1.8 Parameters of AR Block Add IS to A1.10

Edition	Date	Page	Revised Item
9th	Sep. 2011	1-3 1-7 1-9 1-10 1-11 3-1 3-2 3-3 3-4 3-5 4-3 6-1 7-4 8-2 12-4 12-5 13-2 16-5 19-4 A-4 A-5 A-18 A-37 A-40	1.8 Revise standards. Change 1.9.2 (1) A) CENELEC ATEX (KEMA) Intrinsically Safe Type. Change B) CENELEC ATEX (KEMA) Flameproof Type. Change Marking A to N. Add "Wiring Procedure for Ground Terminals" Change "(6) Name Plate". Change Figure 3.1. Change Figure 3.3. Change Figure 3.5, 3.6, and 3.7. Change Figure 3.8. Change Figure 3.9 and 3.10. Change Figure 4.2. Change Figure 6.1. Change specifications of KS25 and KF2. Change URL. Modify description of Table 12.4. Change temperature parameter of 12.8. Modify meaning of Table 13.1. Modify table of 16.17.1. Add "19.3.3 Signature Measuring Result". Change description of Index 2015 and 2016. Change description of Index 2038 and 2051. Modify the table A1.9. Change Figure A5.1. Modify the table of A6.3.
10th	Dec. 2013	i 1-3 1-7 1-9 1-10 1-11 1-12 6-1 7-1 7-2 7-4 16-5 A-1 A-7 A-13 A-30	CENELEC ATEX (KEMA)→ATEX Delete 1.10 Change EMC Conformity Standards CENELEC ATEX (KEMA)→ATEX CENELEC ATEX (KEMA)→ATEX Change specifications of ATEX Intrinsically safe (Ex ic) / Type n (Ex nA) Change Notes Change Notes and Installation Diagram Add name plate for /KN25 Delete 1.10 Low Voltage Directive Change CAUTION of General Change conditions of communication line Change EMC Conformity Standards CENELEC ATEX (KEMA)→ATEX Change specifications of /KN25 Change specifications of Block Alarm Correct relative index 11, 12,13, and 15 Correct relative index 92 Correct relative index 52 to 55, 62, and 63 Change specifications of current draw